SV-X5-Series

Bus Servo Drive

PROFINET

Instruction Manual

May 2026 V1.4
Version: ATC/MX5RH2411

※ Contents

※ 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.

1. 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 include the following warnings in the instruction manual of the equipment that incorporates this product.**
- There is danger due to high voltage equipment.
- There is danger due to residual voltage at the terminals and inside the machine after switching off the power supply.
- Localized 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 equipment 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 manual contains 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 our prior written permission.**

2. Confirmations during unpacking

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

3. 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.	Do not use the drive in any place near water, corrosive or flammable gases, and flammables.
	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 drive the motor by an external power	Otherwise, it may cause a fire.
Other safety precautions		
❗	Please ensure equipment safety after earthquakes.	Please ensure equipment safety after earthquakes.
	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.	Do not block the intake and let any foreign materials enter into the equipment.
	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 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 instruction.	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 servo drive

1.1.1 Drive model

Drive nameplate

Model identification

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

- SV-X5: Product series
- E: Product type
- R: Product type
- 075: Product power
- A: Voltage specifications
- A: Control power supply
- 0: Product iteration serial number
- 00: Hardware customized symbol
- 000: Software customized symbol

Product type

Symbol	Type
E	Standard type
F	With STO

Product type

Symbol	Type
R	PROFINET

Product power

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

Control power supply

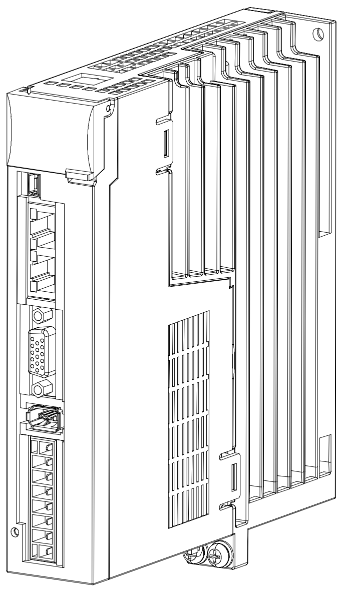
Symbol	Type
A	AC

Voltage specifications

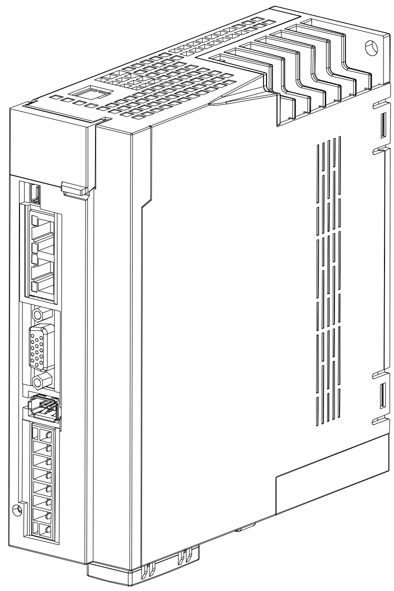
Symbol	Type
A	220V

1.1.2 Drive diagrams

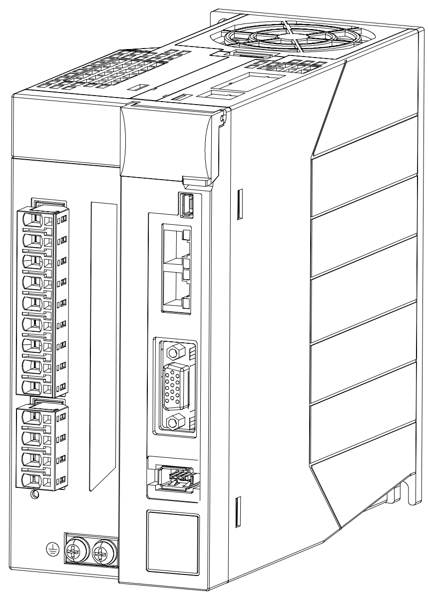
100W~400W Drive diagram



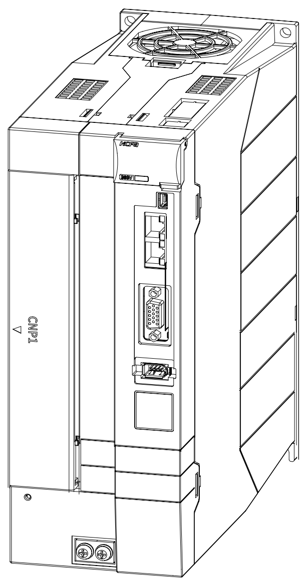
750W~1000W Drive diagram



1.5KW~3KW Drive diagram



5KW-7.5KW Drive diagram



1.1.3 Product overall specifications

①. 220V 100W-2.5kW

Item		Specification							
SV-X5(E)FR □□□ A-A0-00		010	020	040	075	100	150	200	250
Drive power (W)		100W	200W	400W	750W	1kW	1.5kW	2kW	2.5kW
Dimensions	W(mm)	35			52		80		
	H(mm)	174			174		174		
	D(mm)	152			152		184		
Input power supply	Main circuit power supply	Single-phase AC 200 ~ 240V -10%~+10%, 50Hz/60Hz					Single-phase / Three-phase AC 200 ~ 240V -10%~+10%, 50Hz/60Hz		
	Control circuit power supply	DC bus powered, shared with main power input and rectification					Single-phase AC 200V-240V, -10% ~ +10%, 50/60Hz		
Rated current (mA)		1.2	2	3	4.5	6	10	12.5	15.6
Maximum output current (mA)		3.6	6	9	13.5	18	30	37.5	37.5

②. 380V 2kW-7.5kW

Item		Specification			
SV-X5(E)FR □□□ T-A0-00		200	300	500	750
Drive power (W)		2000	3000	5000	7500
Dimensions	W(mm)	80		92	
	H(mm)	174		250	
	D(mm)	184		230	
Input power supply	Main circuit power supply	Three-phase AC 380 ~ 240V -10%~+10%，50Hz/60Hz			
	Control circuit power supply	Single-phase AC 380 ~ 240V -10%~+10%，50Hz/60Hz			
Rated current (mA)		9	12	17	26
Maximum output current (mA)		22.5	30	42.5	65
Ambient temperature		Operating: 0 to 55° C; Storage: -20 to 65° C			
Ambient humidity		Operating and storage: 20 to 85% RH or less (with no condensation)			
Altitude		1000 m or below			
Vibration		5.8 m/s² (0.6 G) or less, 10 to 60Hz (Continuous operation prohibited at resonance frequency)			
Supported protocol		PROFINET protocol			
Process data		RT and IRT			
Acyclic data		Access to profile parameters and function code parameters supported			
Duplex mode		Full-duplex			
Baud rate		100 Mbit/s			
Physical layer		100BASE-TX			
Transmission distance		Distance between 2 nodes: 100 m or less			
Number of slaves		Up to 65535 supported by protocol (determined by PLC performance)			
Configuration file		GSD file			
Commonly used telegrams		Telegrams 1, 3, 102, 105, 111, and additional telegram 750			
Supported control modes		AC1 (Velocity control) AC3 (Servo internal position control) AC4 (Position control in PLC + Servo velocity control) AC4 + DSC (Dynamic servo control)			
Digital inputs and outputs		5 DI, 3 DO			
USB communication		PC communication uses the "HCS-studio" background software			
STO function		Supported in Model F			

Dynamic brake	Built-in
Communication Ethernet port	Two standard 8-pin RJ45 ports
Synchronization cycle time	RT: Min. 1 ms; IRT: Min. 500 μs
Media redundancy	Supported

1.1.4 Overload detection characteristics

For the SV-X5E(F)R series drive, if the motor drive torque exceeds the value indicated in the overload detection characteristic curve below, the protection mechanism activates, triggering an overload fault alarm, and the motor performs an emergency stop.

