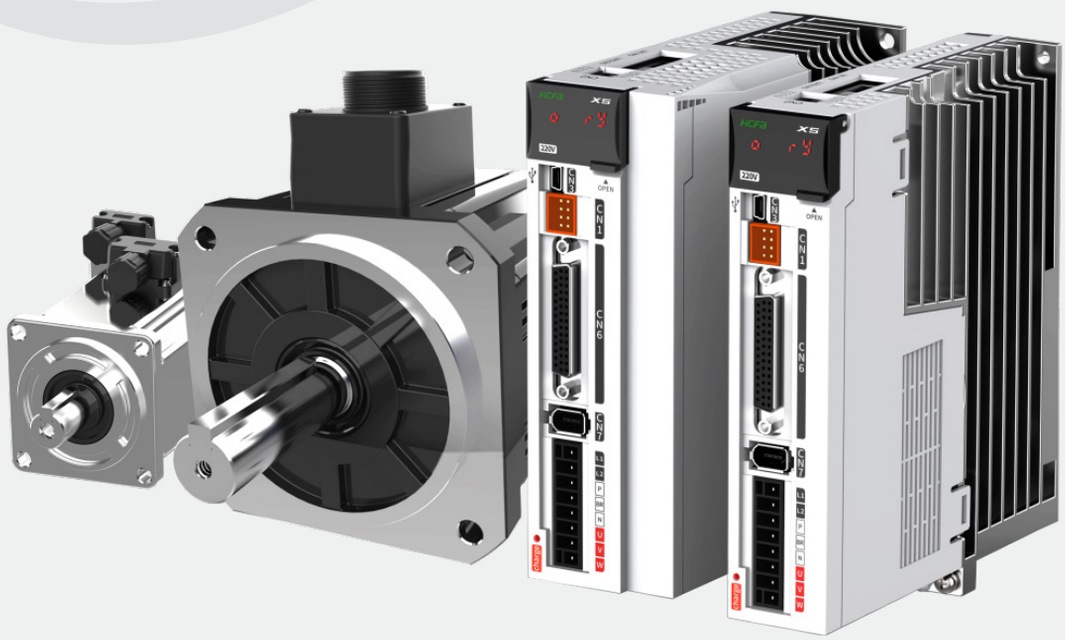
SV-X5-Series

Pulse Servo

Drive

Instruction Manual



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※ Preface

Thank you for using this product. This manual provides information about the SV-X5 series drives and motors.

Incorrect use and handling will not fully utilize the product's performance and may lead to accidents and a shortened product life. Please read this manual carefully and use the product correctly.

About the instruction manual

- Although the contents of this instruction manual are as complete as possible, please feel free to contact us in case of any doubt about the contents.
- Please note the following information in the instruction manual of the equipment to which this product is applied.
  - There is danger due to high voltage.
  - There is danger due to residual voltage at the terminals and inside the machine after switching off the power supply.
  - Partial high temperature
  - Dismantling is strictly prohibited.
- The specifications and functions of this product are subject to change or addition without prior notice due to performance upgrades.
- Please contact us in advance for information on the safety specifications of the device equipped with this product.
- To prolong the service life of the motor and drive, use them under proper operating conditions. For details, refer to the instruction manual.
- The instruction manuals contain the latest product information as much as possible and are subject to change. Please contact us if a new version of the instruction manual is needed.
- Reproduction of this manual in part or whole is prohibited without permission.

Confirmations during unpacking

- Whether the physical product matches the ordered product.
- Whether there is any damage during delivery.
- If problems are found, contact the dealer promptly.

Safety precautions

Please always pay attention to the following safety precautions during acceptance, inspection, installation, wiring, operation, and maintenance.

- The safety instruction levels, which may be caused by the neglect of the instruction or incorrect use of this product, are classified and described in the following table.

⚠ DANGER	Indicates that incorrect handling may result in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may result in injury or property damage.

- What must not be done and what must be done are indicated by the following diagrammatic symbols.

⃠ Indicates what must not be done.

❗ Indicates what must be done.

⚠ DANGER

Installation and wiring		
	Do not connect the motor directly to a commercial power.	Otherwise, it may cause fire or malfunction.
	Do not place any combustibles near the servo motor and drive.	Otherwise, it may cause a fire.
	Please place the drive within a protective case, and leave specified clearances between the drive and control enclosure walls or other equipment.	Otherwise, it may cause an electric shock, fire, or malfunction.
	Please install the drive in a place that frees from excessive dust, water, and oil.	Otherwise, it may cause an electric shock, fire, malfunction, or damage.
	Please install the drive to incombustible, such as metal.	Otherwise, it may cause a fire.
	The wiring must be done by a professional electrician.	Otherwise, it may cause an electric shock.
	The FG terminal of the motor or the drive must be grounded.	Otherwise, it may cause an electric shock.
	Please cut off the upper circuit breaker before wiring.	Otherwise, it may cause an electric shock, injury, malfunction, or damage.
	Please ensure a good connection of the cable with its electrified part being well insulated.	Otherwise, it may cause an electric shock, fire, or malfunction.
Operation and running		
	Do not touch the internal parts of the drive.	Otherwise, it may cause burns or an electric shock.
	The cables must not be excessively damaged, stressed, loaded, or pinched.	Otherwise, it may cause an electric shock, malfunction, or damage.
	Do not touch the rotating parts of the servo motor during operation.	Otherwise, it may cause injury.
	Do not use the drive in any place near water, corrosive or flammable gases, and flammables.	Otherwise, it may cause a fire.
	Do not subject the drive to any extreme vibrations and impact.	Otherwise, it may cause an electric shock, injury, or fire.
	Do not immerse the cables in oil or water during operation.	Otherwise, it may cause an electric shock, injury, or fire.
	Do not conduct wiring or perform operations with wet hands.	Otherwise, it may cause an electric shock, injury, or fire.
	Do not touch the keyway of the motor shaft with bare hands.	Otherwise, it may cause injury.
	Do not touch the motor, drive, and heat spreaders since they will heat up during operation.	Otherwise, it may cause burns or component damage.
	Do not connect the motor to an external power.	Otherwise, it may cause a fire.
Other safety precautions		
	Please ensure equipment safety after earthquakes.	Otherwise, it may cause an electric shock, injury, or fire.
	Ensure a correct installation and setting to prevent fire or personal injury during earthquakes.	Otherwise, it may cause injury, electric shock, fire, malfunction, or damage.
	Please provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.	Otherwise, it may cause injury, electric shock, fire, malfunction, or damage.
Maintenance and inspection		
	As there's dangerous and high-voltage inside the drive, before wiring or inspection, turn off the power and wait for 5 minutes or more until the charge lamp turns off. Do not disassemble the drive.	Otherwise, it may cause an electric shock.

⚠ CAUTION

	Installation and wiring	
❗	Please install the servo motor and drive following the combinations specified in this instruction.	Otherwise, it may cause fire or malfunction.
	Do not touch the connector terminals directly.	Otherwise, it may cause an electric shock or malfunction.
❗	Do not block the intake and let any foreign materials enter into the equipment.	Otherwise, it may cause an electric shock or fire.
	The test operation must be done with the motor being fixed but separated from the mechanical system. Only after confirming the operation can the motor be installed to the mechanical system.	Otherwise, it may cause injury.
	The servo motor must be installed following the specified directions and methods.	Otherwise, it may cause injury and malfunction.
	Ensure a proper installation in accordance with the weight and rated output of the equipment.	Otherwise, it may cause injury and malfunction.
	Operation and running	
⊘	Do not stand or put any heavy objects on the equipment.	Otherwise, it may cause an electric shock, injury, malfunction, or damage.
	Do not make extreme gain adjustments or changes, which will result in unstable running.	Otherwise, it may cause malfunction or damage.
	Keep it away from the direct sunlight.	Otherwise, it may cause malfunction.
	Do not subject the motor and its axis to heavy impact.	Otherwise, it may cause malfunction.
	The electromagnetic brake on the motor is designed to hold its shaft and should not be used for ordinary braking.	Otherwise, it may cause injury and malfunction.
❗	When power is restored after an instantaneous power outage, keep away from the machine because it may be restarted suddenly. Set the machine so that it is secured against personal injury if restarted.	Otherwise, it may cause injury.
	Do not use any malfunctioning or damaged motor or drive.	Otherwise, it may cause an electronic shock, fire, or injury.
	Please confirm that the power supply specification is normal.	Otherwise, it may cause malfunction.
	Holding brake is not a safety stopper used for ensuring machine safety. To ensure safety, install a stopper on the machine side.	Otherwise, it may cause injury.
	When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting the operation.	Otherwise, it may cause injury.
	The brake relay and the emergency stop relay must be connected in series.	Otherwise, it may cause injury or malfunction.
	Transportation and storage	
⊘	Do not subject the equipment to rain, droplets, toxic gas, or fluid.	Otherwise, it may cause malfunction.
	Do not carry the motor by the cables or shaft during transportation.	Otherwise, it may cause injury and malfunction.
❗	Do not drop or overturn the motor during transportation and installation.	Otherwise, it may cause injury and malfunction.
	For long-term storage, please contact HCFA via the contact information listed in this manual.	Otherwise, it may cause malfunction.
	Please store in a storage place that complies with the storage environment specified in this manual.	Otherwise, it may cause malfunction.
	Other safety precautions	
❗	Please insulate the battery with adhesive tape and dispose of it following the law of each country (area).	
	When disposing of the equipment, treat it as an industrial waste.	

Maintenance and inspection		
	Please contact HCFA for further instructions on removal, installation, and repair.	Otherwise, it may cause malfunction.
	Do not turn on and off the main circuit power switch too frequently.	Otherwise, it may cause malfunction.
	Do not touch the heat sink and regenerative resistor of the motor and drive because their temperatures may be high while power is on or for some time after power-off.	Otherwise, it may cause burns or electric shock.
	When the drive becomes faulty, switch off the control circuit and main power.	Otherwise, it may cause a fire.
	If the equipment is to be stored for a long time, please switch off the main power.	Otherwise, it may cause injury caused by the malfunction of the equipment.

Maintenance and inspection

< Warranty period>

● The term of warranty for the product is eighteen (18) months from the date of manufacture. However, for the motor with a brake, the warranty period does not exceed the maximum period that the shaft can accelerate or decelerate.

< Warranty coverage >

● This warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are stated in the instruction. However, even during the warranty period, the repair cost will be charged to customers in the following cases.

① A failure caused by improper storing or handling, repair, and modification.

② A failure caused by drops or damages during transportation.

③ A failure caused by using without following the product specifications.

④ A failure caused by external factors such as inevitable accidents, including without limitation fire, earthquake, thunder and lightning, flooding and wind hazard, salty damage, and abnormal fluctuation of voltage.

⑤ A failure caused by the intrusion of water, oil, metal sheet, and other foreign materials.

● The warranty coverage is only for the product itself. HCFA bears no joint responsibility and makes no compensation for any further damages caused by product malfunction.

Chapter 1 Model introduction, selection and installation

1.1 About the drive

1.1.1 Drive model

Drive nameplate

Model identification

SV-X5 E A 075 A-A 0-00 000

Product series

Product classification	
Symbol	Type
E	Standard type
F	Full-function type

Product type	
Symbol	Type
A	Pulse
N	CANOpen
B	EtherCAT

Product power	
Symbol	Power
010	100W
020	200W
040	400W
075	750W
100	1000W
150	1500W
200	2000W
250	2500W

Voltage specifications	
Symbol	Type
A	220V

Control power supply	
Symbol	Type
A	AC

Product iteration serial number

Hardware customized symbol

Software customized symbol

◆ **Function table for each model**

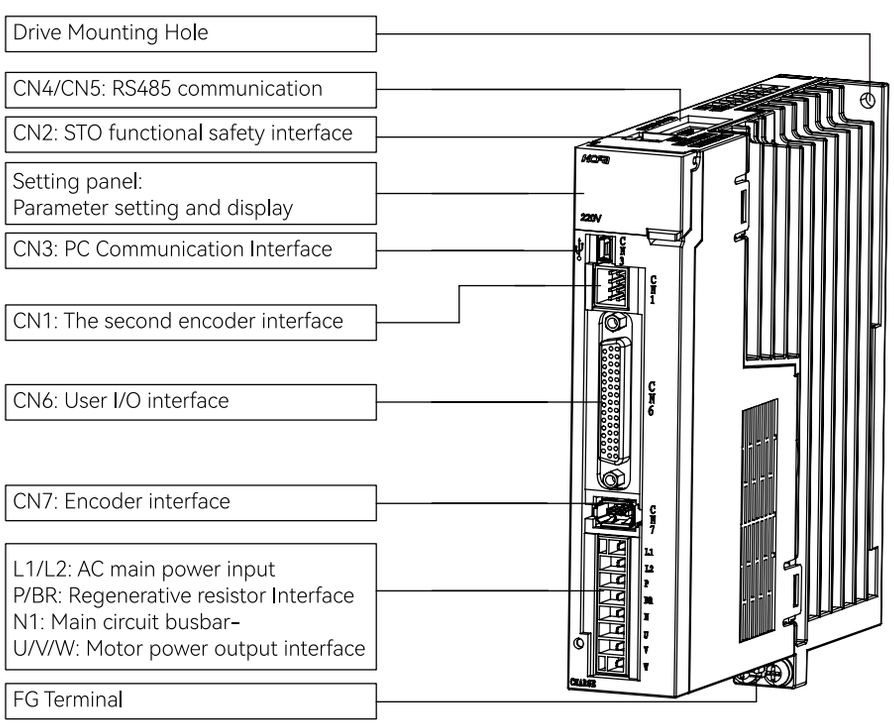
Model / Function	SV-X5EA	SV-X5FA	SV-X5EB	SV-X5FB	SV-X5EN	SV-X5FN
Analog input	Available	2 channel	Unavailable	Unavailable	Unavailable	2 channel
Pulse input	Available	Available	Unavailable	Unavailable	Unavailable	Unavailable
Pulse frequency division output	Available	Available	Unavailable	Unavailable	Unavailable	Available
Z-phase collector output	Available	Available	Unavailable	Unavailable	Available	Available
Serial communication	USB/485	USB/485	USB	USB	USB/485	USB/485
Full closed loop mode	Unsupported	Supported	Unsupported	Unsupported	Unsupported	Unsupported
Gantry synchronization mode	Unsupported	Supported	Unsupported	Unsupported	Unsupported	Unsupported

◆ **Interface table for each model**

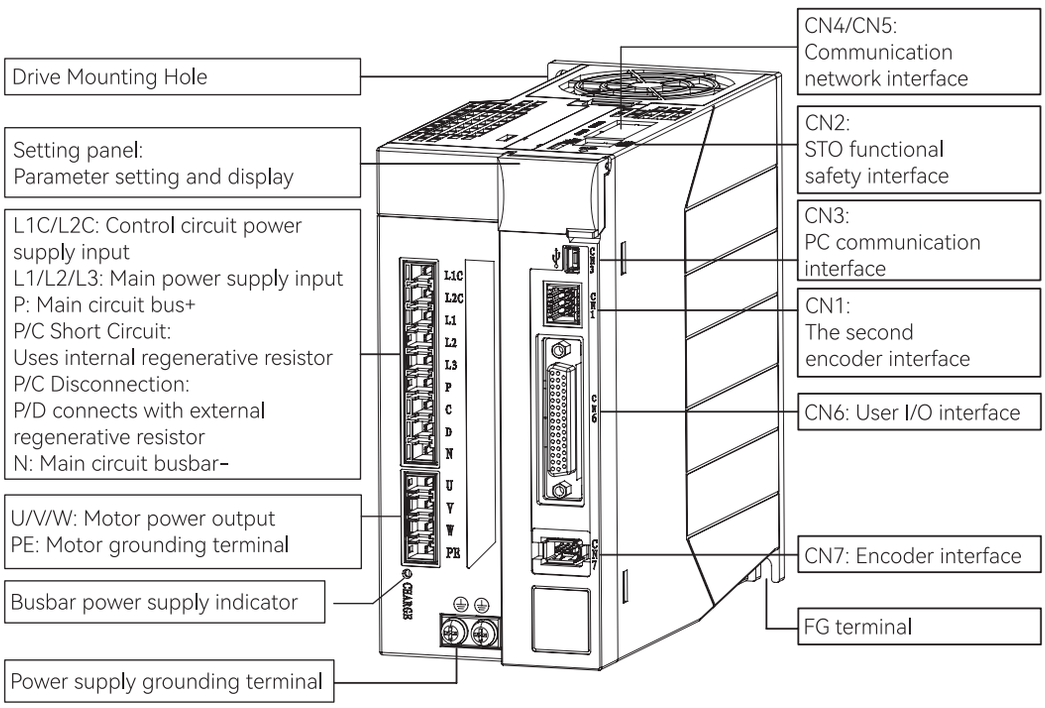
Model / Interface	SV-X5EA	SV-X5FA	SV-X5EB	SV-X5FB	SV-X5EN	SV-X5FN
CN1: the second encoder	Unavailable	Available	Unavailable	Unavailable	Unavailable	Unavailable
CN2: STO interface	Unavailable	Available	Unavailable	Available	Unavailable	Available
CN3: USB interface	Available	Available	Available	Available	Available	Available
CN4/CN5: network interface	Available	Available	Available	Available	Available	Available
CN6: user I/O	Available	Available	Available	Available	Available	Available
CN7: encoder	Available	Available	Available	Available	Available	Available

1.1.2 Part names

◆ **Drive model with a power of 100W~1KW**



◆ **Drive model with a power of 1.5KW~2.5KW**



1.1.3 Basic specifications

◆ **Specifications for a drive with an input power supply of 220V**

Item		Specifications							
Model name SV-X5FAxxxA-A		010	020	040	075	100	150	200	250
Power		100W	200W	400W	750W	1KW	1.5KW	2KW	2.5KW
Dimension	W（mm）	35			52		80		
	H（mm）	174			174		174		
	D（mm）	152			152		184		
Weight（kg）		0.8			1		1.5		
Voltage input		Single-phase 200~240 50/60Hz (for drive model with power less than 1.5 kW) Single/three-phase 200~240V 50/60Hz (for drive model with power larger than 1.5 kW)							

◆ **Basic specifications**

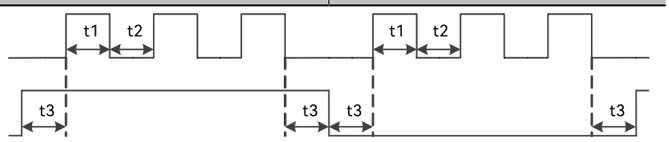
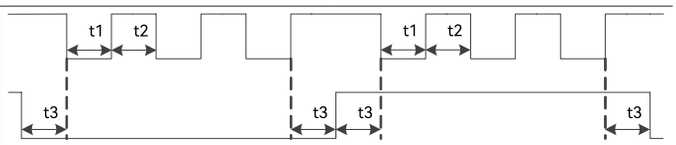
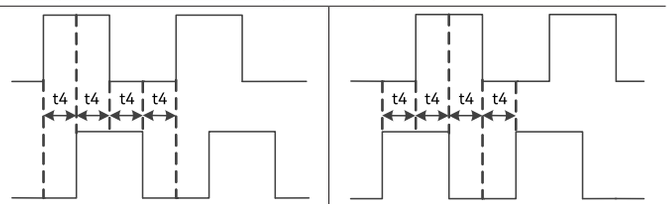
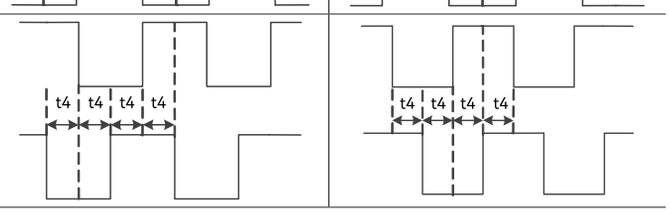
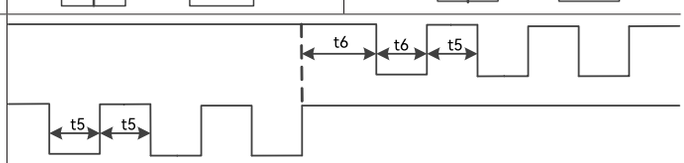
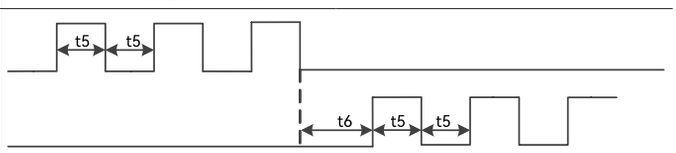
Item				Specifications
Basic specifications	Environmental specifications	Temperature	Ambient operating temperature	0~55℃
			Ambient storage temperature	-20~65℃
		Humidity	Ambient operating humidity	Less than 20~85%RH (with no condensation)
				Less than 20~85%RH or less (with no condensation)
		Operating & Storage atmosphere		Indoors (no direct sunlight) , free from corrosive gas, flammable gas, oil mist, dust and dirt
		Altitude		Less above 1000m

		Vibration		5.8m/s2 (0.6G) or less, 10~60Hz (no continuous operation allowed at frequency of resonance)
	Insulation withstand voltage			Between power terminals and FG terminals: AC1,500 V for 1 min
	Control type			Sine-wave three-phase PWM converter
Function	Encoder feedback			Support 17bit (131072 resolution)/23bit (8388608 resolution) serial encoder
	Control signal		Input	8 inputs (DC24V optoisolator) Switch according to control mode function
			Output	5 outputs (DC24V optoisolator, open collector output) Switch according to control mode function
	Analog signal		Input	2 inputs (±10V) (analog inputs is only available for X5FA series models)
	Pulse signal		Input	4 inputs (2 collector pulse inputs and 2 differential pulse inputs)
			Output	4 outputs (A/B/Z-phase RS-422 differential, Z-phase open collector output)
	Communication function		USB	PC communication (connects with 「HCS-Studio」 software)
			RS485	Host computer remote control communication (1: n)
	Regenerative function			Standard, with external higher power braking resistor
	Dynamic brake			Built-in
	Control mode			Seven modes: position control; speed control; torque control; position/speed control; position/torque control; speed/torque control; bus mode
	Position control	Control input		Servo ON, alarm reset, deviation counter clear, positive overtravel, negative overtravel, reverse instruction input, internal instruction selection input 1, internal instruction selection input 2, internal instruction selection input 3, internal instruction selection input 4, internal position instruction enable input, origin position input
		Control output		Alarm state, servo ready, brake OFF, torque limit output, position near, position arrival, end of origin position reset, motor rotation output, zero speed signal output
		Pulse input	Maximum instruction pulse frequency	Differential pulse input: frequency is up to 4MHz, pulse width is not less than 125ns Open collector: frequency is up to 200KHz, pulse width is not less than 2.5μs.
			Input pulse signal form	Differential input; open-collector
			Input pulse signal method	Pulse+ direction, right angle phase deviation (A Phase + B Phase), CW+CCW pulse
	Position control		Instruction pulse division and multi-plication frequency (gear ratio setting)	A/B A: 1~1073741824 B: 1~1073741824, Encoder resolution/10000000 < A/B <Encoder resolution/2.5
			Instruction filter	Smoothing filter, FIR filter
		Pulse outpu	Output pulse form	A-Phase, B-Phase: Differential output Z-Phase: Differential output or open collector output
			Division ratio	Arbitrary frequency division
			Output pulse function	Encoder position pulse and encoder pulse instruction (configurable)
	Speed control	Control input		Servo ON, alarm reset, reverse rotation speed instruction, zero speed clamp, internal instruction selection input 1, internal instruction selection input 2, internal instruction selection input 3, internal instruction selection input 4, forward rotation external torque limit input, reverse rotation external torque limit input, emergency stop
		Control output		Alarm state, servo ready, brake release, torque limit output, speed limit output, speed arrival, speed conformity, motor rotation output, zero speed signal output

		An-alog input	Speed instruction input	Input voltage -10V to +10V (maximum speed at ±10V)
			Torque limit instruc-tion input	Four options: (1) Forward and reverse internal torque limit with factory default setting. Set P03.09 and P03.10 positive and negative torque limit respectively. (2) Positive and negative external torque limit. Set P03.11 and P03.12 positive and negative torque limitation respectively. Then select the positive and negative torque limit by DI function P_CL and N_CL respec-tively. (3) 2-TLMTP is used as the forward and reverse torque limit, i.e., the AI1 or AI2 input is used as the forward and reverse limit value at the same time. (4) 3-TLMTP, TLMTN positive and negative limiting, i.e., AI1 and AI2 inputs are used as positive and negative limiting values respectively. That is, the AI1 and AI2 inputs are used as the forward and reverse limiting values respectively.
			Torque feed-forward instruction input	Two options: (1) Internal torque feed forward (2) Use TFFD as torque feedforward input, i.e., use AI1 or AI2 input value as torque feedforward.
			Internal speed instruction	Use the DI terminal signal combinations to select speeds from 0 to 16 segments.
	Torque control	Control input		Servo ON, alarm reset, reverse rotation torque instruction, zero speed clamp
		Control output		Alarm state, servo ready, brake release, torque limit, speed limit output, emergency stop
		Analog input	Torque instruc-tion input	DC±10V/ Rated torque (default setting, range can be set by function code)
		Speed limit function		(1) Positive/negative internal speed limit P03.27, P03.28 (2) SPL; AI input value is used as speed limit value.
	Common functions	Speed limit function		Available
		Vibration frequency damping and control function		Available
		Auto-adaptive notch filter		Available
		Auto-tuning function		Unavailable
		Encoder output division and multiplication frequency		Available
		Internal multi-segment positioning function		Available
		Adjusting and function setting		Use the software「HCS-Studio」in the SV-X5E host device for adjusting.
		Protective function		Overvoltage, abnormal power supply, overcurrent, overheat, overload, abnormal encoder, overspeed, overlarge position deviation, abnormal parameter

The functions listed above are not included in some models of the drive, please refer to "1.1.1 Drive model" to confirm the model before use.

Refer to the following table for using pulse instruction input

Parameter P00.07/ P00.27 Pulse train instruction input mode	Logic	Input signal form	Signal name	Minimum necessary time margin （t1、t2、t3、t4、t5、t6）	
				Positive direction instruction	Negative direction instruction
0	Positive logic	Pulse direction Instruction pulse	Pulse CMD_PLS Direction CMD_DIR		
1	Negative logic	Pulse direction Instruction pulse	Pulse CMD_PLS Direction CMD_DIR		
2	Positive logic	AB phase right angle Phase pulse	A Phase CMD_PLS B phase CMD_DIR		
3	Negative logic	AB phase right angle Phase pulse	A Phase CMD_PLS B phase CMD_DIR		
4	Positive logic	Positive direction pulse Reverse direction pulse	CW CMD_PLS CCW CMD_DIR		
5	Negative logic	Positive direction pulse Reverse direction pulse	CW CMD_PLS CCW CMD_DIR		

◆ The maximum pulse frequency and minimum pulse width of the instruction input pulse signal

Input pulse signal	Maximum pulse frequency	Minimum required time（μs）					
		t1	t2	t3	t4	t5	t6
Open collector interface	200Kpps	2.5	2.5	2.5	5.0	2.5	2.5
Differential interface	4Mpps	0.125	0.125	1.25	0.25	0.125	0.125

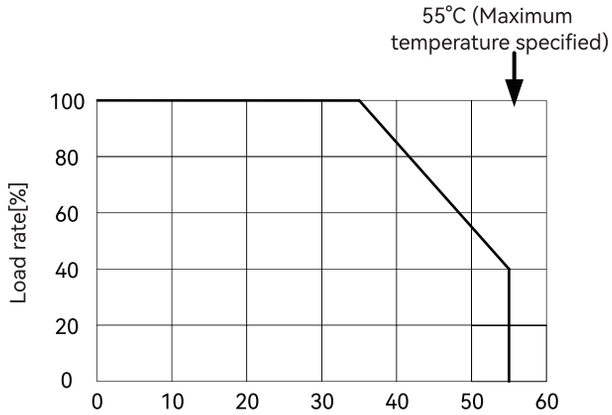
① The rise and fall times of the instruction pulse input signal are set to 0.1μs or less.

② The pulse is counted as it rises from Low to High.

③ Set the pulse input filter parameter P06.41/P06.49 according to the input frequency.

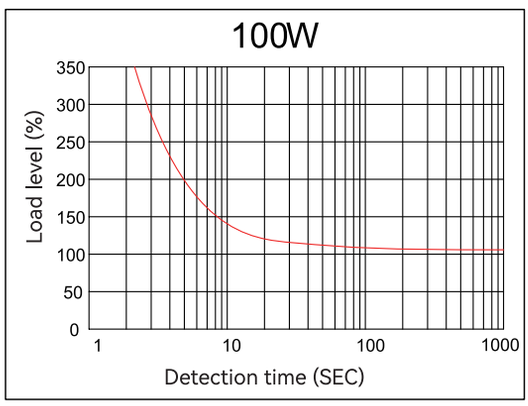
Use the mounting holes on the drive and screw it to the protective case, etc. For details, follow "1.6.3 Installation direction and clearance", and be careful to leave enough space to control the ambient temperature. For details, refer to the following

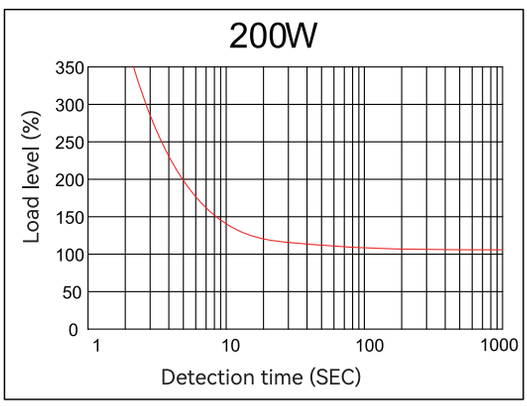
ambient temperature efficiency of the drive.

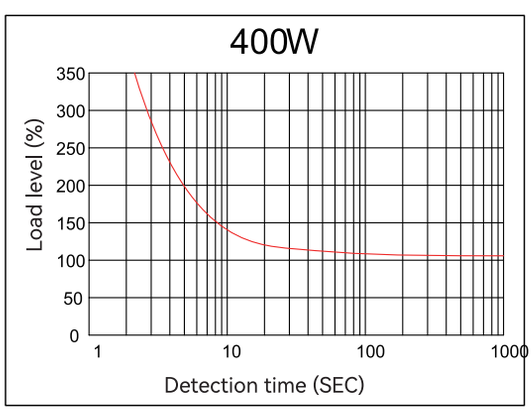


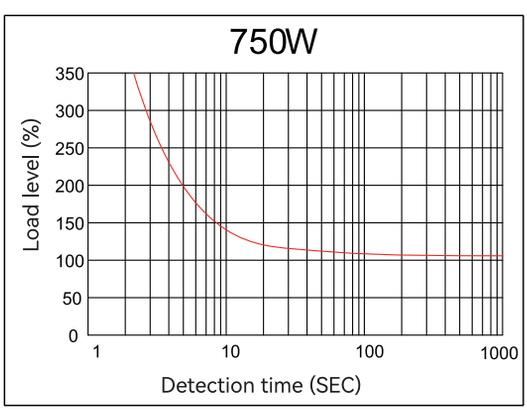
1.1.4 Overload detection characteristics

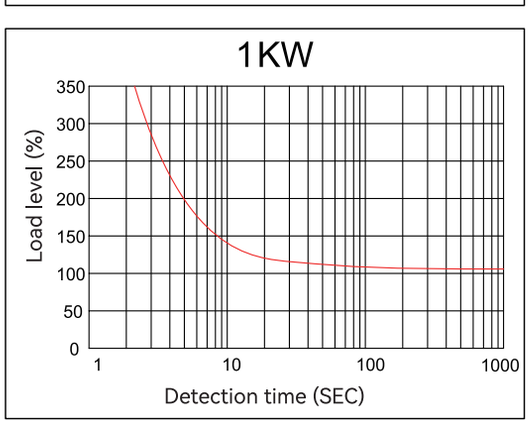
For the SV-X5 series drive, if the torque of the motor drive surpasses the value specified in the overload detection characteristics mentioned below, the protector will trigger, resulting in an overload abnormality alarm and an emergency stop of the motor.

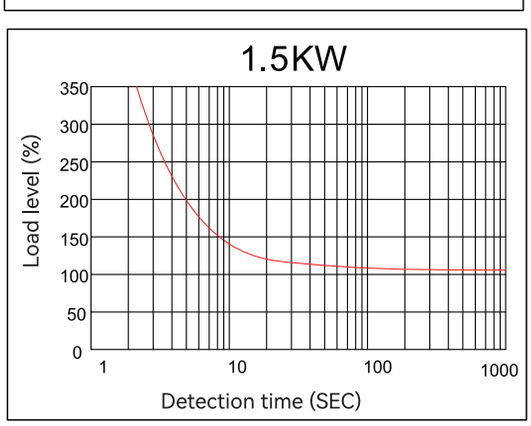


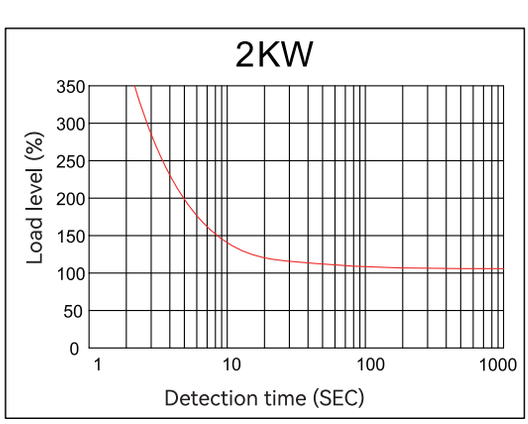


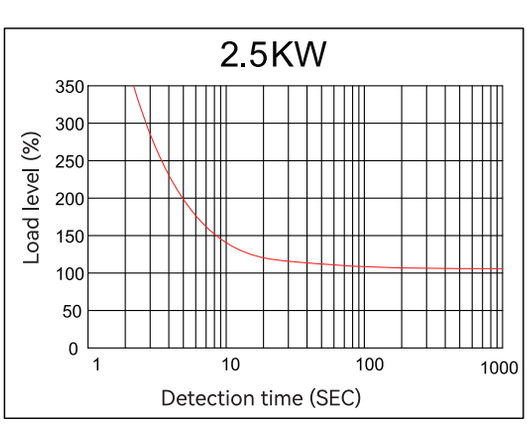








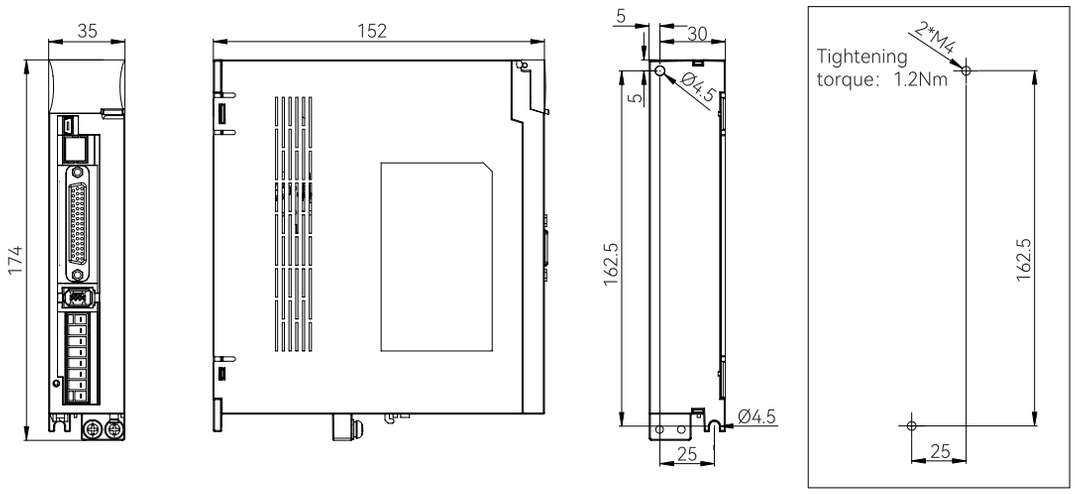




1.1.5 Drive dimension

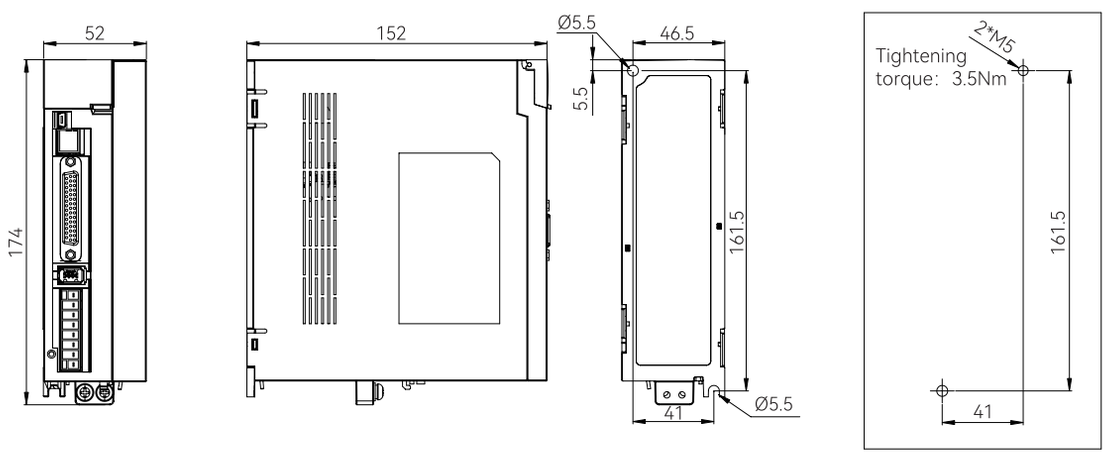
100W/200W/400W

Power input rating: 220V: 100W/200W/400W



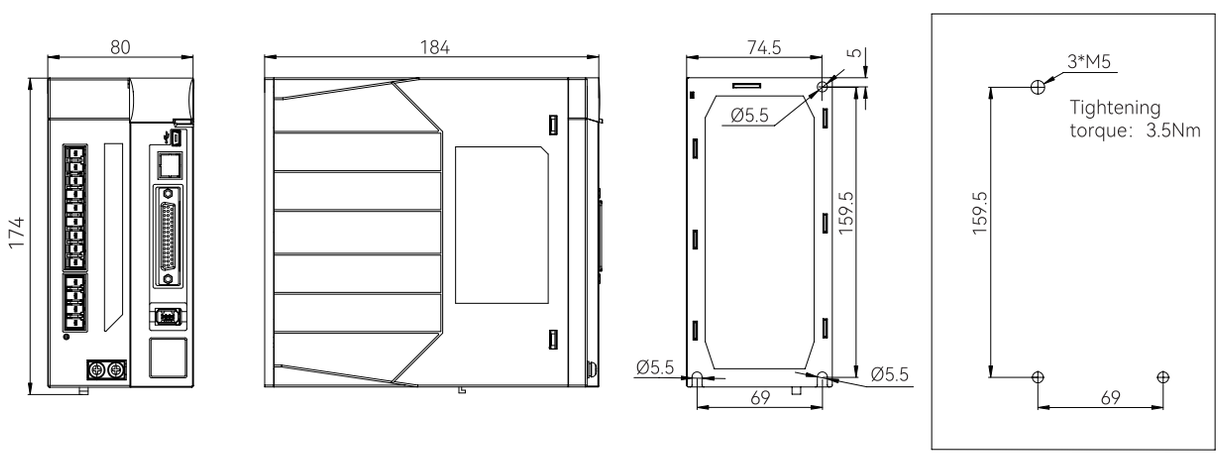
750W/1KW

Power input rating: 220V: 750W/1KW



1.5KW/2KW/2.5KW

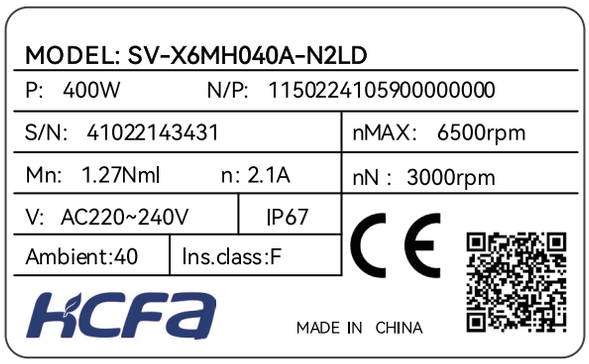
Power input rating: 220V: 1.5KW/2KW/2.5KW



1.2 About the motor

1.2.1 Motor model

Motor nameplate



Model identification

SV-X6 MH 040A - N2LD 000

Product series

Product type	
Symbol	Type
MA	Low inertia
MM	Medium inertia
MH	High Inertia
MG	Large torque at low spe
MQ	Flat type

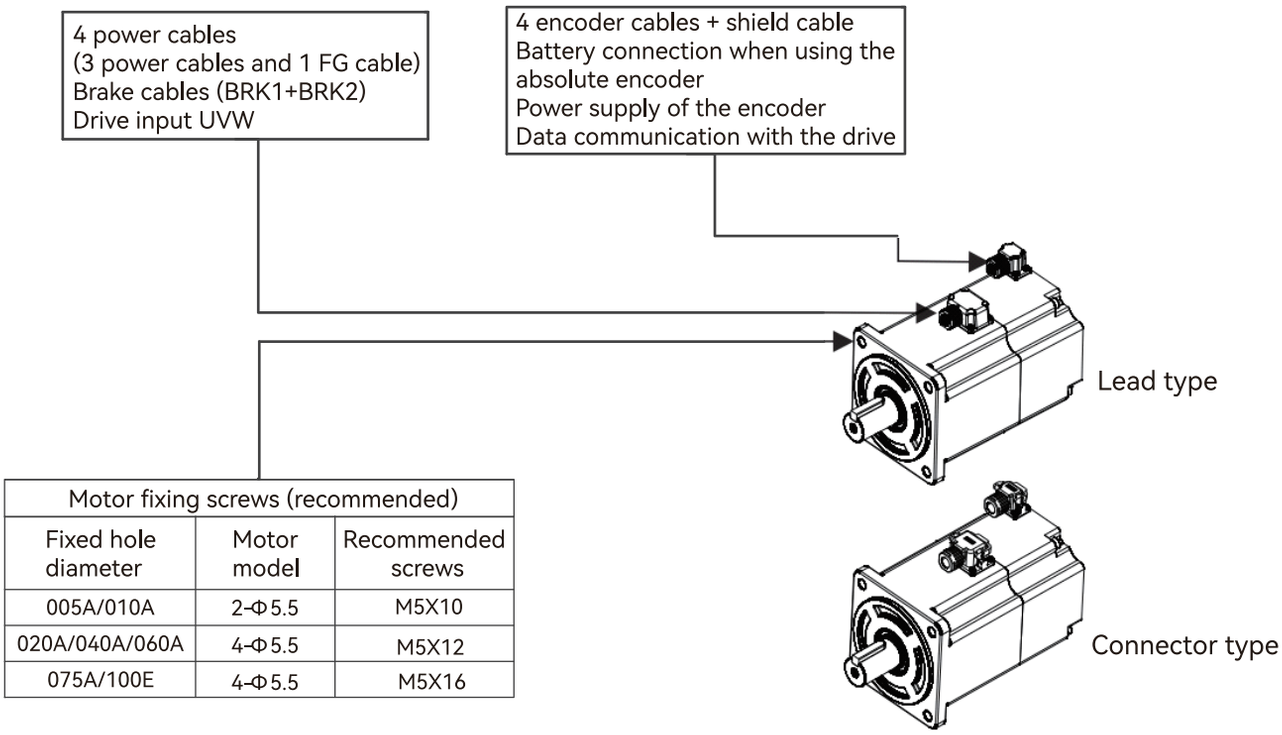
Product power	
Symbol	Power
010A	100W
020A	200W
040A	400W
075A	750W
100A	1kW
150A	1.5kW
180A	1.8kW
200A	2KW

Holding brake	
Symbol	Type
N	No brake
B	24V brake

Encoder type	
Symbol	Type
N	Incremental 17-bit
A	Absolute 17-bit
D	Optical encoder 23-bit

Customized symbol

1.2.2 Motor part names



Motor fixing screws (recommended)		
Fixed hole diameter	Motor model	Recommended screws
005A/010A	2-Φ5.5	M5X10
020A/040A/060A	4-Φ5.5	M5X12
075A/100E	4-Φ5.5	M5X16

1.2.3 Basic specifications

AC200V~240V										
Item			Unit	Specifications						
Voltage			V	DC280V						
Motor model (SV-X6 □□□□□ -****)			-	MH005A High inertia	MH010A High inertia	MA020A Low inertia	MH020A High inertia	MA040A Low inertia	MH040A High inertia
Mounting flange dimension			mm	40		60			
Weight		w/o brake	kg	0.33	0.45	0.9	0.87	1.28	1.22
		w/ brake		0.55	0.66	1.3	1.27	1.67	1.61
Baic specifications	Rated output power		W	50	100	200	200	400	400
	Rated torque		N.m	0.16	0.32	0.64	0.64	1.27	1.27
	Instantaneous maximum torque		N.m	0.56	1.11	1.91	2.23	3.82	4.46
	Rated current		Arms	1.1	1.1	1.7	1.4	2.7	2.1
	Instantaneous maximum current		Arms	5.5	5.5	6.5	6.9	10.2	10.4
	Rated speed		rmp	3000					
	Maximum speed		rmp	6000		5000			
	Torque constant		N.m/ Arms	0.168	0.327	0.427	0.5	0.488	0.67
	Induced voltage constant per phase		mV/(r/min)	5	10.43	14.5	14.61	17.8	20.85
	Rate of change of rated power	w/o brake	kW/ s	6.7	14.4	28.9	14.1	60	28.8
		w/ brake		6.1	13.8	23.8	13.2	54	27.8
	Mechanical time constant	w/o brake	ms	2.8	2.17	0.728	1.39	0.499	1.3
		w/ brake		3.09	2.26	0.848	1.49	0.554	1.35
	Electrical time constant		ms	1.12	1.32	6.17	3.9	6.36	4.21
	Motor rotor inertia	w/o brake	10^(-4) kg.m^2	0.038	0.071	0.16	0.29	0.28	0.56
		w/ brake		0.042	0.074	0.17	0.31	0.29	0.58
	Allowable load	Radial load	N	68	68	245	245	245	245
		Axial load		58	58	98	98	98	98
	Encoder		17bit serial communication（EIA422）						
Brake specifications	Application		Holding brake (note: not for braking)						
	Power supply		-	Use a power supply with reinforced insulation due to SELV power supply or hazardous voltage.					
	Rated voltage		V	DC24V±10%					
	Rated current		A	0.25	0.3	0.36			
	Static friction torque		N.m	0.38 or more		1.6 or more			
	Absorption time		ms	35 or less		50 or more			
	Release time		ms	20 or less					
	Release voltage		V	DC1V or more					
Ambient operating condition	Rated time		Continuous						
	Ambient operating temperature		0℃ ~ 40℃ (with no condensation)						
	Ambient operating humidity		20 ~ 85%RH (with no condensation)						
	Ambient storage temperature		-20℃ ~ 65℃ (with no condensation) Maximum temperature:80℃ for 72 hours						
	Ambient storage humidity		20 ~ 85%RH (with no condensation)						

	Operating & Storage atmosphere	Indoors (no direct sunlight) , free from corrosive gas, flammable gas, oil mist, dust and dirt
	Heat resistance rating	Class B
	Insulation resistance	DC1000V-5MΩ or more
	Insulation withstand voltage	AC1500V for 1 minute
	Altitude	Less above 1000m
	Vibration rating	V15 (JEC2121)
	Vibration resistance	49m/s2（5G）
	Impact resistance	98m/s2（10G）
	Protection rating	IP65/（IP67）
Note	・Grounded in accordance with the regulations, applicable to Class I .	
	・Applicable to「Overvoltage category II」	
	・Applicable to「Pollution degree 2」	
	Rated torque is the value shown when mounted on an L-beam approximately 2 times the size of the motor flange.	
	The brake connection cables have different polarities. Red cable: Connects to +24V Black cable: Connects to GND	

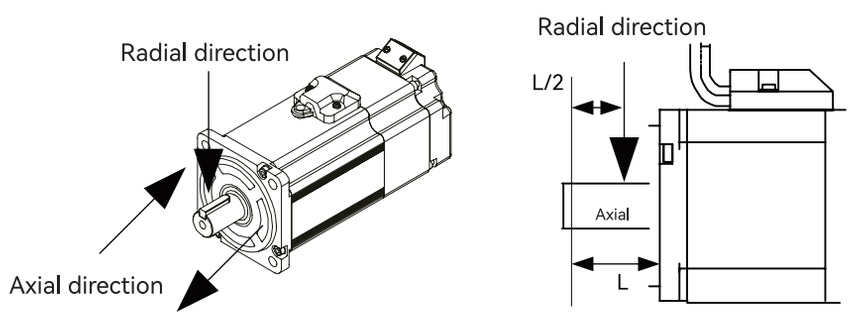
AC200V~240V									
Item			Unit	Specifications					
Voltage			V	DC280V					
Motor model (SV-X6 □□□□□ -****)			-	MA075A low inertia	MH075A high inertia	MH100C high inertia	MM100A medium inertia	MM100B medium inertia	MH100A high inertia
Mounting flange dimension			mm	80		130			
Weight		w/o brake	kg	2.25	2.25	2.68	4.67	/	6.29
		w/ brake		3.01	3.01	3.45	6.27	/	7.89
Basic specifications	Rated output power		W	750	750	1000	1000	1000	1000
	Rated torque		N.m	2.39	2.39	3.185	4.77	4.77	4.77
	Instantaneous maximum torque		N.m	7.16	8.36	11.13	14.3	14.31	14.5
	Rated current		Arms	4.2	3.8	5.7	5.2	8.25	5.2
	Instantaneous maximum current		Arms	17.4	18.8	30	15.6	25	15.6
	Rated speed		rmp	3000			2000		
	Maximum speed		rmp	4500			3000	5000	3000
	Torque constant		N.m/ Arms	0.583	0.648	0.552	0.918	0.573	0.918
	Induced voltage constant per phase		mV/(r/min)	21.33	22.65	21.2	33.65	21.2	33.65
	Rate of change of rated power	w/o brake	kW/s	59.4	36.6	44.7	36.9	56	9.96
		w/ brake		53.8	34.4	42.8	30.8	49.3	9.46
	Mechanical time constant	w/o brake	ms	0.518	1.26	1.19	1.76	1.31	6.52
		w/ brake		0.572	1.34	1.24	2.11	1.48	6.86
	Electrical time constant		ms	11.4	6.54	4.72	9.5	12.53	9.5
	Motor rotor inertia	w/o brake	10^(-4) kg.m^2	0.96	1.56	2	6.18	9.16	22.9
		w/ brake		1.07	1.66	2.1	7.4	10.4	24.1
	Allowable load	Radial load	N	392	392	392	49	490	490
				147	147	147	196	196	196
	Encoder		17bit serial communication (EIA422)						
Brake specifications	Application		Holding brake (note: not for braking)						
	Power supply		-	Use a power supply with reinforced insulation due to SELV power supply or hazardous voltage.					
	Rated voltage		V	DC24V±10%					
	Rated current		A	0.42			0.9		
	Static friction torque		N.m	3.8 or more			14 or more		
	Absorption time		ms	70 or less			100 or more		
	Release time		ms	20 or less			60 or less		
	Release voltage		V	DC1V or more					
Ambient operating condition	Rated time		0℃ ~ 40℃ (with no condensation)						
	Ambient operating temperature		20 ~ 85%RH (with no condensation)						
	Ambient operating humidity		-20℃ ~ 65℃ (with no condensation)						

	Ambient storage temperature	Maximum temperature:80℃ for 72 hours
	Ambient storage humidity	20 ~ 85%RH (with no condensation)
	Operating & Storage atmosphere	Indoors (no direct sunlight) , free from corrosive gas, flammable gas, oil mist, dust and dirt
	Heat resistance rating	Class B
	Insulation resistance	DC1000V-5MΩ or more
	Insulation withstand voltage	AC1500V for 1 minute
	Altitude	Less above 1000m
	Vibration rating	V15 (JEC2121)
	Vibration resistance	49m/s2（5G）
	Impact resistance	98m/s2（10G）
	Protection rating	IP65/（IP67）
Note	・Grounded in accordance with the regulations, applicable to Class I .	
	・Applicable to「Overvoltage category II」	
	・Applicable to「Pollution degree 2」	
	Rated torque is the value shown when mounted on an L-beam approximately 2 times the size of the motor flange.	
	The brake connection cables have different polarities. Red cable: Connects to +24V Black cable: Connects to GND	

AC200V~240V									
Item			Unit	Specifications					
Voltage			V	DC280V					
Motor model (SV-X6 □□□□□ -****)			-	MM150B medium inertia	MH150A high inertia	MM200A high inertia	MG085A Large torque at low speed	MG130A Large torque at low speed	MG180A Large torque at low speed
Mounting flange dimension			mm	150	130	130	130	130	130
Weight		w/o brake	kg	/	7.37	6.98	4.67	5.87	6.98
		w/ brake		/	8.97	8.58	6.27	7.47	8.58
Basic specifications	Rated output power		W	1500	1500	2000	850	1300	1800
	Rated torque		N.m	7.16	7.16	9.55	5.41	8.28	11.5
	Instantaneous maximum torque		N.m	21.5	21.5	28.6	14.3	23.3	28.6
	Rated current		Arms	9.5	8	9.9	5.9	9.3	11.8
	Instantaneous maximum current		Arms	29	24	30	15.6	24	30
	Rated speed		rmp	2000			1500		
	Maximum speed		rmp	5000	3000				
	Torque constant		N.m/ Arms	0.672	0.895	0.9645	0.918	0.895	0.9645
	Induced voltage constant per phase		mV/(r/min)	25.9	34.84	37.95	33.65	34.84	40.18
	Rate of change of rated power	w/o brake	kW/s	75.4	15.4	75.4	47.4	74.8	109
		w/ brake		68.6	14.8	68.6	39.6	75.9	98.7
	Mechanical time constant	w/o brake	ms	3.16	5.15	1.24	1.76	1.41	0.91
		w/ brake		3.47	5.35	1.37	2.11	1.6	1
	Electrical time constant		ms	14.3	12.7	13.88	9.5	12.7	13.88
	Motor rotor inertia	w/o brake	10^(-4) kg.m^2	12.1	33.4	12.1	6.18	9.16	12.1
		w/ brake		13.3	34.6	13.3	7.4	10.4	13.3
	Allowable load	Radial load	N	490	490	490	490	490	490
		Axial load		196	196	196	196	196	196
	Encoder		17bit serial communication（EIA422）						
Brake specifications	Application		Holding brake (note: not for braking)						
	Power supply		-	Use a power supply with reinforced insulation due to SELV power supply or hazardous voltage.					
	Rated voltage		V	DC24V±10%					
	Rated current		A	0.42			0.9		
	Static friction torque		N.m	3.8 or more			14 or more		
	Absorption time		ms	70 or less			100 or more		
	Release time		ms	20 or less			60 or less		
	Release voltage		V	DC1V or more					
Ambient operating condition	Rated time		Continuous						
	Ambient operating temperature		0℃ ~ 40℃ (with no condensation)						
	Ambient operating humidity		20 ~ 85%RH (with no condensation)						

	Ambient storage temperature	-20℃ ~ 65℃ (with no condensation) Maximum temperature:80℃ for 72 hours
	Ambient storage humidity	20 ~ 85%RH (with no condensation)
	Operating & Storage atmosphere	Indoors (no direct sunlight) , free from corrosive gas, flammable gas, oil mist, dust and dirt
	Heat resistance rating	Class B
	Insulation resistance	DC1000V-5MΩ or more
	Insulation withstand voltage	AC1500V for 1 minute
	Altitude	Less above 1000m
	Vibration rating	V15 (JEC2121)
	Vibration resistance	49m/s2（5G）
	Impact resistance	98m/s2（10G）
	Protection rating	IP65/（IP67）
Note	・Grounded in accordance with the regulations, applicable to Class I .	
	・Applicable to「Overvoltage category II」	
	・Applicable to「Pollution degree 2」	
	Rated torque is the value shown when mounted on an L-beam approximately 2 times the size of the motor flange.	
	The brake connection cables have different polarities. Red cable: Connects to +24V Black cable: Connects to GND	

1.2.4 Allowable load of the output shaft

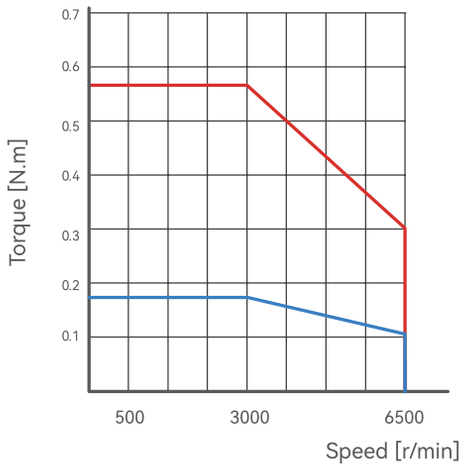


Allowable load	Unit	50W	100W	200W	400W	750W	1kW
Radial direction	N	68.6	68.6	245	245	392	392
Axial direction	N	58.8	58.8	98	98	147	147

