AC SERVO SYSTEM
XDQ1 SERIES

SYNERGY ASIA SOLUTION CO.,LTD | HIGH QUALITY, BETTER VALUE – SAS SERVO MOTOR & SERVO DRIVE | WWW.MOTORSAS.COM

TECHNICAL USER MANUAL V1.04

PREFACE

Summary

First of all, thank you for purchasing the XDQ1 series servo driver!
In order to use the XDQ1 series servo driver correctly, please read this manual carefully. If you have any doubts about some functions and performance, please consult our technical support personnel for help.

Precautions

- In order to illustrate the details of the product, the illustrations in the manual sometimes show the state with the cover or safety cover removed. When using this product, please be sure to install the case or cover according to the regulations, and operate according to the contents of the manual.
- The illustrations in this manual are for illustration only and may differ from the product you ordered.
- Due to product upgrades or specification changes, and for the convenience and accuracy of the manual, the contents of this manual will be changed in time.
- If you need to order the manual due to damage or loss, please contact our regional agents, or directly contact our customer service center.
- If you still have some problems in use, please contact the customer service center of our company.

Symbols

Symbol	Name	Remarks
	Danger	Text beginning with this symbol indicates a high potential hazard which, if not avoided, will result in death or serious injury.
	Warning	Text beginning with this symbol indicates a moderate or low potential hazard which, if not avoided, could result in minor or moderate personal injury.
	Notice	Text beginning with this symbol indicates a potential risk that, if ignored, could result in equipment damage, data loss, reduced equipment performance, or unpredictable results.
	High temperature	Text beginning with this symbol indicates that the equipment is hot, and if these texts are ignored, burns or fire may result.
	Important	Text beginning with this symbol indicates precautions and restrictions that must be observed. At the same time, it can also indicate precautions such as issuing a warning, but not causing damage to the equipment.
	Instructions	Text beginning with this symbol indicates additional information of the main text, which is the emphasis and supplement to the main text.

SAFETY PRECAUSIONS

Overall precautions

- Do not remove covers, cables, connectors and optional equipment while the drive is powered on.
- Do not connect the three-phase power supply to the output terminals U, V, W of the driver.
- Please disconnect the power supply for at least 5 minutes, confirm that the power indicator (CHARGE) is off, and then perform wiring and inspection operations. (Even if the power is turned off, high voltage may remain inside the driver. Therefore, do not touch the power terminals while the power indicator (CHARGE) is on.)

- Please use the power supply specification (number of phases, voltage, frequency, AC/DC) that matches the product.
- Be sure to connect the ground terminals of the driver and motor to the ground electrode.
- Do not disassemble, repair or modify the product without permission.
- Do not damage or pull the cable hard, do not apply excessive force to the cable, and do not hang heavy objects on the cable or block it by the cabinet door.
- Do not touch the inside of the drive.
- When starting the operation after connecting to the machine, make sure that the equipment can be in a state of emergency stop at any time.

- When the power is turned on or just after the power is turned off, the heat sink, regeneration resistor, external dynamic brake resistor, motor, etc. of the driver may be in a high temperature state. Take safety measures such as attaching a cover to prevent accidental contact with hands and parts (cables, etc.).
- Please use equipment with double insulation or reinforced insulation for control power supply.
- Do not use damaged or missing parts of drives and motors.
- Do not use this product near places where it will be splashed with water, corrosive environments, flammable gas environments, and combustibles.
- Do not touch the driver and motor with wet hands.
- Install an external emergency stop circuit to ensure that the power supply can be cut off and the operation can be stopped immediately when an abnormality occurs.
- When using in a poor power supply condition, install protective equipment (AC reactor, etc.) to ensure that the input power is supplied within the specified

voltage fluctuation range.

- Please use a noise filter etc. to reduce the influence of electromagnetic interference.
- Please use the driver and motor in the specified combination.

Storage and transportation precautions

- Please follow the instructions on the outer packaging for storage and do not place excessive load on the product.
- Please place this product in the following environment:
  - Places without direct sunlight.
  - Places without corrosive gas and flammable gas.
  - A place where there is no splash of water, oil, medicine, etc.
  - There are no devices that generate strong magnetic fields nearby.
  - Locations where the ambient temperature does not exceed product specifications.
  - A place where the relative humidity does not exceed the product specification and there is no condensation.
  - Locations with little dust, dust, salt and metal powder.
  - Locations where vibration or shock does not exceed product specifications.

Installation precautions

- Please install the drive in a control cabinet that can provide fire protection and electrical protection.
- Please install the driver and motor in a location with sufficient weight resistance.
- Please install this product in the following environment:
  - Places without direct sunlight.
  - A place where there is no splash of water, oil, medicine, etc.
  - Places without corrosive gas and flammable gas.
  - There are no devices that generate strong magnetic fields nearby.
  - Locations where the ambient temperature does not exceed product specifications.
  - A place where the relative humidity does not exceed the product specification and there is no condensation.
  - Locations with little dust, dust, salt and metal powder.
  - Locations where vibration or shock does not exceed product specifications.
- Do not block the air inlet and air outlet, and do not allow foreign matter to enter the driver and motor.

- Do not step on the product or place heavy objects on the drive.
- Please install the driver in the specified direction.
- Make sure to maintain the specified spacing between the inner surfaces of the drive control cabinet and other machines.

Wiring precautions

- During the wiring between the driver and the motor, do not pass the electromagnetic contactor.
- Connect the power terminals and motor terminals securely.
- A distance of at least 10mm should be maintained between the driver and the control cabinet or other equipment.
- Leave at least 30mm of wiring space above and below the driver.
- The maximum wiring length of the encoder cable is 20m.
- Use twisted-pair shielded cables for signal cables and encoder cables, and ground both ends of the shielded layers.
- Reduce the frequency of power up/down as much as possible.

Operation precautions

- In order to prevent accidents, please test the servo motor with no load (without connecting the drive).
- When installing it on the matching machine and starting to run, please set the user parameters that match the machine in advance.
- During JOG operation and zero return operation, the signals of prohibiting positive rotation side driving (P-OT) and prohibiting negative rotation side driving (N-OT) are invalid.
- When using the motor on a vertical axis, please equip a safety device to prevent the work-piece from falling in the event of an alarm or over-travel.
- Also, make the S-OFF stop setting when over-travel occurs.
- When automatic tuning is not performed, be sure to set the correct moment of inertia ratio to avoid vibration.
- When an alarm occurs, perform a reset after checking the cause and ensuring safety.
- Do not use the holding brake of the holding brake motor for normal braking.

Maintenance precautions

- Please have the inspection work performed by professional technicians.
- When performing the insulation resistance test of the driver, please cut off all connections with the driver first.
- When replacing a drive, transfer the user parameters of the drive to be replaced to the new drive, and then restart operation.
- Do not wipe the case or PCB with gasoline, thinner, alcohol, acid or alkaline detergent to avoid discoloration or breakage of the case.
- Do not disassemble the motor without permission.
- Do not change the wiring while the power is on.

Disposal precautions

- When disposing of the product as waste, please dispose of it as general industrial waste. Regarding the collection and reuse of electronic information products, please abide by local laws and regulations.

Contents

CHAPTER 1 PRODUCT SUMMARY

1.1 Product inspections

In order to prevent negligence in the purchase and delivery of this product, please check the items listed in the table below in detail.

Item	Remarks
Is the arrived product the model you want to buy?	Check the product models on the motor and drive nameplates separately, refer to the model descriptions listed in the next section.
Does the motor shaft run smoothly?	Rotate the motor shaft by hand, if it can run smoothly, it means the motor shaft is normal. However, motors with electromagnetic brakes cannot run smoothly by hand!
Is the appearance damaged?	Visually inspect for any visual damage.
Are there any loose screws?	Use a screwdriver to check whether the servo drive mounting screws are loose.

If any of the above situations occur, please contact the agent or the manufacturer for a proper solution.

1.2 Servo set assemblies

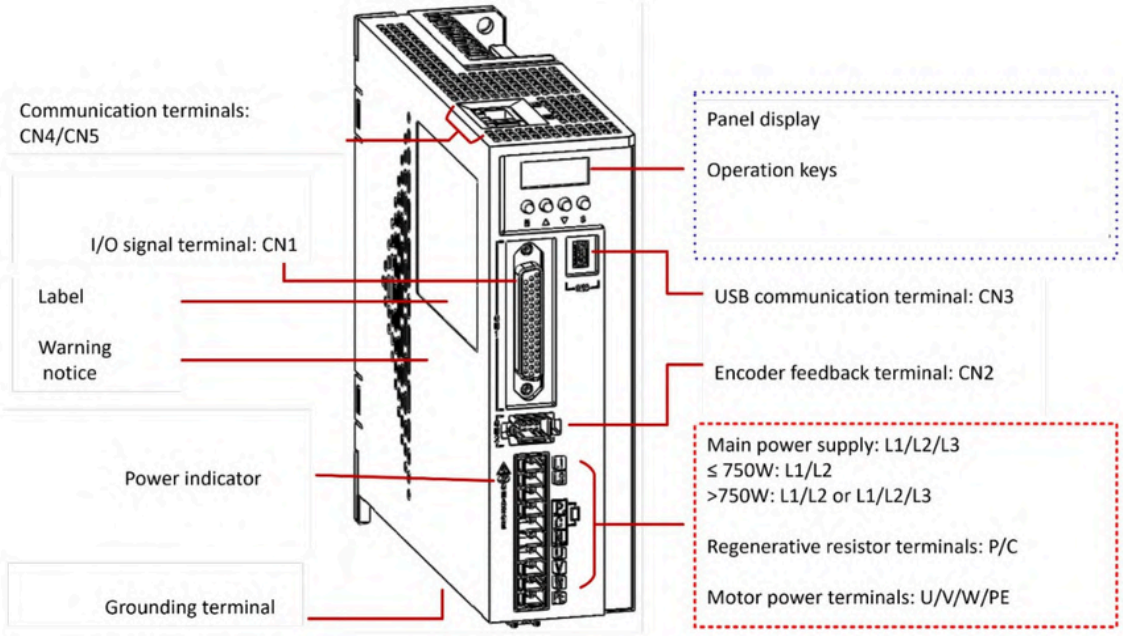
A complete set of servo assemblies should include the following items.

<table>
<tr><th>Item</th><th>Remarks</th></tr>
<tr><td>1</td><td>Servo drive and its matching servo motor</td></tr>
<tr><td>2</td><td>A UVW motor power cable (optional): one end of U, V, W, PE is connected to the driver end, and the other end is connected to the motor end.</td></tr>
<tr><td>3</td><td>CN1 uses a 44-PIN connector or a control cable (optional).</td></tr>
<tr><td>4</td><td>A motor encoder cable (optional): one end is connected to the CN2 (6-PIN connector) of the driver, and the other end is connected to the motor end.</td></tr>
<tr><td>5</td><td>5 PIN connector for CN3 (Mini USB Type B product). (Optional)</td></tr>
<tr><td>6</td><td>RJ45 connector used for CN4 and CN5 for general communication (RS-485, CAN). (Optional)</td></tr>
<tr><td>7</td><td>Driver power input: 10PIN quick connector terminal
(L1、L2、(L3)、P、C、N、U、V、W、PE)
<table>
<tr><th>Power range (chassis)</th><th>Input voltage</th><th>Brake</th><th>Motor main circuit signal</th></tr>
<tr><td>≤750W (A type)</td><td>L1、L2</td><td>P、C</td><td>U、V、W、PE</td></tr>
<tr><td>1KW≤ (B type) ≤2KW</td><td>L1、L2、L3</td><td>P、C</td><td>U、V、W、PE</td></tr>
</table></td></tr>
<tr><td>8</td><td>a plastic press rod</td></tr>
<tr><td>9</td><td>a manual</td></tr>
</table>

1.3 Drive model descriptions

XD	Q1	-	08	P	A	-	XXXX
Product Code	**Product Series**	Delimiter	**Power**	**Interface**	**Voltage level**	Delimiter	**Factory code**
XD: Servo drive	Q1 Series		04: 400W 08: 750W 10: 1KW 15: 1.5KW 20: 2KW 30: 3KW	P: Pulse E: EtherCAT	A: AC220V B: AC380V		Blank: standard 0003: with closed pores 0100: with DB 0300: with analog input 02A0: with CANOPEN 0400: with high speed pulse input

1.4 Drive connectors and interface



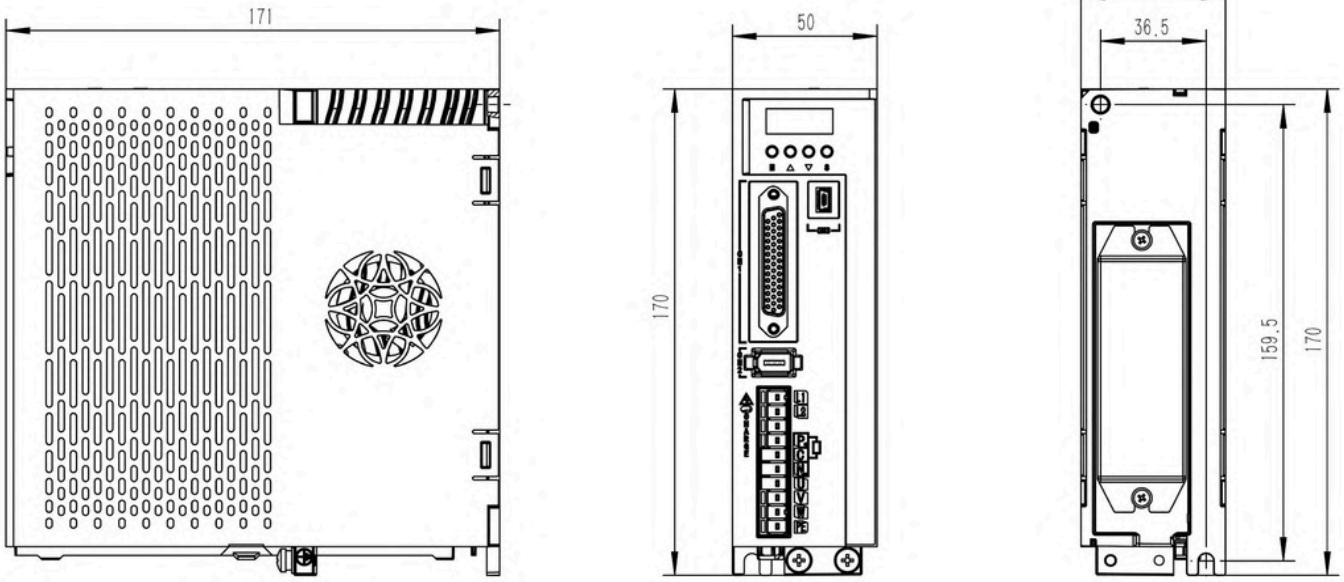
1.5 Drive ratings and specifications

Drive model: XDQ1-	**04□□**	**08□□**	**10□□**	**15□□**	**20□□**	**30□□**
Continuous current [Arms]	2.8	4.8	6.6	8.5	12.0	16.0
Chassis	A type		B type		C type	
Input power	1PH AC200V ~ 230V, 50Hz/60Hz（A type） 1/3PH AC200V ~ 230V, 50Hz/60Hz（B/C type）					
Control method	SVPWM control					
Feedback	Serial communication type encoder ▸ 17-bit magnetic encoder					

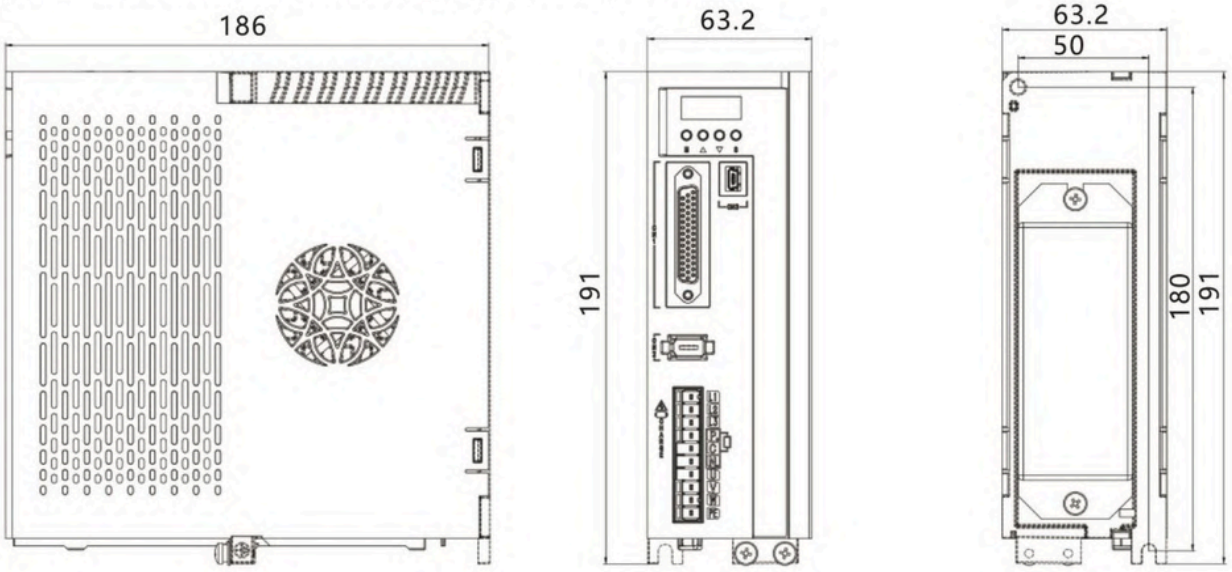
			▸ 23-bit optical encoder
Use conditions	Work	Temperature	-5℃～40℃
		Humidity	5%～95%RH（No condensation, no freezing）
	Storage	Temperature	-20℃～85℃
		Humidity	5%～95%RH（No condensation, no freezing）
	Protection class		IP20
	Altitude		Below 1000m
	Vibration resistant		4.9m/s^2
	Shock proof		19.7m/s^2
	Power Systems		TN system
Installation structure			Base mount
Performance	Speed control range		1：5000
	Speed volatility		±0.01% or less of rated speed (load fluctuation: 0% to 100%)
			0.1% or less of rated speed (voltage fluctuation: ±10%)
			±0.1% or less of rated speed (temperature fluctuation: 25℃±25℃)
	Soft start setting		0～10s (Acceleration and deceleration can be set separately)
Input/output signals	Input signals		Operating voltage range: 24 VDC±20%
			Number of input channels: 6
			The input signals are: /S-ON (servo enable), /C-SEL (control mode switching), P-OT (forward side drive prohibited), N-OT (reverse side drive prohibited), /CLR (position deviation clear), /ALM-RST (alarm reset), etc.
	Output signals		Operating voltage range: 5 VDC～30 VDC
			Number of output channels: 4
			The output signals are: ALM (servo alarm), BK (holding brake signal), CZ (Z pulse signal), COIN (positioning completion), etc.
Communication	RS485		RS485 Communication Based on MODBUS
	USB		Connect to PC for communication with PC software software
	CAN（optional）		CANopen communication
	EtherCAT (under development)		EtherCAT communication
Display			5-digit digital tube
Indicator light			CHARGE
Panel operator			4 buttons
Regenerative braking			External braking resistor
Protective function			Overcurrent, overvoltage, undervoltage, overload, abnormal regeneration, overspeed, etc.
Accessibility			JOG operation, factory reset, alarm record, load inertia identification, automatic tuning, etc.

1.6 Drive Dimensions

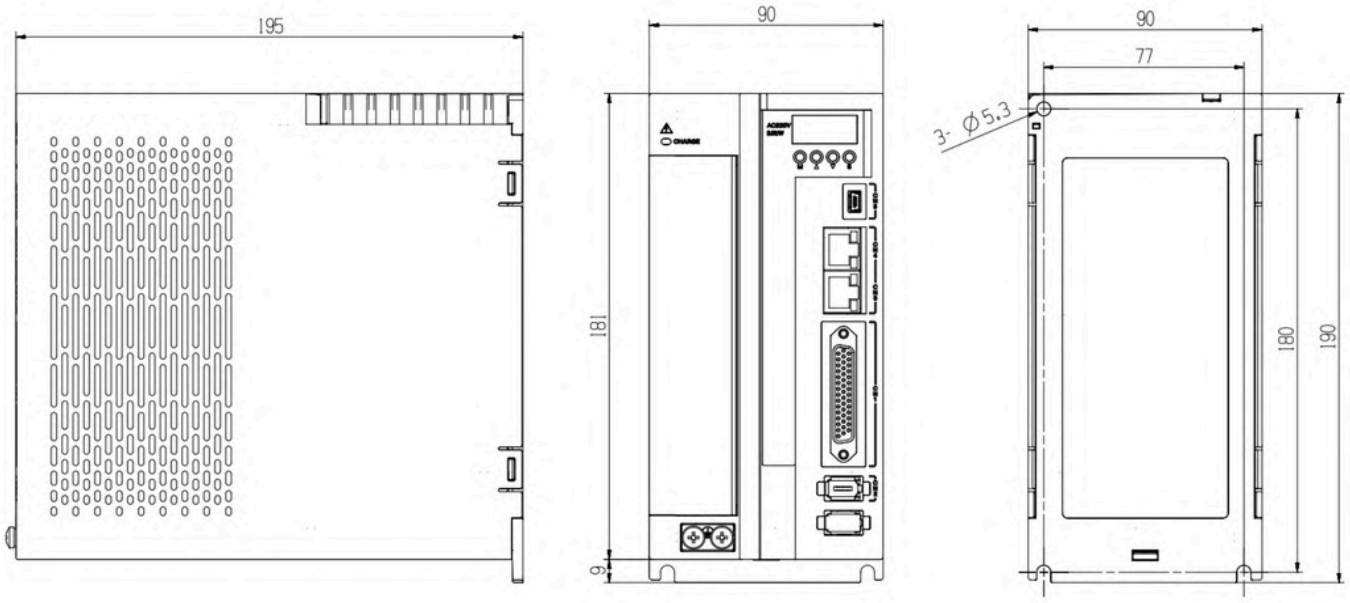
Type A chassis: 400W/750W/(light load) 1KW



Type B chassis: 1KW/1.5KW/(light load) 2.0KW



Type C chassis: 2KW/3KW



1.7 Motor model descriptions

XM	Q1	-	H	80	A	08	B30	S	1	6	-	※※
①	②		③	④	⑤	⑥	⑦	⑧	⑨	⑩		⑪

No.	Name	Remarks
①	**Product code**	XM: servo motor
②	**Product series**	Q1 series
③	**Inertia**	A: Low inertia H: High inertia G: Medium inertia
②	**Flange**	60: 60mm flange 80: 80mm flange 100: 100mm flange 110: 110mm flange 130: 130mm flange 180: 180mm flange
⑤	**Rated voltage**	A: AC220V B: AC380V
⑥	**Rated power**	04: 400W 08: 750W 09: 850W 10: 1KW 13: 1.3KW 15: 1.5KW 18: 1.8KW 20: 2KW

		30: 3.0KW
⑦	**Rated speed**	B10：1000rpm B15：1500rpm B20：2000rpm B30：3000rpm
⑧	**Options**	N None C With brake S With oil seal E With brake and oil seal
⑨	**Encoder**	1 17-bit incremental, magnetic 2 17-bit absolute, magnetic 3 23-bit, optical encoder 4 23-bit multi-turn optical encoder
⑩	**Shaft**	0 Flange output 2 Straight shaft, keyway, no thread 6 Straight shaft, keyway, threaded
⑪	**Customizations**	Blank: standard type ※※ Consult the manufacturer

1.8 Motor specifications

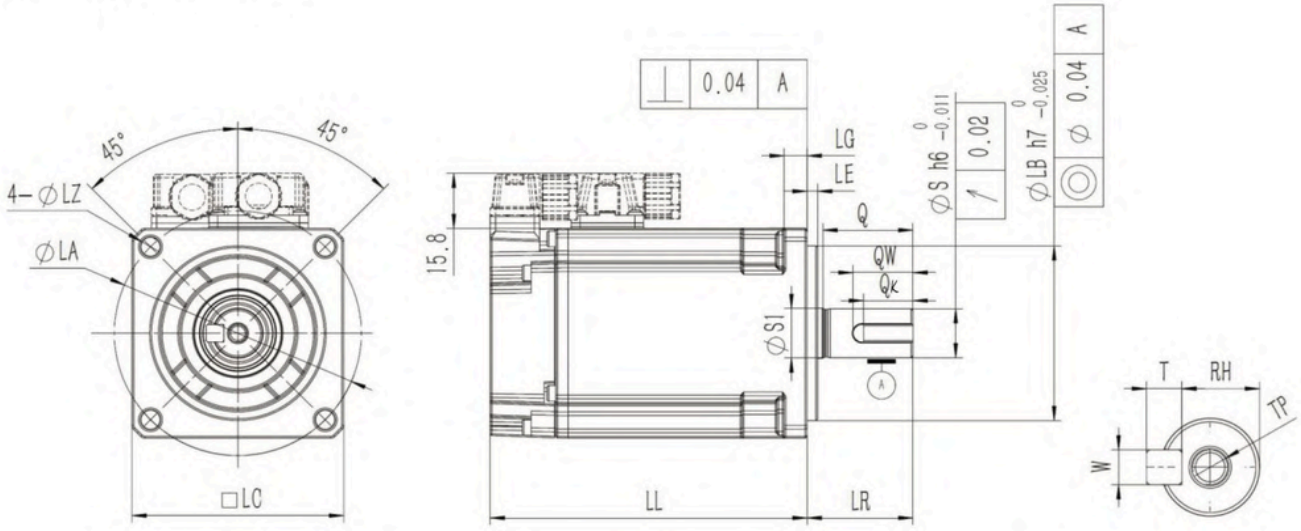
Servo motor model: XMQ1-	**H60A04B 30**	**H80A 08B30**	**H80A 10B30**	**A130A 10B20**	**A130A 15B20**	**A130A 20B20**	**G130A 09B15**	**G130A 13B15**	**G130A 18B15**
Rated output power [kW]	0.4	0.75	1.0	1.0	1.5	2.0	0.85	1.3	1.8
Rated input voltage [V]	220								
Rated torque [Nm]	1.27	2.39	3.18	4.77	7.16	9.55	5.39	8.34	11.5
Maximum torque [Nm]	4.45	8.37	11.13	14.3	21.5	28.6	16.17	25.02	34.5
Rated current [Arms]	2.6	4.8	6.1	4.77	7.01	9.25	5.43	7.69	11.2
Maximum current [Arms]	9.1	16.8	21.35	14.31	21.03	27.75	16.29	21	28
Rated speed [rpm]	3000			2000			1500		
Maximum speed [rpm]	6000			3000			3000		
Rotary inertia [10^{-4}kg·m2]	0.594	1.58	1.89	10.2	14.3	18.4	14.4	19.6	24.8
Brake rated voltage	DC 24V±10%								
Brake rated power [W]	7.3	8.5	8.5	23	23	23	23	23	23
Brake holding torque [Nm]	1.27	2.39	3.18	4.77	7.16	9.55	5.39	8.34	11.5
Brake inertia [10^{-4}kg·m2]	0.013	0.05	0.05	1.22	1.22	1.22	1.22	1.22	1.22
Heat resistance	Class F								
Insulation resistance	DC500V,1S ≥100MΩ								
Insulation voltage	AC1800V, 1S, leakage current≤8mA								
Excitation method	Permanent magnet								
Installation method	Flange								
Connection method	Direct connection								
Vibration level	V15								
Use ambient temperature	0～40℃ (no freezing)								

Use ambient humidity	20%～80%RH (no condensation)	
Installation environment	▸Indoor places without corrosive or explosive gas, dust, garbage or moisture ▸Easy place for inspection and cleaning, with good ventilation ▸Altitude below 1000m	
Storage environment	Storage temperature: -20°C to +60°C (no freezing) Storage humidity: 20%RH ~ 80%RH (no condensation)	
Vibration resistance level	49m/s²	49m/s² (front/back direction 24.5m/s²)
Impact resistance (flange)	490m/s², 2 times	
IP rating	IP67 with oil seal	

1.9 Motor dimensions

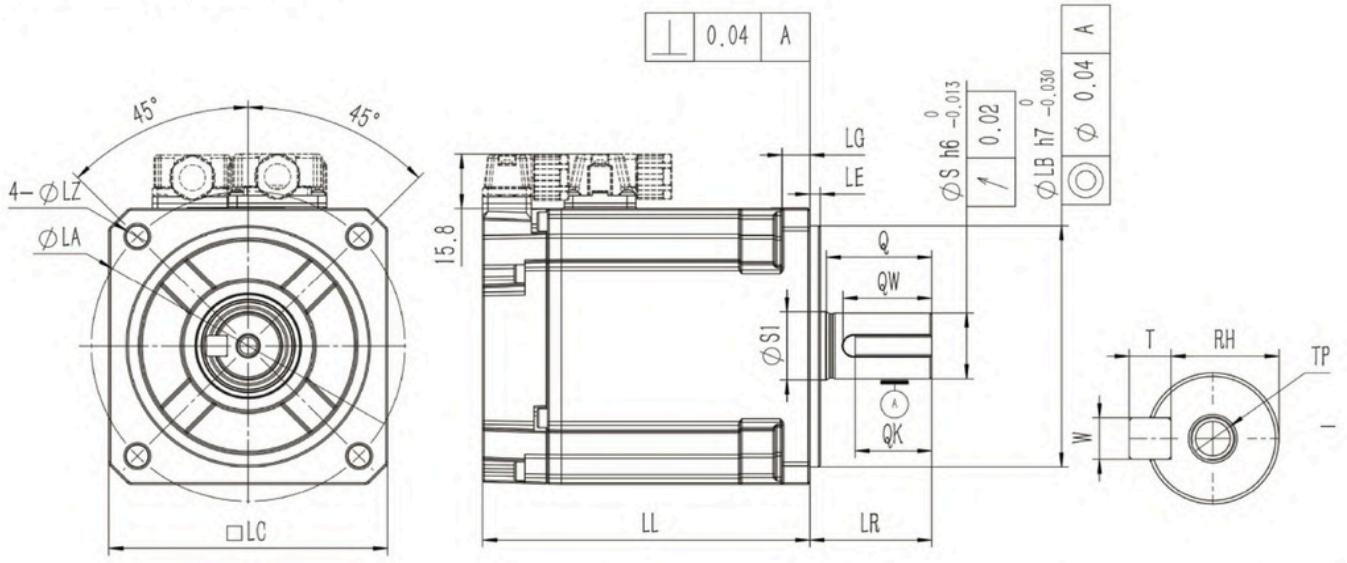
**LL in brackets: with brake.

60mm flange (unit:mm)



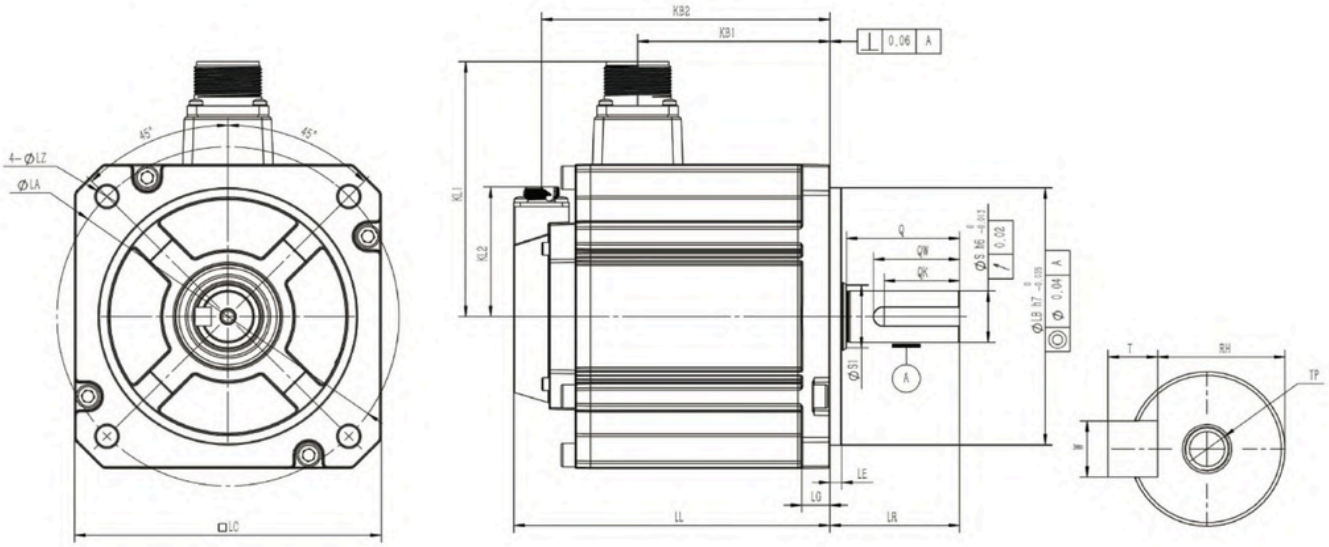
Model	Motor body		Flange						Shaft								
XMQ1-	LL	LR	LA	LB	LC	LE	LG	LZ	S	SI	Q	QK	QW	W	Y	TH	TP
H60A04	89.8(122.4)	30	70	50	60	3	6.5	5.5	14	14.2	25.5	14	17	5	5	11	M5D12

80mm flange (unit:mm)



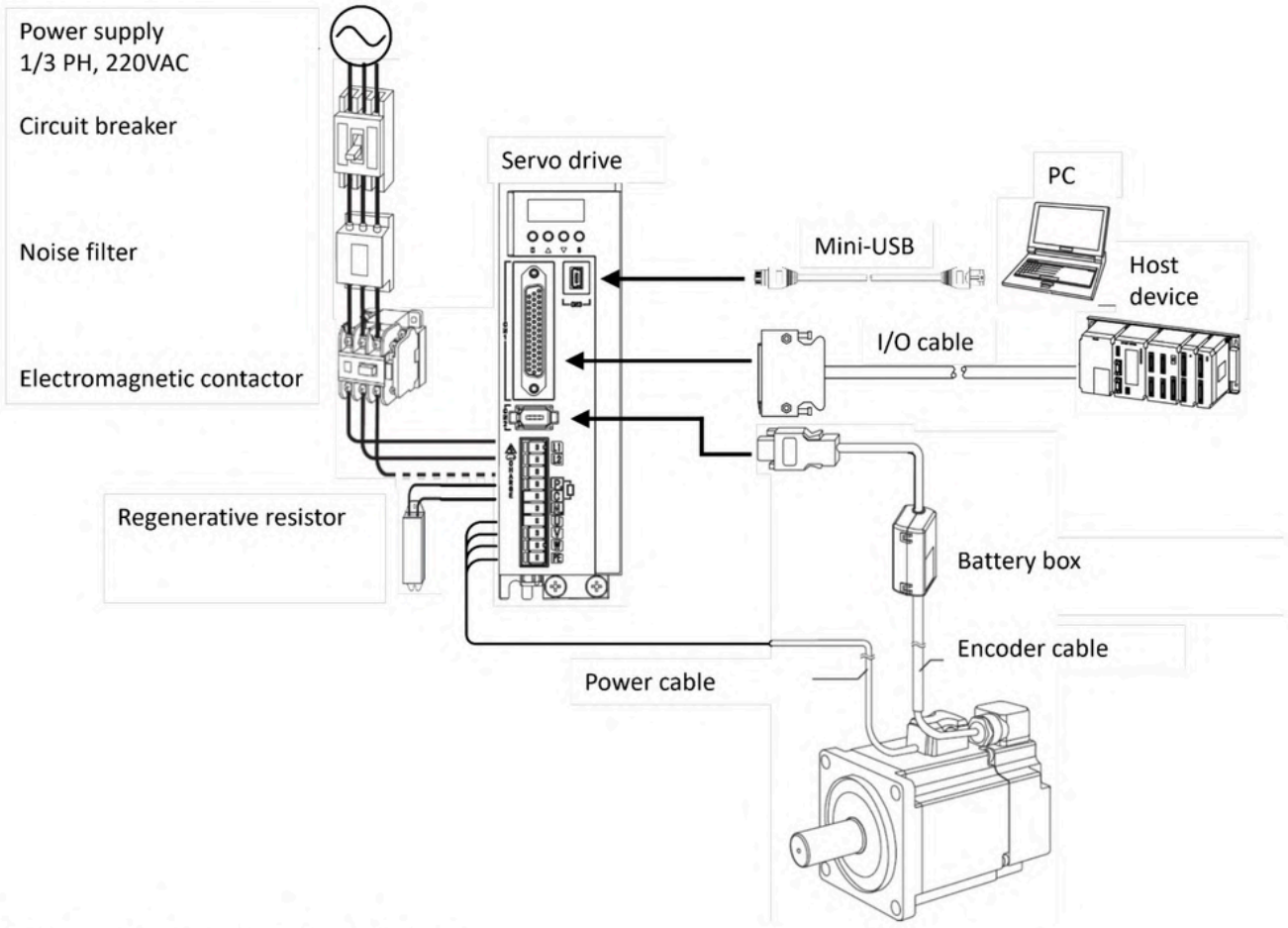
Model	Motor body		Flange						Shaft								
XMQ1-	LL	LR	LA	LB	LC	LE	LG	LZ	S	SI	Q	QK	QW	W	Y	TH	TP
H80A08	93.9(131)	35	90	70	80	3	8	6.4	19	19.7	30.2	22	25.5	6	6	15.5	M6D12
H80A10	102.3(139.4)	35	90	70	80	3	8	6.4	19	19.7	30.2	22	25.5	6	6	15.5	M6D12

130mm flange (unit:mm)



Model XMQ1-	Motor body						Flange						Shaft								
	LL	LR	KB1	KB2	KL1	KL2	LA	LB	LC	LE	LG	LZ	S	SI	Q	QK	QW	W	T	RH	TP
A130A10	119(148)	55	66.5	107.3	109	55.3(99.3)	145	110	130	5	12	9	22	26.8	48	32	36.5	8	7	18	M6D12
G130A09	119(148)	55	66.5	107.3	109	55.3(99.3)	145	110	130	5	12	9	22	26.8	48	32	36.5	8	7	18	M6D12
A130A15	134(163)	55	81.5	122.3	109	55.3(99.3)	145	110	130	5	12	9	22	26.8	48	32	36.5	8	7	18	M6D12
G130A13	134(163)	55	81.5	122.3	109	55.3(99.3)	145	110	130	5	12	9	22	26.8	48	32	36.5	8	7	18	M6D12
A130A20	149(178)	55	95.6	137.3	109	55.3(99.3)	145	110	130	5	12	9	22	26.8	48	32	36.5	8	7	18	M6D12
G130A18	149(178)	55	95.6	137.3	109	55.3(99.3)	145	110	130	5	12	9	22	26.8	48	32	36.5	8	7	18	M6D12

1.10 System configurations



Minimum system configurations

The minimum system configuration includes at least the following components.

Name	Remarks
Power supply	Single-phase/Three-phase AC 200V ~ 240V, -15% ~ +10%, 50Hz/60Hz
Circuit Breaker	To protect the power cord and cut off the circuit in case of overcurrent.
Noise filter	To prevent external noise interference. Rated current is 10A or 20A.
Contactor	On-off control of the input loop.
Rege. resistor	Connect a regenerative resistor between terminals P and C.
Driver	Servo driver
Motor	Servo motor
Host device	For example, a PLC.
PC Debug Tool	PC software
Cable	Encoder cables, power cables, control cables, communication cables, etc.

Basic Peripherals Specifications

Model	Voltage	Regenerative resistor		Recommended rated current of circuit breaker
		Power	Resistance	
XDQ1-04	1PH AC 200V ~ 240V	--	30Ω	10A
XDQ1-08	1PH AC 200V ~ 240V	50Ω / 60W	30Ω	20A
XDQ1-10	1/3 PH AC 200V ~ 240V	50Ω / 80W	20Ω	20A
XDQ1-15	1/3 PH AC 200V ~ 240V	50Ω / 80W	20Ω	30A
XDQ1-20	1/3 PH AC 200V ~ 240V	50Ω / 80W	20Ω	30A

1.11 Model matching table

Capacity	Configurations	Drive Model	Motor Model	Power cable	Encoder cable
0.4KW	Standard	XDQ1-04PA	XMQ1-H60A04B30S16	LQ1-P0M0A-□□	LQ1-E0A0-□□
0.75KW	Standard	XDQ1-08PA	XMQ1-H80A08B30S16	LQ1-P0M0B-□□	LQ1-E0A0-□□
1KW	Standard	XDQ1-10PAL	XMQ1-H80A10B30S16	LQ1-P0M0B-□□	LQ1-E0A0-□□
1KW	Standard	XDQ1-10PA	XMQ1-A130A10B20S16	LQ1-P0M2C-□□	LQ1-E0A2-□□
1.5KW	Standard	XDQ1-15PA	XMQ1-A130A15B20S16	LQ1-P0M2C-□□	LQ1-E0A2-□□
2KW	Standard	XDQ1-20PAL	XMQ1-A130A20B20S16	LQ1-P0M2C-□□	LQ1-E0A2-□□
2KW	Standard	XDQ1-20PA	XMQ1-A130A20B20S16	LQ1-P0M2D-□□	LQ1-E0A2-□□
3KW	Standard	XDQ1-30PA	XMQ1-A130A30B20S16	LQ1-P0M2D-□□	LQ1-E0A2-□□
0.85KW	Standard	XDQ1-10PA	XMQ1-G130A09B15S16	LQ1-P0M2C-□□	LQ1-E0A2-□□
1.3KW	Standard	XDQ1-15PA	XMQ1-G130A13B15S16	LQ1-P0M2C-□□	LQ1-E0A2-□□
1.8KW	Standard	XDQ1-20PA	XMQ1-G130A18B15S16	LQ1-P0M2C-□□	LQ1-E0A2-□□
0.4KW	With brake	XDQ1-04PA	XMQ1-H60A04B30E16	LQ1-P0B0A-□□	LQ1-E0A0-□□
0.75KW	With brake	XDQ1-08PA	XMQ1-H80A08B30E16	LQ1-P0B0B-□□	LQ1-E0A0-□□
1KW	With brake	XDQ1-10PAL	XMQ1-H80A10B30E16	LQ1-P0B0B-□□	LQ1-E0A0-□□
1KW	With brake	XDQ1-10PA	XMQ1-A130A10B20E16	LQ1-P0B2C-□□	LQ1-E0A2-□□
1.5KW	With brake	XDQ1-15PA	XMQ1-A130A15B20E16	LQ1-P0B2C-□□	LQ1-E0A2-□□
2KW	With brake	XDQ1-20PAL	XMQ1-A130A20B20E16	LQ1-P0B2C-□□	LQ1-E0A2-□□
2KW	With brake	XDQ1-20PA	XMQ1-A130A20B20E16	LQ1-P0B2D-□□	LQ1-E0A2-□□
3KW	With brake	XDQ1-30PA	XMQ1-A130A30B20E16	LQ1-P0B2D-□□	LQ1-E0A2-□□
0.85KW	With brake	XDQ1-10PA	XMQ1-G130A09B15E16	LQ1-P0B2C-□□	LQ1-E0A2-□□
1.3KW	With brake	XDQ1-15PA	XMQ1-G130A13B15E16	LQ1-P0B2C-□□	LQ1-E0A2-□□
1.8KW	With brake	XDQ1-20PA	XMQ1-G130A18B15E16	LQ1-P0B2C-□□	LQ1-E0A2-□□
0.4KW	Absolute encoder	XDQ1-04PA	XMQ1-H60A04B30S26	LQ1-P0M0A-□□	LQ1-E0B0-□□
0.75KW	Absolute encoder	XDQ1-08PA	XMQ1-H80A08B30S26	LQ1-P0M0B-□□	LQ1-E0B0-□□
1KW	Absolute encoder	XDQ1-10PAL	XMQ1-H80A10B30S26	LQ1-P0M0B-□□	LQ1-E0B0-□□
1KW	Absolute encoder	XDQ1-10PA	XMQ1-A130A10B20S26	LQ1-P0M2C-□□	LQ1-E0B2-□□
1.5KW	Absolute encoder	XDQ1-15PA	XMQ1-A130A15B20S26	LQ1-P0M2C-□□	LQ1-E0B2-□□
2KW	Absolute encoder	XDQ1-20PAL	XMQ1-A130A20B20S26	LQ1-P0M2C-□□	LQ1-E0B2-□□

2KW	Absolute encoder	XDQ1-20PA	XMQ1-A130A20B20S26	LQ1-P0M2D-□□	LQ1-E0B2-□□
3KW	Absolute encoder	XDQ1-30PA	XMQ1-A130A30B20S26	LQ1-P0M2D-□□	LQ1-E0B2-□□
0.85KW	Absolute encoder	XDQ1-10PA	XMQ1-G130A09B15S26	LQ1-P0M2C-□□	LQ1-E0B2-□□
1.3KW	Absolute encoder	XDQ1-15PA	XMQ1-G130A13B15S26	LQ1-P0M2C-□□	LQ1-E0B2-□□
1.8KW	Absolute encoder	XDQ1-20PA	XMQ1-G130A18B15S26	LQ1-P0M2C-□□	LQ1-E0B2-□□
0.4KW	With brake, absolute	XDQ1-04PA	XMQ1-H60A04B30E26	LQ1-P0B0A-□□	LQ1-E0B0-□□
0.75KW	With brake, absolute encoder	XDQ1-08PA	XMQ1-H80A08B30E26	LQ1-P0B0B-□□	LQ1-E0B0-□□
1KW	With brake, absolute encoder	XDQ1-10PAL	XMQ1-H80A10B30E26	LQ1-P0B0B-□□	LQ1-E0B0-□□
1KW	With brake, absolute encoder	XDQ1-10PA	XMQ1-A130A10B20E26	LQ1-P0B2C-□□	LQ1-E0B2-□□
1.5KW	With brake, absolute encoder	XDQ1-15PA	XMQ1-A130A15B20E26	LQ1-P0B2C-□□	LQ1-E0B2-□□
2KW	With brake, absolute encoder	XDQ1-20PAL	XMQ1-A130A20B20E26	LQ1-P0B2C-□□	LQ1-E0B2-□□
2KW	With brake, absolute encoder	XDQ1-20PA	XMQ1-A130A20B20E26	LQ1-P0B2D-□□	LQ1-E0B2-□□
3KW	With brake, absolute encoder	XDQ1-30PA	XMQ1-A130A30B20E26	LQ1-P0B2D-□□	LQ1-E0B2-□□
0.85KW	With brake, absolute encoder	XDQ1-10PA	XMQ1-G130A09B15E26	LQ1-P0B2C-□□	LQ1-E0B2-□□
1.3KW	With brake, absolute encoder	XDQ1-15PA	XMQ1-G130A13B15E26	LQ1-P0B2C-□□	LQ1-E0B2-□□
1.8KW	With brake, absolute encoder	XDQ1-20PA	XMQ1-G130A18B15E26	LQ1-P0B2C-□□	LQ1-E0B2-□□

□□ in the cable model: □ represents the length (such as: 01, 05, 08, 12, etc., 01 marks the length of 1m. Among them A5 (0.5m), B5 (1.5m), C5 (2.5m), D5 (3.5 m)), in meters. A flexible cable is also available, marked with "-RX".

CHAPTER 2 INSTALLATIONS

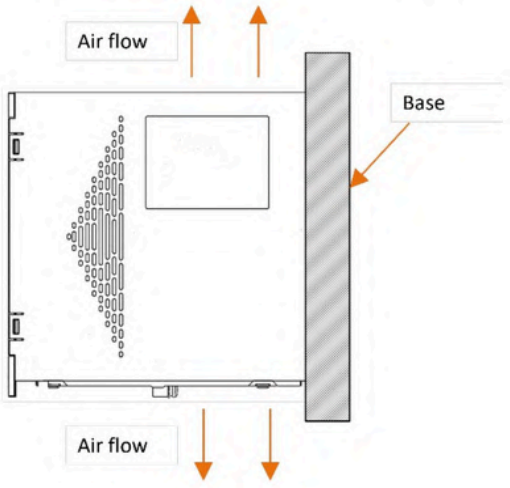
2.1 Precautions

- When installed near a heat generating body To make the temperature around the driver match the environmental conditions, please control the temperature rise caused by the heat radiation or convection of the heat generating body.
- When installing near a vibration source Install a vibration damper on the driver's mounting surface to prevent vibration from being transmitted to the driver.
- Others: Do not install in places with high temperature and humidity, places with splashes of water droplets or cutting oil, places with a lot of dust or iron powder in the ambient gas, places with corrosive gases, and places exposed to radiation.