AC220 100W	
Load ratio (%)	Overload time (S)
120	420
140	39.4
160	19.4
180	12.4
200	7.8
220	5.9
240	4.4
260	3.4
280	2.5
300	2.2

AC220V 200W	
Load ratio (%)	Overload time (S)
120	426
140	102.9
160	32.2
180	19.8
200	13.2
220	10.1
240	8
260	6.6
280	5.4
300	4.6

AC220V 400W	
Load ratio (%)	Overload time (S)
120	252
140	66
160	28.8
180	18.7
200	11.9
220	9.4
240	7.6
260	6.1
280	5
300	4.3

AC220V 750W	
Load ratio (%)	Overload time (S)
120	429
140	141.5
160	43.3
180	25.3
200	15.1
220	11.3
240	9.1
260	7.4
280	6.1
300	5.3

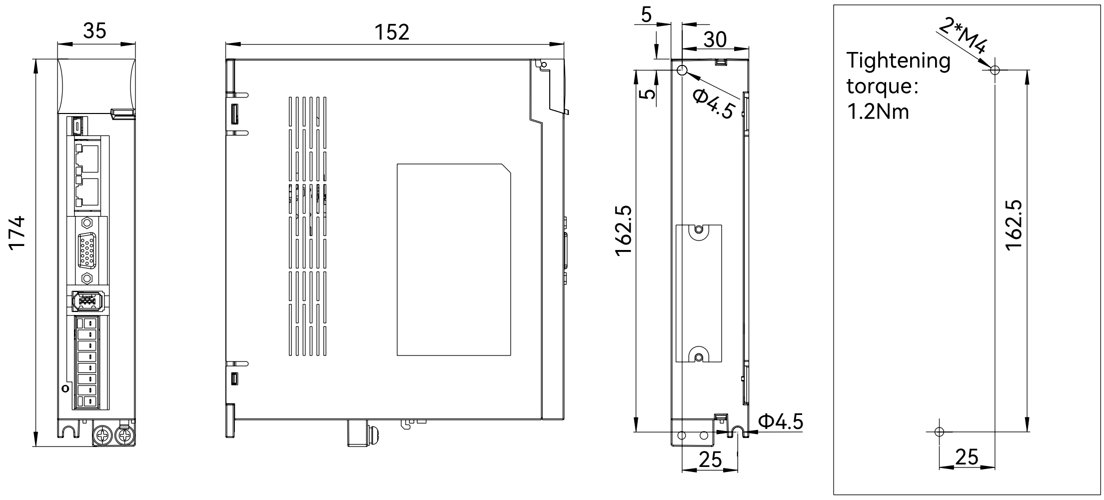
AC220V 1kW	
Load ratio (%)	Overload time (S)
120	696
140	114
160	22.4
180	20.3
200	13.2
220	10.1
240	8
260	6.5
280	5
300	4.3

AC220V 1.5kW-2.5kW	
Load ratio (%)	Overload time (S)
120	240
140	65.2
160	21.8
180	18
200	11.9
220	9.4
240	7.4
260	6.0
280	5
300	4.3

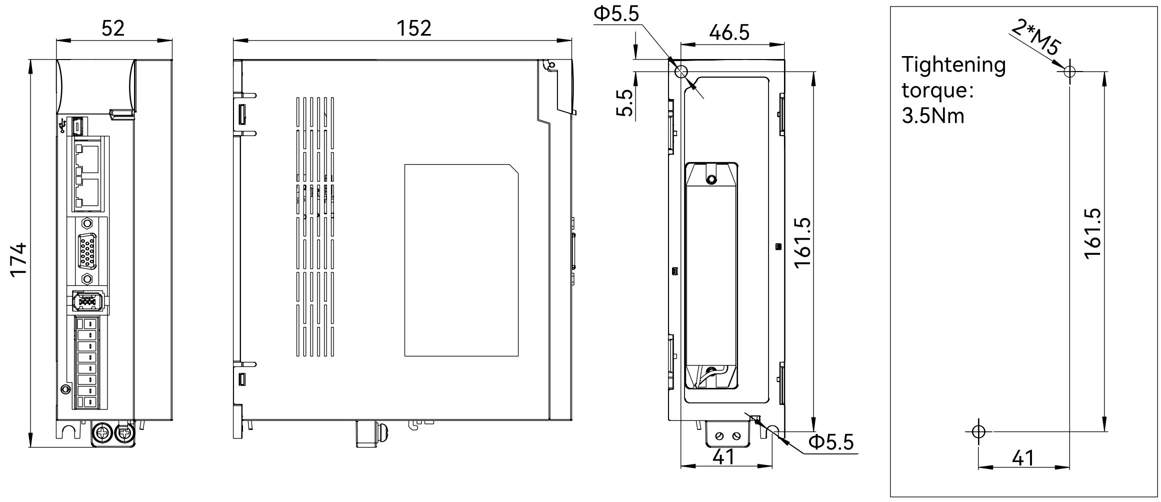
AC380V 2kW-7.5kW	
Load ratio (%)	Overload time (S)
120	3065
140	533
160	101.5
180	51.5
200	36.5
220	21.0
240	16.2
260	11.5
280	8.2
300	5