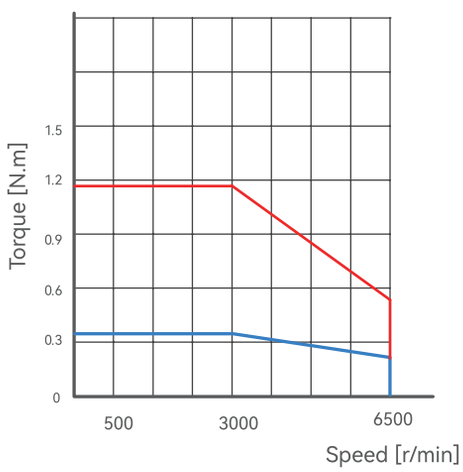
Allowable load	Unit	1.5kW	2kW	850W	1.3kW	1.8kW
Radial direction	N	490	490	490	490	490
Axial direction	N	196	196	196	196	196

1.2.5 N-T characteristics chart

MM005A

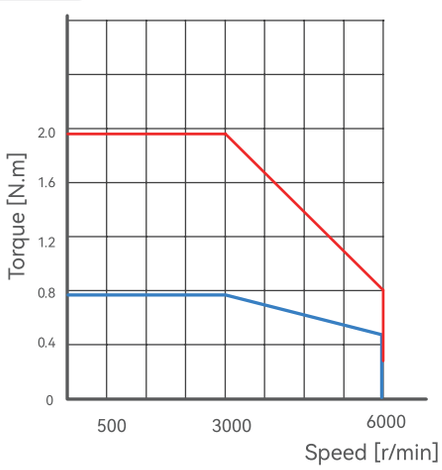


MM010A

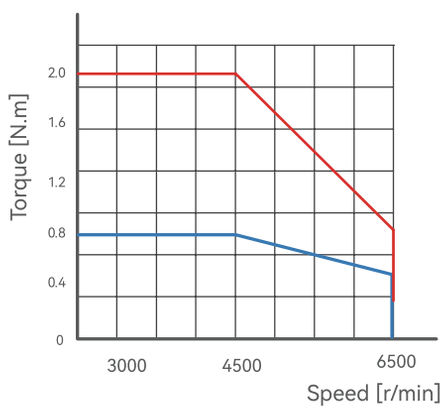


MA020A、MH020A

MA020

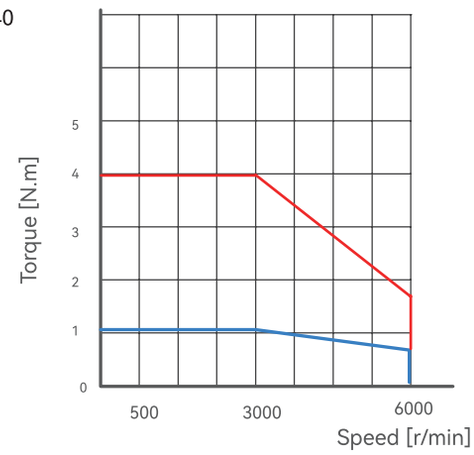


MH020



MA040A、MH040A

MA040



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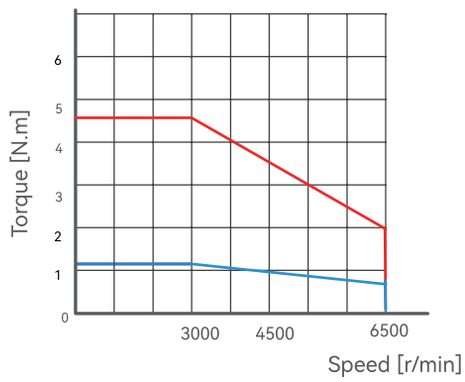
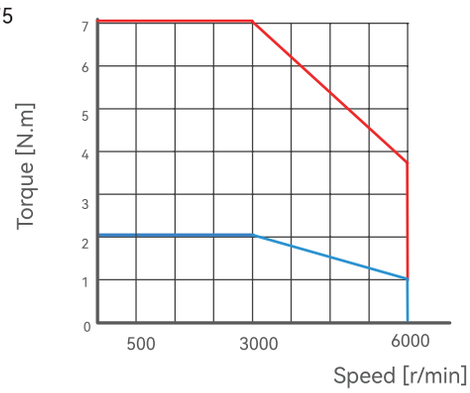


MA075A、MH075A

MA075



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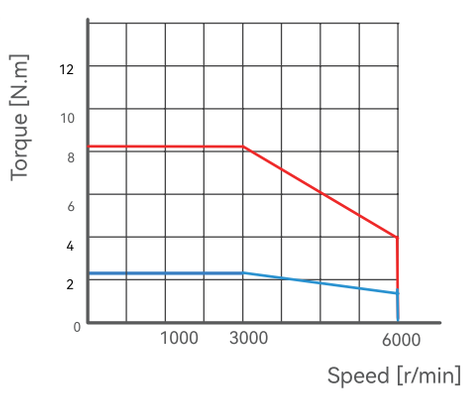
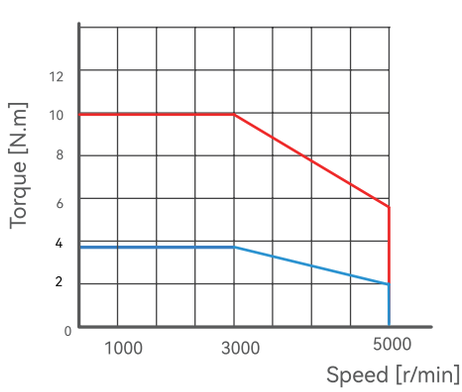


MA0100A、MH0100A

MA100



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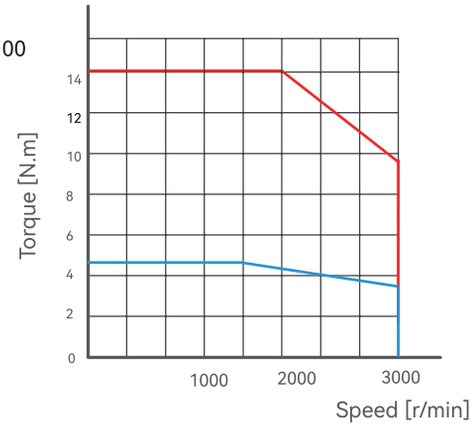
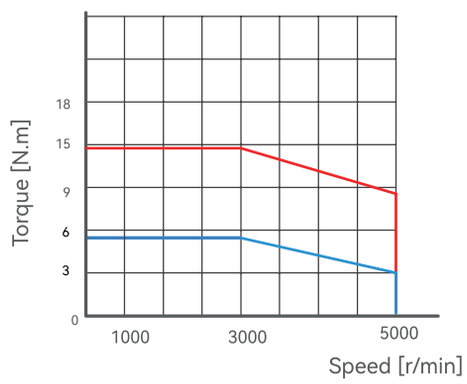
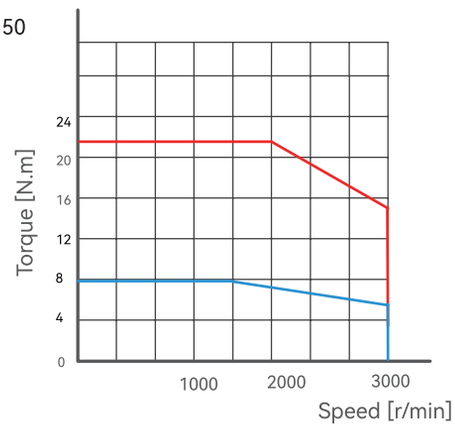


MA0150A、MH0150A

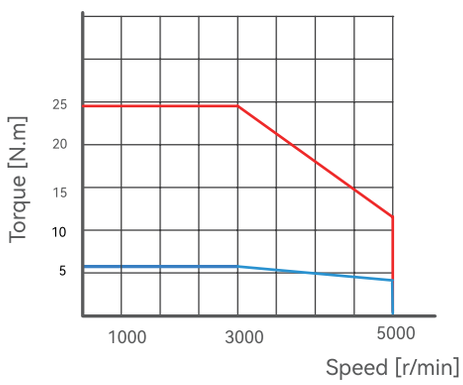
MA150



MH150



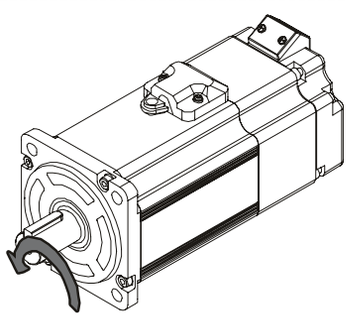
MA0200A



1.2.6 Encoder specifications

Item	Specifications		Note
Model name	SV- □□□□□□□□ -***N (17bit)	SV- □□□□□□□□ -***A (17bit)	—
Supply voltage VCC	DC4.5V ~ 5.5V		5% or less
External power supply BAT	—	DC2.4V ~ 5.5V	
External capacitor CAP	—	DC2.4V ~ 5.5V	
Supply voltage VCC current consumption	Typ 160mA		Powe surges excluded
External power supply BAT current consumption	—	Typ 10μA	Battery voltage 3.6V when motor is stopped at room temperature
One-turn optical resolution	Absolute 131,072（17bit）		—
Multiple-turn revolution count	—	—	
Maximum rotation speed	6,000 r/min		—
Output and input pattern	Differential transmission		—
Upward counting direction (Note 1)	CCW direction		—
Transmission method	Half-duplex non-simultaneous serial communication		—
Communication speed	2.5Mbps		—
Operating temperature	0 ~ 85℃		—
External interference magnetic field	±2mT (20G) or less		—

Note 1: Upward counting direction

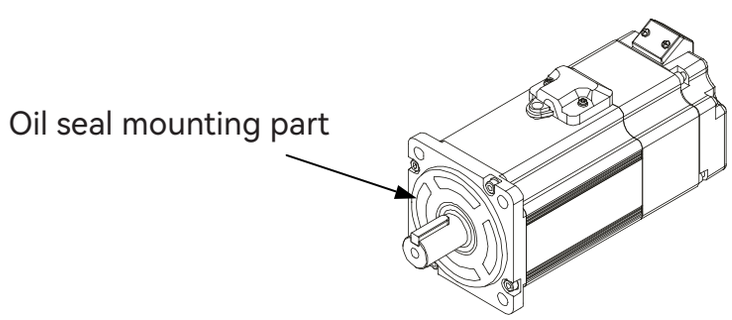


CCW ※When viewed from the front of the flange, the shaft rotates counterclockwise, i.e., CCW.

Note: For motors with brake, please comply with the brake voltage specifications.

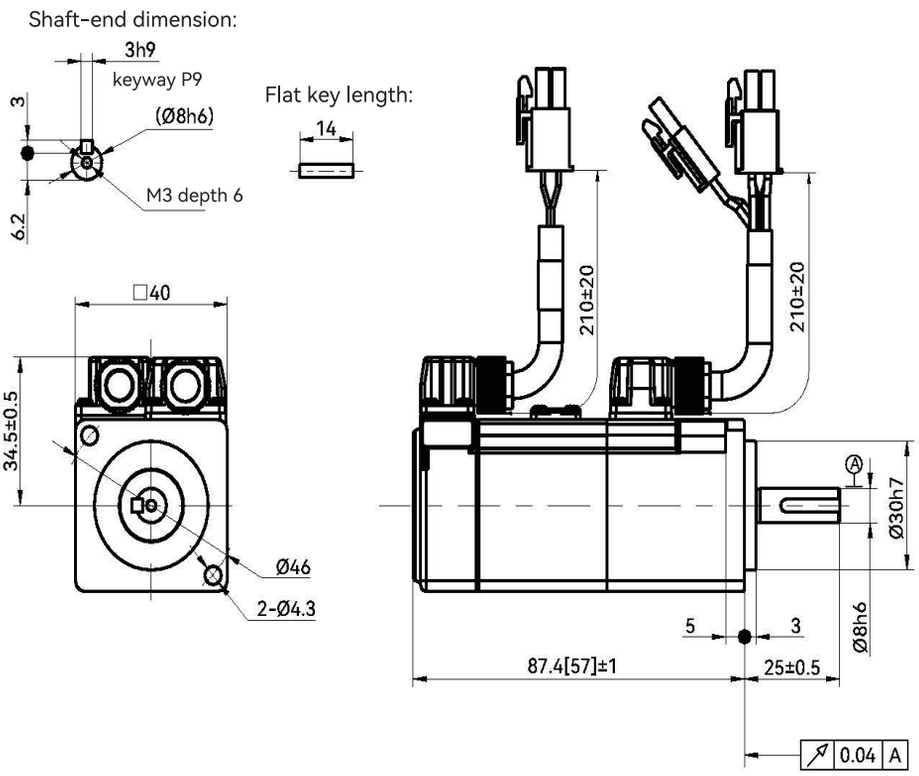
1.2.7 About the oil seal

When used in combination with a gearhead, oil may seep into the motor through the output shaft, so use an oil seal to prevent oil from seeping into the motor, and all SV-X2 series motors are equipped with a part for mounting an oil seal. If an oil seal is required, specify the SV-X2 servomotor with an oil seal when ordering.

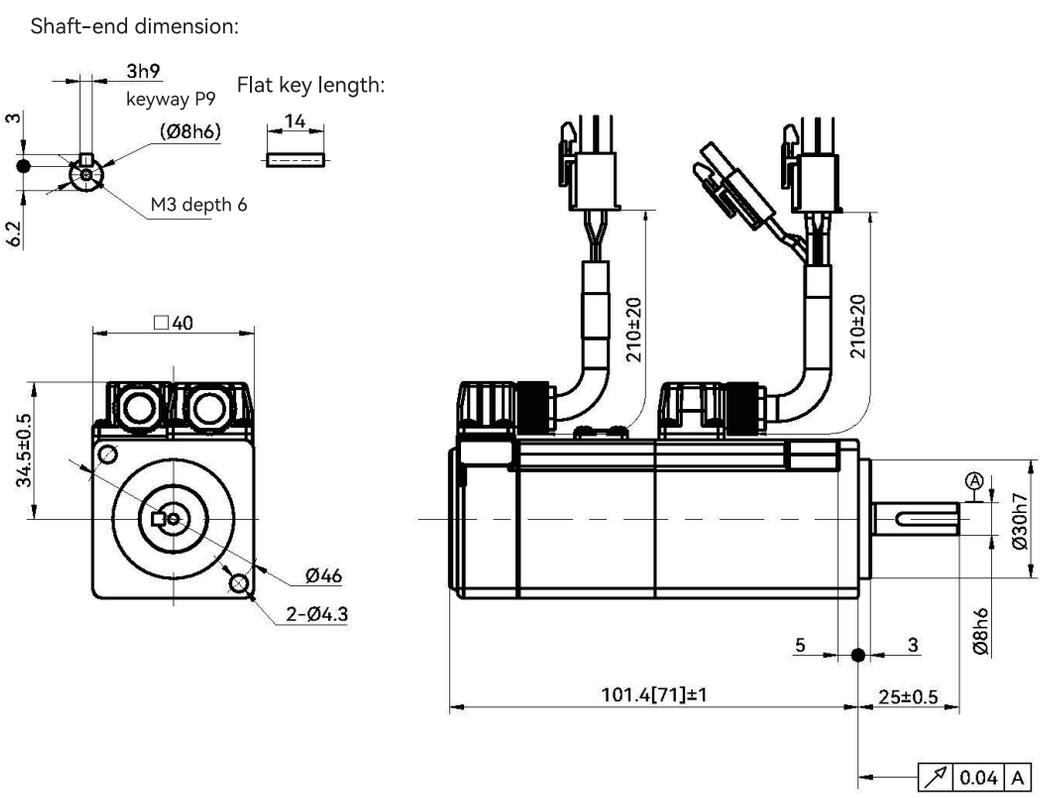


1.2.8 Motor dimension

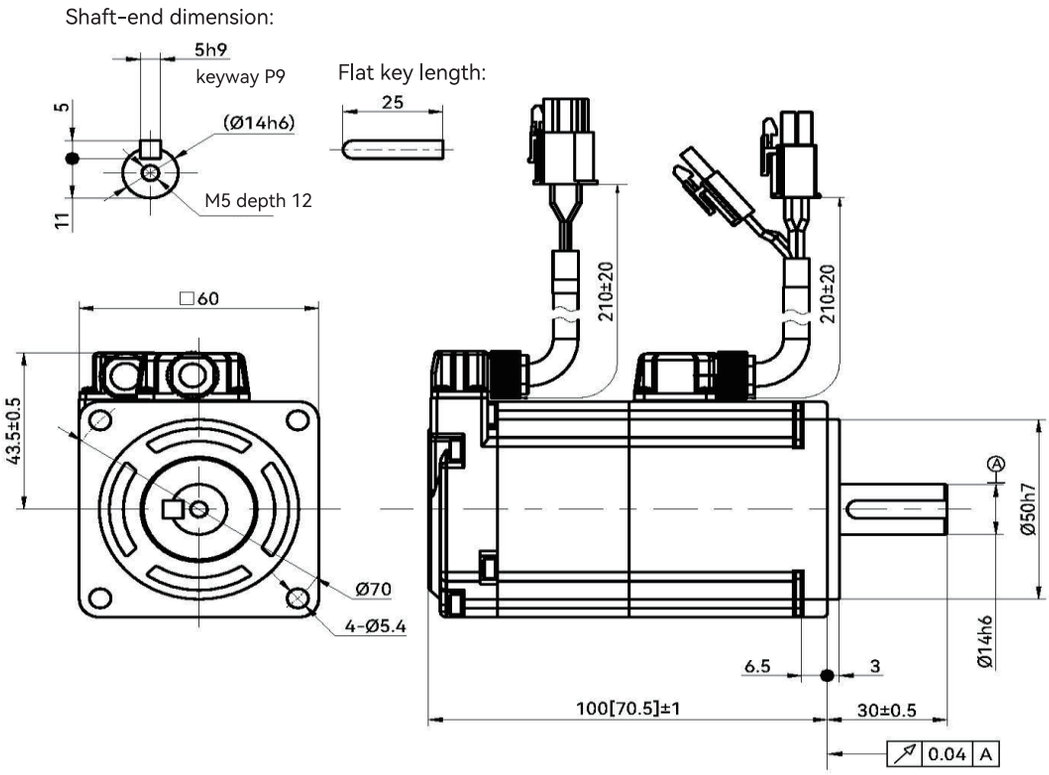
MH005A High inertia



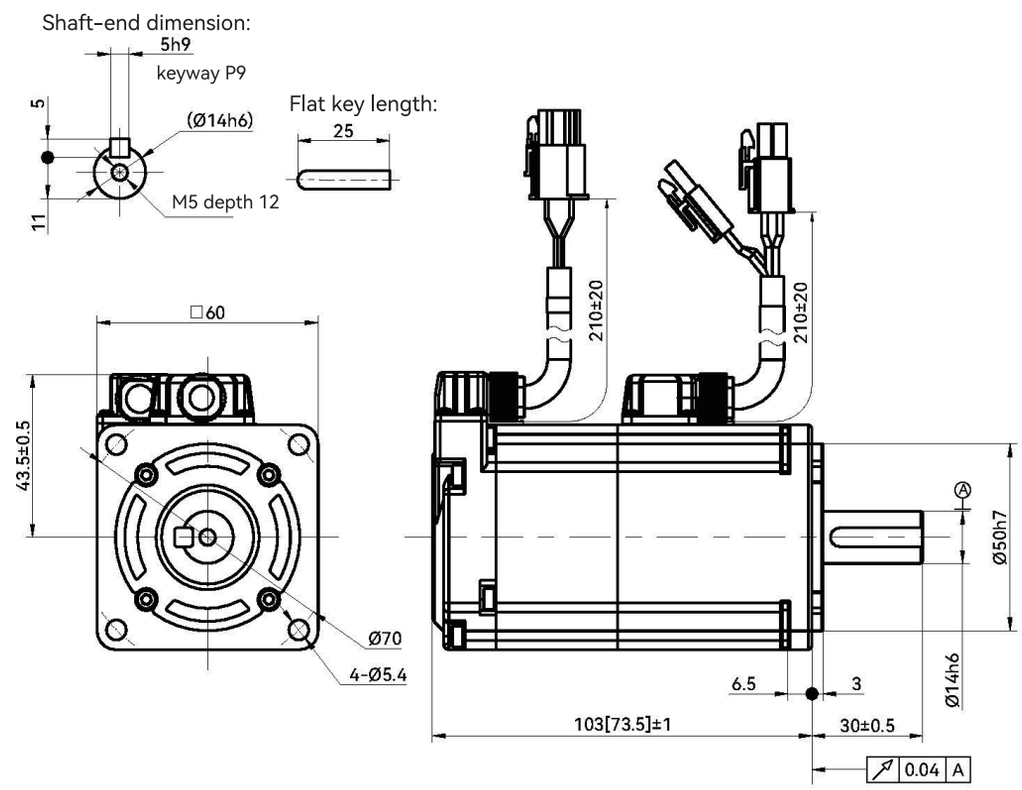
MH010A High inertia



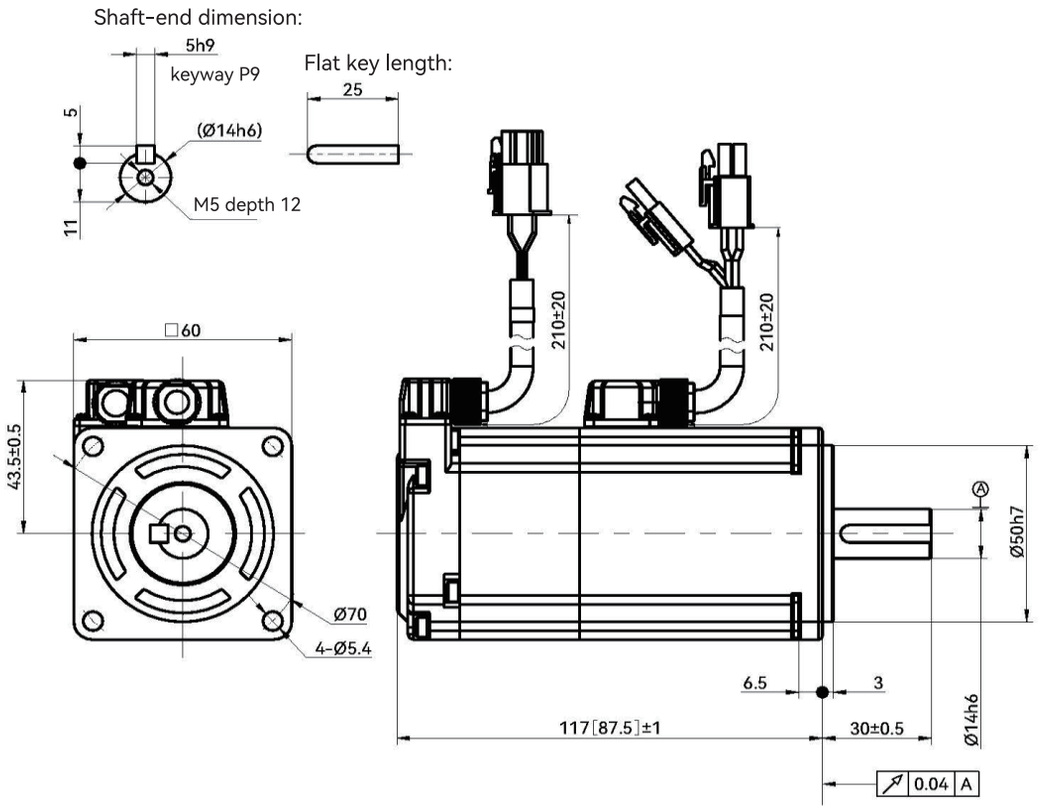
MH020A High inertia



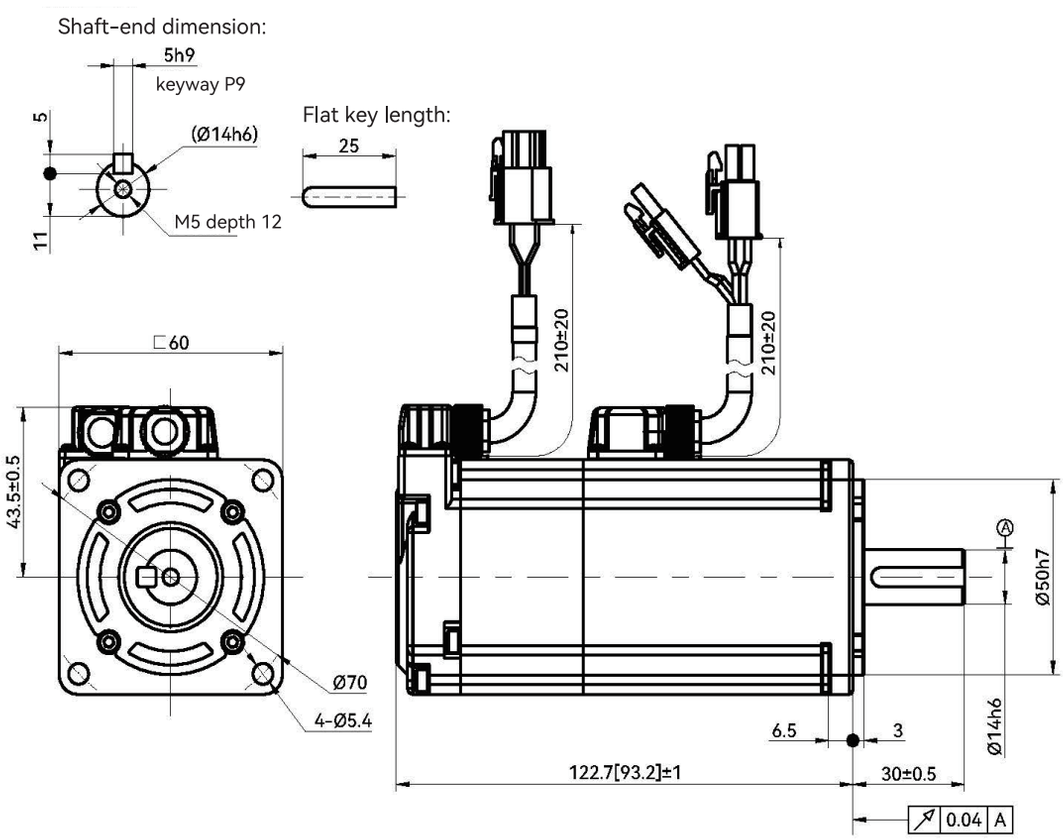
MA020A High inertia



MH040A High inertia

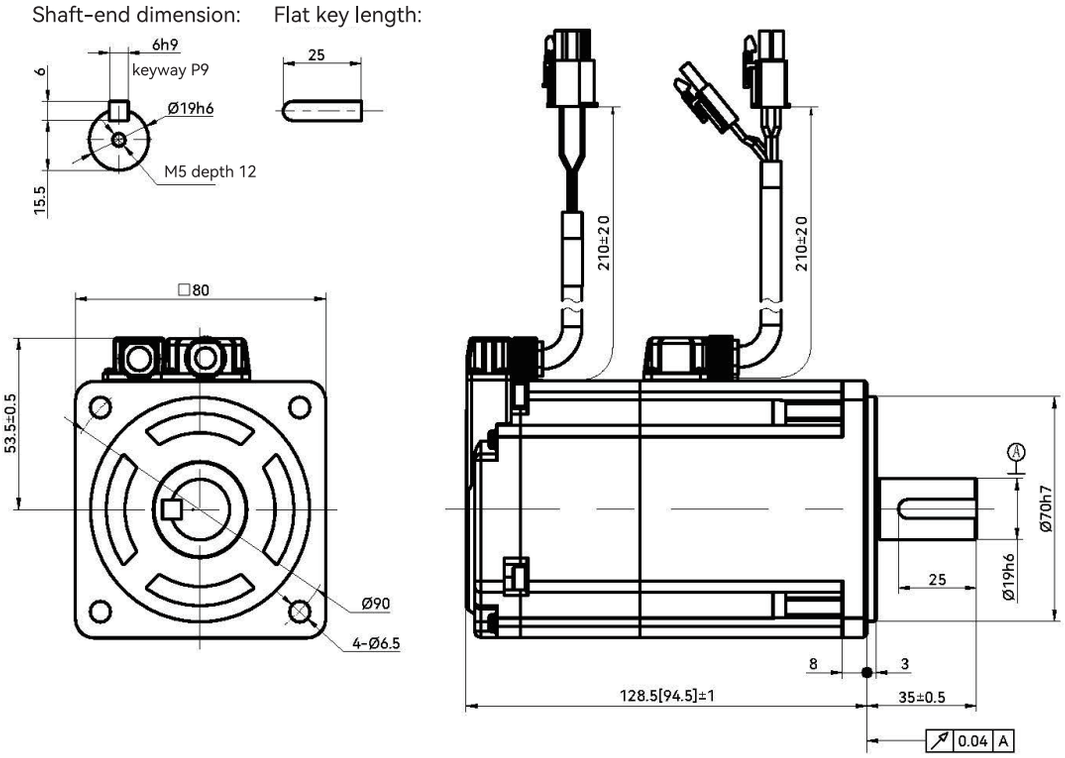


MA040A High inertia



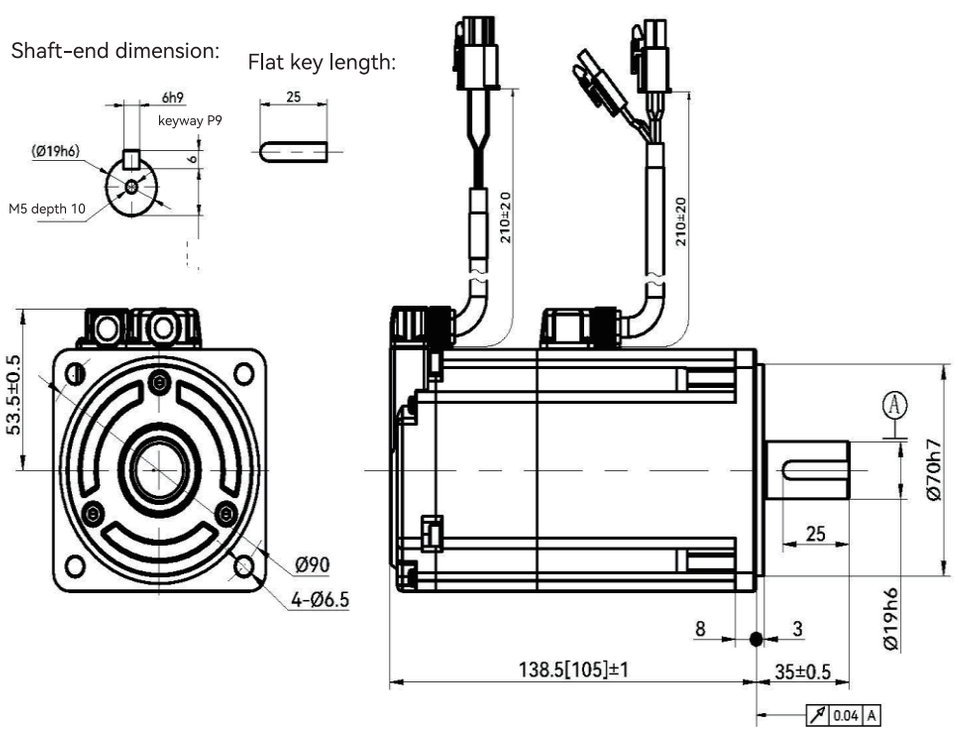
MH075A High inertia

Shaft-end dimension: Flat key length:



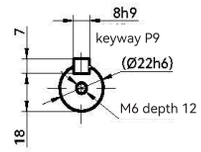
MA075A High inertia

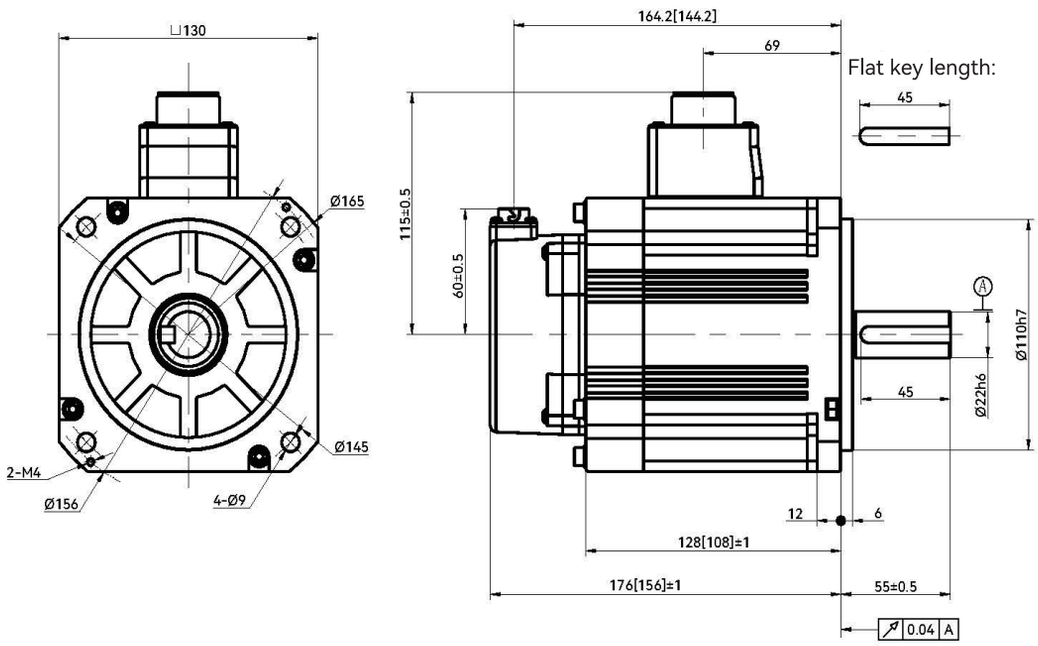
Shaft-end dimension: Flat key length:



MH100A High inertia

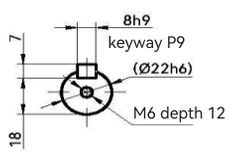
Shaft-end dimension:

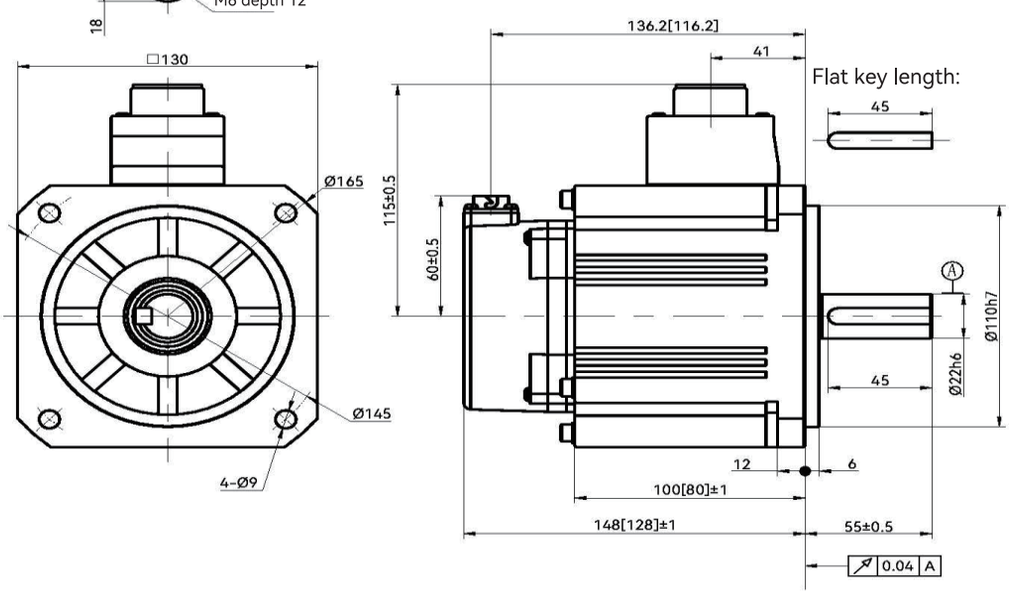




MM100A High inertia

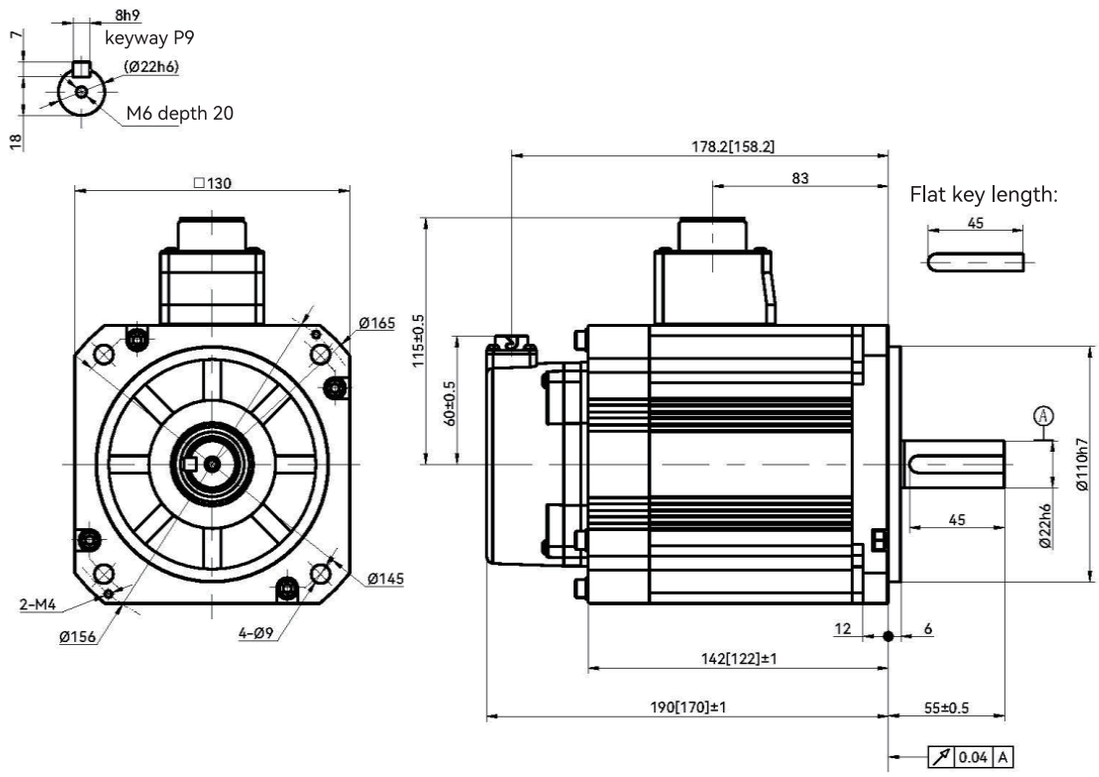
Shaft-end dimension:





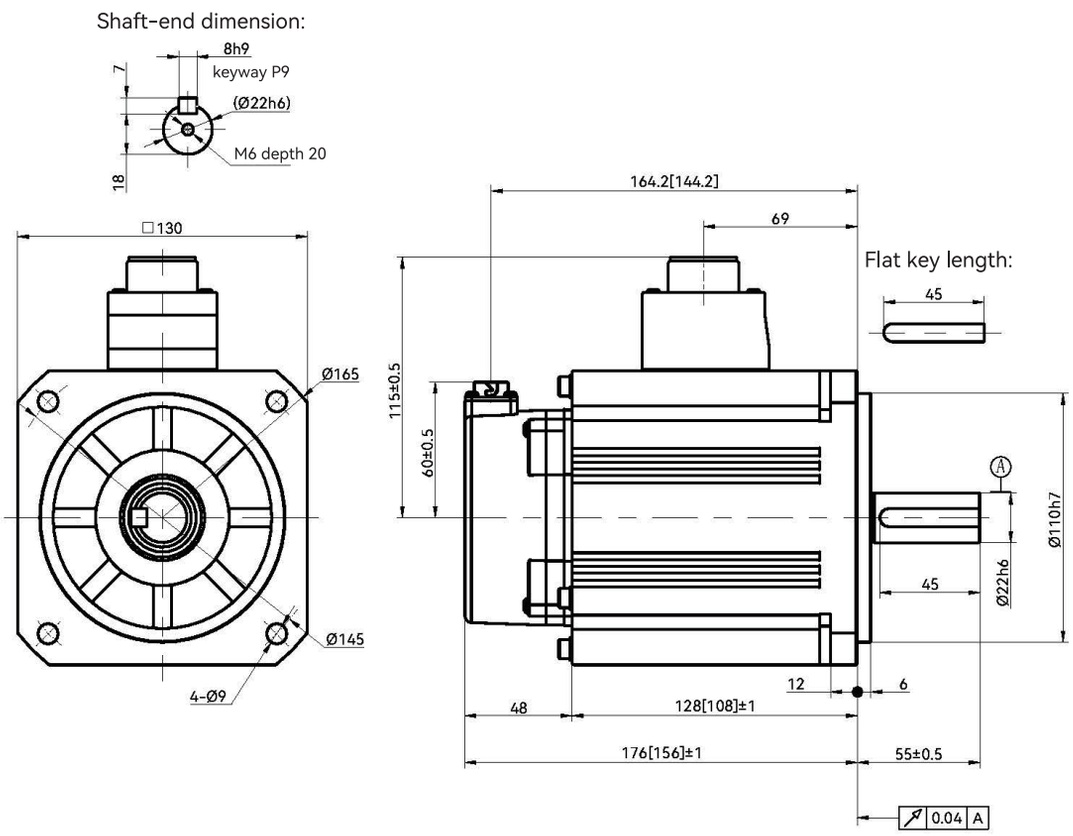
MH150A High inertia

Shaft-end dimension:



MM200A High inertia

Shaft-end dimension:



1.3 External regenerative resistor selection

(1) Regenerative resistor value configuration

For X5 drives with the power of 100W~1KW, customers have the option to include a regenerative resistor when purchasing. The size of the resistor is configured based on specific requirements.

Power	100W	200W	400W	750W	1KW
Regenerative resistance value	50Ω	50Ω	50Ω	50Ω	50Ω
Regenerative allowable power	50W	50W	50W	80W	80W

For X5 drives with the power of 1.5KW~2.5KW, customers have the option to include a regenerative resistor when purchasing. The size of the resistor is configured based on specific requirements.

Power	1.5KW	2KW	2.5KW
Regenerative resistance value	40Ω	40Ω	40Ω
Regenerative allowable power	100W	100W	100W

(2) External regeneration resistor value

For the drive with the voltage input class of 220V and the power of 100W~1KW, P and BR of the power input interfaces are connected to the regenerative resistor, and the specifications of the optional regenerative resistor for each model of the drive are as follows.

Power	100W	200W	400W	750W	1KW
Regenerative resistance value	≥ 45Ω	≥ 45Ω	≥ 45Ω	≥ 40Ω	≥ 40Ω
Regenerative allowable power	≥ 50W	≥ 50W	≥ 50W	≥ 80W	≥ 80W

For the drive with the voltage input class of 220V and the power of 1.5KW~2.5KW, the internal regenerative resistor is used when P and C of the power input interfaces are short-circuited.

When P and C of the power input interfaces are short-circuited, an external regenerative resistor is connected between P and D. The specifications of the regenerative resistor for each model of the drive are as follows.

Power	1.5kW	2kW	2.5kW
Regenerative resistance value	≥ 30Ω	≥ 30Ω	≥ 30Ω
Regenerative allowable power	≥ 100W	≥ 100W	≥ 100W

When using an external regenerative resistor, it is necessary to set the drive parameters P00.21 (braking resistor configuration), P00.22 (power capacity of the external regenerative resistor), P00.23 (resistance of external regenerative resistor), and P00.24 (external regenerative resistor heat-up time constant).

Note: If a regenerative resistor is required, please refer to the above table to install a regenerative resistor.

Using the regenerative resistor values in the above table does not necessarily guarantee a good performance.

If an external regenerative resistor is used and the temperature is too high, increase the resistance value or the regenerative allowable power.

1.4 Matching models for drives and motors

Power supply input rating	Capacity	Servo motor model		Motor frame number (Flange dimension mm)	Drive model
220V	50W	High inertia	MH005A	40	SV-X5 ☐☐ 005A-A
	100W	High inertia	MH010A		SV-X5 ☐☐ 010A-A
		Flat type	MQ010A		
	200W	Low inertia	MA020A	60	SV-X5 ☐☐ 020A-A
		High inertia	MH020A		
		Flat type	MQ020A		
	400W	Low inertia	MA040A		SV-X5 ☐☐ 040A-A
		High inertia	MH040A		
		Flat type	MQ040A		
	750W	Low inertia	MA075A	80	SV-X5 ☐☐ 075A-A
		High inertia	MH075A		
	1KW	High inertia	MH100C	80	SV-X5 ☐☐ 100A-A
		Medium inertia	MM100A	130	
		High inertia	MH100A		
	1.5KW	Medium inertia	MM150A	130	SV-X5 ☐☐ 150A-A
		High inertia	MH150A		
	2KW	Medium inertia	MM200A		SV-X5 ☐☐ 200A-A
	850W	Large torque at low speed	MG085A		SV-X5 ☐☐ 150A-A
		Large torque at low speed	MG085B		
	1.3KW	Large torque at low speed	MG130A		
		Large torque at low speed	MG130B		
	1.8KW	Large torque at low speed	MG180A		SV-X5 ☐☐ 250A-A
		Large torque at low speed	MG180B		
380V	2KW	Medium inertia	MM200A	180	SV-X5 ☐☐ 200T-A
	3KW	Medium inertia	MM300A		SV-X5 ☐☐ 300T-A
	4KW	Medium inertia	MM400A		SV-X5 ☐☐ 500T-A
	5KW	Medium inertia	MM500A		
	7.5KW	Medium inertia	MM750A		SV-X5 ☐☐ 750T-A
	2.9KW	Large torque at low speed	MG290A		SV-X5 ☐☐ 500T-A
	4.4KW	Large torque at low speed	MG440A		SV-X5 ☐☐ 750T-A
	5.5KW	Large torque at low speed	MG550A		

1.5 Selection of peripheral cables and connector accessories

(1) Voltage input class 220V: 750W or less

Item	Application	Name	Note
1	Drive and motor power connector		
2	Drive and motor power connection cable	Connection cable -CAB-PWR75A-0.5M	Length: 0.5 m
		Connection cable -CAB-PWR75A-1.5M	Length: 1.5 m
		Connection cable -CAB-PWR75A-3M	Length: 3 m
		Connection cable -CAB-PWR75A-5M	Length: 5 m
		Connection cable -CAB-PWR75A-10M	Length: 10 m
3	Encoder cable terminal	ENC-TE 750W	
4	Regular encoder cable	Connection cable -SVCAB-ENC75A-0.5M	Length: 0.5 m
		Connection cable -SVCAB-ENC75A-1.5M	Length: 1.5 m
		Connection cable -SVCAB-ENC75A-3M	Length: 3 m
		Connection cable -SVCAB-ENC75A-5M	Length: 5 m
		Connection cable -SVCAB-ENC75A-10M	Length: 10 m
5	Absolute encoder cable	Connection cable -SVBOX-ENCABS+ Connection cable -SVCAB-ENC75A-?M	

(2) Voltage input class 220V: 1KW ~ 2.5KW

Item	Application	Name	Note
1	Drive and motor power connector	PWR-CON 1KW	
2	Drive and motor power connection cable	Connection cable -CAB-PWR100A-0.5M	Length: 0.5 m
		Connection cable -CAB-PWR100A-1.5M	Length: 1.5 m
		Connection cable -CAB-PWR100A-3M	Length: 3 m
		Connection cable -CAB-PWR100A-5M	Length: 5 m
		Connection cable -CAB-PWR100A-10M	Length: 10 m
3	Brake connector	PWB-CON 1KW	
4	Encoder cable terminal	ENC-TE 1KW	
5	Regular encoder cable	Connection cable -CAB-ENC100A-0.5M	Length: 0.5 m
		Connection cable -CAB-ENC100A-1.5M	Length: 1.5 m
		Connection cable -CAB-ENC100A-3M	Length: 3 m
		Connection cable -CAB-ENC100A-5M	Length: 5 m
		Connection cable -CAB-ENC100A-10M	Length: 10 m
6	Absolute encoder cable	Connection cable -CAB-ENC100A-ABS-0.5M	Length: 0.5 m
		Connection cable -CAB-ENC100A-ABS-1.5M	Length: 1.5 m
		Connection cable -CAB-ENC100A-ABS-3M	Length: 3 m
		Connection cable -CAB-ENC100A-ABS-5M	Length: 5 m
		Connection cable -CAB-ENC100A-ABS-10M	Length: 10 m
7	50P pulse connector	Pulse connector（CON-50P）	

(3) Voltage input class 380V: 2KW ~ 7.5KW

Item	Application	Name	Note
1	Drive and motor power connector	PWR-CON 2KW	
2	Drive and motor power connection cable	Connection cable -CAB-PWR400C-0.5M	Length: 0.5 m
		Connection cable -CAB-PWR400C-1.5M	Length: 1.5 m
		Connection cable -CAB-PWR400C-3M	Length: 3 m
		Connection cable -CAB-PWR400C-5M	Length: 5 m
		Connection cable -CAB-PWR400C-10M	Length: 10 m
3	Brake connector	PWB-CON 2KW	
4	Encoder cable terminal	ENC-TE 2KW	
5	Regular encoder cable	Connection cable -CAB-ENC100A-0.5M	Length: 0.5 m
		Connection cable -CAB-ENC100A-1.5M	Length: 1.5 m
		Connection cable -CAB-ENC100A-3M	Length: 3 m
		Connection cable -CAB-ENC100A-5M	Length: 5 m
		Connection cable -CAB-ENC100A-10M	Length: 10 m
6	Absolute encoder cable	Connection cable -CAB-ENC100A-ABS-0.5M	Length: 0.5 m
		Connection cable -CAB-ENC100A-ABS-1.5M	Length: 1.5 m
		Connection cable -CAB-ENC100A-ABS-3M	Length: 3 m
		Connection cable -CAB-ENC100A-ABS-5M	Length: 5 m
		Connection cable -CAB-ENC100A-ABS-10M	Length: 10 m
7	44P pulse connector	Pulse connector（CON-44P）	

(4) Circuit breaker selection

Make sure to have a circuit breaker on the power input side of the drive to prevent accidents when using internal short circuits.

① Main circuit power supply single-phase input (any two interfaces from L1/L2/L3)

Model	L1C-L2C control Power Circuit breaker (A) recommended	L1-L2 main power supply Circuit breaker (A) recommended	Main power supply Circuit breaker (A) recommended
SV-X45A010A-A	-	6	6
SV-X5EA020A-A	-	6	6
SV-X5EA040A-A	-	10	10
SV-X5EA075A-A	-	16	16
SV-X5EA100A-A	-	16	16
SV-X5EA150A-A	6	20	20
SV-X5EA200A-A	6	25	25
SV-X5EA250A-A	6	25	25

② Main circuit power supply three-phase input (L1/L2/L3)

Model	L1C-L2C control Power Circuit breaker (A) recommended	L1-L2 main power supply Circuit breaker (A) recommended	Main power supply Circuit breaker (A) recommended
SV-X5EA150A-A	6	10	10
SV-X5EA200A-A	6	16	16
SV-X5EA250A-A	6	16	16

1.6 Installation of the drive and motor

1.6.1 Installation environment

Please ensure an installation environment that meets the following conditions as follow.

1. Install the equipment in a place out of direct sunlight.

2. The drive must be installed in a control cabinet.

3. Free from water, oil (cutting oil, oil mist), and moisture.

4. Free from flammable and explosive gases, sulfuric gases, chlorinated gases, ammonia, and other corrosive atmospheres including acid/alkali and salt.

5. Free from dust, iron powder, cutting powder, and so on.

6. Free from high temperature, excessive vibrations, and severe impacts.

When installing in an environment that is not specified above, please consult HCFA in advance.

1.6.2 Dustproof and waterproof

The drive is not waterproof, and the protective structure of the motor, except for the shaft output part and the connector part, complies with the IEC 34-5 (International Electrical Standards Association) IP65 standard.

1.6.3 Installation direction and clearance

◆ **Impact, weight-bearing**

The motor can withstand an impact of 200m/s2 (20G) or less. When transporting, mounting, or dismounting the motor, do not apply excessive impact or weight. Do not hold the encoder part, cable part, or connector part during transport. A claw puller must be used when removing the pulley and coupling from the motor shaft.

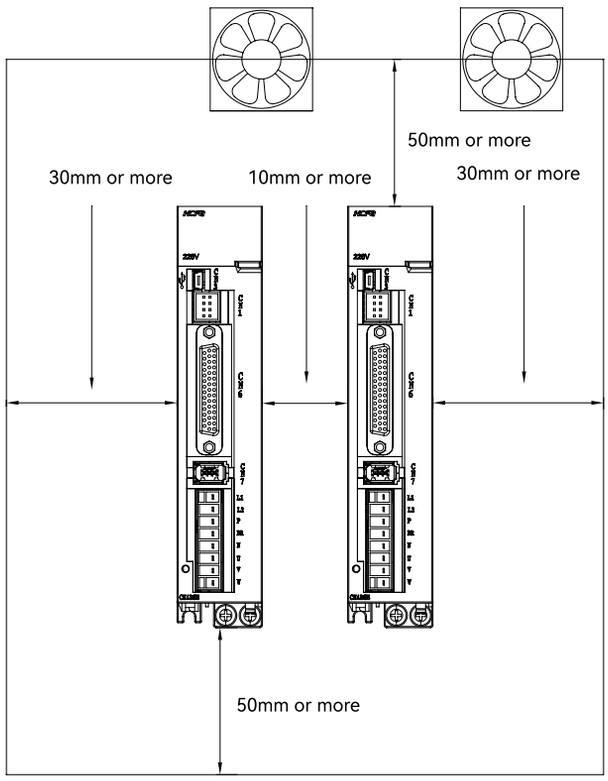
◆ **Integration with the mechanical system**

The motor specifications state the permissible load value of the motor shaft. Exceeding the permissible load value may shorten the lifetime of the internal bearings of the motor and cause damage to the motor shaft. Use a shaft coupling that can fully absorb the eccentricity load. Do not apply more than 6kgf or more pressure to the encoder cable when assembling the motor. Bend the power and encoder cables to a radius of R20mm or more.

◆ **Installation direction and clearance**

When installing the drive, please leave sufficient clearances to ensure effective heat dissipation and convection in the sealed control cabinet.

Figure Mounting clearance diagram



• The drive can be installed only in the vertical direction. During installation, use two M5 screws to fix the drive with an output power of 750W or less. Use three M5 screws each to secure the drive with an output power of 1kW or more and the main drive when installing them.

• When installing the drive into the sealed cabinet such as a control cabinet, it is necessary to use fans or cooling machines to ensure that the ambient temperature around plates is lower than 55℃. A fan or cooler is required for cooling.

• The surface temperature of the cold plates would be 30℃ higher than their surrounding temperature.

• Use heat-resistant wiring materials and isolate them from temperature-sensitive machines and cables.

• The life span of the servo drive depends on the temperature around the electrolytic capacitor. When the electrolytic capacitor is near the end of its life span, the static capacity will decrease and internal resistance will increase. Consequently, it will lead to overvoltage alarm, malfunction caused by noise, and component damages. The life span of the electrolytic capacitor is approximately 5 to 6 years under the condition of an average annual temperature of 30℃, 80% load rate, and average operation time of less than 20 hours per day.

◆ Other precautions

(1) The motor shaft comes from the factory with antirust oil on it. To prevent the motor shaft from rusting when installing loads on the motor shaft, please antirust the motor shaft again.

(2) Never disassemble the encoder or the motor.

(3) Use the same power supply for the control voltage (24V and GND) and the upper control device.

(4) When exchanging batteries or performing maintenance on the encoder, be sure to turn off the main power switch beforehand.

(5) When the main power is switched off, there is a residual voltage in the power supply device for about 30 seconds. Please be careful.

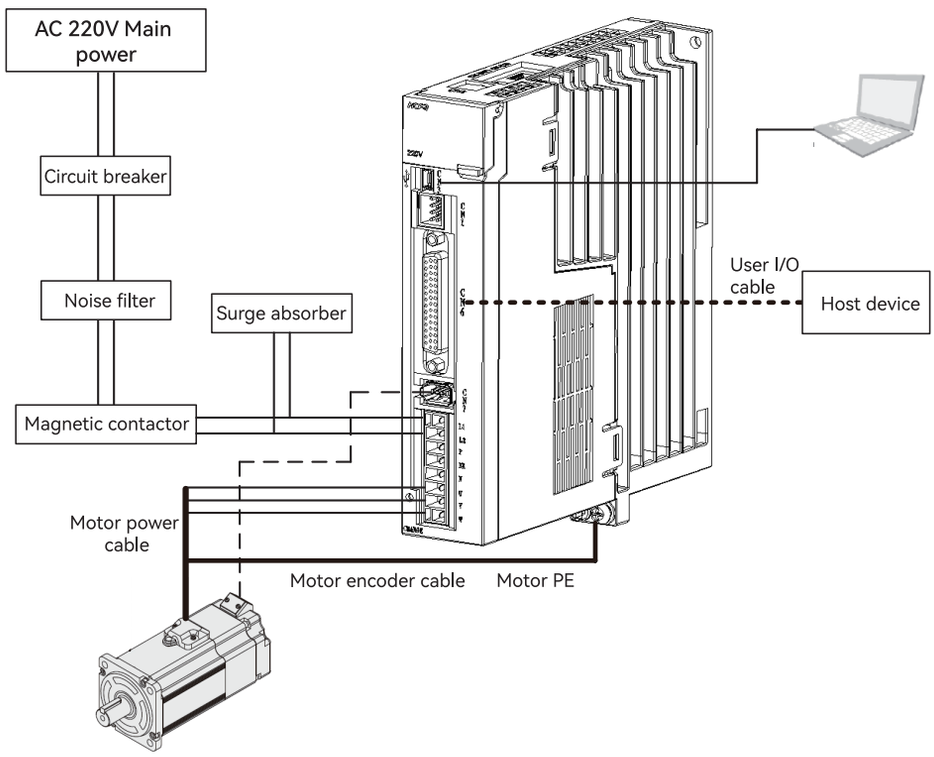
(6) Do not replace the fuse.