2.2 Installation Type and Orientation

The drive is base mounted and should be mounted on a painted metal surface. Figure 2-1 is a schematic diagram of installing the drive vertically.
Also, install with the front (wiring side) of the driver facing the operator. Secure the device to the mounting surface with 2 or 3 mounting holes (the number of mounting holes depends on the capacity of the drive).

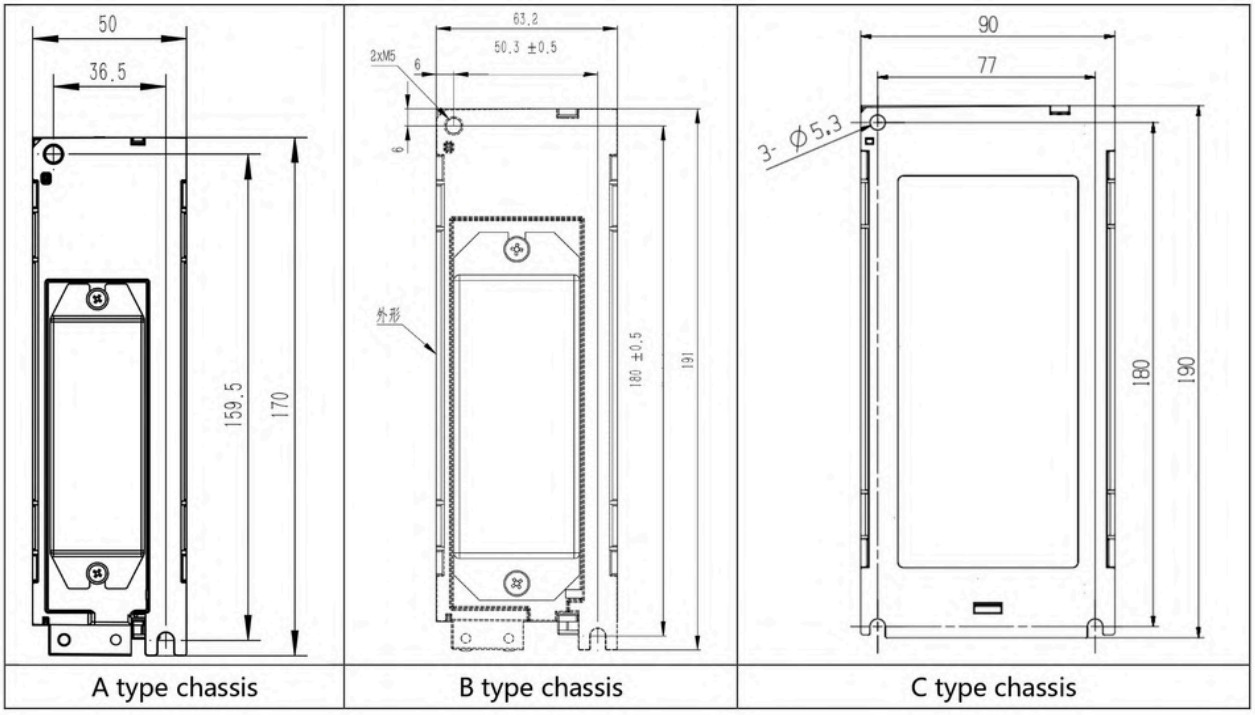
Figure 2-1 Vertical Pedestal Mounting



2.3 Mounting hole size

Please use 2~4 mounting holes for each device and fix it firmly on the mounting surface. When installing, please prepare a screwdriver whose length is longer than the depth of the device.

Figure 2-2 Vertical Pedestal Mounting

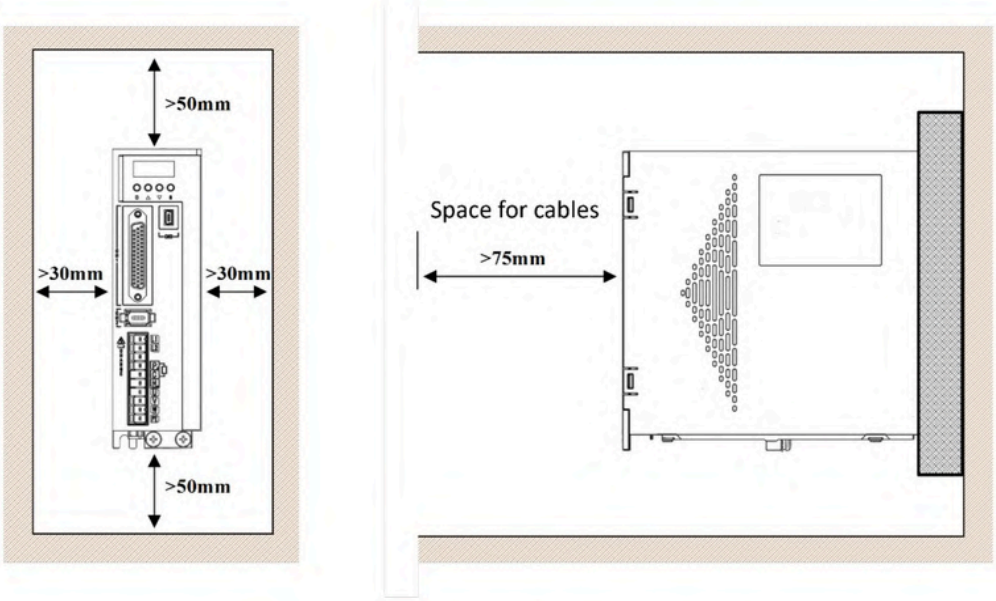


A type chassis	B type chassis	C type chassis

2.4 Installation intervals

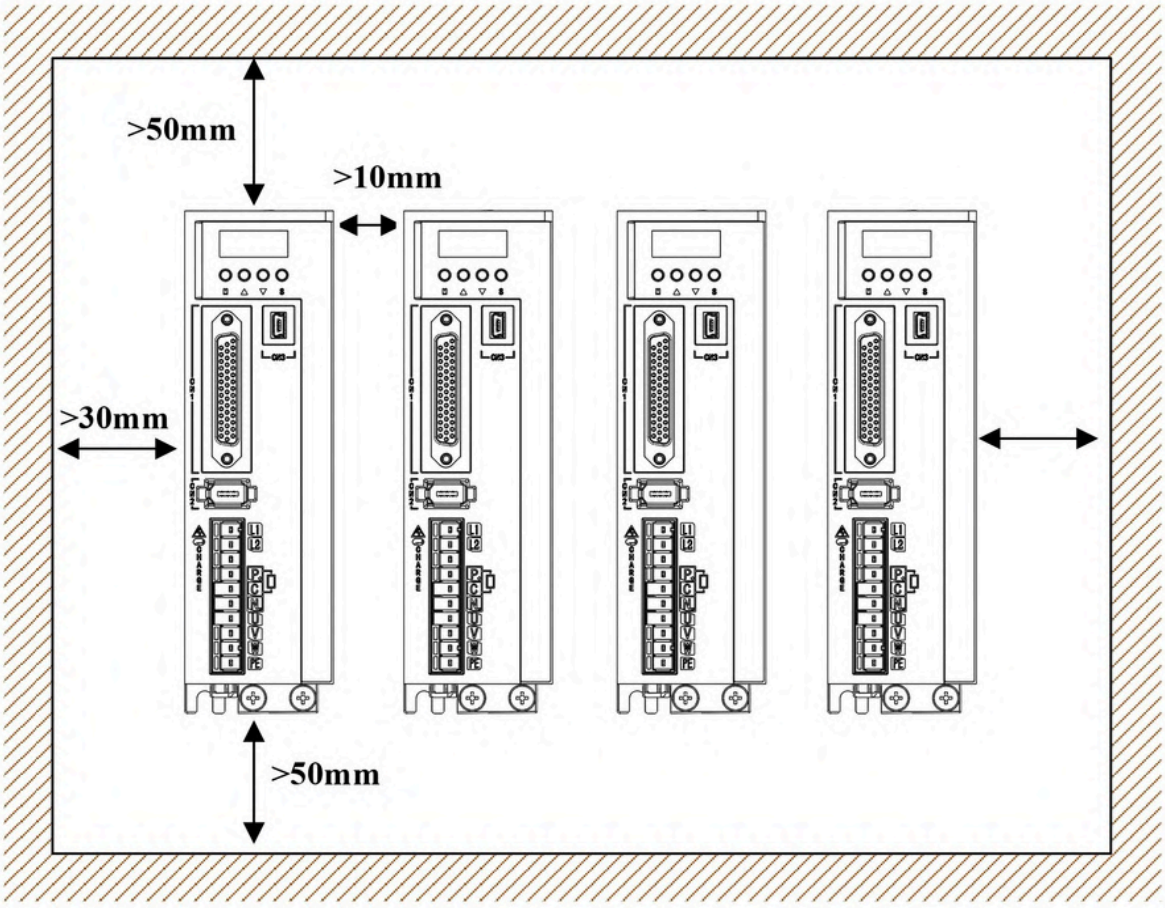
When installing a single drive in the control cabinet, ensure the spacing shown in Figure 2-3.

Figure 2-3 When installing a single drive to the control cabinet



When installing multiple drives in the control cabinet, ensure the spacing shown in Figure 2-4.

Figure 2-4 When installing multiple drives to the control cabinet



CHAPTER 3 WIRINGS AND CONNECTIONS

3.1 Wiring precautions

3.1.1 General precautions

Do not change the wiring during the power-on process to avoid electric shock or injury.

- Please have professional technicians perform wiring or inspection work.
- Please check the wiring and power supply carefully. The output circuit may be short-circuited due to incorrect wiring or application of abnormal voltage. When the above fault occurs, the brake does not operate, so it may cause mechanical damage or personal injury.
- When connecting the AC power supply and DC power supply to the driver, please connect to the designated terminals.

- Please confirm that the charging indicator (CHARGE) light is off at least 5 minutes after the power is turned off, and then perform wiring and inspection operations. Even if the power is turned off, high voltage may remain inside the drive. Therefore, do not touch the power terminal while the charge indicator (CHARGE) lamp is on.
- Please follow the precautions and procedures described in this manual for wiring and trial operation.
- Please perform wiring correctly and reliably. Connectors and connector pin arrangements vary by model. Be sure to confirm the pin arrangement with the technical documentation of the corresponding model.
- For input/output signal cables and encoder cables, use shielded twisted-pair wires or multi-core twisted-pair overall shielded wires.
- The main circuit cable of the driver must ensure that it can still work normally at 75°C.
- When wiring the main circuit terminals of the driver, be sure to observe the following precautions.
  - –Turn on the power of the driver after all the wiring including the main circuit terminal is completed.
  - –When the main circuit terminal is a connector type, remove the connector from the driver body before wiring.
  - –Only 1 wire can be inserted into 1 wire socket of the main circuit terminal.

– When inserting the wire, do not make the burr of the core wire come into contact with the adjacent wire and cause a short circuit.

- Install safety devices such as C-type MCBs to prevent short circuits in external wiring.

- When wiring, please use the cables specified by our company as much as possible.
- Please firmly tighten the fixing screw and locking mechanism of the cable connector to prevent the cable connector from falling off.
- Do not use the same bushing for strong current wires (main circuit cables) and weak current wires (input/output signal cables and encoder cables), and do not bind them together. When placing strong and weak current wires in separate casings, keep a distance of more than 30cm when wiring.
- □ Please use C-type MCB to protect the main circuit.
- □ The driver is directly connected to the commercial power supply, and no transformer is used for isolation. In order to prevent the accident of mixed contact between the servo system and the outside world, be sure to use the C-type MCB.
- □ Please install an earth leakage circuit breaker. To build a safer system, configure a residual current circuit breaker for both overload and short-circuit protection, or install a residual current circuit breaker for grounding short-circuit protection in combination with a C-type MCB.

3.1.2 Anti-interference countermeasures

Since the servo system is an industrial device, no measures are taken to prevent radio interference. Since the main circuit of the driver uses high-speed switching elements, peripheral equipment may be affected by switching disturbances. Please take anti-interference measures when using it near a private residence or when you are concerned about radio interference.

This drive has a built-in microprocessor. Therefore, it may be affected by noise from peripheral equipment of the drive. In order to suppress noise interference between the driver and peripheral equipment, the following anti-interference measures can be taken as required.

Please install the input command device and noise filter as close to the driver as possible.

Be sure to connect surge absorbers to the coils of relays, solenoid valves, and magnetic contactors.

Do not put strong and weak current wires in the same casing, and do not bundle them together. Also, keep a distance of 30cm or more when wiring.

Do not use the same power source as a welding machine, EDM, etc. Even if it is not the same power supply, when there is a high-frequency generator nearby, connect a noise filter to the input side of the main circuit power cable and control power

cable. For the connection method of the noise filter, see "Noise Filter".
Please perform proper grounding treatment. For grounding treatment, see "3.1.3 Grounding".

Noise filter

In order to ensure that the EMI filter can exert the maximum effect to suppress the interference of the servo drive, in addition to the installation and wiring of the servo drive according to the contents of the user manual, the following points should also be paid attention to:

1 Both the servo driver and the noise filter must be installed on the same metal plane.

2 The wiring should be as short as possible.

3 The metal plane should be well grounded.

4 The metal casing or grounding of the servo drive and noise filter must be fixed on the metal plane very reliably, and the contact area between the two should be as large as possible.

5 Use the shielded copper mesh cable for the motor power line (it is better if there is a double shield).

6 The shielded copper mesh at both ends of the motor cable must be grounded with the shortest distance and the largest contact area.

3.1.3 Grounding

Please observe the following guidelines for grounding. Malfunctions due to interference can also be prevented if proper grounding is taken. When wiring the grounding cable, note the following:

- The grounding resistance is 100mΩ or less.
- Must be grounded at a single point.
- When the servo motor and the machine are insulated from each other, please ground the servo motor directly.

Ground of the motor frame or ground of the motor

When the servo motor is grounded mechanically, the switching interference current will flow out from the main circuit of the drive through the floating capacitor of the servo motor.
To prevent this phenomenon, be sure to connect the frame terminal (FG) or ground terminal (FG) of the servo motor to the ground terminal of the drive. In addition, the ground terminal must be grounded. ⏚

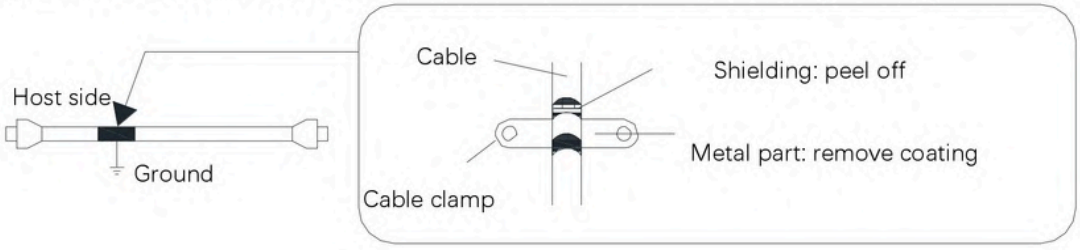
When noise occurs in the cable for I/O signals

If there is interference in the I/O signal cable, connect the shield wire of the I/O signal cable to the connector housing before grounding. When the motor power cable is covered with a metal tube, single-point grounding shall be performed on the metal

bushing and the grounding box.

Fixing of cables

Secure the shield portion of the cable with a conductive fastener (cable clamp) to the grounding plate.

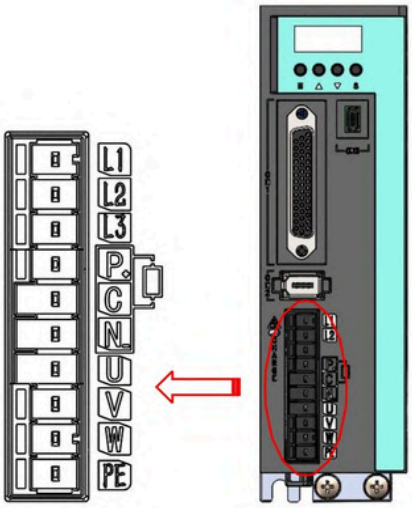


Ferrite Coil

Although ferrite coils can be used to solve specific EMC application problems, they are not necessarily required.

3.2 Main circuit wiring

3.2.1 Terminal arrangement and definition



Terminal	Name	Remarks
L1、L2、L3	Power input terminal	▸ AC 200V～240V，-15%～+10%，50Hz/60Hz; ▸ L1、L2：A type（≤750W）single-phase power supply; ▸ L1、L2、L3：B/C type（>750W）single/three-phase power supply;
P、C	Regenerative resistor terminal	External regenerative resistor.
N	DC bus connection negative terminal	When multiple servo drives adopt a common DC bus structure, connect all drives P and N respectively
U、V、W	Motor power connection terminal	Connect the U, V, W phases of the motor.
PE	Ground terminal	Connect the power or motor ground terminal. Alternatively, connect to the ground terminal of the drive heatsink.

3.2.2 Wiring instructions

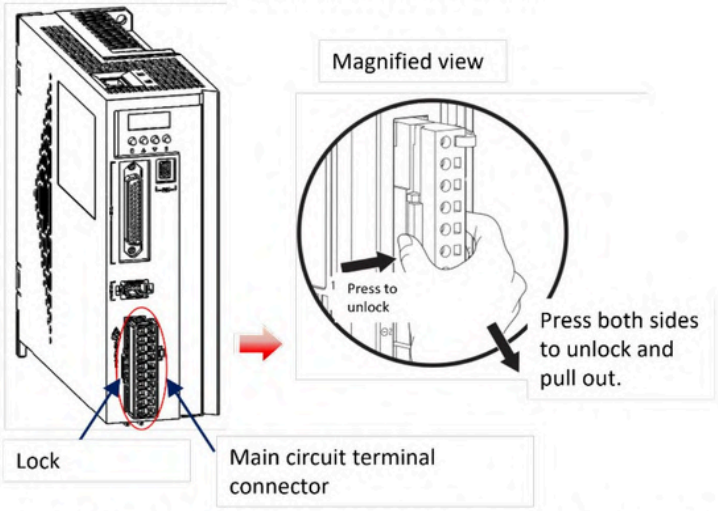
- Do not turn ON the power of servo until all wiring work including the main circuit terminal connector is completed.
- Remove the removable main circuit terminal connector before wiring.
- When inserting the wire, do not short-circuit to the adjacent wire.

The following items are required before preparing to wire the power connection terminals.

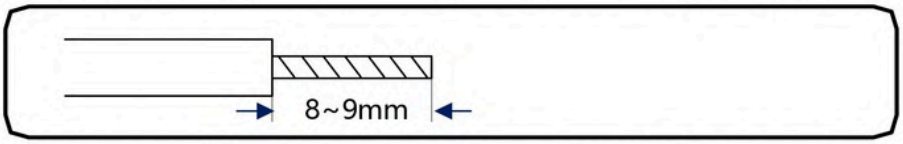
Prepare items	Remarks
Slotted screwdriver or crimper	Flat-blade screwdriver: commercially available products with a blade width of 3.0mm to 3.5mm
cold press terminal	Crimper: Standard accessory for servo drives
wiring pliers	Sleeve-type products with a cross-section of about 1.5mm2 to 2.5mm2

Follow the instructions below to wire the power connection terminals.

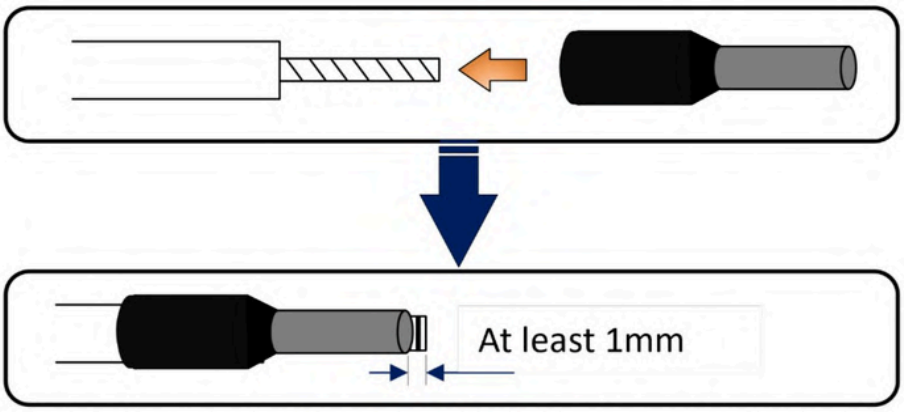
Step 1 Remove the main circuit terminal from the connector of the drive.



Step 2 Use wire pliers to strip off the outer layer of the connecting wire, generally 8mm to 9mm.

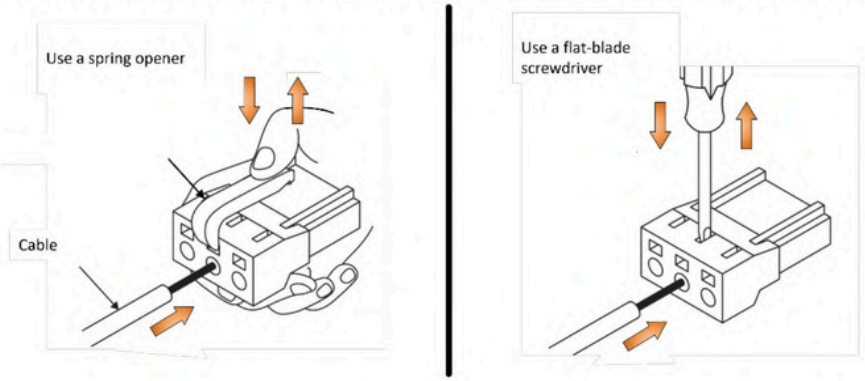


Step 3 Insert the core of the wire into the cold-pressed terminal (the core should be exposed at least 1mm from the cold-pressed terminal).



Step 4 Use wire pliers to compress the wire with the ferrules and trim the exposed wire ends.

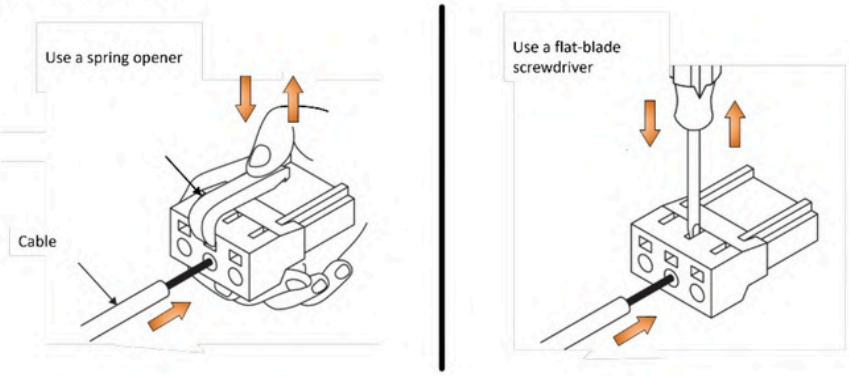
Step 5 Use a tool (spring opener or a flat-blade screwdriver with a 3~3.5mm blade) to insert the pressed wire into the connection terminal (take a 3-core terminal as an example).



Step 6 With the wires inserted into the terminals, pull out the spring splitter or flat-blade screwdriver.

Step 7 Repeat the above operation to make the necessary wiring.

Step 8 To change the wiring, unplug the wire from the connection terminal. When pulling out, use a tool (spring opener or flat-blade screwdriver) to depress the spring of the connection terminal, and then pull out the wire.



Step 9 After the wiring is completed, install the main circuit connection terminal and the control circuit connection terminal to the connector of the drive.

Finish

3.2.3 Cable specifications

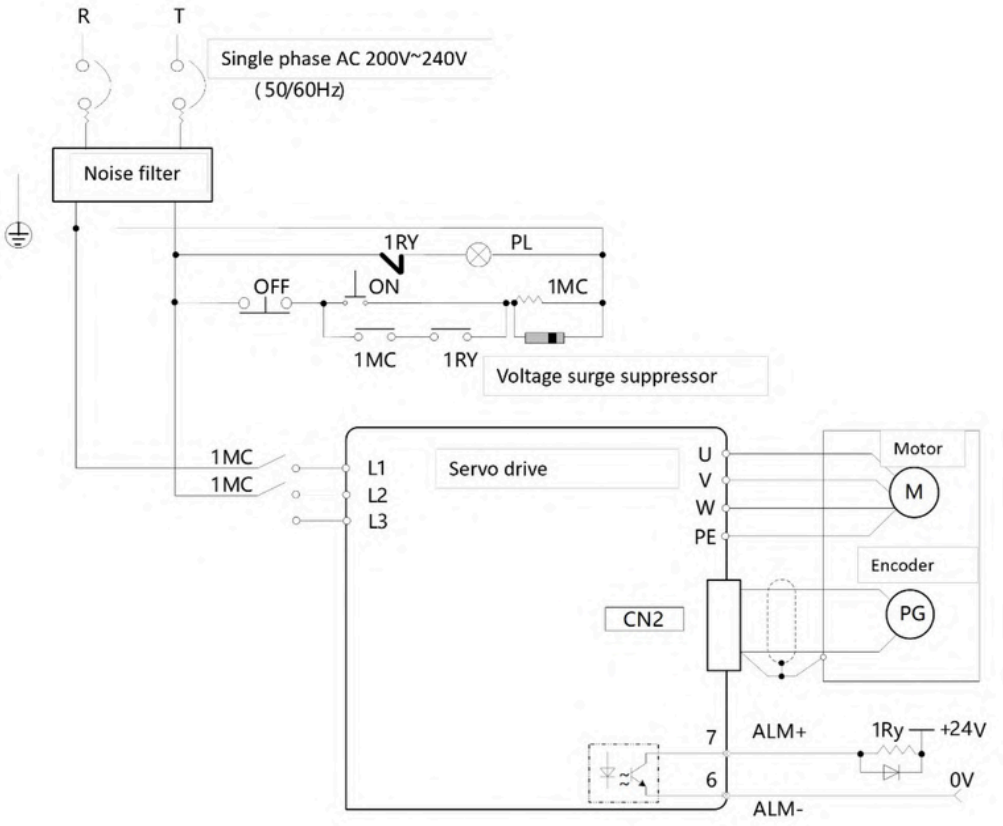
The wiring specification of the driver varies with the model.

External cable name	**Terminal**	**Diameter mm2(AWG)**				
		XDQ1-				
		04	**08**	**10**	**15**	**20**
Main circuit cable	L1、L2、L3	1.25(AWG-16)	1.5(AWG-15)		2.0(AWG-14)	
Control power cable	24V，0V	1.25(AWG-16)				
Motor power cable	U、V、W、PE	1.25(AWG-16)	1.5(AWG-15)		2.0(AWG-14)	
Regenerative cable	P，C	1.25(AWG-16)				
Ground wire	⏚	Above 2.0(AWG-14)				

3.3 Main circuit power cable connection

- Please design the power-on sequence as follows: After outputting the "servo alarm" signal, the main circuit power supply should be turned off.
- Use a circuit breaker or fuse for wiring to protect the main circuit.
- Install an earth leakage circuit breaker.
- Please avoid frequent ON/OFF of the power supply.
- Please note that the power-off time of the model without braking resistor is longer.

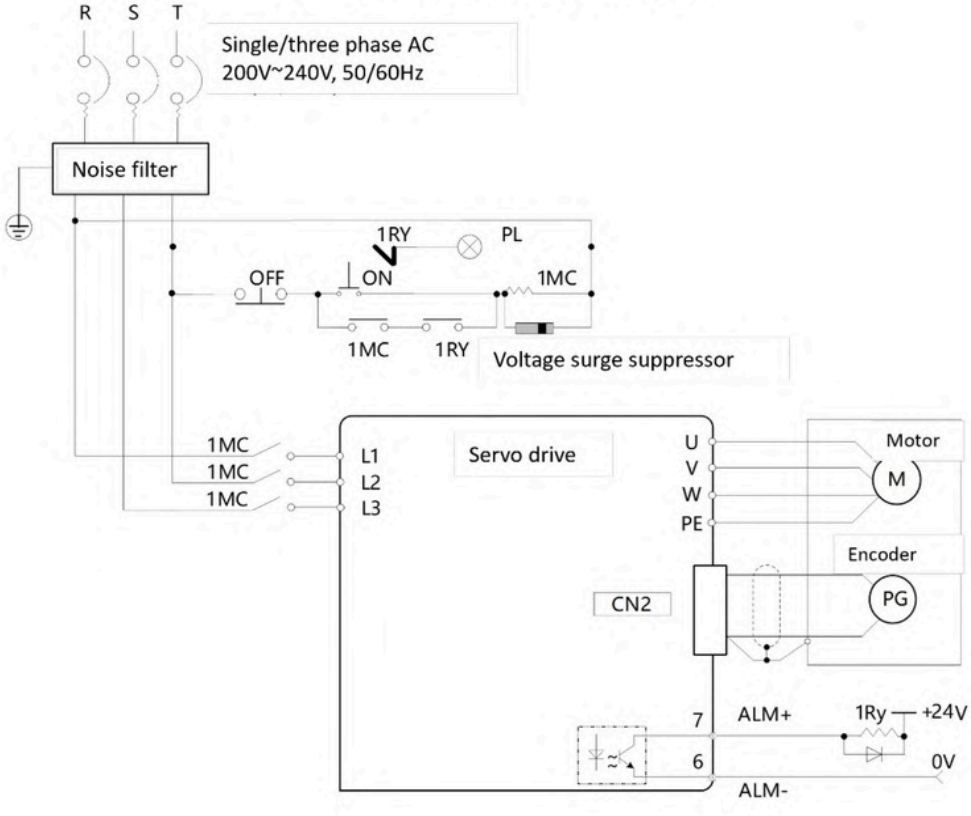
Single-phase AC220V power input



Notes:

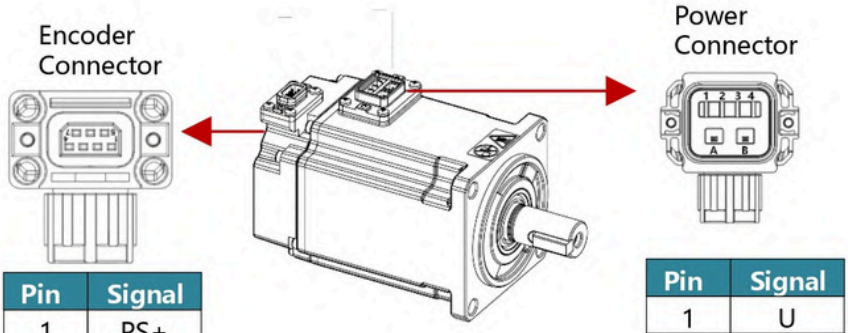
1. Type A chassis (≦750W) only supports single-phase 220V power input.
2. Type B/C chassis (>750W) can support both single or three phase 220V power input.

Three-phase AC220V power input



3.4 Motor Terminal Description

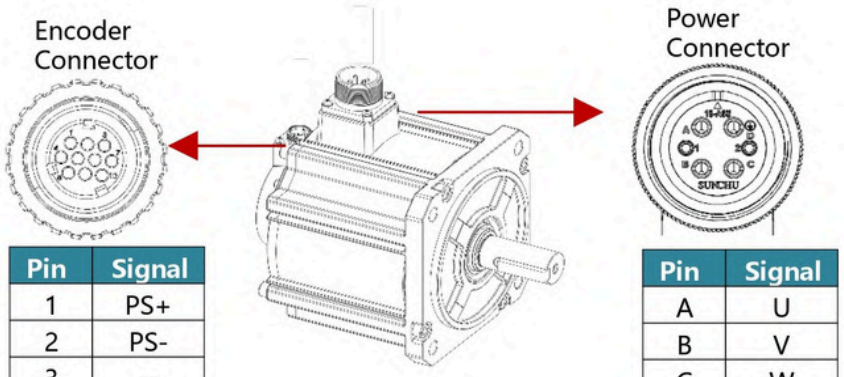
3.4.1 Plug-in terminal interface (60/80 flange motor socket)



Pin	Signal
1	PS+
2	PS-
3	BAT+
4	BAT-
5	PG5V
6	PG0V
7	PE

Pin	Signal
1	U
2	V
3	W
4	PE
A	(BK)
B	(BK)

3.4.2 Aviation plug terminal interface (130 flange motor socket)



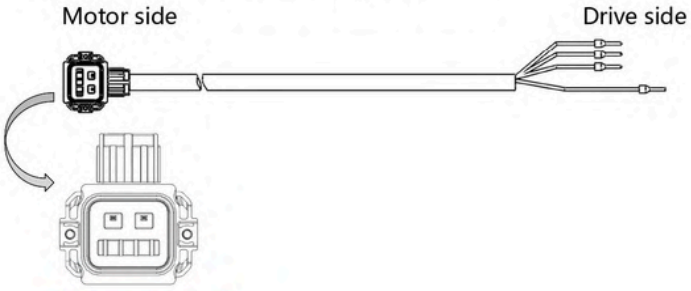
Pin	Signal
1	PS+
2	PS-
3	--
4	PG5V
5	BAT-
6	BAT+
7	--
8	--
9	PG0V
10	PE

Pin	Signal
A	U
B	V
C	W
D	PE
1	(BK)
2	(BK)

3.5 Motor power cable connections

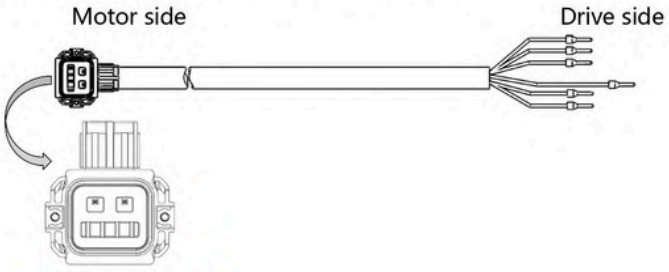
3.5.1 Plug-in power cable (60/80 flange motor)

▸LQ1-P0M0A-□□ / LQ1-P0M0B-□□ (without brake power cable)



Pin	Signal
1	U
2	V
3	W
4	PE
5	--
6	--

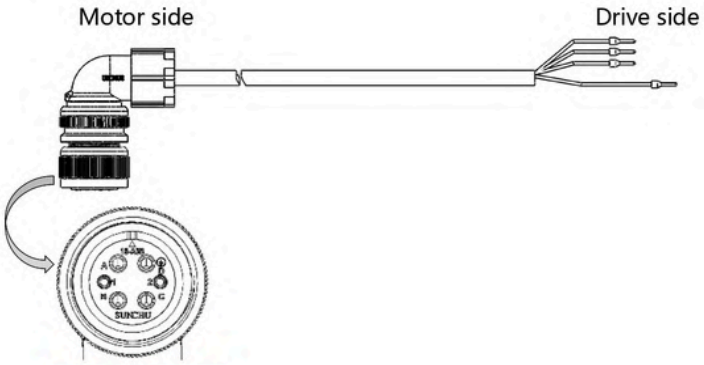
▸LQ1-P0B0A-□□ / LQ1-P0B0B-□□ (**with** brake power cable)



Pin	Signal
1	U
2	V
3	W
4	PE
5	BK
6	BK

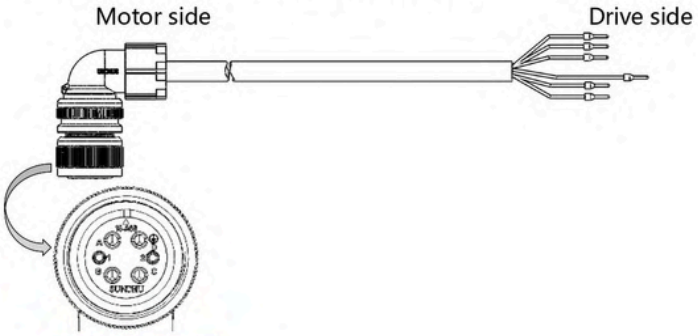
3.5.2 Aviation plug power cable

▸LQ1-P0M2C-□□ / LQ1-P0M2D-□□ (without brake power cable)



Pin	Signal
A	U
B	V
C	W
D	PE
1	--
2	--

▸LQ1-P0B2C-□□ / LQ1-P0B2D-□□ (with brake power cable)

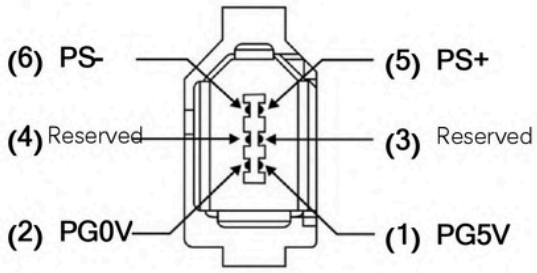


Pin	Signal
A	U
B	V
C	W
D	PE
1	BK
2	BK

3.6 Motor encoder cable connections

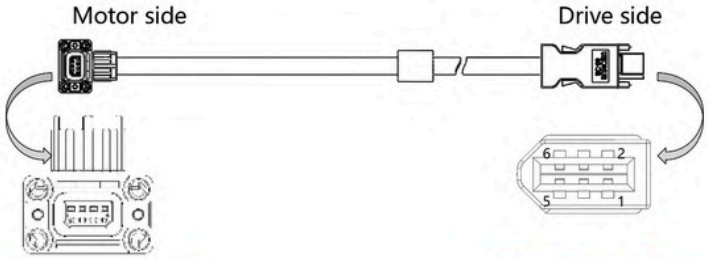
3.6.1 Drive side encoder interface CN2

▸ Socket appearance and signal



3.6.2 Plug-in encoder cable (60/80 motor)

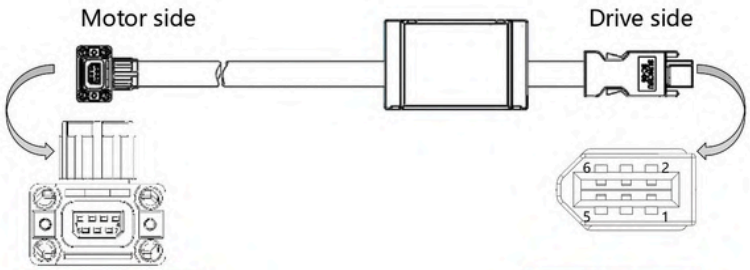
▸LQ1-E0A0-□□ (**Encoder cable without battery**)



Pin	Signal
1	PS+
2	PS-
3	--
4	--
5	PG5V
6	PG0V
7	PE

Pin	Signal
1	PG5V
2	PG0V
3	--
4	--
5	PS+
6	PS-

▸LQ1-E0B0-□□ (**Encoder cable with battery**)

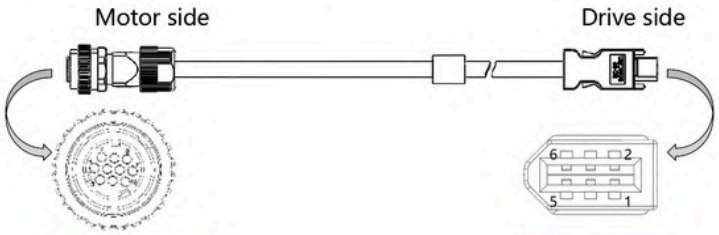


Pin	Signal
1	PS+
2	PS-
3	BAT+
4	BAT-
5	PG5V
6	PG0V
7	PE

Pin	Signal
1	PG5V
2	PG0V
3	--
4	--
5	PS+
6	PS-

3.6.3 Aviation plug encoder cable

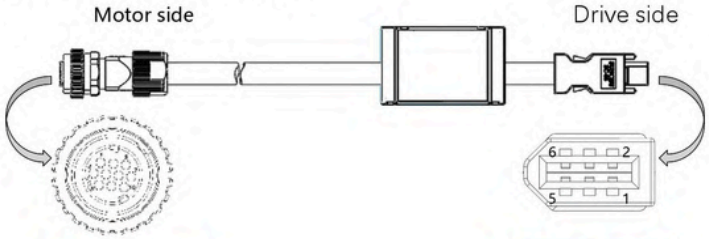
▸LQ1-E0A2-□□ (**Encoder cable without battery**)



Pin	Signal
1	PS+
2	PS-
3	--
4	PG5V
5	--
6	--
7	--
8	--
9	PG0V
10	PE

Pin	Signal
1	PG5V
2	PG0V
3	--
4	--
5	PS+
6	PS-

▸LQ1-E0B2-□□ (**Encoder cable with battery**)



Pin	Signal
1	PS+
2	PS-
3	--
4	PG5V
5	BAT -
6	BAT+
7	--
8	--
9	PG0V
10	PE

Pin	Signal
1	PG5V
2	PG0V
3	--
4	--
5	PS+
6	PS-

Note:

1. If the communication encoder is absolute value type, use BAT+ and BAT- to connect the external battery. If the communication encoder is incremental, the BAT+ and BAT- signals are not used.

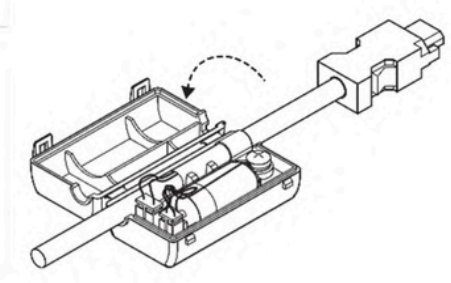
3.6.4 Install or replace the battery

■ When using an absolute encoder motor, a battery needs to be connected. Battery type: LS 14500 (3.6V, AA type).
■If warning A.930 or alarm E.55A occurs, please replace the battery as soon as possible. After replacing the battery, please perform the "clear multi-lap alarm" and "clear multi-lap information" operations.

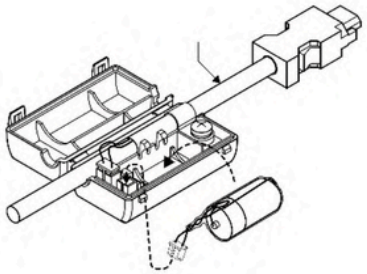
Follow the instructions below to install or replace the battery of the absolute encoder cable.

Step 1 Keep the input power of the drive connected.

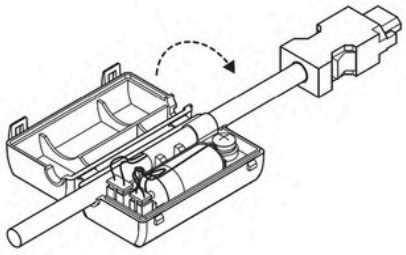
Step 2 Open the battery compartment cover on the encoder cable.



Step 3 Remove the old battery and install the new one.



Step 4 Close the cover of the battery compartment.



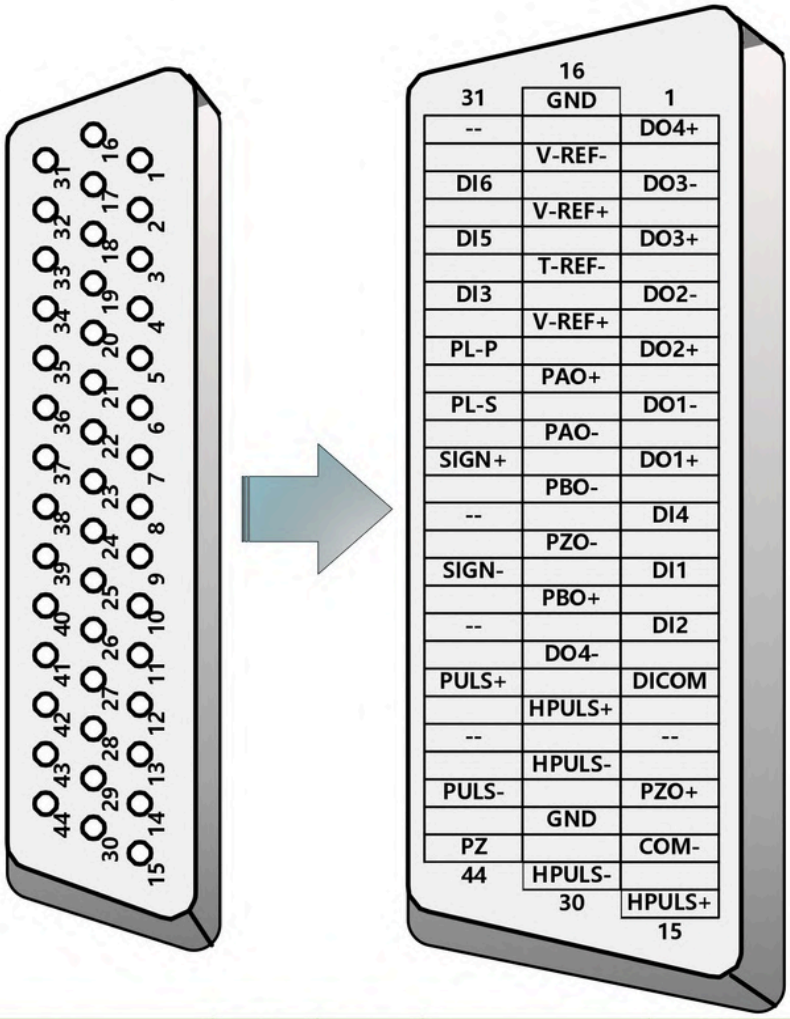
Step 5 Disconnect and reapply input power to the drive.

Step 6 Use the operation panel to execute Fn010 and Fn011 or use PC software to reset the alarm.

Step 7 After confirming that the alarm no longer occurs, the drive can run again.

3.7 Connection of I/O cable

3.7.1 Arrangement of connector CN1 terminal socket



31	--	--	16	--	--	1	DO4+	Digital output 4 +
32	DI6	Digital input 6	17	V-REF-	Velocity reference input -	2	DO3-	Digital output 3 -
33	DI5	Digital input 5	18	V-REF+	Velocity reference input +	3	DO3+	Digital output 3 +
34	DI3	Digital input 3	19	T-REF-	Torque reference input -	4	DO2-	Digital output 2 -
35	PL-P	Open collector pulse input (24V)	20	T-REF+	Torque reference input +	5	DO2+	Digital output 2 +
36	PL-S	Open collector sign input (24V)	21	PAO+	Encoder output A +	6	DO1-	Digital output 1 -
37	SIGN+	Sign input +	22	PAO-	Encoder output A -	7	DO1+	Digital output 1 +
38	--	--	23	PBO-	Encoder output B -	8	DI4	Digital input 4
39	SIGN-	Sign input -	24	PZO-	Encoder output Z -	9	DI1	Digital input 1
40	--	--	25	PBO+	Encoder output B +	10	DI2	Digital input 2
41	PULS+	Pulse input +	26	DO4-	Digital output 4 -	11	DICOM	IO power supply
42	--	--	27	HSIGN+	High speed sign input +	12	--	--
43	PULS-	Pulse input -	28	HSIGN-	High speed sign input -	13	PZO+	Encoder output Z +
44	--	--	29	GND	Signal ground	14	--	--
			30	HPULS-	High speed pulse input -	15	HUPLS+	High speed pulse input +

■The signal definitions corresponding to the IO pins of all drivers are the same.

■The input and output signals can be assigned by Pn500~Pn513.

■Do not use empty terminals.