1.1.5 Overall dimensions

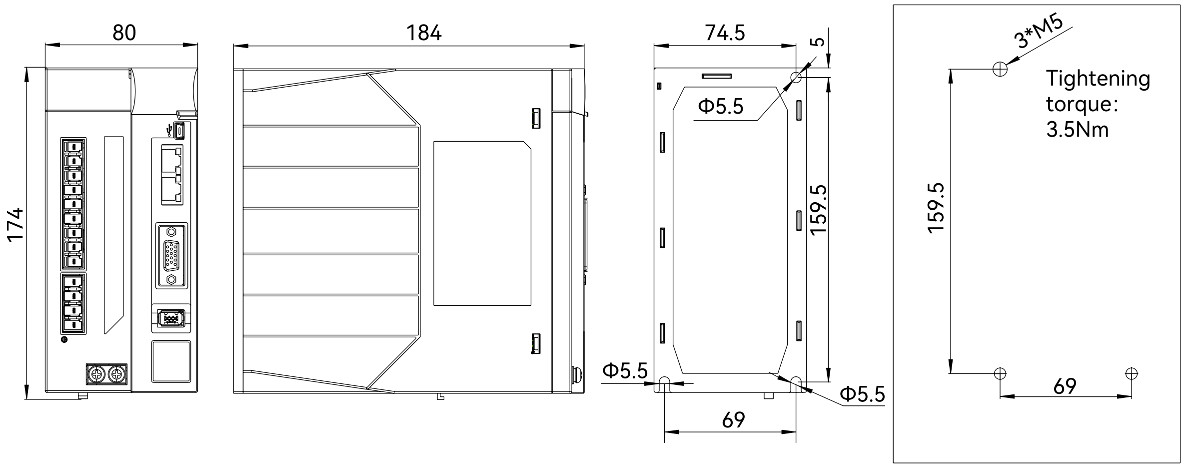
100W/200W/400W



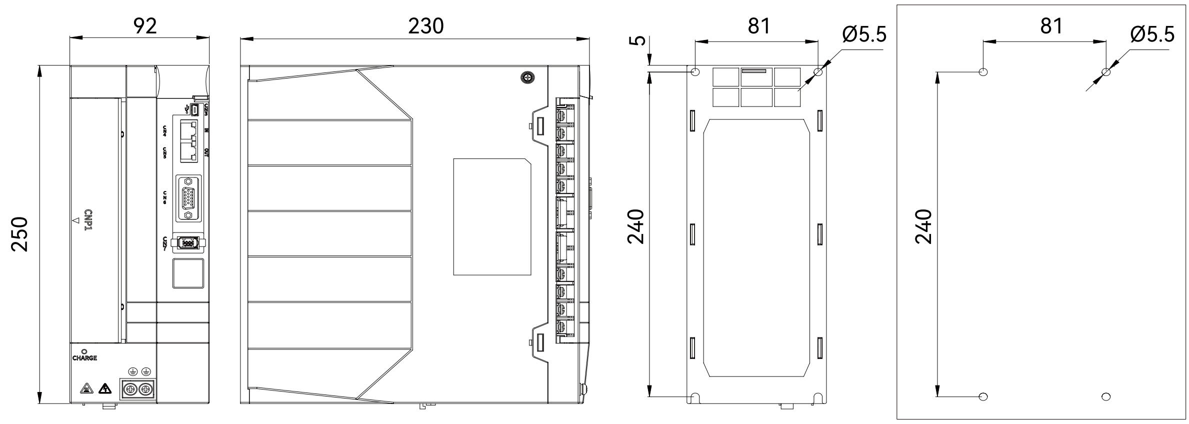
750W/1kW



1.5kW/2kW/3kW



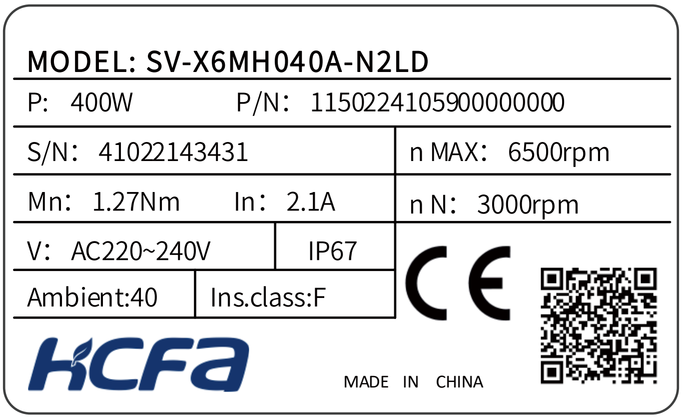
5kW-7.5kW



1.2 About motor

1.2.1 Motor model

Nameplate



Model

SV-X2 MM 005A - B 2 L N - **

- SV-X2: Product series
- MM: Inertia specifications
- 005A: Product power
- B: Holding brake
- 2: Voltage specifications
- L: Shaft end shape/ Oil seal
- N: Encoder type
- **: Customized marking

Inertia specifications

Mark	Power
MA	Low inertia
MM	Medium inertia
MH	High inertia
MG	High torque at low speed
MQ	Flat type

Product power

Mark	Power
005A	50W
010A	100W
020A	200W
040A	400W
075A	750W
085A	850W
100A	1000W
150A	1500W
130A	1300W
180A	1800W
200A	2000W

Voltage specifications

Mark	Volatge
2	AC220V

Holding brake

Mark	Brake
N	Without brake
B	24V brake

Encoder type

Mark	Specifications
N	Incremental 17bit
A	Absolute 17bit
D	Absolute 23bit

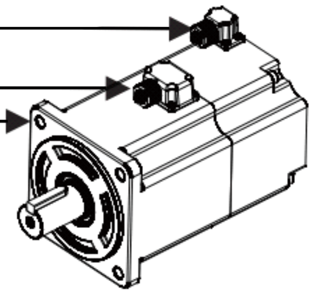
Shaft end shape/ Oil seal

Mark	Shaft end / Oil seal
K	Keyway shaft/ Without oil seal
L	Keyway shaft/ With oil seal

1.2.2 Motor part names

4 Power cables (3 Power cables+1 FG cable)
Drive input UVW
Brake cable (BRK1+BRK2)

4 Encoder cables + shielded cable
Encoder power supply
Data communication with the drive
Battery connection when using absolute encoder



Lead type

Motor fixing screws (recommended)		
Motor model	Fixed aperture	Recommended screws
MH005A、MH010A	2-Φ4.3	M4X12
MH020A	4-Φ5.4	M5X13
MH040A		
MA075A MH075A MH100C	4-Φ6.0	M5X16
MM100A MM100B MH100C	4-Φ6.0	M5X16
MM150B MH150A MM200A		
MG085B MG130A MG180B		

1.2.3 Motor basic specifications

AC200V~240V									
Item			Unit	Specifications					
Voltage			V	DC280V					
Motor model (SV-X2 □□□□□ -****)			-	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	Without brake		kg	0.33	0.45	0.9	0.87	1.28	1.22
	With 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	Without brake	kW/s	6.7	14.4	28.9	14.1	60	28.8
		With brake		6.1	13.8	23.8	13.2	54	27.8
	Mechanical time constant	Without brake	ms	2.8	2.17	0.728	1.39	0.499	1.3
		With 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	Without brake	10^{-4}kg.m^2	0.038	0.071	0.16	0.29	0.28	0.56
		With 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 (not for dynamic 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	1000m or below			
	Vibration rating	V15 (JEC2121)			
	Vibration resistance	$49m/s^2$ (5G)			
	Impact resistance	$98m/s^2$ (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 are divided into polarity. Red cable: Connects to +24V, Black cable: Connects to GND				