(7) Do not touch the ventilation openings on the right side of the servo drive with a power of 750W or more, and do not block the servo drive or the ventilation openings in close proximity to the servo drive.

Chapter 2 Motor and drive wiring instructions

2.1 System wiring diagram

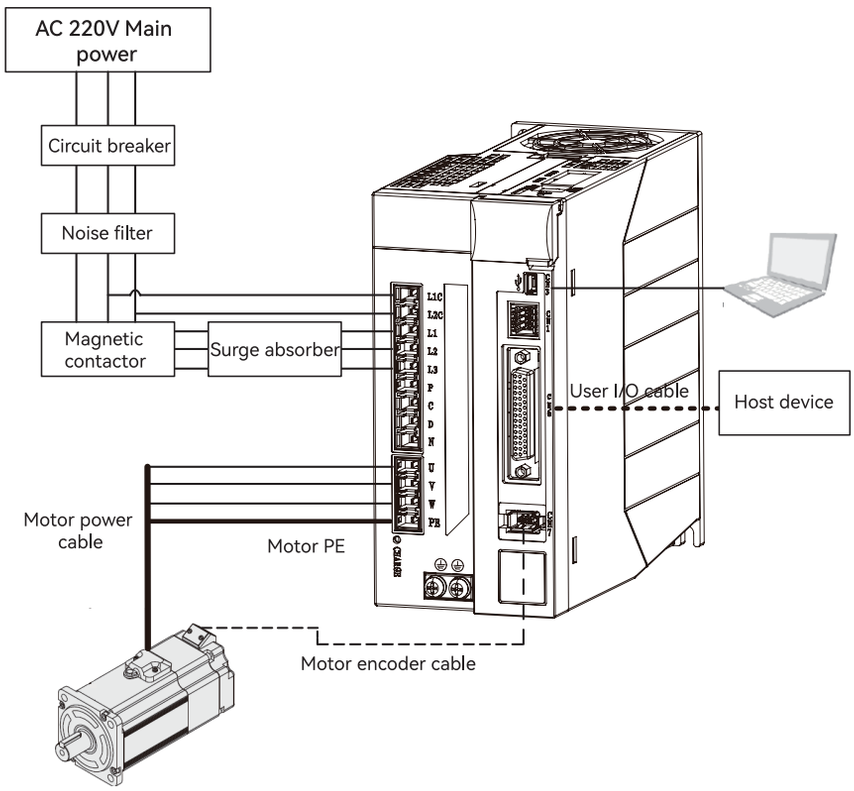
◆ **System wiring diagram for a drive with a power of 100W~1KW**



[Points for correct wiring]

- The power supply is connected to L1 and L2, please use the single-phase AC220V.
- Please use a twisted-pair shielded cable if the I/O cable is longer than 50cm.
- The encoder cable should be shorter than 20m.

◆ **System wiring diagram for a drive with a power of 1.5KW~2.5KW**



[Points for correct wiring]

- The power supply is connected to L1 and L2, please use the single-phase AC220V.
- Main power supply L1/L2/L3, can be connected to three-phase AC220V or single-phase AC220V.
- Please use a twisted-pair shielded cable if the I/O cable is longer than 50cm.
- The encoder cable should be shorter than 20m
- Common DC bus solution must be at the same voltage input level and be powered up at the same time..

Item	Description
Peripheral device composition	In order to comply with European EC standards, select the appropriate device for each specification and set it according to the diagrams above.
Installation environment	The drive can be installed in a pollution degree 2 or pollution degree 1 environment according to IEC60664-1.
Power supply 1: AC200 to 240V (Main circuit and control circuit power supply)	The drive can be used in overvoltage category II power supply environments according to IEC60664-1.
Power supply 2: DC24V I/O power supply Motor brake release power supply	The following conditions must be met to select the specifications for the DC24V external power supply. Use a SELV power supply (※) with a capacity of 150W or less, which is a CE-compliant condition. ※SELV: safety extra low voltage (Safety extra low voltage/non-hazardous voltage. Hazardous voltage requires reinforced insulation)
Wiring	For motor power cables, AC220V input cables, FG cables, and main circuit power distribution cables of multi-axis configurations, use AWG18/600V voltage-resistant cables for the power of 750W or less, and AWG14/600V voltage-resistant cables for the power of 1KW or more.
Earth leakage circuit breaker	In order to protect the power cable, it is necessary to disconnect the circuit when overcurrent flows. According to the above diagram, be sure to use a UEC-specified and UL-approved circuit breaker between the power supply and the noise filter. To comply with EMC standards, use a circuit breaker with a leakage detection function recommended by our company.
Noise filter	Prevents noise interference from the power cable. To comply with EMC standards, use the noise filters recommended by our company.
Electromagnetic contactor	Perform main power switching (ON/OFF). Connect an overvoltage protector for use.
Surge absorber	To comply with EMC standards, use an overvoltage protector recommended by our company.
Signal cable noise filter / Ferrite core	To comply with EMC standards, use the noise filter recommended by our company.
Regenerative resistor	This product has a regenerative discharge resistor inside the drive with a power of 1.5KW or more, and can be connected with an external regenerative resistor. A regenerative resistor is required when the internal smoothing capacitor of the power supply device is not sufficient to absorb and process regenerative power. For reference, check the regenerative discharge condition on the setting panel, and use the regenerative resistor when the regenerative voltage warning is ON. For the reference specifications of regenerative resistor, please refer to [1.3 External regenerative resistor selection]. Use the built-in thermostat and set the overheat protection circuit.
Earth grounding	The products are equipped with protection settings for Class 1 equipment. The products are grounded using a protective grounding terminal, which is implemented in a protective box or electrical box with EMC compliance. The protective earth terminal is indicated by the FG mark as shown below. 

2.2 Description of motor connector interface

◆ Motor connector terminal arrangement and wiring color coding

Voltage input class 220V (750W or less)

Figure Motor connector and pin arrangement (50~750W)

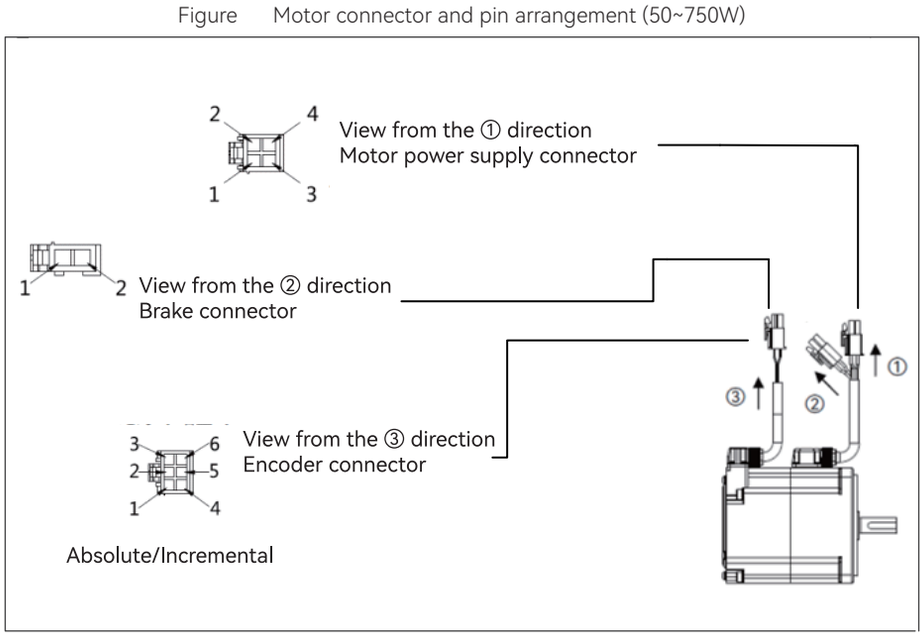


Table List of cables（750W or less）

Name	Cable
Motor power input	AWG18
Brake（Note 1）	AWG22
Encoder (incremental)	Power supply: AWG22
Encoder (absolute)	Signal: AWG24

Note 1: Applicable to motors with brakes.

Table For motor with the power of 750W or less

名称	端子号码	信号名	内容	配线色别
Motor power input	1	U	Motor power U-phase output	Red
	2	V	Motor power V-phase output	White
	3	W	Motor power W-phase output	Black
	4	FG	Motor housing grounding	Green
Brake (※1)	1	BRK +	Brake power supply DC24 V	Yellow
	2	BRK-	Brake power supply GND	Blue
Encoder (incremental)	1	—	NC	-
	2	+D	Serial communication data + data	White (red dot)
	3	-D	Serial communication data - data	White (black dot)
	4	VCC	Encoder power supply 5V output	Orange (red dot)
	5	GND	Signal grounding	Orange (black dot)
	6	SHIELD	Shielded cable	Black
Encoder (absolute)	1	BAT	External battery (※2)	Yellow (black dot)
	2	+D	Serial communication data + data	White (red dot)
	3	-D	Serial communication data - data	White (black dot)
	4	VCC	Encoder power supply 5V output	Orange (red dot)
	5	GND	Signal grounding	Orange (black dot)
	6	SHIELD	Shielded cable	Black

Note: 1. Applicable to motors with brakes.

2. The external capacitors and batteries have GND as their reference potential.

3. The internal circuit (IC) is already connected internally and does not need to be connected to any cables here.

Voltage input class 220V（1KW~2.5KW）

Figure Motor connector and pin arrangement（1kW or more）

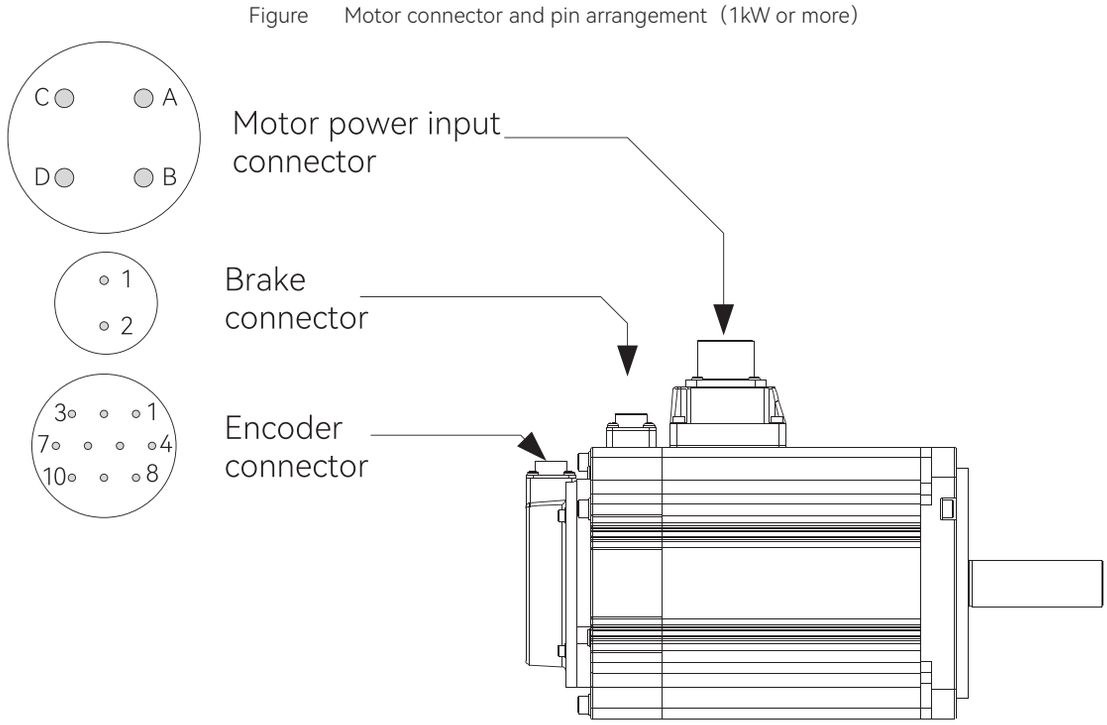


Table List of cables（1kW or more）

Name	Cable
Motor power input	AWG19
Brake（Note 1）	AWG21
Encoder (incremental)	AWG24
Encoder (absolute)	

Note: Applicable to motors with brakes.

Table For motor power with the power of 1 kW or more

Name	Terminal No.	Signal name	Description	Note
Motor power input	A	U	Motor power U-phase output	
	B	V	Motor power V-phase output	
	C	W	Motor power W-phase output	
	D	FG	Motor housing grounding	
Brake（※1）	z	BRK +	Brake power supply DC24 V	
	2	BRK-	Brake power supply GND	
Encoder (incremental)	1	VCC	Encoder power supply 5V output	
	2	GND	Signal grounding	
	3	—	NC	
	4	—	NC	
	5	+D	Serial communication data + data	
	6	-D	Serial communication data - data	
	7	—	NC	
	8	—	NC	
	9			
	10	SHIELD	Shielded cable	
Encoder (absolute)	1	VCC	Encoder power supply 5V output	
	2	GND	Signal grounding	
	3	CAP	External capacitor (※2)	
	4	BAT	External battery (※2)	
	5	+D	Serial communication data + data	
	6	-D	Serial communication data - data	
	7	IC	Internal connection (※3)	
	8	IC	Internal connection (※3)	
	9	GND	Signal grounding	
	10	—	NC	

Note: 1. Applicable to motors with brakes.

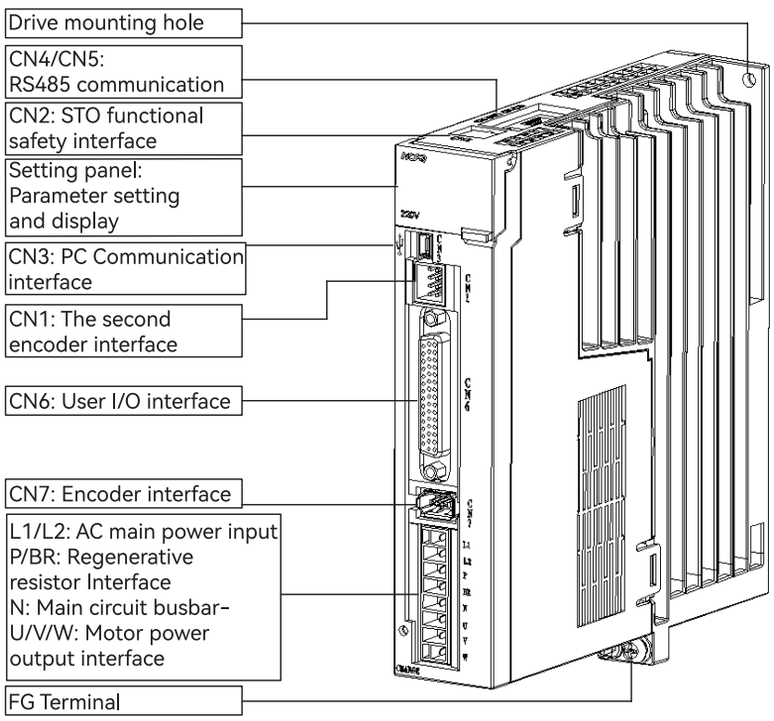
2. The external capacitors and batteries have GND as their reference potential.

3. The internal circuit (IC) is already connected internally and does not need to be connected to any cables here.

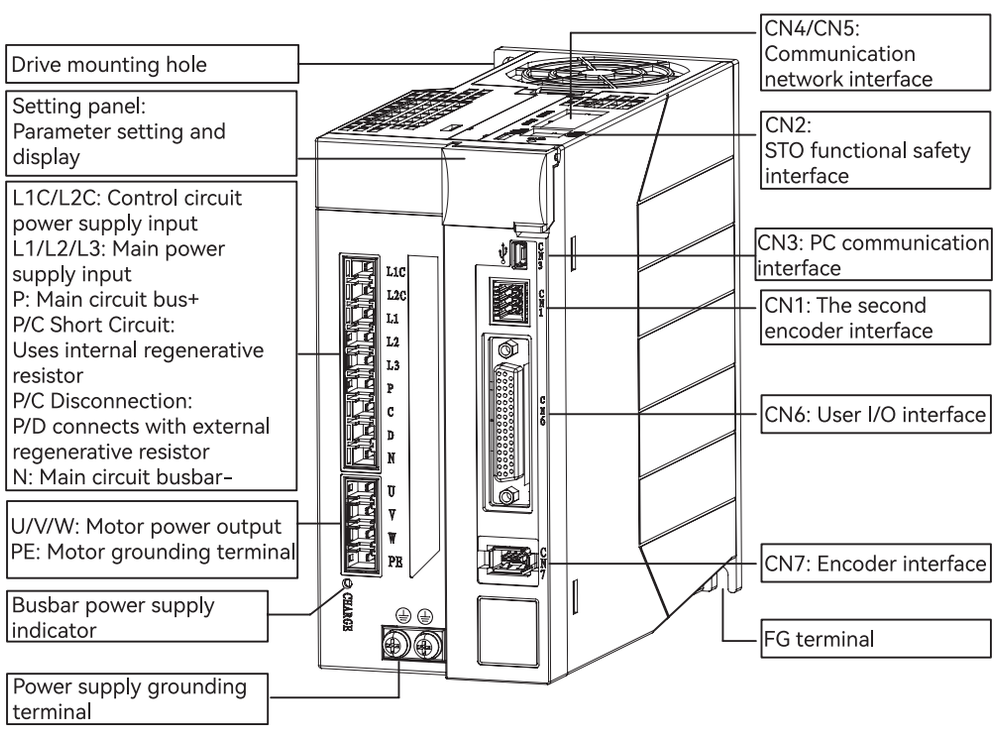
2.3 Description of drive connector interface

Before using, confirm the model number of the drive. Standard type drive has fewer functions than full-function type and lacks certain interfaces corresponding to some functions.

◆ **Connector interface definition for a drive with a power of 100W~1KW**



◆ **Connector interface definition for a drive with a power of 1.5KW~2.5KW**

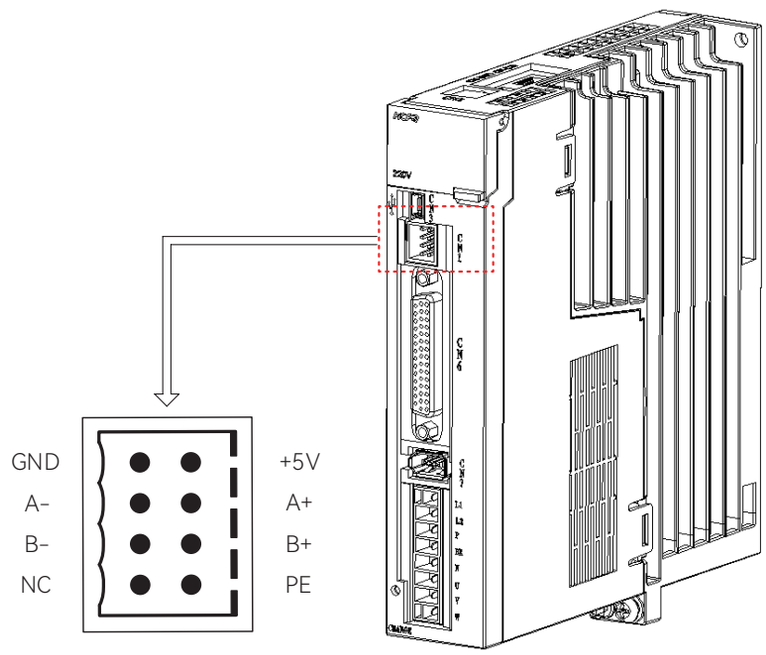


Note: CN1 and CN2 are not available for X5EA standard drive.

2.4 Instructions for using the CN1 interface (the second encoder connection)

The second encoder is only available for X5FA (X5 pulse series full-function model), which has the second encoder interface for connecting to an external displacement sensor, mainly for full closed-loop function and gantry synchronization.

◆ CN1 interface diagram



◆ CN1 pin definition

Name	Signal name	Description
The second encoder	5V	Power supply for external displacement sensor
	GND	Connected to GND of the control circuit
	A+	Parallel signals Maximum frequency accepted: 5M (after 4x frequency)
	A-	
	B+	
	B-	
	PE	Connected to the ground terminal inside the servo

◆ Instructions for using the second encoder

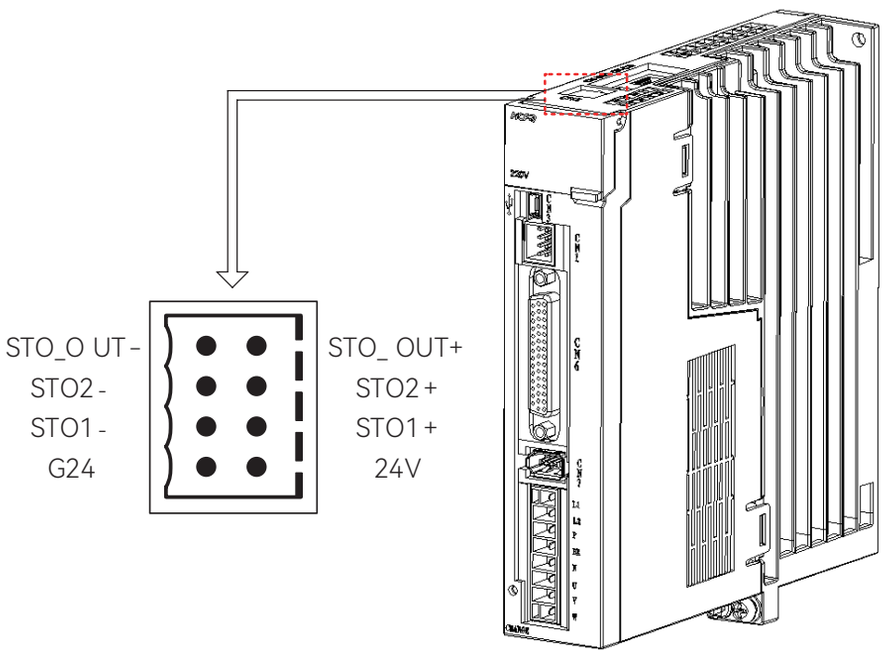
For the 5V power supply of the external sensor, please use the power output of pin 1 and pin 2 of the second encoder interface (the maximum output current is 300mA).

Please connect the shield of the external sensor to that of the encoder cable, and connect the shield of the encoder cable to the PE of the second encoder interface. During operation, please keep the encoder cable away from the power supply cables (L1, L2, L3, L1C, L2C, U, V, W).

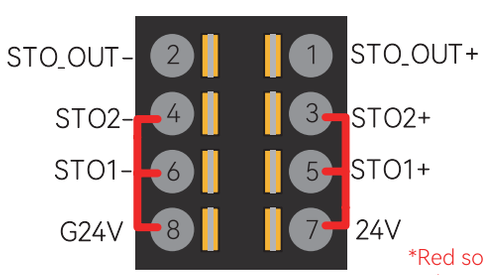
2.5 Instructions for using the CN2 interface (STO function)

◆ STO wiring instructions

Safe Torque Off (STO) is a safety function that prevents the drive from transferring energy to the motor to generate current. A safety bypass plug is supplied as standard. When the safety function is not used, please short-circuit the safety bypass plug as required, otherwise the drive panel will display "sto". To use the safety function, connect the safety bypass plug to the host controller as required.



◆ CN2 interface diagram

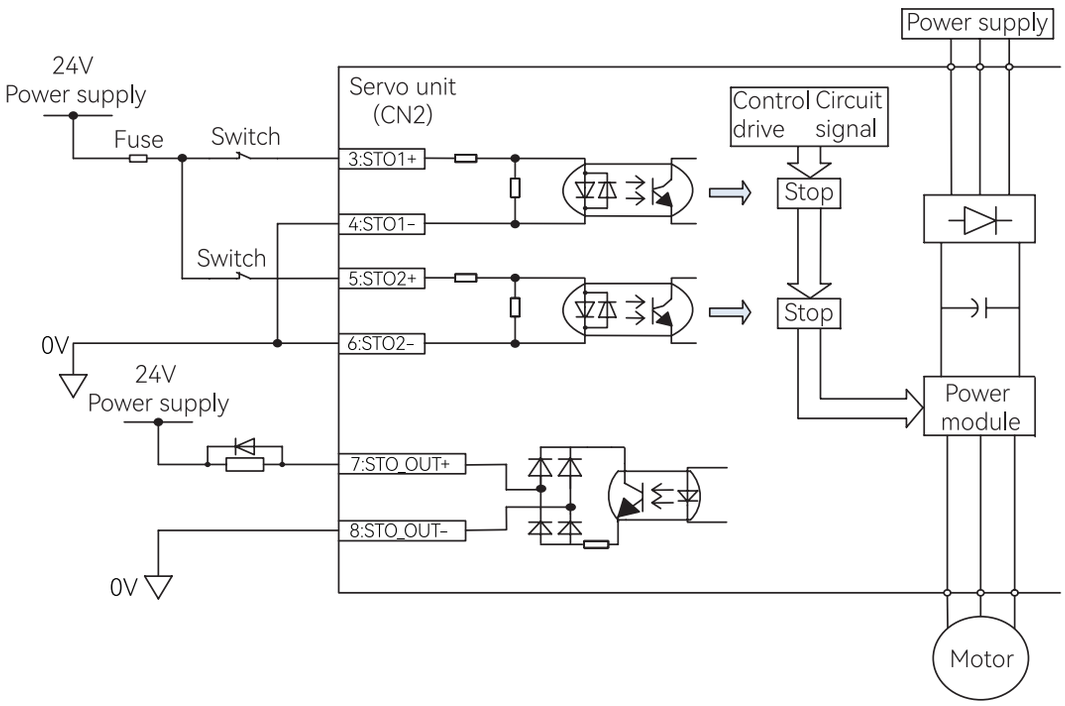


When not using STO, short-circuit the safety bypass plug as shown above.

◆ CN2 pin definition

Name	Symbol	Signal name	Description
STO function	CN2	24V	24V source output
		G24	
		STO1+	Two separate sets of circuits Turn off the drive signal of the power module and cut off the power supply
		STO1-	
		STO2+	
		STO2-	
		STO_OUT+	Monitor output that is used for monitoring safety function faults
		STO_OUT-	

◆ STO function block diagram



The external power supply must be a 24V DC power source.

◆ Instructions for using the STO function

STO1 status	STO2 status	STO_OUT status	Drive panel status
Closed	Closed	OFF	o ry
Closed	Open	OFF	Sto
Open	Open	ON	Sto
Open	Closed	OFF	Sto

◆ STO safety precautions

When using the STO function, ensure that the safety requirements of the system are met. The following safety considerations should be taken into account for STO function actions:

If an external force is applied along the vertical shaft, the motor will rotate. To maintain the position of the motor, an external brake needs to be applied to hold the position. In addition, it's important to note that the brake on motors with brakes is designed exclusively for holding and cannot be used for stopping.

If no external force is applied and the dynamic brake fails to stop the motor at the set position, the motor will coast to stop, which will result in a longer stopping distance. It is important to be aware of this situation when using the motor to prevent any potential issues.

The STO function cuts power to the motor, but not the servo drive. To ensure safety during servo drive or equipment maintenance, disconnect the main power supply.

2.6 Instructions for using the CN3 interface（USB connection interface)

This interface is used for connecting the drive to the computer, and the host device software [HSC-Studio] can be used to operate the drive for trial operation, parameter adjustment, waveform acquisition and other operations.

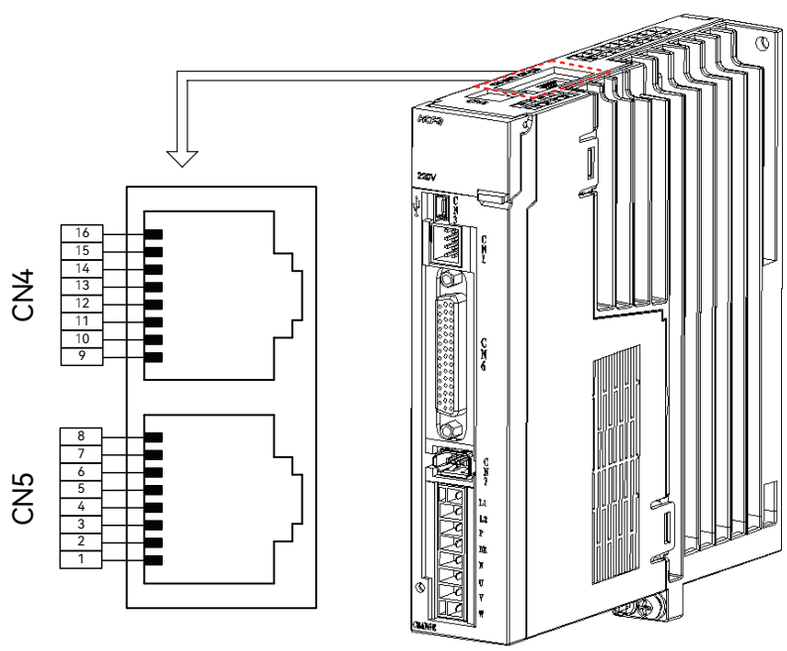
Name	Symbol	Terminal No	Signal name	Description
USB connection interface	CN3	1	VBUS	USB power supply
		2	D-	USB data-
		3	D+	USB data+
		4	NC	-
		5	GND	USB signal grounding

Note: For the connection cable between the drive and the computer, use USB mini-B (commercially available).

2.7 Instructions for using the CN4/CN5 interface

The definition of the network interface is varied for different drive models, so please check the model before using it. There are mainly the following types of network interfaces corresponding to different models.

◆ **CN4/CN5 interface diagram**



◆ **CN4/CN5 pin definition**

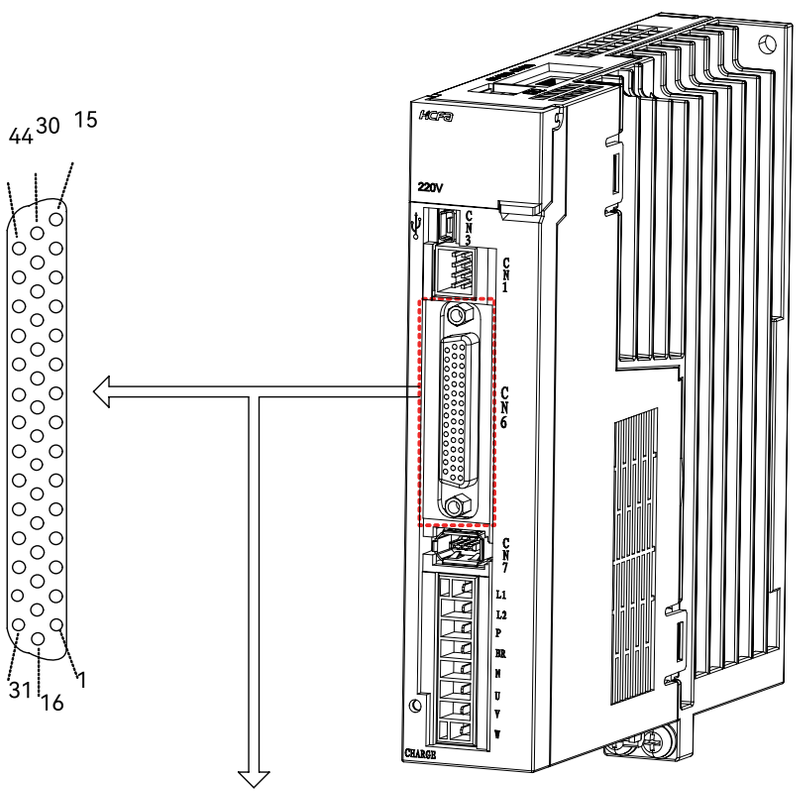
X5 pulse model（X5EA/X5FA）

Model	Symbol	Terminal No.	Signal name	Description
Pulse model	CN4	1	NC	—
		2	NC	
		3	NC	
		4	RS485+	RS485+ signal from the host device
		5	RS485-	RS485- Signal from the host device
		6	NC	—
		7	NC	
		8	NC	

	CN5	9	NC	—
		10	NC	
		11	NC	
		12	RS485+	RS485+ signal from the host device
		13	RS485-	RS485- signal from the host device
		14	NC	—
		15	NC	
		16	NC	

2.8 Instructions for using the CN6 interface（user I/O）

◆ **User I/O (CN6) interface description**

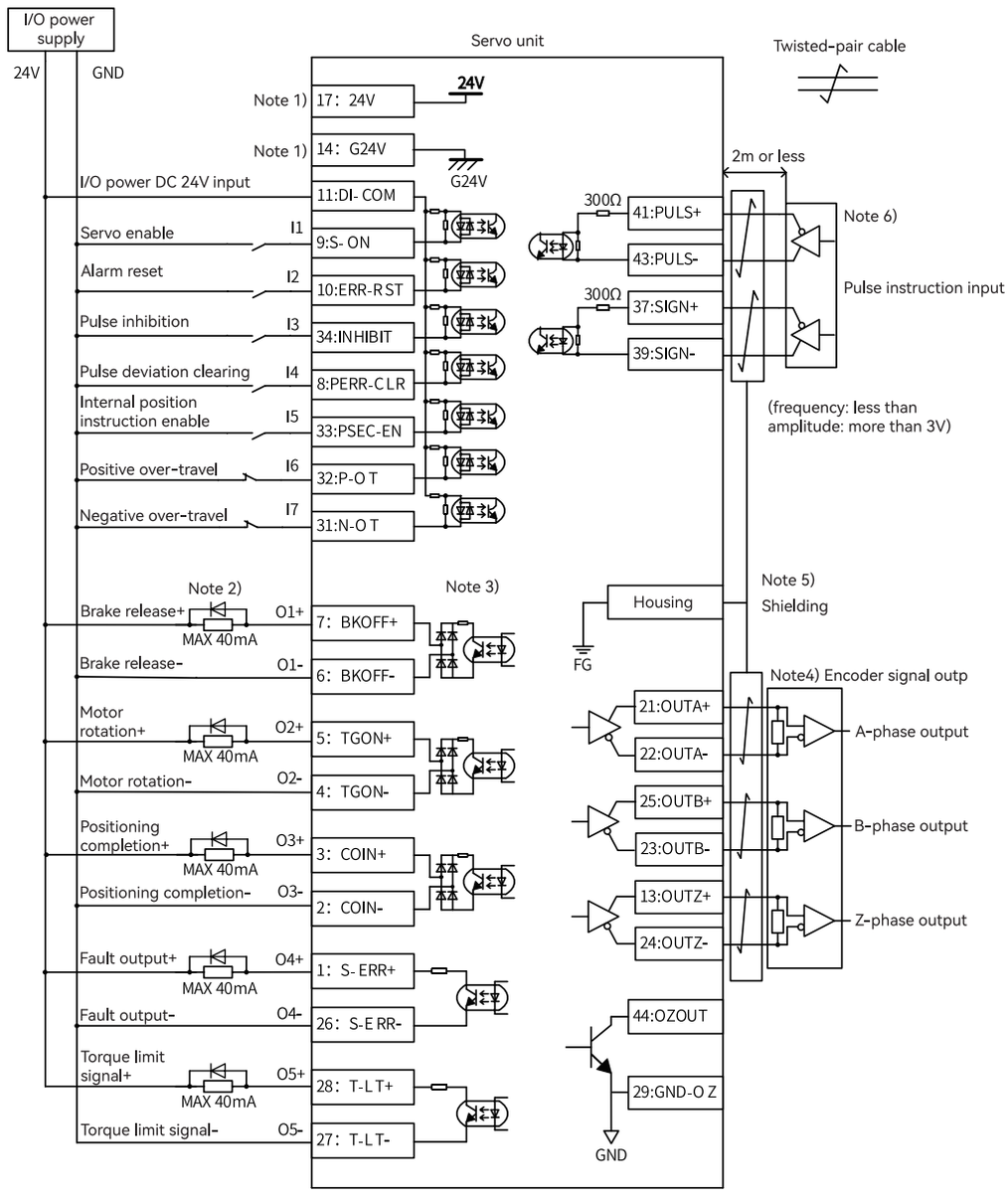


15	14 G24	13 OUTZ+	12 CC_D	11 DI_COM	10 DI2	9 DI1	8 DI4	7 DO1+	6 DO1-	5 DO2+	4 DO2-	3 DO3+	2 DO3-	1 DO4+	
30 DI8	29 GND_OZ	28 DO5+	27 DO5-	26 DO4-	25 OUTB+	24 OUTZ-	23 OUTB-	22 OUTA-	21 OUTA+	20 GND	19 AI2	18 AI1	17 +24V	16	
44 OZOUT	43 PULS-	42	41 PULS+	40	39 SIGN-	38	37 SIGN+	36	35 CC_P	34 DI3	33 DI5	32 DI6	31 DI7		

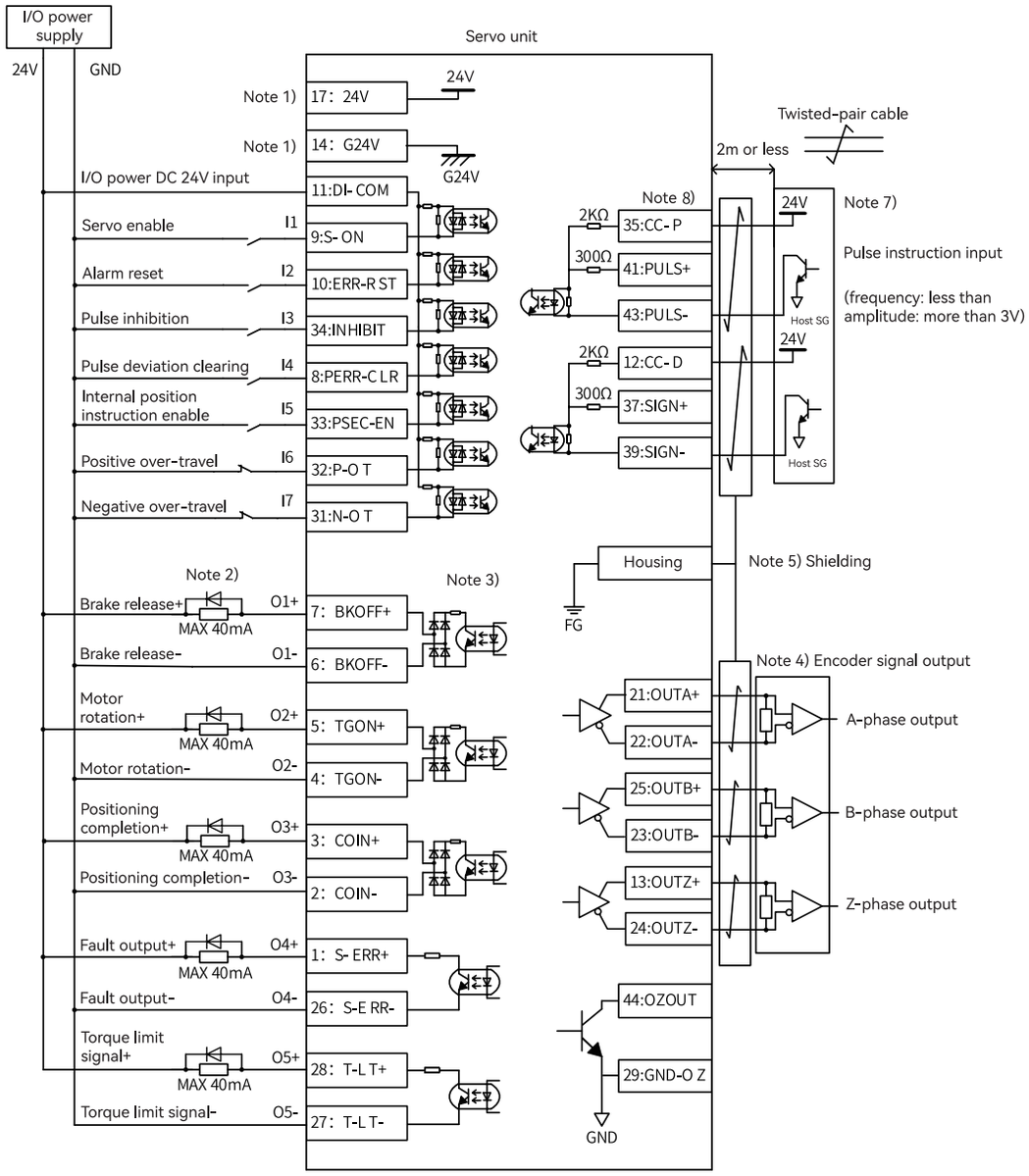
Name	Terminal No.	Signal name	Description
	1	DO4+	Digital signal output +
	2	DO3-	Digital signal output -
	3	DO3+	Digital signal output +
	4	DO2-	Digital signal output -
	5	DO2+	Digital signal output +
	6	DO1-	Digital signal output -
	7	DO1+	Digital signal output +
	8	DI4	Digital signal input
	9	DI1	Digital signal input
	10	DI2	Digital signal input
	11	DI_COM	Digital signal input common terminal
	12	CC-D	Collector pulse instruction input SIGN power supply (24V)
	13	OUTZ+	Pulse output Z signal +
	14	G24V	Drive power supply GND
	15	-	-
	16	-	-
	17	+24V	Drive power supply 24V output
	18	AI1	Analog input 1
	19	AI2	Analog input 2
User-controlled I/O	20	GND	Analog reference GND
24V power output	21	OUTA+	Pulse output A signal +
Parallel I/O	22	OUTA-	Pulse output A signal -
Pulse sequence	23	OUTB-	Pulse output B signal -
Instruction input	24	OUTZ-	Pulse output Z signal -
ABZ output	25	OUTB+	Pulse output B signal +
	26	DO4-	Digital signal output -
	27	DO5-	Digital signal output -
	28	DO5+	Digital signal output -
	29	GND_OZ	Collector Z signal output reference ground
	30	DI8	Digital signal input
	31	DI7	Digital signal input
	32	DI6	Digital signal input
	33	DI5	Digital signal input
	34	DI3	Digital signal input
	35	CC-P	Collector pulse instruction input PULS power supply (24V)
	36	-	-
	37	SIGN+	Pulse instruction SIGN+
	38	-	-
	39	SIGN-	Pulse instruction SIGN-
	40	-	-
	41	PULS+	Pulse Instruction PULS+
	42	-	-
	43	PULS-	Pulse instruction PULS-
	44	OZOUT	Collector Z signal output

◆ User I/O (CN6) wiring instructions

Pulse instruction differential input

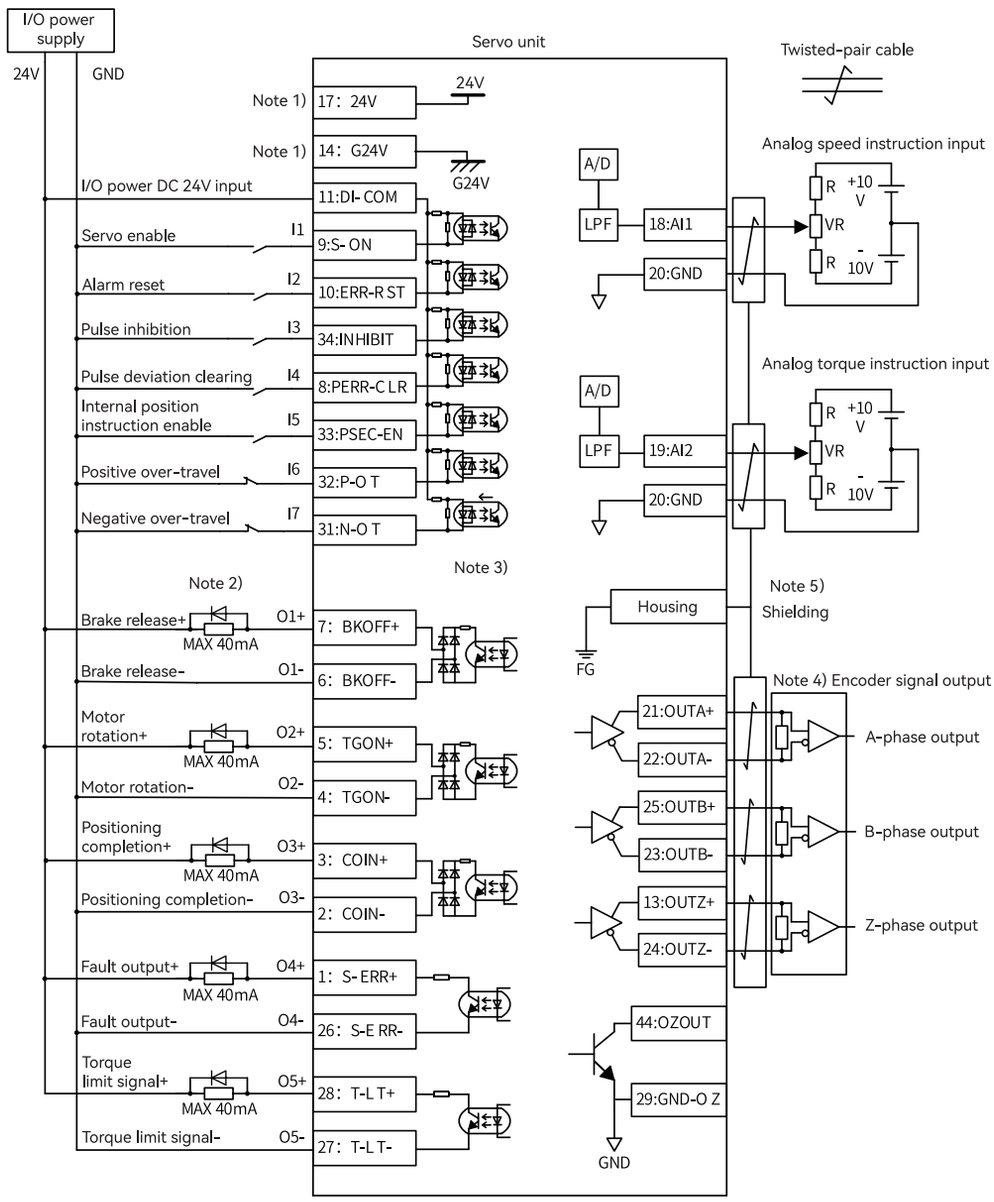


Pulse instruction 24V open collector input



Note: The 24V collector pulse input wiring for the X5E(F)A user IO has one more pin 12 (CC_D) than that of the X2E. This pin needs to be connected to 24V for 24V collector NPN wiring and 0V for 24V collector PNP wiring.

Analog instruction inputs

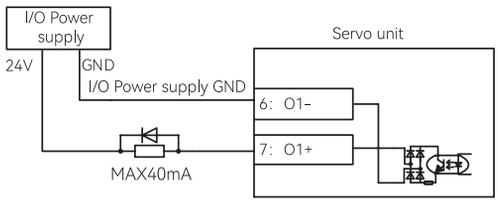


Note 1) The control power supply output (24V, G24V) can be used as a power supply for I/O (COM+, COM-) with the maximum output current is 150mA. Use an external independent power supply when driving outputs such as relays and brakes.

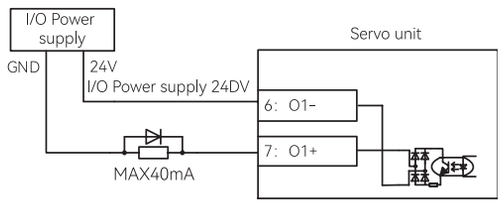
Note 2) When driving inductive loads such as relays, please connect a protection circuit (continuity diode).

Note 3) Depending on the wiring method, the output pin can output a high or low level.

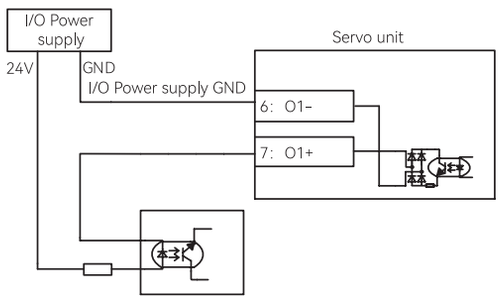
The specific connection ways are as follows:



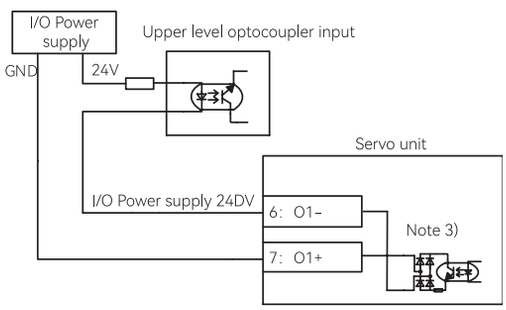
Low level output from the output pin



High level output from the output pin



Low level output from the output pin



High level output from the output pin

Note 4) Termination resistors need to be connected to the differential signal connection terminals for differential pulse output.

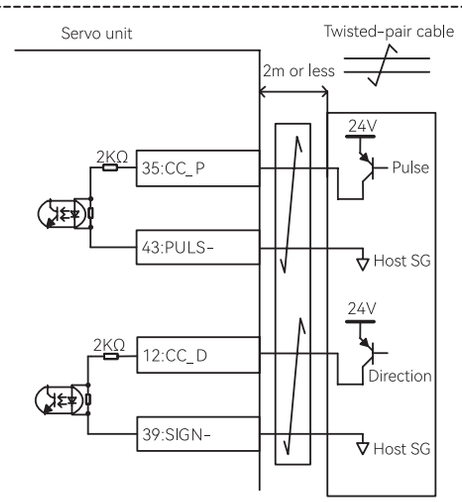
Note 5) The shield of the connection cable between the drive and the host device needs to be connected to the drive housing and the host device housing respectively.

Note 6) Differential pulse instruction input refers to differential pulse with amplitude ±5V, which is divided into two types according to the pulse frequency: regular pulse instruction input and high-speed pulse instruction input.

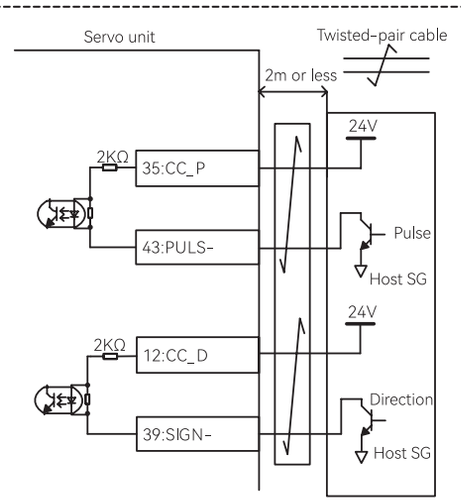
① Regular pulse instruction (pulse frequency ≤ 500k Hz). In this case, P00.05 is set to 0, and the pulse input filter parameter is P06.41.

② High-speed pulse instruction (pulse frequency ≤ 4M Hz) . In this case, P00.05 is set to 3, and the pulse input filter parameter is P06.49.

Note 7) There are two cases here, which are distinguished according to the different ways of pulse generation, one is the NPN type, and the other one is the PNP type, as shown in the figure below.

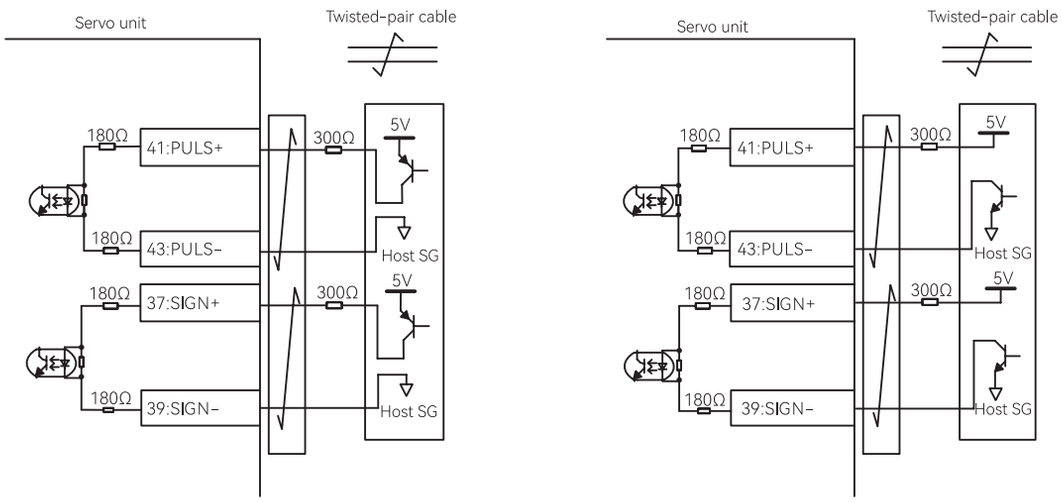


PNP type



NPN type

Note 8) For pulse instruction 5V open collector input, it can be received by 5V differential with 300Ω external resistor, there are two cases, one is NPN type and the other is PNP type according to the way of pulse generation.



PNP type

NPN type

Note:

※The DI function can be flexibly configured by function code, DI is by default valid when it is conducted, and its positive and negative logic can be modified by function code.

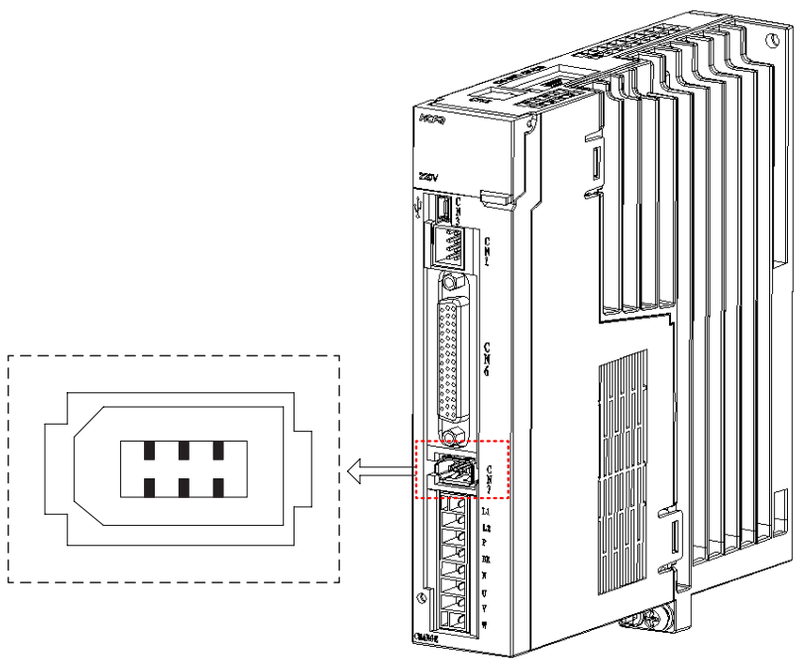
※DO function can be flexibly configured by function code, DO is by default conducted when it is valid, and its positive and negative logic can be modified by function code;

※The digital filter of the collector and common pulse input is P06.41, when the pulse frequency is below 500k Hz, set P06.41 to 80, if the interference is too strong, adjust this parameter appropriately. The digital filter of high-speed pulse input is P06.49, when the pulse frequency is 500K~3M, set P06.49 to 20, when the pulse frequency is 3M~4M, set P06.49 to 10.

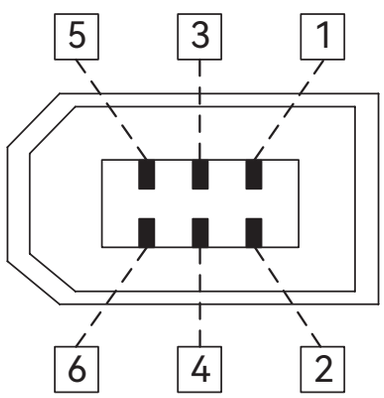
2.9 Instructions for using the CN7 interface (encoder connection)

The interface is used for connecting the drive to the motor encoder. When using, the cable should be 30cm away from the main circuit wiring.