3.7.2 Signal description of connector CN1

■ **Input signal and functions (default settings)**

Signal	Pin	Function	
DI1 (/S-ON)	9	Servo enabled: The motor becomes powered on.	
DI2 (/C-SEL)	10	Control mode switching: Two control modes switching.	
DI3 (P-OT)	34	Positive drive prohibited	Over-travel Prohibit: Stop the servo motor when it is ON.
DI4 (N-OT)	8	Negative drive prohibited	
DI5 (/CLR)	33	Position deviation clear: clear deviation pulse in position control.	
DI6 (/ALM-RST)	32	Alarm reset: Release the servo alarm state.	
DICOM	11	User 24VDC power supply for IO.	
PULS+	41	Low-speed channel pulse (differential≤500Kpps, collector≤200Kpps) ◆ Sign + pulse train ◆ CCW+CW pulse train ◆ A+B pulse train	
PULS-	43		
SIGN+	37		
SIGN-	39		
HPULS+	15	High-speed channel pulse (differential≤4Mpps): ◆ Sign + pulse train ◆ CCW+CW pulse train ◆ A+B pulse train	
HPULS-	30		
HSIGN+	27		
HSIGN-	28		
PL-P	35	Collector pulse command input PULS power supply (24V)	
PL-S	36	Collector pulse command input SIGN power supply (24V)	
V-REF+	18	Analog speed command. Maximum input voltage: ± 12 V	
V-REF-	17		
T-REF+	20	Analog torque command. Maximum input voltage: ± 12 V	
T-REF-	19		

■ **Output signal and functions (default settings)**

Signal	Pin	Function	
PAO+	21	A-phase signal	Two-phase pulse (A-phase, B-phase) encoder frequency division output signal
PAO-	22		
PBO+	25	B-phase signal	
PBO-	23		
PZO+	13	Z-phase signal	Origin pulse (Z-phase) signal
PZO-	24		
DO1+ (ALM+)	7	Servo alarm: OFF when abnormal state is detected.	
DO1- (ALM-)	6		
DO2+ (CZ+)	5	Optocoupler output Z-phase pulse	
DO2- (CZ-)	4		
DO3+ (BK+)	3	Motor brake signal output	
DO3- (BK-)	2		
DO4+ (COIN+)	1	Positioning complete: In the position control mode, when the deviation pulse is less than Pn606 (positioning complete width), this signal is valid.	
DO4- (COIN-)	26		
SG	29	Signal ground	

3.7.3 Wiring instructions

1) Low-speed command input circuit

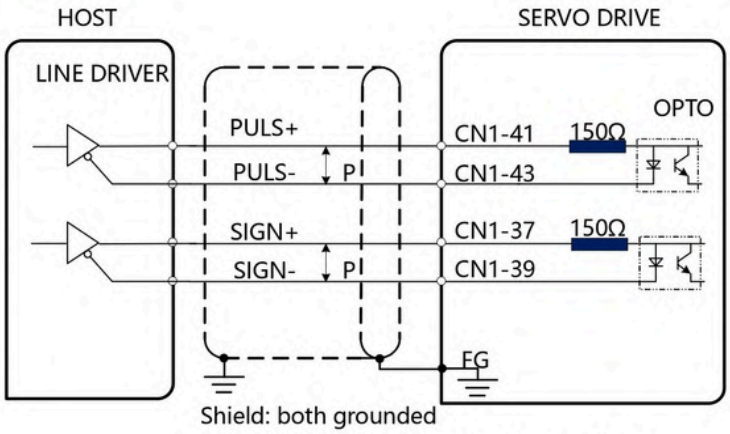
Position command input circuit

The following describes terminals 41-43 (low-speed command pulse input) and 37-39 (low-speed command symbol input) of the CN1 connector.

The output circuit of the command pulse from the host device side can be selected from line driver output and open collector output. The descriptions are listed below.

Do not directly wire 24V power to the SIGN+, SIGN-, PULS+ and PULS- pins, otherwise the related circuits will be damaged.

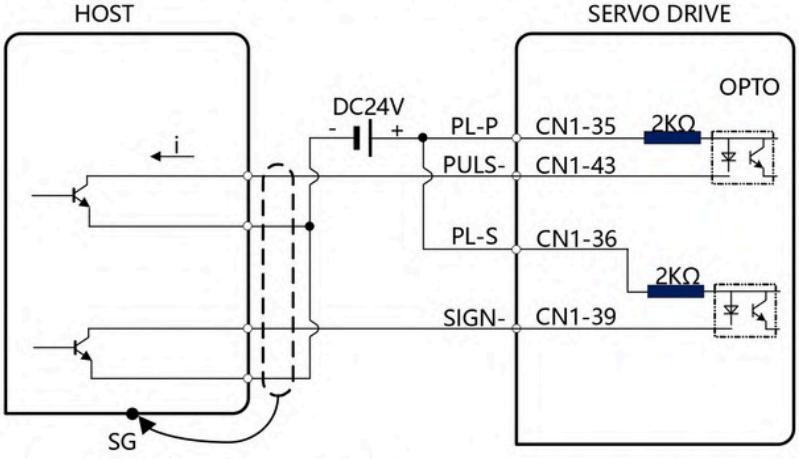
■ **Line driver output**



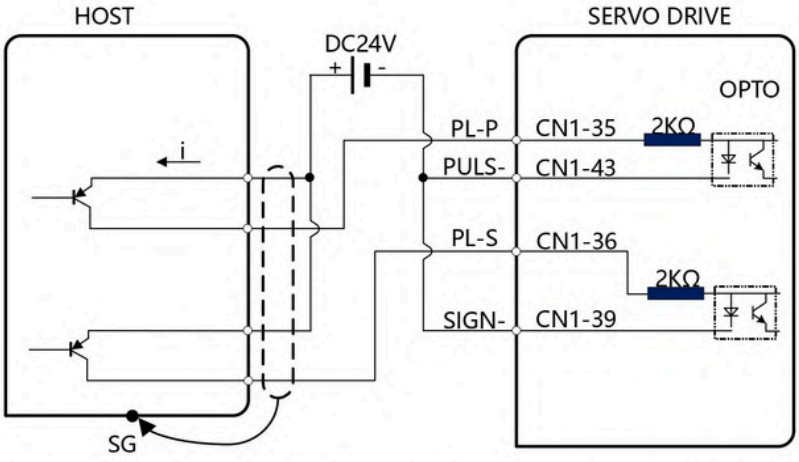
Line driver: TI AM26LS31 or equivalent

■ **Open collector output**

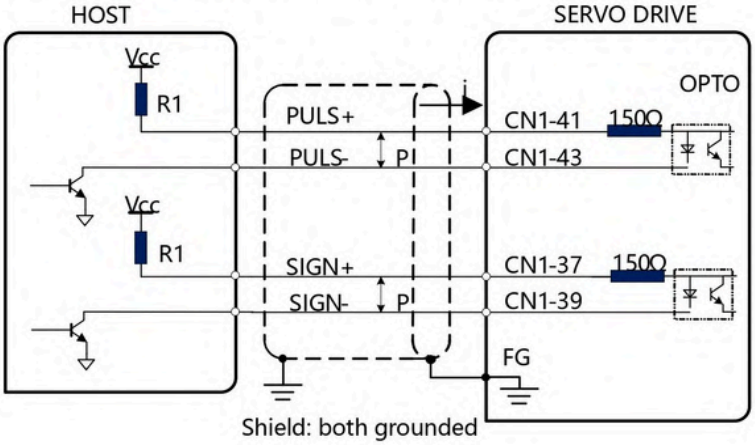
a) **The host computer is NPN type open-collector output, using external power supply, connection method 1 (using the internal 2K resistor of the driver).**



b) **The host computer is a PNP type open collector output, using an external power supply, connection method 2 (using the internal 2K resistor of the driver).**



c) **When the host computer is open-collector output and provides 5VDC, 12VDC, 24VDC signal power, connection method 3 (using an external pull-up resistor).**



- Please set resistor R1 within the range of input current value i = 10～15mA

  When Vcc is 24V, R1=2KΩ

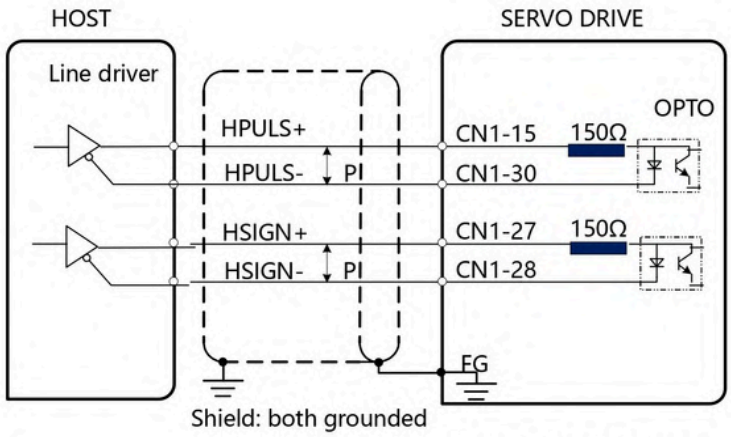
  When Vcc is 12V, R1=510Ω

  When Vcc is 5V, R1=180Ω

- Generally, the pulse input of the open collector mode is susceptible to interference. There are mainly the following ways to reduce the interference:
- Wiring: The shielding layer of the control line is connected to the power ground at the end of the host computer (such as 24V power supply, the shielding is connected to the 24V ground), and the shielding of the control line at the driver end is suspended;
- Modify the parameters of Pn201.0: the larger the parameter setting, the larger the filter and the lower the input cut-off frequency;

2) High-speed command input circuit

The following describes terminals 15-30 (high-speed command pulse input) and 27-28 (high-speed command symbol input) of the CN1 connector. The output circuit of the command pulse on the host device side can only be output from the 5V line driver.



Line driver: TI AM26LS31 or equivalent

3) Wiring of Sequence Input Signals

◆Optocoupler Input Loop

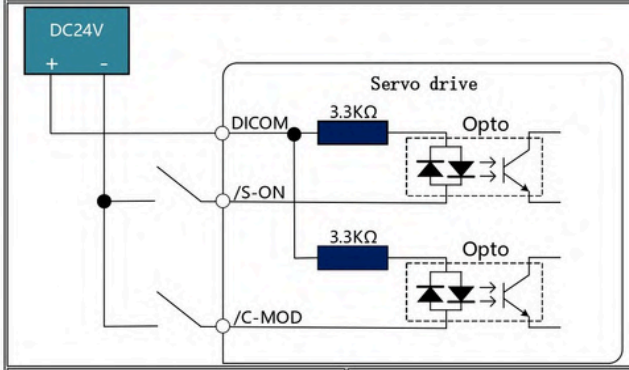
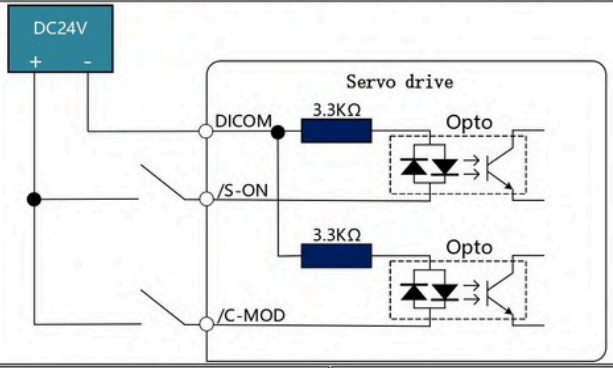
The input loop of the servo unit uses a bidirectional photocoupler. Please select common collector loop connection or common emitter loop connection according to the specifications of the machine.

The input signal can use common cathode connection and common anode connection.

Input signal—CN1 terminal pin						**CN1 common pin**
DI1	DI2	DI3	DI4	DI5	DI6	DICOM
CN1-9	CN1-10	CN1-34	CN1-8	CN1-33	CN1-32	CN1-11

Taking /S-ON as an example, Figure 3-1 shows the wiring diagram of using an external DC24V power supply.

Figure 3-1 Input signal wiring example

Common collector circuit		**Common Emitter Circuit**	
			
The polarity of the input signal		**The polarity of the input signal**	
Optocoupler	**Internal signal level**	**Optocoupler**	**Internal signal level**
ON	L	ON	L
OFF	H	OFF	H

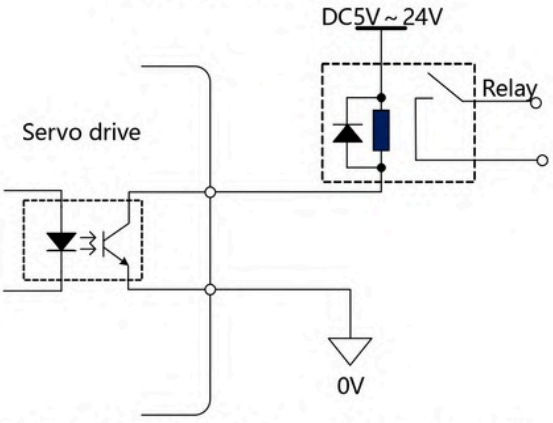
Users can assign he input signals through Pn500~Pn505 include: /S-ON (servo ON), /C-SEL (control mode switching), P-OT (forward side drive prohibited), N-OT (reverse side prohibited) drive), /CLR (position deviation clear), /ALM-RST (alarm reset), /G-SEL (gain switching), etc.
For signal assignment, see "5.7 IO Signal Assignment".

4) Sequence output signal wiring

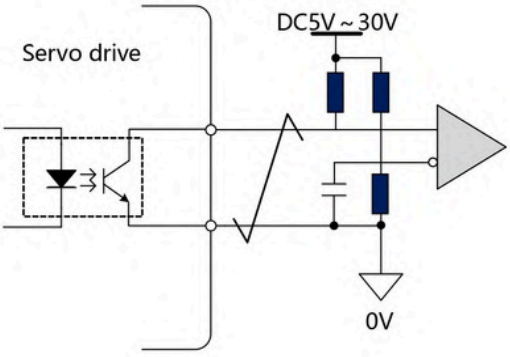
◆Optocoupler output circuit

Servo alarm output (ALM) signal, servo ready output (S-RDY) signal and other sequence control output signals are photocoupler output circuits.

Relay circuit example



Line receiver example



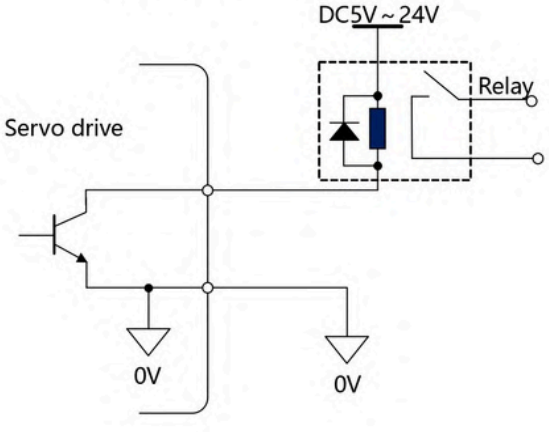
Maximum allowable voltage & current for optocoupler output:

- Maximum voltage: DC30V
- Maximum current: DC5~50mA

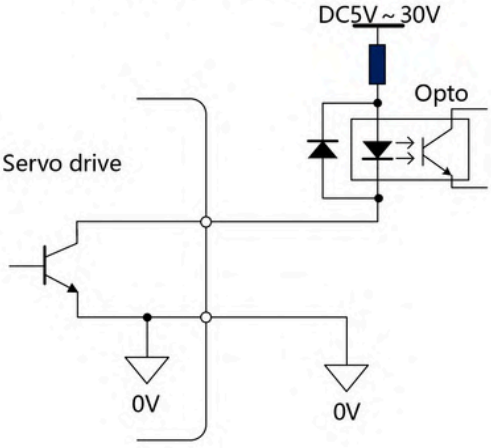
◆Open collector output circuit

The PZ-OUT signal is an open-collector transistor output loop. Please receive via optocoupler loop, relay loop or linear receiver loop.

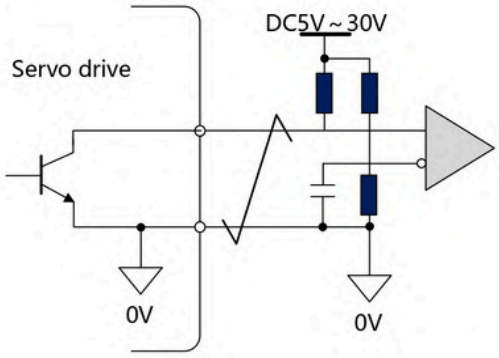
Relay circuit example



Optocoupler circuit example



Line receiver circuit example



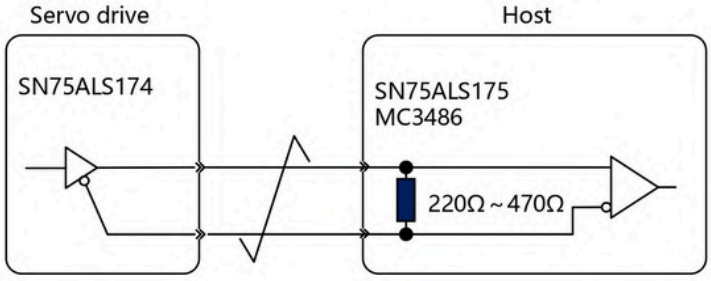
Maximum allowable voltage & current for optocoupler output:

- Maximum voltage: DC30V
- Maximum current: DC5~50mA

♦Line driver output circuit

The following describes terminals 21-22 (A-phase signal), 25-23 (B-phase signal), and 13-24 (Z-phase signal) of the CN1 connector.

Convert the serial data of the encoder into 2-phase (A-phase, B-phase) pulse output signals (PAO, PAO-, PBO, PBO-) and the encoder's 1-turn origin signal (PZO, PZO-) through line driver circuit. On the host device side, please use the line receiver.

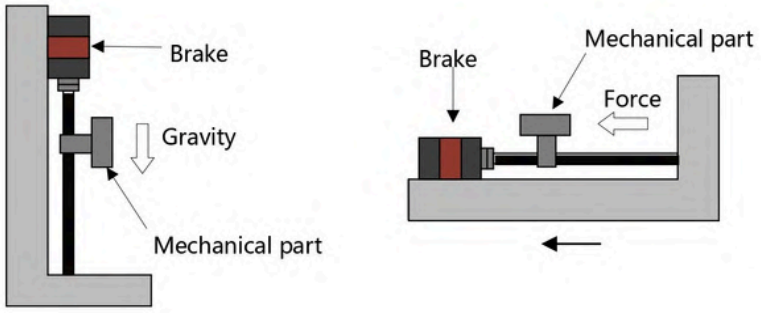


Users can assign he output signals through Pn510~Pn513 include: ALM (alarm signal output), CZ (encoder Z pulse output), BK (brake control output), COIN (positioning completion output), TGON (speed detection output) , S-RDY (servo ready output), TLC (torque limit detection output), OT (overtravel signal output), TREACH (torque arrival). For signal assignment, see "5.7 IO Signal Assignment".

3.7.4 Brake Wiring

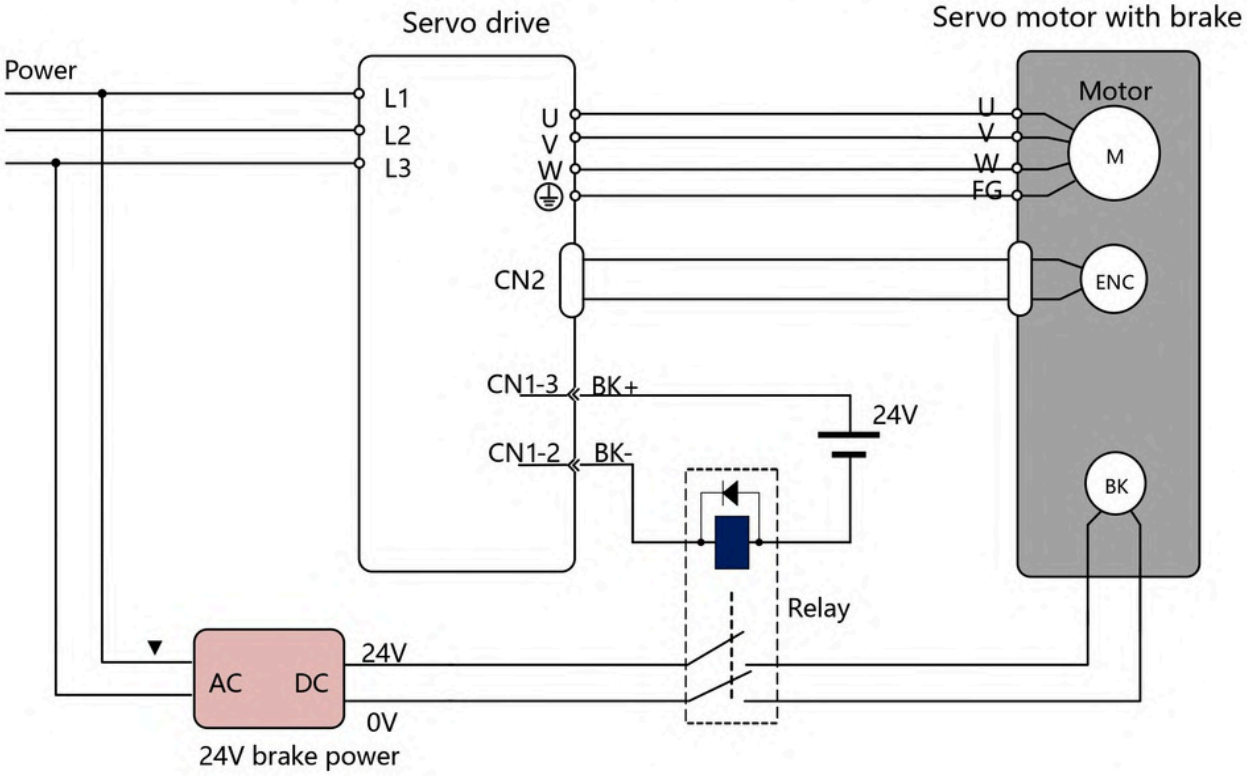
The holding brake is used when a servo motor drives a vertical axis, etc. When the power of the servo drive is OFF, use a servo motor with a brake to keep the movable part from moving due to gravity, as shown in Figure 3-2.

Figure 3-2 Schematic diagram of the holding brake



- The brake in the built-in servo motor is a non-excitation operation type holding special brake, which cannot be used for braking, but can only be used to hold the stopped state of the servo motor.
- The length of the motor brake cable needs to consider the voltage drop caused by the cable resistance, and the voltage for the normal operation of the brake should be at least 21V.
- The wiring of the brake input signal has no polarity, please equip the brake with an independent 24V external power supply.
- The recommended diameter of the input signal wire of the brake is 0.5mm².

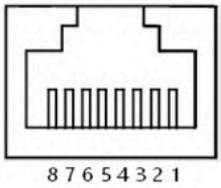
Figure 3-3 Schematic diagram of brake control signal connection



3.8 Connection of communication cable

3.8.1 RS485 & CAN communication wiring

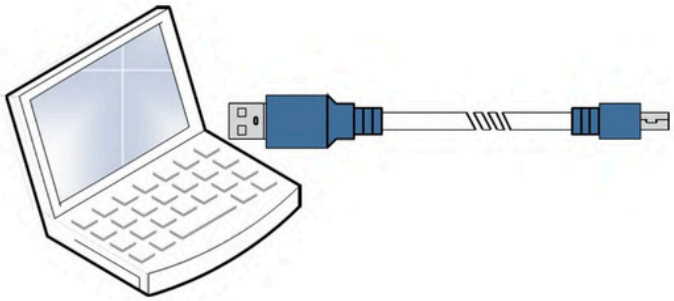
Connectors CN4 and CN5 are RJ45 communication sockets, which are used for RS485 and CAN communication.
RJ45 socket signal definition

CN4，CN5 socket	Pin	Signal	Function
	1	RS485+	RS485 positive signal
	2	RS485-	RS485 negative signal
	3	CANH	CAN positive signal
	4	NC	Empty, can not be wired
	5	NC	Empty, can not be wired
	6	CANL	CAN negative signa
	7	GND	Digital ground
	8	NC	Empty, can not be wired

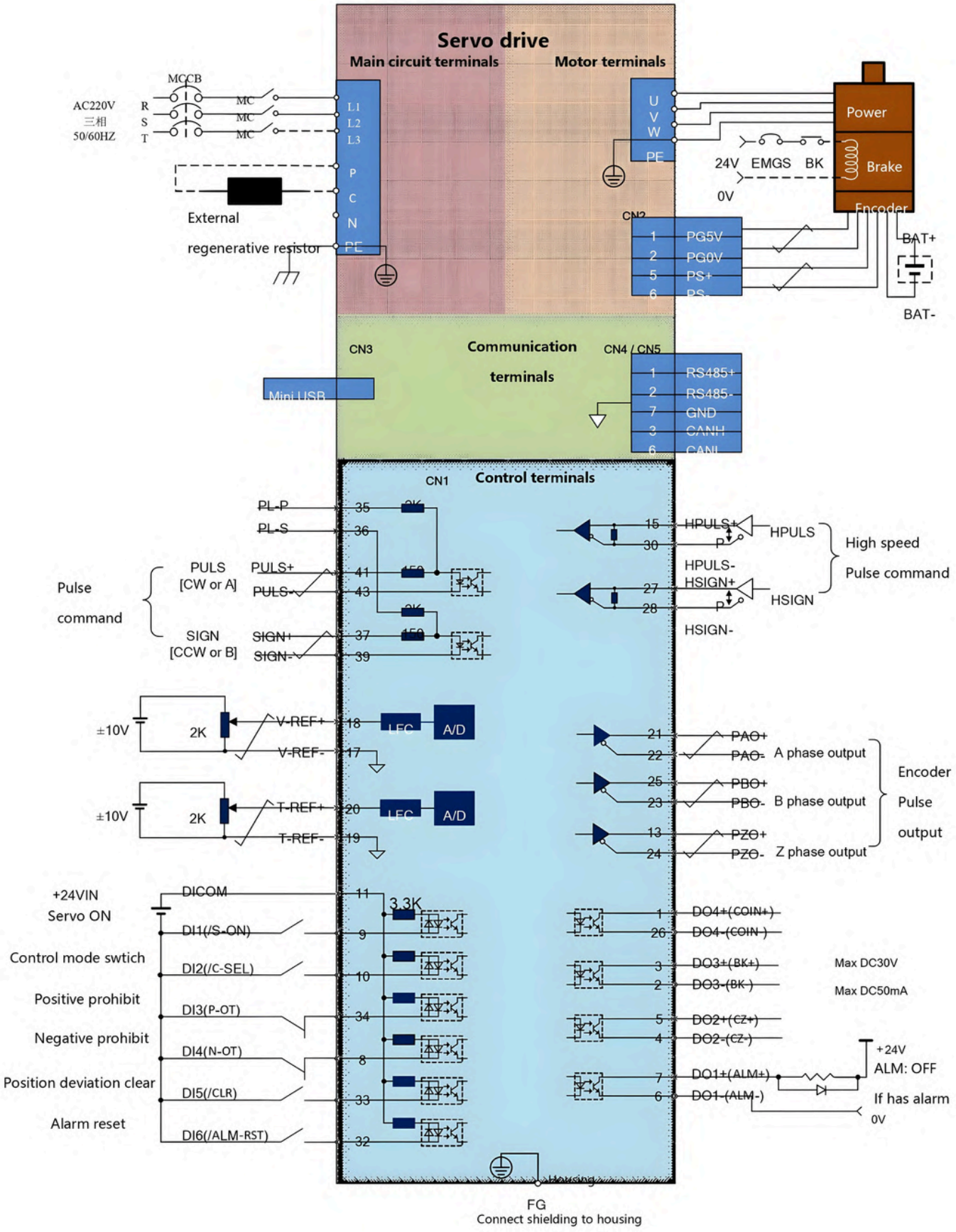
Please use Category 5e shielded/double shielded twisted pair cable (CAT5e SFTP). It is recommended to use metal shielded connectors to prevent signal interference.

3.8.2 Connection to PC software

Users can use a Mini-USB cable to connect the PC to the drive for online operations.



3.9 Standard Wiring Diagram

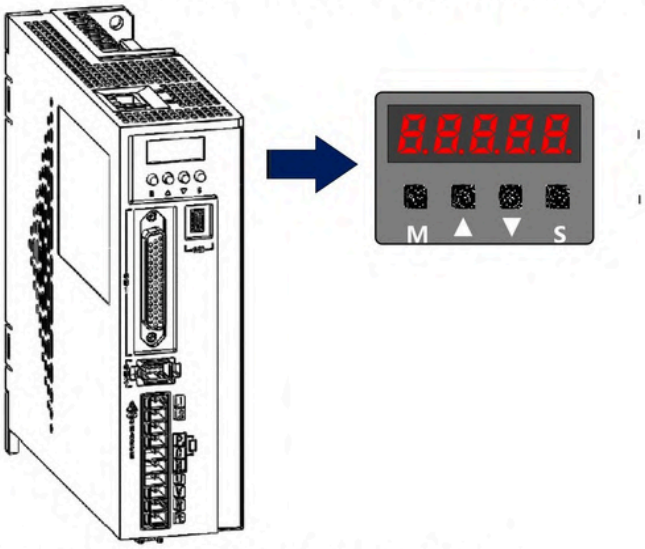


CHAPTER 4 PANEL OPERATIONS

4.1 Operation panel

4.1.1 Panel Composition Description

Figure 4-1 Operation panel illustration



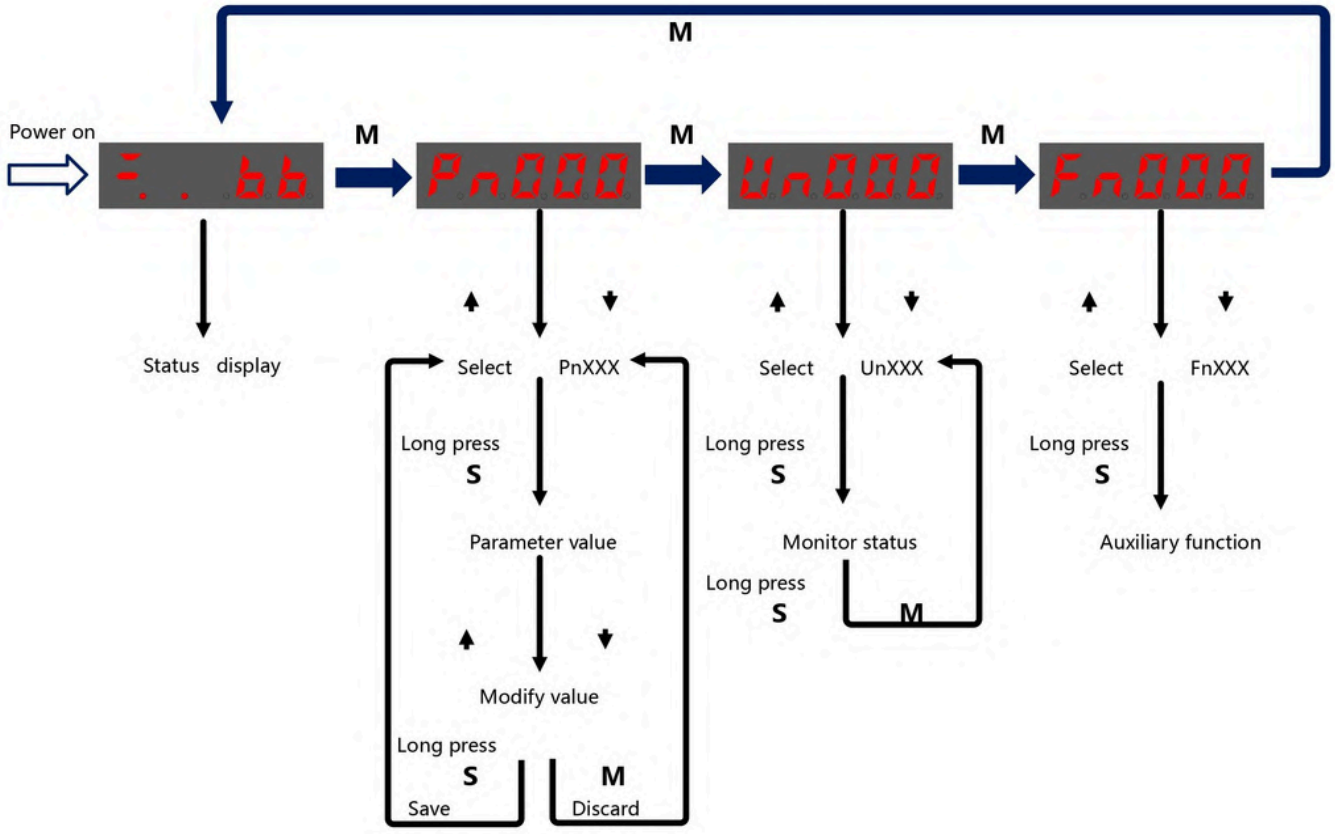
The description of the operation keys is shown in the table below.

Key	Function
M	Mode switch/setting cancel
▲	Increase the value of the blinking bit
▼	Decrease the value of the blinking bit
S	Short press (SHIFT): the digital tube flashes and shifts Long press (SET): data setting/exit

4.1.2 Panel Display Description

The basic mode can be switched through the operation panel, and operations such as status display, parameter setting, and running commands can be performed at the same time. Basic modes include status display mode, auxiliary function mode, monitoring mode, and parameter setting mode. After pressing the [M] key, the modes are switched in the order shown in Figure 4-2.

Figure 4-2 Display switching sequence



4.2 Status display mode

After the power is turned on, the operation panel will display the current status of the drive. The information displayed in the status is divided into two parts, as shown in Figure 4-3.

- The first two digits are "bit data", which represent some common signal descriptions when the drive is running.
- The last three digits are "short code", which indicate the current operating status of the drive.

Figure 4-3 Operation panel display description

Code	Meaning	Code	Meaning
bb	**Base block** Indicates the servo OFF state	not	**Prohibit Negative drive state** Indicates that the input signal (N-OT) is valid.
run	**Running status** Indicates the servo ON state	E.030	**Alarm status** Flashes the alarm number
Pot	**Positive prohibit status** Indicates that P-OT signal is valid.	A.900	**Warning status** Flashes warning number

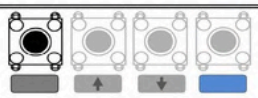
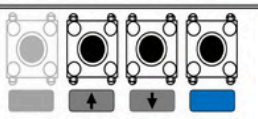
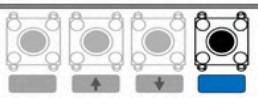
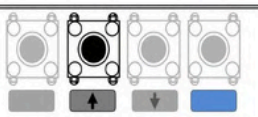
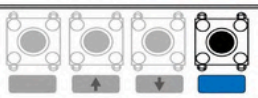
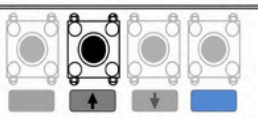
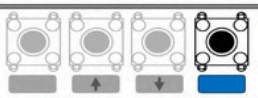
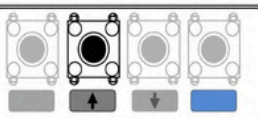
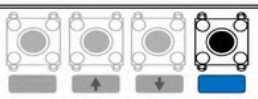
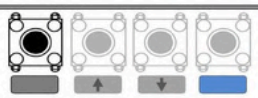
Display	Meaning

	Control power ON display Lights up when the control power of the servo drive is turned on. Turns off when the control power of the servo drive is turned off.
	Base block display Lights up when the base is blocked (servo OFF state). Turns off when the servo is ON.
	During position control: Indicates the positioning completion (COIN) display The light is on when the deviation between the position command and the actual position of the motor is within the specified value (set by Pn606, the factory default value is 10 command units), and it is off when it exceeds the specified value. During speed and torque control: Indicates speed matching (V-CMP) The light is on when the difference between the speed of the servo motor and the command speed is within the specified value (set by Pn522, the factory default value is 10 rpm), and it is turned off when it exceeds the specified value. Always lights up during torque control.
	Rotation detection (TGON) display The light is on when the rotation speed of the servo motor is higher than the specified value (set by Pn521, the factory default value is 20 rpm), and it is off when it is lower than the specified value.
	During position control: Displayed during command pulse input Lights up when a command pulse is input. Turns off when no command pulse is input. During speed and torque control: Displayed during speed command input The light is on when the input speed command is greater than the specified value (set by Pn521, the factory default value is 20 rpm), and off when it is less than the specified value.
	During position control: Displayed to clear the signal input Lights up when a clear signal is input. Turns off when no clear signal is input. During speed and torque control: Displayed during torque command input Lights up when the torque command being input is larger than the specified value (10% of the rated torque), and turns off when it is smaller than the specified value.
	Power ready display Lights up when the main circuit power supply is ON. Turns off when the main circuit power is OFF.

4.3 Parameter mode

Function parameter setting

The following takes parameter Pn008 (function selection application switch 8) as an example, and its parameter value is changed from 0000 to 1021.			
Step	**Display after operation**	**Keys used**	**Operations**

Step 1			After the driver is powered on, press the [M] key to switch to the parameter setting mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select parameter Pn008.
Step 3			Long press the [S] key to display the current parameter value of Pn008. The 0th (rightmost digit) nixie tube flashes.
Step 4			Press the [▲] key to set the 0th digit (the rightmost digit) to 1.
Step 5			Short press the [S] key, the first digit flashes.
Step 6			Press the [▲] key to set the first digit to 2.
Step 7			Short press the [S] key twice, the third digit flashes.
Step 8			Press the [▲] key to set the third digit (the rightmost digit) to 1.
Step 9			After long pressing the [S] key, it will exit to the parameter number display interface after parameter modification.
			Press the [M] key to exit to the parameter number display interface.
Finish			

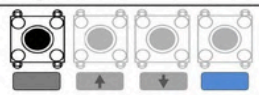
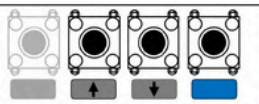
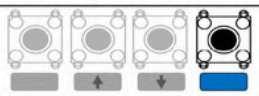
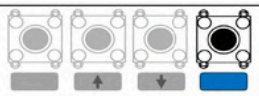
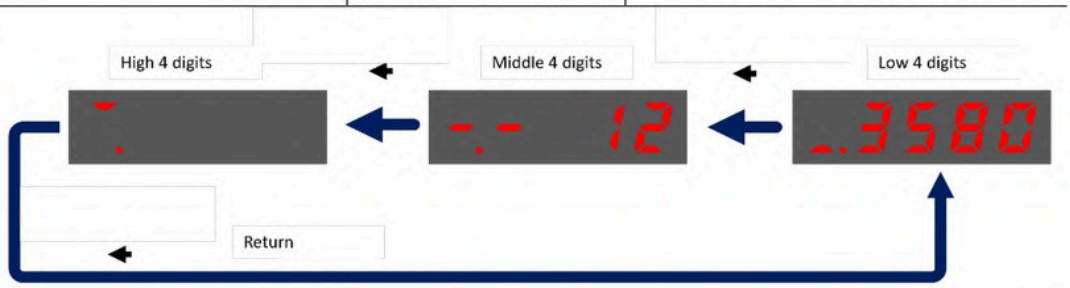
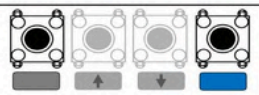
The operation panel can normally display 5-digit value. For values of 6-digit or above, short press the [S] key to shift to display the low, middle, and high digits.

4.4 Monitor function parameters

In monitor mode, the user can view the command value input to the drive, the status of input/output signals, and the internal state of the drive. Even if the motor is running, it can enter the monitoring mode for operation.

4.4.1 How to use monitoring mode

Below is an example of monitor function parameter No. Un005.

Step	Display after operation	Keys used	Operations
Step 1			After the driver is powered on, press the [M] key to switch the monitoring mode.
Step 2			Press the [▲] key, [▼] key or short press the [S] key to select Un005.
Step 3			Press and hold the [S] key to display the current value of Un005.
Step 5			Short press the [S] key to shift to the low, middle, and high digits.
			
Step 6			After long pressing the [S] key, exit to the monitoring interface. Press [M] to exit to the monitor number display interface.
Finish			

4.4.2 List of monitor function parameters

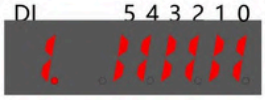
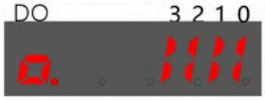
Code	Content	Unit	Data	Address
Un000	Motor speed	【r/min】	int16	0xE000
Un001	Motor feedback pulse number (encoder unit)	【1 encoder pulse】	int32	0xE001
Un003	Command pulse number (before electronic gear)	【1 command pulse】	int32	0xE003
Un005	Position deviation pulse number (encoder unit)	【1 encoder pulse】	int32	0xE005
Un007	Feedback pulse counter	【1 command unit】	int32	0xE007
Un009	Position deviation counter	【1 command unit】	int32	0xE009

Code	Content	Unit	Data	Address
Un00D	Rotation angle 1 (32-bit decimal display)	【1 encoder pulse】	Int32	0xE00D
Un00F	Rotation angle 2	【deg】	Int16	0xE00F
Un010	Input signal monitoring	—	Int16	0xE010
Un011	Output signal monitoring	—	Int16	0xE011
Un015	main circuit voltage	【V】	Int16	0xE015
Un016	Command pulse frequency	【0.1KHz】	int16	0xE016
Un020	Internal torque command (value relative to rated torque)	【%】	int16	0xE020
Un021	Torque analog voltage	【0.01V】	int16	0xE021
Un022	Internal speed command	【r/min】	int16	0xE022
Un023	Speed analog voltage	【0.01V】	int16	0xE023
Un030	Motor cumulative load ratio (take the cumulative load rating as 100%)	【%】	Int16	0xE030
Un031	Drive load ratio (take the drive load rating as 100%)	【%】	Int16	0xE031
Un032	Regenerative load factor (take the regenerative load rating as 100%)	【%】	Int16	0xE032
Un033	DB load ratio (take the DB load rating as 100%)	【%】	Int16	0xE033
Un035	total running time	【100ms】	Int32	0xE035
Un05A	Current alarm number	—	Int16	0xE05A
Un060	Encoder Resolution: 17-bit encoder resolution is 131072; 20-bit encoder resolution is 1048576; 23-bit encoder resolution is 8388608;	pulse	Int32	0xE060
Un062	Motor rated speed	【r/min】	Int16	0xE062
Un063	Motor maximum speed	【r/min】	Int16	0xE063
Un064	Motor rated torque	【0.01N·M】	Int16	0xE064
Un065	Motor rated current	【0.1A】	Int16	0xE065
Un066	Motor maximum current	【0.1A】	Int16	0xE066

Code	Content	Unit	Data	Address
Un080	Encoder single-turn value	【1 encoder pulse】	Int32	0xE080
Un082	Encoder multi-turn value	【1 turn】	Int16	0xE082
Un084	Motor absolute position lower 32 bits (encoder unit)	【1 encoder pulse】	int32	0xE084
Un086	Motor absolute position lower 32 bits (encoder unit)	【1 encoder pulse】	int32	0xE086
Un088	Motor absolute position lower 32 bits (user unit)	【1 command unit】	int32	0xE088
Un08A	Motor absolute position high 32 bits (user unit)	【1 command unit】	int32	0xE08A
Un100	Effective gain monitoring (1st gain=1, 2nd gain=2)	—	Int16	0xE100
Un101	Moment of inertia ratio	%	Int16	0xE101
Un105	Position positioning settling time	【0.1ms】	int32	0xE105
Un107	Position positioning overshoot	【1 command unit】	int32	0xE107
Un10A	Residual vibration frequency	【0.1Hz】	Int16	0xE10A

For No. Un010 and Un011, please check below

- The relevant optocoupler is turned-on or turned-off depending on whether the signal is inverted.
- When the signal is not inverted, the optocoupler will turn on when it is conducted, and turns off when it is not conducted.
- When the signal is reversed, the optocoupler will turn off when it is conducted, and turn on when it is not conducted.

Code	Data	Remarks
Un010	DI 5 4 3 2 1 0 Number  Upper: valid Lower: invalid	0: DI1 (CN1-9) input 1: DI2 (CN1-10) input 2: DI3 (CN1-34) input 3: DI4 (CN1-8) input 4: DI5 (CN1-33) input 5: DI6 (CN1-32) input
Un011	DO 3 2 1 0 Number  Upper: valid Lower: invalid	0: DO1 (CN1-6, 7) output 1: DO2 (CN1-4, 5) output 2: DO3 (CN1-2, 3) output 3: DO4 (CN1-26, 1) output

4.5 Auxiliary function parameters

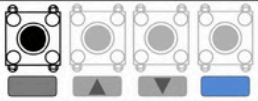
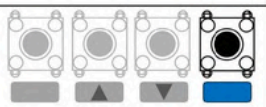
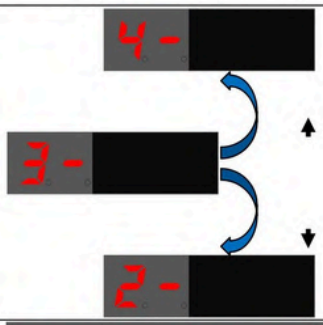
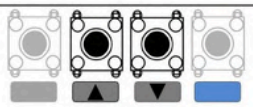
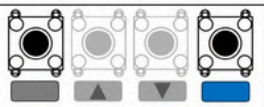
In the auxiliary function mode, you can use the panel operator to perform the following application operations:

Fn code	Function	Chapter
Fn000	Display of the alarm log	4.5.1
Fn001	Single parameter adjustment	8.3.3
Fn002	Jog operation mode	7.3.2
Fn003	Origin search	--
Fn004	PJOG run	7.5
Fn005	Parameter initialization	4.5.4
Fn006	Clearing the alarm record	4.5.5
Fn007	Automatic adjustment of analog (speed, torque) command offset	4.5.6
Fn008	Manual adjustment of speed command offset	4.5.7
Fn009	Manual adjustment of torque command offset	4.5.8
Fn010	Absolute encoder data initialization	4.5.9
Fn011	Absolute encoder alarm initialization	4.5.10
Fn015	Restore all parameters to factory defaults	--
Fn020	Position teaching (only valid in position mode)	--
Fn021	Parameter write prohibition setting	4.5.11
Fn02F	Software reset	4.5.12
Fn030	Display driver software version	4.5.13
Fn032	Display motor model	--
Fn050	Load inertia detection	8.2
Fn060	Autotuning	8.3.1
Fn062	Advanced parameter tuning	8.3.2

4.5.1 Fn000 (Display of the alarm log)

The ten recent alarms can be seen in the function of displaying alarm history data. The following are the operation steps to display the alarm history data.

Step	Display after operation	Keys used	Operations

Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 3			Long press the [S] key, the alarm number of the latest alarm will be displayed at this time.
Step 5			Press the [▲] key or the [▼] key to change the "Sequence No." , and you can view the recent alarm number.
Step 6			Press the [M] key and long press the [S] key to return to the display of function numbers.
Finish			

◆When no alarm occurs, the alarm number is 0 and "-" is displayed.
◆Alarm record can be deleted by "Delete alarm record (Fn004)".
◆The alarm with serial number 0 is the latest alarm, and the alarm with serial number 9 is the oldest alarm.

4.5.2 Fn002 (Jog operation mode)

JOG operation is often used for trial operation to confirm the servo motor operation through speed control without connecting the host device.

- When the servo enabling signal (/S-ON) signal is ON, please switch it to OFF.
- Please set the JOG speed after considering the operating range of the machine used, etc. The JOG running speed is set by Pn304.
- The overtravel prevention function is disabled during JOG operation. The operating range of the machinery used must be taken into account during operation.
- Please take necessary safety measures so that it can be in a state of emergency stop at any time.

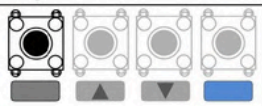
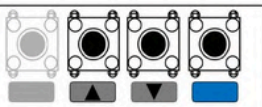
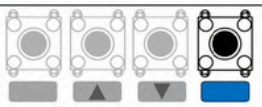
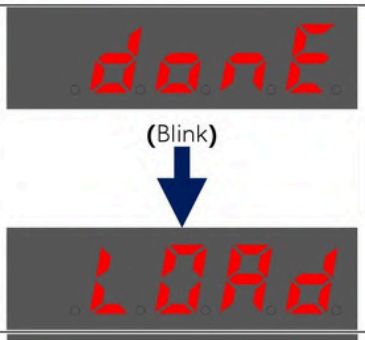
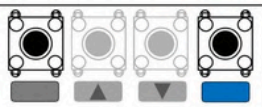
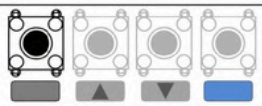
To ensure safety, install a stop device on the mechanical side.

4.5.3 Fn004 (PJOG run)

PJOG operation is often used for trial operation, please refer to "7.5.5 PJOG operation" for details.