AC200V~240V								
Item		**Unit**	**Specifications**					
Voltage		V	DC280V					
Motor model (SV-X2 □□□□□ -****)		-	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	Without brake	kg	2.25	2.25	2.68	4.67	/	6.29
	With 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	Without brake	kW/s	59.4	36.6	44.7	36.9	56	9.96
		With brake		53.8	34.4	42.8	30.8	49.3	9.46
	Mechanical time constant	Without brake	ms	0.518	1.26	1.19	1.76	1.31	6.52
		With 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	Without brake	10^{-4}kg.m^2	0.96	1.56	2	6.18	9.16	22.9
		With brake		1.07	1.66	2.1	7.4	10.4	24.1
	Allowable load	Radial load	N	392	392	392	49	490	490
		Axial load		147	147	147	196	196	196
	Encoder		17bit serial communication (EIA422)						
Brake specifications	Application		Holding brake (not for dynamic 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		1000m or below						
	Vibration rating		V15 (JEC2121)						
	Vibration resistance		49m/s^2 (5G)						
	Impact resistance		98m/s^2 (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 are divided into polarity. Red cable: Connects to +24V Black cable: Connects to GND

AC200V~240V									
Item			Unit	Specifications					
Voltage			V	DC280V					
Motor model (SV-X2 □□□□□ -****)			-	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	Without brake		kg	/	7.37	6.98	4.67	5.87	6.98
	With brake			/	8.97	8.58	6.27	7.47	8.58
Basic specifi-cations	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	Without brake	kW/s	75.4	15.4	75.4	47.4	74.8	109
		With brake		68.6	14.8	68.6	39.6	75.9	98.7
	Mechanical time constant	Without brake	ms	3.16	5.15	1.24	1.76	1.41	0.91
		With 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	Without brake	$10^{-4}kg.m^2$	12.1	33.4	12.1	6.18	9.16	12.1
		With 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 (not for dynamic 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	1000m or below
	Vibration rating	V15 (JEC2121)
	Vibration resistance	$49m/s^2$ (5G)
	Impact resistance	$98m/s^2$ (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 are divided into polarity. Red cable: Connects to +24V Black cable: Connects to GND	

1.2.4 Allowable load of the output shaft

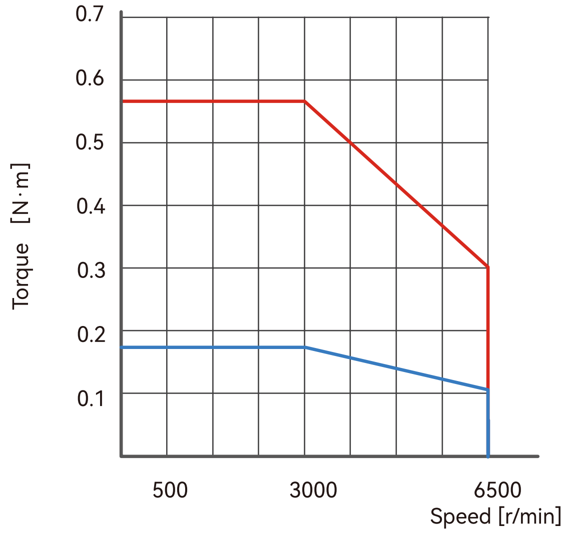
Allowable load	Unit	50W	100W	200W	400W	750W	1kW
Radial direction	N	68.6	68.6	245	245	392	392
Axial direction	N	58.8	58.8	98	98	147	147

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

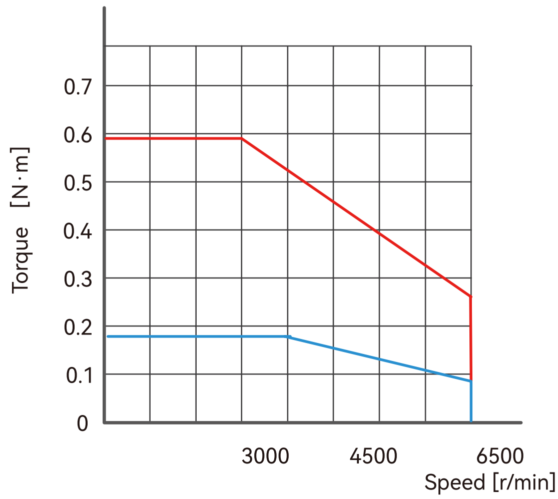
1.2.5 N-T characteristic chart

Instantaneous working area — Continuous working area

MA005



MH005



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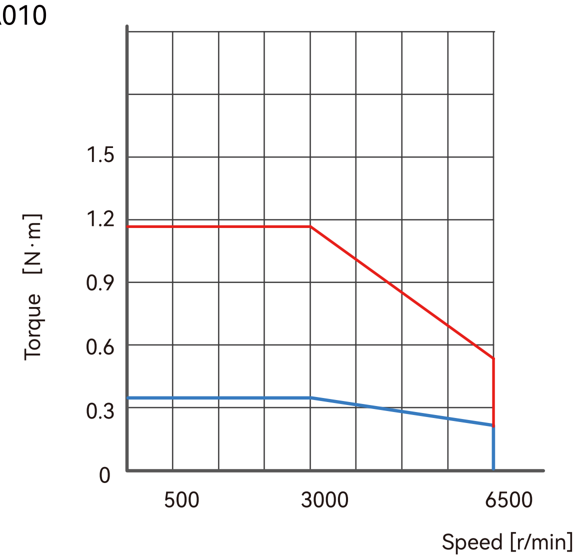

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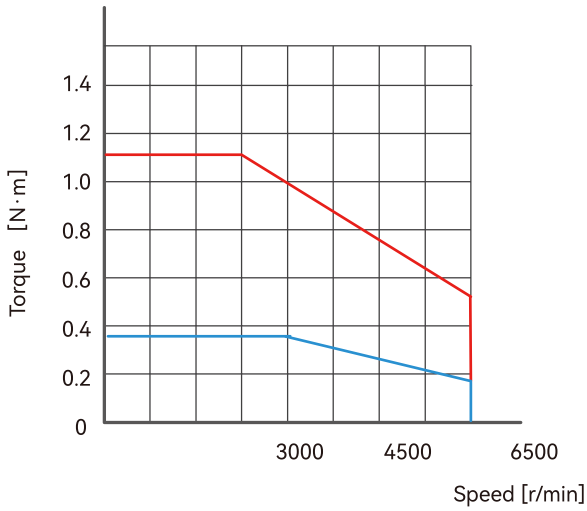

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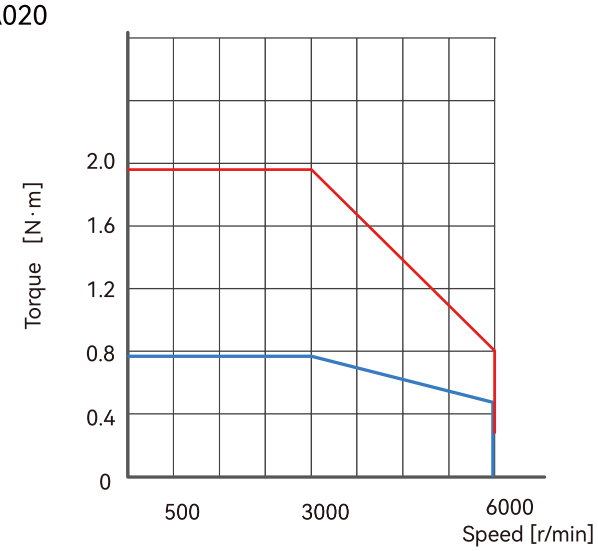