◆ **CN7 interface diagram:**



◆ **CN7 pin diagram:**



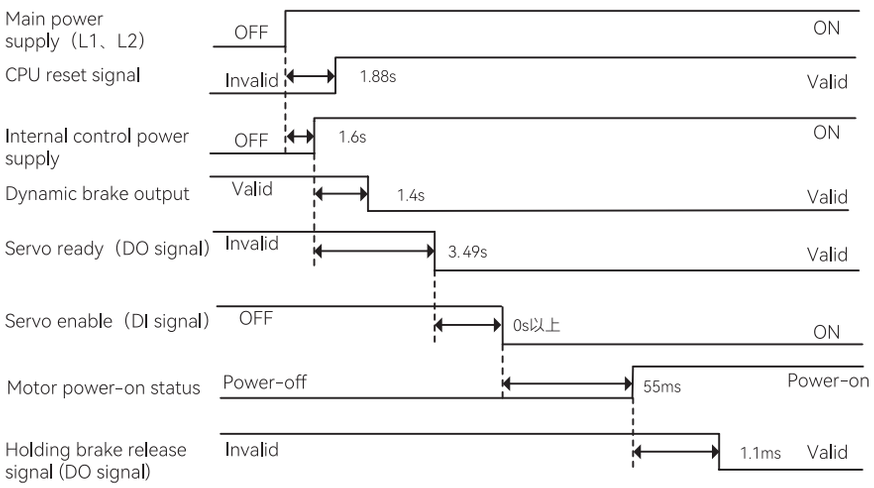
◆ **CN7 pin definition:**

Encoder	CN7	1	VCC	Encoder power supply 5V output
		2	GND	Signal ground
		3	NC	-
		4	NC	-
		5	+D	Encoder signal: data input/output
		6	-D	Encoder signal: data input/output
		—	FG	Connect the shielded cable to the connector housing

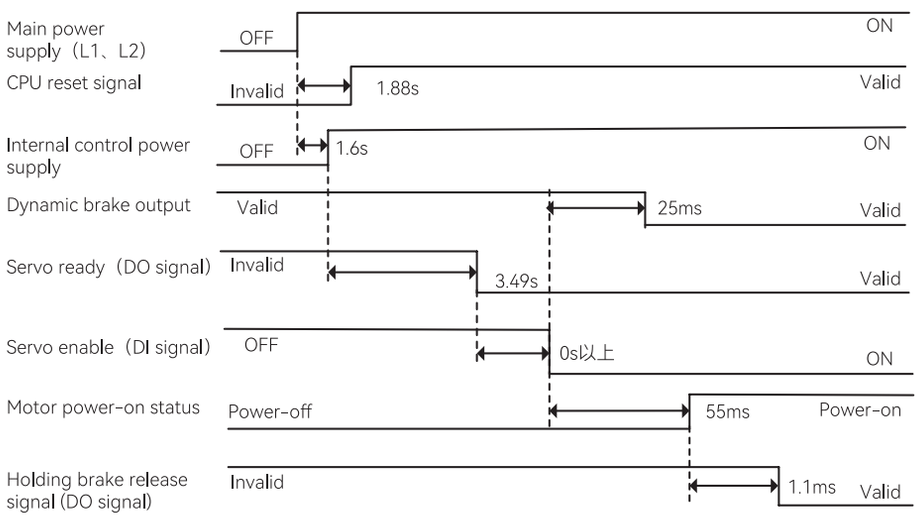
2.10 Timing diagram

◆ When the power is ON (timing of receiving servo enable signal)

P06.26=0 ~ 2 (not to hold DB during power-on)

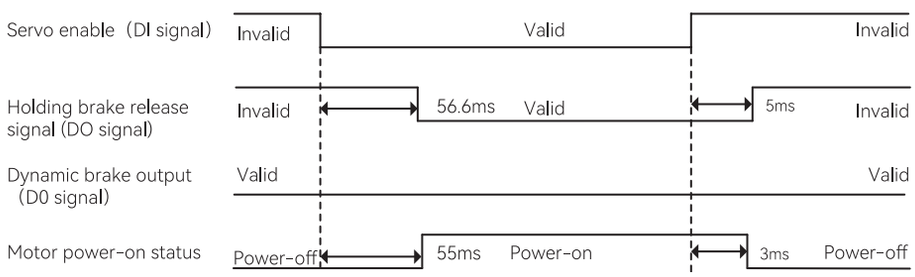


P06.26=3 ~ 5 (hold DB during power-on)



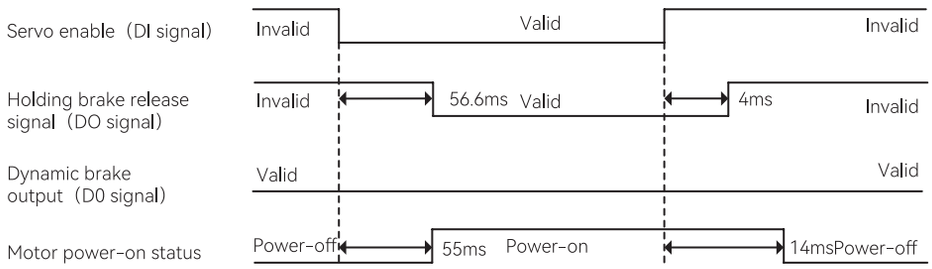
◆ Servo-enabling on/off action during motor rotation

P06.26=0（coast to stop, remain free）



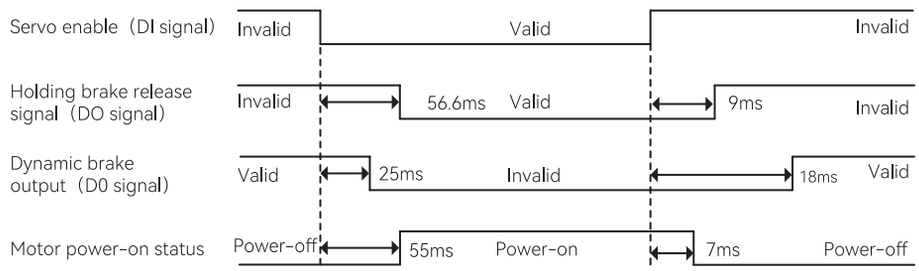
The timing of " Holding brake release signal" during the servo OFF is related to the setting of servo parameter P04.52 and P04.53 and the running speed of the motor, see the parameter description for details, and the minimum value is 5ms.

P06.26=1/2（quick stop, remain free）



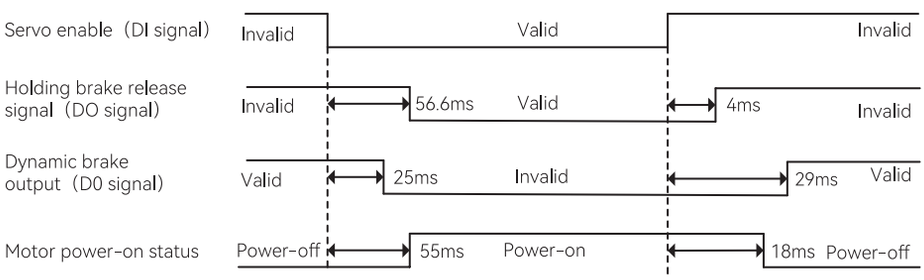
The timing of " Holding brake release signal" during the servo OFF is related to the motor running speed, see the parameter description for details, and the minimum value is 4ms.

DB stop P06.26=3（DB stop，hold DB）



The timing of " Holding brake release signal" during the servo OFF is related to the motor running speed, see the parameter description for details, and the minimum value is 9ms.

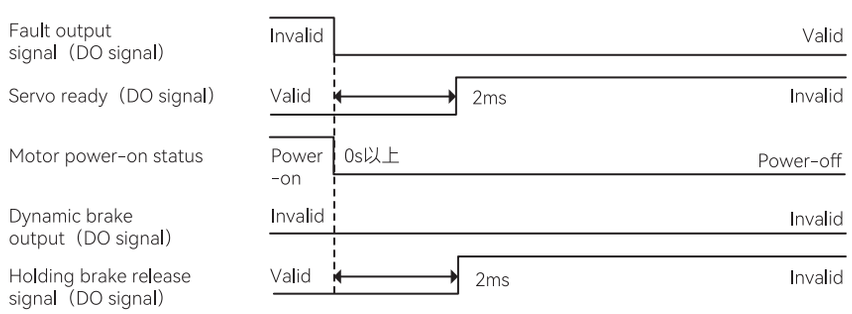
DB stop P06.26=4/5（quick stop, hold DB）



The timing of " Holding brake release signal" during the servo OFF is related to the motor running speed, see the parameter description for details, and the minimum value is 4ms.

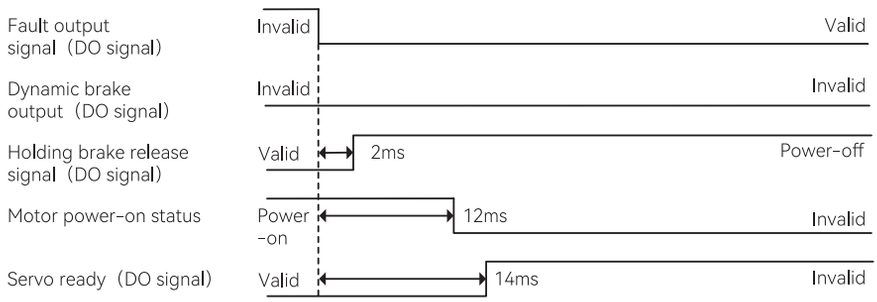
◆ When an abnormality (malfunction) occurs (instruction status of servo-enable is on)

P06.27=0（coast to stop, remain free）



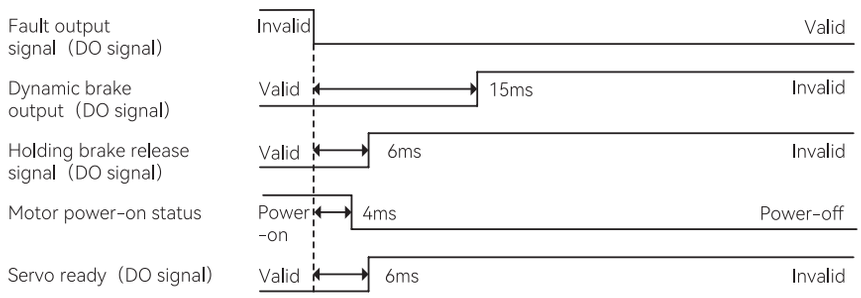
The timing of the "Holding brake release signal" during the faulty stop is related to the servo parameters P04.52 and P04.53 and the motor running speed, see the parameter description for details, and the minimum value is 2ms.

P06.27=1/2（quick stop, remain free）



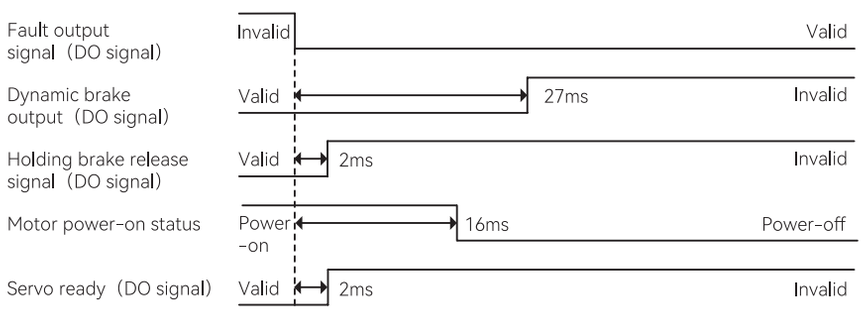
The timing of the "Holding brake release signal" during the faulty stop is related to the motor running speed, see the parameter description for details, and the minimum value is 2ms.

P06.27=3（DB stop, hold DB）



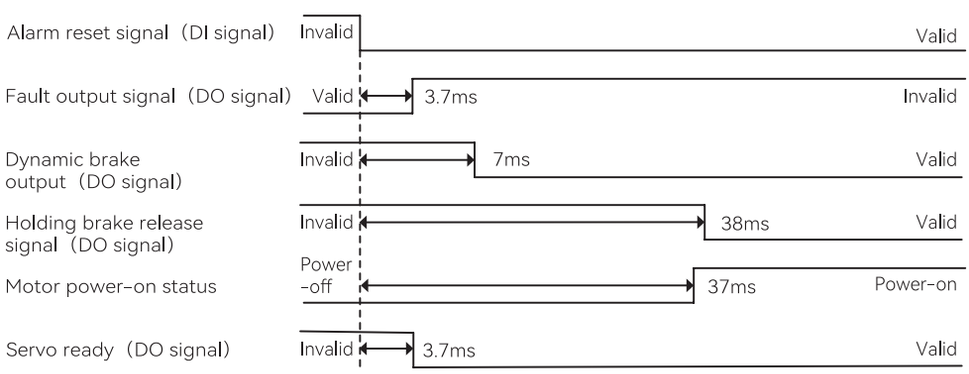
The timing of the "Holding brake release signal" during the faulty stop is related to the motor running speed, see the parameter description for details, and the minimum value is 6ms. The timing of the "servo ready" during the fault stop depends on the speed of the motor and the minimum value is 6ms.

P06.27=4/5（quick stop, hold DB）



The timing of the "Holding brake release signal" during the faulty stop is related to the motor running speed, see the parameter description for details, and the minimum value is 2ms. The timing of the "servo ready" during the faulty stop depends on the speed of the motor and the minimum value is 2ms.

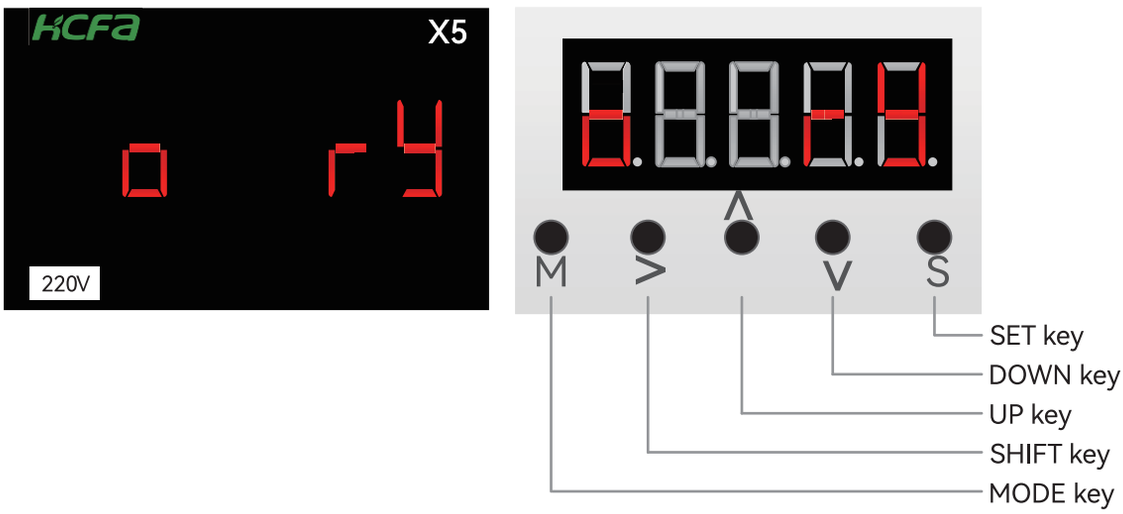
◆ **When alarms are cleared (instruction status of servo-enable is on)**



◆ **When STO is disabled (instruction status of servo-enable is on)**

Chapter 3 Panel display and operation

3.1 Panel display and key description



MODE key: Generally, it is used to exit the panel display of a higher level and return to the panel display of a lower level; if the current panel display is already zero level, press the MODE key to enter the panel display of the first level.

SET key: Generally, it is used to enter into the panel display of memory, or to confirm the parameter modification.

UP key: Multiply the corresponding authority value by step 1 to increment the numeric value.

DOWN key: Multiply step size 1 by the corresponding authority value to decrease the numeric value.

SHIFT key: Generally used to move the modified digit, for 32-digit number, long press SHIFT can flip the page to display the high digit, and long press again can flip the page to display the sign digit. When the panel is at zero level, press the SHIFT key to switch the display of monitored parameters.

3.2 Display description

After powering up, the panel will show 888 , which indicates initialization is in progress. The contents of the level 0 panel are displayed thereafter.

◆ **Level 0 panel display:**

When a fault occurs:

The level-0 panel blinks to display the error or alarm code.

For example: Err.021

Alarm display: AL.086 , warning display.

Press the SET button, and the panel will stop blinking. Press the MODE button to enter the Level-1 panel.

No fault: When all the settings after initialization are normal, the panel displays oK rdy .

Level 0 panel can monitor up to 12 status parameters, with a maximum of 12 in case of faults or warnings, and a maximum of 11 in normal conditions. When there is a fault or warning, the first one is the fault or warning, and the second one is the operating status indicator. When normal, the first one is the running status flag, and the remaining 10 are set through P07:01 to P07_10. The set value can be any ordinal value within the P21 group except for 0. Setting it to 0 indicates that there are no monitoring parameters at the corresponding position, and pressing the SHIFT key will directly skip it. If P07:01 is set to 1, monitor P21-01 (actual operating speed). These monitoring parameters can be switched to display using the SHIFT key. If the monitored parameter is 32-bit, such as P21_17 (feedback pulse counter), it can be displayed by long pressing the SHIFT key to turn pages.

The displays are shown below:

If the parameters configured by P007:01 to P007_10 is displayed, then 2 1- x x will be shown, and the last two digits x x are the set values for P07:01 to P07_10 such as P21-01 .

During runtime, depending on the control mode, the displays can be divided into the following four types.

Pc run Indicates the running position mode

Sc run Indicates the running speed mode

tc run Indicates the running torque mode

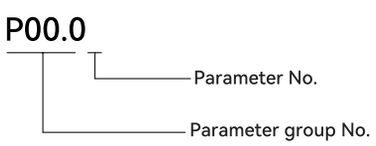
◆ **Level 1 panel display:**

Displays parameter group No., e.g. P00, and the rightmost digit blinks to be modified. When

modifying other digits, press the SHIFT button. Press the SET key to enter the level 2 panel. Press the MODE key to return to the level 0 panel.

◆ **Level 2 panel display:**

The parameter No. is shown below:



Displays the parameter group number and offset within the group, Take P0 1.00 for an example, after entering, the rightmost bit blinks to indicate that it can be modified, and if other bits need to be modified, shift them with the SHIFT key.

The second row displays the properties of the parameter in the following ways.

Press the SET button to enter the Level-3 panel display.

Press the MODE button to return to the Level-1 panel display.

◆ Level 3 panel display:

Take P01.00 as an example.

Displays the parameter value determined by the group number and offset, Take P01.00 for an example, the display shows 0135.0 . The specific value is determined by the properties of each parameter value. If the parameter value can be modified, the rightmost bit blinks after entering, and if other digits need to be modified, shift them with the SHIFT key. If it is a 32-bit parameter value, it can be displayed by long-pressing the SHIFT key to turn the page.

The display has the following types after pressing the SET key.

r.PowOn Indicates that the parameter has been successfully modified and requires re-powering up to take effect, and will be displayed until the user presses the MODE key.

wrt.End Indicates that the parameter has been successfully modified and takes effect immediately (about 4ms). After this parameter displays about 1s, it returns to the Level-2 panel display automatically.

wrt.StP Indicates that the parameter has been modified successfully. This parameter becomes valid after the servo stops or power restarts. After displaying for about 1s, it returns to the Level-2 panel display automatically.

rd.Only Indicates the parameter is read-only and cannot be modified, it will automatically return to the 2-level panel display after about 1 second.

roLock Indicates that the current parameter cannot be written due to a constraint on the value of a parameter. For example, if the value of P00.02 is not 0, none of the parameters in group P01 can be written.

Press the MODE key to return to the level 2 panel.

3.3 JOG and parameter identification

3.3.1 JOG operation and display

（1）Before entering the JOG interface page

To access the JOG interface page, go to P20.00. The servo drive should be disabled at this time. First, press the key to locate P20.00, then press the SET key to enter the JOG page and display the setting value of the speed (value of P03.04). When each parameter is a factory parameter, the display is as follows.

 If the last digit is blinking, it means that it can be modified. Press SHIFT to move the blinking digit, and press UP and DOWN to add or subtract the digit respectively.

（2）After entering the JOG page

After entering the JOG page, press the SET key again and the display will be as follows.

 If the digit is no longer blinking, it means that it can no longer be modified, and the JOG process has been initiated at this time.

Press and hold the UP key, the motor rotates positively with the displayed speed value. If the DOWN key is pressed and held, the motor rotates in reverse with the displayed speed value. When the UP or DOWN key is no longer pressed, the motor stops rotating, but it does not exit the JOG state, i.e., it is still in the speed mode of operation, but the instruction is zero.

Press the MODE key to exit the JOG process.

3.3.2 Key operation and display for parameter identification

（1）Before entering the identification page

Before identifying the inertia offline, please enter P20.00 and JOG to confirm the motor can run normally. The operation interface of inertia and initial angle dentification is located in P20.03, at this time, the servo drive should be in the disable position, press the key to find P20.03, the display will be as follows.

 If the last digit is blinking, it means it can be modified. Changing to 1 means forward inertia identification will be performed; changing to 2 means reverse inertia identification will be performed; changing to 5 means encoder initial angle identification will be performed; changing to other values means undefined.

（2）After entering the identification page

After entering the identification page, if the parameter value displayed is changed to 1 or 2, and the SET keyis pressed, the inertia identification will be activated and the display will be as follows.

 Indicates the value of the current inertia value (P00.04).

After the identification is completed, press and hold the SET key (for more than two seconds) to store the newly identified inertia value to the EEPROM. In fact, the newly identified inertia value is recorded to the P00.04, and then the P00.04 is stored in the EEPROM.

After entering the identification page, if the parameter value displayed is 5 and then the SET key is pressed, the initial angle identification of the encoder is activated and the value of the current electrical angle (P21.09) is displayed.

After the initial angle identification is completed, there is no need to store it, and long pressing of the SET key (holding down the SET key for more than two seconds) has no effect. Press the MODE key to exit the identification process.

Chapter 4 Control function

4.1 Position control mode

◆ Overview

Position control is performed based on position instructions from the host device (e.g. pulse input) or servo internal position instructions, and the basic functions during position control are explained below.

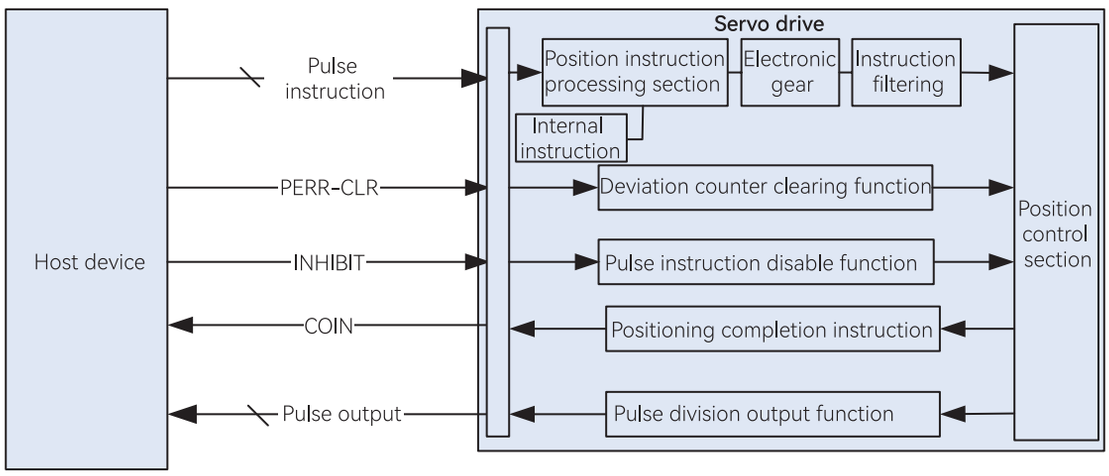


Figure Basic function block diagram of position control function

◆ Function description

Position instruction processing section:

The Position instruction processing section determines the source of the instruction and counts the instruction to give the unit of instruction required for the current control in real time. There are three sources of position instructions (P00.05):

0 - pulse instruction;

1 - step value setting;

2 - internal position instruction.

Among these, pulse instructions are further divided into six patterns (P00.07):

0 - Direction + Pulse, positive logic. (default);

1 - Direction + Pulse, negative logic;

2 - Phase A (pulse) + Phase B (sign), quadrature pulse, 4 times frequency, positive logic;

3 - Phase A + Phase B, quadrature pulse, 4 times frequency, negative logic;

4 - CW+ CCW, positive logic;

5 - CW+ CCW, negative logic.

Users need to set P00.05 and P00.07 or P00.27 according to the actual instruction pattern of the host device and determine whether the wiring is differential input or open collector (OC) input according to the signal method of the host device.

When the instruction source is a step value, set the step value in P00.26. The drive will have the interpolation at a very low speed to complete the specified position distance, which can be used for manual adjustment.

When the instruction source is internal position control, set the 16 positions, speeds, and acceleration/deceleration times. The drive will have linear interpolation based on the set parameters to complete the specified position distance.

Relevant parameters:

P00	05	Position instruction source	0: Pulse instruction 1: Step value setting 2: Internal position instruction 3: High-speed pulse instruction
P00	07	Pulse train form	0: Direction + Pulse, positive logic. (default) 1: Direction + Pulse, negative logic 2: Phase A (pulse) + Phase B (sign), quadrature pulse, 4x frequency, positive logic 3: Phase A + Phase B, quadrature pulse, 4x frequency, negative logic 4: CW+CCW, positive logic 5: CW+CCW, negative logic
P00	27	High-speed pulse train pattern	
P00	26	Step value setting	-9999 ~ 9999 instruction unit

For the internal 16-segment position function, please refer to P08 parameters.

◆ Electronic gear:

The main function of the electronic gear is to multiply the input position instruction from the host device by a certain fractional ratio to get the position control instruction based on the minimum resolution of the encoder required by the servo internal position controller.

When P00.08 is not 0, position control instruction = encoder resolution * input instruction / P00.08;

When P00.08 is 0, position control instruction = electronic gear ratio numerator * input instruction / electronic gear ratio denominator.

The current electronic gear ratio is selected via the DI functions GEAR_SEL1 and GEAR_SEL2.

GEAR_SEL1 is not valid, GEAR_SEL2 is not valid → electronic gear ratio 1

GEAR_SEL1 is valid, GEAR_SEL2 is invalid → electronic gear ratio 2

GEAR_SEL1 is not valid, GEAR_SEL2 is valid → electronic gear ratio 3

GEAR_SEL1 is valid, GEAR_SEL2 is valid → electronic gear ratio 4

Relevant parameters:

P00	08	Required pulse instruction number per turn of motor rotation (32 bits)	0 Unit/Turn ~ 2147483646 Unit/Turn
P00	10	Electronic gear numerator 1 (32 bits)	1 ~ 2147483646
P00	12	Electronic gear denominator (32 bits)	1 ~ 2147483646
P06	00	Electronic gear numerator 2 (32 bits)	1 ~ 2147483646
P06	02	Electronic gear numerator 3 (32 bits)	1 ~ 2147483646
P06	04	Electronic gear numerator 4 (32 bits)	1 ~ 2147483646

Although the numerator and denominator of the electronic gear ratio are set within a wide range, an electronic gear setting error Err.048 will be reported when the ratio exceeds the range. Therefore, the electronic gear ratio must be set to meet the following range.

Encoder resolution / 10000000 ≤ numerator / denominator ≤ encoder resolution / 2.5

Position instruction filtering

To smooth the instructions calculated by the electronic gears, the position instruction filters must be used. There are two built-in position instruction filters: one is a low-pass smoothing filter (IIR) and FIR filter. The longer the filter time, the better the filtering effect with the response delay being longer.

Relevant parameters:

P02	00	Position instruction smoothing filter	0.0ms ~ 6553.5 ms
P02	01	Position instruction FIR filter	0.0ms ~ 128.0 ms
P02	19	Position instruction FIR filter 2	0.0ms ~ 128.0 ms

Pulse division output function

The pulse division output function can convert the rotary position of the motor into AB-phase orthogonal pulses and output them to the host device. In addition, one Z-signal pulse can be output for each revolution of the motor. The pulse output source, resolution, phase sequence logic, and Z-signal logic can be set by function codes.

Relevant parameters:

P00	14	Pulse number per turn of motor rotation (32-bit)	16PPR ~ 1073741824PPR (count the corresponding number of cables by incremental optical encoder)
P00	16	Pulse output positive direction definition	0: CCW (motor rotation direction when pulse output OA is ahead of OB) 1: CW
P00	17	Pulse output OZ polarity	0: High level at the arrival of the Z pulse. 1: Low level at the arrival of the Z pulse. 2: High-precision Z pulse, high level at the arrival of the Z pulse. 3: High-precision Z pulse, low level at the arrival of Z pulse
P00	18	Pulse output function selection	0: Encoder division output 1: Pulse instruction synchronization output 2: Pulse instruction interpolation output (gantry synchronization) 3: External encoder pulse synchronization output

Pulse deviation clearing function

This function is used to set the conditions under which the pulse deviation of the internal position controller can be cleared to zero, thus preventing the position deviation from accumulating when it is not required.

Relevant parameters:

P06	06	Position deviation clearing function	0: Position deviation pulse is cleared when the servo is OFF and a fault occurs. 1: Position deviation pulse is cleared only when a malfunction occurs. 2: Clear position deviation only when servo is OFF, an error occurs, and PERR_CLR is valid. 3: Cleared only by PERR_CLR

Input pulse inhibition setting

Use this function to disregard the pulse input signal when needed, and the counting of the position instruction input counter will be forced to stop.

Relevant parameters:

P06	42	Pulse inhibition input setting	0: 0.5ms 2 times in a row 1: 0.5ms 3 times in a row 2: 1ms 3 times in a row 3: 2ms 3 in a row

Positioning completion detection function

Positioning completion and positioning near are judged by detecting whether the position deviation is within the set

range, and digital signals COIN and NEAR are output in response.

Relevant parameters:

P04	47	Positioning completion range	1P ~ 65535P
P04	48	Positioning completion output setting	0: If the absolute value of the position deviation is less than the positioning completion range (P04_47), the COIN signal is output; 1: If the absolute value of the position deviation is less than the positioning completion range (P04_47) and the position instruction is 0, the COIN signal is output; 2: If the absolute value of the position deviation is less than the positioning completion range (P04_47) and the position instruction is 0, the COIN signal is output and the hold time is P04_49; 3: If the absolute value of the position deviation is less than the positioning completion range (P04_47) and the filtered position instruction is 0, the COIN signal is output; 4: If condition 0 and the zero speed signal are valid at the same time, the COIN signal is output; 5: If condition 1 and zero speed signal are valid at the same time, the COIN signal is output; 6: If condition 2 and zero speed signal are valid at the same time, output COIN signal; 7: If condition 3 and zero speed signal are valid at the same time, the COIN signal is output.
P04	49	Positioning completion holding time	1 ~ 65535ms
P04	50	Positioning near range	1P ~ 65535P

4.2 Speed control mode

◆ Overview

Speed control is performed based on speed instructions from the host device (e.g. analog input) or servo internal speed instructions, and the basic functions during speed control are explained below.

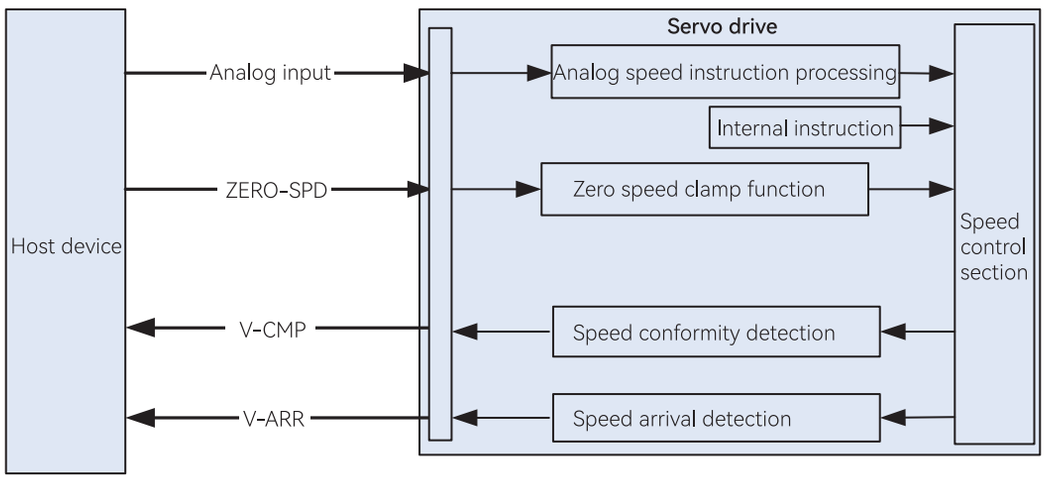


Figure Basic function block diagram of speed control mode

◆ Function description

Speed instruction processing

The speed source is set by P03.00. When P03.00 is equal to 1, the analog input channel (default AI1) of the SPR is set by P05.16~18, and the analog speed processing section converts the analog voltage given by the host device to A/D, and then corresponds the converted digital result to the specific speed instruction value following the set correspondence. At the same time, a digital filter can be set to prevent interference and eliminate noise.

When P03.00 is equal to 0, P03.03 is used to set the numerical value of speed instruction.

The 16-segment internal speed instruction value and acceleration/deceleration time are set in P03.31 ~ P03.51, and DI function No. 6, 7, 8, and 9 need to be configured for multi-segment speed selection.

Relevant parameters:

P03	00	Speed instruction source	0: Digitally setting (P03-03) 1: SPR (default AI1) 2: SPR, multi-segment instruction 2~16 switching 3: Multi-segment instruction 1~16 switching 4: Communication setting 5: SPR+ digital setting 6: Multi-segment instruction 1~16 switching + digital setting
P03	03	Speed instruction setting value	-9000rpm ~ 9000rpm
P05	00	AI1 minimum input	-10.00V ~ 10.00V
P05	01	Setting value corresponding to the AI1 minimum input	-100.0% ~ 100.0% Torque corresponds to the maximum system torque (100% speed corresponds to the maximum system speed)
P05	02	AI1 maximum input	-10.00V ~ 10.00V
P05	03	Setting value corresponding to the AI1 maximum input	-100.0% ~ 100.0%
P05	04	AI1 zero-point fine tuning	-500mV ~ 500mV
P05	05	AI1 dead band setting	0.0~20.0%

P05	06	AI1 input filtering time	0.0ms ~ 6553.5ms
P05	07	AI2 minimum input	-10.00V ~ 10.00V
P05	08	Setting value corresponding to the AI2 minimum input	-100.0% ~ 100.0%
P05	09	AI2 maximum input	-10.00V ~ 10.00V
P05	10	Setting value corresponding to the AI2 maximum input	-100.0% ~ 100.0%
P05	11	AI2 zero-point fine tuning	-500mV ~ 500mV
P05	12	AI2 dead band setting	0.0~20.0%
P05	13	AI2 input filtering time	0.0ms ~ 6553.5ms
P05	14	AI setting 100% speed	0~9000rpm
P05	15	AI setting 100% torque	0~5.00 times rated motor torque
P05	16	AI1 function selection	0: SPR, speed instruction 1: TQR, torque instruction 2: SPL, speed limit 3: TLMTP, positive torque limit 4: TLMTN, negative torque limit 5: TFFD, analog input as torque feed forward
P05	17	AI2 function selection	0: SPR, speed instruction 1: TQR, torque instruction 2: SPL, speed limit 3: TLMTP, positive torque limit 4: TLMTN, negative torque limit 5: TFFD, analog input as torque feed forward

Zero speed clamp (ZERO_SPD) function

By using the DI function ZERO_SPD, the speed instruction can be forced to 0. Setting parameter P03.19 determines whether it is necessary to switch to position control mode for locking.

Relevant parameters:

P03	19	Zero-speed clamp function	0: Invalid 1: When ZERO_SPD is valid, the speed instruction is forced to be 0 2: When ZERO_SPD is valid, the speed instruction is forced to 0. When the actual motor speed is lower than P 03.2 0, switch to position control and lock at the current position.
P03	20	Zero-speed clamp threshold value	0rpm ~ 1000rpm

Speed conformity（V_ CMP） detection function

The speed conformity V_CMP signal will be output when the speed instruction before acceleration/deceleration and motor speed feedback is within the range specified by P04.44 with a 10 rpm lag in the actual detection.

Relevant parameters:

P04	44	Speed conformity signal width	10rpm ~ 1000rpm

Speed arrival (V_ ARR) function

When the actual speed reaches above the specified speed value, the output speed reaches the V_ ARR signal with a 10 rpm lag in the actual detection.

Relevant parameters:

P04	45	Speed specified value arrival	10rpm ~ 9000rpm

Speed acceleration and deceleration function

There are two groups of acceleration/deceleration time. When an internal multi-stage speed instruction is used, select the acceleration/deceleration time of Group 1 or Group 2. When the acceleration/deceleration time is set to 10ms, it indicates the time of acceleration from 0rpm to 1000rpm or deceleration from 1000rpm to 0rpm is 10ms.

Relevant parameters:

P03	14	Acceleration time 1	0ms ~ 65535ms/1000rpm
P03	15	Deceleration time 1	0ms ~ 65535ms/1000rpm
P03	16	Acceleration time 2	0ms ~ 65535ms/1000rpm
P03	17	Deceleration time 2	0ms ~ 65535ms/1000rpm

4.3 Torque control mode

◆ Overview

Torque control is performed according to the given torque instruction (analog or internal torque setting), and a speed-limiting function must be added to limit the speed of the motor to a certain range for practical applications.

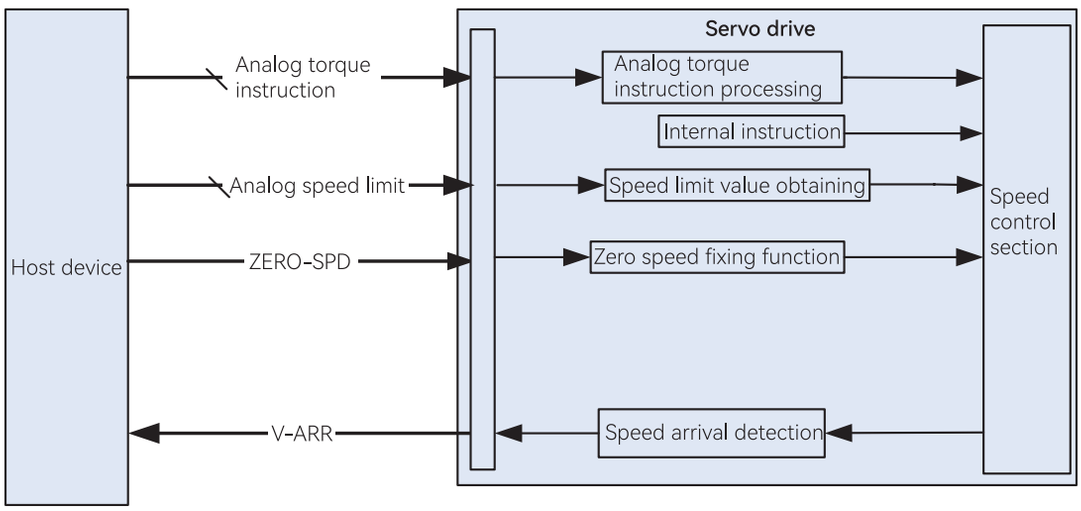


Figure Basic function block diagram of torque control

◆ Functional description

Torque instruction processing

The torque instruction source is set by P03.22. When P03.22 is equal to 1, the analog input channel of the TQR is first set by P05.16~18, and the analog torque instruction processing section converts the analog voltage given by the host device to A/D, and then corresponds the converted digital result to the specific torque instruction value following the set correspondence. At the same time, a digital filter can be set to prevent interference and eliminate noise.

When P03.22 is equal to 0, the speed instruction digital set value is set by P03.25.

When P03.22 is equal to 2, the DI function CMD_SEL switches between digital and analog settings.

Relevant parameters:

P03	22	Torque instruction source	0- Digital setting (P0325) 1- TQR 2- Digital setting, TQR switching (CMD_SEL) 3- Communication setting 4- TQR+ digital setting
P03	25	Torque instruction key set value	-100.0% to 100.0% (based on rated motor torque)

In this case, the analog-related parameters are the same as in the case of speed control.

Speed limit under torque control

In the torque control mode, the speed control circuit is disconnected, so the speed must be limited to prevent accidents. The speed limit function is to limit the motor rotation speed within a specified range. When the motor speed exceeds the speed limit value, the actual torque instruction is no longer equal to the torque instruction, but is equal to the output of the speed limit regulator. The speed limit value can be set by P03.27 and P03.28, or analog input SPL. The final speed limit must not exceed the maximum motor speed.

Relevant parameters:

P03	26	Speed limit source selection under torque control	0-Forward and reverse internal speed limits P03.27、28 1-SPL
P03	27	Internal positive speed limit	0rpm-9000rpm
P03	28	Internal negative speed limit	0rpm-9000rpm

The analog parameters are the same as for speed control.

4.4 Motion control function

4.4.1 Internal position instructions

◆ **Instructions for use**

In the position control mode, the drive can be selected to give instructions internally in addition to the external pulse given instructions, and users can conveniently set the total number of instructions, the running speed, the acceleration and deceleration time.

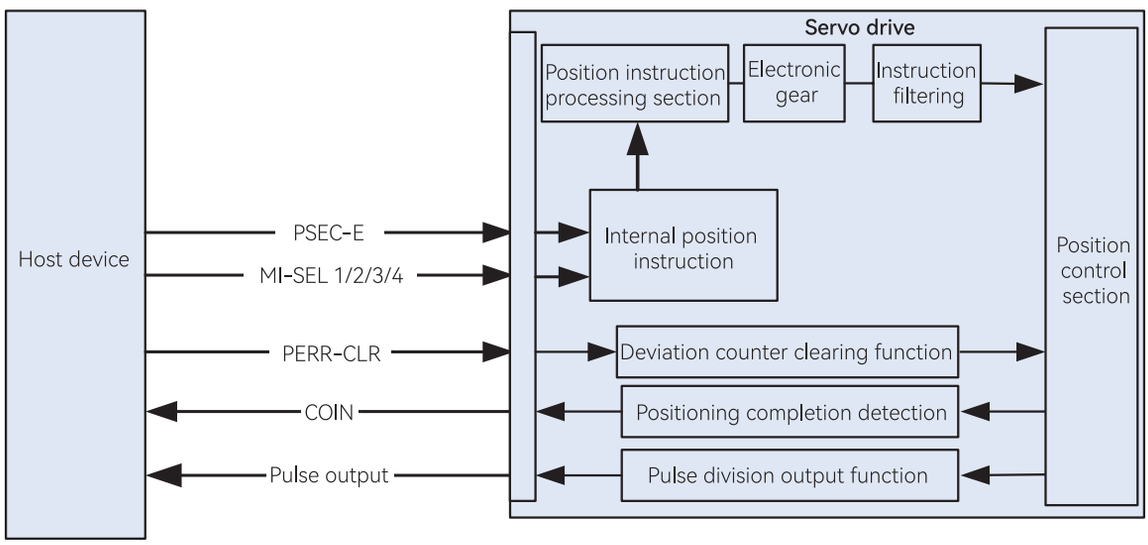


Figure Basic function diagram of internal position instruction

The internal position instruction, like the external pulse instruction, is subject to electronic gearing and position instruction filters, can accept deviation clearing signals, and outputs a positioning completion signal after positioning is completed, and can also be configured with pulse division output.

The internal position instructions are in user instruction unit, not encoder unit (the minimum resolution of the encoder) within the drive, so the electronic gear ratio has to be set to be compatible. For example, if the number of pulses per revolution of the motor encoder is Penc, and the user expects the motor to make one revolution when given Puser instruction units, then the electronic gear ratio to be set is Puser/Penc.

The internal position instructions can be set up to 16 different instruction segments, each with a different speed and acceleration/deceleration time. Sequential and random execution modes are available to execute certain segments of position instructions sequentially or randomly. Relative or absolute instructions can be configured, i.e., whether each segment is an increment relative to the current position or an absolute position relative to the zero point.

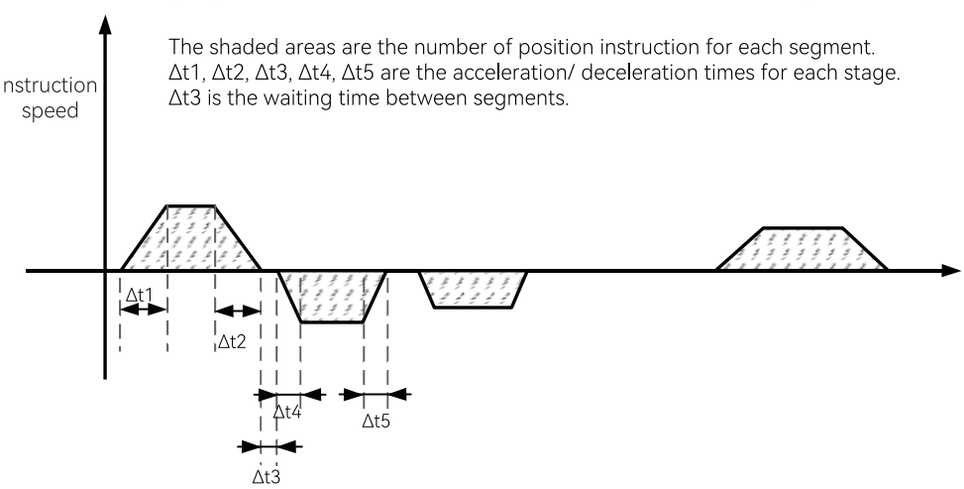
For the sequential execution mode, the starting segment number and the ending segment number can be set, so that it can be executed sequentially from the starting segment until the ending segment; it is possible to choose between a single operation and a cyclic operation. In a single operation, after the completion of the execution of the ending segment, no further operation is carried out. In a cyclic operation, after the completion of the execution of the ending segment, the execution starts again from the starting segment until the user terminates the operation. In addition, when executing sequentially, the waiting time between segments can be set.

For the random execution mode, it is possible to select the segment to be executed by DI terminal input signals or by communication settings. When selecting the segment number with the DI terminal, four DI interfaces at most need to be selected and configured with DI functions 6, 7, 8, and 9, respectively, as shown in the table below.

Segment No. / DI function	DI function 6	DI function 7	DI function 8	DI function 9
Internal position segment 1				
Internal position segment 2				
Internal position segment 3				
Internal position segment 4				
Internal position segment 5				
Internal position segment 6				
Internal position segment 7				
Internal position segment 8				
Internal position segment 9				
Internal position segment 10				
Internal position segment 11				
Internal position segment 12				
Internal position segment 13				
Internal position segment 14				
Internal position segment 15				
Internal position segment 16				

The shaded cells in the table indicate that the input signals of the corresponding DI terminals are valid, while the unshaded cells indicate that the input signals are invalid.

◆ **Refer to the following figure for the internal position instruction using procedure.**



When using the internal position instruction, it is necessary to input the internal multi-segment position enable signal (DI function 25) via DI after servo ON to give the position instruction.

◆ **Internal multi-segment position instruction execution flowchart:**

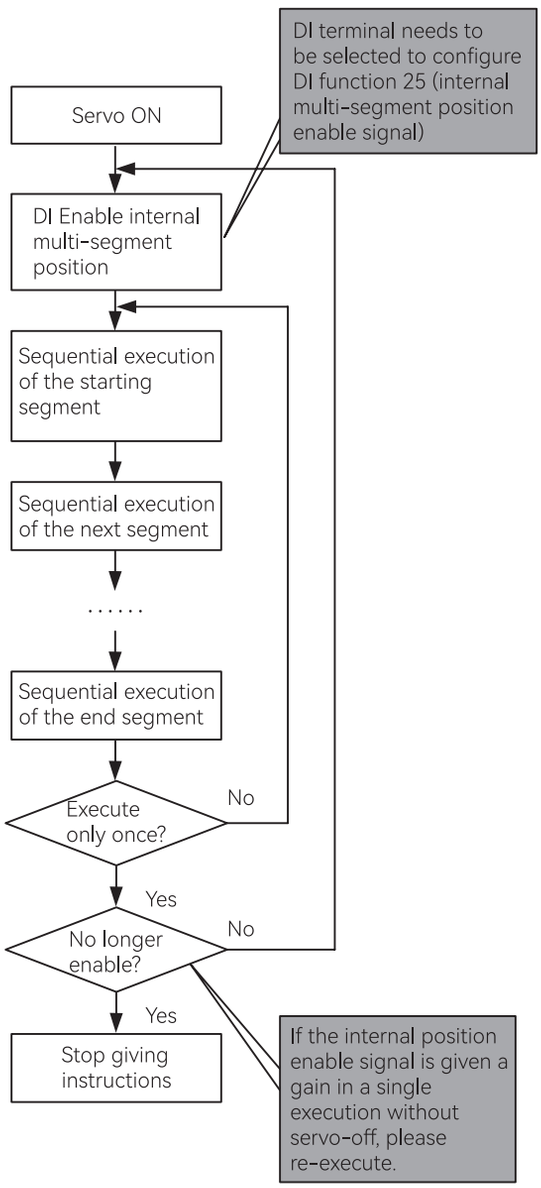


Figure Sequential execution of multiple segment positions

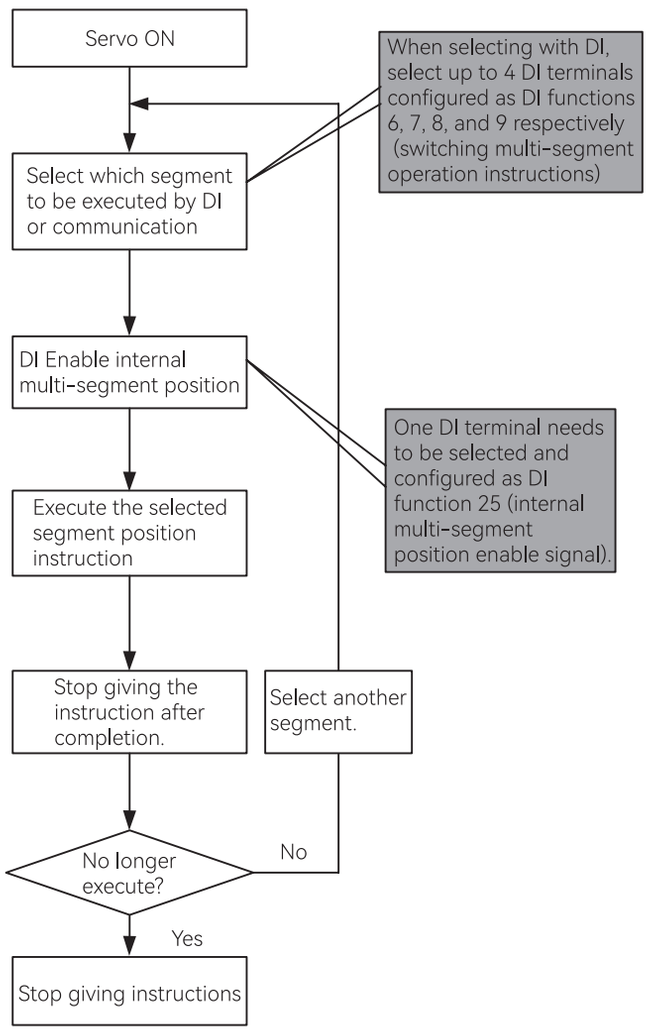


Figure Random selection of execution of multiple segment positions

◆ **Parameters**

To use the internal position instruction, the following parameters need to be configured:

P08	00	Multi-segment preset position execution method	0: Single operation 1: Cyclic operation 2: DI terminal switching operation 3: Communication switching operation 4: Single continuous operation 5: Cyclic continuous operation
P08	01	Starting segment number	The value of P08.01 is not greater than the setting value of P08.02. When P08.01 cannot be changed to a larger value, first change P08.02 to the desired maximum value and then modify P08.01.
P08	02	Ending segment number	The value of P08.02 is not less than the set value of P08.01.
P08	03	Dealing of residual segments after pausing and restarting	0: Run the remaining segments 1: Run from the starting segment again

P08	04	Position instruction type	0: Relative position instruction 1: Absolute position instruction
P08	05	Waiting time unit	0: ms 1: s
P08	06	The first segment displacement (32-bit)	Unit: user instruction unit
P08	08	The first segment maximum speed	Unit: RPM
P08	09	The first segment acceleration/deceleration time	Unit: millisecond
P08	10	Waiting time after the first segment completed	Unit is determined by P08.05

P08.06 to P08.10 is the number of position instruction pulses, running speed, acceleration/deceleration time, and wait time parameters after completion of the first segment, and the rest of the segments are similar as the first segment.

DI functions related to internal position instructions

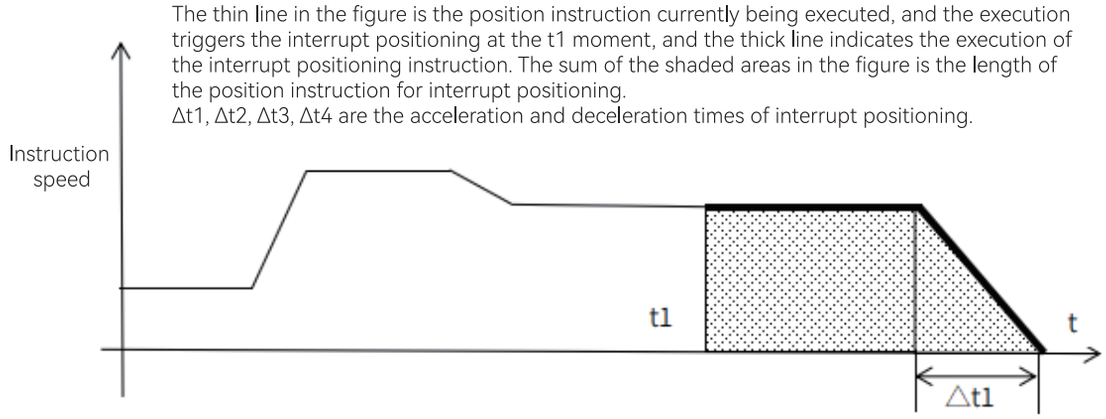
DI function 25	Internal multi-segment position instruction enable signal must be configured.
DI function 6	Switching 16-segment instruction must be configured when P08.00 is configured as 2. DI functions 6, 7, 8, and 9 are composed of four binary digits, Bit0 to Bit3, respectively. When the DI function is valid, it means the binary digit is 1, and when it is invalid, it means the binary digit is 0. Accordingly, the four binary digits, 0000 to 1111, correspond to the first to the sixteenth segments respectively.
DI function 7	
DI function 8	
DI function 9	

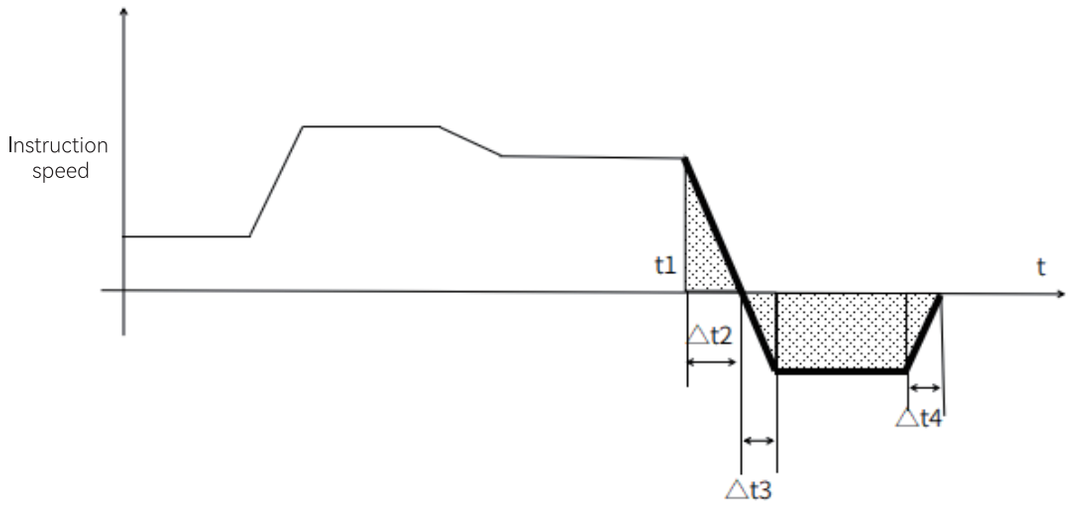
4.4.2 Interrupt positioning

◆ Overview

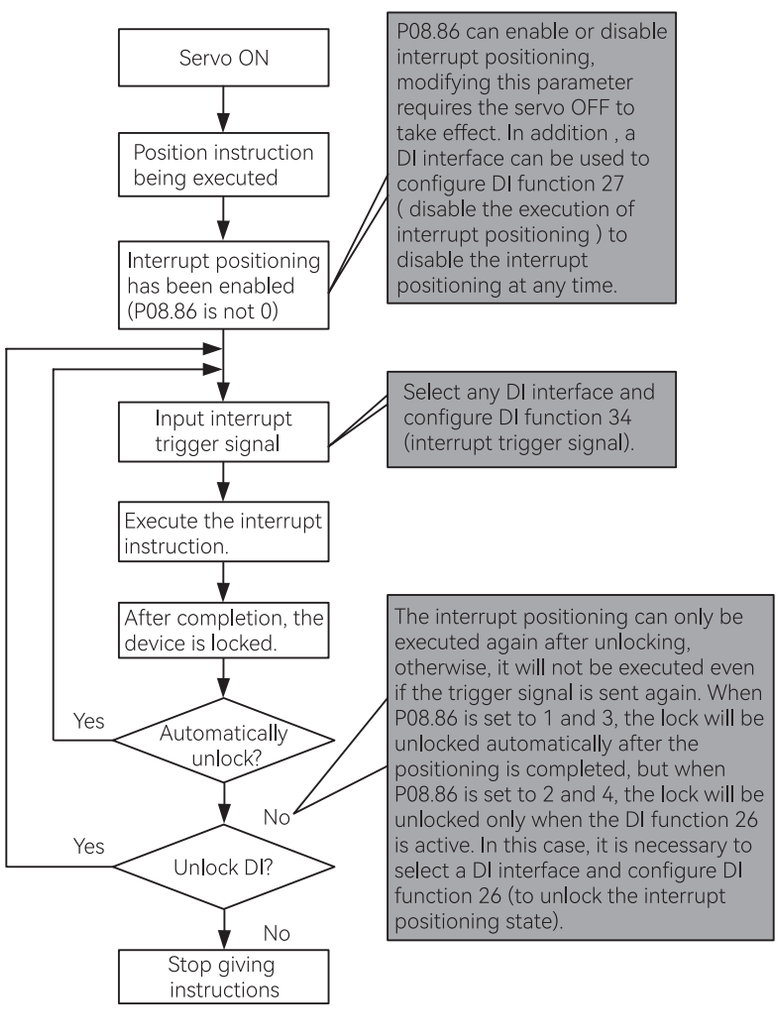
Interrupt positioning is also a form of internal positional instruction that, in position control mode, can interrupt an executing positional instruction (whether it is an external pulse instruction or the rest of the internal positional instructions) at any point in time and go to a user-specified segment of positional instructions, as shown in the figure below.