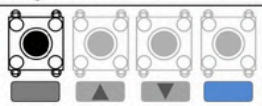
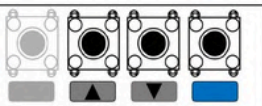
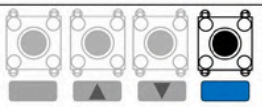
4.5.4 Fn005 (Restore parameters to factory defaults)

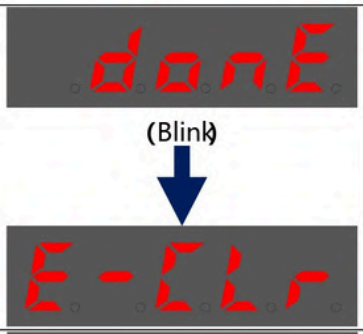
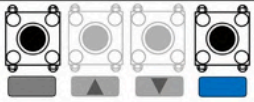
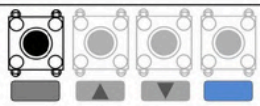
The following are the steps for restoring the factory default values of parameters.

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn005.
Step 3			Long press the [S] key to enter the next layer.
Step 5	 (Blink)		Press and hold the [S] key to restore the factory defaults.
Step 6			Press the [M] key to cancel the operation and return to the previous display.
Finish			

4.5.5 Fn006 (Clearing the alarm record)

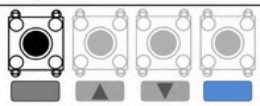
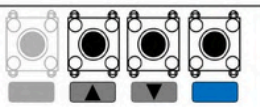
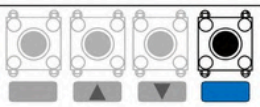
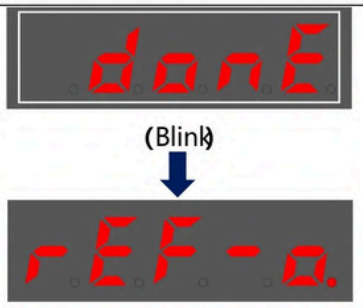
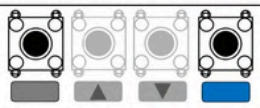
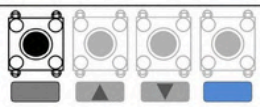
The function of deleting all alarm records recorded in the servo drive. The following are the steps for deleting the alarm record.

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn006.
Step 3			Long press the [S] key to enter the next layer.

Step 4			Press and hold the [S] key to delete the alarm record.
Step 5			Press the [M] key to cancel the operation and return to the previous display.
Finish			

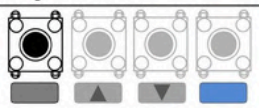
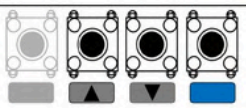
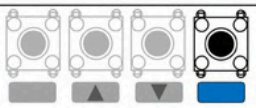
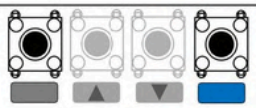
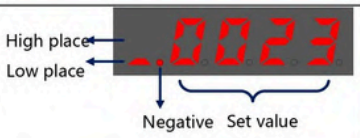
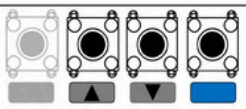
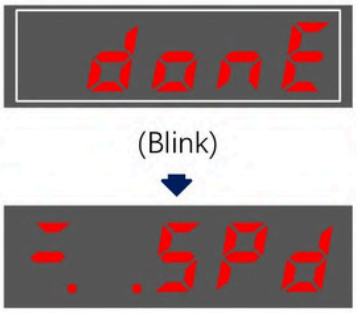
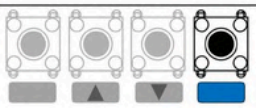
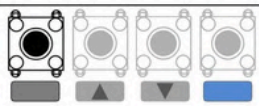
4.5.6 Fn007 (Analog instruction automatic offset adjustment)

This is an automatic adjustment of the instruction voltage (speed instruction and torque instruction) after measuring the offset. The measured offset will be saved in the servo drive.

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn007.
Step 3			Long press the [S] key to enter the next layer.
Step 4			Press and hold the [S] key to execute analog instruction automatic offset adjustment. Press the [M] key to cancel the operation and return to the previous display.
Step 5			Press the [M] key to return to the previous display.
Finish			

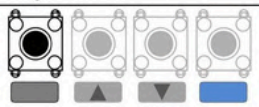
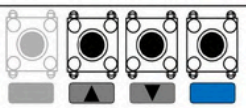
4.5.7 Fn008 (Speed instruction manual offset adjustment)

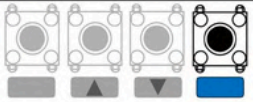
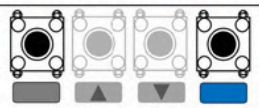
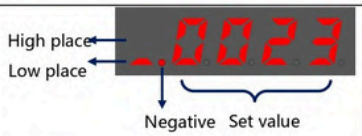
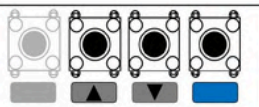
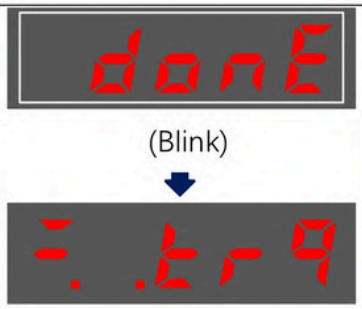
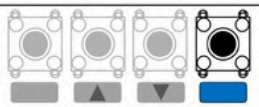
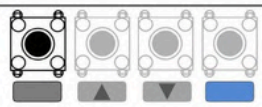
This is manually adjust the speed instruction offset.

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn008.
Step 3			Long press the [S] key to enter the next layer.
Step 4			Long press the [S] key to enter the next layer.
Step 5			Press [▲] key, [▼] key to adjust offset value. Short press the [S] key to toggle between high/low place.
Step 6			Long press [S] key to save current value as speed instruction offset value.
Step 7			Press the [M] key to return to the previous display.
Finish			

4.5.8 Fn009 (Torque instruction manual offset adjustment)

This is manually adjust the torque instruction offset.

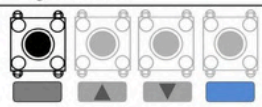
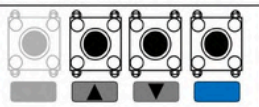
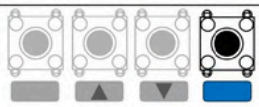
Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn009.

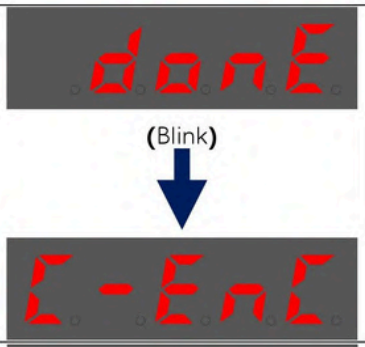
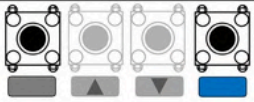
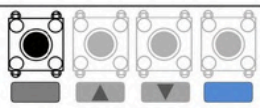
Step 3			Long press the [S] key to enter the next layer.
Step 4			Long press the [S] key to enter the next layer.
Step 5			Press [▲] key, [▼] key to adjust offset value. Short press the [S] key to toggle between high/low place.
Step 6			Long press [S] key to save current value as torque instruction offset value.
Step 7			Press the [M] key to return to the previous display.
Finish			

4.5.9 Fn010 (Absolute encoder data initialization)

- The multi-turn data of the absolute encoder can be cleared only when Servo is OFF.
- Before the drive with absolute encoder is put into use, please perform an Fn010 operation.

The following is the operation procedure of Fn010.

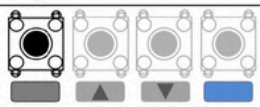
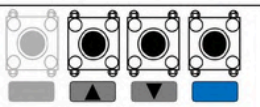
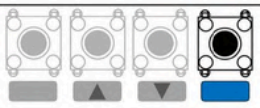
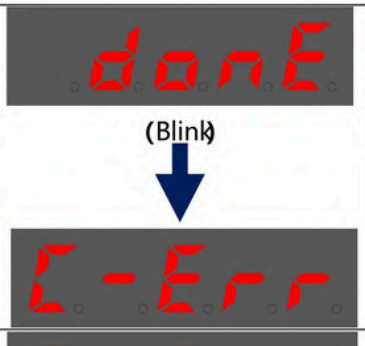
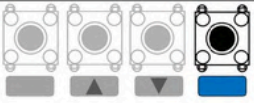
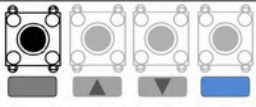
Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn010.
Step 3			Long press the [S] key to enter the next layer.

Step 4			Press the [M] key to clear the multi-turn data of the absolute encoder. After the operation is completed, flash "done" and exit.
			Long press the [S] key to cancel the Fn010 operation and return to the previous display.
Finish			

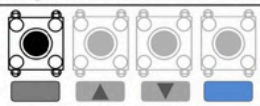
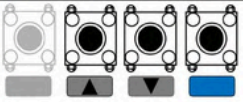
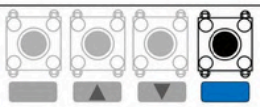
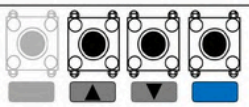
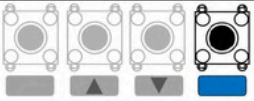
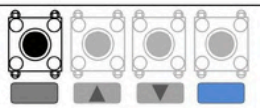
4.5.10 Fn011 (Absolute encoder alarm initialization)

The alarm information of the absolute encoder is stored in the encoder, and it will not be cleared automatically after the alarm is removed in time after powering on again. It needs to be cleared by this operation.

The following is the operation procedure of Fn011.

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn011.
Step 3			Long press the [S] key to enter the next layer.
Step 4			Long press the [S] key to clear alarm information of the absolute encoder. After the operation is completed, flash "done" and exit.
			Long press the [S] key to cancel the Fn010 operation and return to the previous display.
Finish			

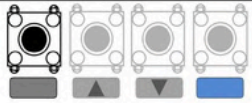
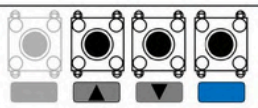
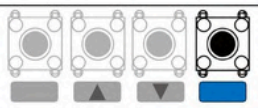
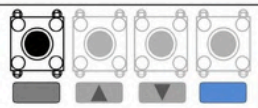
4.5.11 Fn021 (Parameter write prohibition setting)

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn021.
Step 3			Press and hold the [S] key for about 1S to enter the left image.
Step 4			Press the [▲], [▼], [S] keys to set the following values. "P.0000": Change allowed (factory setting). "P.0315": Change is prohibited.
Step 5			Press and hold the [S] key to confirm the setting. Press the [M] key to cancel the setting and return. After the setting is completed, "donE" will flash and return to the display on the left. (Note) ▸ After the setting is completed, A.941 warning may appear. ▸If a value other than "P.0000" and "P.0315" is set, "Error" will be displayed.
Step 6			Press the [M] key to return to the previous display.
Finish			

4.5.12 Fn02F (Software reset)

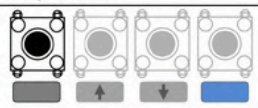
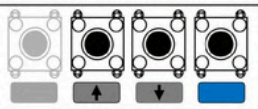
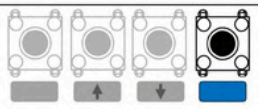
This operation is only used in the servo OFF state.

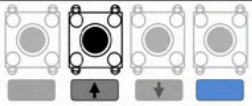
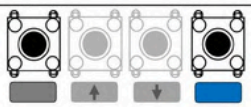
Step	Display after operation	Keys used	Operations

Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn02F.
Step 3			Press and hold the [S] key for about 1S to enter the left image.
Step 4			Press the [▲] key 4 times until the left image is displayed. ▸If an incorrect key operation is performed in the middle (eg, pressing [M]), "no_oP" will flash for about 1 second. ▸ If you do not reset the software, press and hold the [S] key for about 1S to exit.
Step 5			Press the [M] key, the servo drive is reset, the panel display disappears, and the status display screen after the power is turned on.
Finish			

4.5.13 Fn030 (Display driver software version)

The following is the operation step to check the servo software version.

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn030.
Step 3	 Main version Sub-version		Long press the [S] key to enter the next layer. Display the DSP software version, as shown on the left: the main version is V1.01, and the sub-version is 2.

Step 4			Press the [▲] key to switch the display between the DSP version and the FPGA version.
Step 5			Press the [M] key or long press the [S] key to return to the previous display.
Finish			

4.5.14 Fn050 (Load inertia detection)

The load inertia detection operation is often used before tuning. For details, please refer to "8.2 Load inertia detection".

CHAPTER 5 FUNCTIONS AND SETTINGS

5.1 Power settings

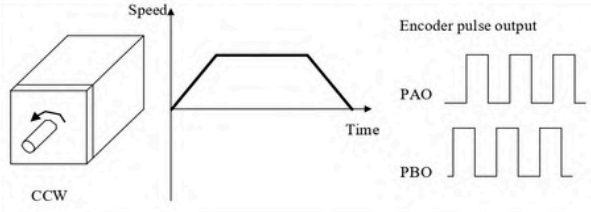
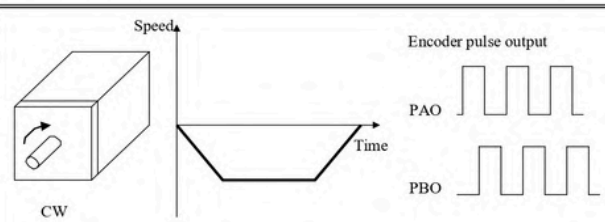
The main circuit and control circuit of the drive can run when AC or DC power is input. When AC power input is selected, single-phase or three-phase power input can be used. The user needs to set the parameter Pn001.2 according to the actual connected power supply.

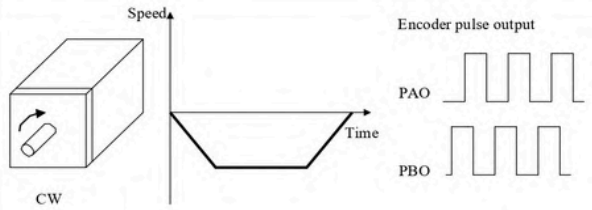
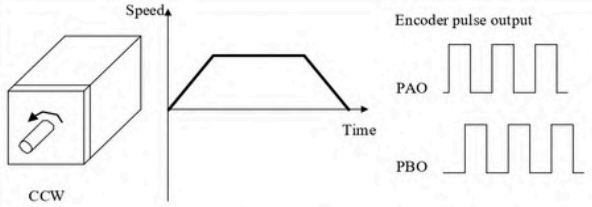
Parameter	Value	Remarks	Effective
Pn001.2	0	AC power input L1, L2 terminals	Restart
	1	AC power input L1, L2, L3 terminals	
	2	DC power input P, N terminals	

■ Please connect the power terminals correctly
→ Connect the AC power supply to the L1, L2 and L3 terminals of the driver.
→ Connect the DC power supply to the P and N terminals of the driver.
■ When DC power is input, install a fuse on the power wiring.
■ Regeneration processing is not performed when using DC power input, so perform regenerative energy processing on the power supply side.

5.2 Motor rotation direction setting

The rotation direction of the motor (Pn001.0) can be switched without changing the polarity (command direction) of the speed command/position command. The "positive rotation direction" in the factory setting is "counterclockwise rotation (CCW)" when viewed from the load side of the motor.

Parameter	Value	Instruction	Rotation direction and feedback	Overtravel
Pn000.0	0 standard mode (Positive rotation command is positive rotation, CCW direction) (Factory	Positive rotation command		Prohibit positive rotation input (P-OT) signal
		Reverse instruction		Prohibit negative rotation input (N-OT) signal

	default)			
	1 Inversion mode (Positive rotation command is negative rotation, CW direction)	Positive rotation command		Prohibit positive rotation input (P-OT) signal
		Reverse instruction		Prohibit negative rotation input (N-OT) signal

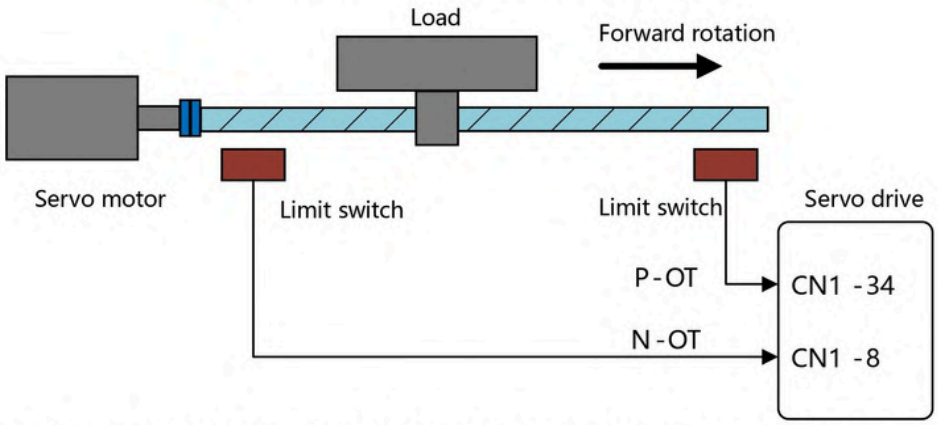
5.3 Overtravel setting

5.3.1 Functional Overview

The drive's overtravel prevention function refers to the safety function of forcibly stopping the motor by inputting the signal of the limit switch when the movable part of the machine exceeds the designed safe movement range.

The wiring example of the driver is shown in Figure 5-1.

Figure 5-1 Wiring diagram of overtravel signal



When the driver is used for rotating loads such as round tables and conveyors, it is usually not necessary to use the overtravel prevention function. In this case, it is not necessary to wire the input signal for overtravel prevention.

- Installation of limit switches

When the contact part of the limit switch has poor contact or disconnection, use the "normally closed contact" to move the motor to the safe side.

When the servo motor is used with a vertical axis

In the overtravel state (due to BK signal ON (brake release)) the workpiece may drop. In order to prevent

the workpiece from falling, please set the servo motor into the zero position fixed state after stopping. For the setting method, please refer to "5.4.2 Motor stop method at overtravel".

■ In order to prevent accidents caused by poor contact and disconnection of the contact parts, use "normally closed contacts" for limit switches.
■ Also, do not change the polarity of the overtravel signal (P-OT, N-OT) from the factory settings.
■ During position control, when the servo motor stops due to overtravel, the position deviation pulse remains unchanged. To clear the position deviation pulse, it is necessary to input the clear signal (CLR).

5.3.2 Connection of overtravel signal

Overtravel signals include positive rotation prohibit (P-OT) signal and negative rotation prohibit (N-OT) signals. Even in the overtravel state, it is still allowed to drive in the opposite direction by inputting a command.

Type	Name	Pin	Status	Meaning
Input	P-OT	CN1-34	ON	Positive rotation not allowed
			OFF	Positivie rotation allowed
	N-OT	CN1-8	ON	Negative rotation not allowed
			OFF	Negative rotation allowed

5.3.3 Overtravel prevention function valid/invalid selection

The user can select parameters Pn500~Pn505 by setting the input IO signal to enable or disable the overtravel function.

Parameter	Value	Remarks	Effective
Pn50X	h.2XX2	P-OT is often ineffective	Immediate
	h.1XX2	P-OT often effective	
	h.00X2	The input signal controls the valid or invalid of P-OT	
	h.01X2	After the input signal is inverted, control the valid or invalid of P-OT	
Pn50X	h.2XX3	N-OT is often ineffective	
	h.1XX3	N-OT often effective	
	h.00X3	The input signal controls the valid or invalid of N-OT	
	h.01X3	After the input signal is inverted, control the valid or invalid of N-OT	

5.4 Motor stop method setting

There are three ways to stop the drive when an alarm occurs or the servo is OFF:

Motor stop method	Meaning
Dynamic Brake (DB) stop	Short-circuit the electrical circuit of the motor to stop the motor in an emergency.
Coast to stop	It stops naturally due to friction when the motor rotates.
Reverse brake	Set the speed command to "0" to make an emergency stop of the motor.

There are four states after the motor stops:

Motor state after stop	Meaning
Coasting	The state in which the driver does not control the motor (the machine operates when force is applied from the load side).
Dynamic Brake (DB)	Short-circuit the electrical circuit of the motor.
Zero clamp	The stop state when the position command is "0" (the current stop position is maintained).
Normal operation	The state in which the driver continues to control the motor.

5.4.1 Motor stop method when an alarm occurs/servo OFF

The stop method of the drive when an alarm occurs and the servo is OFF can be selected through Pn001.0 (the stop method of the motor when an alarm occurs/SOFF).

Para	Value	Motor stop method	After stop	Effective
Pn001.0	0	Use dynamic brake (DB)	Keep DB	Restart
	1	Use DB, then release DB	Free state	
	2[default]	Not use DB, motor in free state	Free state	

5.4.2 Motor stop method when overtravel

When overtravel occurs, the motor stop method can be selected by Pn001.1 (Stop method at overtravel).

Para	Value	Motor stop method	After stop	Effective
Pn001.1	0 [default]	DB stop or free running stop (the stop method is the same as Pn001.0).	Free state	Restart
	1	Decelerate and stop the motor with the set torque of Pn406 as the maximum value, and then enter the servo lock state.	Zero clamp	
	2	Decelerate and stop the motor with the set torque of Pn406 as the maximum value, and then enter the free running state.	Free state	

◆When the brake is reversely connected, the speed command is set to "0", and the soft start is invalid at this time (that is, the parameters Pn305 and Pn306 are invalid).
◆When the brake is reversely connected, the user also needs to set Pn406 (emergency stop torque limit).

5.4.3 Torque limit setting during reverse brake

When Pn001.1 is set to 1 or 2, the motor will decelerate with the torque set in Pn406 as the maximum value.

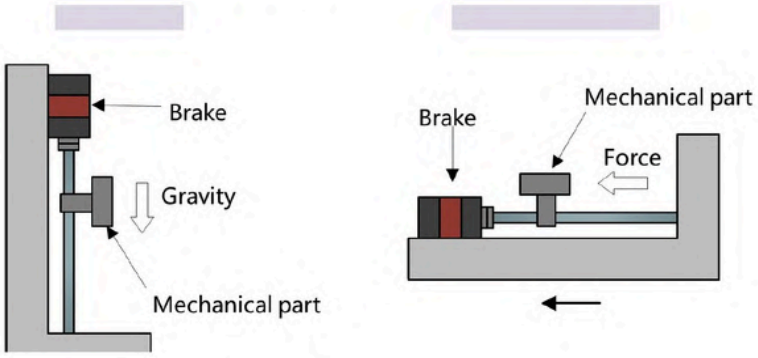
Para	Range	Unit	Default	Effective
Pn406	0～400	1%	400	Immediate

5.5 Holding brake

5.5.1 Function overview

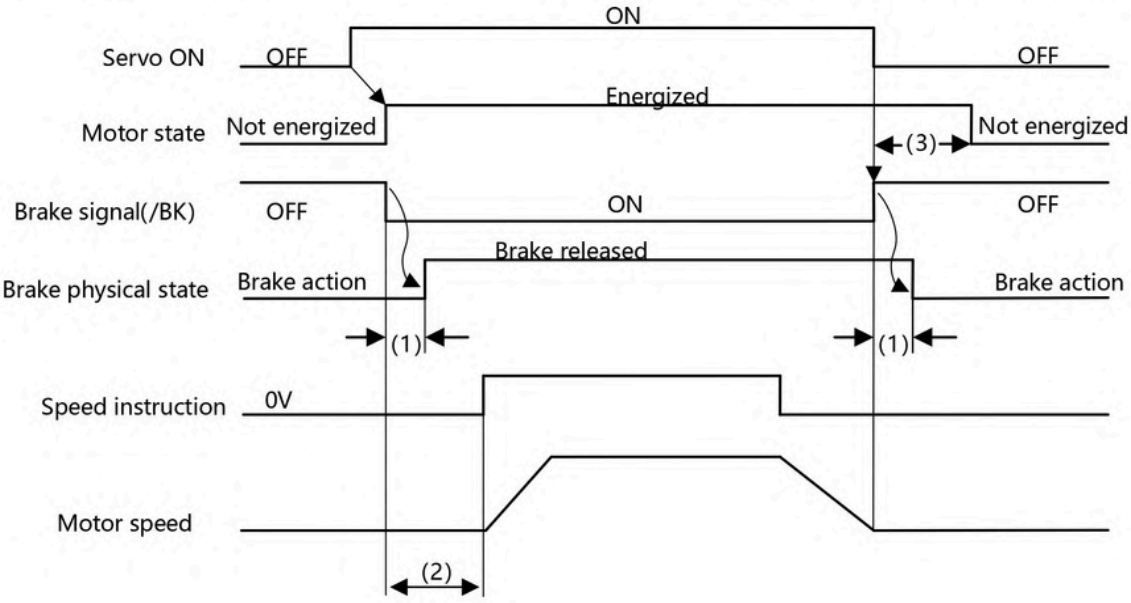
The brake is a part that keeps the position fixed when the power of the driver is turned off, so that the movable part of the machine does not move due to its own weight or external force. The brake is built into the servo motor with brake, so please install it on the machine side.
Please use it in the situation shown in Figure 5-2.

Figure 5-2 Schematic diagram of the holding brake



5.5.2 Brake action sequence

Consider the opening time and action time of the brake, and set the operating time of the brake as follows.



(1): Brake delay time.

(2): After S-ON and BK signal valid, please wait for at least 50ms to give instructions to servo drive.

(3): Brake action and servo OFF time setting please refer to Pn526, Pn527 & Pn529.

5.5.3 Brake control output signal (BK)

When the servo is OFF or an alarm is detected, the BK signal is OFF (brake action). The time to activate the brake (the time when the BK signal is OFF) is adjusted by Pn527 (basic waiting flow).

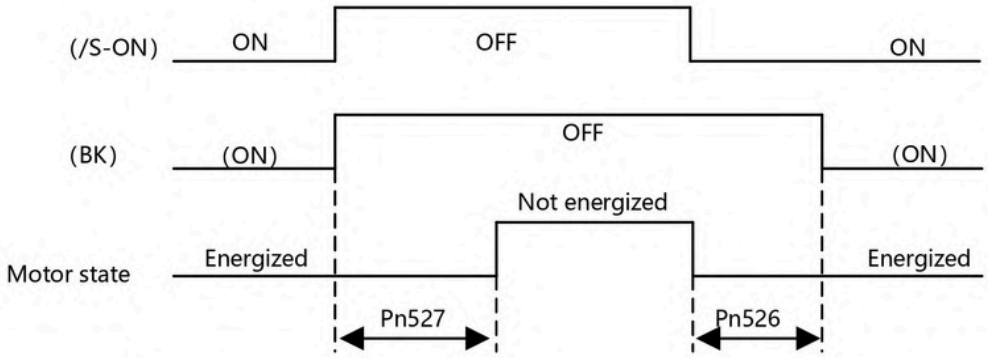
Type	Name	Pin	Status	Meaning
Output	BK	Pn510~ Pn513	ON	Brake open
			OFF	Brake action

The brake control output signal (BK) is assigned to pins CN1-2/3 with Pn512 by default, and the BK signal can also be assigned to other output pins of CN1 through parameters.

Para	Value	Pin	Remarks
Pn512	2	CN1-3	BK signal is output from CN1-3 and CN1-2.
		CN1-2	

5.5.4 Brake ON/OFF setting (when the motor is stopped)

In the factory setting, the BK signal is output at the same time as the drive excitation enable signal (from the bus enable signal, the /S-ON signal of the IO port, the enable signal under auxiliary functions), and the servo ON/OFF can be changed through user parameters. The timing chart of OFF is as follows.



Para	Name	Range	Unit	Default	Effective
Pn526	Servo ON wait time	0 ~ 2000	ms	0	Immediate
Pn527	Basic waiting process	0 ~ 1000	ms	0	Immediate

Pn526: When the servo is ON, the motor will be powered on immediately, and then the BK signal will output after waiting for the set time.

When used on a vertical axis, etc., the mechanical movable part may move slightly due to its own weight or external force due to the ON/OFF setting of the brake.
This small movement can be eliminated by adjusting the servo ON/OFF operation time with the above user parameters.

When an alarm occurs, regardless of the above parameter settings, the motor immediately enters the state of no power supply. At this time, the machine may move before the brake is actuated due to the dead weight or external force of the mechanical movable part.

5.5.5 Setting of brake ON/OFF (when the servo motor is rotating)

When a stop command is issued to the rotating servo motor when the servo is OFF or an alarm occurs, the output conditions of the BK signal can be changed according to the following user parameters.

Para	Name	Range	Unit	Default	Effective
Pn528	Brake waiting speed	10 ~ 5000	1rpm	100	Immediate
Pn529	Brake waiting time	100 ~ 5000	1ms	500	Immediate

5.6 Absolute encoder settings

5.6.1 Absolute encoder selection

The absolute encoder needs to be powered by a battery, so that it can still memorize the position after stopping even after the power is turned off.

In a system using an absolute encoder, the current position can be obtained by the host controller. Therefore, there is no need to perform zero return when the system is powered on.

Para	Value	Pin	Effective
Pn002.2	0	Use absolute value encoder as absolute value encoder	Restart
	1[Default]	Using absolute encoders as incremental encoders	
◆ When used as an incremental encoder, no backup battery is required. ◆ After changing this parameter, the power must be restarted for the setting to take effect.			

When using the motor with absolute encoder, before the drive is put into use, please perform the operation of "Clear multi-turn information and alarm (Fn010)" once.
By default, the driver uses an incremental encoder. If an absolute encoder motor is used, after the driver is powered on, please set Pn002.2=0, and then restart the driver.

5.6.2 Absolute encoder alarms

If warning A.930 or E.55A occurs, replace the battery as soon as possible. After replacing the battery, please perform the operations of "Clear Multi-Turn Alarm" and "Clear Multi-Turn Information" (Fn010).
Please refer to "3.6.4 Installing or Replacing the Battery" for the replacement method of the battery and the operation after the replacement.
■Please replace the battery while keeping the servo drive control power ON.
■After replacing the battery, turn off the servo driver to cancel the "serial encoder battery warning (A.930)".
■Restart the power supply of the servo drive.
■When the control power of the servo drive is turned off and the battery connection is removed (including the removal of the encoder cable), the data in the absolute encoder will be lost and a related alarm will be generated. In this case, it is necessary to perform the setting operation of the absolute value encoder. Please refer to "4.5.6 Fn010 (clear multi-turn data and alarm information of absolute encoder)".

When the multi-turn data overflows, the E.556 alarm will output. Parameter Pn007.1 can disable this alarm.

Para	Value	Pin	Effective
Pn007	h.□□0□	The E.556 alarm will be generated when the absolute value encoder multi-turn data overflows. (Default)	Restart
	h.□□1□	There is no alarm when the multi-turn data of the absolute encoder overflows.	

5.7 IO signal assignment

The I/O signal connector (CN1) has pre-assigned functions, but some terminals can be assigned other functions or change the polarity. Assignment of functions and setting of polarity are performed by parameters.

5.7.1 Input signal assignment

CN1 provides a total of 6 pins for assigning input signals DI1~DI6, corresponding to parameters Pn500~Pn505.

The input pin number has priority. When the signal is repeatedly assigned to multiple pin numbers, only the pin number with the highest priority will take effect. The priority of ports is arranged from low to high as follows: CN1-9 (DI1) > CN1-10 (DI2) > CN1-34 (DI3) > CN1-8 (DI4) > CN1-33 (DI5) > CN1-32 (DI6).

Set Pn500 ~ Pn505 as the assigned value representing the input signal, indicating that the input signal is assigned to the corresponding pin number. Table 5-1 lists the assigned values representing the input signals and their names.

Table 5-1 Input signal description

Input signal	Name	Value
/S-ON	Servo enable	0
/C-SEL	Control mode switch	1
P-OT	Positive drive prohibited	2
N-OT	Negative drive prohibited	3
/CLR	Position deviation clear	4
/ALM-RST	Alarm reset	5
/ ZEROSPD	Zero speed clamp	6
/CMDINV	Negate the command	7
/PSEL	Command pulse input magnification switching	8
/INHIBIT	Command pulse input prohibited	9
/P-CL	External torque limit on the forward side	A
/N-CL	Reverse side external torque limit	B
/G-SEL	Gain switching	C
/INSPD0	Internal command speed selection 0	F
/INSPD1	Internal command speed selection 1	10
/INTor0	Internal command torque selection 0	13
/INTor1	Internal command torque selection 1	14

5.7.2 Output signal assignment

CN1 provides a total of 4 pins for assigning output signals DO1~DO4, corresponding to parameters Pn510~Pn513.

The same output signal can be assigned to different output circuits.

Set the parameters of Pn510~Pn513 to assign them to the corresponding pin numbers.

Table 5-2 lists the assigned values representing the output signals and their names.

Table 5-2 Description of output signals

Output signal	Name	Value
ALM	Alarm signal output	0
CZ	Z pulse collector signal	1
BK	Brake control signal	2
COIN	Positioning completed	3
WARN	Warning signal output	4
S-RDY	Servo ready output	5
VCMP	Speed consistent output	6
TGON	Motor rotation detection	7
TLC	Torque limit detection signal	8
VLC	Speed limit detection signal	9
NEAR	Location is approaching	A
TREACH	Torque reached	B

5.8 Torque limit

Torque limit is a function to limit the output torque of the motor.

There are 4 types of torque limitation, and the outline of each limitation method is shown below.

Type	Summary	Reference
Internal torque limit (non-parameter)	The drive automatically calculates the maximum torque according to the matching situation, so as to limit it.	--
Internal torque limit (parameter)	Torque is always limited by parameters (Pn402, Pn403).	--
External torque limit	The torque is limited by the input signal (P-CL/N-CL) from the host device.	--
Torque limit for /CLT based on the output signal	Torque is limited by the output signal/CLT of the servo command.	--

Even if set value exceeds the maximum torque of the motor used, the actual torque will be limited within the maximum torque of the motor.

5.8.1 Internal torque limit

Internal torque limits includes positive rotation side (Pn402) and negative rotation side (Pn403).

Para	Name	Range	Unit	Default	Effective
Pn402	Forward torque limit	0～400	%	400	Immediate
Pn403	Reverse torque limit	0～400	%	400	Immediate

5.8.2 External torque limit

When the machine needs to limit the torque under certain operating conditions, the upper device sends an ON or OFF signal to execute the torque limit. It can be used for applications such as push-to-stop motion or robot workpiece stabilization.

The command signals for external torque limit include the forward-side external torque limit input (/P-CL) signal and the reverse-side external torque limit input (/N-CL) signal.

Type	Name	Pin	Status	Meaning
Input	/P-CL	Need assignment	ON (close)	Turn ON the external torque limit on the positive rotation side. Limit value: the smaller of the Value of Pn402 and Pn404
			OFF (open)	Turn off the external torque limit on the positive rotation side. Limit value: Pn402
	/N-CL	Need assignment	ON (close)	Turn on the reverse external torque limit. Limit value: the smaller value among the Values of Pn403 and Pn405
			OFF (open)	Turn off the reverse external torque limit. Limit value: Pn403

Torque limit parameters

Para	Name	Range	Unit	Default	Effective
Pn402	Forward side internal torque limit	0～400	%	400	Immediate
Pn403	Reverse side internal torque limit	0～400	%	400	Immediate
Pn404	Forward side external torque limit	0～400	%	100	Immediate
Pn404	Reverse side external torque limit	0～400	%	100	Immediate

Torque limit detection output (TLC) signal

Type	Name	Pin	Status	Meaning
Output	TLC	Need assignment	ON (close)	Motor output torque is limited.
			OFF (open)	Motor output torque is not limited.

5.9 Soft start

The soft start function refers to converting the step-like speed command into a relatively smooth constant acceleration and deceleration speed command. First, the user needs to select the running curve of the speed command through Pn30A.2 (speed command curve form).

Para	Value	Speed command curve form	Effective
Pn30A.2	0	Ramp [Default]	Restart
	1	Primary filter	
	2	Secondary filtering	

When speed command in ramp mode (Pn30A.2 = 0)

Pn306 is the time for the motor to accelerate from the stop state to 1000mm/s, and Pn307 is the time for the motor to go from 1000mm/s to the stop state.

Para	Name	Range	Unit	Default	Effective
Pn305	Soft start acceleration time	0 ~ 10000	ms	100	Immediate
Pn306	Soft start deceleration time	0 ~ 10000	ms	100	Immediate

When speed command uses filter (Pn30A.2=1 or 2)

Through Pn308 (speed filter time constant), a delay filter can be applied to the analog speed command (VREF) input to smooth the speed command.

This parameter usually does not need to be set. If the value is too large, the responsiveness may be reduced. It is recommended to set while confirming the responsiveness.

5.10 Instantaneous power failure

5.10.1 Instantaneous power failure torque settings

This is a function to limit the torque within the capacity of the drive in a power failure state, and is not applicable to all load conditions or operating conditions.

Para	Name	Range	Unit	Default	Effective
Pn008.1	0: No undervoltage warning is detected. 1: An undervoltage warning is detected. 2: Undervoltage warning is detected, and torque limit is executed by Pn433 and Pn434.	0~2	--	0	Restart
Pn52A	Instantaneous power failure hold time	20 ~ 1000	1ms	20	Immediate
Pn433	Torque limit when main circuit voltage drops	0 ~ 100	1%	50	Immediate
Pn434	Torque limit release time when main circuit voltage drops	0 ~ 1000	ms	100	Immediate

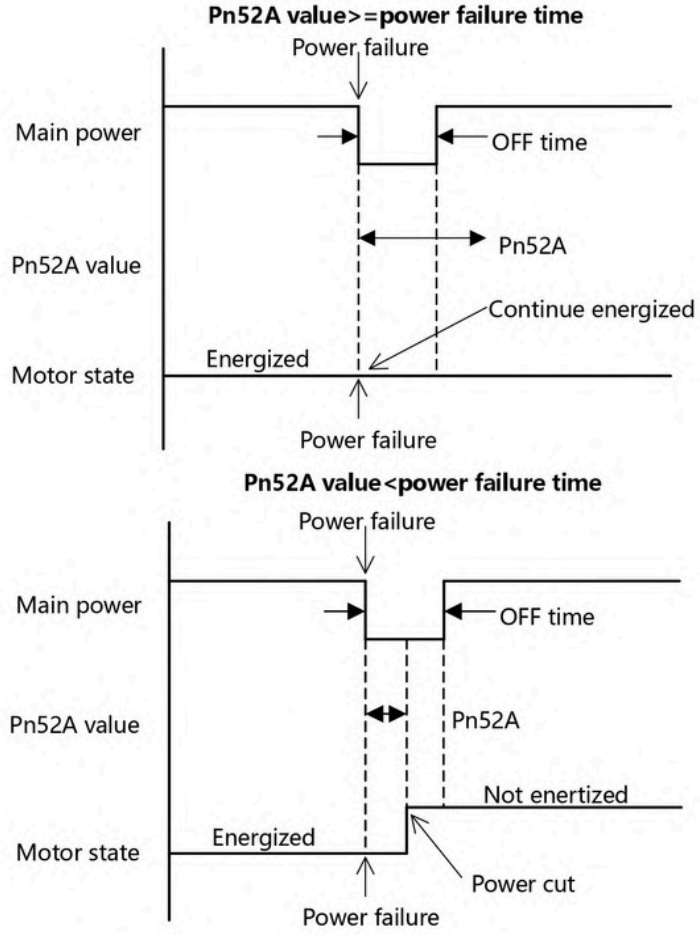
5.10.2 Instantaneous power failure hold time settings

When the Pn52A instantaneous power failure hold time is set, the time from power-off to motor power-off becomes longer. To power off the motor immediately, use the Servo OFF command.

However, in the following cases, the value of the user parameter cannot take effect.

- When the load of the servo motor is too large, the "undervoltage alarm (E.410)" occurs during the momentary power failure
- When the control power supply becomes uncontrollable during the momentary power failure period (same as normal power OFF operation)

The maximum hold time at instantaneous power failure is 1000ms, but the hold time of the servo drive control power supply is about 100ms. The holding time of the main circuit depends on model.



Para	Name	Range	Unit	Default	Effective
Pn52A	Instantaneous power failure hold time	20～1000	1ms	20	Immediate

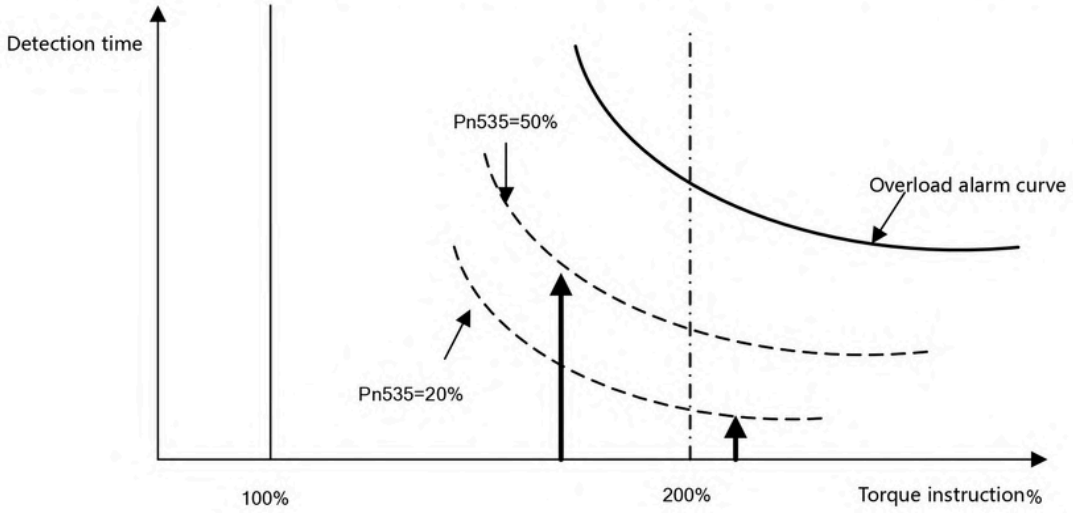
5.11 Setting of motor overload detection value

This servo driver can change the detection time of overload warning (A.910) and overload (continuous maximum load) alarm (E.130). However, the overload characteristics and the detection value of the overload (instantaneous maximum load) alarm (E.120) cannot be changed.

(1) Change of overload warning (A.910) detection time

The overload warning detection time by default is 20% of the overload alarm detection time. The overload warning detection time can be changed by changing the overload warning value (Pn535). Using this function as an overload protection function for the system in use can improve safety.

For example, as shown in the figure below, when the overload warning value (Pn535) is changed from 20% to 50%, the overload warning detection time is half (50%) of the overload alarm detection time.



Para	Name	Range	Unit	Default	Effective
Pn535	Overload warning value	1～100	1%	20	Immediate

Change of overload alarm (E.130) detection time

Overload alarm (continuous maximum load) can be detected in advance to prevent motor overload.

The overload alarm detection time can be shortened by using the "base current after derating" in the following formula to detect the overload alarm. The detection value of overload (instantaneous maximum load) alarm (E.120) cannot be changed.

Motor base current × motor overload detection base current derating (Pn536) = motor base current after derating

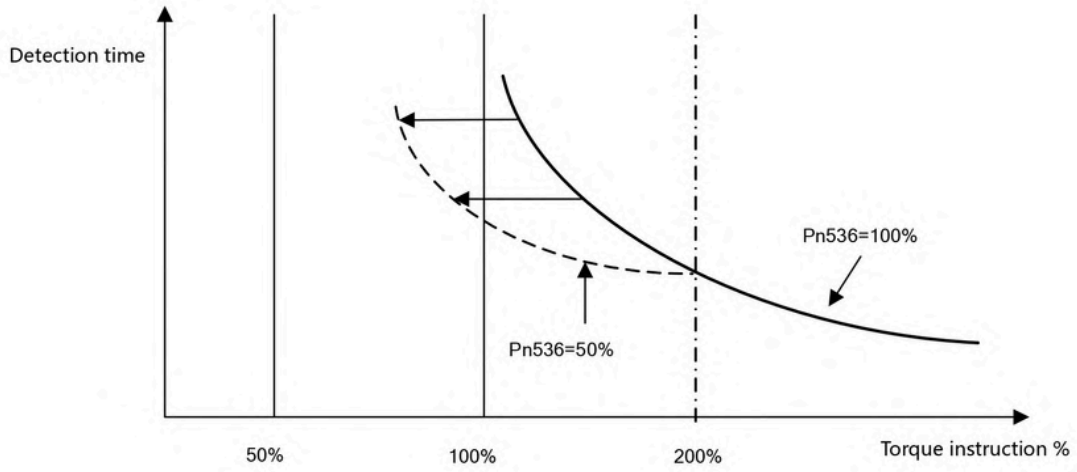
◆Motor base current: start to calculate the motor current threshold for overload alarm

◆Motor overload detection base current rated value reduction (Pn536): the rate of reduction in the rated value of the motor base current

For example, as shown in the figure below, after setting Pn536 to 50%, since the motor overload is calculated from 50% of the base current, the overload alarm can be detected early.

After changing the value of this Pn536, since the overload warning detection time will be changed, the overload warning detection time will be changed accordingly.

Considering the ambient temperature, heat dissipation, etc., setting it to Pn536 can be changed to a more appropriate overload alarm detection time, so as to realize the overload protection of the motor.



Para	Name	Range	Unit	Default	Effective
Pn536	Motor overload detection base current derating	10～100	1%	100	Restart

CHAPTER 6 DISPLAY AND OPERATIONS

6.1 General basic function settings

6.1.1 Control mode selection

Para	Name	Range	Unit	Default	Effective
Pn000	**Control mode**	h.0000~01A1	--	h.0000	Restart

Para	Value	Control mode	Chapter
Pn000	h.□□0□ 【Default】	**Position control (pulse command)** Use the pulse train position command to control the position of the servo motor. The position is controlled by the number of input pulses, and the speed is controlled by the frequency of the input pulses. It is used when positioning action is required.	6.2
	h.□□1□	**Speed control** Use the analog voltage speed command to control the speed of the servo motor ◆ When you want to control the speed ◆ When the encoder pulse output of the servo drive is used, the position loop is constructed by the host device	6.3
	h.□□2□	**Torque control** Use the analog voltage torque command to control the output torque of the servo motor.	6.4
	h.□□3□	**Speed control (internally set speed selection)** Using a total of 2 input signals, INSPD0 and INSPD1, the speed is controlled by the 3-stage running speed set in the servo driver in advance. When this control method is selected, no analog command is required.	6.5

6.1.2 Servo ON settings

(1) Servo ON signal (S-ON)

Type	Signal	State	Input level	Remarks
Input	S-ON	ON	CN1-40: "L" level	The servo motor is energized (servo ON state), and operation is possible.
		OFF	CN1-40: "H" level	The servo motor cannot be operated in the non-energized state (servo OFF state).

(2) Servo ON signal input level selection

Parameter		Remarks
Pn500	h.□0□□	The S-ON signal input from the input terminal CN1-40 is active low. (Default)
	h.□1□□	The S-ON signal input from the input terminal CN1-40 is active high.

6.2 Position control

6.2.1 Parameter settings

When using pulse train for position control, set the following user parameters.