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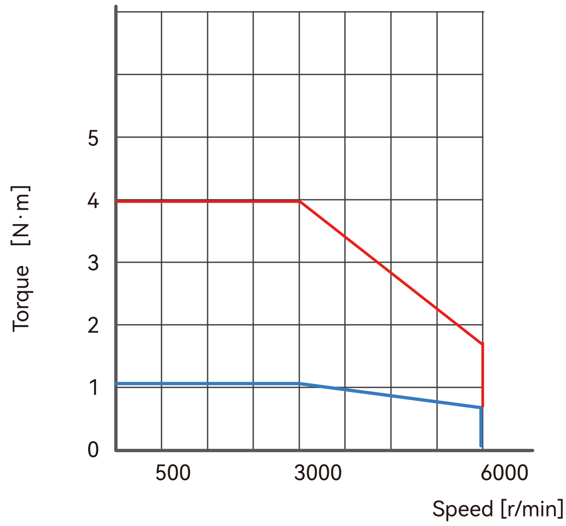

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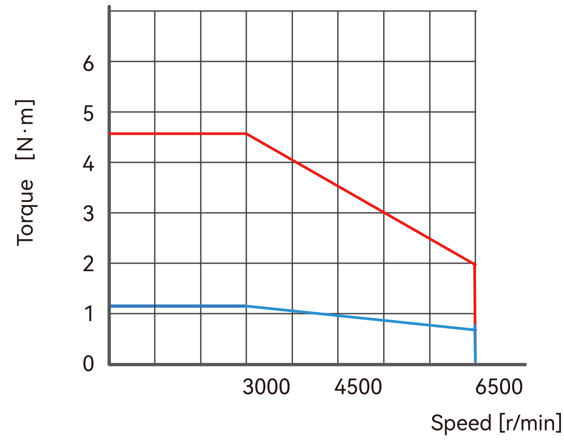

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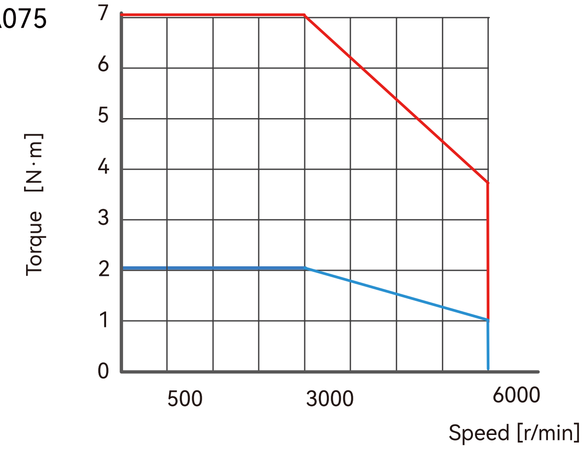

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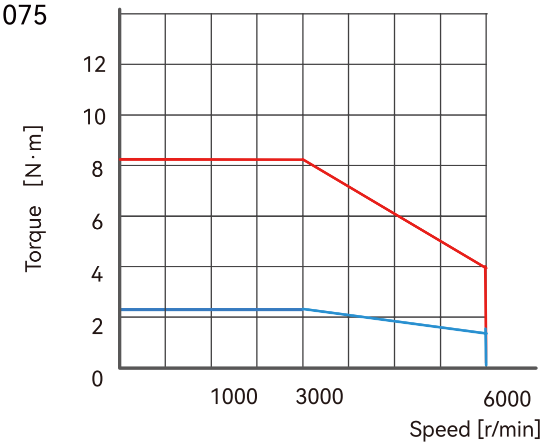
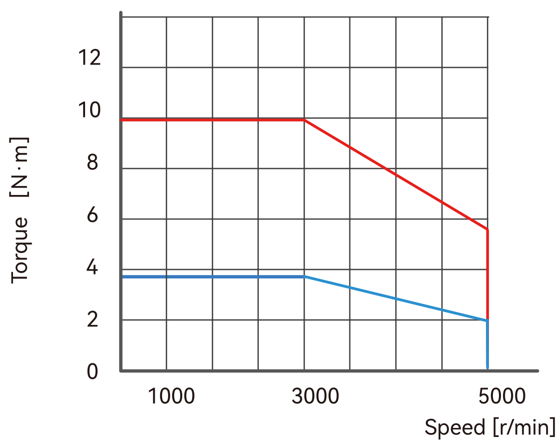


MA100



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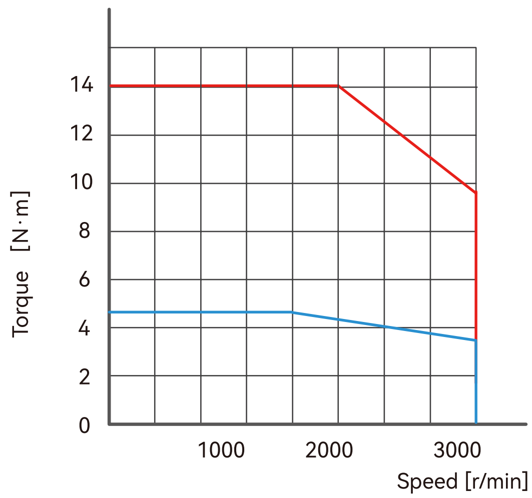

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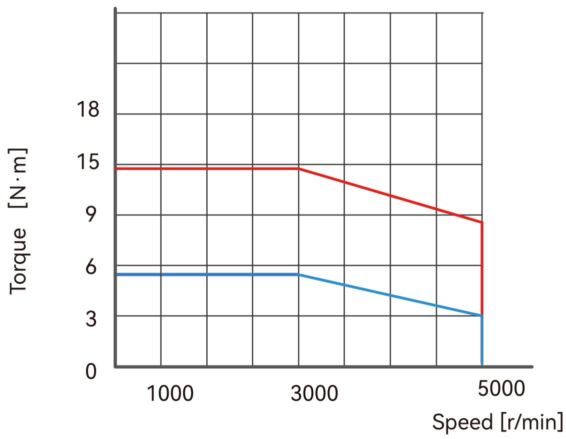