The thin line in the figure is the position instruction currently being executed, and the execution triggers the interrupt positioning at the t1 moment, and the thick line indicates the execution of the interrupt positioning instruction. The sum of the shaded areas in the figure is the length of the position instruction for interrupt positioning.
Δt1, Δt2, Δt3, Δt4 are the acceleration and deceleration times of interrupt positioning.





◆ **nterrupt positioning execution process**



To use interrupt positioning, it is necessary to configure the following parameters and the DI interface, and if necessary, configure two DO function outputs, which can be used to monitor the process of Interrupt positioning. The number of position instructions and the acceleration/deceleration times for the interrupt positioning are configured using the 16th instruction parameter of the internal position instruction, see the following table for the specific parameter configuration.

◆ Parameters for interrupt positioning configuration

P08	81	The 16th segment displacement (32-bit)	Unit: User instruction unit, which is used to set the length of the interrupt positioning instruction
P08	83	The 16th segment maximum speed	Unit: RPM, which is used to set the running speed during interrupt positioning.
P08	84	The 16th segment acceleration/deceleration time	Unit: ms, which is used to set the acceleration and deceleration time during interrupt positioning.
P08	86	Position instruction interrupt execution setting	0: Disable the function of interrupt execution; 1: Enable, interrupt at the rising edge of the DI signal, and automatically release the interrupt lock state after completion; 2: Enable, interrupt at the rising edge of DI signal, and release the interrupt status by DI signal XINT_ULK (DI function 26) after completion; 3: Enable, interrupt at the falling edge of the DI signal, and release the interrupt status automatically after completion; 4: Enable, interrupt at the falling edge of DI signal, after completion, interrupt by DI signal XINT_ULK (DI function 26). XINT_ULK (DI function 26) to release the interrupt status.

◆ DI function related to internal position instruction

DI function 34	Trigger interrupt positioning, which must be configured
DI function 26	Release interrupt positioning, which must be configured if P08.86 is set to 2 or 4, and can be configured to any DI interface.
DI function 27	Disable the use of interrupt positioning at any time, optional, configurable to any DI interface
DI function 15	When output monitoring is valid, it indicates that interrupt positioning has been executed. It is optional, which indicates that it can be configured to any DO interface
DI function 18	When output monitoring is valid, it indicates that interrupt positioning is being executed. It is optional, which indicates that it can be configured to any DO interface

◆ Interrupt execution direction

(1) Set the second digit from the right of P07.16 to 0: follow the current running direction

Current running direction	Instruction increment for interrupt positioning	The direction of the running interrupt
Positive	Negative	Negative
Positive	Positive	Positive
Negative	Positive	Negative
Negative	Negative	Positive

(2) Set the second digit from the right of P07.16 to 1: determined by the sign of the instruction value

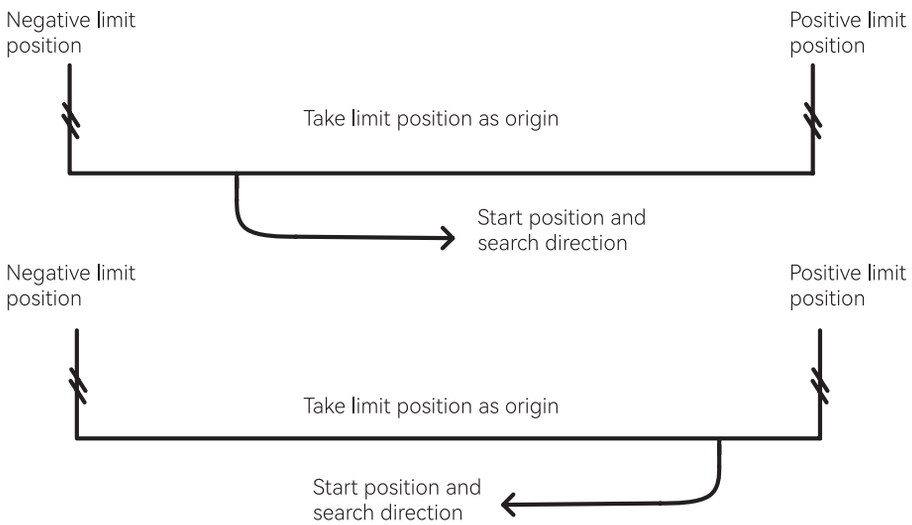
Current running direction	Instruction increment for interrupt positioning	The direction of the running interrupt
Positive	Negative	Negative
Positive	Positive	Positive
Negative	Positive	Positive
Negative	Negative	Negative

When the position instruction is 0, the direction of interrupt operation is the direction of the interrupt position instruction increment.

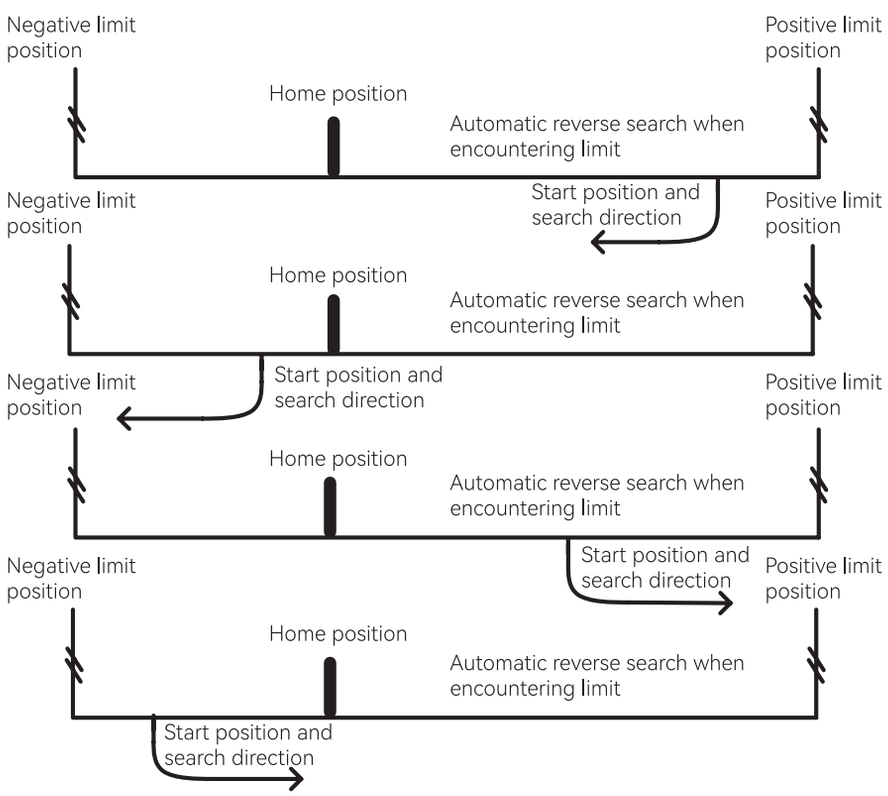
4.4.3 Homing

◆ **Instructions for use**

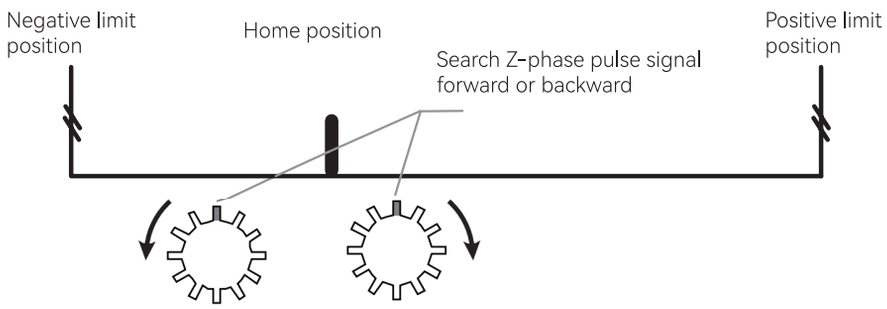
The servo drive is equipped with an internal homing function, which supports various ways for searching the origin independently, and can work together with the upper device to realize the homing function. If the limit position is the origin, as shown in the figure below, the Z pulse signal can be searched according to actual need, and various ways of searching origin can be realized.



Please refer to the following figures for the situation involving the origin sensor. Several factors need to be considered: the difference between positive and negative search at the start position, the use of rising edge or falling edge for the home position sensor signal, the decision to use the Z-phase pulse signal, and determining the direction of the Z-phase pulse signal search (finding the Z-phase pulse signal forward or backward after locating the home position sensor signal).



When using Z-phase pulses, different directions for finding Z-phase pulses will lead to different origin position. For details, refer to the figure below.



◆ Parameters

To use the homing function, set the following parameters and DIDO functions. Use P08.88 to configure the startup method of homing, and use P08.89 to set the method of searching for the origin. During origin search, the limit position may be encountered. When encountering the limit position, choose the alarm stop or automatic direction searching, and use P08.90 to configure the handling method of the limit position. Use P08.92 and P08.93 to set the high-speed search speed and low-speed search speed, and use P08.94 to set the acceleration and deceleration time during the search. In addition, since there is a time limit on the origin search, use P08.95 to set the upper time limit. If the origin is not found beyond the set time, AL.96 will be reported and the search will be stopped.

Homing-related parameters

P08	88	Homing start method	0: OFF 1: Start by STHOME via DI function 2: Start by operation panel 3: Start by communication 4: Immediate start after the first servo ON
P08	89	Homing mode	0: Forward rotation to search for the origin, with the positive limit as the origin 1: Reverse rotation to search for the origin, with the negative limit as the origin 2: Forward rotation to search for the origin, with the HOME_IN signal OFF → ON as the origin 3: Reverse rotation to search for the origin, with the HOME_IN signal OFF → ON as the origin 4: Forward rotation to search for the origin, with the HOME_IN signal ON → OFF as the origin 5: Reverse rotation to search for the origin, with the HOME_IN signal ON → OFF as the origin 6: Forward rotation to directly search for the nearest Z signal as the origin 7: Reverse rotation to directly search for the nearest Z signal as the origin 8: Directly use the current position as the origin

P08	90	Limit switch and Z-phase signal setting during homing	0: Reverse to find Z-phase signal after encountering limit switch; 1: Forward to find Z-phase signal after encountering limit switch; 2: Not to find Z-phase signal after encountering limit switch; 3: Stop and output alarm after encountering limit switch, reverse to find Z -phase signal 4: Stop and output alarm after encountering limit switch, forward to find Z-phase signal 5: Stop and output alarm after encountering limit switch, not to find Z-phase signal Note: For encountering limit switch, if the homing mode is set to 0 to 1, no alarm or stop even though this parameter is set to 3, 4 or 5. If the homing mode i s set to 0 to 1 , find Z -phase signal after encountering limit switch; If homing mode is set to 2 to 5, find Z-phase signal after encountering HOME_IN signal.
P08	92	Origin search high speed	Start with this speed when homing is enabled
P08	93	Origin search low speed	Switch to low speed after encountering origin point or deceleration point
P08	94	Acceleration/deceleration time at origin search	Set the acceleration/deceleration time at the start/ stop of origin search. Unit: ms.
P08	95	Homing time limit	Limit the longest time of homing. If origin point is still not found after the time set in P08.95, AL.96 occurs and operation stops.
P08	96	Origin offset (32-bit)	The absolute position counter will be cleared after finding the origin point or set the absolute position counter to the value of this parameter.
P08	98	Mechanical origin offset (32-bit)	System can move further in the distance set in this parameter after origin point is found.

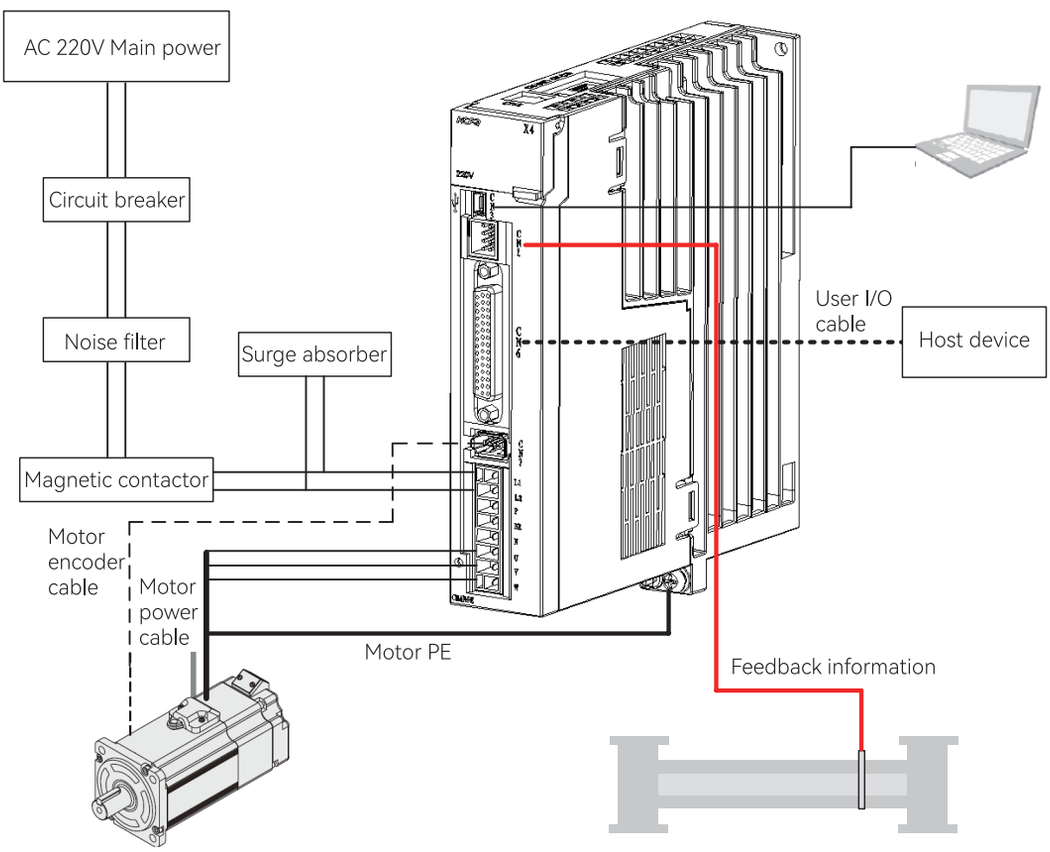
Related DI DO function during homing

DI function 29	Homing start, must be set and can be configured to any DI terminal.
DI function 28	Origin signal, when P08.89= 2, 3, 4, 5, must be set and can be configured to any DI terminal.
DI function 33	Deceleration point sensor signal, optional, but it is not necessary in most occasions.
DO function 17	Homing completion signal and can be configured to any DO terminal.

4.5 Full closed-loop control

X5 series drive, X5FA (X5 pulse full-function type) model has a second encoder interface and supports full closed-loop control mode, so please check the drive model before use. Full closed-loop control is a mode of control that involves detecting the position of the controlled object using a position detector, such as a grating, and then providing position information back to the servo for control. A full closed-loop control system is capable of disregarding errors generated by the transmission system and directly controlling the object with precision.

◆ Wiring diagram



◆ Instructions for use

1. Correct wiring

After making sure that the wiring is correct according to the above wiring diagram, proceed to connect the power supply and turn it on to verify that the drive is not enabled. Refer to section 2.1 "System wiring diagram" in this manual for specific details regarding the drive power supply cable specifications.

2. JOG

With the full closed loop function is enabled, mount the motor on the device and perform JOG to check if the device can operate normally. If it does not run normally or other problems occur, please solve all the problems until it can be JOG normally, then proceed to the next step.

3. Set parameters for fully closed loop mode

Before the fully closed-loop mode is enabled, there are some relevant parameters to be set, mainly P17.01 (external sensor pitch), P17.03 (fully closed-loop mixed deviation threshold), P17.05 (mixed deviation count setting).

(1) 17.01 External sensor pitch

The value of P17.01 (external encoder pitch) is set to the number of pulses fed back from the grating for one revolution of the motor. There are two ways to set the pitch:

① By calculating:

External sensor pitch 1 = Lead / grating resolution

Lead: If a screw is used, the lead is equal to one pitch.

Grating resolution: Available from the grating instruction manual, or from the engineer who purchased the external sensor.

External sensor reception method

If AB orthogonal reception is used:

External sensor pitch 2 = External sensor pitch 1 X 4

Reduction gear between motor and grating

External sensor pitch 3 = External sensor pitch 2 / Reduction ratio

② Disconnecting the grating closed loop test: (recommended)

Check and connect the grating;

View the P17.13 parameter value when enabled and record the parameter value;

Run the motor for one revolution by other means such as internal position or pulse control;

Subtract the current parameter value from the recorded parameter value to get the number of pulses traveled during the running process, and repeat steps 2) 3) several times to avoid errors; Set the external sensor pitch according to the number of pulses traveled;

According to the positive and negative direction of the number of pulses traveled, set the way of using the external sensor;

③ Manual test

In case the parameters of the machine are not clear, follow the steps below to set up:

First, check the P17.13 parameter value and record the parameter value;

Check the P17.13 parameter value by manually rotating the motor in the forward direction for one revolution.

Subtract the current parameter value from the recorded parameter value to get the number of pulses traveled during the running process. Repeat steps 2) and 3) several times to avoid errors. Set the external sensor pitch according to the number of pulses traveled.

Set the external sensor use mode according to the positive or negative direction of the number of pulses traveled.

(2) P17.03 Fully closed loop mixed deviation excessive threshold value

To ensure safety, before turning on the full closed-loop mode, please set a reasonable full closed-loop mixed deviation oversize threshold (P17.03), if the value of P17.09 is greater than the value of P17.03, the system will report Err.069.

(3) P17.05 Mixed deviation count setting

Set the proper mixed deviation count value (P17.05). The mixed deviation will be cleared to zero after a set number of motor revolutions.

(4) Enable full closed-loop mode

Before enabling full closed loop mode, manually or by JOG, rotate the motor in the forward direction to see if the value of P17.13 (external sensor counter) increases or decreases. If the value of P17.13 increases, set P17.00 to 1 to enable full closed loop mode. If the value of P17.13 decreases, set P17.00 to 2 to enable full closed loop mode.

P17	00	External encoder usage	0: No external sensor is used for position feedback 1: The external sensor is used as position feedback, and the external encoder count is increased when the motor direction is CCW. 2: The external sensor is used as position feedback and the external encoder counter increased when the motor direction is CCW.

◆ Functions related to full closed-loop control

1、Pulse output function

Set P00.18 (pulse output function selection) to select either motor encoder division frequency output or external encoder pulse synchronous output, depending on the customer's requirements. For details, see "Pulse division output" in the section 5.4 of this manual.

21	OUTA+	Pulse output A
22	OUTA-	Pulse output /A
25	OUTB+	Pulse output B
23	OUTB-	Pulse output /B

2、Absolute value system

To remember the current position after a power off, please enable the absolute value system of the servo, further details are given in the section "5.3 Absolute system", and use the value of P21.07 as the feedback.

◆ Precautions

Please confirm the drive model before use. Full closed-loop control mode is only supported by the full-function model.

Do not enable the servo before setting the parameters according to the above steps. If the parameters do not match, enabling the servo will cause excessive mixed deviation or tripping.

The scale full closed loop interface is currently only suitable for general-purpose scale signals and can only receive AB quadrature pulses.

If P06.49 (high-speed pulse input filtering) is not set correctly, it may cause the servo to receive an abnormal number of scale pulses, resulting in servo running position deviation. The value of P06.49 is related to the frequency of the scale input pulses, and the specific settings are as follows:

Scale input pulse frequency (Hz) = (Pitch X maximum speed) ÷ 60

For example:

The pitch is 20000, maximum speed is 1300rpm.

The scale input pulse frequency is (20000 X 1300) ÷ 60 = 433333Hz.

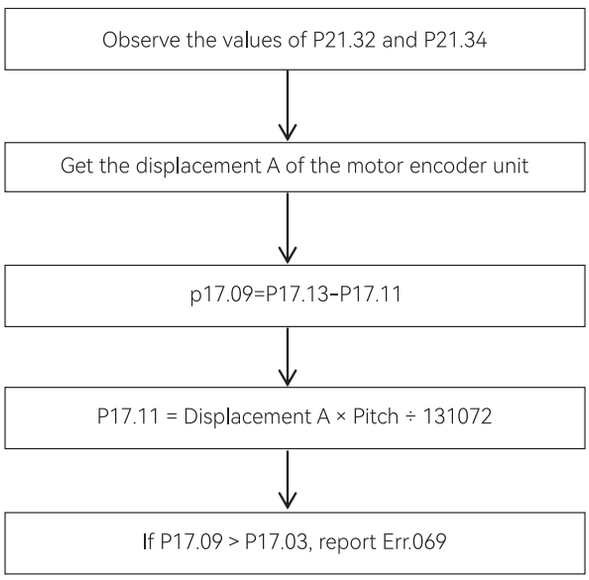
According to the parameter description, the recommended filter is 20 when the input frequency is 433KHz, so P06.49 is set to 20.

When using the host device to observe the waveform, the display curve changes as follows:

m Test 1: External speed feedback

m Test 2: External position feedback

◆ Relation diagram of 17-bit encoder motor parameters



◆ Configuration parameters related to full closed-loop control

P00	18	Pulse output function selection	0- Encoder division output 1- Synchronized output of pulse instruction 2- Pulse instruction interpolation output (gantry synchronization) 3- External encoder pulse synchronization output
P06	49	High-speed pulse input filtering	0 ~ 100 (unit: 10ns) 250KHZ or less, recommended value: 40; 250K ~ 500K, recommended value: 20; 500K ~ 1M, recommended value: 10; 1M or more; recommended value: 5; 2M or more; set to 0.
P17	00	External sensor usage	0- Use no external sensor for position feedback 1- Use external sensor for position feedback, motor encoder count (P21.34) increases, external sensor count (P17.13) increases 2- Using an external sensor for position feedback increases the motor encoder count (P21.34) and the external sensor count (P17.13) decreases.
P17	01	External sensor pitch	Sets the number of feedback pulses from the external sensor for one revolution of the motor: 0 ~ 1073741824
P17	03	Full closed loop mixed deviation threshold (32-bit)	If the full closed-loop mixed deviation exceeds this setting, the system reports a mixed excessive deviation fault; when set to 0, it does not turn on; 0~1073741824
P17	05	Mixed deviation count setting	0 ~ 100%
P17	08	Full closed loop speed feedback setting	0- Closed loop feedback using internal speed 1- Closed loop feedback using external speed
P17	09	External units for full closed loop mixed deviation	Difference between external sensor pulse count and internal encoder count
P17	11	External units for internal encoder count value	Internal encoder count, converted to external pulse unit display
P17	13	External sensor count value	External sensor pulse input count, indicating external position information

Chapter 5 Application function

5.1 Stop protection function

The stop protection functions include instantaneous power failure protection, fault stop protection, and over-travel stop protection, which are not enabled by default. Users can turn on the corresponding protection function according to actual demands.

5.1.1 Instantaneous power failure protection

When the machine is in normal operation, if a sudden power failure occurs in the factory, after the power failure protection function is turned on, the servo can use the residual internal power to stop the motor quickly, so that the motor does not coast to stop and result in mechanism damages. Parameters related to the instantaneous power failure protection function are P06.24 and P06.25

P06.24	Instantaneous power failure protection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	立即生效	P	S	T

By enabling this protection function, the previous status before the main power failure can be restored immediately if an instantaneous restoration of power is conducted.

0: Not enabled (In case of the third type of fault, the motor will be stopped according to the setting of P06.27)

1: Enabled (In case of instantaneous power failure, the quick stop will be carried out according to the time set in P06.25)

P06.25	Instantaneous power failure deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	20	1ms	Immediate	P	S	T

After the instantaneous power failure protection is enabled, when the main power supply suddenly loses power, the stop deceleration time is set by this parameter. The range is 0ms to 10000ms/1000rpm, this parameter can be set according to users' actual needs, and it is generally recommended to set this parameter within 30.

5.1.2 Fault stop protection

When the drive is running normally, if a fault occurs suddenly, after setting the fault stop mode, the servo motor can be stopped quickly, so that the motor does not coast to stop and result in mechanism damages.

P06.27	Selection of the second type of fault stop method	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	4	--	Restart	P	S	T

0: Coast to stop, and remain free. After the second type of fault occurs, the motor current will be switched off and the motor will coast to stop.

1: Zero-speed stop, and remain free. After the second type of fault occurs, the motor current will keep outputting for a certain period until the motor stops completely, after which the motor remains free.

2: Stop by emergency stop torque, and remain free. After the second type of fault occurs, the motor will be stopped immediately with the torque set in parameter P06.32. After the stop, the motor remains free.

3: DB stop, and hold DB. After the second type of fault occurs, the motor will conduct a DB stop and continue to hold the DB after the stop is completed.

4: Zero-speed stop, and hold DB. After the second type of fault occurs, the motor current will keep outputting for a certain period until the motor stops completely, after which the motor remains in the DB status.

5: Stop by emergency stop torque, and hold DB. After the second type of fault occurs, the motor will be stopped immediately with the torque set in parameter P06.32. After the stop, the motor remains in a DB status.

P06.32	Stop by emergency stop torque	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	1000	0.1%	Immediate	P	S	T

0.0% to 300.0% (based on rated motor torque)

5.1.3 Over-travel stop protection

The overtravel stop mode is used to meet the stopping needs of different situations. If a quick stop is required, it can be set to a zero-speed stop or stop by emergency stop torque.

P06.28	Overtravel input setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Restart	P	S	T

0: DI function 14 (P_OT) positive drive is disabled, and DI function 15 (N_OT) negative drive is disabled.

1: Invalid

P06.29	Over-travel stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P	S	T

0: Coast to stop, and remain zero-speed. (motor shaft is locked when over-travel is valid)

1: Zero-speed stop, and remain zero-speed. (motor shaft is locked when over-travel is valid)

2: Stop by emergency stop torque, and remain free. (positive over-travel is valid, positive direction is locked, negative direction remains free; negative over-travel is valid, negative direction is locked; positive direction remains free)

5.1.4 Stop protection deceleration time

When the fault stop mode is coast to stop, no deceleration process is planned.

When the overtravel stop mode is zero-speed stop or stop by emergency stop torque, the instruction deceleration time is controlled by P07.14.

When in position mode with external pulse instructions, the fault stop mode is zero-speed or stop by emergency stop torque, and the stop time is controlled by P07.14.

When in position mode with internal position instructions, the fault stop mode is zero-speed or stop by emergency stop torque, and the stop time is controlled by P08.09.

When in position mode with internal position interrupt, the fault stop mode is zero-speed or stop by emergency stop torque, and the stop time is controlled by P08.84.

When in speed and torque modes, the fault stop mode is zero-speed or stop by emergency stop torque, and the stop time is controlled by P03.15.

5.2 Soft limit function

The soft limit function is designed to meet the needs of different situations. After enabling the soft limit function, when the motor runs beyond the set range, the drive will report the overtravel warning, the motor will stop running, so that it can play a protective role.

Related parameters : P06.28, P06.29, P07.08, P07.24, P07.26

◆ **Parameter setting method**

Set P06.28 to 0 to enable over-travel setting. Select over-travel stop mode in P06.29.

The soft limit function is activated by setting P07.08 at the fourth digit from the right:

P07.08 = "Hx 0000", soft limit is not enabled.

P07.08 = "Hx 1000", soft limit detection is enabled immediately after power-on.

P07.08 = "Hx 2000", soft limit detection is enabled after the homing is completed.

P07.24 sets the value of the positive soft limit. P07.26 sets the value of the negative soft limit.

P07.24	Positive soft limit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	2147483647	--	Restart	P	S	T

The positive soft limit is effective in position control, speed control, and torque control modes.

P07.26	Negative soft limit (32-bits)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	-2147483648	--	Restart	P	S	T

The negative soft limit is , effective in position control, speed control and torque control modes.

If the value of P21.07 (absolute position counter) exceeds the range set in P07.26 to P07.24 during motor operation, an over-travel warning is reported and the motor is stopped for protection.

5.3 Absolute system

◆ Introduction

The absolute system, if it is enabled normally after the drive main power supply and control power supply is cut off, the motor encoder value will not be cleared and will continue to be powered by the external battery, with the encoder absolute position data remaining unchanged. After re-powering on, the drive can get the motor's absolute position information from the encoder and display it in parameters P21.32 (number of absolute position encoder turns) and P21.34 (absolute position encoder single-turn position).

◆ Relevant parameters

P06.47	Absolute system setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 19	0	--	Restart	P	S	T

0 ~ 19

Ones place:

0: Incremental system;

1: Absolute system(Err.12 needs manual clearing, set P20.06 to 7);

2: Absolute system (Err.12 needs manual clearing, set P20.06 to 7);

3~9: Absolute system with overflow error.

Tens place:

0: Battery undervoltage warning and keep running;

1: Battery undervoltage warning and stop.

The incremental or absolute mode can be set in the ones place of this parameter, and whether AL.097 or Err.015 is reported in the event of the encoder battery undervoltage can be set in the tens place.

◆ Instruction for use

When using the absolute value system, P06.47 needs to be set to 1 or 2 to enable the absolute value system.

When the absolute system is enabled for the first time and the power is restored, Err.012 (abnormal number of absolute encoder turn) is reported, which is a warning for the initialization of the encoder. If P06.47 is set to 1, the fault is reset with DI or is cleared by P20.01, and the "ok rdy" state can be entered by re-powering up after the fault is cleared.

If P06.47 is set to 2, it is necessary to set parameter P20.06 to "7" one time to initialize the encoder, and then reset with DI or clear the fault with P20.01 or re-power on the encoder, then the encoder can enter the "ok rdy" state.

If the servo still reports fault No. 12 when the power is restored after performing the above operations, please check as follows:

① Check whether there is any abnormality in the encoder wiring, if so, please rewire it.

② Check whether the battery is normal, if the voltage is insufficient, please replace the battery.

③ Detect whether there are 6 encoder cables, if not, then this encoder cable is incremental and cannot remember the absolute position, please replace the cable.

5.4 Pulse output function

The drive has three main pulse outputs, A, B and Z. See the table below for details:

Signal name	Output pin No.	Name	Note
OUT_A	CN6-21	Encoder division pulse output A-phase	As the motor rotates, the A-phase and B-phase pulses are output outward with a 90° phase difference.
OUT_/A	CN6-22		
OUT_B	CN6-25	Encoder division pulse output B-phase	
OUT_/B	CN6-23		
OUT_Z	CN6-13	Encoder division pulse output Z-phase	The motor rotates one revolution and outputs a pulse.
OUT_/Z	CN6-24		

5.4.1 Pulse division output

The parameters related to the pulse division output are P00.14 (output pulse number per turn of motor rotation (32-bit)) and P00.16（pulse output positive direction definition）. The details of the parameters are shown as follow.

（1）The number of division frequency output pulse is set by P00.14.

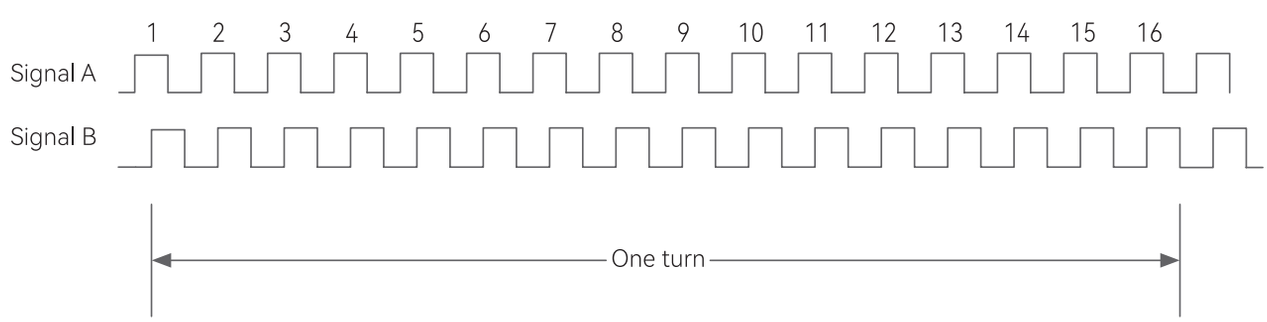
P00.14	Pulse number per turn of motor rotation (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		16 ~ 1073741824	2500	1PPR	Restart	P		

Set the number of OUTA or OUTB pulses output per turn of the motor.

16PPR ~ 1073741824PPR（calculation of the corresponding number of cables by incremental optical encoder）

Example:

When P00.14 = 16, the motor rotates one turn and 16 pulses are output from phase A and phase B respectively, as shown below.



(2) The positive direction of division frequency output pulse is set by P00.14.

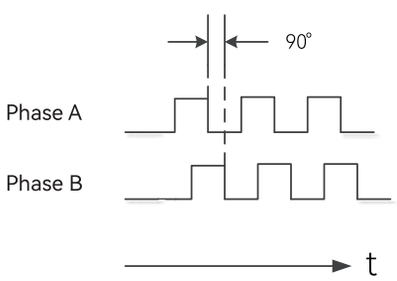
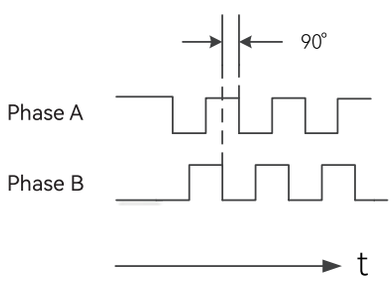
P00.16	Pulse output positive direction definition	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Set the phase sequence logic for the pulse output function.

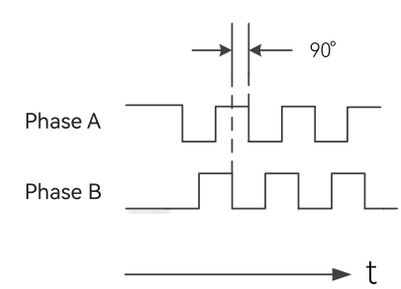
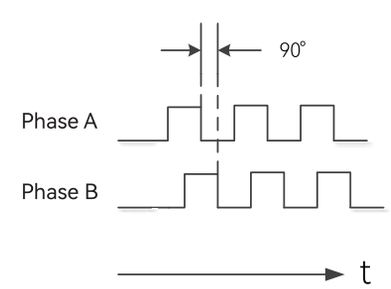
0: CCW (Pulse output OUTA is ahead of OUTB when the motor rotation direction is CCW.)

1: CW (Pulse output OUTA is ahead of OUTB when the motor rotation direction is CW.)

When P00.16 = 0, the A/B pulse output phase relation is as follows:

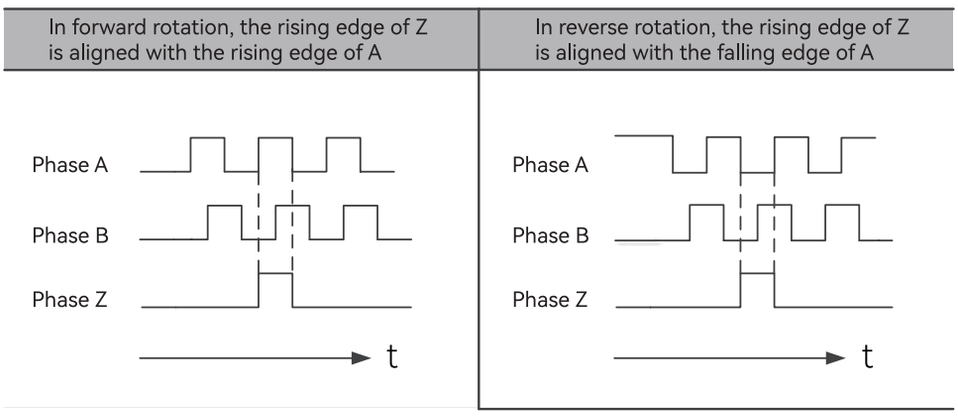
In forward rotation, phase A is 90° ahead of phase B	In reverse rotation, phase B is 90° ahead of phase A
	

When P00.16 = 1, the A/B pulse output phase relation is as follows:

In forward rotation, phase B is 90° ahead of phase A	In reverse rotation, phase A is 90° ahead of phase B
	

5.4.2 Z-phase signal output

Generally, the Z-phase output pulse is shown below:

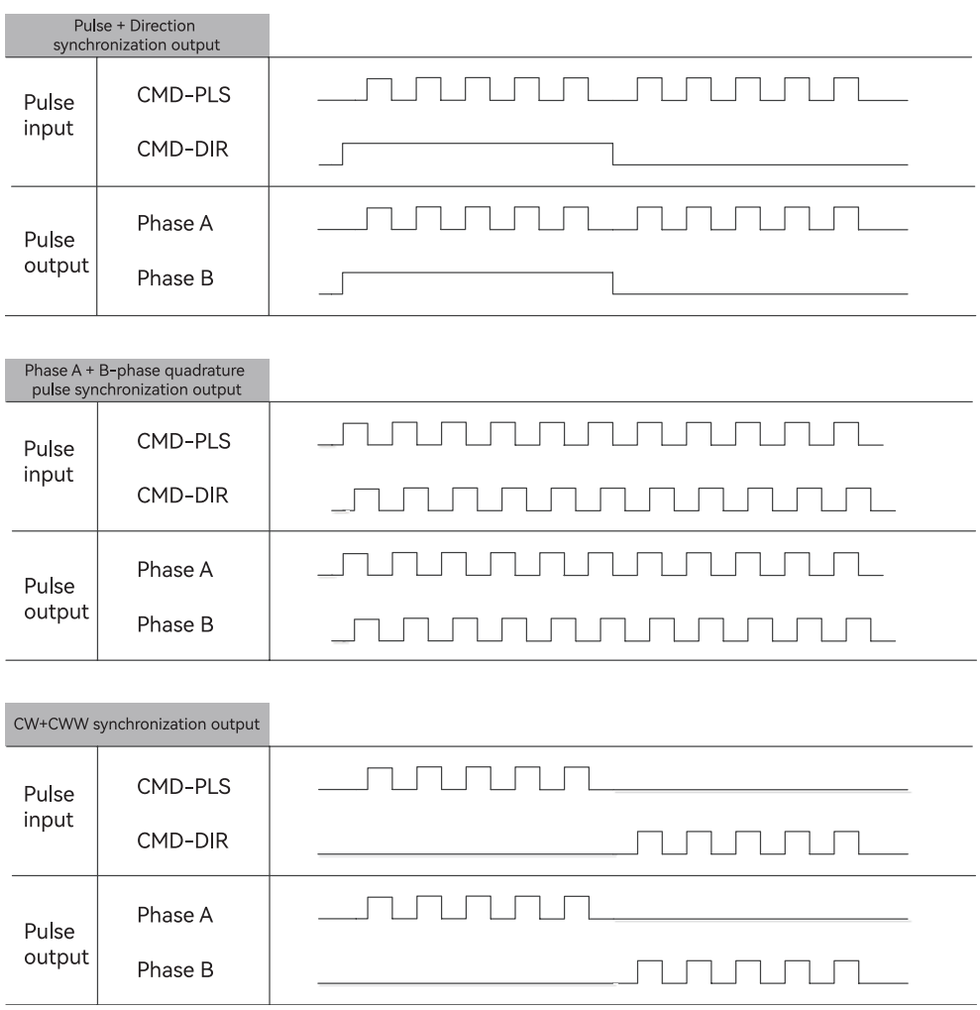


P00.17 can set whether the Z-phase pulse is high or low when it arrives, the default is high.

P04.57 can set the width of the Z-phase pulse when it arrives, the default is 0, and the width is the same as that of A.

5.4.3 Pulse synchronization output function

Set P00.18 to 1 to achieve the function of synchronizing the pulses of multiple drives, in which the outputs of drives A and B are in line with the input pulses (no need to enable).



5.5 MODBUS communication

The following describes the wiring method between drives and the setting method for the communication address of each drive.

With multi-station communication, the host device, when is only wired to one servo drive, can change the parameters of multiple servo drives and observe the waveforms of position deviation, rotation speed, etc.

The communication conditions are shown in the table to the right:

Communication condition	
Electrical specifications	EIA485
Communication mode	Asynchronous serial communication (half duplex)
Communication speed	2.4 kbps ~ 115.2 kbps
Data bit	8 bit
Check bit	0 bit ~ 1 bit
Stop bit	1 bit ~ 2 bit
Alarm detection	CRC16-CCITT
Data transfer	8 bit binary coding
Data communication length	Less than 35 bytes

5.5.1 Read/write parameter by communication

The following numbers have "H" added at the end to indicate hexadecimal numbers.

Communication parameter address: 8 bits to the left of the group number + in-group offset.

For example, if the value of P08.11 is calculated according to the rule, the address is 080BH.

Without encryption, all parameters are readable and writable.

Certain parameters are not rewritable while the drive is running, in which case communication returns an error when the rewrite instruction is entered.

The 32-bit function code must read and write the high and low 16 bits at one time, and cannot read and write only the high or low 16 bits, i.e., it can only read 32 bits with 03H instruction and write 32 bits with 10H instruction.

The user password parameter only supports writing, when reading, it always returns 0, and when the password parameter uses communication input, i.e., when it is input with 06H or 10H instruction, it does not change the value of the password itself, but only inputs the password, and the password can only be changed with the keyboard operation.

When the communication writes a parameter, it usually only rewrites the value in the memory and does not write it to the EEPROM. If the rewritten parameter needs to be written to the EEPROM (it can be recovered after power loss), the corresponding address value of the parameter will be summed up with the E000H as the address of the parameter, and then it will be written again. For example, to rewrite the value of P08.11, the address is 080BH, and if it needs to be stored in EEPROM after rewriting, the address will be 080BH + E000H = E80BH.

5.5.2 Read/write command by communication

1. Command for communication to read one or more consecutive 16-bit registers 03H

The format of the request frame for the 03H command is shown in the following table (all data in the table are hexadecimal numbers):

Slave address	Modbus instruction	Start address of registers read (H)	Start address of registers read (L)	Register quantity (H)	Register quantity (L)	CRC (L)	CRC (H)
01	03	12	00	00	01	81	72

2. Command for communication to write a 16-bit register 06H

The format of the request frame for the 06H command is shown in the following table (all data in the table are hexadecimal numbers):

Slave address	Modbus instruction	Start address of registers written (H)	Start address of registers written (L)	Data value written (H)	Data value written (L)	CRC (L)	CRC (H)
01	06	08	01	00	02	5B	AB

The request frame and response frame of the 06H command are identical.

3. Command for communication to write multiple consecutive 16-bit registers 10H

The request frame format for the 10H command is shown in the following table (all data in the table are hexadecimal numbers):

01	Slave address
10	Modbus instruction
08	Start address of registers written (H)
0B	Start address of registers written (L)
00	Register quantity (H)
05	Register quantity (L)
0A	Total bytes of data written
4E	The first written value (H)
20	The first written value (L)
00	The second written value (H)
00	The second written value (L)
04	The third written value (H)
B0	The third written value (L)
00	The fourth written value (H)
64	The fourth written value (L)
00	The fifth written value (H)
14	The fifth written value (L)
F8	CRC (L)
5B	CRC (H)

The format of the response frame for the 10H command is shown in the table below (all data in the table are hexadecimal numbers):

Slave address	Modbus instruction	Start address of registers written (H)	Start address of registers written (L)	Register quantity (H)	Register quantity (L)	CRC (L)	CRC (H)
01	10	08	0B	00	05	73	A8

4. Error response frame

The format of the error response frames for the 03H, 06H, and 10H commands is shown in the table below (all data in the table are hexadecimal numbers):

Slave address	03H/06H/10H Command error response	Error code	CRC (L)	CRC (H)
01	83/86/90	xx	CRCL	CRCH

The meaning of the error code is as follows: 01, command error; 03, invalid parameter; 04, CRC check error.

For responding to an invalid parameter, the number of registers is 0 for the 0x03 command, or twice the number of registers is not equal to the total number of bytes written for the 0x10 command, and a maximum of 125 is allowed when reading or writing multiple registers. In addition, if the error code 03 (i.e., invalid parameter) is returned, refer to the value of P21.61, and the meaning is as follows.

16: The total number of parameters in the parameter group is exceeded, or the parameter group number is not defined.

17: The number of parameters to be read is zero.

18: The 32-bit function parameter must read the upper and lower 16 bits at one time, and it is not allowed to read only the lower 16 bits or the upper 16 bits.

19: The parameter written exceeds the upper and lower limits.

20: The user password has not been entered or has become invalid.

22: Read-only parameters and reserved parameters are not allowed to be rewritten, parameters that can only be rewritten at stop cannot be rewritten at runtime, or the parameters cannot be modified because they are constrained by the value of another parameter.

24: Password parameters can only be written individually and cannot be mixed with other parameters.

25: Input user password error.

26: Input user password error for 5 consecutive times.

5.5.3 Control DI functions by communication

1. Control DI functions by communication

In addition to the physical DI interfaces described in the previous section, X5 Series drives can use communications to directly control all of the DI functions described in the DI function table. To control DI functions using communications, there are three steps:

Step 1: Check if the DI interface configuration interface parameter of X5 series is configured with the DI function controlled by communication, and if so, it should be canceled.

Step 2: Enable the DI function controlled by communication.

Step 3: Send the DI function status to the specified address by communication.

Configure the interface parameters for the DI interface of the X5 series:

Parameter No.	Description	Parameter value
P04.01	DI1 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.02	DI2 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.03	DI3 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.04	DI4 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.05	DI5 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.06	DI6 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.07	DI7 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.08	DI8 terminal function selection	The value 1 to 46 listed in the DI function definition table
P04.09	DI9 terminal function selection	The value 1 to 46 listed in the DI function definition table

Enable setting interface for the communication control DI function:

Parameter No.	Description	Parameter value
P09.05	Communication control DI enabling setting 1	Each binary bit of this parameter represents a DI function. BIT 0 is reserved. BI T1 ~ BI T15 corresponds to DI 1 ~ 15 in the DI function definition table respectively. The value of the binary bit indicates whether the corresponding DI function of communication control is enabled: 0: Disable 1: Enable (Same definition for the following three parameters.)
P09.06	Communication control DI enabling setting 2	BIT0 ~ BIT15 corresponds to DI 1 6 ~ 31 in the DI function definition table

P09.07	Communication control DI enabling setting 3	BIT0 ~ BIT15 corresponds to DI 32 ~ 47 in the DI function definition table respectively (Note 1).
P09.08	Communication control DI enabling setting 4	BIT0 ~ BIT15 corresponds to DI 48 ~ 63 in the DI function definition table respectively (Note 2).

Parameter No.	Description	Parameter configuration value description
3607H	Communication writing DI function status 1	Each binary bit of this parameter represents a DI function. BIT 0 is reserved. BIT1 ~ BIT15 corresponds to DI 1 ~ 15 in the DI function definition table respectively. The value of the binary bit indicates whether the corresponding DI function is enabled: 0: Disable 1: Enable (Same definition for the following three parameters.)
3608H	Communication writing DI function status 2	BIT0 ~ BIT15 corresponds to DI 16 ~ 31 in the DI function definition table
3609H	Communication writing DI function status 3	BIT0 ~ BIT15 corresponds to DI 32 ~ 47 in the DI function definition table respectively (Note 1).
360AH	Communication writing DI function status 4	BIT0 ~ BIT15 corresponds to DI 48 ~ 63 in the DI function definition table respectively (Note 2).

Note 1: DI functions 38 to 47 are reserved.

Note 2: DI functions 48 to 63 are reserved.

2. Example of control DI functions by communication

Example 1: P04.01 has been configured with DI function 1 (servo ON), and is now ready to control DI function 1 by communication.

The configuration to be modified is as follows:

Step 1: Change the value of P04.01 to 0 and set the value of P09.05 to 2H.

The binary BIT1 bit of parameter P09.05 is set to 1 to enable the DI function 1, so here P09.05 is set to 2H (hexadecimal number).

Step 2: Write 2H to address 3607H by communication to make the corresponding DI function effective, and write 0H to make it ineffective. It is required to write continuously with an interval time of no more than 5 seconds (factory setting, interval time can be changed, see parameter P09.11).

The BIT1 of the written value at address 3607H corresponds to DI function 1, and 2H is written to make DI function 1 effective, and 0H is written to make it ineffective.

Note: If the value of P09.05 is set to 2H without changing the value of P04.01 to 0, the Err.27 (DI assignment duplication error) will be reported; if there is no consecutive writing, or if the time interval exceeds the value set in P09.11, the communication is considered disconnected, and the corresponding DI function will be invalidated.

5.5.4 Read DO function by communication

1. Read DO function status by communication

Similar to the communication write DI function, the communication output DO function needs to be enabled first, and the corresponding parameters are P09.09 and P09.10. The read addresses are 3688H and 3689H.

The enable setting interface of the communication D0 function:

Parameter No.	Description	Parameter value
P09.09	Communication reading DO enable setting 1	Each binary bit of this parameter represents a DO function. BIT0 is reserved. BIT1 ~ BIT15 corresponds to DO functions 1 ~ 15. The value of the binary bit indicates whether the corresponding DO function of communication control is enabled: 0: Invalid 1: Valid
P09.10	Communication reading DO enable setting 2	Each binary bit of this parameter represents a DO function. BIT1 ~ BIT15 corresponds to DO functions 16 ~ 31. The value of the binary bit indicates whether the corresponding DO function of communication control is enabled: 0: Invalid 1: Valid

List of addresses for communication reading DO function status:

Parameter No.	Description	Parameter value
3688H	Communication reading DO function status 1	Each binary bit of this parameter represents a DO function. BIT0 is reserved. BIT1 ~ BIT15 corresponds to DO functions 1 ~15. The value of the binary bit indicates whether the corresponding DO function of communication control is enabled: 0: Invalid 1: Valid (Same definition for the following three parameters.)
3689H	Communication reading of DO function status 2	BIT0 ~ BIT15 corresponds to DI 16 ~ 31 in the DI function definition table respectively.

2. Example of read DO function by communication

Read DO function 6 by communication (speed conformity)

Step 1: Check parameter P04.21 to P04.29, if any parameter is set to 6, it is necessary to set the value of that parameter to 0 first, and then set BIT6 of parameter P09.09 to 1 to enable DO function 6, so P09.09 should be set to 40H (hexadecimal number, corresponding to the binary number 1000000B).

Step 2: Read the status value of DO function from the communication address 3688H. The binary bit BIT6 read indicates the status value of DO function 6.

5.5.5 Read encoder absolute position

◆ Read encoder absolute position

(1) Requests the value of the encoder lap register, address is P21.32 and the data is signed 32 bits.

The request frame format is as follows.

Slave address	Modbus instruction	Start address of registers written (H)	Start address of registers written (L)	Register quantity (H)	Register quantity (L)	CRC (L)	CRC (H)
01	03	15	20	00	02	C1	CD

The format of the response frame for the command is shown in the following table (all data in the table are hexadecimal numbers, signed):

Slave address	Modbus instruction	Byte count	Bit 8~15	Bit 0~7	Bit 24~31	Bit 16~23	CRC (L)	CRC (H)
01	03	04	00	03	00	00	0A	33

(2) Request encoder single-turn position register value, address is P21.34, data is unsigned 32-bit, range is 0~131072 (the maximum value of the range is related to the number of motor encoder bits).

The request frame format is as follows.

Slave address	Modbus instruction	Start address of registers written (H)	Start address of registers written (L)	Register quantity (H)	Register quantity (L)	CRC (L)	CRC (H)
01	03	15	22	00	02	60	0D

The format of the response frame for the command is shown in the following table (all data in the table are hexadecimal numbers, unsigned)

Slave address	Modbus instruction	Byte count	Bit 8~15	Bit 0~7	Bit 24~31	Bit 16~23	CRC (L)	CRC (H)
01	03	04	36	07	00	01	85	BA

Chapter 6 Tuning

6.1 Gain tuning

6.1.1 Overall description

◆ **Purpose:**

Servo drives need to drive motors stably, quickly, and accurately, allowing the motor to faithfully track position, speed, or torque instructions with as little delay as possible. To achieve this, the gain of the servo drive control loop must be adjusted.

See the example below:

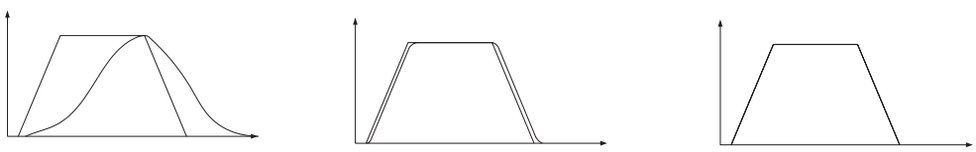
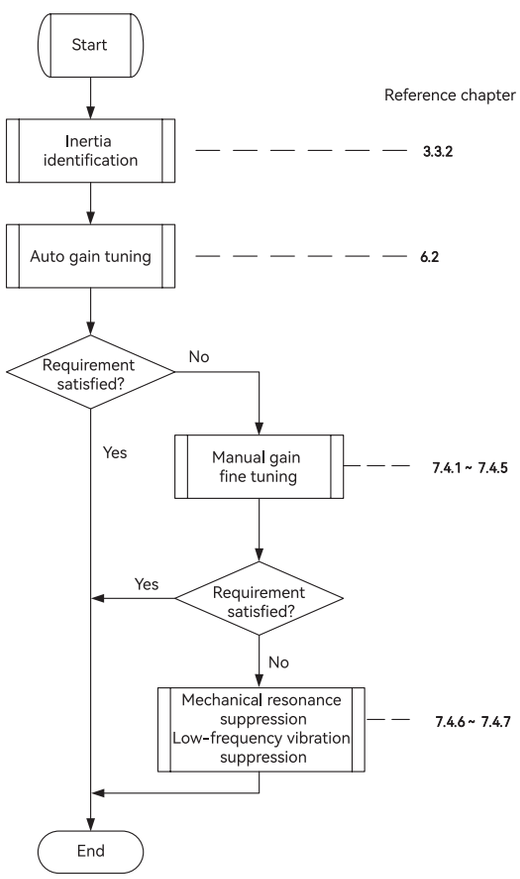


Figure Figure 6.1 Example of gain definition

Gain setting grade: Low	Gain setting grade: High	Gain setting grade: High + feedforward
Position loop gain: 20.0HZ	Position loop gain: 100.0HZ	Position loop gain: 100.0HZ
Speed loop gain: 50.0HZ	Speed loop gain: 50.0HZ	Speed loop gain: 50.0HZ
Speed loop integral time: 50.0	Speed loop integral time: 50.0	Speed loop integral time: 50.0
Speed feedforward: 0	Speed feedforward: 0	Speed feedforward: 50.0
Inertia ratio: 1.00	Inertia ratio: 1.00	Inertia ratio: 1.00

◆ **Procedure:**

After confirming the compatibility of servo drive and servo motor, users can follow procedures below for gain tuning:



6.2 Automatic gain tuning

Function description

◆ **Overview:**

Automatic gain tuning means that with the rigidity level selection function (P00-03), the servo drive will automatically generate a set of matched gain parameters to meet the needs of stability, accuracy, and speed.

◆ **Procedure:**

Before starting the automatic gain tuning process, it is important to perform self-learning of the load parameters (which currently consists mainly of load inertia identification) or to obtain the relevant load parameters by manual calculation.

The automatic gain tuning process is shown below.

There are two main types of real-time auto-tuning modes (P00.02):

1-Standard mode, which is mainly applicable to speed and torque control.

2-Positioning mode, which is mainly applicable to the position control mode, and has the same effect as the standard mode in speed control and torque control. The setting range of rigidity level (P00.03) is from 0 to 31. Level 0 corresponds to the weakest rigidity and the smallest gain; level 31 corresponds to the strongest rigidity and the largest gain.