(1) Control mode selection

Para	Name	Range	Unit	Default	Effective
Pn000	**Control mode**	h.0000~01A1	--	h.0000	Restart
Parameter		**Remarks**			
Pn000	h.□□0□	Control mode selection: position control (pulse train)			

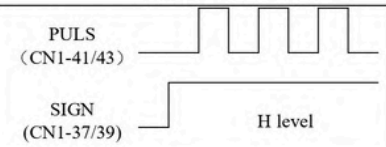
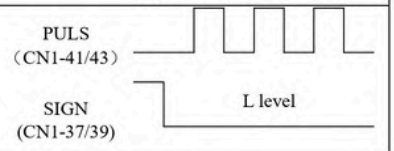
(2) Pulse input channel selection

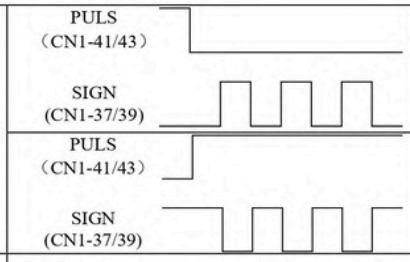
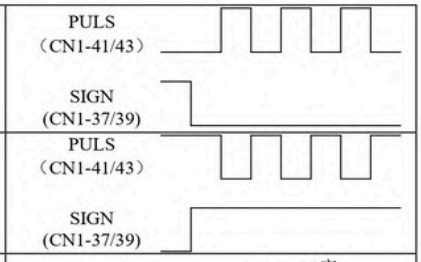
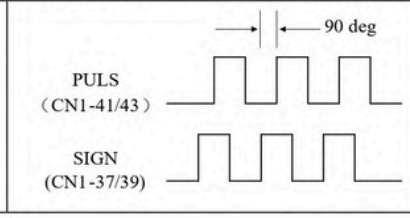
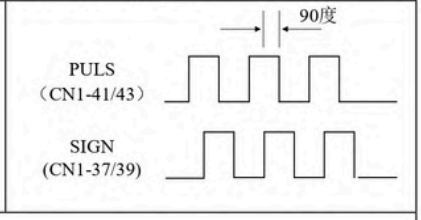
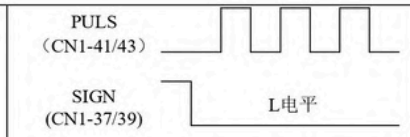
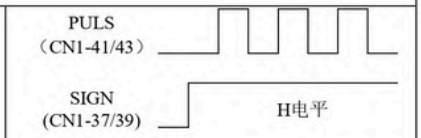
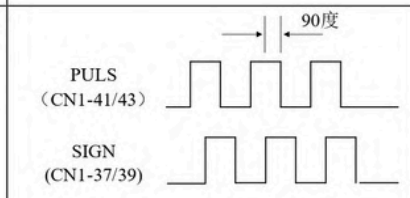
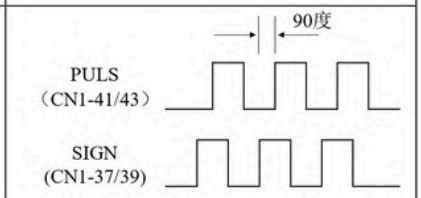
Parameter		Remarks
Pn200	h. 0□□□	Select low-speed pulse channel input
	h. 1□□□	Select high-speed pulse channel input

(3) Selection of pulse command form

Type	Name	Pin	
Input	PULS+	CN1-41	Low-speed command pulse input
	PULS-	CN1-43	Low-speed command pulse input
	SIGN+	CN1-37	low speed sign input
	SIGN-	CN1-39	low speed sign input
	HPULS+	CN1-15	High-speed command pulse input
	HPULS-	CN1-30	High-speed command pulse input
	HSIGN+	CN1-27	high-speed sign input
	HSIGN-	CN1-28	high-speed sign input

Please set the user parameters Pn200.0 and Pn200.1 according to the specification of the command controller for the input form of the servo drive.

Parameter		Pulse form	Forward	Reverse
Pn200	h.□□00	Sign + pulse (Positive logic) (Default)		

	h.□□01	CW+CCW		
	h.□□02	A phase +B phase quadruple frequency (Positive logic)		
	h.□□10	Sign + pulse (Negative logic)		
	h.□□12	A phase +B phase quadruple frequency (Negative logic)		

(4) Selection of clear action

Under conditions other than the clear signal (CLR), which timing to use to clear the offset pulse can be selected according to the state of the servo drive. The action mode of the offset pulse can be selected from the following three types by the user parameter Pn200.2.

Parameter		Content
Pn200	h.□0□□	Clear the position deviation pulse when the servo is OFF or an alarm occurs
	h.□1□□	Clear the position deviation pulse by CLR signal
	h.□2□□	Clear the position deviation pulse when an alarm occurs or by CLR.

6.2.2 Electronic gear settings

(1) Number of encoder pulses

Encoder reolution monitor		Encoder type	Resolution
Un060	131072	17-bit	131072 (17bit)
	8388608	23-bit	8388608 (23bit)

(2) Electronic gear

The electronic gear function is a function that can set the workpiece movement amount equivalent to 1 pulse

of the command controller input command to an arbitrary value.

This kind of command 1 pulse from the command controller, that is, the smallest unit is called "1 command unit".

(3) Relevant user parameters

Pn20E	**The first electronic gear (numerator)**			
	Setting range	Unit	Default	Effective
	1 ~ 1073741824	—	4	Restart
Pn210	**Electronic gear (denominator)**			
	Setting range	Unit	Default	Effective
	0 ~ 1073741824	—	1	Restart

Pn210	**Electronic gear ratio**
≠0	Pulse input → Pn20E / Pn210 → Position insutruction
=0	Pulse input → Encoder resolution / Pn20E → Position insutruction

■Important

Recommended electronic gear setting range: 0.01≤ B/A ≤ 200

(4) Electronic gear setting steps

Please follow the steps below to set the electronic gear ratio

Step	**Content**	**Instruction**
1	Confirm mechanical specifications	Check the reduction ratio, ball screw pitch, pulley diameter, etc.
2	Check the number of encoder pulses	Check the encoder pulse number of the servo motor used.
3	Decide Command Unit	Determines 1 command unit from the command controller. Determine the command unit after considering factors such as machine specifications and positioning accuracy.
4	Calculate the amount of movement for one rotation of the load shaft	Based on the command unit, calculate the command unit amount required for one rotation of the load shaft.
5	Calculate the electronic gear ratio	Calculate the electronic gear ratio (B/A) according to the electronic gear ratio calculation formula.
6	Set user parameters	Set the calculated value as the electronic gear ratio.

6.2.3 Position command

A command in the form of a pulse train is issued to control the position of the servo motor.

The pulse train output form of the command controller includes the following types.

→+24V open collector output

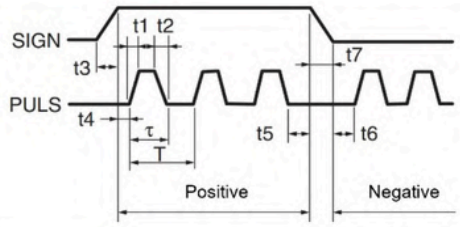
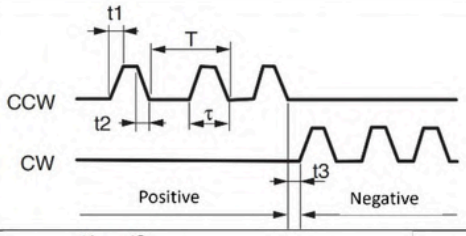
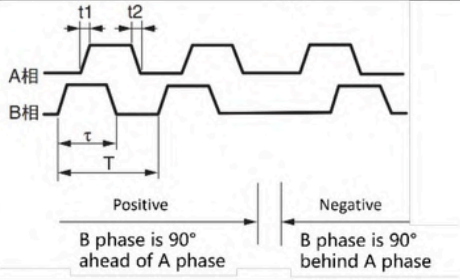
→+12V open collector output

→+5V open collector output

■ Precautions for open collector output

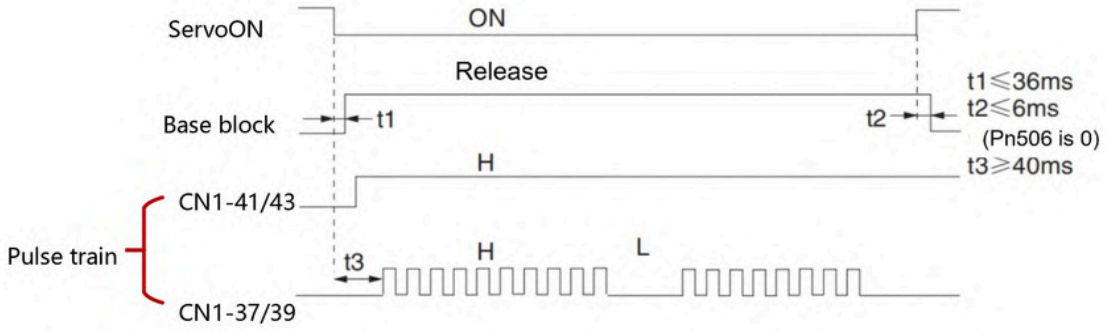
When pulse input is performed through open collector, the interference tolerance of the input signal is reduced. If the offset occurs due to interference, please change it in the following user parameters.

Electrical Specifications of Pulse Train Command

Pulse form	Specifications		Remarks
SIGN + PULS Max frequency: 500kpps (Open collector: 200kpps)		t1、t2、t3、t7 ≤ 0.025μS t4、t5、t6 ≥ 0.5μS τ ≥ 0.125μS T-τ ≥ 0.125μS	SIGN H=Forward L=Reverse
CW+CCW Max frequency: 500kpps (Open collector: 200kpps)		t1、t2 ≤ 0.025μS t3 ≥ 0.5μS τ ≥ 0.125μS T-τ ≥ 0.125μS	--
A-phase + B-phase Max frequency:×4 quadruple: 200kpps (Open collector: 150kpps)		t1 ≤ 0.1μS t2 ≤ 0.1μS τ ≥ 0.5μS T-τ ≥ 0.5μS	--

Time sequence of pulse train command

Take the sign + pulse train as an example to indicate the time when the pulse train command can be input after the servo is turned on.



Set the time interval (t3) from the servo ON to the start of pulse train command input to 40ms or more. If the input is within 40ms, the servo unit may not be able to receive command pulses.

6.2.4 Smoothing function settings

The command pulse input of a certain frequency can be filtered inside the servo drive.

(1) Filter related user parameters

Pn216	**Position command acceleration and deceleration time**			
	Setting range	Unit	Default	Effective
	0～32767	0.1ms	0	Immediate
Pn217	**Position command moving average time**			
	Setting range	Unit	Default	Effective
	0～1000	rpm	0	Immediate

■ Important

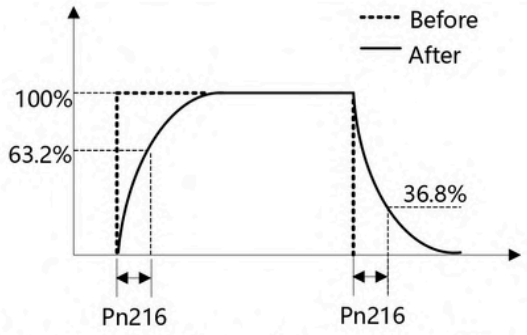
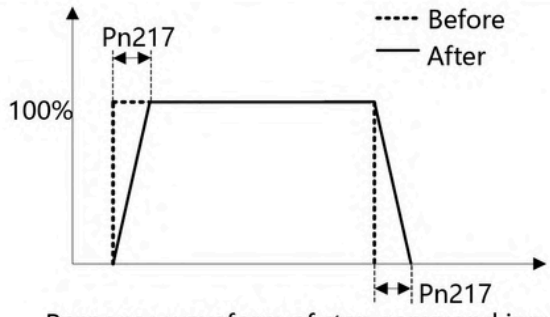
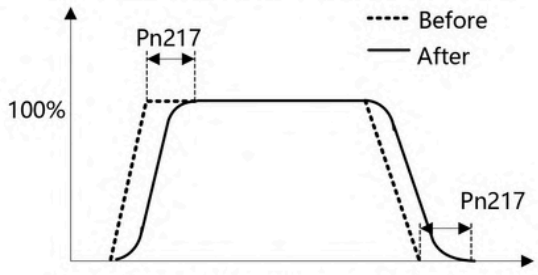
Pn216 & Pn217 will take effect only when there is no command pulse input. Therefore please CLR signal to prohibit the command pulse or clear the offset pulse as the servo ON.

The motor can be operated smoothly even in the following situations. In addition, this setting has no effect on the movement amount (command pulse number).

- When the command controller that issued the command cannot perform acceleration and deceleration;
- When the frequency of the command pulse is low;
- When the number of electronic gear is relatively large (more than 100 times).

■ Notes

The difference between the position command acceleration/deceleration time constant (Pn216) and the position command average movement time (Pn217) is as follows

Position command acceleration and deceleration time	**Position command moving average time**
Pn216	Pn217
 Response waveform of step command input	 Response waveform of step command input
	 Response waveform of trapezoidal command input

6.2.5 Positioning completion signal (COIN)

This signal indicates the completion of positioning of the servo motor during position control. Please use it when the command controller performs the interlock of positioning completion confirmation.

Type	Name	Pin	Level	Function
Output	COIN	CN1-1、26 (Default)	ON=L level	Positioning complete
			OFF=H level	Positioning not complete
The positioning completion signal is assigned to CN1-1 and 26 by default. It can be assigned to other terminals through user parameters Pn510~ Pn522, please refer to "5.7 IO signal assignment".				

Pn606	Positioning completion width			
	Setting range	Unit	Default	Effective
	0~1073741824	1 command unit	10	Immediate
If the difference between the command pulse number after electronic gear and the servo motor feedback pulse is lower than the value of this parameter, positioning completion signal (COIN) will output. The unit is the command unit, which depends on the command set by the electronic gear ratio. Attention: if this value is set too large, the offset can be reduced during low-speed operation, but the COIN signal may always output. This parameter does not affect the final positioning accuracy.				

6.2.6 Positioning near signal (NEAR)

Positioning near signal (NEAR) is a signal indicating that the servo motor is near the completion of positioning. Usually paired with a Position Completion Signal (COIN).

It is used to receive the positioning near signal before the command controller confirms the positioning completion signal, and prepares the operation sequence after the positioning completion to shorten the time required for the operation when the positioning is completed.

Type	Name	Pin	Level	Function
Output	NEAR	Need assignment	ON=L level	Positioning near
			OFF=H level	Positioning not near
Positioning near signal can be assigned to output terminals through user parameters Pn510~Pn522. For input signal assignment, please refer to "5.7 IO Signal Assignment".				

Pn608	NEAR signal width			
	Setting range	Unit	Default	Effective
	1~1073741824	1 command unit	100	Immediate
If the difference (offset) between the command pulse number of the command controller and the movement amount of the servo motor is lower than the value of this user parameter Pn608, the Positioning near signal (NEAR) will be output. Unit is the command unit, which depends on the command unit set by the electronic gear. Normally, set a value larger than the positioning completion width (Pn606). For input signal assignment, please refer to "5.7 IO Signal Assignment".				

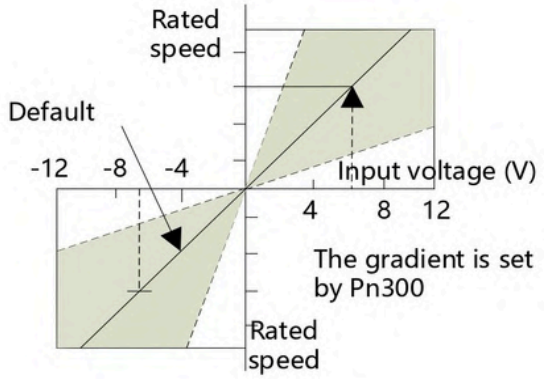
6.3 Speed control (optional feature)

6.3.1 Parameter settings

Parameter		Meaning
Pn000	n.□□1□	Control mode selection: speed control

Pn300	**Speed command input gain**			
	Range	Unit	Default	Effective
	150~3000	0.01V/ rated speed	600	-

This parameter is for setting the instruction voltage (V-REF) at motor rated speed.



Examples:

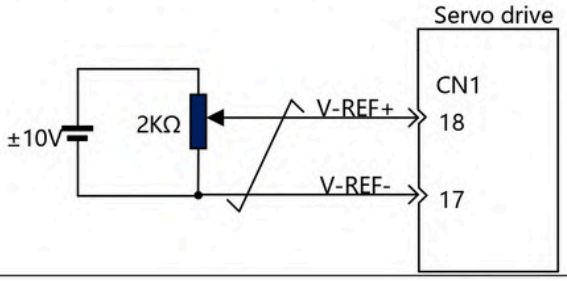
- Pn300=600 means that with 6V input, the motor will be at the rated speed (default) ;
- Pn300=1000 means that with 10V input, the motor will be at the rated speed.

6.3.2 Input signals

If speed instruction is sent to the servo drive, servo motor will run at a speed proportional to input voltage.

Type	Signal	Pin	Name
Input	V-REF+	CN1-18	Speed instruction input +
	V-REF-	CN1-17	Speed instruction input -

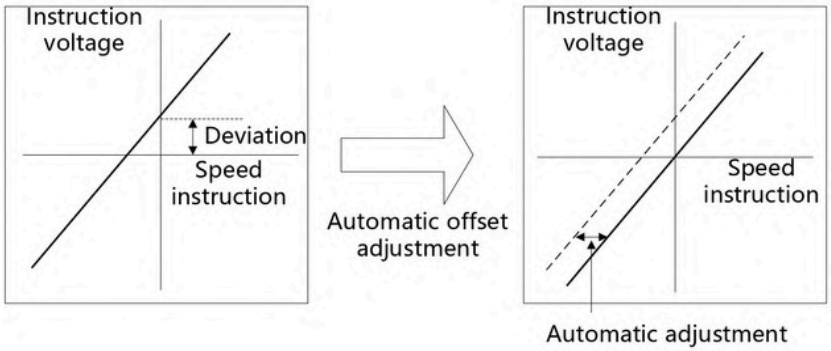
Please use multi-strand twisted wire to prevent interferences.



6.3.3 Speed instruction offset adjustment

When in speed control mode, even with 0V instruction, the motor may still rotate at a slight speed. This happens when instruction voltage of upper controller or external circuit has slight (mV unit) deviation (offset) . In this case, instruction offset can be adjusted automatically or manually by using the panel operator. Please use automatic or manual offset adjust by referring to Chapter 4.5.7.

Automatic offset adjustment is the function of offset measuring and automatic voltage adjustment. When the voltage instruction of upper controller and external circuit is deviated, the servo drive will adjust the offset automatically as follows:



1) Analog instruction automatic offset adjustment

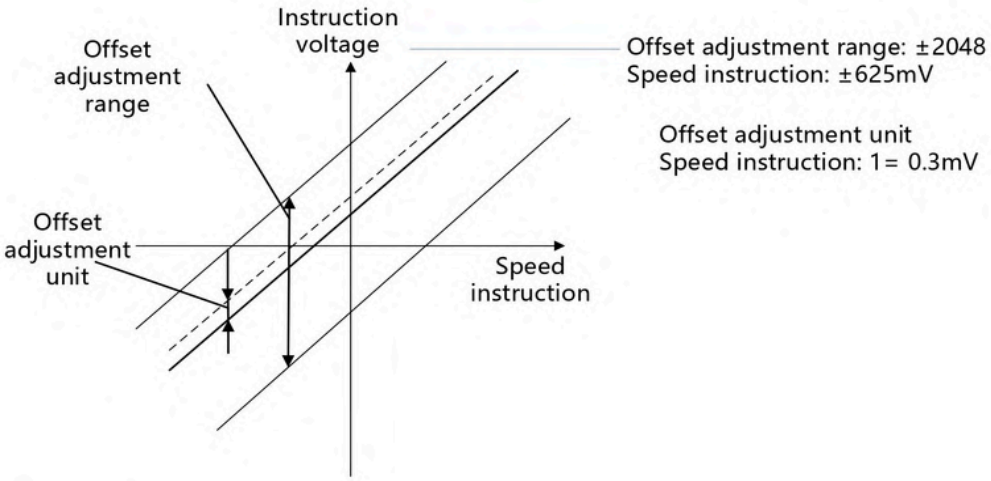
When the servo position loop is configured by host computer and the servo deviation pulse is set to 0 in lock state, the analog instruction offset automatic adjustment (Fn007) cannot be used. In this case, use the speed instruction manual offset adjustment (Fn008).

There is also a zero-clamp speed control function that enforces servo lock at zero speed command. Please refer to Chapter 6.3.6.

2) Speed instruction manual offset adjustment

Use Fn008 in following situations (Please refer to Chapter 4.5.7):

- When servo is locked and deviation pulse is set to 0
- When user wants to set offset to a certain value

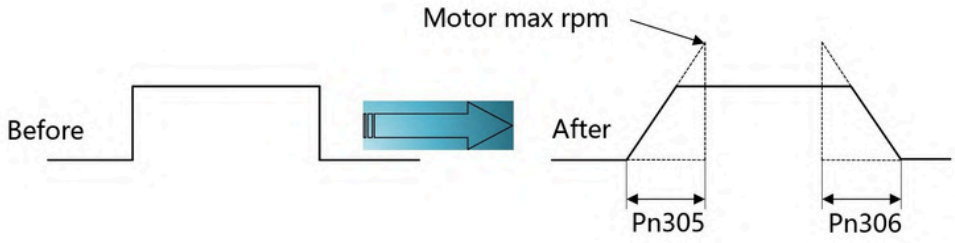


6.3.4 Soft start

Soft start is the function that phase step speed instruction input is transformed to instruction with certain acceleration and deceleration curves inside servo drive, thus to achieve smooth operations.

Pn305	**Soft start acceleration time**			
	Range	Unit	Default	Effective
	0~10000	1ms	0	Immed
Pn306	**Soft start deceleration time**			
	Range	Unit	Default	Effective
	0~10000	1ms	0	Immed

- Pn305: Acceleration time from 0rpm to max rpm;
- Pn306: Deceleration time from max rpm to 0rpm.



6.3.5 Speed instruction filter time constant

Pn30A	**Speed instruction filter time constant**			
	Range	Unit	Default	Effective
	0~65535	0.01ms	40	Immed
Analog speed instruction (V-REF) is input through 1-time relay filter to smooth speed				

instruction. The responsiveness will be reduced if this value is too large.

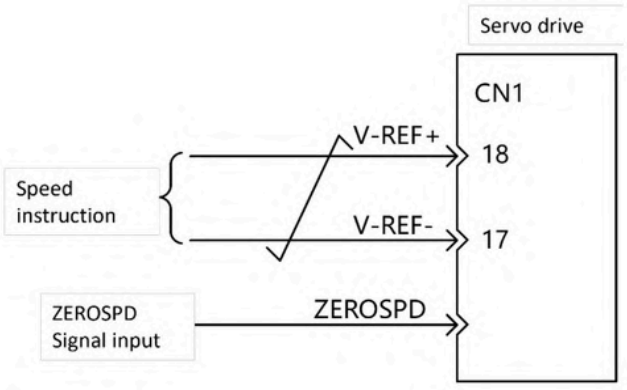
6.3.6 Zero-speed clamp function

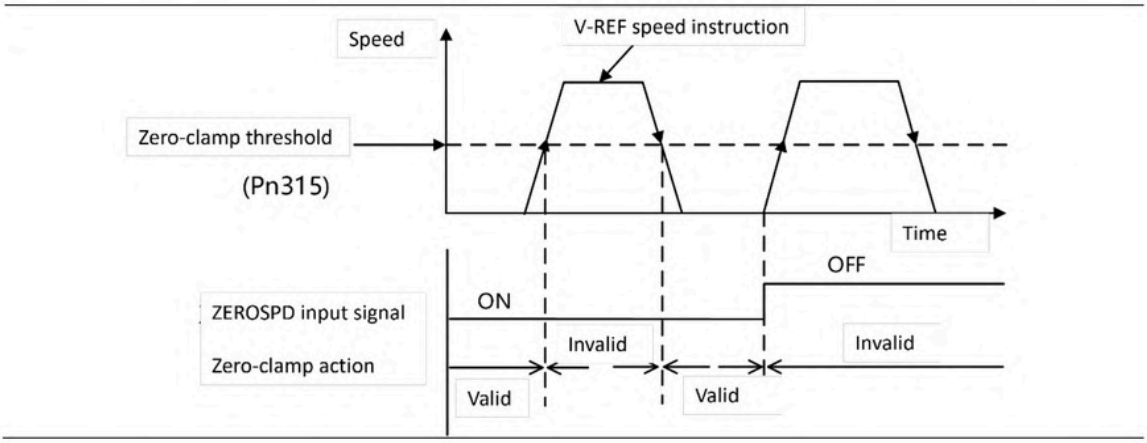
This is a function used in speed control mode when position loop is not configured in host computer.

If the zero clamp (ZEROSPD) signal is set to ON, or the input voltage of the speed command (V-REF) (Pn310.0=1) is below Pn315 (the speed of the zero-clamp level, the position loop is configured inside the servo drive), the servo drive will ignore the speed command and make the servo motor stop urgently to enter the servo lock state.

The servo motor is clamped within ±1 pulse at the position where the zero clamp is effective, and even if it is rotated by external force, it will return to the zero-clamp position.

Pn500~ Pn505	**DI signal selection**			
	【06】Zero Speed Clamp (ZEROSPD)			
Pn310	**Speed control function switch 0**			
	h.×××□: Zero clamp signal selection 0: IO signal (ZEROSPD) control 1: Zero clamp control is performed automatically. When the given speed is lower than Pn315 (zero fixed value), enter the zero-clamp mode			
Pn315	**Zero speed clamp threshold**			
	Range	Unit	Default	Effective
	0~5000	1rpm	10	Immed

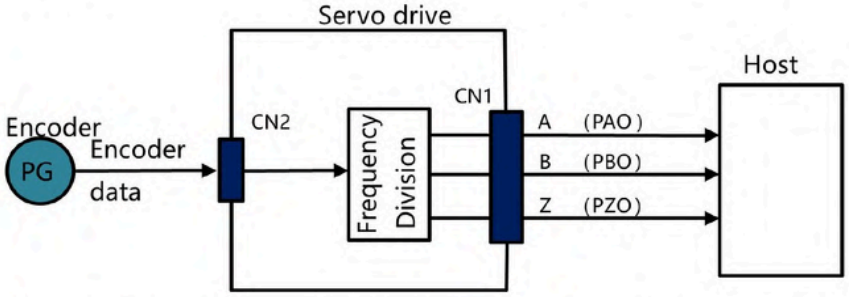




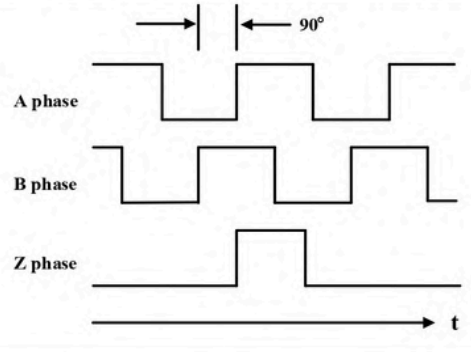
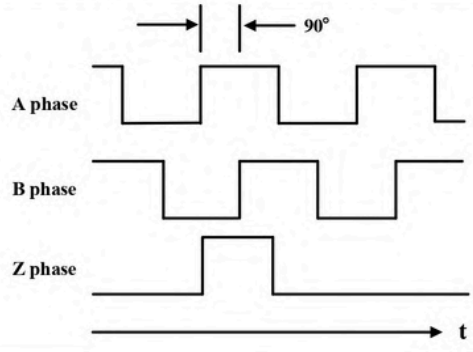
6.3.7 Encoder signal output

Pulse feedbacks from the encoder are processed inside the servo drive before outputting to the upper controller.

Type	Signal	Pin	Name
Output	PAO	CN1-21	Encoder Output A Phase
	/PAO	CN1-22	Encoder Output /A Phase
Output	PBO	CN1-25	Encoder Output B Phase
	/PBO	CN1-23	Encoder Output /B Phase
Output	PZO	CN1-13	Encoder Output Z Phase (reference point)
	/PZO	CN1-24	Encoder Output /Z Phase (reference point)



Note: Z phase width is 4-times Z phase, regardless of frequency division

Positive rotation (B phase is π/2 ahead of A phase)	Negative rotation (A phase is π/2 ahead of B phase)
	

Please rotate the servo motor by two turns before using servo drive Z phase pulse output for mechanical reference point reset action.

If this can not be done due to the structure of the mechanical system, please implement reference point reset action at speed below 200rpm (calculated according to servo motor rotating speed).

- **Frequency division**

This is a transformation process of the encoder pulse feedbacks by changing the density of pulses. The parameter is PA210.

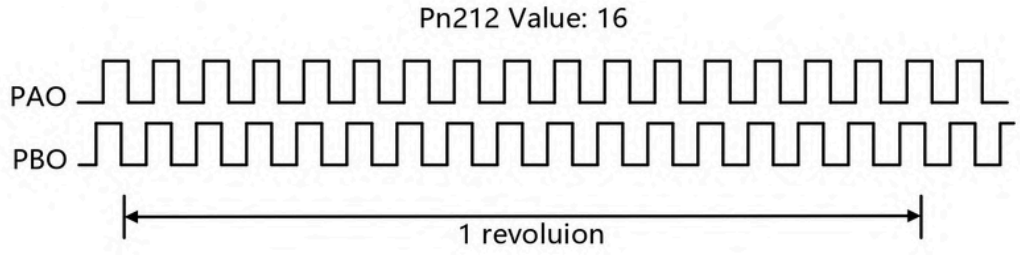
- **Encoder frequency-division setting**

Pn212	Encoder frequency-division setting			
	Range	Unit	Default	Effective
	16~16384	1Pulse/ rev	16384	Immed

The setting range is dependent on the encoder resolution.

Encoder specification	Resolution	Pulse per revolution	Range
17-bit	131072	32768ppr	16~16384

- **Example: Pn212=16**



6.3.8 Speed instruction reached (VCMP)

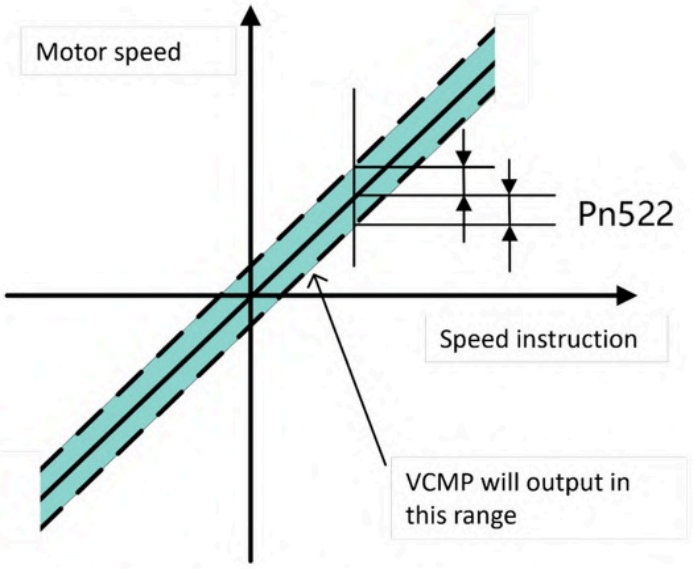
When motor rotation speed is same as speed instruction, VCMP will output

Type	Signal	Pin	Level	Name
Output	VCMP	To be allocated	ON=L level	Same speed
			OFF=H level	Not same speed

Please refer to Chapter 5.7.2.

Pn522	VCMP signal detection width			
	Range	Unit	Default	Effective
	0~100	rpm	10	Immed

If the difference between motor speed and instruction speed is less than Pn522 value, VCMP will output.



For example, Pn522=100, speed instruction is 2000rpm, if motor speed is within 1900rpm to 2100rpm, VCMP will be ON.

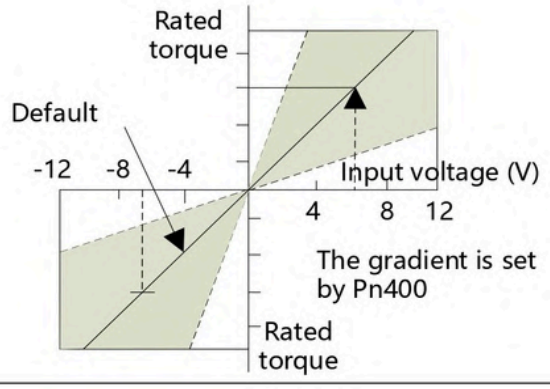
6.4 Torque control (optional feature)

6.4.1 Parameter settings

Parameter		Meaning
Pn000	n.□□2□	Control mode selection: torque control

Pn400	**Torque command input gain**			
	Range	Unit	Default	Effective
	10~100	0.1V/ rated torque	30	Immediate

This parameter is for setting the instruction voltage (T-REF) at motor rated torque.



Examples:

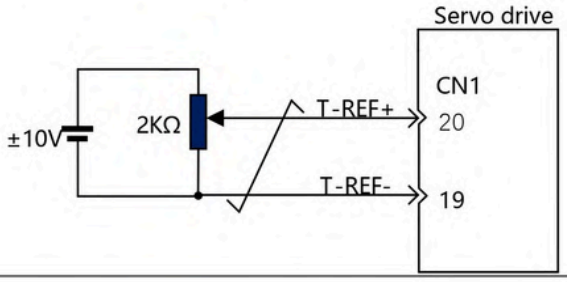
- Pn400=30 means that with 3V input, the motor will be at rated torque (default) ;
- Pn400=100 means that with 10V input, the motor will be at rated torque.

6.4.2 Input signals

If torque instruction is sent to the servo drive, servo motor will run at torque level proportional to input voltage.

Type	Signal	Pin	Name
Input	T-REF+	CN1-20	Torque instruction input +
	T-REF-	CN1-19	Torque instruction input -

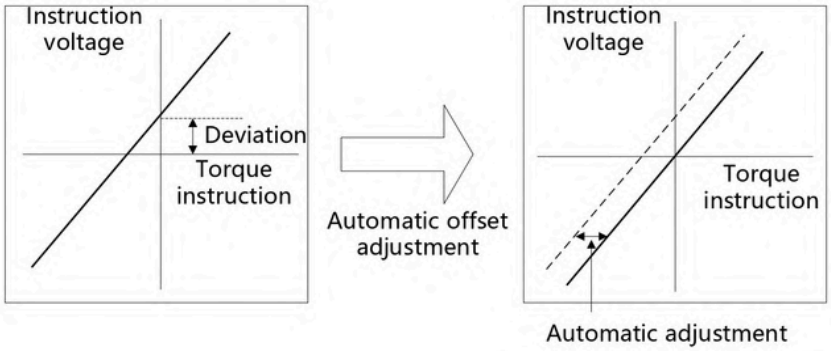
Please use multi-strand twisted wire to prevent interferences.



6.4.3 Torque instruction offset adjustment

When in torque control mode, even with 0V instruction, the motor may still rotate at a slight speed. This happens when instruction voltage of upper controller or external circuit has slight (mV unit) deviation (offset). In this case, instruction offset can be adjusted automatically or manually by using the panel operator. Please use automatic or manual offset adjust by referring to Chapter 4.5.7.

Automatic offset adjustment is the function of offset measuring and automatic voltage adjustment. When the voltage instruction of upper controller and external circuit is deviated, the servo drive will adjust the offset automatically as follows:



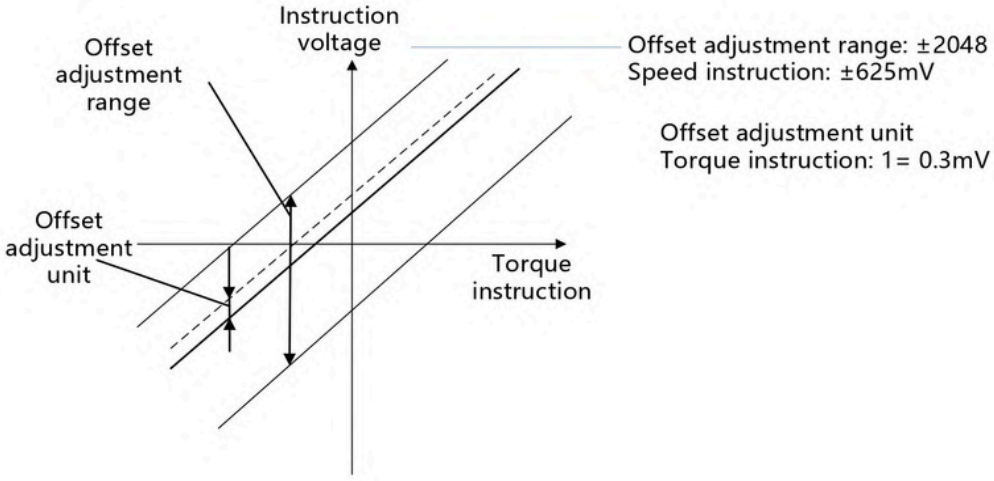
1) Analog instruction automatic offset adjustment

When the servo position loop is configured by host computer and the servo deviation pulse is set to 0 in lock state, the analog instruction offset automatic adjustment (Fn007) cannot be used. In this case, use the torque instruction manual offset adjustment (Fn009).

2) Torque instruction manual offset adjustment

Use Fn009 in following situations (Please refer to Chapter 4.5.8):

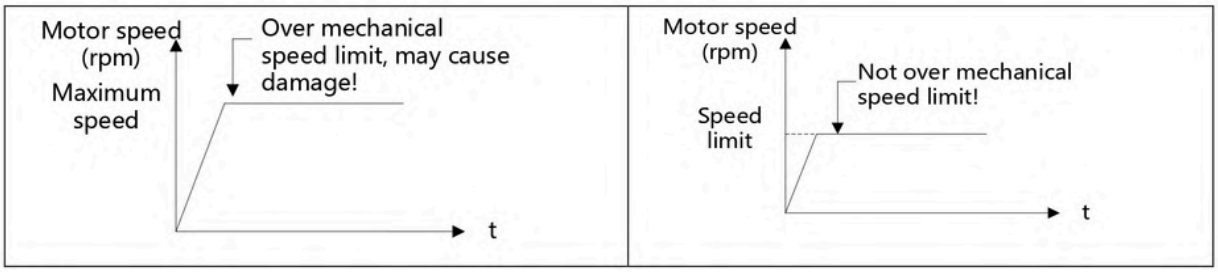
- When servo is locked and deviation pulse is set to 0
- When user wants to set offset to a certain value



6.4.4 Speed limit in torque control mode

When servo motor needs to be output torque following torque instructions, motor's rotating speed is not controlled. If instruction torque is too large due to the load torque at mechanical side, motor's rotating speed may increase too much. As a protection measure at mechanical side, servo motor's rotating speed needs to have limits in torque control mode.

With no speed limit	With speed limit



- **Speed limit in torque control mode selection**

Parameter		Meaning
Pn002	n.□□0□	Use Pn407 as speed limit (internal speed limit)
	n.□□1□	Use V-REF & Pn300 setting as speed limit (external speed limit)

- **Speed limit in torque control mode**

Pn407	Speed limit in torque control mode			
	Range	Unit	Default	Effective
	0~5000	rpm	1500	Immediate
When Pn002.1=0, settings of this parameter is effective. Pn407 value shall not exceed motor max speed.				

- **External speed limit**

Type	Signal	Pin	Name
Input	V-REF+	CN1-18	External speed limit +
	V-REF-	CN1-17	External speed limit -

Pn300 setting has no polarity

Pn300	Speed command input gain			
	Range	Unit	Default	Effective
	150~3000	0.01 V/rated speed	600	Immediate

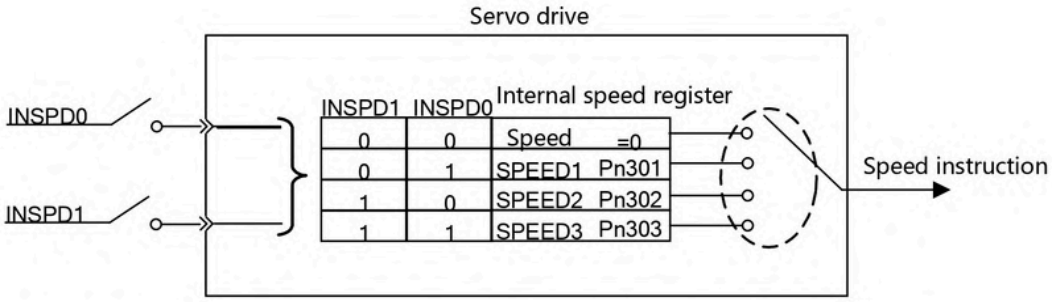
For example, in torque control mode, Pn300=600, V-REF+/V-REF- is 6V, speed limit is motor rated speed.

6.5 Speed control (internal speed)

The internal speed is a function of setting three kinds of motor speeds in advance through the user parameters inside the servo driver, and selecting them by external input signals to perform speed control operation.

It is not necessary to configure a speed generator or pulse generator externally.

The combination of INSPD1 and INSPD0 selects the internal speed, INSPD1 is high and INSPD0 is low.



Note: After selecting the external input signals as INSPD1 and INSPD0, if the INSPD1 and INSPD0 signals are not input, the selected speed is "speed=0" (00); if the INSPD0 signal is valid and the INSPD1 is invalid, then "SEEPD1" (01) is selected. , the speed value is Pn301.

6.5.1 Parameter settings

Parameter		Meaning
Pn000	h.□□3□	Control mode selection: speed control

Pn301	**Internal speed 1 (SPEED1)**			
	Setting range	Unit	Default	Effective
	- 6000～6000	rpm	100	Immediate
Pn302	**Internal speed 2 (SPEED2)**			
	Setting range	Unit	Default	Effective
	- 6000～6000	rpm	200	Immediate
Pn303	**Internal speed 3 (SPEED3)**			
	Setting range	Unit	Default	Effective
	- 6000～6000	rpm	300	Immediate

Even if a value exceeding the maximum speed of the servo motor used is set in Pn301 to Pn303, the actual value is still limited to the maximum speed of the servo motor used.

6.5.2 Input signal settings

Use the following input signals to switch the operating speed.

Type	Signal	Pin	Function
Input	INSPD0	CN1-□□ (Need assignment)	Internal speed selection signal 0
	INSPD1	CN1-□□ (Need assignment)	Internal speed selection signal 1

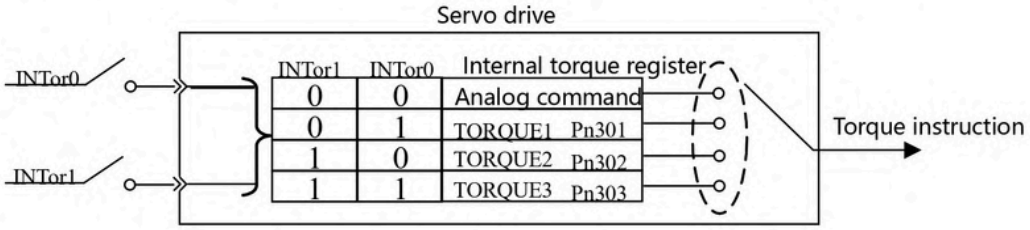
About input signal selection

The combination of the two signals INSPD0 and INSPD1 corresponds to three speeds.

When operating with INSPD0 and INSPD1, it is necessary to assign input signals through Parameter Pn500 to Pn505. Please refer to "5.7 IO signal assignment".

6.6 Torque control (internal torque)

Internal torque control operation is achieved by pre-setting 3 torque commands through the parameters inside the servo drive and using external input signals to select them for torque control operation.
It is not necessary to configure the torque generator externally.
The combination of INTor1 and INTor0 selects the torque command, INTor1 is high and INTor0 is low.



Note: After selecting the external input signal as INTor1 and INTor0, if the INTor1 and INTor0 signals are not input, the selected torque is "external analog command" (00). 01), the torque value is Pn301.

6.6.1 Parameter settings

Parameter		Meaning
Pn000	h.□□2□	Control mode selection: torque control

Pn301	**Internal torque 1 (TORQUE1)**			
	Setting range	Unit	Default	Effective
	- 6000 ~ 6000	0.1%	100	Immediate
Pn302	**Internal torque 2 (TORQUE2)**			
	Setting range	Unit	Default	Effective
	- 6000 ~ 6000	0.1%	200	Immediate
Pn303	**Internal torque 3 (TORQUE3)**			
	Setting range	Unit	Default	Effective
	- 6000 ~ 6000	0.1%	300	Immediate

Even if a value exceeding the maximum torque of the servo motor used is set in Pn301 to Pn303, the actual value is still limited to the maximum torque of the servo motor used.

6.6.2 Input signal settings

Use the following input signals to switch the operating torque.

Type	Signal	Pin	Function
Input	INTor0	CN1-□□ (Need assignment)	Internal torque selection signal 0
	INTor1	CN1-□□ (Need assignment)	Internal torque selection signal 1

About input signal selection

The combination of the two signals INTor0 and INTor1 corresponds to three kinds of torque. When operating with INTor0 and INTor1, it is necessary to assign input signals through Parameter Pn500 to Pn505. Please refer to "5.7 IO signal assignment".

CHAPTER 7 JOG RUN

7.1 Jog run preparations

Step	Content
1	Setup, installation. Setup conditions Setup motors and drives. First, check the operation at no-load. At this point, the motor is not connected to the mechanical system.
2	Wiring, connecting. Wiring the actuator. Check the operation of the motor alone. At this time, the driver control terminal CN1 is not connected.
3	Confirmation before trial operation.
4	Turn on the power.
5	Absolute encoder setting. If an absolute encoder is used, the absolute encoder multi-turn data and alarms need to be reset.

7.2 Jog run inspections

In order to perform the test operation safely and correctly, please confirm the following items before Jog.
» Drive and motor setup, wiring and connections are made.
» The power supply voltage to the drive is normal.
» There is no looseness in the fastening parts of the motor.
» When using a motor with an oil seal, the oil seal part is undamaged and oil is applied.
» When using a motor that has been stored for a long time, the maintenance and inspection of the motor have been completed.
» Motors with brakes have pre-released brakes. To release the brake, the specified voltage (DC24V) must be applied to the brake. For brake wiring, see "3.6.4 Brake Wiring".

7.3 Motor stand-alone operation

Use the JOG operation function when performing the test operation of the servo motor alone.

JOG operation refers to the function of driving the motor at the pre-set JOG speed (rotation speed) without connecting the host device, and confirming the servo operation.

The overtravel function will be disabled during JOG operation, so the operating range of the machine used must be considered during operation.

7.3.1 Items to check before operations

Before executing JOG operation, be sure to check the following.

▸The main circuit power supply must be ON;

▸ No alarm occurred;

▸ STO function must be disabled;

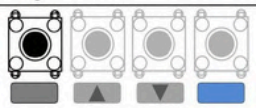
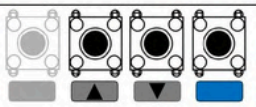
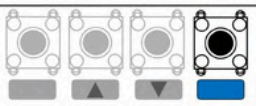
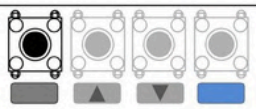
▸It must be in the servo OFF state;

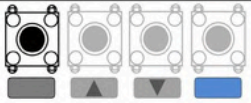
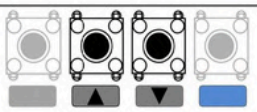
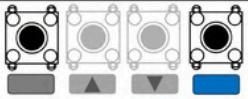
▸ The setting of the JOG speed must take into account the operating range of the machine used, etc. Set the JOG speed with the following parameters.

Para	Name	Range	Unit	Default	Effective
Pn304	JOG speed	0 ~ 6000	rpm	500	Immediate
Pn306	Soft start acceleration time	0 ~ 10000	ms	0	Immediate
Pn307	Soft start deceleration time	0 ~ 10000	ms	0	Immediate

7.3.2 Jog run (Fn002)

Panel operations

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn002.
Step 3			Long press the [S] key to enter the JOG operation interface.
			If the JOG operation conditions are not met, the interface will display "no-op", indicating that the JOG operation cannot be performed.
			Press the [M] key to enter the servo ON (motor power-on) state.

			Press [M] to switch between servo ON and servo OFF. If you want to run the motor, you must go to servo ON.
Step 4			Press the [▲] key or the [▼] key, the motor starts to rotate in the forward or reverse direction. Press and hold the [▲] key or the [▼] key to make the motor rotate continuously. The servo motor rotates at the speed set by Pn304.
Step 5			Press the [M] key and long press the [S] key to return to the display of function numbers.
Finish			

7.4 Jog run with mechanical parts

7.4.1 Attention

In the state where the machine and the servo motor are connected, if an operation error occurs, not only the machine will be damaged, but it may also lead to personal injury.

If the overtravel signal (P-OT, N-OT) has been disabled during the stand-alone test run of the servo motor, please change the overtravel signal (P-OT, N-OT) to be enabled to enable the protection. Function works.