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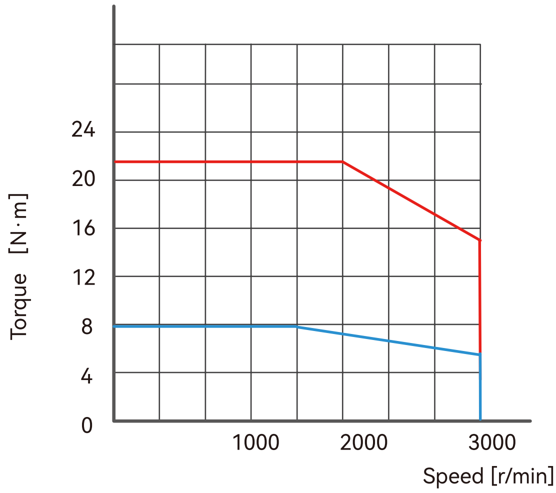
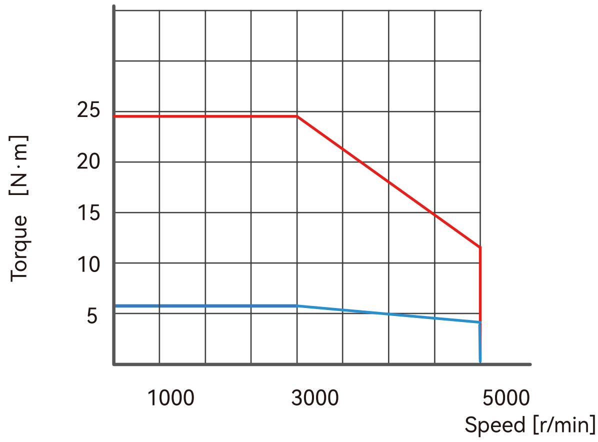


MA200

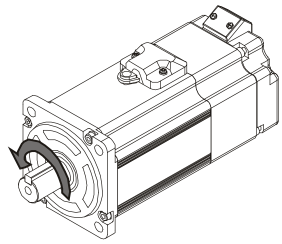


1.2.6 Encoder specifications

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 disturbing magnetic fields	Under ±2mT (20G)		—

Note 1): Upward counting direction

CCW



When viewed from the front of the flange, the shaft turns back in the counterclockwise direction, i.e., CCW.

【Note】

※ When the motor rotation is used at 180 degrees or less, the 1-turn rotation accuracy deteriorates.

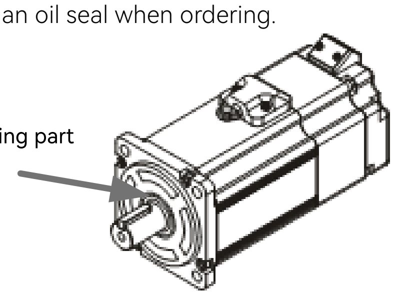
※ For motors with brake, please comply with the brake voltage specifications.

※ The 1-turn rotation accuracy deteriorates when the brake voltage is less than 12V and when it is used in reverse polarity.

1.2.7 About the oil seal

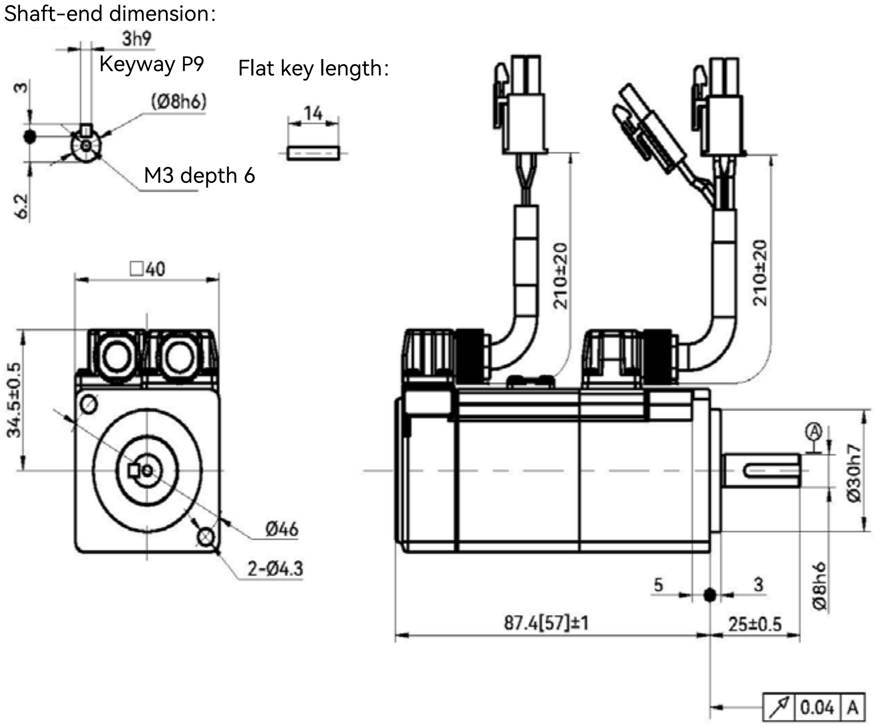
When used in combination with a gearhead, oil may seep into the motor through the output shaft, so use an oil seal to prevent oil from seeping into the motor, and all SV-X2 series motors are equipped with a part for mounting an oil seal. If an oil seal is required, specify the SV-X2 servo motor with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