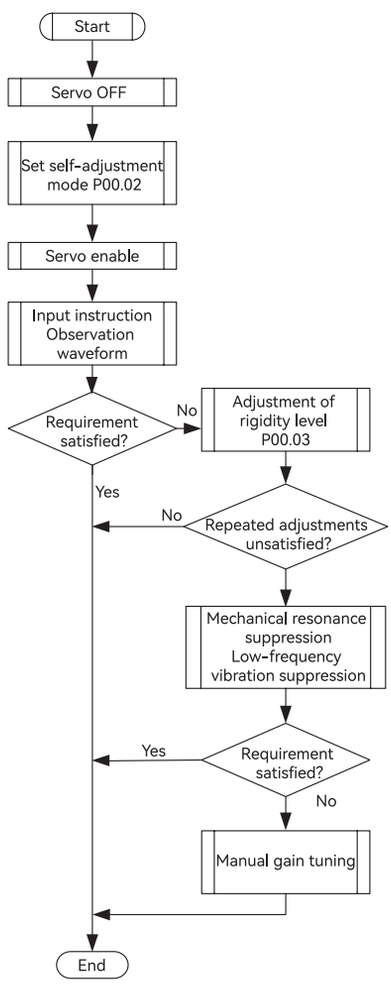
Depending on the load type, the following empirical values for the rigidity level can be used for reference:

Level 5 to 8, some complex transmission machinery

Level 9 to 14, belt drive, cantilever beam structure and other systems with low rigidity.

Level 15 to 20, higher rigidity systems such as ball screws, rack and pinion, and direct drive systems.

The flowchart of automatic gain tuning:



◆ **Relevant parameters:**

P00	02	Real time auto-tuning	0: Invalid; 1: Standard auto-tuning 2: Positioning mode	1	0	Immediate	Set at stop	PST
P00	03	Rigidity grade setting	0~31	1	12	Immediate	Set at operation	PST
P00	04	Inertia ratio	0~60.00	0.01	1.00	Immediate	Set at operation	PST

◆ **Parameters that are updated automatically:**

As the rigidity level changes, the servo drive automatically calculates the gain parameters internally, thereby updating the following parameters.

Function code		Name	Description	Unit	Value
P01	00	Position loop gain 1	1.0Hz ~ 2000.0Hz	0.1HZ	Automatic update
P01	01	Speed loop gain 1	1.0Hz ~ 2000.0Hz	0.1HZ	Automatic update
P01	02	Speed loop integral time 1	0.15ms ~ 512.00ms	0.01ms	Automatic update
P01	04	Torque instruction filtering 1	0.00ms ~ 100.00ms	0.01ms	Automatic update
P01	05	Position loop gain 2	1.0Hz ~ 2000.0Hz	0.1HZ	Automatic update
P01	06	Speed loop gain 2	1.0Hz ~ 2000.0Hz	0.1HZ	Automatic update
P01	07	Speed loop integral time 2	0.15ms ~ 512.00ms	0.01ms	Automatic update
P01	09	Torque instruction filtering 2	0.00ms ~ 100.00ms	0.01ms	Automatic update

◆ **Parameters that are set to fixed values:**

The following parameters will be set to fixed values.

Function code		Name	Description	Unit	Value
P01	03	Speed detection filtering 1	0.00ms ~ 100.00ms	0.01ms	0.00ms
P01	08	Speed detection filtering 2	0.00ms ~ 100.00ms	0.01ms	0.00ms
P01	12	Speed feedforward gain	0.0% ~ 100.0%	0.1%	30.0%
P01	13	Speed feedforward filtering time	0.00ms ~ 64.00ms	0.01ms	0.50ms
P01	15	Torque feedforward gain	0.0% ~ 100.0%	0.1%	0.0%
P01	16	Torque feedforward filtering time	0.00ms ~ 64.00ms	0.01ms	0.00ms

◆ **Parameters that are updated on conditions:**

The following parameters are set to fixed values when the real-time auto-tuning mode is the positioning mode, otherwise they remain unchanged.

Function code		Name	Description	Unit	Value
P01	18	Position control switching mode	0: The 1st gain fixed 1: The 2nd gain fixed 2: Utilize DI input (GAIN-SWITCH) 3: Large torque instruction 4: Sharply-changed speed instruction 5: Large speed instruction 6: Large position deviation (P) 7: With position instruction (P) 8: Uncompleted positioning (P) 9: Large actual speed (P) 10: With position instruction (P) actual speed (P)	1	10

P01	19	Position control switching delay	0~1000.0ms	0.1ms	5.0ms
P01	20	Position control switching class	0~20000 (Unit: based on gain switching mode description)	1	50
P01	21	Position control switching hysteresis	0~20000 (Unit: based on gain switching mode description)	1	33
P01	22	Position gain switching time	0~1000.0ms	0.1ms	3.3ms

6.3 Adaptive filter

6.3.1 Function description

◆ **Overview:**

In actual operation, the internal resonance detection module of the drive uses the vibration components in the motor feedback to determine the resonance frequency, and accordingly automatically sets the parameters of the built-in notch filter to attenuate the vibration near the resonance point.

This function is only available in the position control and speed control modes, where the motor is in a state of unobstructed normal rotation (not in a state of speed limitation, torque limitation, travel limitation, or clearing of the position deviation counter).

◆ **Precautions:**

The adaptive filter function may not be effective under the following conditions:

1. When the resonant point frequency is less than 3 times the speed response frequency;

2. When the peak resonance or gain is so low that the effect of the resonance on the control performance is not visible;

3. When there are more than 3 resonance points;

4. When the speed of the motor changes drastically due to mechanical non-linear factors;

5. When the rapid acceleration instruction (the absolute value of acceleration and deceleration speed is more than 30,000rpm/s).

◆ **Procedure:**

Set the adaptive filter mode (P02.02) to a value other than 0 or 4, and input the enable command and control command. The effect of the resonance point will be shown in the motor speed. The resonance detection module will detect the mechanical resonance point and display it in parameters P02.31~P02.36, and at the same time, the parameters of the 3rd notch filter or (and) 4th notch filter will be updated dynamically according to the number of the set adaptive filters. Generally, if mechanical vibration is detected, P02.02 can be set to 1, and then the parameters of the 3rd notch filter will be updated automatically. After the parameters are stabilized, observe whether the mechanical vibration is effectively suppressed, and if the effect is satisfactory, set P02.02 to 0 and work with fixed parameters. However, given that some mechanical systems have more than one resonance point, if a relatively large residual vibration is found, set P02.02 to 2. At this time, the parameters of the 4th notch filter will also be automatically updated to attenuate the vibration of another vibration point. If the result is satisfactory, set P02.02 to 0 and work with fixed parameters. If there is still a large vibration, it can be suppressed by manually setting the 1st and 2nd notch filter parameters (see Section 7.4.6 for details).

◆ **Relevant parameters:**

Function code		Name	Setting range	The smallest unit	Default setting
P02	02	Adaptive filter mode	0-4 0: Adaptive is invalid, the 3rd and the 4th filters are functioning but parameters are not updated; 1: One adaptive filter is valid. Only the 3rd filter is functioning with updated parameters. 2: Two adaptive filter are valid. The 3rd and the 4th filters are functioning with updated parameters. 3: Resonance frequency testing, but parameters are not updated. 4: Clear adaptive records, the 3rd & 4th filters are not functioning.	1	0
P02	31	Resonance point 1 frequency	50 ~ 5000Hz	1Hz	Display parameter
P02	32	Resonance point 1 bandwidth	0 ~ 20	1	Display parameter
P02	33	Resonance point 1 depth	0 ~ 99	1	Display parameter
P02	34	Resonance point 2 frequency	50 ~ 5000Hz	1Hz	Display parameter
P02	35	Resonance point 2 bandwidth	0 ~ 20	1	Display parameter
P02	36	Resonance point 2 depth	0 ~ 99	1	Display parameter

◆ **Parameters that are updated automatically:**

P02	10	The 3rd notch filter frequency	50 ~ 5000Hz	1Hz	5000Hz
P02	11	The 3rd notch filter width	0 ~ 20	1	2
P02	12	The 3rd notch filter depth	0 ~ 99	1	0
P02	13	The 4th notch filter frequency	50 ~ 5000Hz	1Hz	5000Hz
P02	14	The 4th notch filter width	0 ~ 20	1	2
P02	15	The 4th notch filter depth	0 ~ 99	1	0

6.4 Manual gain tuning

6.4.1 Overall description

The X5 series servo drives can use the automatic gain tuning function in most applications. However, under certain complex load conditions, automatic gain tuning may not always result in optimal performance. Therefore, it is necessary to readjust the gain parameters. This section explains the manual gain tuning method in various control modes.

When tuning the gain parameters, the response curve of the instruction can be observed by the background software installed on the computer, which can be used as a reference for manually tuning the parameters.

6.4.2 Tuning in the position mode

◆ **Procedures:**

1. Set the correct load inertia value P00.04, or set it automatically with the load parameter self-learning function.
2. Set the following parameters to the default values shown in the table below:

P00	02	Real-time auto-tuning mode	0
P01	00	Position loop gain 1	40.0HZ
P01	01	Speed loop gain 1	20.0HZ
P01	02	Speed loop integral time 1	30.00ms
P01	03	Speed detection filtering 1	0.00ms
P01	04	Torque instruction filtering 1	1.00ms
P01	05	Position loop gain 2	40.0HZ
P01	06	Speed loop gain 2	20.0HZ
P01	07	Speed loop integral time 2	30.00ms
P01	08	Speed detection filtering 2	0.00ms
P01	09	Torque instruction filtering 2	1.00ms
P01	10	Speed regulator PDFF coefficient	100.0%
P01	12	Speed feedforward gain	0

P01	13	Speed feed-forward filtering time	0
P01	18	Position control switching mode	0
P01	23	Speed control switching mode	0
P01	27	Torque control switching mode	0
P02	00	Position instruction smoothing filtering	0
P02	01	Position instruction FIR filtering	0
P02	02	Adaptive filter mode	0
P02	04	The 1st notch frequency (manual)	5000
P02	07	The 2nd notch frequency (manual)	5000
P02	10	The 3rd notch frequency	5000
P02	13	The 4th notch frequency	5000
P02	20	The 1st damping frequency	0
P02	22	The 2nd damping frequency	0

3. Adjust the parameter values in the table below as target values until the desired performance index is achieved.

P01	00	Position loop gain 1	50.0 1/s	Observe the positioning time, if the positioning time is too long, increase this value; otherwise, reduce it. If the time is too long, vibration may occur.
P01	01	Speed loop gain 1	30.0HZ	Adjust the gain upwards provided that no vibration occurs, there are no abnormal noises, and there is no significant overshoot, otherwise adjust it downwards.
P01	02	Speed loop integral time 1	25.00ms	If the value is reduced, the positioning time decreases. If the value is too small, vibration may occur. If the value is large, it may not be able to converge to 0.
P01	04	Torque instruction filter 1	0.50ms	When vibration occurs, try to change this value. This value is used in conjunction with P01.02 and is positively correlated.
P01	12	Speed feedforward gain	30.0%	Increase the feedforward gain can reduce the real-time position deviation without causing vibrations and rattles. Uneven input instructions can be improved by increasing the feedforward filter time constant P01.13. Before using speed feedforward, set P01.11 to a non-zero value.

6.4.3 Tuning in the speed mode

The procedure for the speed control mode is similar to that for the position control mode, except for the position loop related parameters P01.00, P01.05, and the speed feedforward parameters P01.12, P01.13.

6.4.4 Gain switching function

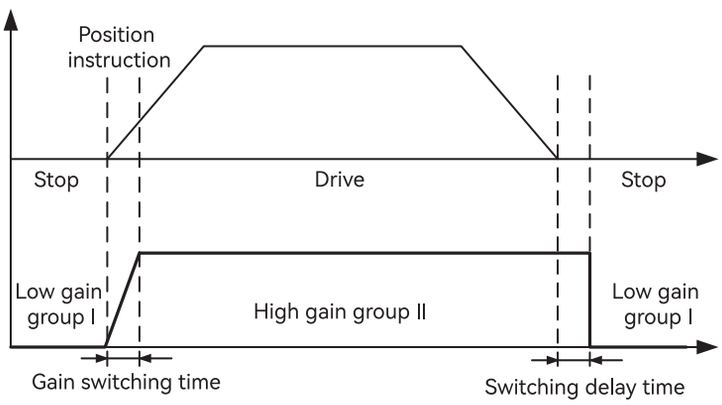
◆ **The following effects can be achieved by switching the gain according to the internal status or by an external signal:**

1. Suppress vibration during stop while improving the dynamic response of servo following performance as much as possible.

2. Increase the gain of the whole timing to shorten the positioning time.

3. Switch gain according to external signals

◆ **Gain switching example:**



◆ **Procedure:**

Here is an example of how to achieve high-response following during operation and low noise and vibration during stop.

1. Firstly, the gain switching function is not enabled, the 1st gain is fixed, and the 1st gain is adjusted when there is a running instruction so that the motor can achieve a good dynamic following performance.

2. Copy the group 1 gain parameters to group 2 parameters.

3. Set the gain switching conditions, P01.18 can be set to 7 for position control, and P01.19~P01.22 can be set according to actual needs, and the default value can be used.

4. When the instruction stops, the 1st speed loop gain (P01.01) is reduced and the torque instruction filtering time (P01.04) is slightly increased, which causes the noise to stop and the vibration to decrease.

◆ **Gain switching condition description:**

No.	The 2nd gain switching condition P01.18 P01.23 P01.27	Applicable mode	Timing diagram	Delay time P01.19 P01.24 P01.28	Switching grade P01.20 P01.25 P01.29	Switching hysteresis P01.21 P01.26 P01.30
0	The 1st gain fixed	PST		Inapplicable	Inapplicable	Inapplicable
1	The 2nd gain fixed	PST		Inapplicable	Inapplicable	Inapplicable
2	Utilize DI input (GAIN-SWITCH)	PST		Inapplicable	Inapplicable	Inapplicable
3	Large torque instruction	PST	A	Applicable	Applicable（%）	Applicable（%）
4	Sharply-changed speed instruction	S	B	Applicable	Applicable（10rpm/s）	Inapplicable
5	Large speed instruction	PS	C	Applicable	Applicable（1rpm/s）	Applicable（1rpm/s）
6	Large position deviation	P	D	Applicable	Applicable（1 Encoder resolution unit）	Applicable（1 Encoder resolution unit）
7	With position instruction	P	E	Applicable	Inapplicable	Inapplicable
8	Uncompleted positioning	P	F	Applicable	Inapplicable	Inapplicable
9	Large actual speed	P	C	Applicable	Applicable（1rpm/s）	Applicable（1rpm/s）
10	With position instruction	P	G	Applicable	Applicable（1rpm/s）	Applicable（1rpm/s）

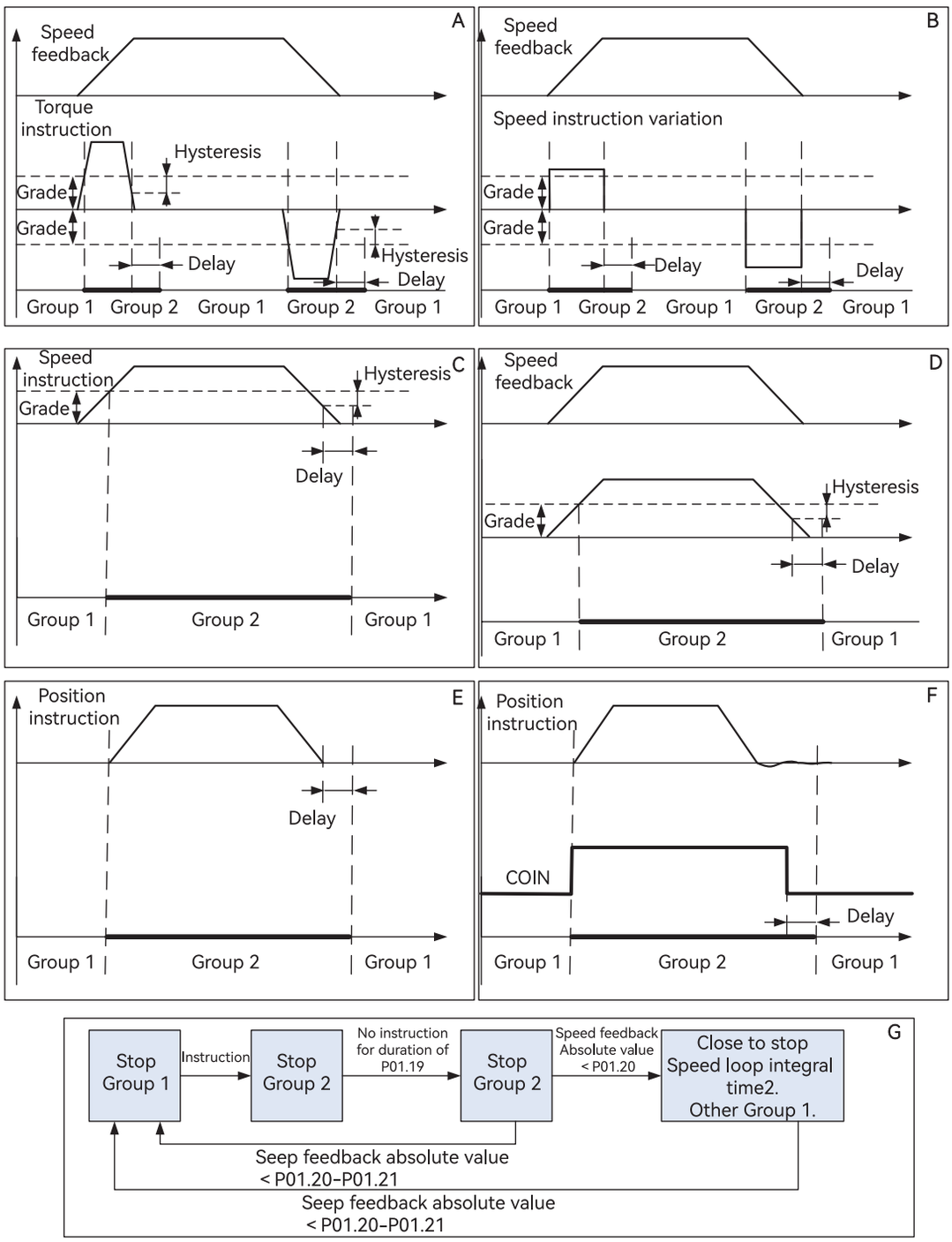
◆ **View the following timing diagrams in numbered order:**

1. When the gain switching condition is "Utilize DI input (GAIN-SWITCH)", only when the function code DI function GAIN-

SWITCH switching selection (P01.17) is set to 1 will the gain switching of groups 1 and 2 be carried out. Otherwise, the P/PI switching of the speed loop will be carried out.

2. The delay time only applies when the 2nd gain returns to the 1st gain.

3. When P01.18 is equal to 10, the definition of each parameter is different from other modes, so please refer to the G diagram in the Figure. 8.5.



6.4.5 Feedforward function

◆ **Overview:**

For position control, the desired speed control value can be calculated from the position control instruction, i.e. the speed feedforward. This is added to the speed instruction regulated according to the feedback to output the actual speed control instruction. Compared with a feedback-only control system, this algorithm reduces the real-time position deviation and improves the system response characteristics. The larger the feedforward gain, the smaller the position deviation will be. Theoretically, when the feedforward gain is equal to 100%, the position deviation is equal to 0.

The position deviation follows the calculation formula:

Position deviation = (Position instruction speed / Position loop gain) x (100.0% - Speed feedforward gain).

Similarly, the desired torque control value, i.e. the torque feedforward, can be calculated from the speed control instruction. This is added to the torque instruction regulated from the feedback to output the actual torque control instruction. This algorithm reduces the real-time speed deviation and improves the system response characteristics compared to a feedback-only control system. In position control, the use of torque feedforward can reduce the position deviation in the constant acceleration section. When using torque feedforward, make sure the load inertia parameter (P00.04) is set correctly.

In practice, when the feedforward gain is too large, it may lead to a significant overshoot (position overshoot), which can cause mechanical vibration. The machine will work with a large sound, at this time, vibration and noise can be reduced by two methods:

1: Turn down the feedforward gain;

2: Increase the time constant of the feedforward filter.

◆ **Relevant parameters:**

Function code		Name	Setting range	The smallest unit	Default setting
P01	11	Speed feedforward control selection	0: No speed feedforward 1: Internal speed feedforward	1	0
P01	12	Speed feedforward gain	0.0% ~ 100.0%	0.1%	30.0%
P01	13	Speed feedforward filtering time	0.00ms ~ 64.00ms	0.01ms	0.50ms
P01	14	Torque feedforward control selection	0: No torque feedforward 1: Internal torque feedforward 2: Use TFFD as torque feedforward input	1	0
P01	15	Torque feedforward gain	0.0% ~ 100.0%	0.1%	0.0%
P01	16	Torque feedforward filtering time	0.00ms ~ 64.00ms	0.01ms	0.00ms

The torque feedforward can use the analog input external feedforward, which can be used in the case of the upper device calculating the torque feedforward. In this case, it is necessary to set the torque feedforward selection (P01.14) to 2 and specify the input channel of TFFD in the analog input-related settings, and the correspondence between instruction and voltage.

6.4.6 Mechanical resonance suppression

The mechanical system has a certain resonance frequency, when the servo gain is increased, it may resonate near the mechanical resonance frequency, resulting in the gain not being able to continue to increase. There are two ways to suppress mechanical resonance:

1. Torque instruction filter（P01.04，P01.09）

The torque instruction filter is a digital low-pass filter that suppresses mechanical resonance by setting the filter time constant to attenuate the amplitude of the frequency components of the torque instruction near and above the cut-off frequency.

Filter cut-off frequency fc (Hz) = 1000 / [2π × torque instruction filter time constant (ms)].

2. Notch filter

The torque instruction filters are digital band-reject filters. The X5 servo drive has a total of 4 sets of series-connected notch filters to choose from. The 1s and 2nd notch filters are manual settings and the 3rd and 4th notch filters are adaptive filters.

◆ **Adaptive filter**

For a description of the adaptive filters, see section 6.3.

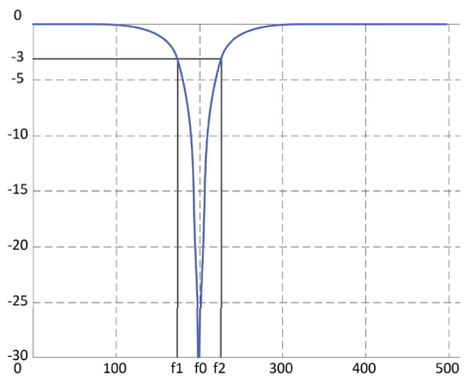
◆ **Notch filter**

When the adaptive filter does not enable adaptive parameter settings (P02.02 is not set to 1,2), all 4 notch filters can be manually adjusted. In this case, the resonance frequency detection module can still be activated by setting the adaptive filter mode (P02.02) to 3 to give servo enable and control instructions. Check the display parameters P02.31~P02.36 to get the mechanical resonance data and use it as a reference to set the filter manually. If available, the resonance data can also be obtained by adding a vibration tester to the mechanical actuator to test the modal state of the mechanical system.

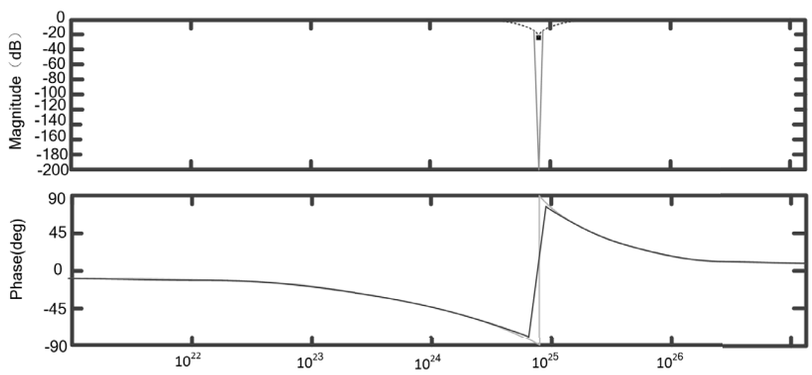
Function code		Name	Setting range	The smallest unit	Default setting
P02	04	The 1st notch filter frequency (manual)	50 ~ 5000Hz	1Hz	5000Hz
P02	05	The 1st notch filter width	0 ~ 20	1	2
P02	06	The 1st notch filter depth	0 ~ 99	1	0
P02	07	The 2nd notch filter frequency (manual)	50 ~ 5000Hz	1Hz	5000Hz
P02	08	The 2nd notch filter width	0 ~ 20	1	2
P02	09	The 2nd notch filter depth	0 ~ 99	1	0
P02	10	The 3rd notch filter frequency	50 ~ 5000Hz	1Hz	5000Hz
P02	11	The 3rd notch filter width	0 ~ 20	1	2
P02	12	The 3rd notch depth	0 ~ 99	1	0
P02	13	The 4th notch filter frequency	50 ~ 5000Hz	1Hz	5000Hz
P02	14	The 4th notch filter width	0 ~ 20	1	2
P02	15	The 4th notch filter depth	0 ~ 99	1	0

The notch filter frequency, denoted as f0, represents the center frequency of the notch filter. Meanwhile, the notch filter width is determined by the bandwidth coefficient of the stopband, which can be calculated as Kw = (f2 - f1) / f0. Here, f2 and f1 refer to the upper and lower frequencies that correspond to an attenuation of -3dB in the amplitude-frequency response (AFR) characteristic, respectively. Additionally, the notch filter depth, represented by the notch filter attenuation depth coefficient, can be calculated as the amplitude ratio of the output to the input at the notch center frequency point, denoted as Kd = A / A0.

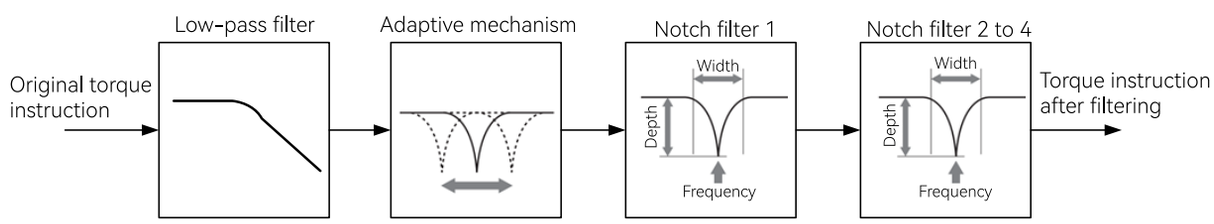
Notch filter amplitude-frequency characteristics:



◆ **The frequency domain response curve when the notch filter depth is set to 1 and 0, respectively:**

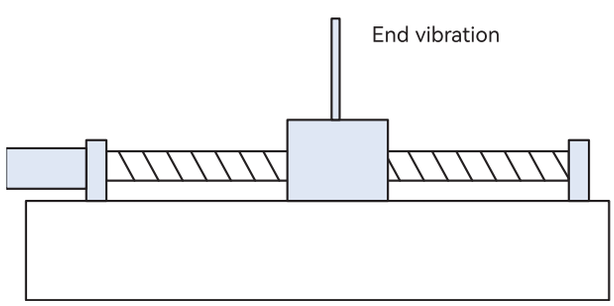


The role of the notch filter in servo control:



6.4.7 Low-frequency vibration suppression

◆ **Overview:**



If the mechanical load at the end is long, vibration is likely to occur when the positioning stops, which can affect the positioning effect. This type of vibration typically has a lower frequency than the mechanical resonance frequency, so it is referred to as low-frequency vibration. The function of low-frequency vibration suppression can effectively reduce the vibration ampli-

tude and positioning time.

◆ **Procedure:**

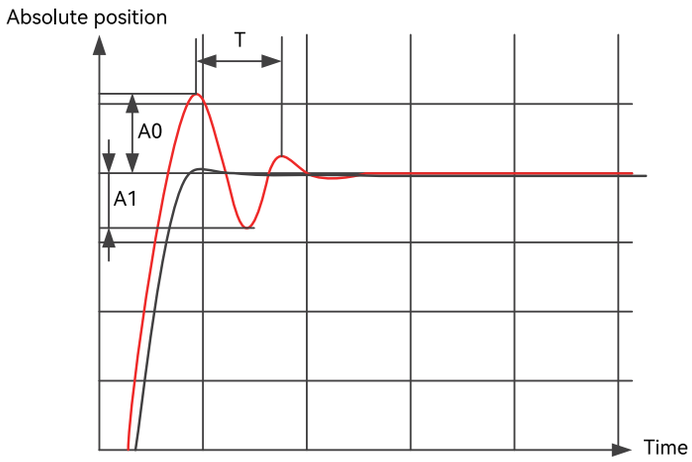
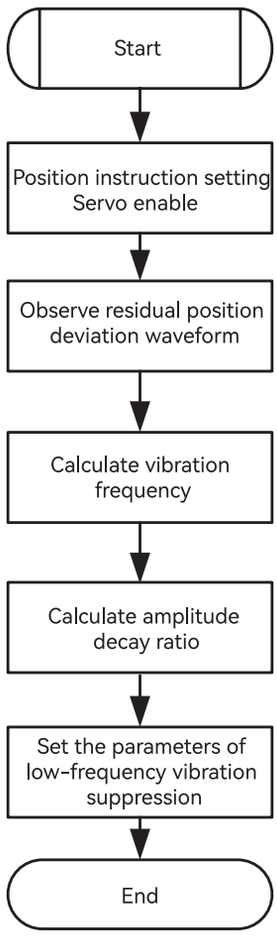


Figure　Figure Low-frequency vibration waveform during positioning control

In practical applications, it is possible to encounter a situation where there is a long end mechanism on the actuating part and there is an obvious oscillation when the position instruction stops, which is reflected in the position control waveform with periodic vibration in the position deviation (or absolute position feedback), as shown in Figure 8.10. In this case, users can follow the steps shown in Figure 8.11 to observe the waveform of sampling absolute position or position deviation triggered when the speed of position instruction is changed from non-zero to zero through the background software, and calculate the low-frequency vibration frequency and attenuation coefficient (attenuation coefficient = A1/A0), and correctly set to the 1st damping parameter (P02.20, P02.21). After completing the above operation, observe the waveform again, if there is still periodic vibration, continue to set the 2nd damping parameter according to the method shown in Figure 8.11. After the low-frequency suppression works, the positioning response waveform will be greatly improved, and the positioning tuning time will be shortened obviously, as shown by the thick line in Figure 8.10.

Function code		Name	Setting range	The smallest unit	Default setting
P02	20	The 1st damping frequency	10.0HZ~100.0HZ	0.1Hz	0.0Hz
P02	21	The 1st damping filter setting	0~1.0	0.1	0
P02	22	The 2nd damping frequency	10.0HZ~100.0HZ	0.1Hz	0.0Hz
P02	23	The 2nd damping filter setting	0~1.0	0.1	0



6.5 Inertia identification

6.5.1 Self-learning of load parameters

Chapter 7 Parameters

7.1 List of parameters

Relevant mode:

P: position control S: speed control T: torque control

The symbol "●" indicates applicable in this mode; and "—" indicates inapplicable in this mode.

Group No.		Name	Relevant mode		
			P	S	T
P00 Basic setting	00	Motor rotation positive direction definition	●	●	●
	01	Control mode selection	●	●	●
	02	Real-time auto-tuning mode	●	●	●
	03	Rigidity grade setting	●	●	●
	04	Inertia ratio	●	●	●
	05	Position instruction source	●	●	●
	07	Pulse train form	●	–	–
	08	Required pulse instruction number per turn of motor rotation (32-bit)	●	–	–
	10	Electronic gear 1 numerator (32-bit)	●	–	–
	12	Electronic gear denominator (32-bit)	●	–	–
	14	Pulse number per turn of motor rotation (32-bit)	●	–	–
	16	Pulse output positive direction definition	●	●	●
	17	Pulse output OZ polarity	●	–	–
	18	Pulse output function selection	●	–	–
	19	Overlarge position deviation threshold (32-bit)	●	●	●
	21	Braking resistor setting	●	●	●
	22	External resistor power capacity	●	●	●
	23	External resistor value	●	●	●
	24	External resistor heating time constant	●	●	●
	25	Regenerative voltage point	●	●	●
	26	Step value setting	●	–	–
	27	High-speed pulse train pattern	●	–	–
	28	Modulus mode low bit (32-bit)	●	–	–
	30	Modulus mode high bit (32-bit)	●	–	–

Group No.		Name	Relevant mode		
			P	S	T
P01 Gain tuning	00	Position loop gain 1	●	–	–
	01	Speed loop gain 1	●	●	–
	02	Speed loop integral time 1	●	●	–
	03	Speed detection filtering 1	●	●	●
	04	Torque instruction filtering 1	●	●	●
	05	Position loop gain 2	●	–	–
	06	Speed loop gain 2	●	●	–
	07	Speed loop integral time 2	●	●	–
	08	Speed detection filtering 2	●	●	●
	09	Torque instruction filtering 2	●	●	●
	10	Speed regulator PDFF coefficient	●	●	–
	11	Speed feed-forward control selection	●	–	–
	12	Speed feed-forward gain	●	–	–
	13	Speed feed-forward filtering time	●	–	–

Group No.		Name	Relevant mode		
			P	S	T
P01 Gain tuning	14	Torque feed-forward control selection	●	●	-
	15	Torque feed-forward gain	●	●	-
	16	Torque feed-forward filtering time	●	●	-
	17	DI function GAIN—SWITCH action switching selection	●	●	—
	18	Position control switching mode	●	●	-
	19	Position control switching delay	●	●	-
	20	Position control switching class	●	●	-
	21	Position control gain switching hysteresis	●	●	-
	22	Position gain switching time	●	●	-
	23	Speed control switching mode	-	●	-
	24	Speed control switching delay	-	●	-
	25	Speed control switching class	-	●	-
	26	Speed control switching hysteresis	-	●	-
	27	Torque control switching mode	-	-	●
	28	Torque control switching delay	-	-	●
	29	Torque control switching class	-	-	●
	30	Torque control switching hysteresis	-	-	●
	31	Observer enabled	●	●	●
	32	Observer cut-off frequency	●	●	●
	33	Observer phase compensation time	●	●	●
	34	Observer inertia coefficient	●	●	●
	41	Model tracking option	●	-	-
	42	Model tracking gain	●	-	-
	43	Model tracking compensation factor	●	-	-
	44	Model tracking speed compensation gain	●	-	-
	45	Model tracking torque compensation gain 1	●	-	-
	46	Model tracking torque compensation gain 2	●	-	-
	47	Model tracking gain 2	●	-	-
	48	Model tracking compensation coefficient 2	●	-	-
	49	Model anti-resonance frequency	●	-	-
	50	Model residual vibration frequency	●	-	-
	51	Vibration suppression frequency point	●	-	-
	52	Vibration suppression compensation coefficient	●	-	-
	53	Model delay bandwidth parameter	●	-	-
	54	Model delay compensation parameter	●	-	-

Group No.		Name	Relevant mode		
			P	S	T
P02 Vibration suppression	00	Position instruction smoothing filter	●	—	—
	01	Position instruction FIR filter	●	-	-
	02	Adaptive filter mode	●	●	●
	03	Adaptive filter load mode	●	●	●
	04	The first notch filter frequency (manual)	●	●	●
	05	The first notch filter width	●	●	●
	06	The first notch filter depth	●	●	●
	07	The second notch filter frequency (manual)	●	●	●
	08	The second notch filter width	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P02 Vibration suppression	09	The second notch filter depth	●	●	●
	10	The third notch filter frequency	●	●	●
	11	The third notch filter width	●	●	●
	12	The third notch filter depth	●	●	●
	14	The fourth notch filter width	●	●	●
	15	The fourth notch filter depth	●	●	●
	19	Position instruction FIR filter 2	●	–	–
	20	The first vibration damping frequency	●	●	–
	21	The first vibration damping filtering setting	●	●	–
	22	The second vibration damping frequency	●	●	–
	23	The second vibration damping filtering setting	●	●	–
	31	Resonance point 1 frequency	●	●	●
	32	Resonance point 1 bandwidth	●	●	●
	33	Resonance point 1 depth	●	●	●
	34	Resonance point 2 frequency	●	●	●
	35	Resonance point 2 bandwidth	●	●	●
	36	Resonance point 2 depth	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P03 Speed & torque control parameters	00	Speed instruction source	—	●	—
	03	Speed instruction setting value	–	●	–
	04	JOG speed setting	–	●	–
	08	Torque limit source	●	●	–
	09	Internal forward torque limit	●	●	–
	10	Internal reverse torque limit	●	●	–
	11	External forward torque limit	●	●	–
	12	External reverse torque limit	●	●	–
	14	Acceleration time 1	–	●	●
	15	Deceleration time 1	–	●	●
	16	Acceleration time 2	–	●	–
	17	Deceleration time 2	–	●	–
	19	Zero-speed clamp function	–	●	●
	20	Zero-speed clamp threshold value	–	●	●
	22	Torque instruction source	–	–	●
	25	Torque instruction key set value	–	–	●
	26	Speed limit source under torque control	–	–	●
	27	Internal positive speed limit	–	–	●
	28	Internal negative speed limit	–	–	●
	29	Hard limit torque limit	●	●	●
	30	Hard limit torque limit detection time	●	●	●
	31	Speed instruction number selection mode	–	●	–
	32	Acceleration time number for speed instruction from segment 1 to 8	–	●	–
	33	Deceleration time number for speed instruction from segment 1 to 8	–	●	–
	34	Acceleration time number for speed instruction from segment 9 to 16	–	●	–
	35	Deceleration time number for speed instruction from segment 9 to 16	–	●	–
	36	Segment 1 speed	–	●	–

Group No.		Name	Relevant mode		
			P	S	T
P03 Speed & torque control parameters	37	Segment 2 speed	-	●	-
	38	Segment 3 speed	-	●	-
	39	Segment 4 speed	-	●	-
	40	Segment 5 speed	-	●	-
	41	Segment 6 speed	—	●	—
	42	Segment 7 speed	-	●	-
	43	Segment 8 speed	-	●	-
	44	Segment 9 speed	-	●	-
	45	Segment 10 speed	-	●	-
	46	Segment 11 speed	-	●	-
	47	Segment 12 speed	-	●	-
	48	Segment 13 speed	-	●	-
	49	Segment 14 speed	-	●	-
	50	Segment 15 speed	-	●	-
	51	Segment 16 speed	-	●	-

Group No.		Name	Relevant mode		
			P	S	T
P04 Digital input and output	00	Normal DI filter selection	●	●	●
	01	DI1 terminal function selection	●	●	●
	02	DI2 terminal function selection	●	●	●
	03	DI3 terminal function selection	●	●	●
	04	DI4 terminal function selection	●	●	●
	05	DI5 terminal function selection	●	●	●
	06	DI6 terminal function selection	●	●	●
	07	DI7 terminal function selection	●	●	●
	08	DI8 terminal function selection	●	●	●
	11	DI1 terminal logic selection	●	●	●
	12	DI2 terminal logic selection	●	●	●
	13	DI3 terminal logic selection	●	●	●
	14	DI4 terminal logic selection	●	●	●
	15	DI5 terminal logic selection	●	●	●
	16	DI6 terminal logic selection	●	●	●
	17	DI7 terminal logic selection	●	●	●
	18	DI8 terminal logic selection	●	●	●
	19	DI9 terminal logic selection	●	●	●
	21	DO1 terminal function selection	●	●	●
	22	DO2 terminal function selection	●	●	●
	23	DO3 terminal function selection	●	●	●
	24	DO4 terminal function selection	●	●	●
	25	DO5 terminal function selection	●	●	●
	31	DO1 terminal logic level selection	●	●	●
	32	DO2 terminal logic level selection	●	●	●
	33	DO3 terminal logic level selection	●	●	●
	34	DO4 terminal logic level selection	●	●	●
	35	DO5 terminal logic level selection	●	●	●
	36	DO6 terminal logic level selection	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P04 Digital input and output	37	DO7 terminal logic level selection	●	●	●
	38	DO8 terminal logic level selection	●	●	●
	39	DO9 terminal logic level selection	●	●	●
	41	FunINL signal unassigned status (HEX)	●	●	●
	42	FunINH signal unassigned status (HEX)	●	●	●
	43	Motor rotational signal (TGON) threshold	●	●	●
	44	Speed conformity signal width	-	●	-
	45	Speed specified value arrival	●	●	●
	47	Positioning completion range	●	-	-
	48	Positioning completion output setting	●	-	-
	49	Positioning completion holding time	●	-	-
	50	Positioning near range	●	-	-
	51	Servo OFF delay time after holding brake taking action when speed is 0	●	●	●
	52	Speed setting for holding brake to take action in motion	●	●	●
	53	Waiting time for holding brake to take action in motion	●	●	●
	55	Torque set value arrival	●	●	●
	56	Torque arrival detection width	●	●	●
	57	Z-phase pulse width adjustment	●	●	●
	58	Zero-speed signal output threshold	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P05 Analog input and out put	00	AI1 minimum input			
	01	Setting value corresponding to the AI1 minimum input	●	●	●
	02	AI1 maximum input	●	●	●
	03	Setting value corresponding to the AI1 maximum input	●	●	●
	04	AI1 zero-point fine tuning	●	●	●
	05	AI1 dead band setting	●	●	●
	06	AI1 input filtering time	●	●	●
	07	AI2 minimum input	●	●	●
	08	Setting value corresponding to the AI2 minimum input	●	●	●
	09	AI2 maximum input	●	●	●
	10	Setting value corresponding to the AI2 maximum input	●	●	●
	11	AI2 zero-point fine tuning	●	●	●
	12	AI2 dead band setting	●	●	●
	13	AI2 input filtering time	●	●	●
	14	AI setting 100% speed	●	●	●
	15	AI setting 100% torque	●	●	●
	16	AI1 function selection	●	●	●
	17	AI2 function selection	●	●	●
	28	AO1 signal selection (need optional card)	●	●	●
	29	AO1 voltage offset	●	●	●
	30	AO1 multiplication	●	●	●
	31	AO2 signal selection (need optional card)	●	●	●
	32	AO2 voltage offset	●	●	●
	33	AO2 multiplication	●	●	●
	34	AO monitoring value type	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P06 Expansion parameters	00	Electronic gear numerator 2 (32-bit)	●	–	–
	02	Electronic gear numerator 3 (32-bit)	●	–	–
	04	Electronic gear numerator 4 (32-bit)	●	–	–
	06	Position deviation clearing function	●	–	–
	09	Electronic gear ratio switching delay	●	–	–
	10	Potential energy load torque compensation	●	●	–
	11	P06.10 and friction compensation storage options	●	●	–
	12	Forward rotation frictional torque compensation	●	●	–
	13	Reverse rotation friction torque compensation	●	●	–
	14	Viscous friction compensation	●	●	–
	15	Friction compensation time constant	●	●	–
	16	Friction compensation low speed range	●	●	–
	18	The first type fault stop selection	●	●	●
	19	Parameter identification rate	●	●	–
	20	Parameter identification acceleration time	●	●	–
	21	Parameter identification deceleration time	●	●	–
	22	Parameter identification mode selection	●	●	–
	23	Initial angle identification current limit	●	●	●
	24	Instantaneous power failure protection	●	●	●
	25	Instantaneous power failure deceleration time	●	●	●
	26	Servo OFF stop mode selection	●	●	●
	27	The second type fault stop mode selection	●	●	●
	28	Over-travel input setting	●	●	●
	29	Over-travel stop mode selection	●	●	●
	30	Input power phase loss protection	●	●	●
	31	Output power phase loss protection	●	●	●
	32	Stop by emergency stop torque	●	●	●
	33	Tripping protection function	●	●	●
	34	Overload warning value	●	●	●
	35	Motor overload protection coefficient	●	●	●
	36	Undervoltage protection point	●	●	●
	37	Over-speed fault point	●	●	●
	38	Maximum input pulse frequency	●	–	–
	39	Short circuit to ground detection protection selection	●	●	●
	40	Encoder interference detection delay	●	●	●
	41	Input pulse filtering setting	●	–	–
	42	Input pulse inhibition setting	●	–	–
	43	Deviation clearing input setting	●	–	–
	44	The second encoder input filtering	●	●	●
	45	Overlarge speed deviation threshold	●	●	–
	46	Torque saturation timeout duration	●	●	●
	47	Absolute system setting	●	●	●
	48	Encoder battery undervoltage threshold	●	●	●
	49	High-speed pulse input filtering	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P07 Auxiliary function parameters	00	Panel display option	●	●	●
	01	Panel monitoring parameter setting 1	●	●	●
	02	Panel monitoring parameter setting 2	●	●	●
	03	Panel monitoring parameter setting 3	●	●	●
	04	Panel monitoring parameter setting 4	●	●	●
	05	Panel monitoring parameter setting 5	●	●	●
	08	Function selection 1	●	●	●
	09	Function selection 2	●	●	●
	10	User password	●	●	●
	11	Instant memory storage during power outage	●	●	●
	12	User password screen-lock time	●	●	●
	14	Fast deceleration time	●	●	●
	16	Function selection 3	●	●	●
	17	Resolution	●	-	-
	19	Function selection 5	●	●	●
	20	Function selection 6	●	●	●
	21	Function selection 7	●	●	●
	22	Function selection 8	●	●	●
	23	Fault reset timing	●	●	●
	24	Positive soft limit (32-bit)	●	●	●
	26	Negative soft limit (32-bit)	●	●	●
	28	Holding time of return completion signal during non-DI return	●	●	●
	30	Total number of DB stop	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P08 Internal position instruction	00	Multi-segment preset position execution method	●	-	-
	01	Starting segment number	●	-	-
	02	Ending segment number	●	-	-
	03	Dealing of residual segments after pausing and restarting	●	-	-
	04	Position instruction type	●	-	-
	05	Waiting time unit	●	-	-
	06	The first segment displacement (32-bit)	●	-	-
	08	The first segment maximum speed	●	-	-
	09	The first segment acceleration/deceleration time	●	-	-
	10	Waiting time after the first segment completed	●	-	-
	11	The second segment displacement (32-bit)	●	-	-
	13	The second segment maximum speed	●	-	-
	14	The second segment acceleration/deceleration time	●	-	-
	15	Waiting time after the second segment completed	●	-	-
	16	The third segment displacement (32-bit)	●	-	-
	18	The third segment maximum speed	●	-	-
	19	The third segment acceleration/deceleration time	●	-	-
	20	Waiting time after the third segment completed	●	-	-
	21	The fourth segment displacement (32-bit)	●	-	-
	23	The fourth segment maximum speed	●	-	-
	24	The fourth segment acceleration/deceleration time	●	-	-
	25	Waiting time after the fourth segment completed	●	-	-

Group No.		Name	Relevant mode		
			P	S	T
P08 Internal position instruction	28	The fifth segment maximum speed	●	–	–
	29	The fifth segment acceleration/deceleration time	●	–	–
	30	Waiting time after the fifth segment completed	●	–	–
	31	The sixth segment displacement (32-bit)	●	–	–
	33	The sixth segment maximum speed	●	–	–
	34	The sixth segment acceleration/deceleration time	●	–	–
	35	Waiting time after the sixth segment completed	●	–	–
	36	The seventh segment displacement (32-bit)	●	–	–
	38	The seventh segment maximum speed	●	–	–
	39	The seventh segment acceleration/deceleration time	●	–	–
	40	Waiting time after the seventh segment completed	●	–	–
	41	The eighth segment displacement (32-bit)	●	–	–
	43	The eighth segment maximum speed	●	–	–
	44	The eighth segment acceleration/deceleration time	●	–	–
	45	Waiting time after the eighth segment completed	●	–	–
	46	The ninth segment displacement (32-bit)	●	–	–
	48	The ninth segment maximum speed	●	–	–
	49	The ninth segment acceleration/deceleration time	●	–	–
	50	Waiting time after the ninth segment completed	●	–	–
	51	The 10th segment displacement (32-bit)	●	–	–
	53	The 10th segment maximum speed	●	–	–
	54	The 10th segment acceleration/deceleration time	●	–	–
	55	Waiting time after the 10th segment completed	●	–	–
	56	The 11th segment displacement (32-bit)	●	–	–
	58	The 11th segment maximum speed	●	–	–
	59	The 11th segment acceleration/deceleration time	●	–	–
	60	Waiting time after the 11th segment completed	●	–	–
	61	The 12th segment displacement (32-bit)	●	–	–
	63	The 12th segment maximum speed	●	–	–
	64	The 12th segment acceleration/deceleration time	●	–	–
	65	Waiting time after the 12th segment completed	●	–	–
	66	The 13th segment displacement (32-bit)	●	–	–
	68	The 13th segment maximum speed	●	–	–
	69	The 13th segment acceleration/deceleration time	●	–	–
	70	Waiting time after the 13th segment completed	●	–	–
	71	The 14th segment displacement (32-bit)	●	–	–
	73	The 14th segment maximum speed	●	–	–
	74	The 14th segment acceleration/deceleration time	●	–	–
	75	Waiting time after the 14th segment completed	●	–	–
	76	The 15th segment displacement (32-bit)	●	–	–
	78	The 15th segment maximum speed	●	–	–
	79	The 15th segment acceleration/deceleration time	●	–	–
	80	Waiting time after the 15th segment completed	●	–	–
	81	The 16th segment displacement (32-bit)	●	–	–
	83	The 16th segment maximum speed	●	–	–
	84	The 16th segment acceleration/deceleration time	●	–	–
	85	Waiting time after the 16th segment completed	●	–	–

Group No.		Name	Relevant mode		
			P	S	T
P08 Internal position instruction	86	Position instruction interrupt execution setting	●	-	-
	88	Homing start method	●	-	-
	89	Homing mode	●	-	-
	90	Limit switch and z-phase signal setting when homing	●	-	-
	92	Origin search high speed	●	-	-
	93	Origin search low speed	●	-	-
	94	Acceleration/deceleration time during origin searching	●	-	-
	95	Homing time limit	●	-	-
	96	Origin offset (32-bit)	●	-	-
	98	Mechanical origin offset (32-bit)	●	-	-

组号		名称	相关模式		
			P	S	T
P09 Communication setting	00	Servo axis address number	●	●	●
	01	Modbus baud rate	●	●	●
	02	Modbus data format	●	●	●
	03	Communication timeout	●	●	●
	04	Communication response delay	●	●	●
	05	Communication DI enabling setting 1	●	●	●
	06	Communication DI enabling setting 2	●	●	●
	07	Communication DI enabling setting 3	●	●	●
	08	Communication DI enabling setting 4	●	●	●
	09	Communication DO enabling setting 1	●	●	●
	10	Communication DO enabling setting 2	●	●	●
	11	Communication instruction holding time	●	●	●

组号		名称	相关模式		
			P	S	T
P17 Expansion position control	00	External encoder usage	●	—	—
	01	External encoder pitch (32-bit)	●	—	—
	03	Full-closed mixed deviation threshold(32-bit)	●	—	—
	05	Mixed deviation counting setting	●	—	—
	06	Mixed vibration suppression gain	●	—	—
	07	Mixed vibration suppression time constant	●	—	—
	09	External units for full closed loop mixed deviation (32-bit)	●	—	—
	11	External units for internal encoder count value (32-bit)	●	—	—
	13	External encoder count value (32-bit)	●	—	—
	16	Position comparison output mode	●	—	—
	17	The first position (32-bit)	●	—	—
	19	The second position (32-bit)	●	—	—
	21	The third position (32-bit)	●	—	—
	23	The fourth position (32-bit)	●	—	—
	25	Signal validity time 1	●	—	—
	26	Signal effective time 2	●	—	—
	27	Signal effective time 3	●	—	—
	28	Signal effective time 4	●	—	—
	29	Display delay	●	—	—

组号		名称	相关模式		
			P	S	T
P18	00	Motor model code (32-bit)	●	●	●

组号		名称	相关模式		
			P	S	T
P20 Key and communication control	00	Key JOG trial	●	●	●
	01	Fault reset	●	●	●
	02	Communication parameters	●	●	●
	03	Parameter identification function	●	●	●
	05	Analog input automatic offset adjustment	●	●	●
	06	System initialization function	●	●	●
	08	Communication operation instruction input	●	●	●
	09	Communication operation status output	●	●	●
	11	Communication setting DI input	●	●	—
	12	Communication starting homing	●	—	—

组号		名称	相关模式		
			P	S	T
P21 Status parameters	00	Servo status	●	●	●
	01	Motor speed feedback	●	●	●
	02	Servo fault codes	●	●	●
	03	Speed instruction	●	●	●
	04	Internal torque instruction (relative to rated torque)	●	●	●
	05	Phase current effective value	●	●	●
	06	DC busbar voltage	●	●	●
	07	Absolute position counter (32-bit)	●	●	●
	09	Electrical angle	●	●	●
	10	Mechanical angle (relative to encoder zero point)	●	●	●
	11	Load inertia identification value	●	●	●
	12	Speed value relative to input instruction	●	●	●
	13	Position deviation counter (32-bit)	●	●	●
	15	Input pulse counter (32-bit)	●	●	●
	17	Feedback pulse counter (32-bit)	●	●	●
	19	Position deviation counter instruction unit (32-bit)	●	●	●
	21	Digital input signal monitoring	●	●	●
	22	Inertia identification value	●	●	●
	23	Digital output signal monitoring	●	●	●
	24	Encoder status	●	●	●
	25	Total power-on time (32-bit)	●	●	●
	27	AI1 voltage after adjustment	●	●	●
	28	AI2 voltage after adjustment	●	●	●
	29	AI1 voltage before adjustment	●	●	●
	30	AI2 voltage before adjustment	●	●	●
	31	Module temperature	●	●	●
	32	Number of turns of absolute encoder (32-bit)	●	●	●
	34	Single turn position of absolute encoder (32-bit)	●	●	●
	36	Version code 1	●	●	●
	37	Version code 2	●	●	●

组号		名称	相关模式		
			P	S	T
P21 Status parameters	38	Version code 3	●	●	●
	39	Product series code	●	●	●
	40	Fault record display	●	●	●
	41	Fault code	●	●	●
	42	Time stamp upon selected fault (32-bit)	●	●	●
	44	Current rotation speed of the selected fault	●	●	●
	45	U-phase current of the selected fault	●	●	●
	47	Busbar voltage of the selected fault	●	●	●
	48	Input terminal state of the selected fault	●	●	●
	49	Output terminal state of the selected fault	●	●	●
	50	Customized software version number	●	●	●
	51	Load ratio	●	●	●
	52	Regenerative load ratio	●	●	●
	53	Internal warning code	●	●	●
	54	Current segment number of internal instruction	●	●	●
	55	Customized serial code	●	●	●
	56	Absolute position counter high 32 bits (32-bit)	●	●	●
	58	Feedback pulse counter high 32 bits (32-bit)	●	●	●

7.2 Parameter description

P00 Basic setting

P00.00	Motor rotation positive direction definition	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Set the relation between instruction direction and motor rotational direction:

0: When the instruction is positive, motor rotational direction is CCW (counterclockwise from facing the motor shaft)

1: When the instruction is positive, motor rotational direction is CW (clockwise from facing the motor shaft)

P00.01	Control mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 7	0	--	Restart	P	S	T

Set the desired control mode

0: Position mode;

1: Speed mode;

2: Torque mode;

3: Position mode / speed mixed mode

4: Position/Torque mixed mode

5: Speed mode / Torque mixed mode

6: (Reserved)

7: CANOpen mode / EtherCAT mode

When modes 3 to 5 are selected, the DI function MODE_SEL is used to switch between the two modes; when MODE_SEL is 0, the control mode is mode 1, and when MODE_SEL is 0 or 1, the control mode changes to mode 2. When CANOpen communication control or EtherCAT communication control is used, mode 7 is configured.

P00.02	Real-time auto-tuning mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	1	--	Immediate	P	S	T

Set the mode for real-time auto-tuning.

0: Invalid, real-time auto-tuning function is invalid.

1: Standard mode, no gain switching.

2: Positioning mode, with gain switching, is especially suitable for position control.

3: Dynamic testing of load, without parameter setting

P00.03	Rigidity grade setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	12	--	Immediate	P	S	T

Set the response level for real-time auto-tuning.

The higher the setting value from 0 to 31, the higher the bandwidth of the servo control circuit, the faster the response, and the greater the vibration that may be generated.

Be sure to check the effect of the movement while adjusting the rigidity level from low to high.

The changed parameter is effective only when the control instruction is 0. Change the parameter, stop the instruction, and confirm that the parameter has taken effect before proceeding to the next step.

P00.04	Inertia ratio	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6000	100	0.01	Immediate	P	S	T

Set the ratio of load to motor inertia.

0 ~ 60.00

P00.05	Position instruction source	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P		

Set the source of instruction for position control.

0: Pulse instruction

1: Step value instruction

2: Internal position control

3: High-speed pulse instruction

P00.07	Pulse train form	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Restart	P		

Set the input form of the pulse instruction.

0: Direction + Pulse, positive logic. (Default)

1: Direction + pulse, negative logic

2: A-phase (Pulse)+B-phase (sign) orthogonal pulse 4 multiplication frequency, positive logic (A is ahead of B)

3: Phase A (Pulse)+Phase B (sign) orthogonal pulse 4 multiplication frequency, negative logic (B is ahead of A)

4: CW+CCW, positive logic

5: CW+CCW, negative logic

P00.08	Required pulse instruction number per turn of motor rotation (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	10000	1Unit	Restart	P		

Set the required pulse instruction number per turn of motor rotation, which can be used in place of electronic gears.

0 Unit/Turn ~ 1073741824 Unit/Turn

It works when this function code value is 0.

P00.10	Electronic gear 1 numerator (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Immediate	P		

Set the numerator of the first group electronic gear.