When using the brake, please pay attention to the following points before trial operation.

◆ Before confirming the operation of the brake, be sure to take measures to prevent the machine from falling naturally or vibrating due to external force.

◆ Use the brake control output (/BK) signal of the driver to control the brake action.

■ Drive failure and damage caused by incorrect wiring of the brake circuit, application of different voltages, etc. may result in mechanical damage or personal injury.

■ Follow the precautions and steps described in this manual for wiring and trial operation.

7.4.2 Items to check before operations

Before performing JOG run with mechanical parts, be sure to confirm the following.

▸The connection between the driver and the host device and the peripheral equipment is correct.

▸Check the wiring of the overtravel signal (P-OT, N-OT).

▸Check the wiring of the brake signal (/BK).

▸Wiring of emergency stop circuit

▸Wiring of the host device

7.4.3 Procedures

Step 1	For details, refer to "5.3 Overtravel Setting".
Step 2	Make settings related to protection functions such as overtravel and brake.
Step 3	For the function and setting of overtravel, please refer to "5.3 Setting of Overtravel".
Step 4	For the setting of the brake, please refer to "5.5 Holding the Brake".
Step 5	Remove power from the drive. Turn off the control power and main circuit power.
Step 6	Connect the servo motor to the machine.
Step 7	Turn on the power of the machine (host device) and the input power of the driver.
Step 8	For future maintenance work, please use any of the following methods to save the set parameters. ▸ Using PC software to save the parameters to a file. ▸ Write down by hand.
Finish	

7.5 PJOG run (Fn004)

PJOG operation is a function that performs continuous operation in a preset operation mode (moving distance, moving speed, acceleration/deceleration time, waiting time, and number of moves).

This function is the same as the JOG operation. It is not connected to the host device when setting, and the movement of the motor can be confirmed and a simple positioning operation can be performed.

7.5.1 Attention

Before executing PJOG operation, be sure to check the following.

▸The main circuit power supply must be ON

▸No alarm has occurred

▸The servo must be in the OFF state

▸Please set the correct moving distance and speed in consideration of the operating range of the machine

▸No overtravel shall occur

7.5.2 Relevant parameters

Pn700	**P-Jog run switch**			
	Setting range	Unit	Default	Effective
	0000 ~ 0005	--	0000	Immediate
	0000	(Wait time Pn705 → Forward movement Pn701) × Movement times Pn706		
	0001	(Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706		
	0002	(Wait time Pn705 → Forward movement Pn701) × Movement times Pn706 (Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706		
	0003	(Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706 (Wait time Pn705 → Forward movement Pn701) × Movement times Pn706		
	0004	(Waiting time Pn705 → Forward movement Pn701 → Waiting time Pn705 → Reverse movement Pn701) × Movement times Pn706		
	0005	(Wait time Pn705 → Reverse movement Pn701 → Wait time Pn705 → Forward movement Pn701) × Movement times Pn706		
Pn701	**P-Jog run distance**			
	Setting range	Unit	Default	Effective
	1 ~ 1073741824	1 command unit	32768	Immediate
Pn703	**P-Jog run speed**			
	Setting range	Unit	Default	Effective
	1 ~ 6000	1rpm	500	Immediate
Pn704	**P-Jog run acceleration/deceleration time**			
	Setting range	Unit	Default	Effective
	10 ~ 10000	1ms	100	Immediate
Pn705	**P-Jog run waiting time**			
	Setting range	Unit	Default	Effective
	0 ~ 10000	1ms	100	Immediate
Pn706	**P-Jog run cycles**			
	Setting range	Unit	Default	Effective
	0 ~ 1000	1 cycle	1	Immediate

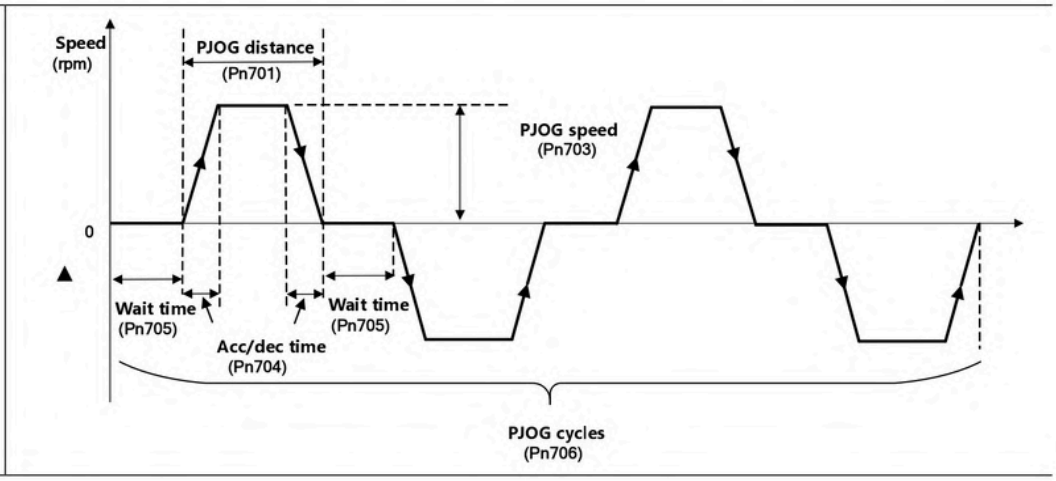
7.5.3 PJOG example

An example of the P-Jog run operation mode is shown below. The following assumes that the motor rotation direction is set to Pn000.0=0 (positive rotation when positive rotation is commanded).

Only the setting when Pn700.0=4 is used for description here.

Pn700.0=4	(Wait time Pn705 → Forward movement Pn701 → Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706

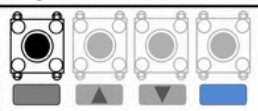
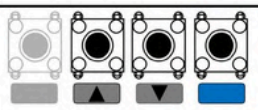
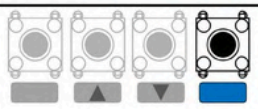
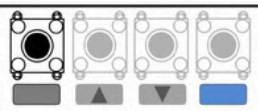
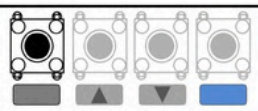
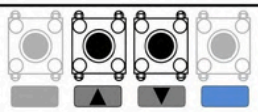
Speed chart

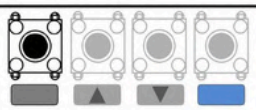


How to set unlimited runs

- When Pn700.0=0, 1, 4, 5, set Pn706 to 0, and it can run infinitely.
- To finish the infinite operation, press MODE to turn off the servo.
- When Pn700.0=2, 3, it cannot run infinitely.
- When Pn700.0=0, 1, it can only run in one direction. Be careful with moving range!

7.5.4 PJOG operations

Step	Display after operation	Keys used	Operations
Step 1			After the drive is powered on, press the [M] key several times to select the auxiliary function mode.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn004.
Step 3			Long press the [S] key to enter the next layer of PJOG operation interface.
			If the operation requirements are not met, 'no-op' is displayed.
Step 4			Press the [M] key to enable the servo.
			Press [M] to switch between servo ON and servo OFF. If you want to run the motor, you must go to servo ON.
			Press the [▲] key or [▼] key corresponding to the initial movement direction of the operation mode,

			Then the operation will start after the set waiting time has elapsed. < Supplement > → If the [M] key is pressed during running, it will enter the Servo OFF state and the motor will stop running. →If you press and hold the [S] key for about 1 second during operation, it will return to Step 2.
Step 5			If P-Jog run is funished, the display returns to Step 4 after blinking "End". < Supplement > →If you press the MODE key during operation, it will enter the Servo OFF state and return to Step 3. → If you press and hold the SET key for about 1 second during operation, go back to Step 2.
Step 6			Press the [M] key to cancel the operation and return to the previous display.
Finish			

CHAPTER 8 TUNING

8.1 Summary

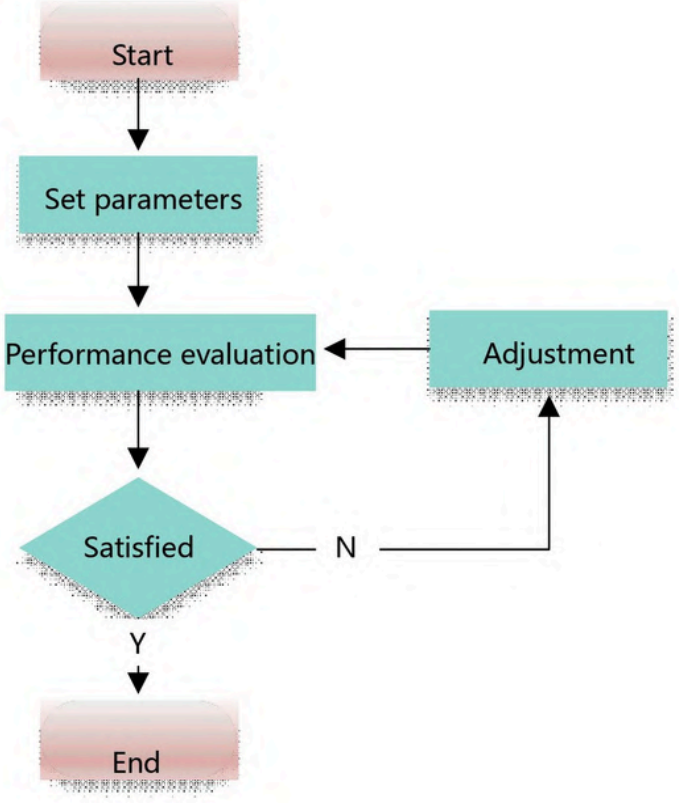
8.1.1 Basic information

Tuning refers to the process of making the servo performance meet the requirements by adjusting the servo parameters. The key is to master the adjustment method of the servo parameters and to correctly evaluate the servo performance.

Adjustment process

The tuning process is usually an iterative process, as shown in Figure 9-1.

Figure 9-1 General tuning process



Parameter classification

The parameters in the tuning process can be divided into the following two types:

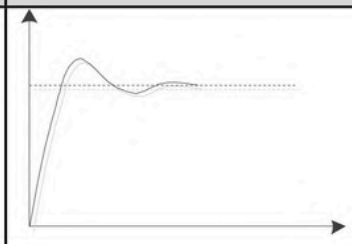
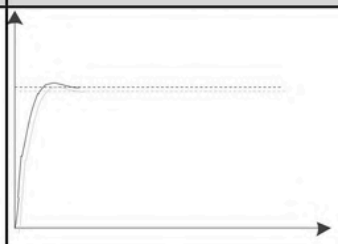
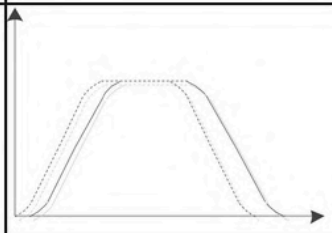
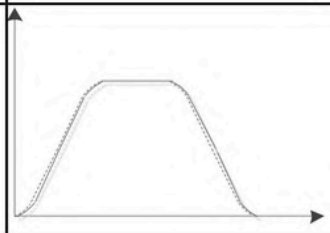
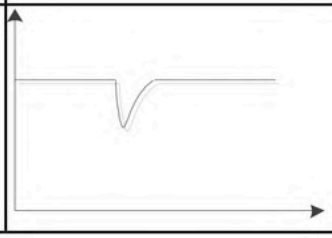
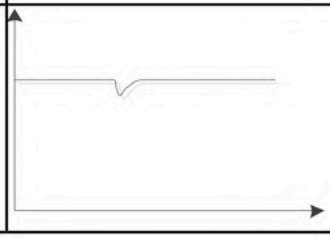
▸Function parameters: It involves the selection or switch of some application functions, and the use of these functions may improve the servo performance.

▸Adjustment parameters: It involves some parameters that affect servo performance, increasing/decreasing these parameters may improve servo performance.

Performance indicators

The indicators usually used to evaluate servo performance are bandwidth, response time, overshoot, steady-state error, anti-load disturbance, speed fluctuation, torque fluctuation and so on. Table 9-1 lists some performance comparison graphs before and after tuning.

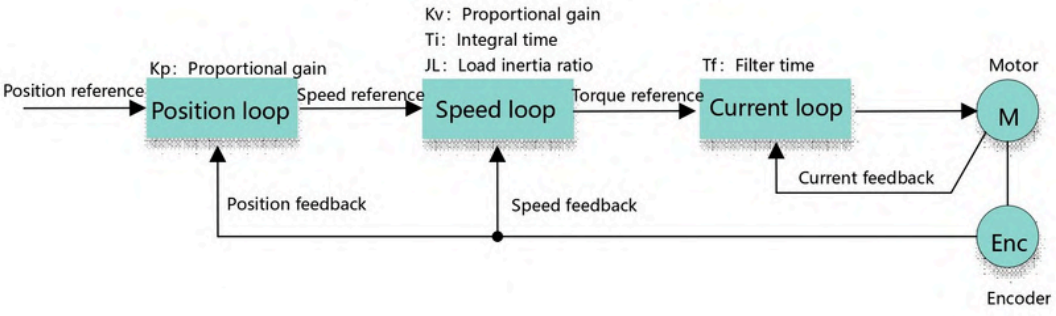
Table 9-1 Performance comparison before and after tuning

Indicator	Before	After
Speed step response		
Position tracking		
Response to load disturbance		

8.1.2 Servo control diagram

Before tuning, it is necessary to understand the control principle of the servo, as shown in Figure 9-2. Among them, the position loop, speed loop and torque loop are cascade structures, corresponding to the position control mode, speed control mode and torque control mode respectively.

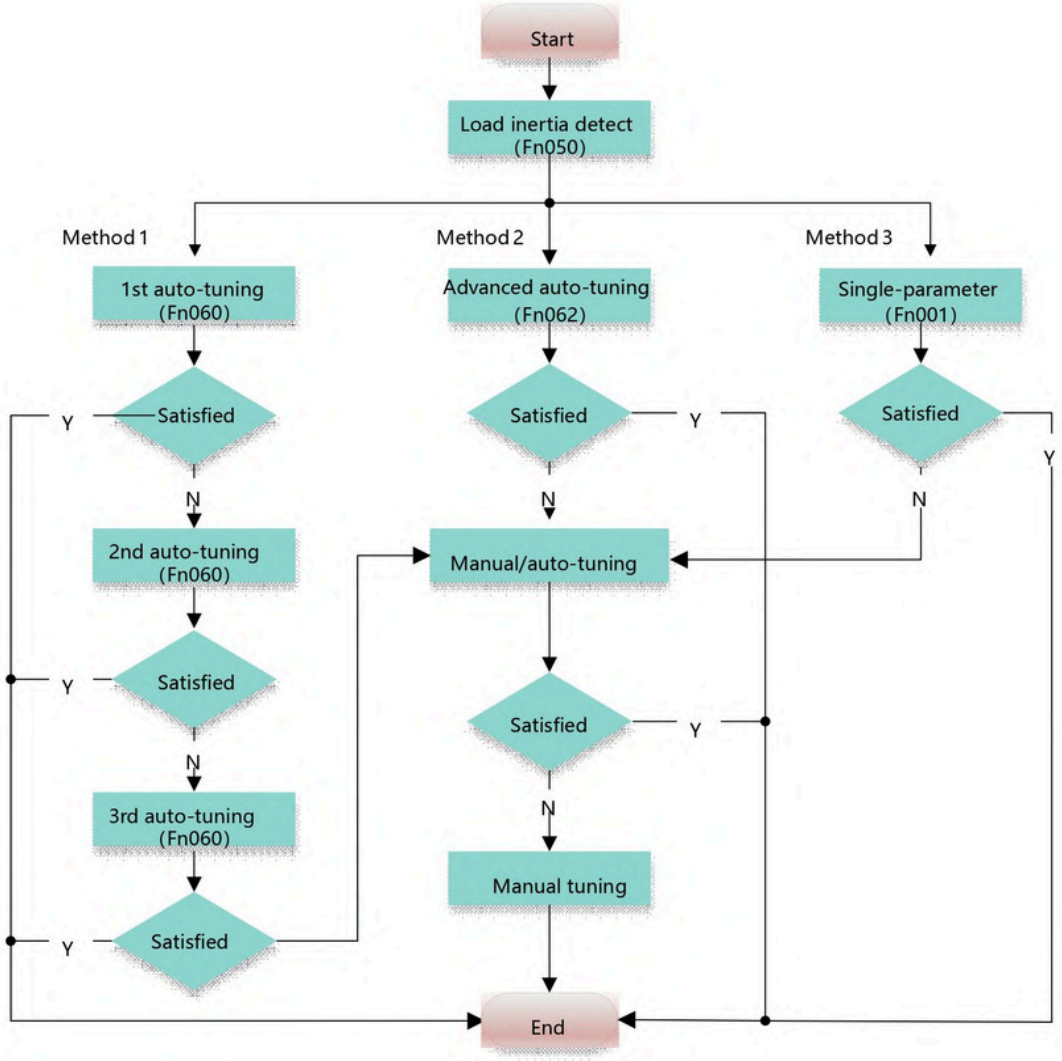
Figure 9-2 Servo control principle



8.1.3 Adjustment flowchart

The servo driver provides a variety of adjustment methods. Users can adjust the device according to the process shown in Figure 9-3.

Figure 9-3 Servo adjustment process



If the servo motor is disassembled or the load device is replaced, the tuning operation should be performed again.

8.1.4 Attentions

- Before executing the tuning function, make sure that the limit function is valid.
- Before executing the tuning function, make sure that the servo motor can be stopped urgently.
- Before executing the tuning function, the torque limit value should be set according to the actual situation.

- Operators should not directly or indirectly touch moving parts when performing tuning functions.

8.2 Load inertia detection (Fn050)

Load inertia detection refers to the function of estimating the inertia moment of the load during automatic operation (reciprocating motion of forward and negative rotation) of the servo unit without sending a command from the host device.

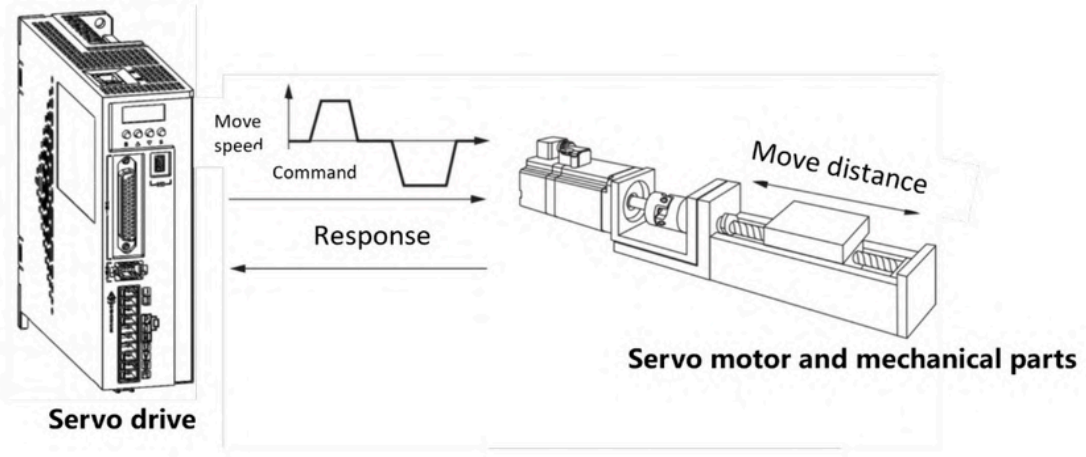
The moment of inertia ratio (the ratio of the moment of inertia of the load to the moment of inertia of the motor) is the reference parameter for performing gain adjustment, and must be set to the correct value (Pn103) as much as possible.

The moment of inertia of the load can be calculated according to the weight and composition of each part of the machine, but the operation is very complicated. Moreover, with recent complex mechanical formations, it is getting harder and harder to get it right. Using this function, a high-precision load moment of inertia value can be obtained as long as the servo motor is actually driven several times in the positive/negative direction.

8.2.1 Load inertia detection description

Execute load inertia detection without connecting the host device. The operation specifications of inertia detection are as follows.

- Moving distance: 1 to 6 turns can be set. Default is equivalent to 3 revolutions of the motor.
- Maximum speed: 1/6~3/6 motor rated speed can be set. Default is equivalent to 1/3 of the rated speed of the motor.
- Acceleration level: 1~3. Default is level 2.



(1) When the load inertia detection cannot be performed

→When the mechanical system can only run in one direction
→When the active range is narrower than 0.5 circle

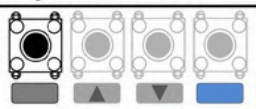
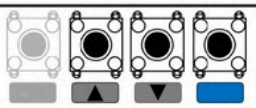
(2) Check items before executing load inertia detection

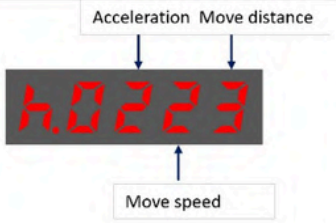
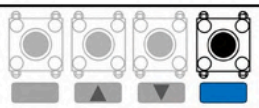
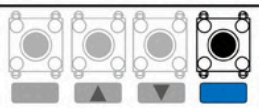
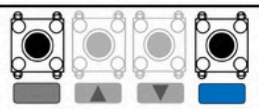
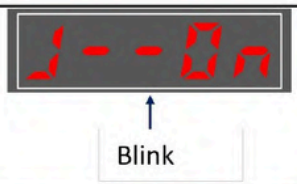
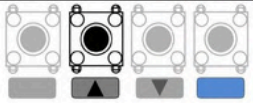
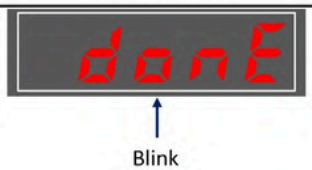
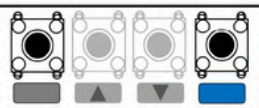
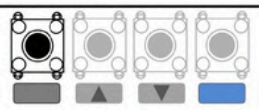
Before executing load inertia detection, be sure to confirm the following settings.
a) Confirm the following items, if the setting is incorrect, "NO-OP" will be displayed during operation.
→The main circuit power must be ON
→ Servo must be OFF
→ Overtravel signals (P-OT, N-OT) shall not be valid
→Not for torque control
→Auto gain switching must be disabled
→The 2nd gain cannot be selected
→Do not generate alarms or warnings
b) Confirm the following items, if the setting is incorrect, it will not work.
→Write Prohibition (Fn021) is not set to "Write Prohibited"

8.2.2 Load inertia detection procedures

- Please set the appropriate gain parameters to check the load inertia. If the gain is too large, it will cause vibration. If the gain is too small, it will easily cause overshoot, which may make the load inertia detection inaccurate.
- When the load inertia detection is executed, vibration or overshoot may occur during operation. To ensure safety, execute it in a state where an emergency stop is possible at any time.

(1) Procedures

Step	Display after operation	Keys used	Operations
Step 1			Press the "M" key to select auxiliary functions.
Step 2			Press [▲] key, [▼] key or short press [S] key to select function number Fn050.

Step 3			Press and hold the "S" key for about 1 second to enter the distance, speed, acceleration movement parameter setting interface. The moving distance Unit is a circle. Range is 1~6. The moving speed Unit is 1/6 of the rated speed of the motor. Range is 1~3. The moving acceleration unit is 1~3 grade acceleration.
Step 4			Press and hold the "S" key for about 1 second to enter the load inertia detection operation interface.
Step 5			Press "M" and "S" keys at the same time, after the servo is ON, it will display "J--ON"
Step 6			Press the [▲] key, the motor starts to run.
Step 7			After the detection is completed, the inertia value is displayed successfully when the inertia is detected. Or inertia detection error "J-ERR" is displayed blinking.
Step 8			Press and hold the "S" key for 1 second, the detected load inertia value will be automatically saved. "donE" will be displayed flashing. Press the "M" key to return without saving the inertia value.
Step 9			Press the "M" key to return to the display of "Fn050".
Finish			

8.3 Tuning mode

8.3.1 Auto-tuning（Fn060） (under development)

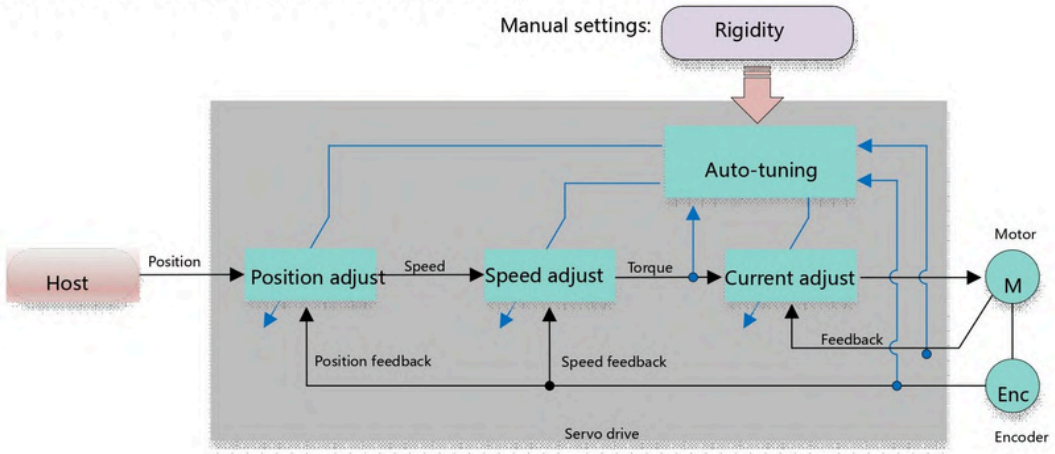
8.3.2 Advanced auto-tuning（Fn062） (under development)

8.3.3 Single parameter tuning

Function description

When performing single-parameter adjustment, the user only needs to manually set the rigidity level of the servo without using the automatic parameter adjustment module. The so-called "single parameter adjustment" refers to the Fn001 servo rigidity setting level, that is, its working diagram is shown in Figure 9-6.

Figure 9-6 Working diagram of single tuning



Compared with auto-tuning, single-parameter tuning has the following characteristics:

- Simple to use: only need to set a rigidity level.
- Better servo performance can be obtained when the load inertia ratio is set accurately.

Suitable conditions

Load inertia is > 15 times compared to motor rotary inertia

Motor can run at full speed

Restrictions

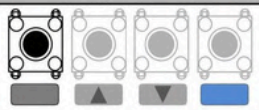
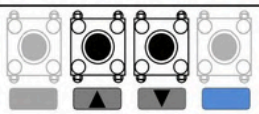
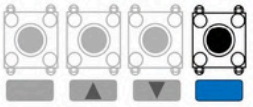
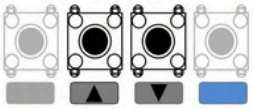
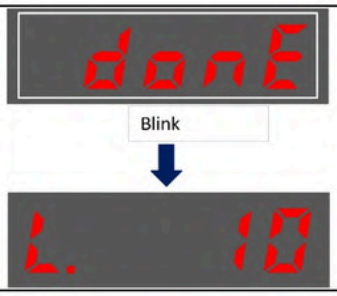
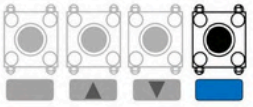
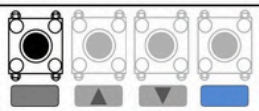
When using single-parameter tuning, the following functions are unavailable or invalid:

- Model tracking control is invalid

Relevant parameters

Para	Value	Function	Effective	Type

Fn001	4[Default]	The default rigidity level is level 4	Immediate	Set up
Pn100	-	1st speed loop gain	Immediate	Adjustment
Pn101	-	1st speed loop integral time constant	Immediate	Adjustment
Pn102	-	1st position loop gain	Immediate	Adjustment
Pn103	-	Load inertia ratio	Immediate	Adjustment
Pn401	-	Torque command filter time constant	Immediate	Adjustment

Step	Display after operation	Keys used	Operations
1			Press the "M" key to select auxiliary functions.
2			Press the [▲] or [▼] key to display "Fn001" .
3			Press "S" key for about 1 second, "L. XX" displays the current rigidity value of the system.
4			Press the [▲] or [▼] key to set the rigidity level to be set, such as 10. The rigidity setting becomes valid immediately. Observe the adjustment result. If there is loud noise or abnormal phenomenon during operation after the rigidity is increased, please reduce the rigidity value.
6			After pressing the "S" key for about 1 second, the displayed stiffness value will be set in the corresponding parameter.
8			Press the "M" key to return to the display of "Fn001".
9	Finish		

8.3.4 Manual tuning

Function description

When performing manual parameter adjustment, the user needs to manually set the gain

parameters until the servo achieves the desired performance.

When performing manual adjustment, it is necessary to adjust the three-loop control parameters of the servo in turn from the inside out, that is, the adjustment sequence is "current loop→speed loop→position loop". In addition, in order to meet the stability, the bandwidth of the current loop should be adjusted to be the largest, followed by the speed loop, and the position loop should be the smallest.

When performing manual adjustment, the following parameters need to be adjusted in each loop.

■ Torque loop/torque control mode

– Torque command filter time constant Tf: The torque command filter is to filter the torque command input to the torque loop to remove high-frequency components, which can effectively reduce the torque fluctuation of the servo motor output and eliminate signal noise and reduce the motor temperature rise.

The larger the torque command filter time constant, the better the filtering effect on the torque command, but the larger the phase lag, the slower the torque response. Therefore, an acceptable smaller value should be selected to obtain a larger torque loop bandwidth during actual adjustment.

■ Speed loop/speed control mode

– Torque control parameter (Tf)

– Load inertia ratio JL. Correctly setting the load inertia ratio is the premise of whether tuning can achieve better performance. The load inertia ratio can be obtained through calculation or analysis tools (load inertia detection), etc., or it can be modified in real time through the controller.

– Speed loop gain Kv, speed loop integral time Ti

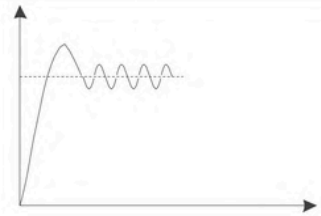
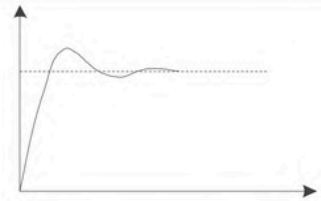
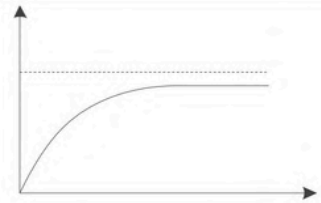
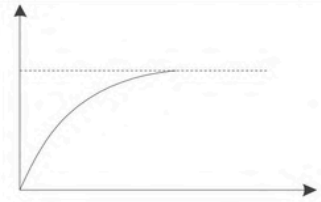
The speed loop uses a PI regulator with proportional gain and integral time constant. They all affect the speed loop bandwidth and anti-disturbance performance of the servo.

The larger the proportional coefficient, the wider the speed loop bandwidth, and the better the anti-load disturbance performance. The smaller the integral time constant is, the stronger the integral action is, the wider the speed loop bandwidth, and the better the anti-load disturbance performance. Integral action also reduces the steady state error to zero.

According to the characteristics of the speed step response, Table 9-2 lists several commonly used adjustment methods.

Table 9-2 Speed loop adjustment example

Waveform	Remarks	Adjustment method

	The speed loop bandwidth is too high	Properly reduce the proportional gain or increase the integral time constant
	Speed loop damping ratio is low	Appropriately increase the integral time constant
	There is a steady state error	Appropriately reduce the integral time constant
	Low speed loop bandwidth	Properly increase the proportional gain or decrease the integral time constant

In actual adjustment, it is recommended to set a larger proportional gain and a smaller integral time constant to obtain a larger speed loop bandwidth.

■Position Loop/Position Control Mode

– Speed control parameters (Kv, Ti, Tf, JL)

– Position loop gain Kp

The position loop uses a P regulator and contains only proportional gain. This coefficient will affect the bandwidth of the position loop. The larger the proportional gain, the wider the position loop bandwidth and the better the anti-disturbance performance, but it may cause position overshoot or jitter.

In actual adjustment, it can take 1/4 of the speed loop gain coefficient, and make appropriate adjustments on this basis.

Suitable conditions

Load inertia is over 50 times compared to motor rotary inertia

Motor can run at full speed

Parameters

Para	Value	Remarks	Effective	Type
Pn100/Pn104	-	1st/2nd speed loop gain	Immediate	Adjustment
Pn101/Pn105	-	1st/2nd speed loop integration time	Immediate	Adjustment
Pn102/Pn106	-	1st/2nd position loop gain	Immediate	Adjustment

Pn103	-	Load inertia ratio	Immediate	Adjustment
Pn401/Pn40A	-	First/second torque command filter time constant	Immediate	Adjustment

8.4 Application functions

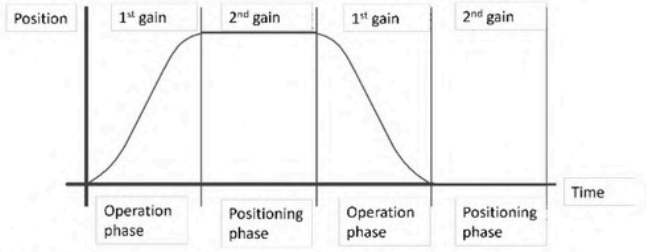
8.4.1 Gain switch

Function description

When using manual adjustment, the gain switching function can be used, the purpose is to switch to another set of parameters in a certain stage of the servo operation, so that the comprehensive performance of the servo system can reach the specified performance index.

In Figure 9-23, the "positioning phase" pays more attention to performance such as position fluctuation and position rigidity, while the "operation phase" pays more attention to performance such as tracking error. At this time, two sets of gain parameters need to be used to meet the servo performance requirements of the two stages.

Figure 9-23 Gain switching example

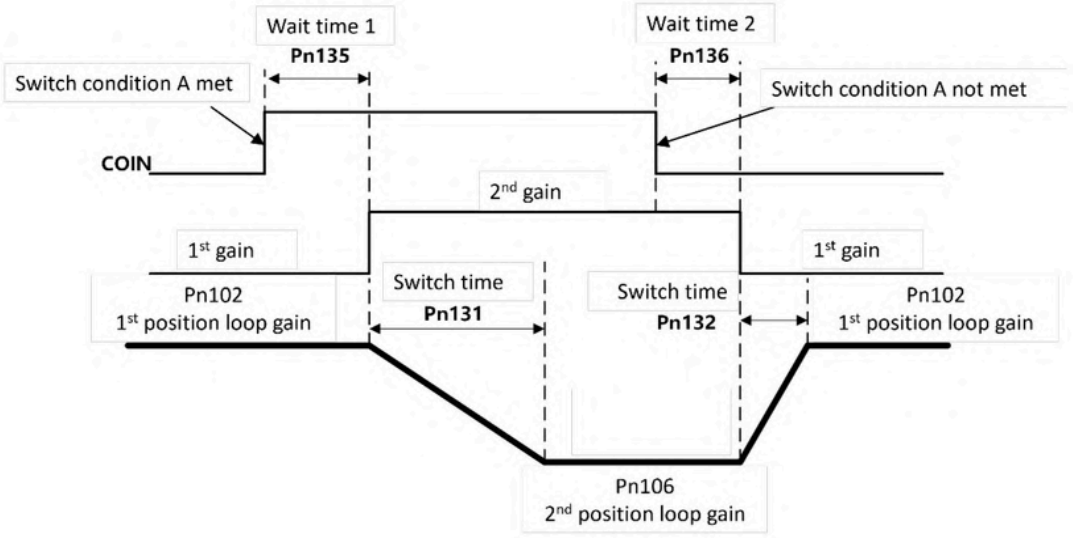


The parameters of the first gain and the second gain are as follows.

Parameter	First gain	Second gain
Speed loop gain	Pn100	Pn104
Speed loop integral time	Pn101	Pn105
Position loop gain	Pn102	Pn106
Torque command filter time constant	Pn401	Pn40A

The gain switching function includes two aspects: one is the conditions for starting the gain switching, which is used to start the gain switching; the other is the process of the gain switching. Taking COIN as the gain switching condition, the gain switching process is shown in Figure 9-24.

Figure 9-24 Gain switching process



Set switch conditions

The driver uses the first set of gain parameters by default, and the user can set the "condition for starting gain switching" through Pn130.1, which means that when the set conditions are met, the second set of gain parameters will be switched and used.

Para	Value	Remarks	Effective	Type
Pn130.0	1	Automatically switch gain	Restart	Function
Pn130.1	0	Positioning completion signal (COIN) ON (signal valid)	Immediate	Function
	1	Positioning completion signal (COIN) OFF		
	2	Proximity signal (NEAR) ON (signal valid)		
	3	Proximity signal (NEAR) OFF		
	4	Position command filter output=0 and command pulse input OFF		
	5	Position command pulse input ON		
	6	The torque command is greater than the switching level (Pn137, Unit 1%)		
	7	The speed command is greater than the switching level (Pn137, Unit 1rpm)		
	8	The position deviation is greater than the switching level (Pn137, Unit pulse)		
	9	The actual acceleration is greater than the switching level (Pn137, Unit: 1rpm/S)		
	A	The actual speed is greater than the switching level (Pn137, Unit 1rpm)		
	B	There is a position command + the actual speed is greater than the switching level (Pn137, Unit 1rpm)		

▸When Pn130.1 is set to 1～B, it means that when the set gain switching conditions are met, the second set of gain parameters will be switched and used; otherwise, the first set of gain parameters will be used.

▸At this time, the user needs to set appropriate waiting time and switching time to avoid mechanical vibration caused by sudden change of gain. As shown in Figure 9-24.

Relevant parameters

Para	Value	Remarks	Effective	Type
Pn131	-	Gain switching time 1	Immediate	Adjustment
Pn132	-	Gain switching time 2	Immediate	Adjustment
Pn135	-	Gain switching wait time 1	Immediate	Adjustment
Pn136	-	Gain switching wait time 2	Immediate	Adjustment
Pn137	-	Gain switching threshold level	Immediate	Adjustment

8.4.2 P/PI switch

The drive uses the PI regulator by default to control the adjustment of the speed loop. The user can set the "P/PI (mode switch) switching condition" through Pn10B, which means that when the set conditions are met, switch and use P control.

Para	Value	Remarks	Effective	Type
Pn10B.0	0[Default]	Conditioned by internal torque command	Immediate	Set up
	1	Conditioned by speed command		
	2	Conditioned by acceleration		
	3	Conditioned by position deviation pulse		
	4	No mode switch function		

"Fixed as PI control" (Pn10B=4), means PI control is always used.

When Pn10B is set to 0~3, it means that when the set switching condition threshold is met, switch and use P control; otherwise, use PI control. The corresponding threshold settings are shown in the table below.

Para	Value	Remarks	Effective	Type
Pn10C	-	Mode switch level This parameter is valid when Pn10B.0=0~3 When Pn10B.0=0, as the torque switch level, Range 0~400 is valid, Unit 1%; When Pn10B.0=1, as the speed command switch level, Range 0~3000 is valid, Unit 1rpm; When Pn10B.0=2, as the acceleration switch level, Range 0~30000 is valid, Unit 1 rpm/s; When Pn10B.0=3, as position deviation pulse switch level, Range 0~10000 is valid, Unit 1 pulse;	Immediate	Adjustment

For example, the default setting of Pn10B is 0, and the default "torque command percentage threshold" is "200", which means that when the torque command percentage > 200, the adjustment of the speed loop will be switched from PI control to P control; When the percentage is less than or equal to 200, the adjustment of the speed loop switches to PI control again.

8.4.3 Feedforward

Feedforward includes speed feedforward and torque feedforward.

▸Speed feedforward can speed up position response and reduce position tracking error.
▸Torque feedforward can speed up the speed response and reduce the speed tracking error.

In general, the derivative of the position/speed reference can be used as feedforward, but sometimes feedforward is required by a controller or other application function.

When using "speed feed forward" or "torque feed forward", in order to reduce the impact of feed forward, you can set "speed feed forward percentage" (Pn109) or "torque feed forward percentage" (Pn107) to adjust Feedforward compensation value.

In order to filter out the noise introduced by the differentiation, the speed/torque feedforward is filtered separately. The larger the speed/torque feedforward filter time constant, the better the noise filtering effect, but may cause overshoot due to the feedforward lag.

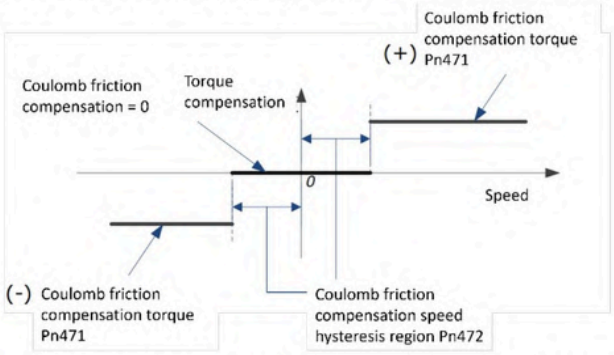
Para	Value	Remarks	Effective	Type
Pn107	-	Torque feed forward gain	Immediate	Adjustment
Pn108	-	Torque feedforward filter time constant	Immediate	Adjustment
Pn109	-	Speed feed forward gain	Immediate	Adjustment
Pn10A	-	Speed feedforward filter time constant	Immediate	Adjustment

8.4.4 Friction compensation

In a transmission system, there must be a certain amount of frictional load. Larger friction loads easily lead to low-speed creep, waveform distortion when the speed crosses zero, slow positioning, etc., which affect the dynamic and static performance of the system.
The friction compensation function means that the driver uses the known friction parameters to compensate the relevant friction load, which is suitable for applications with frequent forward and reverse directions and high requirements for speed stability.
Friction compensation is divided into Coulomb friction compensation and viscous friction compensation.

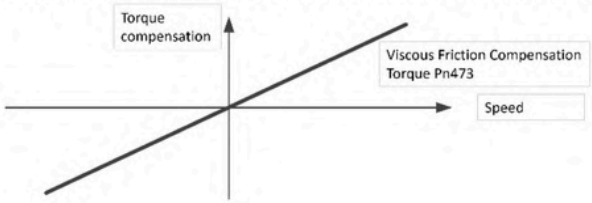
The user can set the compensation value of "Coulomb friction compensation torque" through Pn471, and its direction is consistent with the rotation speed. In addition, in order to prevent the motor from frequently changing the compensation direction near zero speed, it is necessary to set the "Coulomb friction compensation speed hysteresis area" (Pn472), in this area, the "Coulomb friction load" (Pn471) is "0", as shown in the figure 9-26.

Figure 9-26 Schematic diagram of friction compensation



The viscous friction compensation has a linear relationship with the speed of the motor, and the user can set the "viscous friction compensation torque" through Pn473. The relationship is shown in Figure 9-27.

Figure 9-27 Relationship between viscous friction and rotational speed

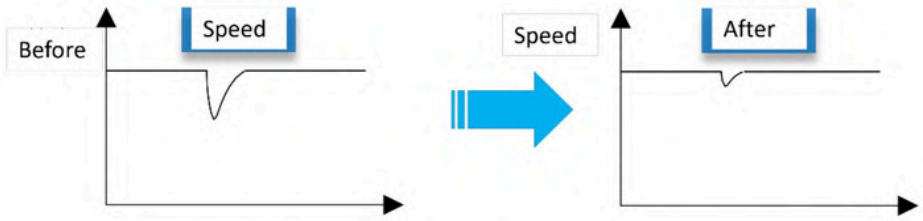


Para	Value	Remarks	Effective	Type
Pn471	-	Coulomb friction compensation torque	Immediate	Adjustment
Pn472	-	Coulomb friction compensation speed hysteresis region	Immediate	Adjustment
Pn473	-	Viscous Friction Compensation Torque	Immediate	Adjustment

8.4.5 Load torque compensation

During the operation of the motor, if there is a sudden load torque, it will cause the speed to drop or the position to move, and the continuously changing load torque will also cause the speed to fluctuate or the position to shake. At this time, it is generally necessary to improve the anti-load disturbance performance of the servo through tuning. During the tuning process, considering that the command response performance and the anti-load disturbance performance cannot be taken into account, the load torque compensation function can be used to improve the anti-load disturbance performance.

For example, the speed drop in the figure below is caused by a sudden load torque. Using the load torque compensation function can reduce the speed drop.



The load torque compensation function is to observe the load torque through the load torque observer, and then compensate the torque to the torque given, so as to achieve the effect of load torque compensation.

In order to reduce the overshoot caused by the load torque compensation, use the disturbance compensation coefficient to adjust the compensation value: Load torque compensation = load torque observation value × disturbance compensation coefficient (Pn123)

In addition, the user can adjust the bandwidth of the load torque observer through the "disturbance compensation gain" (Pn121). The larger the value, the closer the observed load torque is to the actual load torque, but may introduce noise or instability.

The disturbance compensation function will take effect only after the disturbance compensation switch (Pn40F.3) is turned on.

Para	Value	Remarks	Effective	Type
Pn40F.0	1	Using Disturbance Compensation	Immediate	Adjustment
Pn121	-	Disturbance Compensation Gain	Immediate	Adjustment
Pn123	-	Disturbance compensation coefficient	Immediate	Adjustment

8.4.6 Model Tracking Control (under development)

8.5 Vibration suppression

8.5.1 Notch filter

Notch filters are mainly used to eliminate vibrations caused by mechanical resonance. It can be used to suppress the vibration frequency of 500~5000Hz, and is suitable for high frequency vibration suppression.

There are a total of 4 notch filters in the driver, they can be used independently or in combination, and their working diagram is shown in Figure 9-30.

Figure 9-30 Working diagram of notch filter

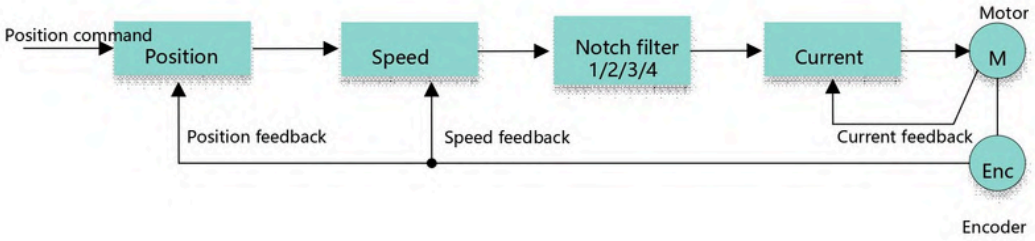
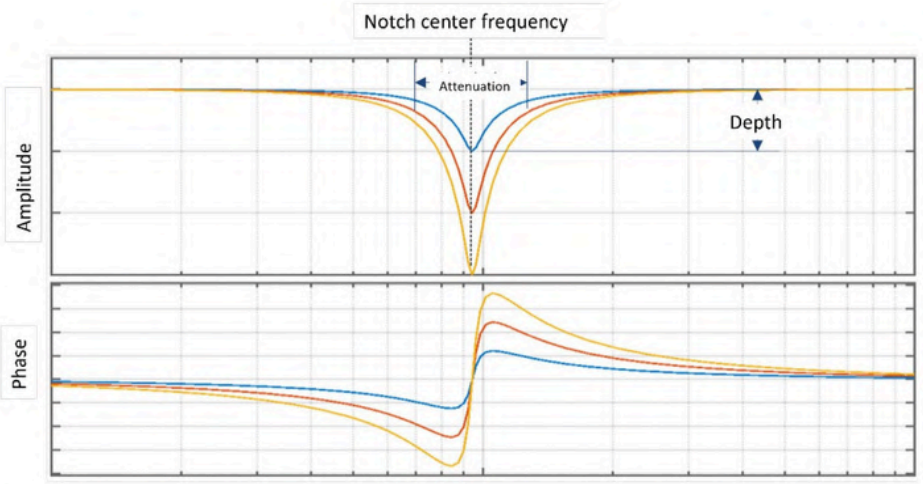


Figure 9-31 is a schematic diagram of the frequency characteristics of the notch filter. Since the notch filter has an attenuation effect on the signal at the notch frequency, if the user sets the notch frequency as the vibration frequency (Pn411/Pn414/Pn421/Pn424), the vibration signal in the torque setting can be filtered.