Oil seal mounting part

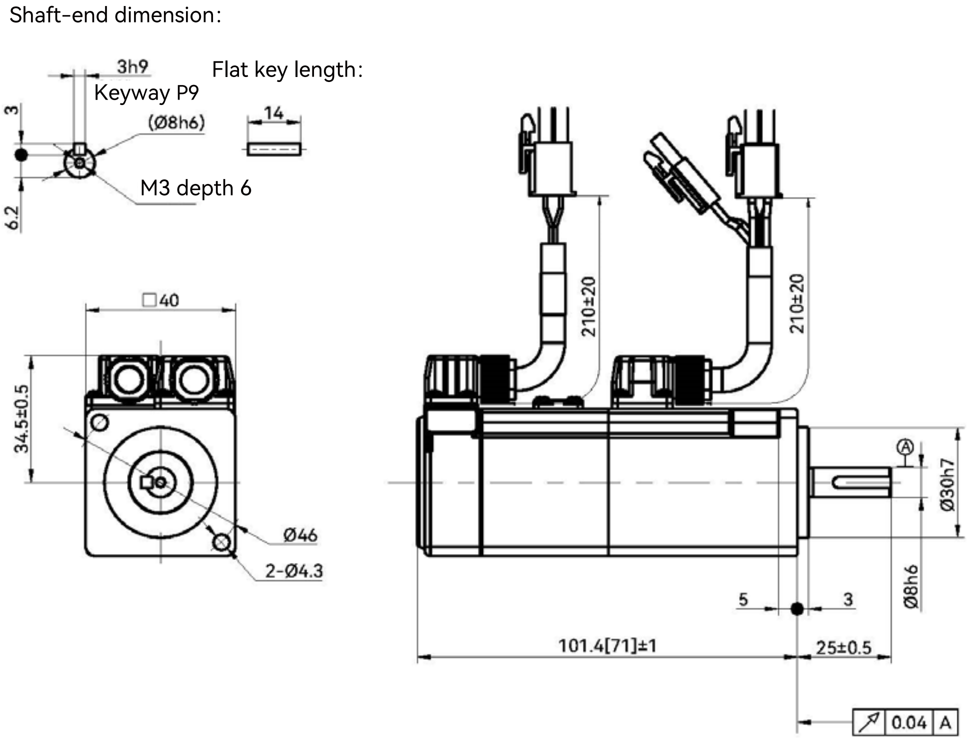


1.2.8 Motor dimension

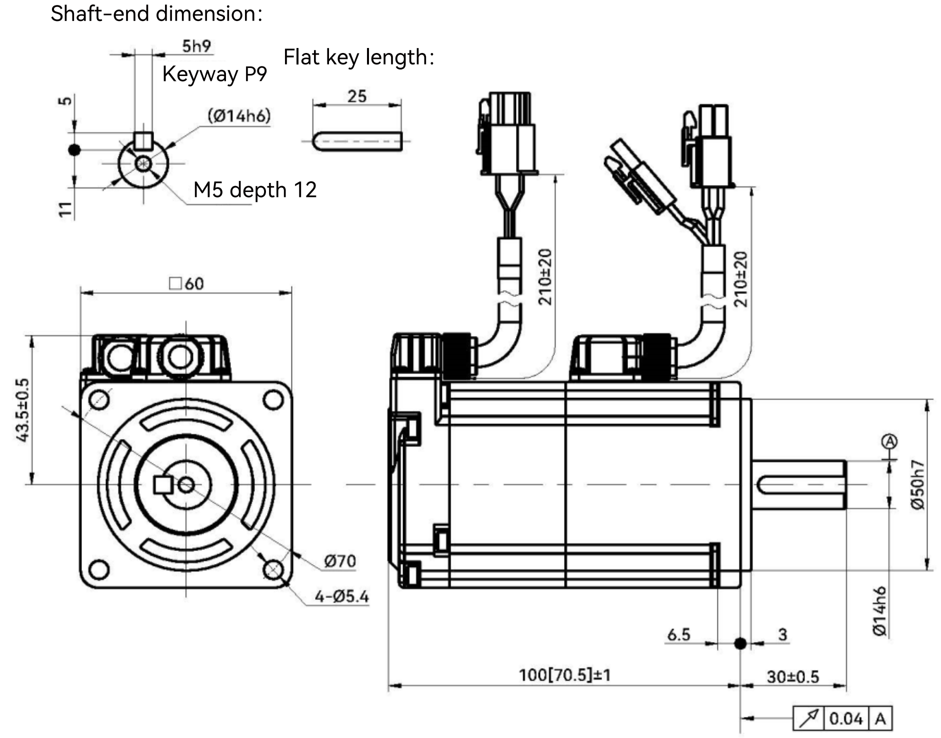
MH005A High inertia



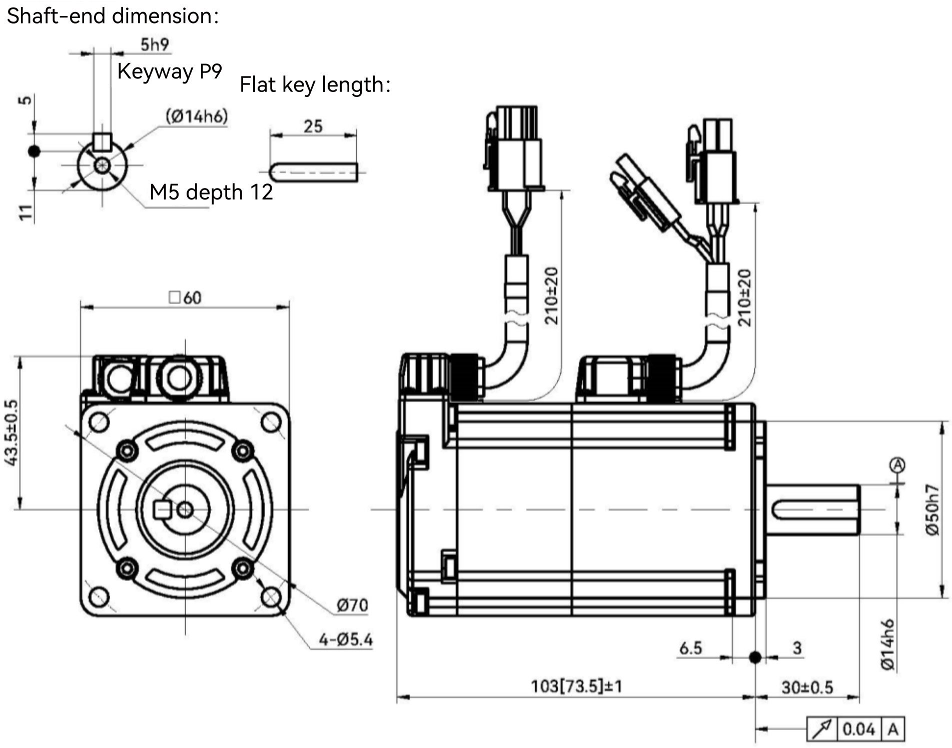
MH010A High inertia



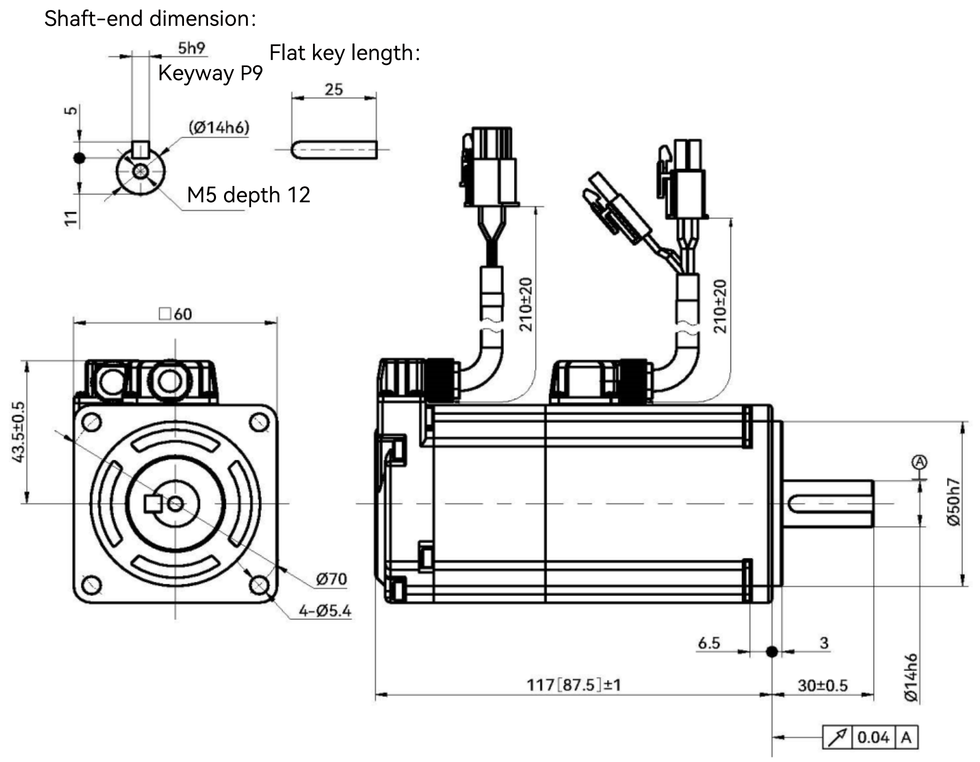