1 ~ 1073741824

It works when P00.08=0.

P00.12	Electronic gear denominator (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 1073741824	10000	--	Immediate	P		

Set the denominator for the first group electronic gears.

1 ~ 1073741824

It works when P00.08=0.

P00.14	Pulse number per turn of motor rotation (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		16 ~ 131071	2500	1PPR	Restart	P		

Set the number of OUTA or OUTB pulses output per turn of the motor rotation.

16PPR ~ 65535PPR (calculate the number of lines according to the incremental photoelectric encoder)

P00.16	Pulse output positive direction definition	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Set the phase sequence logic for the pulse output function.

0: CCW (pulse output OUTA ahead of OUTB when the motor rotation direction is CCW)

1: CW (pulse output OUTA ahead of OUTB when the motor rotation direction is CW)

P00.17	Pulse output OZ polarity	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P		

0: High level at the arrival of Z-phase pulse

1: Low level at the arrival of Z-phase pulse

2: High-precision Z-phase pulse, high level at the arrival of Z-phase pulse

3: High-precision Z-phase pulse, low level at the arrival of Z-phase pulse

P00.18	Pulse output function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P		

0: Encoder frequency division output;

1: Pulse instruction synchronous output.

2: Pulse instruction interpolation output (gantry synchronization)

3: External encoder pulse synchronization output

P00.19	Overlarge position deviation threshold (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 1073741824	200000	1P	Immediate	P	S	T

Set the threshold for detecting over large position deviation (Err.043 error) in units of the encoder minimum resolution.

1P ~ 1073741824P

P00.21	Braking resistor setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Immediate	P	S	T

Set the form in which the energy-consumption braking resistor is used.

0: Use internal regenerative resistor (100s)

1: Use external regenerative resistor and natural cooling (150s) or forced air cooling (200s)

P00.22	External resistor power capacity	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	100	1W	Immediate	P	S	T

Set the power of the energy consumption braking resistor.

1W ~ 65535W

P00.23	External resistor value	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 1000	100	1Ω	Immediate	P	S	T

Set the resistance value of the energy consumption braking resistor.

1Ω ~ 1000Ω

P00.24	External resistor heating time constant	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 30000	2000	0.1s	Immediate	P	S	T

Set the heating time constant of the energy consumption braking resistor.

0.1s ~ 3000.0s

P00.25	Regenerative voltage point	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	385	--	Immediate	P	S	T

0V ~ 1000V（generally default）

P00.26	Step value setting	Range	Default	Unit	Effective	Relevant mode		
		-9999 ~ 9999	50	--	Immediate	P		

Set the instruction setting value for step amount position control.

-9999 to 9999 instruction unit

P00.27	High pulse train form	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Restart	P		

0: Direction + pulse, positive logic (default)

1: Direction + pulse, negative logic

2: Phase-A (pulse) +Phase-B(sign) orthogonal pulse, 4 multiplication, positive logic

3: Phase-A +Phase-B orthogonal pulse, 4 multiplication, negative logic

4: CW+CCW, positive logic

5: CW+CCW, negative logic

P00.28	Modulus mode low bit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Restart	P		

Set the low 32 bits of the modulus parameter (64 bits)

Set to 0:The modulus function is invalid.

Set to greater than 0: P21.17 will cycle from 0 to the analog setting value.

P01 Gain tuning

P01.00	Position loop gain 1	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	400	0.1/s	Immediate	P		

Set the position loop gain to determine the position loop response level.

1.0/s ~ 2000.0/s。

The higher the gain, the faster the position loop response. However, too large a setting may cause vibration.

P01.01	Speed loop gain 1	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	200	0.1HZ	Immediate	P	S	

Set the speed loop gain to determine the speed loop response level.

1.0Hz to 2000.0Hz.

The higher the gain, the faster the speed loop response. However, too large a setting may cause vibration.

P01.02	Speed loop integral time 1	Range	Default	Unit	Effective	Relevant mode		
		15 ~ 51200	3000	0.01ms	Immediate	P	S	

Set the integration time of the speed loop controller.

0.15ms to 512.00ms.

The smaller the setting value, the smaller the steady-state deviation.

When the integration time is equal to 512.00, the integration is invalid.

P01.03	Speed detection filtering 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 15	0	--	Immediate	P	S	T

Set the filter level for speed detection.

0 ~ 15

The larger the value, the better the vibration suppression effect. However, the response bandwidth may be reduced.

P01.04	Torque instruction filtering 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	100	0.01ms	Immediate	P	S	T

Set the first-order low-pass filter time constant for the torque instruction section.

0.00ms to 100.00ms.

It suppresses the resonance caused by mechanical distortion.

P01.05	Position loop gain 2	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	400	0.1/s	Immediate	P		

1.0/s ~ 2000.0/s, the second set of parameters acts as above.

P01.06	Speed loop gain 2	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	200	0.1HZ	Immediate	P	S	

1.0 Hz to 2000.0 Hz, the second set of parameters acts as above.

P01.07	Speed loop integral time 2	Range	Default	Unit	Effective	Relevant mode		
		15 ~ 51200	3000	0.01ms	Immediate	P	S	

0.15ms ~ 512.00ms, the second set of parameters acts as above.

P01.08	Speed detection filtering 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 15	0	--	Immediate	P	S	T

Sets the filter level for speed detection.

0 to 15

The larger the value, the better the vibration suppression effect, however, the response bandwidth will be reduced.

P01.09	Torque instruction filtering 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	100	0.01ms	Immediate	P	S	T

0.00ms ~ 100.00ms, the second set of parameters acts as above.

P01.10	Speed regulator PDFF coefficient	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	1000	0.1%	Immediate	P	S	

Set the PDFF coefficient of the speed regulator, 0 to 100.0%

Setting to 100% is equivalent to the PI regulator (default), and setting to 0% is equivalent to PDF regulation;

Setting to an intermediate value reduces overshoot, but decreases the response level of the speed loop (relative to the PI

regulator).

P01.11	Speed feed-forward control selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P		

Set the speed feedforward selection for position control.

0: No speed feedforward

1: Internal speed feedforward

P01.12	Speed feed-forward gain	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1500	300	0.1%	Immediate	P		

Set the speed feedforward gain for position control. Position deviation at a certain speed can be reduced.

0.0% to 100.0

P01.13	Speed feed-forward filtering time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6400	50	0.01ms	Immediate	P		

Set the speed feedforward filter time constant for position control.

0.00ms ~ 64.00ms

P01.14	Torque feed-forward control selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P	S	

Set the torque feedforward selection for position or speed control.

0: No torque feedforward

1: Internal torque feedforward

2: TFFD is used as torque feedforward input.

P01.15	Torque feed-forward gain	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	0.1%	Immediate	P	S	

Set the torque feedforward gain for position or speed control. Position deviation during acceleration and deceleration can be reduced.

0.0% to 100.0%

P01.16	Torque feed-forward filtering time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6400	0	0.01ms	Immediate	P	S	

Set the time constant of the torque feedforward filter for position or speed control.

0.00ms to 64.00ms

P01.17	DI function GAIN—SWITCH action switching selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	

Set the role of the DI function GAIN-SWITCH.

0: Speed loop regulator P(1)/PI(0) switching, gain is fixed to the first group.

1: First gain (0), second gain (1) switching

P01.18	Position control switching mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10	0	--	Immediate	P	S	

Trigger condition setting for gain switching during position control.

0: The first gain fixed (P01.00 ~ P01.04)

1: The second gain fixed (P01.05 to P01.09)

2: Group 1 and 2 gain switching using DI input (GAIN_SEL) or P/PI switching by the speed regulator.

3: Large torque instruction, torque instruction over level (P01.20) + hysteresis (P01.21) switches to the 2nd gain, and when the torque instruction is lower than level (P01.20) - hysteresis (P01.21) it returns to the 1st gain within the specified delay time. Unit:0.1%.

4: Not applicable to position control and full closed-loop control mode

5: Speed instruction is large, speed instruction exceeds the level (P01.20) + hysteresis (P01.21) to switch to the 2nd gain, when the speed instruction is lower than the level (P01.20) - hysteresis (P01.21) in the specified delay time to return to the 1st gain Unit: 1rpm

6: position deviation is large, position deviation over the level (P01.20) + hysteresis (P01.21) switch to the 2nd gain, when the position deviation is lower than the level (P01.20) - hysteresis (P01.21) in the specified delay time to return to the 1st gain Unit: 1 encoder resolution

7: There is a position instruction, position instruction is not 0 when switching to the second gain, when the position instruction continues to be 0 in the specified delay time back to the first gain

8: When the positioning is not completed, switch from the 1st gain to the 2nd gain; when the positioning is completed and then return to the 1st gain within the specified delay time.

9: the actual speed is large, speed feedback over the level (P01.20) + hysteresis (P01.21) switch to the 2nd gain, when the speed feedback is lower than the level (P01.20) - hysteresis (P01.21) in the specified delay time to return to gain 1

10: With position instruction plus actual speed, switch to 2nd gain when position instruction is not 0, return to 1st gain when position instruction is 0 and the absolute value of actual speed is lower than the grade (P01.20) - hysteresis (P01.21).

P01.19	Position control switching delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	50	0.1ms	Immediate	P	S	

Set the delay time for gain switching during position control.

0 ~ 100.0ms

P01.20	Position control switching class	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20000	50	--	Immediate	P	S	

Set the trigger level of gain switching for position control.

0 to 20000 (Unit: according to the gain switching mode description), note that this parameter takes the value set in P01.21 as the lower limit.

P01.21	Position control gain switching hysteresis	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20000	33	--	Immediate	P	S	

Set the hysteresis of the trigger level of gain switching for position control.

0 to 20000 (Unit: according to the gain switching mode description), note that this parameter takes the setting value of P01.20 as the upper limit.

P01.22	Position gain switching time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	33	0.1ms	Immediate	P	S	

Set the transition time from small gain to large gain for gain switching during position control.

0 ~ 1000.0ms

P01.23	Speed control switching mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Immediate		S	

Trigger condition setting for gain switching during speed control.

0: The first gain fixed (P01.00 ~ P01.04)

1: The second gain fixed (P01.05 to P01.09)

2: Group 1 and 2 gain switching using DI function 3 (GAIN_SEL) or P/PI switching by the speed regulator.

3: Large torque instruction, torque instruction over level (P01.25) + hysteresis (P01.26) switches to 2nd gain, and when the torque instruction is lower than level (P01.25) - hysteresis (P01.26) it returns to 1st gain within the specified delay time. Unit: 0.1 %

4: The speed instruction change is large; the speed instruction change amount exceeds the level (P01.25) + hysteresis (P01.26) switching to the 2nd gain when the speed instruction change amount is lower than the level (P01.25) - hysteresis (P01.26) return to the 1st gain within the specified delay time. Unit: 10rpm/s

5: Speed instruction is large, speed instruction over rank (P01.25) + hysteresis (P01.26) switches to 2nd gain, when speed instruction is lower than rank (P01.25) - hysteresis (P01.26) returns to 1st gain within the specified delay time. Unit: 1rpm

P01.24	Speed control switching delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	0.1ms	Immediate		S	

Set the delay time for gain switching during speed control.

0 ~ 100.0ms

P01.25	Speed control switching class	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20000	0	--	Immediate		S	

Set the trigger level for gain switching during speed control.

0 to 20000 (Unit: according to the gain switching mode description), note that this parameter takes the value set in P01.26 as the lower limit.

P01.26	Speed control switching hysteresis	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20000	0	--	Immediate		S	

Set the hysteresis of the trigger level for gain switching during speed control.

0 to 20000 (Unit: according to the gain switching mode description), note that this parameter takes the setting value of P01.25 as the upper limit.

P01.27	Torque control switching mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Immediate			T

Trigger condition setting for gain switching during torque control.

0: The first gain fixed (P01.00 ~ P01.04)

1: The second gain fixed (P01.05 to P01.09)

2: Group 1 and 2 gain switching using DI input (GAIN-SWITCH) or P/PI switching by speed regulator.

3: Large torque instruction, torque instruction over level (P01.29) + hysteresis (P01.30) switches to the 2nd gain, and when the torque instruction is lower than level (P01.29) - hysteresis (P01.30) it returns to the 1st gain within the specified delay time, Unit: 0.1%

P01.28	Torque control switching delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	0.1ms	Immediate			T

Set the delay time for gain switching during torque control.

0 ~ 100.0ms

P01.29	Torque control switching class	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20000	0	--	Immediate			T

Set the trigger level for gain switching during torque control.

0 to 20000 (Unit: according to the gain switching mode description), note that this parameter takes the value set in P01.30 as the lower limit.

P01.30	Torque control switching hysteresis	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20000	0	--	Immediate			T

Set the hysteresis of the trigger level for gain switching during torque control.

0 to 20000 (Unit: according to the gain switching mode description) Note that this parameter takes the value set in P01.29 as the upper limit.

P01.31	Observer enabled	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P	S	T

0-Not Enabled

1-Debugging

2-Enabled

P01.32	Observer cut-off frequency	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	100	1Hz	Restart	P	S	T

P01.33	Observer phase compensation time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	0	0.01ms	Immediate	P	S	T

P01.34	Observer inertia coefficient	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	1000	--	Restart	P	S	T

P01.41	Model tracking option	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 7	0	--	Immediate	P		

0-Not enabled

1-Enabled, model 1, no external feedforward

2-Enabled, model 1, valid external feedforward

3-Enabled, model 2, no external feedforward

4-Enabled, model 2, valid external feedforward

P01.42	Model tracking gain	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	500	0.1	Immediate	P		

-

P01.43	Model tracking compensation factor	Range	Default	Unit	Effective	Relevant mode		
		500 ~ 2000	1000	0.1%	Immediate	P		

-

P01.44	Model tracking speed compensation gain	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	1000	0.1	Immediate	P		

-

P01.45	Model tracking torque compensation gain 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	1000	0.1	Immediate	P		

-

P01.46	Model tracking torque compensation gain 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	1000	0.1	Immediate	P		

-

P01.47	Model tracking gain 2	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	500	0.1	Immediate	P		

-

P01.48	Model tracking compensation coefficient 2	Range	Default	Unit	Effective	Relevant mode		
		500 ~ 2000	1000	0.1%	Immediate	P		

-

P01.49	Model anti-resonance frequency	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 2000	500	0.1HZ	Immediate	P		

-

P01.50	Model residual vibration frequency	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 2000	700	0.1HZ	Immediate	P		

-

P01.51	Vibration suppression frequency point	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 2000	800	0.1HZ	Immediate	P		

-

P01.52	Vibration suppression compensation coefficient	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 1000	100	--	Immediate	P		

-

P01.53	Model delay bandwidth parameter	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 30000	4500	0.1	Immediate	P		

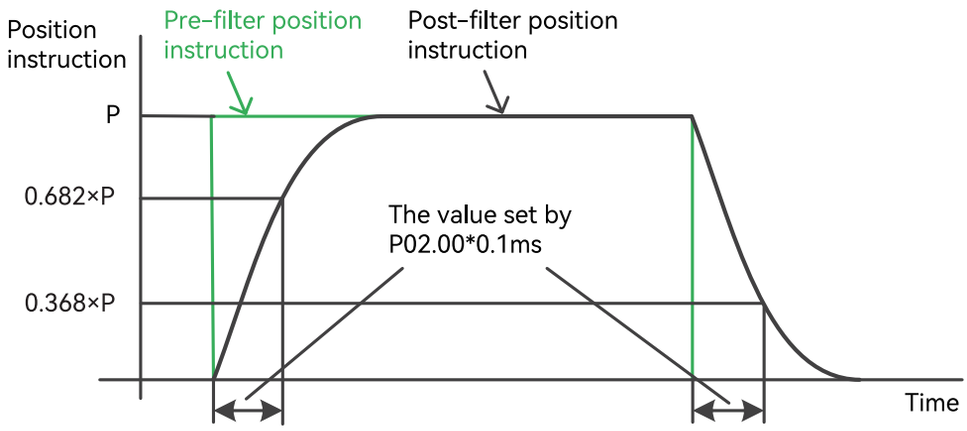
-

P01.54	Model delay compensation parameter	Range	Default	Unit	Effective	Relevant mode		
		500 ~ 1500	800	--	Immediate	P		

P02 Vibration suppression

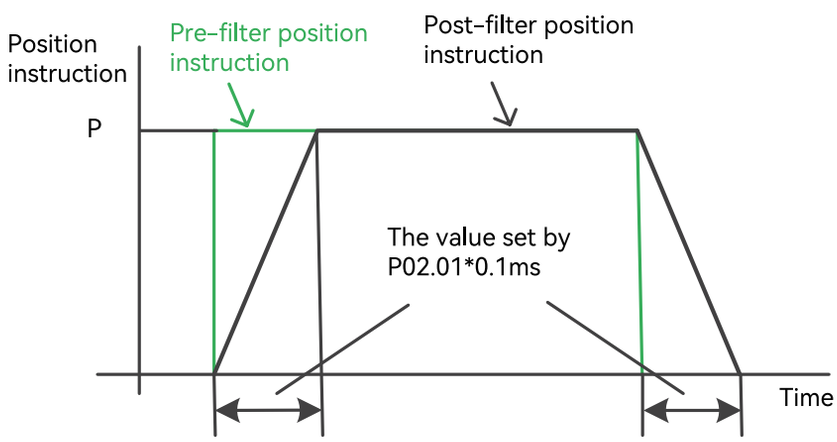
P02.00	Position instruction smoothing filter	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.1ms	Immediate	P		

In position control mode, set the position instruction first-order low-pass filter time constant, and the filtering effect is shown below:



P02.01	Position instruction FIR filter	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1280	0	0.1ms	Immediate	P		

In position control mode, set the position instruction first-order low-pass filter time constant, and the filtering effect is shown below:



P02.02	Adaptive filter mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Immediate	P	S	T

Set the operating mode of the adaptive filter.

0: Adaptation is not valid; the 3rd and 4th filters work but the parameters are unchanged

1: One adaptive filter is valid (the 3rd filter parameters are updated according to the adaptive result)

2: Two adaptive filters valid (the 3rd,4th filter parameters updated according to adaptive results)

3: Resonance frequency determination, results are displayed but filter parameters are not updated

4: Clear adaptive results (adaptive not valid and the 3rd and 4th filters are not working)

P02.03	Adaptive filter load mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	T

0: 1

0: High rigidity load

1: Low rigidity load

P02.04	The first notch filter frequency (manual)	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 5000	5000	1Hz	Immediate	P	S	T

Set the center frequency of the 1st notch filter.

50 to 5000Hz. This filter is not effective at 5000Hz.

P02.05	The first notch filter width	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 12	2	--	Immediate	P	S	T

Set the frequency width of the 1st notch filter.

0 ~ 12

P02.06	The first notch filter depth	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P	S	T

Set the depth corresponding to the center frequency of the 1st notch filter.

0 ~ 99

P02.07	The second notch filter frequency (manual)	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 5000	5000	1Hz	Immediate	P	S	T

Set the center frequency of the 2nd notch filter.

50 ~ 5000Hz. This filter is not effective at 5000Hz.

P02.08	The second notch filter width	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 12	2	--	Immediate	P	S	T

Set the frequency width of the 2nd notch filter.

0 ~ 12

P02.09	The second notch filter depth	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P	S	T

Set the depth corresponding to the center frequency of the 2nd notch filter.

0 ~ 99

P02.10	The third notch filter frequency	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 5000	5000	1Hz	Immediate	P	S	T

Set the center frequency of the 3rd notch filter (i.e., the first adaptive filter).

50 ~ 5000Hz, This filter is not effective at 5000Hz.

P02.11	The third notch filter width	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 12	2	--	Immediate	P	S	T

Set the frequency width of the 3rd notch filter (i.e., the first adaptive filter).

0 ~ 12

P02.12	The third notch filter depth	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P	S	T

Set the depth corresponding to the center frequency of the 3rd notch filter (i.e., the first adaptive filter).

0 ~ 99

P02.13	The fourth notch filter frequency	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 5000	5000	1Hz	Immediate	P	S	T

Set the center frequency of the 4th notch filter (i.e., the second adaptive filter).

50 ~ 5000Hz. This filter is not effective at 5000Hz.

P02.14	The fourth notch filter width	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 12	2	--	Immediate	P	S	T

Set the frequency width of the 4th notch filter (i.e., the second adaptive filter).

0 ~ 12

P02.15	The fourth notch filter depth	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P	S	T

Set the depth corresponding to center frequency of the 4th notch filter (i.e., the second adaptive filter).

0 ~ 99

P02.19	Position instruction FIR filter 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1280	0	0.1ms	Immediate	P		

Set the position instruction FIR filter time constant when in position control mode.

0.0ms ~ 128.0ms

P02.20	The first vibration damping frequency	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	0.1Hz	Immediate	P	S	

Set the frequency value of the low-frequency resonance frequency point 1.

10.0HZ ~ 100.0HZ

P02.21	The first vibration damping filtering setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10	0	0.1	Immediate	P	S	

Set the half-cycle attenuation coefficient for the low-frequency resonance frequency point 1.

0 ~ 1.0

P02.22	The second vibration damping frequency	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	0.1Hz	Immediate	P	S	

Set the frequency value of the low-frequency resonance frequency point 2. 10.0HZ ~ 100.0HZ

P02.23	The second vibration damping filtering setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10	0	0.1	Immediate	P	S	

Set the half-period attenuation coefficient for the low-frequency resonance frequency point 2.

0 ~ 1.0

P02.31	Resonance point 1 frequency	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	5000	1Hz	Display only	P	S	T

Resonance frequency detected by the 1st adaptive filter

P02.32	Resonance point 1 bandwidth	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20	2	--	Display only	P	S	T

Frequency width detected by the 1st adaptive filter

P02.33	Resonance point 1 amplitude	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	--	Display only	P	S	T

Amplitude of the resonant frequency detected by the 1st adaptive filter

P02.34	Resonance point 2 frequency	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	5000	1Hz	Display only	P	S	T

Resonance frequency detected by the 2nd adaptive filter

P02.35	Resonance point 2 bandwidth	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 20	2	--	Display only	P	S	T

Frequency width detected by the 2nd adaptive filter

P02.36	Resonance point 2 amplitude	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	--	Display only	P	S	T

Amplitude of the resonance frequency detected by the 2nd adaptive filter

P03 Speed & torque control parameters

P03.00	Speed instruction source	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6	0	--	Restart		S	

Set the source of instruction during speed control.

0: Digital setting (P03:03)

1: SPR (default AI1)

2: SPR, multi-segment instruction 2 ~ 16 switching

3: Multi-segment instruction 1 ~ 16 switching

4: Communication setting

5: SPR + digital setting

6: Multi-segment instruction 1 to 16 switching + digital setting

P03.03	Speed instruction setting value	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	200	1rpm	Immediate		S	

Set the speed instruction digital setting value.

-9000rpm ~ 9000rpm

P03.04	JOG speed setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3000	200	1rpm	Immediate		S	

Set the speed setting value during JOG.

0rpm ~ 3000rpm

P03.08	Torque limit source	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Immediate	P	S	

Torque limiting source selection.

0: Positive and negative internal torque limit (default)

1: Positive and negative external torque limit, when the 16 limit and 17 function of DI (P_CL, N_CL) are configured and valid,

the torque set by parameter P03.11 and P03.12 shall prevail; when this DI function is invalid, the torque limit set by parameter P03.09 and P03.10 shall prevail.

2: TLMTP is used as forward and reverse torque limit, and the input of analog AI1 or AI2 (AI1 or AI2 is selected by P05.16 and P05.17, and when selected at the same time, AI1 prevails) is used as the forward and reverse torque limitation value at the same time.

3: TLMTP, TLMTN forward and reverse limit, with the input of analog AI1 and AI2, respectively, as the forward and reverse torque limit values.

P03.09	Internal forward torque limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	3000	0.1%	Immediate	P	S	

Set the internal torque limit value during forward rotation in the range of 0.0% to 500.0% (based on the rated motor torque).

P03.10	Internal reverse torque limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	3000	0.1%	Immediate	P	S	

Set the internal torque limit value during reverse rotation in the range of 0.0% to 500.0% (based on the rated torque of the motor).

P03.11	External forward torque limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	3000	0.1%	Immediate	P	S	

Set the external torque limit value during the forward rotation in the range of 0.0% to 500.0% (based on the rated motor torque).

When DI is configured with function 16 (P_CL) and the DI input is valid, the forward rotation external torque limit is in effect; this setting value must not be greater than the P03.09

(Forward rotation internal torque limit value) setting value. When this setting value is greater than the value set by parameter P03.09, the torque limit value will be the value set by P03.09.

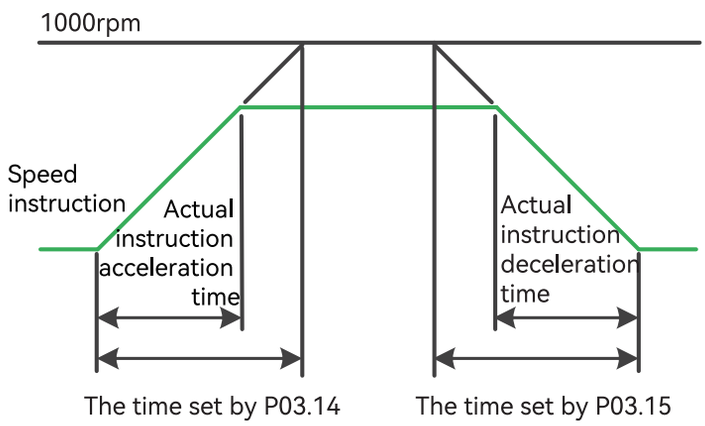
P03.12	External reverse torque limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	3000	0.1%	Immediate	P	S	

Set the external torque limit value during reverse rotation in the range of 0.0% to 500.0% (based on the rated torque of the motor)

When DI is configured with function 17 (N_CL) and the DI input is valid, the reverse rotation external torque limit is in effect; this set value must not be greater than the P03.10 (reverse rotation internal torque limit value) set value. When this setting value is greater than the parameter P03.10 setting value, the torque limit value will be the value set in P03.10.

P03.14	Acceleration time 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate		S	T

Acceleration and deceleration time to set the speed instruction from 0 to 1000rpm as shown below:



P03.15	Deceleration time 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate		S	T

0ms ~ 65535ms/1000rpm

P03.16	Acceleration time 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate		S	

0ms ~ 65535ms/1000rpm

P03.17	Deceleration time 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate		S	

0ms ~ 65535ms/1000rpm

P03.19	Zero-speed clamp function	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Immediate		S	T

Set the action at zero speed clamp.

0: Invalid

1: When ZERO_SPD is valid, the speed instruction is forced to 0

2: When ZERO_SPD is valid, the speed instruction is forced to 0. When the actual motor speed is lower than P03.20, it switches to position control and locks at the current position.

P03.20	Zero-speed clamp threshold value	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	10	1rpm	Immediate		S	T

0rpm ~ 1000rpm

P03.22	Torque instruction source	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Restart			T

Set the source of torque instruction during torque control.

0: Digital setting (P03.25)

1: TQR (using AI input value as torque instruction value)

2: Digital setting, TQR switching (CMD_SEL)

3: Communication setting

4: TQR + digital setting

P03.25	Torque instruction key set value	Range	Default	Unit	Effective	Relevant mode		
			0	0.1%	Immediate			T

-300.0% to 300.0% (based on rated motor torque)

P03.26	Speed limit source under torque control	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate			T

0: Forward and reverse internal speed limits P03.27, P03.28

1: SPL (using AI input value as speed limit)

P03.27	Internal positive speed limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9000	3000	--	Immediate			T

0rpm ~ 9000rpm

P03.28	Internal negative speed limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9000	3000	--	Immediate			T

0rpm ~ 9000rpm

P03.29	Hard limit torque limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4000	3000	0.1%	Immediate	P	S	T

Torque limit value when a hard limit is encountered.

-300.0% to 300.0% (based on motor rated torque).

A hard limit is considered to be encountered when the torque instruction rises rapidly and lasts longer than the detection time set in P03.30. Use the symbol of the torque instruction to distinguish between positive and negative hard limits.

P03.30	Hard limit torque limit detection time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	100	--	Immediate	P	S	T

Torque limit detection time when hard limit is encountered, 0ms to 2000ms.

P03.31	Speed instruction number selection mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart		S	

Set the internal multi-segment speed control method.

0: DI terminal selection

1: Communication selection

P03.32	Acceleration time number for speed instruction from segment 1 to 8	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate		S	

0: Acceleration time 1 (P03.14)

1: Acceleration time 2 (P03.16)

P03.33	Deceleration time number for speed instruction from segment 1 to 8	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate		S	

0: Deceleration time 1 (P03.15)

1: Deceleration time 2 (P03.17)

P03.34	Acceleration time number for speed instruction from segment 9 to 16	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate		S	

0: Acceleration Time 1 (P03.14)

1: Acceleration time 2 (P03.16)

P03.35	Deceleration time number for speed instruction from segment 9 to 16	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate		S	

0: Deceleration time 1 (P03.15)

1: Deceleration time 2 (P03.17)

P03.36	Segment 1 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

16 internal multi-segment speed set values.

-9000rpm ~ 9000rpm

P03.37	Segment 2 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.38	Segment 3 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.39	Segment 4 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.40	Segment 5 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.41	Segment 6 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.42	Segment 7 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.42	Segment 7 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.44	Segment 9 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.45	Segment 10 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.46	Segment 11 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.47	Segment 12 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.48	Segment 13 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.49	Segment 14 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.50	Segment 15 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P03.51	Segment 16 speed	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Immediate		S	

-9000rpm ~ 9000rpm

P04 Digital input and output

P04.00	Normal DI filter selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	500	1us	Restart	P	S	T

0 ~ 10000

P04.01	DI1 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	1	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.02	DI2 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	2	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.03	DI3 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	13	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.04	DI4 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	5	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.05	DI5 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	25	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.06	DI6 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	14	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.07	DI7 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	15	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.08	DI8 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	0	--	Restart	P	S	T

Input function code: 0 ~ 63

0: No definition

1 ~ 63: Refer to the digital input (DI) function definition table, some DI functions are undefined and reserved.

P04.11	DI1 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.12	DI2 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.13	DI3 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.14	DI4 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.15	DI5 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.16	DI6 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.17	DI7 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.18	DI8 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.19	DI9 terminal logic selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Input polarity setting: 0 ~ 1

0: Low level is valid (closed)

1: High level is valid (open)

P04.21	DO1 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	11	--	Restart	P	S	T

Input function code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.22	DO2 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	4	--	Restart	P	S	T

Input function code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.23	DO3 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	7	--	Restart	P	S	T

Input function code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.24	DO4 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	2	--	Restart	P	S	T

Input function code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.25	DO5 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	9	--	Restart	P	S	T

Output code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.31	DO1 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Output polarity setting: 0 ~ 1

0: Conduct when valid (normally-open contact)

1: Not to conduct when valid (normally-closed contact)

P04.32	DO2 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Output polarity setting: 0 ~ 1

0: Conduct when valid (normally-open contact)

1: Not to conduct when valid (normally-closed contact)

P04.33	DO3 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Output polarity setting: 0 ~ 1

0: Conduct when valid (normally-open contact)

1: Not to conduct when valid (normally-closed contact)

P04.34	DO4 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Output polarity setting: 0 ~ 1

0: Conduct when valid (normally-open contact)

1: Not to conduct when valid (normally-closed contact)

P04.35	DO5 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Output polarity setting: 0 ~ 1

0: Conduct when valid (normally-open contact)

1: Not to conduct when valid (normally-closed contact)

P04.41	FunINL signal unassigned status (HEX)	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Set the initial state of the DI function, and the DI function that is not configured to any DI terminal will maintain the initial state after power-on initialization.

Range (hexadecimal number) 0H to FFFFH.

Bit0: Reserved

Bit1: Correspond to DI function 1

Bit2: Correspond to DI function 2

Bit15: Correspond to DI function 15

P04.42	FunINH signal unassigned status (HEX)	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Range (hexadecimal number) 0H to FFFFH.

Bit0: Correspond to DI function 16

Bit1: Correspond to DI function 17

Bit15: Correspond to DI function 31

For DI functions numbered 32 and larger, user-set initial status is not supported.

P04.43	Motor rotational signal (TGON) threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	20	1rpm	Immediate	P	S	T

0rpm ~ 1000rpm

P04.44	Speed conformity signal width	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 1000	50	1rpm	Immediate		S	

10rpm ~ 9000rpm

P04.45	Speed specified value arrival	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 9000	100	1rpm	Immediate	P	S	T

10rpm ~ 9000rpm

P04.47	Positioning completion range	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	100	1P	Immediate	P		

1P ~ 65535P

P04.48	Positioning completion output setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 7	0	--	Immediate	P		

0: When the absolute value of position deviation is less than the positioning completion range (P04_47), output COIN signal.

1: When the absolute value of the position deviation is less than the positioning completion range (P04_47) and the position instruction is 0, output COIN signal.

2: If the absolute value of position deviation is less than the range of positioning completion (P04_47) and the position instruction is 0, the COIN signal is output and the holding time is P04_49.

3: When the absolute value of position deviation is less than the positioning completion range (P04_47), and the filtered position instruction is 0, output COIN signal.

4: Condition 0, zero speed signal is valid, output COIN signal.

5: Condition 1, zero speed signal is valid, output COIN signal.

6: Condition 2, zero speed signal is valid, output COIN signal.

7: Condition 3, zero speed signal is valid, output COIN signal.

P04.49	Positioning completion holding time	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	1	1ms	Immediate	P		

1 ~ 65535ms

P04.50	Positioning near range	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	65535	1P	Immediate	P		

1P ~ 65535P

P04.51	Servo OFF delay time after holding brake taking action when speed is 0	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	10	1ms	Immediate	P	S	T

0ms ~ 9999ms

P04.52	Speed setting for holding brake to take action in motion	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3000	100	1rpm	Immediate	P	S	T

0rpm ~ 3000rpm

P04.53	Waiting time for holding brake to take action in motion	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	10	1ms	Immediate	P	S	T

0ms ~ 9999ms

P04.55	Torque set value arrival	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3000	1000	0.1%	Immediate	P	S	T

0.0% to 300.0% (based on rated motor torque).

When actual torque (absolute value) ≥ (P04.55 + P04.56) is detected, DO function 12 is valid.

If the actual torque (absolute value) detected is < (P04.55 + P04.56), DO function 12 is invalid.

P04.56	Torque arrival detection width	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3000	200	0.1%	Immediate	P	S	T

0.0% to 300.0% (based on motor rated torque)

P04.57	Z-phase pulse width adjustment	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 100	50	--	Restart	P	S	T

0 ~ 100

P04.58	Zero-speed signal output threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	60	1rpm	Immediate	P	S	T

0 to 1000rpm, DO function 5 is valid after the actual speed falls below this threshold.

P05 Analog input and output

P05.00	AI1 minimum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	-1000	0.01V	Immediate	P	S	T

The setting range is -10.00V to 10.00V.

Note that this parameter takes the set value of P05.02 as the upper limit.

P05.01	Setting value corresponding to the AI1 minimum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	-1000	0.1%	Immediate	P	S	T

-100.0% ~ 100.0%

(100% speed corresponds to the speed set in P05.14, and 100% torque corresponds to the torque set in P05.15.)

P05.02	AI1 maximum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	1000	0.01V	Immediate	P	S	T

The setting range is -10.00V to 10.00V.

Note that this parameter takes the set value of P05.00 as the lower limit.

P05.03	Setting value corresponding to the AI1 maximum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	1000	0.1%	Immediate	P	S	T

-100.0% ~ 100.0%

(100% speed corresponds to the speed set in P05.14, and 100% torque corresponds to the torque set in P05.15.)

P05.04	AI1 zero-point fine tuning	Range	Default	Unit	Effective	Relevant mode		
		-500 ~ 500	0	1mV	Immediate	P	S	T

-500mV ~ 500mV

P05.05	AI1 dead band setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 200	0	0.1%	Immediate	P	S	T

0.0 ~ 20.0%

P05.06	AI1 input filtering time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	20	0.1ms	Immediate	P	S	T

0.0ms ~ 6553.5ms

P05.07	AI2 minimum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	-1000	0.01V	Immediate	P	S	T

The setting range is -10.00V to 10.00V.

Note that this parameter takes the set value of P05.09 as the upper limit.

P05.08	Setting value corresponding to the AI2 minimum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	-1000	0.1%	Immediate	P	S	T

-100.0% ~ 100.0%

(100% speed corresponds to the speed set in P05.14, and 100% torque corresponds to the torque set in P05.15.)

P05.09	AI2 maximum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	1000	0.01V	Immediate	P	S	T

The setting range is -10.00V to 10.00V.

Note that this parameter takes the value set in P05.07 as the lower limit.

P05.10	Setting value corresponding to the AI2 maximum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	1000	0.1%	Immediate	P	S	T

-100.0% ~ 100.0%

(100% speed corresponds to the speed set in P05.14, and 100% torque corresponds to the torque set in P05.15.)

P05.11	AI2 zero-point fine tuning	Range	Default	Unit	Effective	Relevant mode		
		-500 ~ 500	0	1mV	Immediate	P	S	T

-500mV ~ 500mV

P05.12	AI2 dead band setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 200	0	0.1%	Immediate	P	S	T

0.0 ~ 20.0%

P05.13	AI2 input filtering time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	20	0.1ms	Immediate	P	S	T

0.0ms ~ 6553.5ms

P05.14	AI setting 100% speed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9000	3000	1rpm	Immediate	P	S	T

0 ~ 9000rpm

P05.15	AI setting 100% torque	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	100	0.01	Immediate	P	S	T

0 to 5.00 times rated motor torque

P05.16	AI1 function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Immediate	P	S	T

0 ~ 5

0: SPR, speed instruction

1: TQR, torque instruction

2: SPL, speed limit

3: TLMTP, positive torque limit

4: TLMTN, negative steering limit

5: TFFD, Torque feed forward

P05.17	AI2 function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	3	--	Immediate	P	S	T

0 ~ 5

0: SPR, speed instruction

1: TQR, torque instruction

2: SPL, speed limit

3: TLMTP, positive torque limit

4: TLMTN, negative steering limit

5: TFFD, Torque feed forward

P05.28	AO1 signal selection (need optional card)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 13	0	--	Immediate	P	S	T

0: Motor speed (1V/1000rpm) default

1: Speed instruction (1V/1000rpm)

2: Torque instruction (1V/100%)

3: Position deviation (0.05V/1 instruction Unit)

4: Position amplifier deviation (after electronic gear) (0.05V/1 encoder pulse unit)

5: Position instruction speed (1V/1000 rpm)

6: Positioning completion instruction (completed: 5V, not completed: 0V)

7: Speed feed-forward (1V/1000rpm)

8: Torque feed-forward (1V/100%)

9: Load rate (1V/100%)

10: Regenerative load rate (1V/100%)

11: Drive temperature (0.1V/1° C)

12: AI1 (1V/1V)

13: AI2 (1V/1V)

P05.29	AO1 voltage offset	Range	Default	Unit	Effective	Relevant mode		
		-10000 ~ 10000	0	1mV	Immediate	P	S	T

-10000mV ~ 10000mV

P05.30	AO1 multiplication	Range	Default	Unit	Effective	Relevant mode		
		-9999 ~ 9999	100	0.01	Immediate	P	S	T

-99.99 ~ 99.99

P05.31	AO2 signal selection (need optional card)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 13	0	--	Immediate	P	S	T

0: Motor speed (1V/1000rpm) default

1: Speed instruction (1V/1000rpm)

2: Torque instruction (1V/100%)

3: Position deviation (0.05V/1 instruction unit)

4: Position amplifier deviation (after electronic gear) (0.05V/1 encoder pulse unit)

5: Position instruction speed (1V/1000 rpm)

6: Positioning completion instruction (completed: 5V, not completed: 0V)

7: Speed feed-forward (1V/1000rpm)

8: Torque feed-forward (1V/100%)

9: Load rate (1V/100%)

10: Regenerative load rate (1V/100%)

11: Drive temperature (0.1V/1° C)

12: AI1 (1V/1V)

13: AI2 (1V/1V)

P05.32	AO2 voltage offset	Range	Default	Unit	Effective	Relevant mode		
		-10000 ~ 10000	0	1mV	Immediate	P	S	T

-10000mV ~ 10000mV

P05.33	AO2 multiplication	Range	Default	Unit	Effective	Relevant mode		
		-9999 ~ 9999	100	0.01	Immediate	P	S	T

-99.99 ~ 99.99

P05.34	AO monitoring value type	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ 00FFH	0	--	Immediate	P	S	T

0 to 255

Hexadecimal number, each bit from right to left.

Digit 1: Set the monitoring value type of AO1;

Digit 2: Set the monitoring value type of AO2.

0: Signed data output, -10V to +10V.

1: Absolute value data output, 0 to 10V.

P06 Expansion parameters

P06.00	Electronic gear numerator 2 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Immediate	P		

1 ~ 1073741824

P06.02	Electronic gear numerator 3 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Immediate	P		

1 ~ 1073741824

P06.04	Electronic gear numerator 4 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Immediate	P		

1 ~ 1073741824

P06.06	Position deviation clearing function	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Immediate	P		

0: Position deviation pulses are cleared when the servo is OFF or when a malfunction occurs.

1: Position deviation pulse is cleared only when a malfunction occurs.

2: Position deviation pulse is cleared when the servo is OFF, a malfunction occurs, or the DI function (PERR_CLR) is active.

3: Position deviation pulse is cleared only by the DI function (PERR_CLR).

P06.09	Electronic gear ratio switching delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P		

0: Position instruction pulse is 0 for 10ms and then switching

1: Real-time switching

P06.10	Potential energy load torque compensation	Range	Default	Unit	Effective	Relevant mode		
		-100 ~ 100	0	1%	Immediate	P	S	

Compensate for gravity loads. Range: -100% ~ 100%

P06.11	P06.10 and friction compensation storage options	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	2	--	Immediate	P	S	

0: Automatic update, power-failure storage

1: Auto-update, re-initialize to set value at power-failure

2: No automatic update

P06.12	Forward rotation frictional torque compensation	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3000	0	0.1%	Immediate	P	S	

0.1% torque

Unit (0 ~ 300.0)

P06.13	Reverse rotation friction torque compensation	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 0	0	0.1%	Immediate	P	S	

0.1% torque

Unit (-300.0 ~ 0)

P06.14	Viscous friction compensation	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 3000	0	0.1%	Immediate	P	S	

0.1% torque

Unit (-300.0 ~ 300.0)

P06.15	Friction compensation time constant	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	0	0.1ms	Immediate	P	S	

0.1ms

Unit (0 ~ 1000.0ms)

P06.16	Friction compensation low speed range	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	1	1rpm	Immediate	P	S	

0 ~ 500rpm

P06.18	The first type fault stop selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

0 -coast to stop, remain free

1-DB stop, hold DB

P06.19	Parameter identification rate	Range	Default	Unit	Effective	Relevant mode		
		100 ~ 1000	500	--	Restart	P	S	

100 ~ 1000rpm

P06.20	Parameter identification acceleration time	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 10000	100	--	Restart	P	S	

50 ~ 10000ms

P06.21	Parameter identification deceleration time	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 10000	100	--	Restart	P	S	

50 ~ 10000ms

P06.22	Parameter identification mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	

0: Inertia is not automatically updated during auto-tuning.

1: Inertia is automatically updated during auto-tuning;

P06.23	Initial angle identification current limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	500	0.1%	Restart	P	S	T

0 ~ 200.0%

P06.24	Instantaneous power failure protection	Range	Default	Unit	Effective	Relevant mode		
		0 ~	0	--	Immediate	P	S	T

This protection function can be enabled in the event of a momentary power failure if the power can be restored immediately, allowing the previous state before the main power failure to be restored immediately after the power is restored.

0: The third type of fault stops in the same way as the second type of fault stops

1: Enable

P06.25	Instantaneous power failure deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	20	1ms	Immediate	P	S	T

After enabling the momentary power failure protection, use this power failure deceleration time when stopping the machine. The range is 0ms to 10000ms/1000rpm.

P06.26	Servo OFF stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	4	--	Restart	P	S	T

0 -coast to stop, remain free

1- Zero speed stop, remain free

2-Stop by emergency stop torque, remain free

3-DB stop, hold DB

4-Zero speed stop, hold DB

5-Stop by emergency stop torque, hold DB

P06.27	The second type fault stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	4	--	Restart	P	S	T

0 -coast to stop, remain free

1- Zero speed stop, remain free

2-Stop by emergency stop torque, remain free

3-DB stop, hold DB

4-Zero speed stop, hold DB

5-Stop by emergency stop torque, hold DB

P06.28	Over-travel input setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Restart	P	S	T

0: DI function 14 (P_OT) positive drive is disabled, DI function 15 (N_OT) negative drive is disabled

1: Invalid

P06.29	Over-travel stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	1	--	Restart	P	S	T

0: Zero speed stop, and maintain zero speed (after overtravel is valid, the motor cannot rotate)

1: Stop at zero speed, and maintain zero speed (after overtravel is valid, the motor cannot rotate)

2: Stop by emergency stop torque, and remain free (the negative rotation is possible when positive overtravel is valid, and the positive rotation is possible when negative overtravel is valid)

P06.30	Input power phase loss protection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	T

0: Enable protection

1: Disable protection

P06.31	Output power phase loss protection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	T

0: Enable protection

1: Disable protection

P06.32	Stop by emergency stop torque	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5000	3000	0.1%	Immediate	P	S	T

0.0% to 300.0% (based on motor rated torque)

P06.33	Tripping protection function	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Immediate	P	S	T

0: Enable protection

1: Disable protection

P06.34	Overload warning value	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P	S	T

1% ~ 100%

P06.35	Motor overload protection coefficient	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 300	100	1%	Immediate	P	S	T

10% ~ 300%

P06.36	Undervoltage protection point	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 130	100	1%	Immediate	P	S	T

50% to 100% (100% corresponds to the default undervoltage point, 180V busbar voltage, P21.06 display value)

P06.37	Over-speed fault point	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 120	120	1%	Immediate	P	S	T

50% to 120% (100% corresponds to maximum motor speed)

P06.38	Maximum input pulse frequency	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 9000	500	1KHZ	Restart	P		

10 ~ 9000K

P06.39	Short circuit to ground detection protection selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	T

0: Enable detection (default)

1: Disable detection

P06.40	Encoder interference detection delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P	S	T

0 ~ 99

P06.41	Input pulse filtering setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	40	--	Restart	P		

0 ~ 500 (Unit: 10ns)

Below 250KHZ, the recommended value is 40;

250K ~ 500K, the recommended value is 20;

500K ~ 1M, the recommended value is 10;

Above 1M, the recommended value is 5;

Above 2M, set to 0.

P06.42	Pulse inhibition input setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P		

0: 0.5ms twice continuously consistent;

1: 0.5ms three times continuously consistent;

2: 1ms three times continuously consistent;

3: 2ms three times continuously consistent.

P06.43	Deviation clearing input setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P		

0: Level is valid;

1: Edge is valid.

P06.44	The second encoder input filtering	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	50	10ns	Restart	P	S	T

0 ~ 500 (Unit: 10ns)

0 ~ 500 (Unit: 10ns)

Below 250KHZ, the recommended value is 40;

250K ~ 500K, the recommended value is 20;

500K ~ 1M, the recommended value is 10;

P06.45	Overlarge speed deviation threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	0	1rpm	Immediate	P	S	

Range: 0 ~ 10000rpm

Not to detect when set to a value of 10 or less.

The absolute difference between the speed instruction and the actual measured speed exceeding this range will report fault Err.16.

P06.46	Torque saturation timeout duration	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 30000	0	1ms	Immediate	P	S	T

Range: 6 ~ 30000ms.

If the torque is saturated for a long time and the duration exceeds this range, error Err.17 is reported.

The torque saturation setting value is the value set in P03.09 or P03.10.

P06.47	Absolute system setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 19	0	--	Restart	P	S	T

0 ~ 19

Ones place:

0: Incremental system;

1: Absolute system (Err.12 needs manual clearing, industrial robotics special);

2: Absolute system (Err.12 needs manual clearing, industrial robotics special);

3~9: Absolute system with overflow error.

Tens place:

0: Battery undervoltage warning but keep running;

1: Battery undervoltage warning and stop.

P06.48	Encoder battery undervoltage threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 33	30	0.1V	Restart	P	S	T

Range: 0.0 ~ 3.3V

When the encoder battery voltage is detected to be lower than this value, it is judged to report a fault or warning according to the setting of P06.47.

P06.49	High-speed pulse input filtering	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	40	10ns	Restart	P	S	T

0 ~ 500 (Unit: 10ns)

Below 250KHZ, the recommended value is 40;

250K ~ 500K, the recommended value is 20;

500K ~ 1M, the recommended value is 10;

Above 1M, the recommended value is 5;

Above 2M, set to 0.

P07 Auxiliary function

P07.00	Panel display option	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Hexadecimal, from right to left:

Digit 1: Display the setting at homepage of panel

0: Status display

When set to 1 to 5, display the parameters set in P07. 01 ~ P07. 05.

Other digits are reserved.

P07.01	Panel monitoring parameter setting 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	1	--	Immediate	P	S	T

0 ~ 79,

Parameters of group P21 except P21.00 can be displayed directly on the panel. Setting to 0 does not display

P07.02	Panel monitoring parameter setting 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	5	--	Immediate	P	S	T

0 ~ 79, , same as P07_01.

P07.03	Panel monitoring parameter setting 3	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	6	--	Immediate	P	S	T

0 ~ 79, , same as P07_01.

P07.04	Panel monitoring parameter setting 4	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	21	--	Immediate	P	S	T

0 ~ 79, , same as P07_01.

P07.05	Panel monitoring parameter setting 5	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	23	--	Immediate	P	S	T

0 ~ 79, , same as P07_01.

P07.08	Function selection 1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Hexadecimal number, from right to left:

Digit 1, the time multiplication of the origin search;

When this value is not zero, the actual time of the time limit value of the homing process is equal to P08.95 multiplied by this value.

Digit 2, Deviation clearing setting during pulse inhibition:

0, No automatic deviation clearing during pulse inhibition

1, Automatic deviation clearing during pulse inhibition

Digit 3, limit detection method during origin search:

Set to 0, detection by DI functions 14 and 15;

Set to 1, detection by hard limit torque limit;

Set to 2, DI function or hard limit torque limit detection.

Digit 4, soft limit detection setting:

Set to 0, no soft limit detection;

Setting to 1, soft limit detection starts at power-on;

Setting to 2, the soft limit is detected only after the return to origin is completed.

P07.09	Function selection 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Reserved

P07.10	User password	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Immediate	P	S	T

0 ~ 65535

P07.11	Instant memory storage during power outage	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	T

0: Disabled

1: Enabled

After turning on, power-down storage stores the following contents:

① Potential load torque compensation value P06.10

② Forward rotation frictional torque compensation P06.12

③ Reverse rotation frictional torque compensation P06.13

④ Feedback pulse counter P21.17

⑤ Total power-on time P21.25

(Without being switched on, the value of P21.25 is stored in hours as the unit; with being switched on, the value of P21.25 is stored in milliseconds as the unit.)

⑥ Absolute position encoder turn P21.32

P07.12	User password screen-lock time	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 30	5	1 min	Immediate	P	S	T

1 ~ 30 minutes

P07.14	Fast deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	5	1ms	Restart	P	S	T

0ms ~ 9999ms

P07.16	Function selection 3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal, from right to left:

Digit 1: Interrupt positioning instruction setting

0: No adjustment with electronic gear;

1: Adjust with electronic gear

Digit 2: Interrupt positioning instruction direction setting

0: Follow the current operation direction

1: Decided by instruction sign

Other digits are reserved.

P07.17	Resolution	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P		

Divide a circle of corresponding pulses into 0 to 99 parts.

P07.19	Function selection 5	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal, from right to left,

Digit 1: Reserved

Digit 2: Reserved

Digit 3: Position feedback initialization selection

Non-absolute system (P06. 47 is equal to zero):

0: Initialize to 0

1: Initialize to the value before power-off (power failure storage needs to be enabled, i.e. set P07.11 to 1)

Absolute system (P06. 47 is not equal to zero), decided by encoder value.

Digit 4: Absolute position (P21. 07) and position feedback (P21. 17) counter bit width selection

0: 32-bit counter

1: 64-bit counter

When using a 64-bit counter, a low 32-bit absolute position is displayed in P21. 07 and high 32-bit displays in P21. 56;

Low 32-bit position feedback displays in P21. 17 and high 32-bit displays in P21. 58.

P07.20	Function selection 6	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal, from right to left:

Digit 1: Motor type selection

0: Read from encoder;

1: Manual setting;

Digit 2: Software overcurrent detection

0: Enable

1: Disable

Other digits are reserved.

P07.21	Function selection 7	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	4096	--	Immediate	P	S	T

Hexadecimal, from right to left:

Digit 1: servo not ready when enabled

0: No error or alarm

1: AL. 084 is reported

2: Er.040 is reported

Digit 2: Fault Er.046, Er.047 reset

0: reset is not allowed;

1: reset is not allowed until 10 seconds after the alarm;

Digit 3: DI DO monitoring display

0: in binary.

1: in hexadecimal

Digit 4: AL.097 reset

0: reset

1: N

P07.22	Function selection 8	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	34	--	Immediate	P	S	T

Hexadecimal, from right to left:

Digit 1: Main power off (Err .56) detection setting

0: Err .56 is detected and reset automatically

1: Err .56; Not to detect Err .56

2: Err .56 is detected but cannot reset automatically

Digit 2: Undervoltage (Err .21) detection setting

0: Err .21 is detected and reset automatically

1: Not to detect Err .21.

2: Err .21 is detected but cannot reset automatically.

The main circuit undervoltage point is 180V by default and can be set via parameter P06.36.

Digit 3: Error records of Err .21 and Err .56

0: Not to store

1: Store

Digit 4: Control power undervoltage error (Err .18) detection

0: Enable

1: Disable

P07.23	Fault reset timing	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P	S	T

0: Y when SON is valid

1: N when SON is valid

P07.24	Positive soft limit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	2147483647	--	Restart	P	S	T

It is valid during forward soft limit, position control, speed control, and torque control modes.

P07.26	Negative soft limit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	-2147483648	--	Restart	P	S	T

It is valid during reverse soft limit, position control, speed control, and torque control modes.

P07.28	Holding time of return completion signal during non-DI return	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	2000	--	Immediate	P	S	T

P07.30	Total number of DB stop	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Restart	P	S	T

P08 Internal position instruction

P08.00	Multi-segment preset position execution method	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Restart	P		

0: Single operation

1: Cyclic operation

2: DI terminal switching operation

3: Communication switching operation (P20.11 selected segment number)

4: Single continuous operation

5: Cyclic continuous operation

There are a total of 16 segment instructions, and the starting segment serial number is set by P08.01, and the ending segment serial number is set by P08.02.

Set to 0 for single operation, start from the start segment and execute each segment in turn until the end segment;

Set to 1, cyclic operation, start from the start segment, execute each segment in turn until the end segment, and then start from the start segment again.

This is repeated until the internal position enable signal is disabled or the servo is OFF;

Set to 2 for DI terminal switching operation, the segment serial number to be executed is selected by DI function 6 to 9, see subsection 4.4.1 of this manual for details;

Set to 3, communication switching operation, which conducts the selection of the segment sequence number via MOUDBUS communication for parameter P20.11;

Set to 4 and 5, corresponding to 0 and 1, the difference is that the current segment does not need to decelerate to 0 before starting the next segment in the transition between the two segments, while each segment of execution mode 0 and 1 needs to decelerate to 0 before starting the next segment.

P08.01	Starting segment number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 16	1	--	Immediate	P		

Range: 1 ~ （P08.02）

The two parameters P08.01 and P08.02 constrain each other.

P08.02	Ending segment number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 16	2	--	Immediate	P		

Range:（P08：01） ~ 16

The two parameters P08.01 and P08.02 constrain each other.

P08.03	Dealing of residual segments after pausing and restarting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Immediate	P		

0: Run the remaining segments

1: Run from the beginning again

P08.04	Position instruction type	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P		

0: Relative position instruction

1: Absolute position instruction

P08.05	Waiting time unit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P		

0: The wait time between sequential execution (single or cyclic) timeslots and segments is measured in ms.

1: Wait time in s between sequential execution (single or cyclic) periods and segments.