In addition, the user also needs to set the depth (Pn413/Pn416/Pn423/Pn426) and width (Pn412/Pn415/Pn422/Pn425) of the notch filter according to the frequency characteristics of the vibration signal.

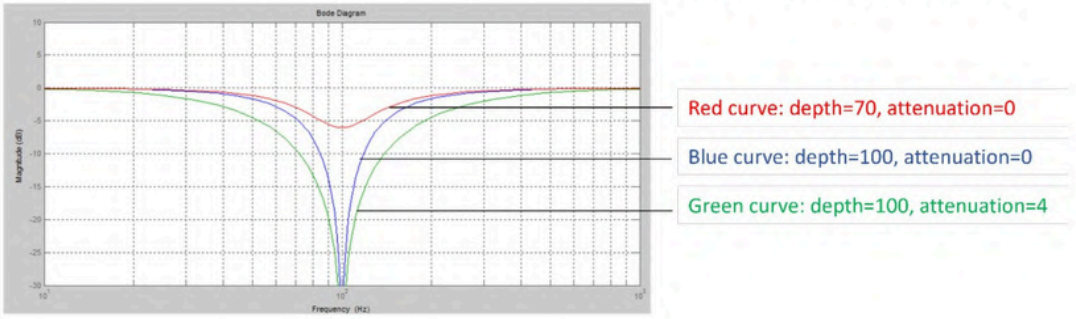
Figure 9-31 Frequency characteristics of the notch filter



Para	Value	Remarks	Effective	Type
Pn410.0	1	Use the 1st-stage notch filter	Immediate	Adjustment
Pn410.1	1	Using the 2nd stage notch filter	Immediate	Adjustment
Pn411	--	1st stage notch filter frequency	Immediate	Adjustment
Pn412	--	1st stage notch filter attenuation value	Immediate	Adjustment
Pn413	--	1st stage notch filter depth	Immediate	Adjustment
Pn414	--	2nd stage notch filter frequency	Immediate	Adjustment
Pn415	--	2nd stage notch filter attenuation value	Immediate	Adjustment
Pn416	--	2nd stage notch filter depth	Immediate	Adjustment
Pn420.0	1	Use a 3rd-stage notch filter	Immediate	Adjustment
Pn420.1	1	Use a 4th-band notch filter	Immediate	Adjustment
Pn421		3rd stage notch filter frequency	Immediate	Adjustment
Pn422		3rd stage notch filter attenuation value	Immediate	Adjustment
Pn423		3rd stage notch filter depth	Immediate	Adjustment

Pn424		4th band notch filter frequency	Immediate	Adjustment
Pn425		4th stage notch filter attenuation value	Immediate	Adjustment
Pn426		4th stage notch filter depth	Immediate	Adjustment

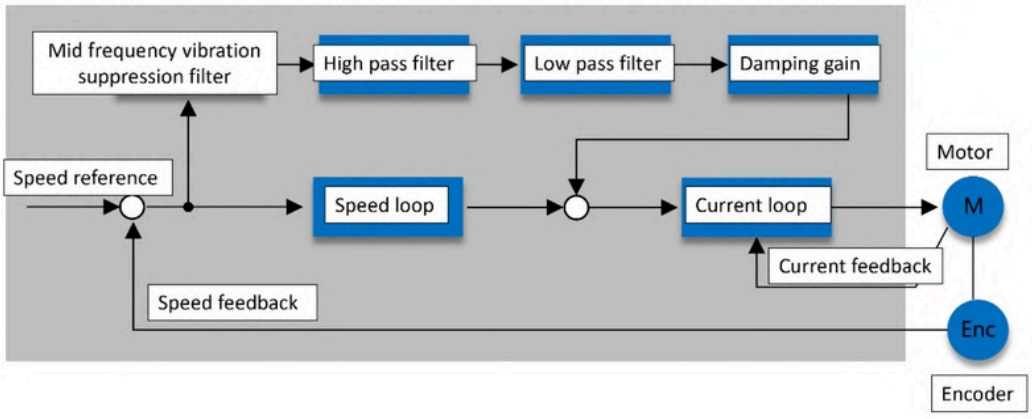
After the related switches (Pn410.1/2, Pn420.1/2) are turned on, the corresponding notch filter will take effect.
The depth is set to "0" to indicate the minimum depth, and the larger the value, the deeper the depth.
The width is set to "0" to indicate the minimum width, and the larger the value, the wider the width.



8.5.2 Medium frequency vibration suppression

The medium frequency vibration suppression is realized by the medium frequency vibration suppression filter. After special treatment of the speed deviation, it is compensated to the torque given, so as to achieve the purpose of suppressing the vibration. It can be used to suppress the vibration frequency of 100~1000Hz, and its working diagram is shown in Figure 9-32.

Figure 9-32 Working diagram of the medium frequency vibration filter



▸ "Mid frequency vibration suppression center frequency" (Pn161) is the signal frequency value to be filtered, generally set as the vibration frequency value.

▸ "Mid frequency vibration suppression bandwidth adjustment" (Pn162) determines the vibration suppression bandwidth of the filter, which means to adjust the effect Range of the filter near the center frequency. Phase of frequencies near the center.

▸High-pass filter and low-pass filter are used to filter high frequency signal and low frequency DC signal respectively.

▸ The mid-frequency vibration suppression damping gain determines the final

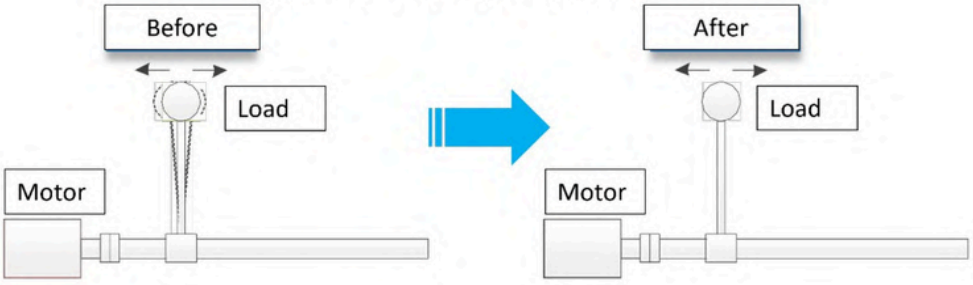
compensated mid-frequency vibration control amount.

Para	Value	Remarks	Effective	Type
Pn161	--	Mid frequency vibration suppression frequency	Immediate	Adjustment
Pn162	--	Mid frequency vibration suppression bandwidth adjustment	Immediate	Adjustment
Pn163	--	Mid frequency vibration Suppression Damping Gain	Immediate	Adjustment
Pn164	--	Mid frequency vibration suppression low-pass filter time constant	Immediate	Adjustment
Pn165	--	Mid frequency vibration suppression high-pass filter time constant	Immediate	Adjustment

8.5.3 Low frequency vibration suppression

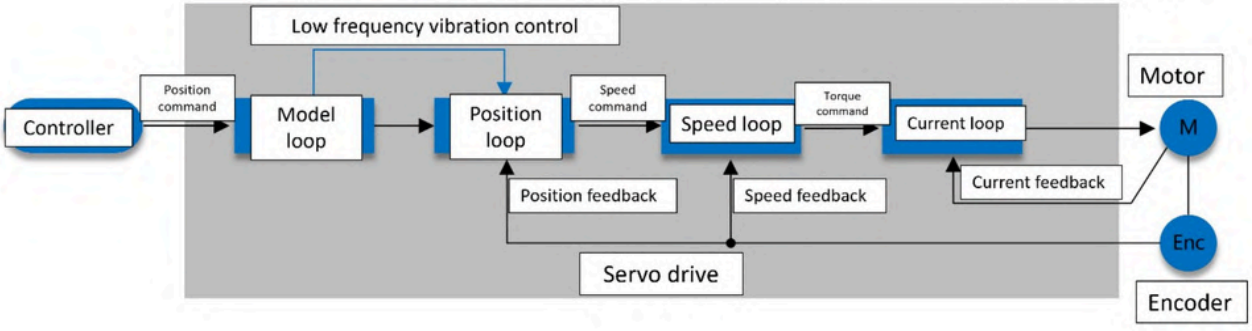
The low-frequency vibration suppression function can suppress the low-frequency vibration of the load end during position control, as shown in Figure 9-33.

Figure 9-33 Low frequency vibration suppression



This function is based on model tracking control. According to the relationship between the load position and the motor position in the model loop, in order to control the position stability of the load end, the position command of the motor end is corrected, and the feedforward value generated by the model is corrected to achieve low-frequency vibration suppression. the goal of. Its working schematic is shown in Figure 9-34.

Figure 9-34 Schematic diagram of low frequency vibration suppression work



Para	Value	Remarks	Effective	Type
Pn150.0	1	Use model tracking and Low frequency suppression	Restart	Set up
Pn155	-	Low frequency vibration frequency	Immediate	Adjustment

» Pn150.0 parameter determines whether the low frequency vibration suppression function is effective.

» "Low frequency vibration suppression frequency" (Pn155) is the vibration frequency when vibration occurs at the load side.

Measurement of low frequency jitter frequency

»If the low frequency jitter frequency can be directly measured by an instrument (such as a laser interferometer), please directly write the measured frequency data (Unit is 0.1Hz) into parameter Pn155.

»If there is no measuring instrument, you can indirectly measure the low-frequency jitter frequency of the load with the help of the drawing function or FFT analysis tool of the communication software PC software.

Restrictions

»Low frequency vibration suppression can only be used when model tracking control is active.

»Applies to manual adjustments only.

» Can only be used in position control mode.

»Cannot be used in full closed loop control mode。

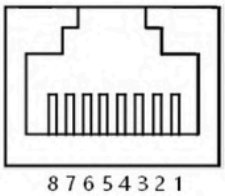
CHAPTER 9 MODBUS COMMUNCIATION

9.1 RS485 communication interface

For the communication interface, please refer to chapter 3.7 "Connection of Communication Cable".

XDQ1 series drives have MODBUS communication function of RS-485 interface, which can be used to modify parameters and monitor the status of servo drives.

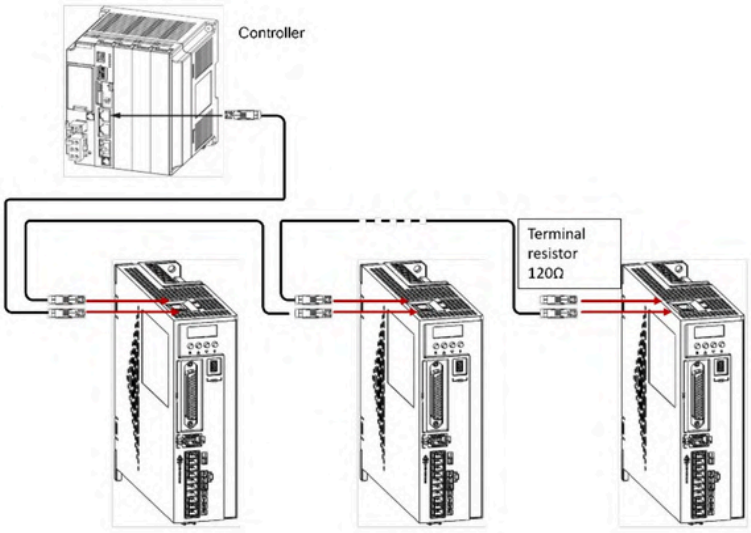
The driver communication connector terminals CN4 and CN5 are defined as follows:

CN4\CN5	Pin	Signal	Function
	1	RS485+	RS485 positive signal
	2	RS485-	RS485 negative signal
	3	CANH	CAN positive signal
	4	NC	Empty
	5	NC	Empty
	6	CANL	CAN negative signal
	7	GND	Digital ground
	8	NC	Empty

1) The cable length should be less than 100 meters in an environment with little interference. If the transmission speed is above 9600bps, please use a communication cable within 15 meters to ensure the transmission accuracy.

2) When using RS485, maximum of 31 servo drives can be connected at the same time, and a 120 ohm resistor should be connected to the end of the RS485 network. If you want to connect more devices, you must use repeaters to expand the number of connected units.

3) The servo drive CN4 is always used as the input terminal of the communication cable, and CN5 is always used as the output terminal of the communication cable (if the slave station needs to be connected, the cable is connected to the next slave device from this terminal; if it is not necessary to connect other slave stations, you can Add a balancing resistor to this terminal). The schematic diagram of multiple communication connections is shown below.


Controller
Terminal
resistor
120Ω

9.2 Communication parameters

The communication description in this document is only for the MODBUS communication of RS485.

Para	Name	Setting range	Unit	Default	Effective
Pn010	Axis address selection	1 ~ 127		1	Restart
Pn011	Communication function selection switch 0	h.0000~1636	--	h.0335	Restart
	h.×××□:RS485 communication speed 0: 2400bps; 1: 4800bps; 2: 9600bps; 3: 19200bps; 4: 38400bps; 5: 57600bps; **h.××□×: communication protocol** 0: 8, N, 1; 1: 8, N, 2; 2: 8, E, 1; 3: 8, O, 1; **h.×□××:CAN communication speed** 0: 20Kbps; 1: 50K bps; 2: 100K bps; 3: 125K bps; 4: 250Kbps; 5: 500Kbps; 6: 1Mbps; **h.□×××: Reserved**				

9.3 Communication protocol

When using the RS-485 serial communication interface, each servo drive must set up its servo drive axis number on the parameters in advance, and the host computer will communicate with the corresponding servo drive according to the axis number.

The communication method is to use MODBUS network communication, in which MODBUS can use the following two modes: ASCII (American Standard Code for information interchange) mode or RTU (Remote Terminal Unit) mode.

XDQ1 series servo drives support RTU (Remote Terminal Unit) mode.

The following is the description of MODBUS-RTU communication.

9.3.1 Coding meaning

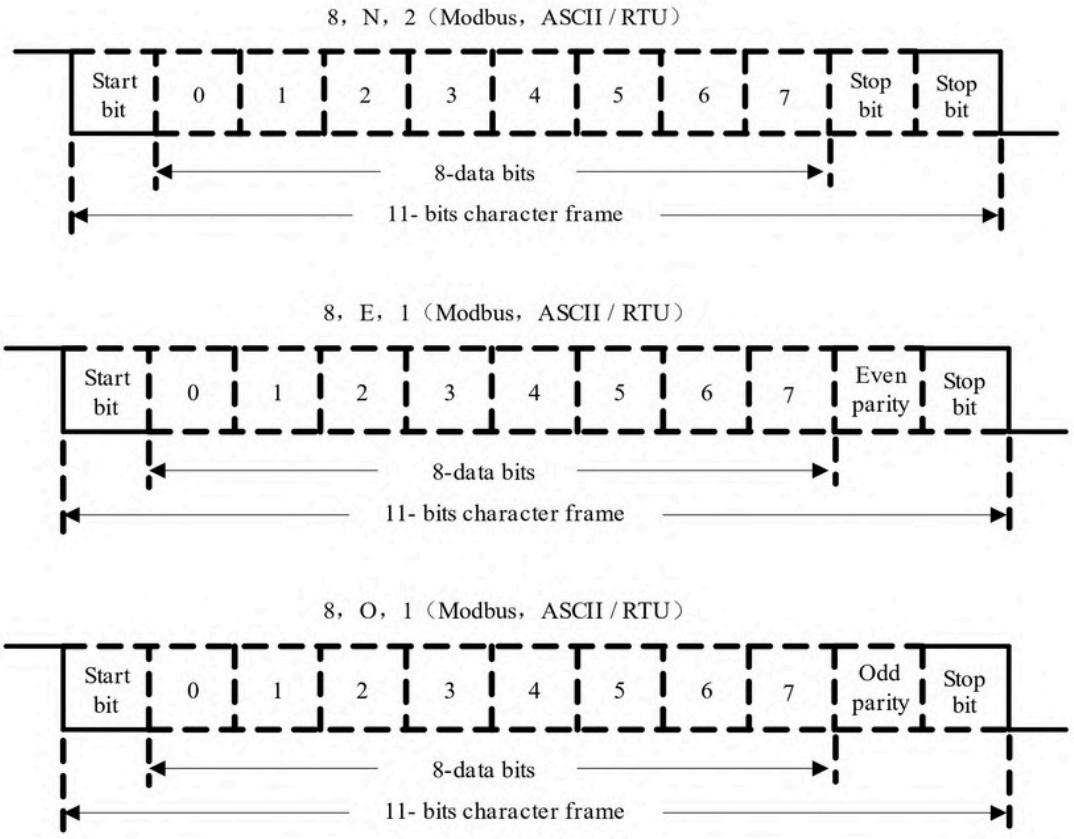
◆ RTU mode

Each 8-bit data consists of two 4-bit hexadecimal bytes. For example: to exchange the value 64H, directly transfer 1-byte data 64H.

9.3.2 Byte structure

◆ Byte box

for 8-bits bytes



9.3.3 Communication data structure

The data format of RTU communication mode is defined as follows:

STX	Static time over 3.5 bytes
ADR	Mailing address: 1-byte
CMD	Instruction code: 1-byte
DATA (n-1)	

.....	Data content: n-word =2n-byte, n<=12
DATA (0)	
CRC	Instruction code: 1-byte
End 1	Static time over 3.5 bytes

The details of each communication data format are described below:

- STX (Start of Communication)

RTU mode: more than 3.5 bytes of inactivity at the current communication rate.

- ADR (mailing address)

Valid mailing addresses are Ranges between 1 and 127. For example: to communicate with the servo drive whose axis number is 16 (hexadecimal 10H):

RTU mode: ADR = 10H

- CMD (command command) and DATA (data byte)

The format of the data bytes depends on the script. Commonly used instruction codes are shown in the table below.

Communication command

Cmd	Content	Remarks
03H	Read N words, N<=29	Standard 03 command
06H	write 1 word	Standard 06 command
10H	Write N words, N<=29	Standard 10 commands

1) Instruction code: 03H, read N words (word), N≤29

For example: read 2 words continuously from the starting address 0200H of the station number 01H servo drive.

RTU mode:

Command:

ADR	**01H**
CMD	**03H**
Starting data address (first high then low)	**02H**
	00H
Number of data words (first high then low)	**00H**
	02H
CRC Check Low	**C5H (Low order byte)**
CRC Check High	**B3H (High order**

Response:

ADR	**01H**
CMD	**03H**
Number of data (in bytes)	**04H**
Starting data address Contents of 0200H	**00H (High order**
	B1H (Low order byte)
Second data address Contents of 0201H	**1FH (High order**
	40H (Low order byte)
CRC Check Low	**A3H (Low order**
CRC Check High	**D4H (High order**

1) Instruction code: 06H, write 1 word (word)

For example: write 100 (0064H) to the starting address 0200H of the servo drive with station number 01H。

RTU mode:

Command:

ADR	**01H**
CMD	**06H**
Starting data address (first high then low)	**02H**
	00H
Number of data words (first high then low)	**00H**
	64H
CRC Check Low	**89H**
CRC Check High	**99H**

Response:

ADR	**01H**
CMD	**06H**
Starting data address (first high then low)	**02H**
	00H
Data content **(first high then low)**	**00H**
	64H
CRC Check Low	**89H**
CRC Check High	**99H**

1) Instruction code: 10H, write N words (word), N≤29

For example: write 100 (0064H) and 102 (0066H) to the servo drive with axis number 01H, and the starting address is 0200H.

◆ RTU mode:

Command:

ADR	**01H**
CMD	**10H**
Starting data address (first high then low)	**02H**
	00H
Data byte number (first high then low)	**00H**
	02H
Data bytes	**04H**
Data 1 content (first high then low)	**00H**
	64H
Data 2 content (first high then low)	**00H**
	66H
CRC Check Low	**2BH**
CRC Check High	**3AH**

Response:

ADR	**01H**
CMD	**10H**
Starting data address (first high then low)	**02H**
	00H
Data byte number (first high then low)	**00H**
	02H
CRC Check Low	**40H**
CRC Check High	**70H**

◆CRC (RTU mode) error detection value calculation

The RTU mode adopts the CRC (Cyclical Redundancy Check) error detection value.

Step 1: A 16-bits register whose content is FFFFH is called a CRC register.

Step 2: Perform Exclusive OR operation on the first byte of the instruction information and the low-order byte of

the 16-bits CRC register, and store the result back to the CRC register.
Step 3: Check the least significant bit (LSB) of the CRC register, if this bit is 0, then shift one bit to the right; if this bit is 1, then the value of the CRC register is shifted one bit to the right, and then XOR with A001H (Exclusive OR).) operation.
Step 4: Go back to Step 3 until Step 3 has been executed 8 times before proceeding to Step 5.
Step 5: Repeat Step 2 to Step 4 for the next byte of the instruction information, until all bit groups are completely processed,
At this time, the content of the CRC register is the CRC error detection value.

Description: After calculating the CRC error detection value, in the command information, the low order of CRC must be filled first, and then the high order of CRC must be filled.

1) End1, End0 (communication Finish)

RTU mode:

Static time exceeding 3.5 bytes at current communication rate.

example:

The CRC value is generated below in C language. This function requires two parameters:

unsigned char * data;
unsigned char length;
this function returns CRC value of unsigned integer

```
unsigned int crc_chk(unsigned char * data,unsigned char
    length){  int i,j;
    unsigned int crc_reg=oxFFFF;
    While(length- -){
        crc_ reg ^=*data++;
        for(j=0;j<8;j++){
            If(crc_reg & 0x01){
                crc_reg=( crc_reg >>1)^0xA001;
            }else{
                crc_reg = crc_reg >>1;
            }
        }
    }
    return crc_reg;
}
```

9.3.4 Communication error handling

During the communication process, errors may occur. Common error sources are as follows:

- When reading and writing parameters, the data address is incorrect;
- When writing a parameter, the data exceeds the maximum value of this parameter or is less than the minimum value of this parameter;
- Communication is disturbed, data transmission error or check code error.

When the above communication error occurs, the operation of the drive is not affected, and the drive will feedback an error frame.

The error frame format is as follows:

Host computer data frame:

Start	Slave address	Command	Data address etc	Verification
		Command		

Drive feedback error frame:

Start	Slave address	Response code	Error code	Verification
		Command + 80h		

In this,

Error frame response code = command + 80H;

Error code = 00H: communication is normal;

=01H/31H: The driver cannot recognize the requested function;

=02H/32H: The data address given in the request does not exist in the drive;

=03H/33H: The data given in the request is not allowed in the drive (exceeds the maximum or minimum value of the parameter);

=04H/34H: The drive has started to execute the request, but cannot complete the request;

For example: the axis number of the drive is 03H, and the data 06H is written to parameter Pn005. Since the maximum and minimum values of parameter Pn005 are both 0, the written data will not be accepted, and the drive will return an error frame with the error code 33H (exceeds the maximum or minimum value of the parameter), the structure is as follows:

Host computer data frame:

Start	Slave address	Command	Data address etc	Verification
	03H	06H	0005H 0006H	

Drive feedback error frame:

Start	Slave address	Response code	Error code	Verification
	03H	86H	33H	

Notes:

If the slave address in the data frame sent by the host computer is 00H, it means that the frame data is broadcast data, and the drive will not return the frame.

9.4 Communication address

Adress	Content	Remarks	Data type	R/W
0000~ 0F00H	Parameter	For example, the corresponding address of Pn101 is 0101H; For example, the corresponding address of Pn407 is 0407H; The function is to read RAM or write RAM and EEPROM non-volatile memory.	According to 11.3, there are the following data types: Unsigned 16 (Int16) signed 16 (int16) Unsigned 32-bit (Int32) Signed 32-bit (int32)	R/W
1000~ 1F00H	Temporary	For example, the corresponding address of Pn101 is 1101H; For example, the corresponding address of Pn407 is 1407H; The function is to read RAM or write to RAM, without modifying the data in EEPROM.	According to 11.3, there are the following data types: Unsigned 16-bit (Int16) Signed 16-bit (int16) Unsigned 32-bit (Int32) Signed 32-bit (int32)	R/W
E000~ E200H	Monitor	For example, the corresponding address of Un000 is E000H; For example, the corresponding address of Un00A is E00AH; For example, the corresponding address of Un080 is E080H;	According to 12.1, there are the following data types: Unsigned 16-bit (Int16) Signed 16-bit (int16) Unsigned 32-bit (Int32) Signed 32-bit (int32)	R

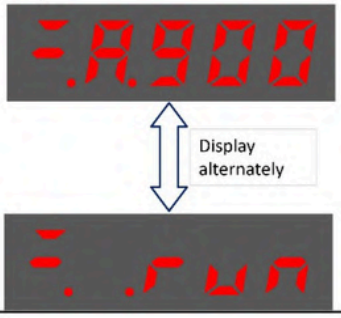
Notes:

1. If the addresses in the above table are continuous, continuous read/write operations can be performed. When the data of continuous operations is not in the table, the read/write data will be invalid. For example, there are only two data at the beginning of 0x0537. When the continuous reading data exceeds 2, the read data driver judges that it is invalid and returns an error code.
2. When operating 32-bit data: when reading data, the lower 16 bits are in front, and the upper 16 bits are in the back; the write operation must use the 0x10 command to write two consecutive words, the lower 16 bits are in front, and the high 16 bits are in the back.
3. In the normal mode, the motor position feedback, encoder multi-turn data, and encoder single-turn data all increase counterclockwise (viewed from the motor axis) and decrease clockwise.
4. Instructions for use of E088H and E08AH: Before use, it is necessary to manually clear the absolute value data (execute the Fn010 operation). After the execution, the data of E088H and E08AH will be automatically cleared; in Customer Unit). For example, the electronic gear is 20:1, the motor runs for 50 revolutions (for example, the pulse of the motor 1 revolution is 131072), and the feedback data is 50*131072/20= 327680, that is, the address E088H data is 0x00050000, and the address E08AH data is 0x00000000.

CHAPTER 10 ALARMS

10.1 Alarm display

The alarm of XDQ1 servo driver is divided into two levels: alarm and warning. These two different levels of alarms will affect the start-stop and status display of the servo system.

Type	Stop method	Panel display
Alarm	Brake the motor according to the setting of Pn001.0.	The panel will flash and display the current alarm number. [Example] E.500 (encoder communication failure) occurred. The operation panel will flash "E.500" 
Warning	Do not brake the motor and continue to run.	The panel will alternately display the current status of the servo and the warning number. [Example] A.900 (Excessive position deviation) occurred when the servo was in the running state "run". The panel will display "run" and "A.900" alternately. 

10.2 List of alarms

Can the alarm be reset

Yes: The alarm can be removed by alarm reset (by pressing the two keys in the middle of the panel at the same time or inputting the ALM_RST signal). But if the alarm factor still exists, it cannot be removed.

No: The alarm cannot be reset

Code	Name	Content	Reset
E.020	Parameters and validation exceptions	The data of the internal parameters of the servo drive is abnormal.	No
E.022	Abnormal system parameters and	The data of the internal parameters of the SERVOPACK is abnormal.	No

	verification		
E.024	The parameter value is abnormal	Servo drive parameters exceed Range.	No
E.02A	System alarm	The internal program of the servo unit is abnormal. I2C communication is abnormal.	No
E.02B	System alarm	An error occurred in the internal program of the servo unit	No
E.02C	System alarm	An error occurred in the internal program of the servo unit	No
E.02D	System alarm	An error occurred in the internal program of the servo unit	No
E.030	Combination error	Outside the combinable motor capacity Range (capacity mismatch)	Yes
E.032	Motor and drive mismatch	The voltage type of the motor and the driver do not match, etc.	Yes
E.03F	Product not supported	An unsupported product is connected	No
E.040	Parameter setting failure	beyond the Setting range	No
E.042	Parameter combination failure	Parameter combination failure	No
E.060	Main circuit detection unit failure	Various detected data errors of the main circuit	
E.070	Current detection fault 1	The current detection circuit is faulty.	No
E.072	Current detection fault 2	The current detection circuit is faulty.	No
E.100	Overcurrent detection	Power transistor overcurrent or heat sink overheating.	No
E.101	Motor overcurrent	Exceeding the allowable current flows through the motor	No
E.120	Motor overload (instantaneous overload)	The motor operated for several seconds to tens of seconds with a torque that exceeded the rated value by a large margin.	Yes
E.121	Drive overload (instantaneous overload)	The drive operated for several seconds to tens of seconds with a torque that exceeded the rated value by a large margin.	Yes
E.130	Motor overload (continuous overload)	The motor has been running continuously with a torque exceeding the rated value.	Yes
E.131	Drive overload (continuous overload)	The drive has operated continuously with a torque exceeding the rated value.	Yes
E.136	Collision Alarm	With the collision protection turned on, the motor load exceeds the setting.	Yes
E.150	DB overload	The rotational or running energy exceeds the capacity of the DB resistor due to DB (Dynamic Brake) action.	Yes
E.160	Inrush current limiting resistor overload	The main circuit power supply frequency is too high.	No
E.170	Main circuit power alarm	The main circuit power supply has the phenomenon of ON→OFF→ON, and Pn00D.0!=0.	Yes
E.176	Heat sink overheating	The heatsink temperature of the drive is too high.	Yes
E.190	Servo ON command invalid alarm	After executing the auxiliary function for energizing the motor, the servo-on (S-ON) signal was input from the host device.	Yes
E.300	abnormal regeneration	The regeneration circuit is faulty.	No
E.320	regeneration overload	A regeneration overload has occurred.	Yes
E.360	Overtravel Alarm	Servo detects overtravel and alarms when Pn00D.3=2.	Yes

E.400	Overvoltage	The main circuit DC voltage is abnormally high.	Yes
E.410	Undervoltage	The main circuit DC voltage is insufficient.	Yes
E.500	Encoder communication failure	Encoder communication failure	No
E.502	Encoder communication error many times	Encoder communication error occurred many times	No
E.504	Encoder communication check abnormal	Encoder communication data verification is abnormal	Yes
E.505	Encoder communication frame error 1	Encoder communication frame error (drive side)	Yes
E.506	Encoder communication frame error 2	Encoder communication frame error (encoder side)	Yes
E.507	Encoder communication frame error 3	Encoder communication data error	Yes
E.530	Encoder and check alarm	The sum check result of the communication encoder memory is abnormal	Yes
E.532	Encoder parameter exception	The parameters of the communication encoder are abnormal	Yes
E.550	Encoder count error 1	Communication encoder count error 1.	Yes
E.552	Multiturn encoder error	Communication type multi-turn encoder error.	Yes
E.554	Encoder overspeed	Communication type multi-turn encoder overspeed error.	Yes
E.555	Encoder count error 2	Communication type multi-turn encoder count error.	Yes
E.556	Encoder count overflow	Communication type multi-turn encoder count overflow error.	Yes
E.558	Encoder multi-turn data error	Communication type multi-turn encoder multi-turn data error.	Yes
E.55A	Encoder battery alarm	Communication type multi-turn encoder battery low voltage alarm	Yes
E.600	Excessive position deviation alarm	In the servo-on state, the position deviation exceeds the excessive position deviation alarm value (Pn530).	Yes
E.601	Excessive position deviation alarm when servo ON	During servo OFF, when the position deviation pulse exceeds the value of Pn532 and attempts to turn the servo ON in this state, the alarm is displayed.	Yes
E.602	Excessive position deviation alarm due to speed limit	When the servo is ON, the speed limit value (Pn538) is used to execute the speed limit, and the command pulse is input in this state, and the position deviation exceeds the value of the position deviation excessive alarm value (Pn530).	Yes
E.620	out of control	Servo motor runaway detected	Yes
E.622	speeding	Motor speed exceeds maximum speed	Yes
E.636	Vibration alarm	Abnormal vibration of motor speed is detected.	Yes
E.638	Automatically adjust the alarm	Vibration was detected during auto tuning.	Yes
E.F00	System alarm 0	Exception 0 occurred in the internal program of the servo drive.	No
E.F01	System alarm 1	Error 1 occurred in the internal program of the servo drive.	No

E.F02	System Alarm 2	Error 2 occurred in the internal program of the servo drive.	No
E.F03	System Alarm 3	Error 3 occurred in the internal program of the servo drive.	No
E.F04	System Alarm 4	Error 4 occurred in the internal program of the servo drive.	No

10.3 Alarm troubleshooting

Alarm code	Reason	Confirmation method	Treatment
E.020: Parameters and validation exceptions (The data of the internal parameters of the servo drive is abnormal)	Instantaneous drop in supply voltage	Measure the power supply voltage.	Set the power supply voltage in the specification Range, and execute the initialization of the parameter Value.
	Power off when parameters are written	Confirm the time of the power outage.	Re-enter the parameter after the parameter Value is initialized.
	The number of times the parameter has been written exceeds the maximum value	Check whether parameters are frequently changed from the host device.	It is possible that the servo drive is faulty. Replace the servo drive. Change the parameter writing method.
	Malfunction due to noise from AC power, ground, static electricity, etc.	Turn on the power of the servo drive again. When the alarm still occurs, it may be disturbed.	Take measures to prevent noise disturbance.
	Failure of components inside the servo drive due to gas, water droplets, or cutting oil, etc.	Confirm the setting environment.	It is possible that the servo drive is faulty. Replace the servo drive.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
	other		Restore all parameters to factory (Fn015).
E.022: Abnormal system parameters and verification (The data of	Instantaneous drop in supply voltage	Measure the power supply voltage.	It is possible that the servo drive is faulty. Replace the servo drive.
	The power was turned off while operating an auxiliary function	Confirm the time of the power outage.	It is possible that the servo drive is faulty. Replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
the internal parameters of the servo drive is abnormal)		Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
	Servo drive failure		
	other		Restore all parameters to factory (Fn015).
E.024: The parameter value is abnormal	Power off when parameters are written	Confirm the time of the power outage.	Re-enter the parameter after the parameter Value is initialized.
	The power was turned off while operating an auxiliary function	Confirm the time of the power outage.	It is possible that the servo drive is faulty. Replace the servo drive.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
	other		Restore all parameters to factory (Fn015).
E.02A: E.02B: E.02C: E.02D: system alarm	Instantaneous drop in supply voltage	Measure the power supply voltage.	It is possible that the servo drive is faulty. Replace the servo drive.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
	Failure of components inside the servo drive due to gas, water droplets, or cutting oil, etc.	Confirm the setting environment.	It is possible that the servo drive is faulty. Replace the servo drive.
	other		Restore all parameters to factory (Fn015).

Alarm code	Reason	Confirmation method	Treatment
E.030: Wrong capacity combination (outside the combinable motor capacity Range)	The capacity of the servo drive does not match the capacity of the servo motor	Confirm that (motor capacity) / (servo drive capacity) ≤ 1/4 or (motor capacity) / (servo drive capacity) ≤ 4.	Match the capacity of the servo driver and the servo motor to each other.
	Encoder failure	Replace it with another motor and confirm that the alarm does not occur again.	Replace the servo motor (encoder).
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
E.032: Incorrect voltage combination (outside the combinable motor capacity Range)	The voltage of the servo drive does not match the voltage of the servo motor	Confirm that the motor input voltage is consistent with the servo drive voltage.	Match the voltage of the servo drive and the servo motor to each other.
	Encoder failure	Replace it with another motor and confirm that the alarm does not occur again.	Replace the servo motor (encoder).
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
E.03F: Product not supported	The motor parameter file is not written to the motor encoder.	Check whether the motor parameter file is written to the motor encoder.	Write the motor parameter file to the motor encoder.
	The servo drive is connected to an unsupported motor, encoder, etc.	Confirm product combination specifications	Change the driver and motor to a matching combination

Alarm code	Reason	Confirmation method	Treatment
E.040: The parameter setting is abnormal (exceeds the Setting range)	The capacity of the servo drive does not match the capacity of the servo motor	Check the capacity and combination of the servo driver and servo motor.	Match the capacity of the servo driver and the servo motor to each other.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
	Outside the parameter Setting range	Check the Setting range of the changed parameter.	Set the changed parameter to the value within the setting range.
	The Value of the electronic gear ratio is outside the setting range	Check if the electronic gear ratio is	Set the electronic gear ratio to
		0.001<(Pn20E/Pn210)<64000.	0.001<(Pn20E/Pn210)<64000.
	other		Restore all parameters to Default (Fn015).
E.042: parameter combination exception	Because the electronic gear ratio (Pn20E/Pn210) or the servo motor is changed, the speed of P-Jog run (PJOG) does not meet the Setting range.	Check whether the detection condition formula*1 is satisfied.	Decrease the value of the electronic gear ratio (Pn20E/Pn210).
	Due to the change of P-Jog run (PJOG) speed (Pn703), the running speed of P-Jog run does not meet the Setting range	Check whether the detection condition formula is satisfied	Increase the value of P-Jog run speed (Pn703).
	Due to the change of the electronic gear ratio (Pn20E/Pn210) or the servo motor, the movement speed of the internal command	Confirm whether the detection condition formula is satisfied*	Decrease the value of the electronic gear ratio (Pn20E/Pn210).

Alarm code	Reason	Confirmation method	Treatment
	type automatic adjustment does not meet the Setting range.		
A.060: Main circuit detection part failure	Various detected data errors of the main circuit	In the case of power input, check the bus voltage (Un015)	It is possible that the servo unit is faulty. Replace the SERVOPACK.
E.070: Current detection fault 1	U-phase current detection circuit fault	--	Turn on the power of the servo drive again. If the alarm still occurs, the servo drive may be faulty. Replace the servo drive.
	Motor did not stop completely at power up	--	After the motor stops, Restart
E.072: Current detection fault 2	V-phase current detection circuit fault	--	Turn on the power of the servo drive again. If the alarm still occurs, the servo drive may be faulty. Replace the servo drive.
	Motor did not stop completely at power up	--	After the motor stops, Restart.
E.100: Overcurrent detection (overcurrent flowing	The main circuit cable or the main circuit cable of the motor is wired incorrectly, or has poor contact	Verify that the wiring is correct. For details, refer to "Main circuit wiring".	Modify wiring.

Alarm code	Reason	Confirmation method	Treatment
through power transistor or heat sink overheating)	The main circuit cable or the motor main circuit cable is internally short-circuited, or a ground short-circuit has occurred	Check whether there is a short circuit between UVW phase-to-phase, UVW and ground of the cable. For details, refer to "Main circuit wiring".	There is a possibility of a short circuit in the cable. Replace the cable.
	A short circuit or a short circuit to ground has occurred inside the servo motor.	Check whether there is a short circuit between UVW phase-to-phase, UVW and ground of the motor terminals. For details, refer to "Main circuit wiring".	It is possible that the servo motor is faulty. Replace the servo motor.
	There is a short circuit or a short circuit to the ground inside the servo drive	Check whether there is a short circuit between UVW phase-to-phase, UVW and ground of the servo drive motor connection terminal. For details, refer to "Main circuit wiring".	It is possible that the servo drive is faulty. Replace the servo drive.
	Wrong wiring of regeneration resistor or poor contact	Verify that the wiring is correct. For details, refer to "Regeneration Resistor Connection".	Modify wiring.
	High instantaneous overload current causes power device alarm	Reduce overload multiplier. Or increase the acceleration and deceleration time.	Decrease the value of Pn402 and Pn403.
			Increase the value of Pn216 and Pn217 under position control; increase the value of Pn305 and Pn306 under speed control.

Alarm code	Reason	Confirmation method	Treatment
E.120: Motor overload (instantaneous overload)	Poor motor wiring, encoder wiring or poor connection	Confirm wiring.	Check whether there is any problem with the motor wiring and encoder wiring.
E.121: Drive overload (instantaneous overload)	The motor is running beyond the overload protection characteristic	Check the overload characteristics of the motor and the operation command.	Review the load conditions and operating conditions. Or re-examine the motor capacity.
E.130: Motor overload (continuous overload)	The motor cannot be driven due to mechanical factors, resulting in excessive load during operation	Confirm the operation command and motor speed.	Improve mechanical factors.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
E.131: Drive overload (continuous overload)	Motor failure	Replace with the same model.	There may be a motor failure. Replace the servo motor.
	Frequent and rapid acceleration and deceleration	Increase the acceleration and deceleration time	Increase the value of Pn216 and Pn217 under position control; increase the value of Pn305 and Pn306 under speed control.
E.136: Motor crash error	1. Check whether Pn525 is set too low;	Check operation and load conditions.	According to the real torque setting and protection time, if the setting is too low, it will malfunction; if the setting is too high, the protection function will be lost;
	2. Confirm whether the time of Pn00D.2 is set too short;		Troubleshoot mechanical problems.

Alarm code	Reason	Confirmation method	Treatment
	3. Check whether there is any abnormality in the mechanical part		
E.150: DB overload (excessive power consumption of the dynamic brake detected)	The motor is driven by external force	Confirm the operating status.	Do not drive the motor by external force.
	The rotational or running energy when the DB is stopped exceeds the capacity of the DB resistor.	Check the frequency of use of the DB by the power consumption of the DB resistor.	Try the following measures.
			• Decrease the command speed of the servo motor.
			• Decrease the moment of inertia ratio or mass ratio.
			• Reduce the number of DB stops. -
	Servo drive DB loop failure.	Turn on the power of the servo drive again. If the alarm still occurs, the DB circuit may fail.	If the DB function is not used, set the stop mode to free stop (Pn001.0=2).
			If you need to use the DB function, replace the servo drive.
E.160: Inrush current limiting resistor overload (main circuit power supply frequency is too high)	Exceeds the allowable number of inrush current limiting resistors when the main circuit power is turned ON/OFF		Reduce the ON/OFF frequency of the main circuit power supply.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
E.170: Main circuit power drop alarm	The main circuit power supply has the phenomenon of ON→OFF→ON, and Pn00D.0!=0.	Use a multimeter or an oscilloscope to measure the input power supply and observe whether the power supply has dropped.	Increase the momentary stop holding time Pn52A;
			Or set Pn00D.0=0.
E.176: The heat sink is overheated (the temperature of the power module is abnormal)	Ambient temperature is too high	Measure the ambient temperature with a thermometer. Or check the operation status by setting the environment monitoring of the servo driver.	Improve the setting conditions of the servo drive and reduce the ambient temperature.
	Excessive load, or operation exceeding the regeneration capacity	The running load is confirmed by the cumulative load factor, and the regeneration processing capacity is confirmed by the regeneration load factor.	Review the load conditions and operating conditions.
	The installation direction of the servo drive and the distance from other servo drives are unreasonable	Check the installation status of the servo driver.	Install according to the installation standard of the servo drive.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
E.190: Servo ON command invalid alarm	After executing the auxiliary function for energizing the motor, the servo-on (S-ON) signal was input from the host device.	--	Restart, and then input the servo ON (S-ON) signal from the host device.
E.300: Regeneration failure	When the driver is not connected with a regenerative resistor, Pn00E.0 is not set to 1.	Confirm whether the drive has internal or external braking resistor and the wiring is correct.	≤400W driver has no built-in braking resistor, ≥750W driver has built-in braking resistor.
			When using the built-in braking resistor, P and D are short-circuited, and P and C are disconnected.
			When using an external braking resistor, P and D are disconnected, and P and C are connected to the external braking resistor.
	Driver regeneration resistor not connected	Check the connection of the external regenerative resistor or regenerative resistor unit.	After connecting an external regenerative resistor, set an appropriate value to Pn560.
	Defective, disconnected or disconnected wiring of the external regenerative resistor	Check the wiring of the external regenerative resistor.	Wire the external regenerative resistor correctly.
		Confirm the wiring of the power terminal jumper.	Wire jumpers correctly.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
E.320: regeneration overload	Supply voltage exceeds specification Range	Measure the power supply voltage.	Set the power supply voltage within the specification Range.
	The external regenerative resistor value or regenerative resistor capacity is insufficient, or the	Reconfirm the operating conditions and capacity	Change the regeneration resistance value and regeneration resistance capacity. Adjust the operating conditions again.
	regeneration state		
	Continuous negative load, in continuous regeneration state	Check the load applied to the running servo motor.	Double check the system including servos, mechanics, operating conditions.
	The capacity set in Pn560 (regenerative resistor capacity) is smaller than the capacity of the external regenerative resistor	Check the connection of the regenerative resistor and the value of Pn560.	Correct the Value of Pn560.
	External regenerative resistor value is too large	Check that the regenerative resistor value is correct.	Change it to the correct resistance value and capacity.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
E.360: Overtravel Alarm	Servo detects overtravel and alarms when Pn00D.3=2	Check for overtravel signal	Set Pn00D.3=0 or 1.
E.400: Overvoltage (overvoltage	When the AC220V servo drive is used, a DC power supply	Measure the power supply voltage.	Adjust the AC/DC power supply voltage to within the product specification Range.

Alarm code	Reason	Confirmation method	Treatment
detected by the main circuit power supply inside the servo drive)	voltage of 410 V or more is detected;		
	A DC power supply voltage of 820 V or more was detected in the servo drive for AC380 V		
	The power supply is in an unstable state, or has been affected by a lightning strike	Measure the power supply voltage.	Improve the power condition, set the surge suppressor and turn the power back on again. If the alarm still occurs, the servo drive may be faulty. Replace the servo drive.
	Accelerated and decelerated	Check the power supply voltage and operating speed	Adjust the AC mains voltage to within the product specification Range.
		degrees, torque.	
	External regenerative resistor value is larger than operating conditions	Check the operating conditions and regeneration resistance value.	Select an appropriate regenerative resistor value considering the operating conditions and load.
	In the allowable load moment of inertia to	Confirm that the load inertia ratio is within the allowable load inertia ratio.	Extend the deceleration time or reduce the load.
	run in the state of		
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	Turn on the control power again without turning on the main circuit power. If the alarm still occurs, the servo drive may be faulty. Replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
E.410: Undervoltage (The main circuit power supply inside the servo drive detects undervoltage)	For AC220V servo drives, the AC power supply voltage is below 120 V; for AC380V servo drives, the AC power supply voltage is below 240 V	Measuring supply voltage	Adjust the supply voltage to the normal Range.
	Supply voltage drops during operation	Measuring supply voltage	Increase the power supply capacity.
	Instantaneous power failure occurs	Measuring supply voltage	If the momentary stop hold time (Pn52A) is changed, set a smaller value.
	The fuse of the servo drive is blown		Replace or repair the servo drive and connect the AC/DC reactor before using the servo drive.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	It is possible that the servo drive is faulty. Replace the servo drive.
E.500: Encoder communication failure	Poor contact or wrong wiring of the encoder connector	Check the status of the encoder connector.	Insert the encoder connector again, and check the encoder wiring.
	The encoder cable is broken, short-circuited, or a cable that exceeds the specified impedance is used	Check the status of the encoder cable. Check the wiring of the encoder cable shield.	Use the encoder cable of the specified specification.
	Corrosion caused by temperature, humidity and gas; short circuit caused by water droplets and cutting oil; poor contact of	Confirm the usage environment.	Improve the use environment and replace the cable. Even if it still does not improve, replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
	connectors caused by vibration		
	Malfunction due to noise interference		Correctly perform the wiring around the encoder (separation of the encoder cable and servo motor main circuit cable, grounding, etc.).
	Servo drive failure		If the alarm does not occur when the control power is turned on after connecting the servo motor to another servo driver, the servo driver may be faulty. Replace the servo drive.
E.502: Encoder communication error many times	Due to the influence of interference, communication abnormalities occurred many times	Check the encoder wiring.	1. Check whether the ground wire is connected correctly;
			2. Check whether the shielding layer of the encoder cable is properly connected to the driver PE.
E.504: Encoder communication checksum abnormality	Encoder wrong wiring, poor contact	Check the encoder wiring.	Check if there is any problem with the encoder wiring.
E.505: Encoder communication frame error 1	The encoder cable has different specifications and is subject to interference	Check the wiring of the encoder cable shield.	Change the cable specification to twisted-pair shielded wire or twisted-pair unified shielded wire, the core wire is more than 0.12mm2, tinned soft copper stranded wire.
	Encoder cable is too long and is disturbed		For rotary servo motors: The maximum wiring distance of the encoder cable is 20m.

Alarm code	Reason	Confirmation method	Treatment
E.506: Encoder communication frame error 2	The potential of the FG fluctuates due to the influence of the motor-side equipment (welding machine, etc.)	Check the status of the encoder cable and connector.	Ground the machine to prevent the shunt to the encoder side FG.
	The encoder is subjected to excessive vibration and shock	Confirm usage.	Reduce mechanical vibration. Install the servo motor or linear encoder correctly.
E.507: Encoder communication frame error 3	Encoder failure		Turn on the power of the servo drive again. If the alarm still occurs, the servo motor or linear encoder may be faulty. Replace the servo motor or linear encoder.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	Turn on the power of the servo drive again. If the alarm still occurs, the servo drive may be faulty. Replace the servo drive.
E.530: Encoder and check alarm (detected on the encoder side)	Encoder data memory check error	Encoder data memory area data error.	Restart still occurs this alarm, it is possible that the servo motor encoder is faulty. Replace the servo motor or encoder.
	Servo drive failure	When the motor is rotated, the display of the motor speed (Un000) and position (Un001) does not change.	It is possible that the servo drive is faulty. Replace the servo drive.

Alarm code	Reason	Confirmation method	Treatment
E.532: Encoder parameter exception	Encoder data memory area data error	Encoder data memory area data error.	Turn on the power of the servo drive again. If the alarm still occurs, the servo motor encoder may be faulty. Replace the servo motor or encoder.
	wrong encoder model	The encoder does not match the drive.	Check whether the motor encoder model matches the starter.
	Servo drive failure	When the motor is rotated, the display of the motor speed (Un000) and position (Un001) does not change.	It is possible that the servo drive is faulty. Replace the servo drive.
E. 550: Encoder count error	Encoder wrong wiring, poor contact	Check the encoder wiring.	Check if there is any problem with the encoder wiring.
	The encoder cable has different specifications and is subject to interference		Change the cable specification to twisted-pair shielded wire or twisted-pair unified shielded wire, the core wire is more than 0.12mm2, tinned soft copper stranded wire.
	Encoder cable is too long and is disturbed		For rotary servo motors: The maximum wiring distance of the encoder cable is 20m.
	The potential of the FG fluctuates due to the influence of the motor-side equipment (welding machine, etc.)	Check the status of the encoder cable and connector.	Ground the machine to prevent the shunt to the encoder side FG.
	The encoder is subjected to excessive vibration and shock	Confirm usage.	Reduce mechanical vibration. Install the servo motor or encoder correctly.

Alarm code	Reason	Confirmation method	Treatment
	Encoder failure		Turn on the power of the servo drive again. If the alarm still occurs, the servo motor or encoder may be faulty. Replace the servo motor or encoder.
	The multiturn encoder is not connected to the battery or the battery voltage is too low	Multiturn encoder battery not connected or alarms due to previous battery alarms	If it is a multi-turn encoder, after confirming the battery voltage, execute auxiliary function Fn010: reset encoder multi-turn data and alarm.
E. 552: Multiturn encoder error	Serial communication is disturbed	Check the wiring of the encoder cable shield.	Check if there is any problem with the encoder wiring.
E. 555: Encoder count error 2	The multiturn encoder is not connected to the battery or the battery voltage is too low	Multi-turn encoder battery not connected or alarm due to previous battery alarm.	After confirming the battery voltage, execute auxiliary function Fn011: reset encoder alarm.
	The encoder is damaged or the encoder decoding circuit is damaged		Turn on the power of the servo drive again. If the alarm still occurs, the servo motor or encoder may be faulty. Replace the servo motor or encoder.
E. 554: Encoder overspeed	After the power is turned off, the encoder rotates at high speed;	Check whether the motor shaft moves at a large speed during the power off of the servo.	After confirming the battery voltage, execute auxiliary function Fn010: reset encoder multi-turn data and alarm.
	The absolute value encoder is not connected to the battery or the battery voltage is too low	Check whether the absolute value encoder is connected to the battery and whether the battery voltage is correct.	

Alarm code	Reason	Confirmation method	Treatment
E. 556: Encoder count overflow	The multiturn encoder is not connected to the battery or the battery voltage is too low	Multi-turn encoder battery not connected or alarm due to previous battery alarm.	After confirming the battery voltage, execute auxiliary function Fn010: reset encoder multi-turn data and alarm.
	The distance of the motor running in one direction exceeds 65535 turns, and the multi-turn information overflows	16-bit multi-turn information overflow.	
E. 558: Encoder multi-turn data error	The multiturn encoder is not connected to the battery or the battery voltage is too low	Multi-turn encoder battery not connected or alarm due to previous battery alarm.	After confirming the battery voltage, execute auxiliary function Fn010: reset encoder multi-turn data and alarm.
E.55A: Encoder battery alarm (The voltage of the absolute encoder battery is below the specified value)	Bad battery connection, not connected	Confirm the battery connection.	Connect the battery correctly.
	The battery voltage is lower than the specified value (2.7V)	Measure the voltage of the battery.	Replacement battery.
	Encoder failure	Encoder data error.	Turn on the power of the servo drive again. If the alarm still occurs, the servo motor encoder may be faulty. Replace the servo motor or encoder.
E.600: Excessive position	The wiring of U, V, and W of the servo motor is incorrect.	Check the wiring of the servo motor main circuit cable.	Check the motor cable or encoder cable for poor contact and other

Alarm code	Reason	Confirmation method	Treatment
deviation alarm (When the servo is on, the position deviation exceeds the excessive position deviation alarm value (Pn530))			problems. JOG test run to check whether the motor and driver are running normally.
	The position command pulse frequency is high.	Try to reduce the position command pulse frequency before running.	Reduce the position command pulse frequency or command acceleration, or adjust the electronic gear ratio.
	Position command acceleration is too large	Try reducing the commanded acceleration before running.	Added smoothing functions such as Position command acceleration and deceleration time (Pn216).
	The position command acceleration is too large Relative to the running conditions, the position deviation is too large alarm value (Pn530) is low.	Check whether the excessive position deviation alarm value (Pn530) is appropriate.	Correctly set the value of parameter Pn530.
	Servo drive failure	--	Turn on the power of the SERVOPACK again. If the alarm still occurs, the servo unit may be faulty. Replace the SERVOPACK.
E.601: Excessive position deviation alarm when servo ON	During servo OFF, when the position deviation pulse exceeds the value of Pn532 and attempts to turn the servo ON in this state, the alarm is displayed.	Check the position deviation amount when the servo is OFF.	Set so that the positional deviation is cleared when the servo is OFF.
			Correctly set the excessive position deviation alarm value (Pn532) when the servo is ON.

Alarm code	Reason	Confirmation method	Treatment
E.602: Excessive position deviation alarm due to speed limit	When the servo is ON, the speed limit value (Pn538) is used to execute the speed limit, and the command pulse is input in this state, and the position deviation exceeds the value of the position deviation excessive alarm value (Pn530).	--	Set the correct position deviation alarm value (Pn530). Or set the servo-on speed limit value (Pn538) to the correct value.
E.620: Runaway detection (detected when the servo is ON)	The U, V, W phase sequence of the motor wiring is wrong.	Confirm motor wiring	Check if there is a problem with the motor wiring.
	Encoder failure		If there is no problem with the motor wiring, but the alarm still occurs after turning on the power again, the servo motor or linear encoder may be faulty. Replace the servo motor or linear encoder.
	Servo drive failure		Turn on the power of the servo drive again. If the alarm still occurs, the servo drive may be faulty. Replace the servo drive.
E.622: Overspeed	The U, V, W phase sequence of the	Check the wiring of the servo motor.	Check if there is a problem with the motor wiring.

Alarm code	Reason	Confirmation method	Treatment
(motor speed is above the maximum speed)	motor wiring is wrong		
	The command input value exceeds the overspeed value	Confirm the input command.	Decrease command value. or adjust the gain.
	Motor speed exceeds maximum speed	Check the waveform of the motor speed.	Reduce the speed command input gain and adjust the servo gain. or adjust the operating conditions
	Servo drive failure		It is possible that the servo drive is faulty. Replace the servo drive.
E.636: Vibration alarm	Abnormal vibration of motor speed detected	Check the abnormal sound of the motor and the speed and torque waveforms during operation.	Reduce motor speed. Or reduce the speed loop gain (Pn100).
	The value of the moment of inertia ratio (Pn103) is larger than the actual value or has changed greatly	Confirm the moment of inertia ratio or mass ratio	Correctly set the moment of inertia ratio (Pn103).
	Vibration detection value (Pn322) is inappropriate	Check whether the vibration detection value (Pn322) is appropriate.	Set the vibration detection value (Pn322) appropriately.

Alarm code	Reason	Confirmation method	Treatment
E.638: Automatically adjust the alarm (Vibration detected in custom tuning, TFFT, adaptive tuning function	Motor when using autotuning	Check the waveform of the motor speed.	Decrease the load so that it is below the allowable moment of inertia ratio, or increase the load value set by the auto-tuning value to decrease the rigidity value.
	great vibration		
	The motor vibrates a lot during custom tuning and TFFT execution	Check the waveform of the motor speed.	Implement the processing method explained in the operation step of each function.
E.F00: E.F01: E.F02: E.F03: E.F04: system alarm	Failure of components inside the servo drive due to gas, water droplets, or cutting oil, etc.	Confirm the setting environment.	It is possible that the servo drive is faulty. Replace the servo drive.
	Servo drive failure	Turn on the power of the servo drive again. If the alarm still occurs, the driver may be faulty.	
	other		Restore all parameters to factory (Fn015).

10.4 List of warnings

Code	Name	Content
A.900	Position deviation is too large	The accumulated position deviation exceeds the value set by Pn530.
A.901	The position deviation is too large when the servo is ON	The accumulated position deviation when the servo is ON exceeds the value set by Pn532.
A.910	Motor overload	It is a warning display just before the motor overload (E.120 or E.130) alarm is reached. If the operation continues, an alarm may occur.
A.911	drive overload	It is a warning display just before the drive overload (E.120 or E.130) alarm is reached. If the operation continues, an alarm may occur.
A.91A	vibration	Abnormal vibration is detected during motor operation. It is the same as the detected value of E.636, and the vibration detection switch (Pn320) is used to set alarm or warning.
A.920	regeneration overload	It is a warning display before reaching the regeneration overload (E.120) alarm. If the operation continues, an alarm may occur.
A.921	DB overload	It is a warning display before reaching the DB overload (E.150) alarm. If the operation continues, an alarm may occur..
A.930	Battery failure of absolute encoder	It is a warning display that the battery voltage of the absolute encoder is too low.
A.941	Parameter changes that require a power cycle	Changed parameters that require power cycle.
A.971	Undervoltage	It is a warning display before the undervoltage (E.410) alarm is reached. If the operation continues, an alarm may occur.
A.9A0	Overtravel	An overtravel was detected while the servo was ON.

10.5 Warning troubleshooting

Warning code	Reason	Confirmation method	Treatment measures
A.900:	Incorrect wiring of U, V, W of the servo motor	Check the wiring of the servo motor main circuit cable.	Check the motor cable or encoder cable for poor contact and other problems.
Position deviation is too large	Servo drives have low gain	Check whether the gain of the servo driver is too low.	Servo gain is increased by the automatic tuning (no host command) function, etc.
	The frequency of the position command pulse is high	Try lowering the command pulse before running.	Reduce the position command pulse frequency or command acceleration, or adjust the electronic gear ratio.
	Position command acceleration is too large	Try reducing the commanded acceleration before running.	Added smoothing functions such as Position command acceleration and deceleration time (Pn216).

Warning code	Reason	Confirmation method	Treatment measures
	Relative to the operating conditions, the position deviation is too large alarm value (Pn530) is low	Confirm the position deviation is too large alarm value (Pn530) is appropriate.	Correctly set the value of parameter Pn530.
A.901: The position deviation is too large when the servo is ON	The accumulated position deviation when the servo is ON exceeds the value set by Pn532.		Set so that the positional deviation is cleared when the servo is OFF. Correctly set the excessive position deviation alarm value (Pn532) when the servo is ON.
A.910: Motor overload (warning before becoming overload alarm (E.120 or E.130))	Poor motor wiring, encoder wiring or poor connection	Confirm wiring.	Check whether there is any problem with the motor wiring and encoder wiring.
	The motor is running beyond the overload protection characteristic	Check the overload characteristics of the motor and the operation command.	Review the load conditions and operating conditions. Or re-examine the motor capacity.

Warning code	Reason	Confirmation method	Treatment measures
	The motor does not drive due to mechanical factors, resulting in excessive load during operation	Confirm the operation command and motor speed.	Improve mechanical factors.
A.911: Drive overload (warning before becoming overload alarm (E.121 or E.131))	The drive operates beyond the overload protection feature	Confirm the drive model and operation command.	Review the load conditions and operating conditions. Or re-examine the drive capacity.
	The motor does not drive due to mechanical factors, resulting in excessive load during operation	Confirm the operation command and motor speed.	Improve mechanical factors.
A.91A: vibration	Abnormal vibration detected during motor operation	Check the abnormal sound of the motor and the speed and torque waveforms during operation.	Reduce motor speed. Or reduce the servo gain by custom tuning etc.
	The value of the moment of inertia ratio (Pn103) is larger than the actual value or has a large change	Confirm the moment of inertia ratio or mass ratio.	Set the moment of inertia ratio (Pn103) correctly.

Warning code	Reason	Confirmation method	Treatment measures
A.920: Regenerative Overload (Warning before becoming Regenerative Overload (E.320))	Supply voltage exceeds specification Range	Measure the power supply voltage.	Set the power supply voltage within the specification Range.
	The external regenerative resistor value, the capacity of the servo drive or the regenerative resistor capacity is insufficient, or it is in a continuous regeneration state	Confirm the operating conditions and capacity again.	Change the regeneration resistance value, regeneration resistance capacity or servo drive capacity. Adjust the operating conditions again.
	Continuous negative load, in continuous regeneration state	Check the load applied to the running servo motor.	Revisit the system including servos, mechanics, and operating conditions.
A.921: DB Overload (Warning before becoming DB Overload (E.150))	The motor is driven by external force	Confirm the operating status.	Do not drive the motor by external force.
	The rotational or running energy when the DB is stopped exceeds the capacity of the DB resistor.	Check the frequency of use of the DB by the power consumption of the DB resistor.	Try the following measures.

Warning code	Reason	Confirmation method	Treatment measures
			• Decrease the command speed of the servo motor. • Decrease the moment of inertia ratio or mass ratio. • Reduce the number of DB stops. -
	Servo drive DB loop failure.	Turn on the power of the servo drive again. If the alarm still occurs, the DB circuit may fail.	If the DB function is not used, set the stop mode to free stop (Pn001.0=2). If you need to use the DB function, replace the servo drive.
A.930: Battery failure of absolute encoder	Bad battery connection, not connected	Confirm the battery connection.	Connect the battery correctly.
	The battery voltage is lower than the set value (2.7V)	Measure the voltage of the battery.	Replacement battery
A.941:	Changed	–	Turn on the power of the servo

Warning code	Reason	Confirmation method	Treatment measures
Parameter changes that require a power cycle	parameters that require a power cycle		drive again.
A.970: Undervoltage	When using the servo driver for AC220V, the AC power supply voltage is less than 140V	Measure the power supply voltage.	Adjust the supply voltage to the normal Range.
	Supply voltage drops during operation	Measure the power supply voltage.	Increase the power supply capacity.
	Instantaneous power failure occurs	Measure the power supply voltage.	If the momentary stop hold time (Pn52A) is changed, set a smaller value.
A.9A0:	Overtravel detected during servo ON	Check the status of the overtravel signal by monitoring the input signal.	If the overtravel signal cannot be checked by the input signal monitoring, the overtravel may be detected instantaneously. Perform the following items.

Warning code	Reason	Confirmation method	Treatment measures
Overtravel (overtravel condition detected			→The command from the host device to the overtravel area is not executed. →Confirm the wiring of the overtravel signal. → Take anti-interference measures.

CHAPTER 11 LIST OF PARAMETERS

Each bit of the function selection parameter has its own meaning.

Parameter	Meaning
Pn000.0 or h.×××□	Indicates the value represented by the "0 digits" of the Value of Parameter "Pn000".
Pn000.1 or h.××□×	Indicates the value represented by "1 digit" of Value of Parameter "Pn000".
Pn000.2 or h.×□××	Indicates the value represented by the "2 digits" of the Value of Parameter "Pn000".
Pn000.3 or h.□×××	Indicates the value represented by the "3 digits" of the Value of Parameter "Pn000".
Pn500.01 or h.××□□	Indicates the value represented by "0, 1 digits" of the Value of Parameter "Pn500".

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
Pn000	Function selection basic switch 0	h.0000~1130	--	h.0000	Restart	set up	--
	h.×××□: Rotation direction rotation 0: normal mode; 1: negative rotation mode; **h.××□×: Control mode selection** 0: position control; 1: Speed control; 2: Torque control; 3: Internal speed control; **h.×□××: reserved** **h.□×××: Communication selection (optional)** 0: No communication control; 1: CANopen communication;						
Pn001	Function selection basic switch 1	h.0000~1242	--	h.0100	Restart	set up	--
	h.×××□: Servo OFF and stop method when an alarm occurs 0: The motor is stopped by DB (dynamic brake), and it is in DB state after stopping; 1: Stop the motor through DB, then release DB; 2: Do not use DB, set the motor to free running state; **h.××□×: Stop method at overtravel (OT)** 0: DB stop or free running stop (the stop method is the same as Pn001.0); 1: Take the set torque of Pn406 as the maximum value to decelerate and stop the motor, and then enter the servo lock state; 2: Take the set torque of Pn406 as the maximum value to decelerate and stop the motor, and then enter the free running state; **h.×□××: Selection of main circuit power supply AC/DC input** 0: Single-phase AC power input: input single-phase AC power from terminals L1 and L2; 1: Three-phase AC power input: input three-phase AC power from L1, L2, L3 terminals;						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	2: DC power input: input DC power from P and N; **h. □×××: reserved**						
Pn002	Function selection basic switch 2	h.0000~8112	--	h.0100	Restart	set up	--
	h.×××□: reserved **h.××□×: reserved** **h.×□××: How to use the absolute encoder** 0: Use as absolute value encoder; 1: Use the absolute encoder as a 1-turn absolute encoder; **h.□×××: reserved**						
Pn007	Function selection basic switch 7	h.0000~4011	--	h.0000	Restart	set up	--
	h.×××□: Absolute encoder multi-turn data overflow alarm 0 alarm; 1 do not call the police; **h.××××: Alarm/Warning selection when battery voltage is low** 0: Set the low battery voltage as an alarm (E.55A); 1: Set low battery voltage as warning (A.930); **h.×□××: reserved** **h.□×××: reserved**						
Pn008	Function selection basic open 8	h.0000~1211	--	h.0000	Restart	set up	--
	h.×××□: reserved **h.××□×: Function selection when under voltage** 0: No undervoltage warning is detected; 1: An undervoltage warning is detected, and the torque limit is performed by the host device; 2: Undervoltage warning is detected, and torque limit is executed through Pn433 and Pn434; **h.×□××: Warning detection selection** 0: a warning is detected; 1: no warning is detected; **h.□×××: reserved**						
Pn009	Function selection application switch 9	h.0000~1311	--	h.0000	Restart	set up	--
	h.×××□: reserved **h.××□×: reserved** **h.×□××: Speed detection method selection** 0: select speed detection 1; 1: select speed detection 2; **h.□×××: reserved**						
Pn00B	Function selection application switch B	h.0000~9953	--	h.0011	Restart	set up	--
	h.×××□: panel parameter display selection						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	0: Only display the parameters for setting; 1: Display all parameters; **h.××□×: Warning stop method selection** 0: stop at zero speed; 1: DB stop or free running stop (the stop method is the same as Pn001.0); **h.×□××: reserved** **h.□×××: reserved**						
Pn00D	Function selection application switch D	h.0000~2F17	--	h.0000	Restart	set up	--
	h.×××□: Main circuit power OFF alarm **h.××□×: reserved** **h.×□××: Mechanical protection function** **h.□×××: Overtravel warning detection selection** 0: do not detect overtravel warning; 1: Overtravel warning A.9A0 is detected; 2: Overtravel alarm E.360 is detected;						
Pn00E	Function selection application switch E	h.0000~0911	--	h.0300	Restart	set up	--
	h.×××□: regenerative resistance detection (the default value may be different for different power drives) 0: Detect regeneration resistance; 1: Do not detect regeneration resistance; **h.××□×: reserved** **h.×□××: overload level** 0~9: The larger the value, the longer the overload time; **h.□×××: reserved**						
Pn010	Axis address selection	1 ~ 127	--	1	Restart	set up	--
Pn011	Communication function selection switch 0	h.000~1635	--	h.0335	Restart	set up	--
	h.×××□: RS485 communication rate 0: 2400bps; 1: 4800bps; 2: 9600bps; 3: 19200bps; 4: 38400bps; 5: 57600bps; **h.××□×: RS485 communication protocol** 0:8,N,1; 1:8,N,2; 2:8,E,1; 3:8,0,1; **h.×□××: CAN communication rate**						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	0: 20K bps; 1: 50Kbps; 2: 100K bps; 3: 125K bps; 4: 250K bps; 5: 500K bps; 6: 1M bps; **h.□×××: reserved**						
Pn100	1st speed loop gain	10~20000	0.1 Hz	400	Immediate	adjust	--
	Determines the speed loop responsiveness characteristics. In order to increase the position loop gain and improve the overall response of the servo system, it is necessary to increase the setting of the speed loop gain value. However, if the setting is too large, it may cause vibration, please pay attention when modifying.						
Pn101	1st speed loop integral time constant	15~51200	0.01 ms	2000	Immediate	adjust	--
	Set the speed loop integral time constant. The smaller the Value, the greater the integral effect and the stronger the anti-disturbance ability, but an excessively large setting may cause vibration.						
Pn102	1st position loop gain	10~20000	0.1/s	400	Immediate	adjust	--
	Determines the responsiveness of the position control system. Setting a larger position loop gain value can shorten the positioning time. However, if the setting is too large, it may cause vibration, please pay attention when modifying.						
Pn103	Load inertia ratio	0~20000	1%	100	Immediate	adjust	--
	Value of Pn103= the moment of inertia of the load converted from the motor shaft/ rotor moment of inertia of the servo motor× 100 (%)						
Pn104	2nd speed loop gain	10~20000	0.1 Hz	400	Immediate	adjust	--
Pn105	2nd speed loop integral time constant	15~51200	0.01 ms	2000	Immediate	adjust	--
Pn106	2nd position loop gain	10~20000	0.1/s	400	Immediate	adjust	--
Pn107	Torque feedforward gain	0~1000	0.10%	0	Immediate	adjust	--
Pn108	Torque feedforward filter time constant	0~6400	0.01ms	0	Immediate	adjust	--
Pn109	Speed feed forward gain	0~1000	0.10%	0	Immediate	adjust	--
	The speed control command calculated from the internal position command is multiplied by the ratio of this parameter and added to the speed command from the position control process.						
Pn10A	Speed feedforward Filter time constant	0~6400	0.01ms	0	Immediate	adjust	--
Pn10B	Gain class application selector switch 0	h.0000~0014	--	h.0000	Immediate	set up	--
	h.×××□: Mode switch selection						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	0: Conditioned by internal torque command (the value is Pn10C); 1: Conditioned by the speed command (the value is Pn10C); 2: Conditioned by acceleration (the value is Pn10C); 3: Conditioned by the position deviation pulse (the value is Pn10C); 4: No mode switch function, fixed as PI control; **h.××□×: Control method of speed loop** 0: PI control; 1: P control; **h.×□××: reserved** **h.□×××: reserved**						
Pn10C	Mode switch level	0～30000	--	200	Immediate	adjust	--
	This parameter is valid when Pn10B.0=0~3 When Pn10B.0=0, as the torque switch level, Range 0~400 is valid, Unit 1%; When Pn10B.0=1, as the speed command switch level, Range 0~3000 is valid, Unit 1rpm; When Pn10B.0=2, as the acceleration switch level, Range 0~30000 is valid, Unit 1 rpm/s; When Pn10B.0=3, as position deviation pulse switch level, Range 0~10000 is valid, Unit 1 pulse;						
Pn10D	Pseudo-differential feedforward control coefficients	0～1000	0.10%	1000	Immediate	adjust	--
	When this coefficient is set to 100.0, the dynamic response of the speed loop is fast. When set to 0.0, the integral effect of the speed loop is obvious, which can filter out low-frequency interference, but the dynamic response is slow. By adjusting this parameter, the speed loop can not only have fast response, but will not increase the speed overshoot, but also improve the anti-disturbance ability of the low frequency band.						
Pn121	Disturbance Compensation Gain	10~1000	1%	100	Immediate	adjust	--
Pn123	Disturbance compensation coefficient	0~100	1%	0	Immediate	adjust	--
Pn130	Gain class application selector switch 1	h.0000~00B1	--	h.0000	Immediate	adjust	--
	h.×××□: Gain switching selector switch 0: Manually switch the gain; manually switch the gain through the external input signal (/G-SEL); 1: Automatically switch the gain; When switching condition A is satisfied, it automatically switches from the 1st gain to the 2nd gain. When switching condition A is not satisfied, it automatically switches from the second gain to the first gain. **h.××□×: switching condition A** 0: Positioning completion signal (COIN) ON (signal valid); 1: Positioning completion signal (COIN) OFF; 2: Proximity signal (NEAR) ON (signal valid); 3: Proximity signal (NEAR) OFF; 4: Position command filter output = 0 and command pulse input OFF;						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	5: Position command pulse input ON; 6: The torque command is greater than the switching level (the value is Pn137, Unit1%) 7: The speed command is greater than the switching level (the value is Pn137, Unit1rpm) 8: The position deviation is greater than the switching level (the value is Pn137, Unitpulse) 9: The actual acceleration is greater than the switching level (the value is Pn137, Unit: 1rpm/S) A: The actual speed is greater than the switching level (the value is Pn137, Unit1rpm) B: There is a position command + the actual speed is greater than the switching level (the value is Pn137, Unit1rpm) **h.×□××: reserved** **h.□×××: reserved**						
Pn131	Gain switching time 1	0~32767	1ms	0	Immediate	adjust	--
Pn132	Gain switching time 2	0~32767	1ms	0	Immediate	adjust	--
Pn135	Gain switching wait time 1	0~32767	1ms	0	Immediate	adjust	--
Pn136	Gain switching wait time 2	0~32767	1ms	0	Immediate	adjust	--
Pn137	Gain switching threshold level	0~30000	--	0	effective immediately	adjust	--
	Trigger level for gain switching						
Pn13D	Current gain value	100~2000	1%	2000	effective immediately	adjust	--
Pn150	Model Tracking Control Class Switch	h.0000~1121	--	100	Immediate	adjust	--
	h.×××□: Model tracking control selection 0: Do not use model tracking control; 1: Use model tracking control; **h.××□×: Low frequency vibration suppression control selection** 0: No low frequency vibration suppression control; 1: Add low-frequency vibration suppression control function to specific frequencies; 2: Add low-frequency vibration suppression control function to 2 different frequencies; **h.×□××: Adjustment selection of low frequency vibration suppression control function** 0: The low-frequency vibration suppression control function is not automatically adjusted by auxiliary functions; 1: The low-frequency vibration suppression control function is automatically adjusted through auxiliary functions; **h.□×××: reserved**						
Pn151	Model tracking control gain	10~20000	0.1/s	500	Immediate	adjust	--
Pn155	Low frequency vibration suppression control 1 frequency	10 to 2500	0.1Hz	500	Immediate	adjust	--
Pn157	Model tracking control speed	0 to 10000	0.10%	1000	Immediate	adjust	--

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	feedforward compensation						
Pn160	Vibration suppression control switch	0000～0011	--	10	Restart	adjust	--
	h.×××□: IF vibration suppression control selection 0: Do not use IF vibration suppression control; 1: Use IF vibration suppression control; **h.××□×: reserved** **h.×□××: reserved** **h.□×××: reserved**						
Pn161	Mid frequency vibration frequency	100～20000	0.1Hz	1000	Immediate	adjust	--
Pn162	Mid frequency vibration bandwidth adjustment	1 to 300	1%	100	Immediate	adjust	--
Pn163	Mid frequency vibration Damping Gain	0 to 300	1%	0	Immediate	adjust	--
Pn164	Mid frequency vibration suppression low-pass filter time constant	0～1000	0.01ms	0	Immediate	adjust	--
Pn165	Mid frequency vibration suppression high-pass filter time constant	0～1000	0.01ms	0	Immediate	adjust	--
Pn200	Position control function switch 0	h.0000~1232	--	h.0000	Restart	set up	--
	h.×××□: Command pulse form 0: pulse + sign; 1: CW+CCW; 2: A phase + B phase (4 times frequency); **h.××□×: pulse signal inversion operation** 0: PULS and SIGN are not negated; 1: PULS is not negated, SIGN is negated; 2: PULS is negated, SIGN is not negated; 3: PULS negation, SIGN negation; **h.×□××: Pulse clear action** 0: Clear the position deviation pulse when the servo is OFF or an alarm occurs; 1: Clear the position deviation pulse by CLR signal; 2: Clear the position deviation pulse when an alarm occurs or by CLR; **h.□×××: Pulse input channel selection** 0: Select low-speed channel input pulse;						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	1: Select high-speed channel input pulse;						
Pn201	Position control function switch 1	h.0000~3177	--	h.0000	Restart	set up	--
	h.×××□: Input pulse filter level 0~7: The larger the value, the longer the filtering time. **h.××□×: reserved** **h.×□××: Inversion of frequency division pulse output logic** 0: No negation 1: negate **h.□×××: Frequency division Z pulse extension** 0: do not expand 1: Extended						
Pn202	Position control function switch 2	h.0000~0022	--	h.0000	Restart	set up	--
	h.×××□: Positioning signal (COIN) output condition 0: Output when the absolute value of the position deviation is less than the positioning completion range (Pn522); 1: Output when the absolute value of the position deviation is less than the positioning completion range (Pn522) and the filtered command of the position command is 0; 2: Output when the absolute value of the position deviation is less than the positioning completion range (Pn522) and the position command input is 0; **h.××□×: Clear signal (CLR) form** 0: Clear the position deviation pulse when the signal is at H level; 1: The rising edge of the signal clears the position deviation pulse; 2: Clear the position deviation pulse when the signal is L level; 3: The falling edge of the signal clears the position deviation pulse; **h.×□××: reserved** **h. □×××: reserved;**						
Pn20E	Electronic gear ratio (numerator)	1~ 1073741824	1	4	Restart	set up	--
	See Pn210 description						
Pn210	Electronic gear ratio (denominator)	0~ 1073741824	1	1	Restart	set up	--
Pn212	Encoder frequency division setting	16~16384	1Pulse/ rev	2500	Restart	set up	--
	1. Set the number of PAO and PBO pulses outputted by the motor per revolution. If it is set to 1000, the motor rotates one circle, the number of output PAO pulses is 1000, and the number of output PBO pulses is 1000. 2. When the value of Pn212 is set to exceed 1/4 of the encoder resolution, its frequency division value is 1/4 of the encoder resolution. If an encoder with a resolution of 131072 is used, and Pn210 is set to a value greater than 32768, the number of divided pulses is limited to 32768. 3. The PZO pulse width is a PAO pulse width, that is, the smaller the value of Pn212, the wider the PAO width and the wider the PZO pulse at the same speed.						
Pn216	Position command	0~32767	0.1 ms	0	After the	set up	--

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	acceleration and deceleration time				motor stops		
Pn217	Position command moving average time	0～1000	0.1 ms	0	After the motor stops	set up	--
Pn218	The second electronic gear molecule	1 to 100	1 times	1	Immediate	set up	--
Pn300	Speed command input gain	150～3000	0.01 V/rated speed	600	Immediate	set up	--
Pn301	Internal 1st speed	-6000~ 6000	1 rpm	100	Immediate	set up	--

Under the internal speed control, the combination of external input IO signals INSPD1 and INSPD0 selects the internal speed, and Unit is rpm. The corresponding relationship is as follows.

INSPD1	INSPD0	speed control command
invalid	invalid	zero speed
invalid	efficient	Internal 1st speed (Pn301)
efficient	invalid	Internal second speed (Pn302)
efficient	efficient	Internal 3rd Speed (Pn303)

Pn301	Internal first torque	-6000~ 6000	0.10%	100	Immediate	set up	--

Under torque control, when the external input IO signal selects "internal torque selection 0 (INTor0)" or "internal torque selection 0 (INTor0)", and the two signals are not invalid at the same time, the internal torque mode is selected. This parameter Unit is 0.1%, that is, when Pn301=100, the corresponding internal torque is 10% of the rated value.

INTor1	INTor0	Torque control command
invalid	invalid	External analog command
invalid	efficient	Internal first torque (Pn301)
efficient	invalid	Internal second

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
			torque (Pn302)				
	efficient	efficient	Internal third torque (Pn303)				
Pn302	Internal 2nd speed	-6000~ 6000	1 rpm	200	Immediate	set up	--
	Internal second torque	-6000~ 6000	0.10%	200	Immediate	set up	--
Pn303	Internal 3rd speed	-6000~ 6000	1 rpm	300	Immediate	set up	--
	Internal 3rd torque	-6000~ 6000	0.10%	300	Immediate	set up	--
Pn304	JOG speed	0~6000	1 rpm	500	Immediate	set up	--
Pn305	Soft start acceleration time	0 to 10000	1ms	0	Immediate	set up	--
Pn306	Soft start deceleration time	0 to 10000	1ms	0	Immediate	set up	--
Pn307	Deceleration time at servo OFF and forced stop	0 to 10000	1ms	0	Immediate	set up	--
Pn30A	Speed command filter time parameter	0 to 65535	0.01ms	40	Immediate	set up	--
Pn30C	Speed Feedback Filter Time Parameters	0 to 65535	0.01ms	0	Immediate	set up	--
Pn310	Speed control function switch 0	h.0000~0001	--				
	h.×××□: Zero clamp signal selection 0: IO signal (ZEROSPD) control; 1: Zero clamp control is performed automatically. When the given speed is lower than Pn315 (zero fixed value), enter the zero-clamp mode;						
Pn315	Zero-clamp threshold	0 to 5000	1 rpm	10	Immediate	set up	
Pn320	Vibration detection switch	h.0000~0F02	-	h.0000	Immediate	set up	--
	h.×××□: Vibration detection selection 0: no vibration is detected; 1: A warning is issued when vibration is detected (A.91A); 2: An alarm is issued after vibration is detected (E.636); **h.××□×: reserved** **h.□□××: reserved**						
Pn321	Vibration detection sensitivity	50 to 500	1%	100	Immediate	adjust	--
Pn322	Vibration detection value	0 to 5000	1rpm	50	Immediate	adjust	--

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
Pn332	Moment of inertia estimation start value	0 to 20000	1%	300	Immediate	set up	--
Pn400	Torque command input gain	10～100	0.1V/rated torque	30	Immediate	set up	--
Pn401	1st stage torque command filter time constant	0～32767	0.01ms	100	Immediate	adjust	--
Pn402	Forward torque limit	0～400	1%	400	Immediate	set up	--
Pn403	Reverse side torque limit	0～400	1%	400	Immediate	set up	--
Pn404	External torque limit on the forward side	0～400	1%	100	Immediate	set up	--
Pn405	Reverse side external torque limit	0～400	1%	100	Immediate	set up	--
Pn406	Emergency stop torque limit	0～400	1%	400	Immediate	set up	--
Pn407	Speed limit in torque control mode	0～5000	1 rpm	1500	Immediate	set up	--
Pn40A	1st stage 2nd torque command filter time parameter	0 to 32767	0.01ms	0	Immediate	set up	--
Pn40F	Torque function switch 0	h.0000~1111	--	h.0000	Immediate	set up	--
	h.×××□: reserved **h.××□×: Speed limit selection** 0: Use the lower value of the motor maximum speed or Pn407 in the speed limit value; 1: Use the smaller value of the overspeed detection speed or Pn407 in the speed limit value; **h.×□××: reserved** **h.□×××: Disturbance compensation function selection** 0: Disturbance compensation function is not used; 1: Use the disturbance compensation function;						
Pn410	Vibration function switch 0	h.0000~1111	--	h.0000	Immediate	set up	--
	h.×××□: Notch filter selection 1 0: The first stage notch filter is invalid; 1: Use the first stage notch filter; **h.××□×: Notch filter selection 2** 0: The second stage notch filter is invalid; 1: Use the second-stage notch filter; **h.×□××: reserved** **h.□×××: reserved**						
Pn411	1st stage notch filter frequency	50 to 5000	1 Hz	5000	Immediate	adjust	--

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
Pn412	1st stage notch filter attenuation value	50 to 1000	0.01	70	Immediate	adjust	--
Pn413	1st stage notch filter depth	50 to 5000	0.001	0	Immediate	adjust	--
Pn414	2nd stage notch filter frequency	50 to 5000	1 Hz	5000	Immediate	adjust	--
Pn415	2nd stage notch filter attenuation value	50 to 1000	0.01	70	Immediate	adjust	--
Pn416	2nd stage notch filter depth	50 to 5000	0.001	0	Immediate	adjust	--
Pn420	Vibration function switch 2	h.0000~1111	--	h.0000	Immediate	set up	--
	h.×××□: Selection of notch filter 3 0: The third-stage notch filter is invalid; 1: Use the third-stage notch filter; **h.××□×: Notch filter selection 4** 0: The fourth segment notch filter is invalid; 1: Use the fourth-stage notch filter; **h.×□××: reserved** **h.□×××: reserved**						
Pn421	3rd stage notch filter frequency	50 to 5000	1 Hz	5000	Immediate	adjust	--
Pn422	3rd stage notch filter attenuation value	50 to 1000	0.01	70	Immediate	adjust	--
Pn423	3rd stage notch filter depth	50 to 5000	0.001	0	Immediate	adjust	--
Pn424	4th band notch filter frequency	50 to 5000	1 Hz	5000	Immediate	adjust	--
Pn425	4th stage notch filter attenuation value	50 to 1000	0.01	70	Immediate	adjust	--
Pn426	4th stage notch filter depth	50 to 5000	0.001	0	Immediate	adjust	--
Pn433	Torque limit when main circuit voltage drops	0 ~ 100	1%	50	Immediate	set up	--
Pn434	Torque limit release time when main circuit voltage drops	0 ~ 1000	1ms	100	Immediate	set up	--
Pn438	Current loop gain factor	25 ~ 400	1%	100	Immediate	set up	--
Pn439	Current loop integral coefficient	10 ~ 400	1%	100	Immediate	set up	--
Pn456	Sweep torque	1 ~ 400	1%	15	Immediate	adjust	--

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	command amplitude						
Pn460	Notch filter adjustment switch 1	h.0000~0101	--	h.0101	Immediate	adjust	--
	h.×××□: Notch filter adjustment selection 1 0: The notch filter of the first stage is not automatically adjusted by auxiliary functions; 1: The notch filter of the first stage is automatically adjusted by the auxiliary function; **h.××□×: reserved** **h.×□××: Notch filter adjustment selection 2** 0: The second-stage notch filter is not automatically adjusted by auxiliary functions; 1: The second-stage notch filter is automatically adjusted by auxiliary functions; **h.□×××: reserved**						
Pn471	Coulomb friction compensation torque	0~2000	0.01%	0	Restart	set up	
	Unit is 0.01% of the rated torque of the motor						
Pn472	Coulomb friction compensation speed hysteresis region	0~200	Rpm	10	Immediate	set up	
Pn473	Viscous Friction Compensation Torque	0~2000	0.01%	0	Restart	set up	
	Unit is 0.01% of the rated torque of the motor						
Pn475	Gravity Compensation Switch	h.0000~0001	--	h.0000	Restart	set up	--
	h.×××□: Gravity compensation function selection 0: Do not use the gravity compensation function; 1: Use the gravity compensation function; **h.××□×: reserved** **h.×□××: reserved** **h.□×××: reserved**						
Pn476	Gravity compensation torque	-1000 ~ 1000	0.10%	0	Immediate	adjust	--
Pn500	DI1 input signal selection (CN1-9)	h.0000~211F	--	h.0000	Immediate	set up	--
	h.××□□: DI1 input signal selection 【00】Servo enable (/S-ON) 【01】Control mode switch (/C-SEL) 【02】Forbid the forward side drive (P-OT) 【03】Prohibit reverse side drive (N-OT) 【04】Position deviation clear (/CLR) 【05】Alarm reset (/ALM-RST) 【06】Zero Speed Clamp (ZEROSPD) 【06】Command inversion (/CMDINV) 【08】Command pulse input magnification switch (/PSEL)						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	【09】Command pulse input prohibition (/INHIBIT) 【0A】Positive rotation side external torque limit (/P-CL) 【0B】Reverse side external torque limit (/N-CL) 【0C】Gain switch (/G-SEL) 【0F】Internal command speed selection 0 (/INSPD0) 【10】Internal command speed selection 1 (/INSPD1) 【13】Internal command torque selection 0 (/INTOR0) 【14】Internal command torque selection 1 (/INTOR1) **h. ×□××: Invert the input signal of DI1** 【0】Signal is not inverted 【1】Signal inversion **h.□×××: Input signal status of DI1** 【0】The state of input signal is controlled by external IO 【1】Signal is always valid 【2】Signal is always invalid						
Pn501	DI2 input signal selection (CN1-10)	h.0000~211F	--	h.0001	Immediate	set up	--
	Refer to Pn500 description						
Pn502	DI3 input signal selection (CN1-34)	h.0000~211F	--	h.2002	Immediate	set up	--
	Refer to Pn500 description						
Pn503	DI4 input signal selection (CN1-8)	h.0000~211F	--	h.2003	Immediate	set up	--
	Refer to Pn500 description						
Pn504	DI5 input signal selection (CN1-33)	h.0000~211F	--	h.0004	Immediate	set up	--
	Refer to Pn500 description						
Pn505	DI6 input signal selection (CN1-32)	h.0000~211F	--	h.0005	Immediate	set up	--
	Refer to Pn500 description						
Pn50F	DI input signal filter time	0~1000	--	ms	Immediate	set up	
Pn510	DO1 output signal configuration (CN1-7, CN1-6)	h.0000~211F	--	h.0000	Immediate	set up	--
	h.XX□□: DO1 output signal selection 【00】Alarm signal output (ALM) 【01】Z pulse collector signal (CZ)						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	【02】Brake control signal (BK) 【03】Positioning completed (COIN): position deviation is less than the value of Pn606 【04】Warning signal output (WARN) 【05】Servo ready output (S-RDY) 【06】Speed consistent output (VCMP) 【07】Motor rotation detection (TGON) 【08】Torque limit detection signal (TLC) 【09】Speed limit detection signal (VLC) 【0A】Positioning near (NEAR): position deviation is less than the value of Pn608 【0B】Torque arrival (TREACH): torque feedback reaches the value of Pn525 **h. X□XX: Inversion of the output signal of DO1** 【0】Signal is not inverted 【1】Signal inversion **h.□XXX: DO1 output signal status** 【0】The state of the output signal is controlled by the driver 【1】Signal is always valid 【2】Signal is always invalid						
Pn511	DO2 output signal configuration (CN1-5, CN1-4)	h.0000~211F		h.0001	Immediate	set up	--
	Refer to Pn510 description						
Pn512	DO3 output signal configuration (CN1-3, CN1-2)	h.0000~211F		h.0002	Immediate	set up	--
	Refer to Pn510 description						
Pn513	DO4 output signal port configuration (CN1-1, CN1-26)	h.0000~211F		h.0003	Immediate	set up	--
	Refer to Pn510 description						
Pn521	Rotation detection value	1 to 6000	1 rpm	20	Immediate	set up	--
Pn522	VCMP signal detection width	0 ~ 100	1 rpm	10	Immediate	set up	--
Pn525	Torque reaches amplitude	0 ~ 400	1%	50	Immediate	set up	--
Pn526	Servo ON wait time	0 ~ 2000	ms	0	Immediate	set up	--
Pn527	Basic waiting process	0 to 1000	ms	0	Immediate	set up	--
Pn528	brake waiting speed	0 ~ 5000	1 rpm	100	Immediate	set up	--
Pn529	Brake waiting time	100 to 5000	1ms	500	Immediate	set up	--
Pn52A	Instant stop hold time	20 ~ 1000	1ms	20	Immediate	set up	--

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
Pn52E	Motor-load position deviation is too large	1~1073741824	1 command unit	1000	Immediate	set up	--
Pn530	Excessive position deviation alarm value	1 to 500	0.1 laps	50	Immediate	set up	--
Pn531	Excessive position deviation warning value	10 to 100	1%	100	Immediate	set up	--
Pn532	Servo ON when the position error alarm value (ERR)	1 to 500	0.1 laps	50	Immediate	set up	--
Pn533	Excessive position deviation warning value when servo ON	10 to 100	1%	100	Immediate	set up	--
Pn535	Overload warning value	5~100	%	20	Immediate	set up	--
Pn536	Motor overload detection base current derating	10~100	%	100	Immediate	set up	
Pn537	Servo drive overload detection base current derating when single-phase power input is selected	10~100	%	50	Immediate	set up	
Pn538	Speed limit value when servo ON	0 to 10000	1 rpm	10000	Immediate	set up	--
Pn53F	Monitor display at power-on	h.0000~0FFF	--	0FFF	Immediate	set up	--
Pn560	Regenerative resistor capacity	0 to 32767	1W	0	Immediate	set up	--
Pn561	Regenerative resistor value	1~200	ohm	40	Immediate	set up	--
Pn580	Customer code	0~1000	--	0	Restart	set up	--
Pn606	Positioning complete width	1~1073741824	1 Command Unit	7	Immediate	set up	
Pn608	NEAR signal width	1~1073741824	1 Command Unit	65535	Immediate	set up	
Pn610	Overshoot detection value	0 to 100	1%	100	Immediate	set up	--
Pn611	Residual vibration detection range	1 to 3000	0.10%	400	Immediate	set up	
Pn700	PJOG operation switch	h.0000~0005	--	h.0000	Immediate	set up	--
	h.□□□X: PJOG operating parameters						

Pn	Name	Setting range	Unit	Default	Effective	Category	Chapter
	【0】(Wait time Pn705 → Forward movement Pn701) × Movement times Pn706 【1】(Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706 【2】(Wait time Pn705 → Forward movement Pn701) × Movement times Pn706 (Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706 【3】(Wait time Pn705 → Reverse movement Pn701) × Movement times Pn706 (Wait time Pn705 → Forward movement Pn701) × Movement times Pn706 【4】(Wait time Pn705 → Forward movement Pn701 → Waiting time Pn705 → Reverse movement Pn701) × Movement times Pn706 【5】(Wait time Pn705 → Reverse movement Pn701 → Waiting time Pn705 → Forward movement Pn701) × Movement times Pn706 **h.XX□X: reserved** **hX□XX: reserved** **h.□XXX: reserved**						
Pn701	PJOG moving distance	1 ~ 1073741824	1 Command Unit	32768	Immediate	set up	--
Pn703	PJOG movement speed	1 ~ 10000	rpm	500	Immediate	set up	--
Pn704	PJOG acceleration and deceleration time	2 ~ 10000	1ms	100	Immediate	set up	--
Pn705	PJOG wait time	0 ~ 10000	1ms	100	Immediate	set up	--
Pn706	Number of PJOG moves	0 ~ 1000	1 time	1	Immediate	set up	--

OTHER ACCESSORIES

NAME	MODEL	APPEARANCE
Encoder cable connector (Q1 motor side , terminal type)	XPAC-M01	
Power line connector (Q1 motor side , terminal type)	XPAC-M02	
Encoder cable connector (Q1 motor side , aviation connector type)	XPAC-M03	
Power line connector (Q1 motor side , aviation connector type)	XPAC-M04	
Coding front plug (Q2 motor side , mounting type - 9P)	XPAC-M05	
Power cable connector (Q2 motor side , AMP type - 4P)	XPAC-M06	
Power cable connector (Q2 motor side , AMP type - 6P)	XPAC-M07	
Encoder cable connector (Q2 motor side , aviation connector type)	XPAC-M08	
Power line connector (Q2 motor side , aviation connector type)	XPAC-M09	
Encoder cable connector (driver side)	XPAC-E0B0	
USB communication cable	XPAC-L01	
RS485 communication cable	XPAC-L02	
Servo drive muti-machine parallel communication cable	XPAC-L03-□□	
Servo drive CAN and 485 communication terminal matching resistor	XPAC-F10