P08.06	The first segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.08	The first segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.09	The first segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.10	Waiting time after the first segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.11	The second segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.13	The second segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.14	The second segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.15	Waiting time after the second segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.16	The third segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.18	The third segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.19	The third segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.20	Waiting time after the third segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.21	The fourth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.23	The fourth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.24	The fourth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.25	Waiting time after the fourth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.26	The fifth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.28	The fifth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.29	The fifth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.30	Waiting time after the fifth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.31	The sixth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.33	The sixth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.34	The sixth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.35	Waiting time after the sixth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.36	The seventh segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.38	The seventh segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

0 ~ 65535ms

P08.40	Waiting time after the seventh segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.41	The eighth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.43	The eighth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.44	The eighth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.45	Waiting time after the eighth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.46	The ninth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.48	The ninth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.49	The ninth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.50	Waiting time after the ninth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.51	The 10th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.53	The 10th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.54	The 10th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.55	Waiting time after the 10th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.56	The 11th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.58	The 11th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.59	The 11th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.60	Waiting time after the 11th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.61	The 12th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.63	The 12th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.64	The 12th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.65	Waiting time after the 12th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.66	The 13th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.68	The 13th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.69	The 13th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.70	Waiting time after the 13th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.71	The 14th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.73	The 14th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.74	The 14th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.75	Waiting time after the 14th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.76	The 15th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.78	The 15th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.79	The 15th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.80	Waiting time after the 15th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.81	The 16th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

A value between -1073741824 and 1073741824 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.83	The 16th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.84	The 16th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.85	Waiting time after the 16th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.86	Position instruction interrupt execution setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Restart	P		

0: Disable the function of robbing execution;

1: Enable, interrupt at the rising edge of the DI signal, and automatically release the interrupt lock state after completion;

2: Enable, interrupt at the rising edge of the DI signal, and release the interrupt lock state by DI signal INTP_ULK after completion;

3: Enable, interrupt at the falling edge of the DI signal, and automatically release the interrupt lock state after completion;

4: Enable, interrupt at the falling edge of the DI signal, and release the interrupt lock state by DI signal INTP_ULK after completion.

P08.88	Homing start method	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Restart	P		

0: Disable

1: Enable by DI function STHOME

2: Enable by key (panel keys make P20.12=1)

3: Enable by communication (communication control P20.12=1)

4: Enable immediately after powering on the servo ON for the first time

P08.89	Homing mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	2	--	Restart	P		

0: Forward rotation to search for the origin, with the positive limit as the origin

1: Reverse rotation to search for the origin, with the negative limit as the origin

2: Forward rotation to search for the origin, with the HOME_IN signal OFF → ON as the origin

3: Reverse rotation to search for the origin, with the HOME_IN signal OFF → ON as the origin

4: Forward rotation to search for the origin, with the HOME_IN signal ON → OFF as the origin

5: Reverse rotation to search for the origin, with the HOME_IN signal ON → OFF as the origin

6：Forward rotation to directly search for the nearest Z signal as the origin

7：Reverse rotation to directly search for the nearest Z signal as the origin

8：Directly use the current position as the origin

P08.90	Limit switch and z-phase signal setting when homing	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	2	--	Restart	P		

The meaning of the set values is as follows:

0: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will automatically return to the reverse direction to find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will automatically return to the reverse direction and go forward to search for the Z signal.

1: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will automatically return to the reverse direction to find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will directly go forward to search for the Z signal.

2: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and not find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will automatically return to the reverse direction and not find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will automatically return to the reverse direction and go forward to search for the Z signal.

3: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will stop and alarm and return to find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will stop and alarm and go forward to search for the Z signal.

4: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will stop and alarm and go forward to search for the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will stop and alarm and go forward to search for the Z signal.

5: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm and not find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will stop and alarm and not find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will stop and alarm and go forward to search for the Z signal.

P08.92	Origin search high speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 3000	500	1rpm	Immediate	P		

1 ~ 3000rpm。

After the homing process is started, the search for the origin begins at this speed unless a deceleration signal or an origin position signal is already present at the start.

P08.93	Origin search low speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 300	50	1rpm	Immediate	P		

1 ~ 300rpm。

When searching for the origin, switch to a low-speed search after encountering a deceleration point, or after encountering the origin position.

P08.94	Acceleration/deceleration time during origin searching	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 10000	500	1ms	Immediate	P		

1 ~ 10000ms

P08.95	Homing time limit	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	60000	1ms	Immediate	P		

1 ~ 65535ms。

Set the limit time for the origin return process, if the origin is not searched after this time, the search for the origin is stopped and the alarm AL.96 will occur. If the limit time set here is still not enough, the multiplication of the limit time can be set by the 1st digit from the right of P07.08. When digit 1 from the right of P07.08 is not 0, the actual limit time is the product of this value, and digit 1 from the right of P07.08.

P08.96	Origin offset (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

Range: -1073741824 ~ 1073741824

It is used to adjust the value of the origin coordinates. The value displayed at P21.07 after the completion of a normal homing is the value of P08.96, which does not affect the value of P21.34 after the homing process (i.e., it does not affect the actual position of homing).

P08.98	Mechanical origin offset (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

Range: -1073741824 ~ 1073741824

It is used to move a distance after the origin position has been found. The offset unit is the instruction unit (when the gear ratio is 10000 and P08.98 is 5000, there is a half-turn positive offset), the offset speed is P08.92 (high-speed search speed of origin), and the homing completion signal is output only after the offset is completed.

P09 Communication setting

P09.00	Servo axis address number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 255	1	--	Immediate	P	S	T

1 ~ 247

It is used for communication and supports Modbus, CANOpen, and so on.

P09.01	Modbus baud rate	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6	2	--	Immediate	P	S	T

The supported baud rates and for settings are as follows:

0: 2400

1: 4800

2: 9600

3: 19200

4: 38400

5: 57600

6: 115200

P09.02	Modbus data format	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Immediate	P	S	T

0: No parity, 2 stop bit

1: Even, 1 stop bit

2: Odd, 1 stop bit

3: No parity, 1 stop bit

P09.03	Communication timeout	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	0	1ms	Immediate	P	S	T

Monitor the communication busbar for data for a set period of time

P09.04	Communication response delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	0	1ms	Immediate	P	S	T

Respond after delaying for a set period of time after receiving data

P09.05	Communication DI enabling setting 1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 1 ~ 15 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DI function:

0: Not enabled;

1: enabled

Refer to section 5.5.3 of this manual for detailed instructions.

P09.06	Communication DI enabling setting 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 16 ~ 31 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DI function:

0: Not enabled;

1: enabled

Refer to section 5.5.3 of this manual for detailed instructions.

P09.07	Communication DI enabling setting 3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 32 ~ 47 respectively. The value of the binary bit indicates whether to enable the communication

control of the corresponding DI function:

0: Not enabled;

1: enabled

Refer to section 5.5.3 of this manual for detailed instructions.

P09.08	Communication DI enabling setting 4	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 48 ~ 63 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DI function:

0: Not enabled;

1: enabled

Refer to section 5.5.3 of this manual for detailed instructions.

P09.09	Communication DO enabling setting 1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DO function, BIT0 ~ BIT15 corresponds to DO functions 1 ~ 15 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DO function:

0: Not enabled;

1: enabled

Refer to section 5.5.4 of this manual for detailed instructions.

P09.10	Communication DO enabling setting 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DO function, BIT0 ~ BIT15 corresponds to DO functions 16 ~ 31 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DO function:

0: Not enabled;

1: enabled

Refer to section 5.5.4 of this manual for detailed instructions.

P09.11	Communication instruction holding time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 60	5	--	Immediate	P	S	T

The time to maintain the original state when communication is disconnected after the command value is written to the communication can be set from 0 to 60 in seconds. Set to 0 means 0.5 seconds.

P17 Expansion position control function

P17.00	External encoder usage	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P		

0: No external encoder is used for position feedback

1: When using external encoder as position feedback, the external encoder count is increased when the motor direction is CCW.

2: External encoder is used as position feedback, the external encoder count is increased when the motor direction is CW.

P17.01	External encoder pitch (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	10000	--	Restart	P		

Set the number of feedback pulses from the external encoder for one revolution of the motor:

0 ~ 1073741824

P17.03	Full-closed mixed deviation threshold(32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Immediate	P		

0 ~ 1073741824

P17.05	Mixed deviation counting setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 100	0	0.01	Restart	P		

0 ~ 100%

P17.06	Mixed vibration suppression gain	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 30000	400	0.1/s	Immediate	P		

1.0 ~ 3000.0 /s

P17.07	Mixed vibration suppression time constant	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 30000	0	0.1ms	Immediate	P		

0.0 ~ 3000.0ms

P17.09	External units for full closed loop mixed deviation (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P		

-1073741824 ~ 1073741824

P17.11	External units for internal encoder count value (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P		

-1073741824 ~ 1073741824

P17.13	External encoder count value (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P		

-1073741824 ~ 1073741824

P17.16	Position comparison output mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P		

Range: 0 ~ 3,

0: Disable

1: Forward trigger,

2: Reverse trigger,

3: Bi-directional trigger

P17.17	The first position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

The value set by this parameter is output in comparison with the value of P21.07.

P17.19	The second position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

The value set by this parameter is output in comparison with the value of P21.07.

P17.21	The third position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

The value set by this parameter is output in comparison with the value of P21.07.

P17.23	The fourth position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

The value set by this parameter is output in comparison with the value of P21.07.

P17.25	Signal effective time 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65535ms.

P17.26	Signal effective time 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65536ms.

P17.27	Signal effective time 3	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65537ms.

P17.28	Signal effective time 4	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65538ms.

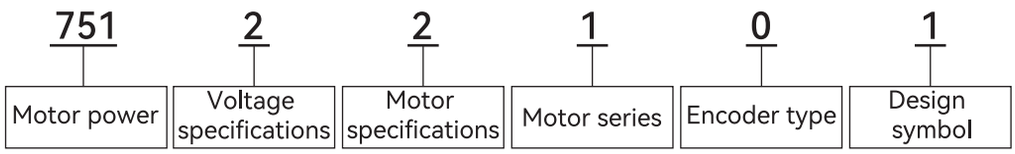
P17.29	Display delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms

P18 Motor model

P18.00	Motor model code (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		00000000H ~ 7FFFFFFFH	1964114433	--	Restart	P	S	T

The motor model code is an 8-digit hexadecimal mechanism number, for example, the code of the motor model is self-identified as 75122101, and each digit indicates the meaning as follows:



Motor power	
101	100W
201	200W
401	400W
751	750W
102	1kW
152	1.5kW
202	2kW
252	2.5kW

Voltage specifications	
1	AC100V
2	AC200V
3	DC24V
4	DC48V
5	DC36V
6	AC380V

Motor series	
0	X3 motor
1	X2 motor
2	X1 motor
3	X6 motor

Encoder type	
0	17-Bit magnetic encoder
1	20-Bit optical encoder
2	23-Bit optical encoder

Motor power	
0	Low inertia(MA),Regular,40~130 Flange
1	Medium Inertia(MM), Regular,40~130 Flange
2	High Inertia(MH),Regular,40~130 Flange
3	Flat type/Special flange/Small flange(MQ),Regular,40~130 Flange
4	Medium Inertia(MM),Large torque,40~130 Flange
5	Low inertia(MA),180~220 Flange
6	Low inertia(MA),14/25 Flange
7	Medium Inertia(MM),180~220 Flange
8	High Inertia(MH),180~220 Flange
9	High Inertia(MH),180~220 Flange

Design symbol	
1	A
2	B
3	C
4	D
5	H
6	Q
7	E
8	S
9	K
A	R

P20 Key and communication control interface

P20.00	Key JOG trial	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	0	rpm	Restart	P	S	T

0 ~ Rated speed of motor

P20.01	Fault reset	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	0	--	Restart	P	S	T

0: No reset

1: Reset

P20.02	Communication parameter	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Restart	P	S	T

0: 65535

P20.03	Parameter identification function	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Restart	P	S	T

0: No operation

1: Forward-rotation inertia identification

2: Reverse-rotation inertia identification

3: Reserved

4: Reserved

5: Encoder initial angle identification

P20.05	Analog input automatic offset adjustment	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P	S	T

0: No operation

1 ~ 2: AI1 ~ AI2 adjustment

P20.06	System initialization function	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Restart	P	S	T

0: No operation

1: Restore factory defaults

2: Clear fault records

7: Absolute encoder reset

Other values are reserved.

P20.08	Communication operation instruction input	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Immediate	P	S	T

0: No operation or stop operation

1~3000: JOG speed, unit is rpm

1102H: Communication forward JOG

1103H: Communication reverse JOG

1300H: Forward-rotation inertia identification

1301H: Reverse-rotation inertia identification

1302H: Store inertia identification values

1500H: Encoder initial angle identification

P20.09	Communication operation status output	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

0 ~ 65535

For communication reading

0: identification in progress

1: identification fault

2: identification completed

3: identification value stored

P20.11	Communication selection of multi-segment instruction sequence numbers	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 16	0	--	Immediate	P	S	

0 ~ 16

P20.12	Communication starting homing	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	0	--	Immediate	P		

0: No operation

1: Start homing

P21 Status parameters

P21.00	Servo status	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Real-time display of the status of the drive.

The following signs are available: rdy, run, Err.00 to 99 (fault), AL.00 to 99 (warning).

P21.01	Motor speed feedback	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Display only	P	S	T

Real-time display of the status of the drive.

The following signs are available: rdy, run, Err.00 to 99 (fault), AL.00 to 99 (warning).

P21.01	Motor speed feedback	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Display only	P	S	T

Real-time display of motor speed. Unit is 1rpm.

P21.03	Speed instruction	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Display only	P	S	T

Real-time display of current speed instructions. Unit is rpm.

P21.04	Internal torque instruction (relative to rated torque)	Range	Default	Unit	Effective	Relevant mode		
		-5000 ~ 5000	0	0.1%	Display only	P	S	T

Real-time display of the internal torque instruction. Unit is 0.1%, i.e. the percentage corresponding to the rated torque.

P21.05	Phase current effective value	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01A	Display only	P	S	T

Real-time display of U-phase current RMS value. Unit is 0.01A.

P21.06	DC busbar voltage	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.1V	Display only	P	S	T

Real-time display of the busbar voltage value. Unit is 0.1V.

P21.07	Absolute position counter (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1Unit	Display only	P	S	T

Real-time display of the absolute position accumulated value. Unit is the instruction unit.

The range of the displayed value is: -1073741824 ~ 1073741824.

P21.09	Electrical angle	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.1 degree	Display only	P	S	T

Real-time display of electrical angle values

The range of the displayed value is: 0.0 to 360.0 degrees.

P21.10	Mechanical angle (relative to encoder zero point)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.1 degree	Display only	P	S	T

Real-time display of the angle value of the motor's rotary axis

0.0 to 360.0 degrees

P21.11	Load inertia identification value	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01 kg c m²	Display only	P	S	T

Real-time display of inertia value recognized online.

The range is 0.01 kg c m² ~ 655.35 kg c m² .

P21.12	Speed value relative to input instruction	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Display only	P	S	T

Real-time display of the speed value corresponding to the input position instruction. Unit is rpm.

P21.13	Position deviation counter (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1P	Display only	P	S	T

Real-time display of the position deviation value. Unit is the minimum resolution of the encoder.

The range of the displayed value is: -1073741824 to 1073741824.

P21.15	Input pulse counter (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1Unit	Display only	P	S	T

Real-time display of the total number of input instruction pulses. Unit is the instruction unit.

The range of the displayed value is: -1073741824 ~ 1073741824.

P21.17	Feedback pulse counter (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1P	Display only	P	S	T

Real-time display of the accumulated value of the position feedback. Unit is the minimum resolution of the encoder.

The range of the displayed value is: -1073741824 ~ 1073741824.

P21.19	Position deviation counter instruction unit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1Unit	Display only	P	S	T

Real-time display of position deviation. Unit is the instruction unit.

P21.21	Digital input signal monitoring	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 255	0	--	Display only	P	S	T

Real-time display of the status of DI1 to DI8 on the panel.

If the third bit from the right of P07.21 is 0, when the DI interface is high level, the digital tube displays the upper half, and when it is low level, the lower half is displayed, and the sequence from right to left is DI1 to DI8.

If the third bit from the right of P07.21 is 1, when the DI interface is high level, it is represented by a binary 1, and when it is low level, it is represented by a binary 0. Binary bits BIT0 to BIT8 are used for DI1 to DI8, respectively.

P21.22	Inertia identification value	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Reserved

P21.23	Digital output signal monitoring	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	Display only	P	S	T

Real-time display of the status of DO1 to DO5 on the panel.

If the third bit from the right of P07.21 is 0, when the DO interface is high level, the digital tube displays the upper half, and when it is low level, the lower half is displayed, and the sequence from right to left is DO1 to DO5.

If the third bit from the right of P07.21 is 1, when the DI interface is high level, it is represented by a binary 1, and when it is low level, it is represented by a binary 0. Binary bits BIT0 to BIT8 are used for DO1 to DO5 respectively.

P21.24	Encoder status	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Reserved

P21.25	Total power-on time (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	0.1s	Display only	P	S	T

Real-time display of the drive's cumulative total power-up time value.

The range of displayed values is: 0.0:214748364.7s

P21.27	AI1 voltage after adjustment	Range	Default	Unit	Effective	Relevant mode		
		-32768 ~ 32767	0	1mV	Display only	P	S	T

Real-time display of the voltage value of AI1, which has been calibrated.

P21.28	AI2 voltage after adjustment	Range	Default	Unit	Effective	Relevant mode		
		-32768 ~ 32767	0	1mV	Display only	P	S	T

Real-time display of the voltage value of AI2, which has been calibrated.

P21.29	AI1 voltage before adjustment	Range	Default	Unit	Effective	Relevant mode		
		-32768 ~ 32767	0	1mV	Display only	P	S	T

Real-time display of the original voltage value of AI1, which has not yet been corrected for processing.

P21.30	AI2 voltage before adjustment	Range	Default	Unit	Effective	Relevant mode		
		-32768 ~ 32767	0	1mV	Display only	P	S	T

Real-time display of the original voltage value of AI2, which has not yet been corrected for processing.

P21.31	Module temperature	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1°C	Display only	P	S	T

Real-time display of module temperature value.

P21.32	Number of turns of absolute encoder (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P	S	T

Record the number of revolutions made in absolute position.

P21.34	Single turn position of absolute encoder (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	P	Display only	P	S	T

Record the number of encoder pulses for less than one revolution in absolute position.

P21.36	Version code 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Display software version number.

P21.37	Version code 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Display software version number.

P21.38	Version code 3	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Display software version number.

P21.39	Product series code	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

PP.XXX

P21.40	Fault record display	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	0	--	Immediate	P	S	T

It can be set to 0 to 9 to view 10 times fault records. When there is a current fault, set it to 0 to display the current fault record; when there is no current fault, display the last 10 times fault record.

0: current fault type

1: Previous 1 time fault

2: Previous 2 times fault

.....

9: Previous 9 times faults

P21.41	Fault code	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Fault codes, for the meaning of the corresponding values, please refer to the Error and alarm code list.

P21.42	Time stamp upon selected fault (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	0.1s	Display only	P	S	T

The total power-up time accumulated when a fault occurs.

P21.44	Current rotation speed of the selected fault	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Display only	P	S	T

Motor speed when a fault occurs.

P21.45	U-phase current of the selected fault	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01A	Display only	P	S	T

The effective value of the U-phase current when a fault occurs.

P21.47	Busbar voltage of the selected fault	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.1V	Display only	P	S	T

The value of the bus voltage when a fault occurs.

P21.48	Input terminal state of the selected fault	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 511	0	--	Display only	P	S	T

The status of DI1 to DI9 when a fault occurs. When the current DI interface is high level, the digital tube displays the upper half, and when it is low, the lower half is displayed.

P21.49	Output terminal state of the selected fault	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 511	0	--	Display only	P	S	T

The status of DO1 to DO9 when a fault occurs. When the current DI interface is high level, the digital tube displays the upper half, and when it is low level, it displays the lower half.

P21.50	Customized software version number	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Customized software version number

P21.51	Load ratio	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	0	1%	Display only	P	S	T

P21.52	Regenerative load ratio	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	0	1%	Display only	P	S	T

P21.53	Internal warning code	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

P21.54	Current segment number of internal instruction	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Display only	P	S	T

P21.55	Customized serial code	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Customized version series number

P21.56	Absolute position counter high 32 bits (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1Unit	Display only	P	S	T

When bit 4 of P07.19 is 1, the absolute position is a 64-bit count, and it is shown here as the high 32 bits. Unit is the instruction unit.

P21.58	Feedback pulse counter high 32 bits (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	1Unit	Display only	P	S	T

When bit 4 of P07.19 is 1, the feedback pulse is a 64-bit count, and it is shown here as the high 32 bits. Unit is the instruction unit.

Digital input (DI) function definition table

Setting value	Symbol	Name	Description
1	S_ON	Servo enable	Invalid- Disable servo motor enable Valid- Enable servo motor power-up
2	ERR_RST	Alarm reset signal	According to the type of alarm, the servo motor is able to continue to work after alarm reset. This function is along the effective level, when the set terminal is level effective, and also only effective when the edge changes are detected.
3	GAIN_SEL	Proportional action switching/gain switching	Invalid - Speed control loop is controlled by PI Valid - Speed control loop is controlled by P
4	CMD_SEL	Torque instruction source switching	Invalid-Currently running instruction is A Valid-Currently running instruction is B
5	PERR_CLR	Pulse deviation clear	Invalid-No action Valid-Clear pulse deviation

6	MI_SEL1	Switching 16 operation instructions	Execute 16 position instructions or speed instructions by selecting them via DI terminal。
7	MI_SEL2	Switching 16 operation instructions	
8	MI_SEL3	Switching 16 operation instructions	
9	MI_SEL4	Switching 16 operation instructions	
10	MODE_SEL	Switching 16 operation instructions	Switch between speed, position, and torque according to the selected control mode (3, 4, 5).
12	ZERO_SPD	Zero speed clamp function	Valid-Enables the zero fixing function Invalid - Disable the zero position fixing function
13	INHIBIT	Pulse inhibit	Valid-Disable instruction pulse input Invalid-Allow instruction pulse input
14	P_OT	Positive overtravel	When the mechanical movement exceeds the movable range limit switch action, enter the overtravel protection function. Valid-Positive overtravel, prohibit forward drive Invalid-Normal range, allow positive drive
15	N_OT	Negative overtravel	When the mechanical movement exceeds the movable range limit switch action, enter the overtravel protection function. Valid-Negative overtravel, prohibit forward drive Invalid-Normal range, allow positive drive
16	P_CL	Positive external torque limit	Valid - External torque limit is valid Invalid - External torque limit is not valid
17	N_CL	Negative external torque limit	Valid - External torque limit is valid Invalid - External torque limit is not valid
18	P_JOG	Positive JOG	Valid - Input according to the set instruction Invalid - Stop input of the running instruction
19	N_JOG	Negative JOG	Valid – Reverse input according to the set instruction Invalid - Stop input of the running instruction
20	GEAR_SEL1	Electronic gear selection	GEAR_SEL1 is invalid, GEAR_SEL2 is invalid-electronic gear 1 GEAR_SEL1 is valid, GEAR_SEL2 is invalid- electronic gear 2 GEAR_SEL1 is invalid, GEAR_SEL2 is valid-electronic gear 3 GEAR_SEL1 is valid, GEAR_SEL2 is valid- electronic gear 4
21	GEAR_SEL2	Electronic gear selection	
22	POS_DIR	Reverse position instruction	Invalid - Not to reverse Valid - Reverse
23	SPD_DIR	Reverse speed instruction	Invalid - Not to reverse Valid - Reverse
24	TOQ_DIR	Reverse torque instruction	Invalid - Not to reverse Valid - Reverse
25	PSEC_EN	Internal multi-segment position enable signal	Invalid-Ignore internal multi-segment instructions Valid-Enable internal multi-segment instructions
26	INTP_ULK	Release the interrupt positioning lock	Invalid-No effect Valid - When parameter P08.86 is set to 2 or 4, the position instruction interrupt execution lock status is released.
27	INTP_OFF	Disable the execution of interrupt positioning.	Invalid - no effect Valid-When parameter P08.86 is not set to 0, DI can be used to disable the execution of the interrupt positioning function at any time after the interrupt execution function is enabled.
28	HOME_IN	Origin position signal	Available as an origin or deceleration position signal
29	STHOME	Enable homing process	Start homing process
30	ESTOP	Emergency stop	Invalid - No effect Valid - Enter emergency stop

31	STEP	Position step enable	Valid-Execute the step amount instruction Invalid-Instruction is zero as the positioning status
32	FORCE_ERR	Forced fault protection input	Invalid - No effect Valid - Enter fault status
34	INTP_TRIG	Interrupt positioning execution trigger signal	Invalid - No effect Valid - When the value of parameter P08.86 is not 0, the position instruction is triggered to interrupt the execution process, which can only be configured to DI8 and DI9.
35	INPOSHALT	Halt generation of internal position instructions	Invalid - No effect Effective-Decelerate and halt execution of internal multi-stage positional and interrupt positioning
36	ANALOG_OFF	Disable analog input	Invalid - No effect Valid: Analog input is disabled
37	ENC_SEN	SEN enable absolute position data transmission	Invalid - No effect Valid - OAOBOZ sends absolute position data, servo cannot be enabled at this time.
38	ENC_ZDETEC	Encoder Z-phase detection input	Invalid - No effect Valid: Encoder Z-phase detection input
39	EXTIN_LATCH1	External latch input 1	Invalid - No effect Valid-External latch input 1
40	EXTIN_LATCH2	External latch input 2	Invalid - No effect Valid-External latch input 1

Digital input (DI) function definition table

Setting value	Symbol	Name	Description
1	S_RDY	Servo ready	The servo state is ready to receive the S_ON valid signal. Valid-Servo ready Invalid - Servo not ready
2	S_ERR	Fault output signal	Valid when a fault is detected
3	S_WARN	Warning output signal	Warning output signal active (on)
4	TGON	Motor rotation output signal	Servo motor rotation speed is above the speed threshold value. Valid-Motor rotation signal is valid Invalid - Motor rotation signal is invalid
5	V_ZERO	Zero speed signal	The signal output when the servo motor stops rotating. Valid-Motor speed is zero Invalid-Motor speed is not zero
6	V_CMP	Speed conformity	For speed control, the absolute value of the difference between the servomotor speed and the speed instruction is valid if it is less than the P04.44 speed deviation setting value.
7	COIN	Position completion	In position control, the position deviation pulse is valid when it reaches within the positioning completion amplitude P04.47.
8	NEAR	Position near signal	In position control, the position deviation pulse is valid when it reaches the setting value of the positioning approach signal amplitude P04.50.
9	T_LT	Torque limit signal	Signal to confirm torque limit Valid - Motor torque is limited Invalid - Motor torque is not limited

10	V_LT	Speed limit signal	Signal to confirm speed limit during torque control Valid – Motor speed is limited Invalid – Motor speed is not limited
11	BKOFF	Brake release signal output	Brake release signal output: Valid – Release the brake, the motor shaft is free Invalid – Resume the brake, the motor shaft is locked
12	T_ARR	Torque specified range arrival	The output signal is valid when the torque instruction value reaches the value set in P04.55, and the permissible variation range is determined by P04.56.
13	V_ARR	Speed feedback specified range arrival	The output signal is valid when the speed feedback value reaches the value set in P04.45, and a variation range of +/-10rpm is allowed.
15	INTP_DONE	Interrupt positioning completion	Output after position instruction interrupt is completed.
16	DB_OUT	Dynamic braking output	External relay or contactor and current limiting resistor are required.
17	HOME	Homing completion	
18	INTP_WORK	Interrupt positioning being executed	Interrupt positioning is being executed.
19	PCOM1	Position 1 comparison trigger signal	Trigger signal is output when the position 1 reaches the corresponding range.
20	PCOM2	Position 2 comparison trigger signal	Trigger signal is output when position 2 reaches the corresponding range.
21	PCOM3	Position 3 comparison trigger signal	Trigger signal is output when position 2 reaches the corresponding range.
22	PCOM4	Position 4 comparison trigger signal	Trigger signal is output when position 4 reaches the corresponding range.
23	HALTING	Pause in effect	Servo is halted.

Chapter 8 Errors & alarms and troubleshooting

8.1 Error and alarm code list

Error code	Name	Stop mode	Reset (Y/N)	Record memory (Y/N)
Err.001	Abnormal system parameter	Stop immediately	N	N
Err.002	Product model selection fault	Stop immediately	N	N
Err.003	Parameter storage fault	Stop immediately	N	N
Err.004	FPGA fault	Stop immediately	N	N
Err.005	Product matching fault	Stop immediately	N	N
Err.006	Program error	Stop immediately	N	N
Err.007	Encoder initialization failure	Stop immediately	N	Y
Err.008	Short circuit to ground detection fault	Stop immediately	N	Y
Err.009	Over-current fault A	Stop immediately	N	Y
Err.010	Hardware initialization fault	Stop immediately	Y	Y
Err.011	Program execution error	Stop immediately	Y	Y
Err.012	Abnormal absolute encoder turns	Stop immediately	N	Y
Err.013	Abnormal encoder communication	Configurable	N	Y
Err.014	Abnormal encoder data	Configurable	N	Y
Err.015	Abnormal under-voltage of encoder battery	Stop immediately	N	Y
Err.016	Overlarge speed deviation	Configurable	Y	Y
Err.017	Torque saturation timeout	Configurable	Y	Y
Err.018	Control power under-voltage	Configurable	Y	Y
Err.019	Tripping	Configurable	Y	Y
Err.020	Over-voltage	Stop immediately	Y	Y
Err.021	Under-voltage	s	Y	Default N, optional
Err.022	Current sampling fault	Stop immediately	Y	Y
Err.023	Overlarge AI sampling voltage	Stop immediately	Y	Y
Err.024	Over-speed	Stop immediately	Y	Y
Err.025	Electric angle identification failure	Stop immediately	Y	N
Err.026	Inertia identification failure	Stop immediately	Y	N
Err.027	DI terminal parameter setting fault	Stop immediately	Y	N
Err.028	DO terminal parameter setting fault	Stop immediately	Y	N
Err.029	Over-current fault B	Configurable	Y	Y
Err.030	Overlarge gantry mixed deviation	Stop immediately	Y	Y
Err.031	Gantry synchronization feedback abnormality	Stop immediately	Y	Y
Err.032	External encoder disconnection	Stop immediately	Y	Y
Err.033	Abnormal external encoder communication	Configurable	Y	Y
Err.034	Gantry synchronization and full closed loop parameter error	Stop immediately	Y	N
Err.039	EEPROM checksum word error	Stop immediately	Y	Y
Err.040	Invalid servo ON instruction fault	Configurable	Y	N
Err.042	Over-speed pulse division output	Configurable	Y	Y
Err.043	Overlarge position deviation	Configurable	Y	Y

Err.044	Main circuit input phase loss	Configurable	Y	Y
Err.045	Drive output phase loss	Configurable	Y	Y
Err.046	Overloaded drive	Stop immediately	Y	Y
Err.047	Overloaded motor	Stop immediately	Y	Y
Err.048	Electronic gear setting error	Configurable	Y	N
Err.049	Overheated heat spreader	Configurable	Y	Y
Err.050	Abnormal pulse input	Configurable	Y	Y
Err.051	Overlarge full-loop position deviation	Configurable	Y	Y
Err.054	User forced fault	Decelerate to stop	Y	Y
Err.055	Absolute position resetting fault	Configurable	Y	Y
Err.056	Main circuit power outage	Decelerate to stop	Y	Default N, optional
Err.057	Overloaded DB brake	Configurable	Y	Y
Err.059	Drive model identification failure	Stop immediately	N	N
Err.060	The first start after writing customized software	Stop immediately	N	N
Err.065	CAN BUS OFF	Configurable	Y	Y
Err.066	Abnormal NMT command	Configurable	Y	Y
Err.067	CAN BUS fault	Decelerate to stop	Y	Y
Err.068	External overspeed (reserved)	Stop immediately	Y	Y
Err.069	Overlarge mixed deviation	Configurable	Y	Y
Err.071	Node protection or heartbeat timeout	Configurable	Y	Y
Err.072	Synchronization invalidation	Configurable	Y	Y
Err.073	CANOpen trace buffer underflow	Configurable	Y	Y
Err.074	CANOpen trace buffer overflow	Configurable	Y	Y
AL.080	Under-voltage alarm	No stop	Y	N
AL.081	Overloaded drive alarm	No stop	Y	Y
AL.082	Overloaded motor alarm	No stop	Y	Y
AL.083	Modification of parameters that need power restart	No stop	Y	N
AL.084	Servo not ready	No stop	Y	N
AL.085	E2PROM writing frequency alarm	No stop	Y	N
AL.086	Positive over-travel alarm	No stop	Y	N
AL.087	Negative over-travel alarm	No stop	Y	N
AL.088	Position instruction over-speed	No stop	Y	N
AL.090	Absolute encoder angle initialization alarm	No stop	Y	Y
AL.093	Overloaded energy consumption brake	No stop	Y	Y
AL.094	Over-small external regenerative resistor	No stop	Y	N
AL.095	Emergency stop	Decelerate to stop	Y	N
AL.096	Homing error	Decelerate to stop	Y	N
AL.097	Encoder battery under-voltage	No stop	Y	N
AL.098	Unfinished AD sampling	No stop	Y	N

8.2 Error and alarm causes and handling measures

Error code and name	Cause	Handling measure
Err.001: Abnormal system parameter	1. Instantaneous decrease in power voltage; 2. The range of some parameters has been changed after software updates, which makes the stored parameters exceed set ranges.	1. Ensure the power voltage is within the specified range. Restore the parameters (P20.06 set to 1); 2. Please restore the parameters first if the software has been upgraded.
Err.002: Product model selection fault	1. The connecting cable of the encoder is damaged or loose; 2. Invalid drive or motor model.	1. Check if the encoder cable is normal and fasten the cable; 2. Replace the faulty motor or drive with a valid one.
Err.003: Parameter storage fault	1. Over-frequent parameter reading/writing; 2. The equipment for parameter storage is faulty; 3. Power supply is unstable; 4. Faulty drive.	1. Check if the modification or writing EEPROM of the host device communication is too frequent. Check if there is an instruction for frequent parameter modification and EEPROM writing in the communication program. 2. Check the control circuit power cable and ensure the control circuit power voltage is within the specified range.
Err.004: FPGA fault	Abnormal software version	Check if software version is matching.
Err.005: Product matching fault	1. The connecting cable of the encoder is damaged or loose; 2. Use a three-party external port such as an encoder, which is not matched with the equipment; 3. The power of the motor and drive are mismatched with each other; 4. Product model number doesn't exist.	1. Check the connection of the encoder cable ; 2. Replace the mismatching product with a matching one; 3. Choose a matching encoder type or replace other types of drives. For example, the error alarm will be reported when choosing a motor, whose power is higher or two-level lower than that of a drive.
Err.006: Program error	1、Abnormal system parameter; 2. Internal fault of drive.	EEPROM fault, set P20.06 to1 to initialize system parameters and reconnect to the power supply.
Err.007: Encoder initialization failure	Abnormal encoder signal detected during power-on.	Check the encoder wiring, or replace the encoder cable.
Err.008: Short circuit to ground detection fault	1. UVW wiring fault; 2. Motor damages; 3. Faulty drive.	1. Check if UVW is short-circuited to ground. If so, then replace the cable; 2. Check if the motor cable or grounding resistor is abnormal. If so, then replace the motor.
Err.009: Over-current fault A	1. The instruction input is synchronized with servo connection or is too fast. 2. The external braking resistor is too small or short-circuited; 3. Bad contact of motor cable; 4. Motor cable is grounded; 5. Motor UVW is short-circuited; 6. Motor is burnt; 7. Software detects the over-current in power transistors.	1. Check instruction input time sequence and input instruction after the servo connects with "o_rdy"; 2. Check if the braking resistor meets specifications. If not, then replace it with a matching resistor according to the manual; 3. Check if the encoder cable is normal and fasten the connector; 4. Check the insulation resistance between the motor UVW wire and the motor ground wire. When insulation is faulty, replace the motor timely; 5. Check if the cable is well connected with UVW. If it is short-circuited, then reconnect the motor cable correctly; 6. Check whether the resistor values between the cables are the same. If not, then replace the motor; 7. Reduce loads, increase the capacity of the drive and motor, and extend the acceleration and deceleration times.

rr.010: Hardware initialization fault	1 Control chip initialization failure; 2 Localized damage to the circuit board;	1. Check if the drive is installed and wired correctly; 2. If the drive is damaged, please contact the manufacturer for repair.
Err.011: Program execution error	Internal drive abnormality, or firmware update abnormality	1. Contact the manufacturer to confirm whether the drive version and firmware version are matching; 2. Replace with a new drive.
Err.012: Abnormal absolute encoder turn	Incremental encoder: 1. Abnormal Z signal receiving; bad wiring of the Z signal cable; or Z signal's loss of absolute encoder resulted from encoder fault; Absolute encoder: 2. Inadequate absolute encoder battery power supply. 3. Parameter P06.47 is set to 1 (set as an absolute system). Encoder initialization is not performed. 4. The encoder motor terminal is unplugged or plugged in during power off.	1. Manually rotate the motor shaft first, if there is still a fault report, then check the encoder wiring, rewire or replace the cable, or replace the encoder, and re-power the equipment; 2. Determine whether the battery is normal first, if the battery voltage is not adequate, please replace the battery; 3. Set P20.06 to 7 to initialize the number of turns, and reconnect to the power supply.; 4. Set P20.06 to 7 to initialize the number of turns, and reconnect to the power supply.
Err.013: Abnormal encoder communication	1. The communication encoder cable is disconnected; 2. The encoder is not grounded; 3. Communication verification is abnormal.	1. Check the encoder connection or replace the encoder cable; 2. Check if the encoder is well grounded.
Err.014: Abnormal encoder data	1. Disconnection or bad contact of the serial encoder ; 2. The reading/writing of the serial encoder data is abnormal.	Check or replace the encoder cable.
Err.015: Abnormal under-voltage of encoder battery	The encoder battery voltage is lower than the threshold value specified by P06.48; the tens place of P06.47 is 1.	Replace the encoder battery.
Err.016: Overlarge speed deviation	The absolute value between the speed instruction and measured speed surpasses the set threshold of P06.45.	1. Increase the setting value of P06.45; 2. Extend acceleration/deceleration time of internal position instruction or adjust the response of the gain system; 3. Set P06.45 to 0 to disable the overlarge speed deviation function.
Err.017: Torque saturation timeout	Torque maintains a long-term saturated state, which lasts longer than the threshold time specified by P06.46.	1. Increase the time span specified by P06.46 ; 2. Check if UVW is disconnected.
Err.018: Control power under-voltage	Control power input cable is not connected well or the input power supply is abnormal.	1. Check input power supply and cables; 2. Replace the drive with a new one.
Err.019: Tripping	Circuit divergence results from incorrect wiring, which leads to motor tripping and loss of speed.	1. Check UVW and encoder wiring. 2. Check the motor and drive. Replace it when necessary and contact HCFA detection.
Err.020: Over-voltage	1. The voltage of the power supply exceeds AC 280V, which surpasses the limited range; 2. Breakage or incompatibility of braking resistor, which leads to failure of absorbing regenerative energy. 3. The load inertia exceeds the allowable range; 4. Faulty drive.	1. Input a correct power voltage range; 2. Check if the drive has already connected with an external resistor; check if the external resistor value has been disconnected to ensure correct wiring. If the resistor has been burnt, it is recommended to replace it with a larger external resistor (please contact HCFA to access relevant suggestions). 3. Extend acceleration/deceleration time or replace a matching drive/motor according to load inertia.

Err.021: Under-voltage	1. Power voltage decrease; 2. Instantaneous power outage; 3. Under-voltage protection threshold (P06.36) is too high; 4. Faulty drive	1. Increase the capacity of power voltage. Make sure input power is stable; 2. Check whether the under-voltage protection threshold (P06.36) is set too high.
Err.022: Current sampling fault	Current sampling fault of the drive	Replace servo drive
Err.023: Overlarge AI sampling voltage	1. AI wiring error 2. External input voltage is too high.	Check whether the AI input is well connected and set the input voltage within the range of ±10V.
Err.024: Over-speed	1. Speed instruction exceeds the specified maximum rotation speed 2. UVW phase sequence error 3. Serious overshoot of speed response 4. Faulty drive	1. Lower the speed instruction; 2. Check whether the UVW phase sequence is correct; 3. Adjust the gain of the speed loop to reduce overshoot; 4. Replace the drive.
Err.025: Electric angle identification failure	1. Over large load or inertia; 2. Incorrect encoder cable wiring	1. Reduce load or increase current loop gains 2. Replace the encoder cable.
Err.026: Inertia identification failure	1. Load or inertia is too large, making the motor fail to operate normally according to the specified curve. 2. Other faults occur, which results in the end of the identification process.	1. Reduce load or increase current loop gains; 2. Ensure a correct identification process.
Err.027: DI terminal parameter setting fault	1. Different physical DI terminals are assigned to the same DI function. 2. Both physical DI terminals and communication control DI functions are assigned at the same time.	1. In P04.01~P04.09, there are cases where the same function is assigned to more than one physical DI terminal; 2. The function assigned in P04.01 to P04.09 is activated at the same time as the corresponding binary bit in P09.05 to P09.08. Please refer to the ways of using P09.05 to P09.08. Reassign the DI function for detailed information.
Err.028: DO terminal parameter setting fault	Different DO terminals are assigned to the same function.	In cases where the same function is assigned to more than one DO terminal in P04.21 to P04.29, please reassign the DO function.
Err.029: Over-current fault B	1. The instruction input is synchronized with servo connection or is too fast. 2. The external braking resistor is too small or short-circuited; 3. Bad contact of motor cable; 4. Motor cable is grounded; 5. Motor UVW is short-circuited; 6. Motor is burnt; 7. Software detects the over-current in power transistors.	1. Check instruction input time sequence and input instruction after the servo connects with "o_rdy"; 2. Check if the braking resistor meets specifications. If not, then replace it with a matching resistor according to the manual; 3. Check if the encoder cable is normal and fasten the connector; 4. Check the insulation resistance between the motor UVW wire and the motor ground wire. When insulation is faulty, replace the motor timely; 5. Check if the cable is well connected with UVW. If it is short-circuited, then reconnect the motor cable correctly; 6. Check whether the resistor values between the cables are the same. If not, then replace the motor; 7. Reduce loads, increase the capacity of the drive and motor, and extend the acceleration and deceleration times.

Err.030: Overlarge gantry mixed deviation	1. The phase sequence of the two shafts of the gantry synchronization may be problematic. 2. One shaft is blocked. 3. The mutual position feedback of the two shafts of the gantry is not normal.	1、Cancel the gantry mode, check whether the two shafts are running normally, and replace the correct wiring to make it normal. 2、Check the machinery, replace the parts, determine the correct initial position, or reassemble it to make it normal. 3、Check whether the feedback wiring between the two shafts is normal, and whether the parameter setting is normal.
Err.031: Gantry synchronization feedback abnormality	1. Serious on-site interference 2. Gantry synchronization feedback wiring error 3. Feedback cable problem	1. Eliminate interference, add magnetic ring to UVW, check whether the ground is standardized; 2. Change the wiring again; 3. Replace the cable with a good one.
Err.032: External encoder disconnection	ABZ signal cable is broken and need to be replaced with a good one.	1. Rotate the motor shaft manually, if it still reports a fault, check the encoder wiring, rewire or replace the cable, or replace the encoder and re-power up.
Err.033: Abnormal external encoder communication	1. Communicating encoder is disconnected; 2. The encoder is not grounded; 3. Abnormal communication verification.	1. Check the encoder wiring, or replace the encoder cable; 2. Check whether the encoder is well grounded.
Err.034: Gantry synchronization and full closed loop parameter error	1. These two functions cannot be turned on at the same time	1. Reset the parameters of group P17 to ensure that the gantry is synchronized and fully closed loop is not turned on at the same time.
Err.039: EEPROM checksum word error	After updating the drive underlay, this fault may occur when powering up for the first time	Re-import the user parameters (including the P18/P19 group parameters), and then re-power up the device.
Err.040: Invalid servo ON instruction fault	After executing the auxiliary function to energize the motor, the servo-ON instruction is still input from the host device.	Change inappropriate operating practices.
Err.042: Over-speed pulse division output	Pulse division output surpasses the upper limit of the hardware.	Change the division output setting function code so that the division output pulse frequency will not exceed the limit in the speed range during operation.
Err.043: Overlarge position deviation	1. Servo motor UVW wiring is incorrect; 2. Servo drive gain is low; 3. Position instruction pulse frequency is high; 4 Position instruction acceleration is too large; 5. Position deviation is too large and P00.19 is set too low; 6. Faulty servo drive/motor ;	1. Reconnect the cables after checking the connection of the BUS circuit cable 2. Increase servo gains if the gain of the servo drive is too low; 3. Re-operate the device after reducing instruction frequency or acceleration, or adjusting gear ratio; 4. Re-operate the device after reducing instruction acceleration and add smoothing parameters such as position instruction acceleration or deceleration time parameter; 5. Check if the value of P00.19 is appropriate. If not, then set an appropriate one (P00.19). 6. Check the running waveform in the background, if there is no feedback from the input, please replace the servo drive.

Err.044: Main circuit input phase loss	1. Bad contact of the three-phase input cable; 2. Phase loss fault, i.e., when the main power supply is ON, the voltage of one of the R\S\T phases is too low for more than 1 second.	1. Check whether the three-phase power supply cable is well connected (Note: Do not operate with the power supply on.); 2. Measure the voltage of each phase of the three-phase power supply to ensure that the input power supply is balanced or that the input power supply voltage conforms to the specifications; 3. Single-phase power supply is used for the main power supply, and this fault can be shielded by parameter P06.30.
Err.045: Drive output phase loss	1. Bad connection of UVW 2. Disconnection resulted from a faulty drive	1. Check UVW wiring 2. Replace servo motor
Err.046: Overloaded drive	The loaded operation exceeds the drive inverse time curve. The causes are as follows: 1. The motor UVW cable or encoder cable is loose or faulty; 2. The motor is blocked or acted upon by force, including mechanical jamming, collision, gravity force, and other acts of force. Or the mechanical brake is not released during operation. 3. Misconnect the UVW and encoder wires of the same motor to different drives when wiring multiple drives. 4. Overload or the drive or motor size is too small. 5. Possible lack of phase or wrong phase sequence. 6. Damaged drive or motor	1. Confirm that the motor UVW wire and encoder wiring are correct; 2. Confirm that the motor is not blocked or driven by force, and confirm that the mechanical brake (holding brake) is on; 3. Confirm that there is no cross-wiring of multiple drives and motors, i.e., the UVW cable and the encoder cable of a motor are connected to their corresponding drive; 4. Extend the acceleration and deceleration time, and re-select the appropriate drive or motor; 5. Check whether the motor output UVW is connected incorrectly and whether it is shorted to ground; 6. Replace the drive or motor;
Err.047: Overloaded motor	Err.047: Overloaded motor The loaded operation exceeds the drive inverse time curve. The causes are as follows: 1. The motor UVW cable or encoder cable is loose or faulty; 2. The motor is blocked or acted upon by force, including mechanical jamming, collision, gravity force, and other acts of force. Or the mechanical brake is not released during operation. 3. Misconnect the UVW and encoder wires of the same motor to different drives when wiring multiple drives. 4. Overload or the drive or motor size is too small. 5. Possible lack of phase or wrong phase sequence. 6. Damaged drive or motor	1. Confirm that the motor UVW wire and encoder wiring are correct; 2. Confirm that the motor is not blocked or driven by force, and confirm that the mechanical brake (holding brake) is on; 3. Confirm that there is no cross-wiring of multiple drives and motors, i.e., the UVW cable and the encoder cable of a motor are connected to their corresponding drive; 4. Extend the acceleration and deceleration time, and re-select the appropriate drive or motor; 5. Check whether the motor output UVW is connected incorrectly and whether it is shorted to ground; 6. Replace the drive or motor
Err.048: Electronic gear setting error	The gear ratio exceeds the specified range [encoder resolution/10000000, encoder resolution/2.5].	Set the correct gear ratio.

Err.049: Overheated heat spreader	1. Faulty fan; 2. Ambient temperature is too high; 3. Repetitive reset overload fault through power-off 4. Install the drive in the wrong direction and leave inappropriate clearance between drives; 5. The servo drive is faulty; 6. The motor or drive is faulty.	1. Check if the fan operates normally, and replace the fan or drive if it is abnormal; 2. Measure the ambient temperature and improve the cooling conditions of the servo drive to reduce the ambient temperature; 3、Check if an overload fault has been reported before. The way to correct the fault is to wait for 30 seconds after overload and then reset the equipment. If the power of the drive or motor is too small, increase the capacity, extend the acceleration and deceleration time, and reduce the load. 4. Confirm the setting state of the drive and install it according to the installation standards; 5. If a fault is still reported after a 5-minute power off and then restart, replace the drive.
Err.050: Abnormal pulse input	1. Input pulse frequency is larger than the specified maximum pulse frequency 2. Input pulse is interfered.	1. Adjust the maximum pulse frequency parameter P06.38; 2. Use the background software to check whether the instruction is abnormal; ensure a reliable grounding; use a twisted pair of shielded wires, and separate the input cable from the power cable.
Err.051: Overlarge full-loop position deviation	1. Abnormal external encoder; 2. Relative setting is too conservative.	1. Confirm that the external encoder is correctly wired. If it is not, then replace it with a new one. 2. Full-loop deviation is too large; the protection function setting is incorrect. Confirm and correct the setting of relevant parameters.
Err.054: User forced fault	Enter faulty state forcibly through DI function 32 (FORCE_ERR).	Normal DI function inputs, which are configured with DI function 32 and valid inputs. Disconnecting the inputs can release the alarm.
Err.055: Absolute position resetting fault	Faulty position reset of absolute encoder	Contact HCFA for technical supports.
Err.056: Main circuit power outage	Power outage or abnormal main power line. (Note: This fault does not store the record by default, it can be set whether to store or not through P07.19	Check if there is an instantaneous power decrease. Increase power voltage capacity.
Err.057: Overloaded DB brake	1. DB braking is too frequent; 2. Load inertia is too large, the speed is too high, resulting in long braking time.	1. Reduce the number of braking times or change the parameter settings 2. Reduce the load inertia or reduce the maximum operating speed.
Err.059: Drive model identification failure	Mismatch between drive hardware identification model and underlay version	Check drive version and software version.
Err.060: The first start after writing customized software	First startup after downloading a customized version of the program in a drive that already has a standard program.	Restore factory values for loading customized parameters.
Err.065: CAN BUS OFF	CAN bus disconnection or abnormal reception or transmission	Check wiring and reconnect.
Err.066: Abnormal NMT command	Receive NMT stop or reset command at servo-ON state.	NMT node reset. Do not stop or reset the CAN node at the servo-ON state.
Err.067: CAN BUS fault	CAN BUS disconnection or abnormal receiving/sending process.	Check the wiring and reconnect it.

Err.068: External overspeed (reserved)	1. The speed instruction exceeds the maximum speed setting; 2. UVW phase sequence error; 3. Speed response is seriously overshoot; 4. Faulty drive	1. Reduce speed instruction; 2. Check the UVW phase sequence is correct; 3. Adjust the speed loop gain to reduce overshoot; 4. Replace the drive.
Err.069: Overlarge mixed deviation	1. External encoder is disconnected; 2. Damaged external encoder; 3. Device transmission failure	1. Check or replace external encoder and wiring; 2. Inspect or replace external encoder and wiring; 3. Inspect and repair mechanical transmission sections
Err.071: Node protection or heartbeat timeout	No response is received when node protection and heartbeat monitoring reach the specified time.	Check if the nodes are online, and reset the NMT node.
Err.072: Synchronization invalidation	Synchronization with the host device is invalid under the CANOpen IP mode	NMT node reset; 6040 sends fault reset command.
Err.073: CANOpen trace buffer underflow	Lose synchronous clock more than 2 times under the CANOpen IP or CSP mode.	Check if there is any interference to the communication and normal operation of the host device; reset NMT node or 6040 sends fault reset command.
Err.074: CANOpen trace buffer overflow	Synchronous clock runs too fast or the actual clock frequency do not match the setting value under the CANOpen IP or CSP mode.	Check any interference to the communication circuit and normal operation of the host device; check the matching between clock frequency and the setting value. NMT node reset or 6040 sends fault reset command.
AL.080: Under-voltage alarm	Busbar voltage is low.	1. Check the main circuit power supply. 2. Lower under-voltage detection parameter P06.36.
AL.081: Overloaded drive alarm	The loaded operation exceeds the drive inverse time curve. The causes are as follows: 1. The motor UVW cable or encoder cable is loose or faulty; 2. The motor is blocked or acted upon by force, including mechanical jamming, collision, gravity force, or other acts of force, or the mechanical brake is not released during operation. 3. Misconnect the UVW and encoder wires of the same motor to different drives when wiring multiple drives. 4. Overload or the drive or motor size is too small. 5. Possible lack of phase or wrong phase sequence. 6. Damaged drive or motor	1. Confirm that the motor UVW wire and encoder wiring are correct; 2. Confirm that the motor is not blocked or driven by force, and confirm that the mechanical brake (holding brake) is on; 3. Confirm that there is no cross-wiring of multiple drives and motors, i.e., the UVW cable and the encoder cable of a motor are connected to their corresponding drive; 4. Extend the acceleration and deceleration time, and re-select the appropriate drive or motor; 5. Check whether the motor output UVW is connected incorrectly and whether it is shorted to ground; 6. Replace the drive or motor.

AL.082: Overloaded motor alarm	The loaded operation exceeds the drive inverse time curve. The causes are as follows: 1. The motor UVW cable or encoder cable is loose or faulty; 2. The motor is blocked or acted upon by force, including mechanical jamming, collision, gravity force, or other acts of force, or the mechanical brake is not released during operation. 3. Misconnect the UVW and encoder wires of the same motor to different drives when wiring multiple drives. 4. Overload or the drive or motor size is too small. 5. Possible lack of phase or wrong phase sequence. 6. Damaged drive or motor	1. Confirm that the motor UVW wire and encoder wiring are correct; 2. Confirm that the motor is not blocked or driven by force, and confirm that the mechanical brake (holding brake) is on; 3. Confirm that there is no cross-wiring of multiple drives and motors, i.e., the UVW cable and the encoder cable of a motor are connected to their corresponding drive; 4. Extend the acceleration and deceleration time, and re-select the appropriate drive or motor; 5. Check whether the motor output UVW is connected incorrectly and whether it is shorted to ground; 6. Replace the drive or motor.
AL.083: Modification of parameters that need power restart	Modify parameters that need restarting for going into effect	Reconnect to the power supply.
AL.084: Servo not ready	Conduct servo-ON when the servo is not ready.	Enable the drive after detecting signals of servo READY.
AL.085: E2PROM writing frequency alarm	Operating E2PROM too frequently.	Reduce EEPROM writing frequency. Use the communication writing instruction that does not save EEPROM.
AL.086: Positive over-travel alarm	1. Pot and Not are valid simultaneously, but generally, they do not appear at the same time on the workbench. 2. Servo axes are in the over-travel state in a certain direction, which can be released automatically.	Positive limit switch is triggered, check the operation mode, give negative instruction or manually rotate the motor away from the positive limit, it will automatically clear the alarm.
AL.087: Negative over-travel alarm	1. Pot and Not are valid simultaneously, but generally, they do not appear at the same time on the workbench. 2. Servo axes are in the over-travel state in a certain direction, which can be released automatically.	Negative limit switch triggered, check operation mode, give positive instruction or manually rotate the motor away from the positive limit, it will automatically clear the alarm.
AL.088: Position instruction over-speed	1. Gear ratio is too large; 2. Pulse frequency is too high.	1. Reduce gear ratio; 2. Reduce pulse frequency.
AL.090: Absolute encoder angle initialization alarm	Over large deviation (more than 7.2 degrees kWh) during re-initialization of encoder angle alarm	Replace motor.

AL.093: Overloaded energy consumption brake	Energy consumption braking power is overloaded: 1. Incorrect wiring or bad contact of the braking resistor; 2. Short connecting cable may be disconnected when using an internal resistor; 3. Insufficient braking resistor capacity; 4. Prolonged braking due to overlarge braking resistor value; 5. Input voltage exceeds the specifications; 6. Incorrect setting of constants including braking resistor value, capacity, or heat generation time constant; 7. Faulty drive.	1. Check if the resistor wiring is correct; 2. Check if the internal resistor wiring is correct; 3. Increase braking resistor capacity; 4. Reduce braking resistor value; 5. Reduce input voltage; 6. Set correct parameters according to specifications; 7. Replace drive.
AL.094: Over-small external regenerative resistor	1. External regenerative resistor value is smaller than the minimum value specified by the drive. 2. Incorrect parameter setting.	1. Configure the power of the external regenerative resistor according to the specifications; 2. Check that parameters P00.21 to P00.24 are correct.
AL.095: Emergency stop	The emergency stop is triggered.	Normal DI function inputs, configured with DI function 30 and valid inputs. Disconnecting the inputs can release the alarm.
AL.096: Homing error	1. Homing time exceeds the value specified by P08.95 2. P08.90 is set to 3, 4, or 5 and encounters the limit; 3. Encounter limit twice when not using limit as the origin.	1. Increase the specified value of P08.95; 2. Reduce homing searching speeds P08.92, and P08.93 to avoid the alarm caused by over-speed of homing.
AL.097: Encoder battery under-voltage	Encoder battery voltage is below the threshold value specified by P06.48.	Check or replace encoder battery.
AL.098: Unfinished AD sampling	ADC sampling fault	Check the drive.

Innovation Integrity Service

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Zhejiang Hechuan Technology Co., Ltd.
No.9, Fucai Road, Longyou Industrial Zone, Quzhou City, Zhejiang Province, P.R. China

R&D Center (Hangzhou)
No. 299, Lixin Road, Qingshanhu Road, Lin'an District, Hangzhou City, Zhejiang Province, P.R. China

400 TEL - 400-012-6969

HCFA Official Website - www.hcfa.cn