MH020A High inertia



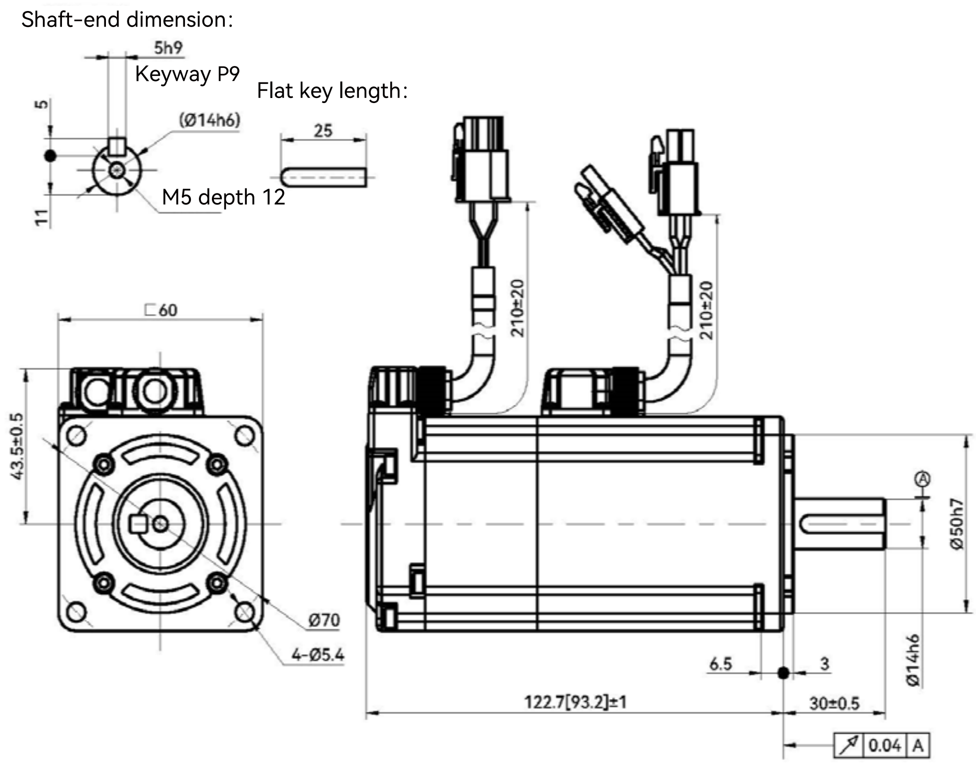
MA020A High inertia



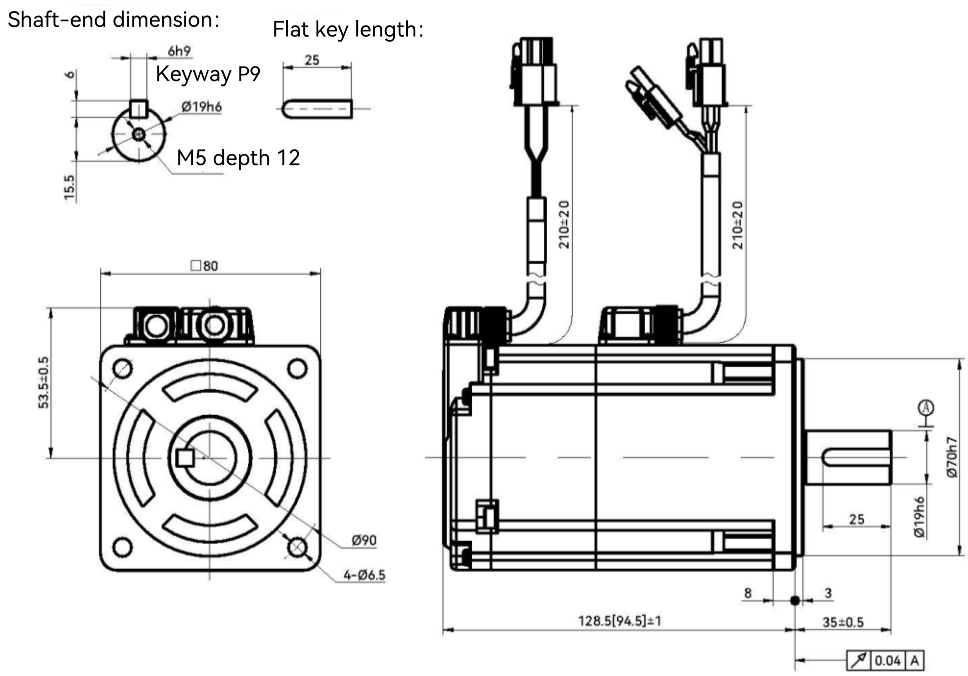
MH040A High inertia



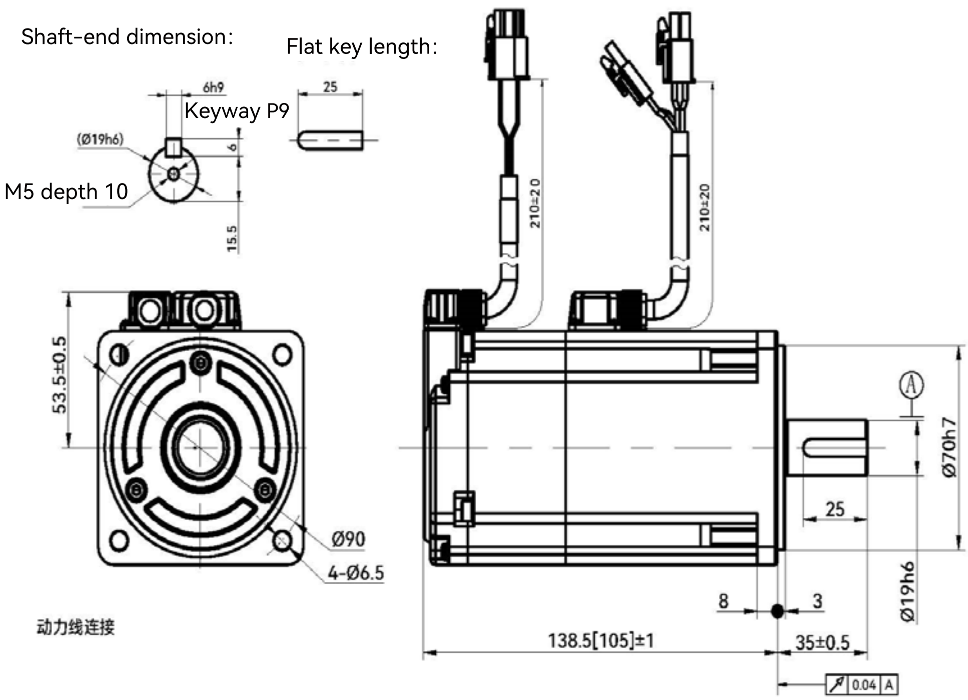
MA040A High inertia



MH075A High inertia

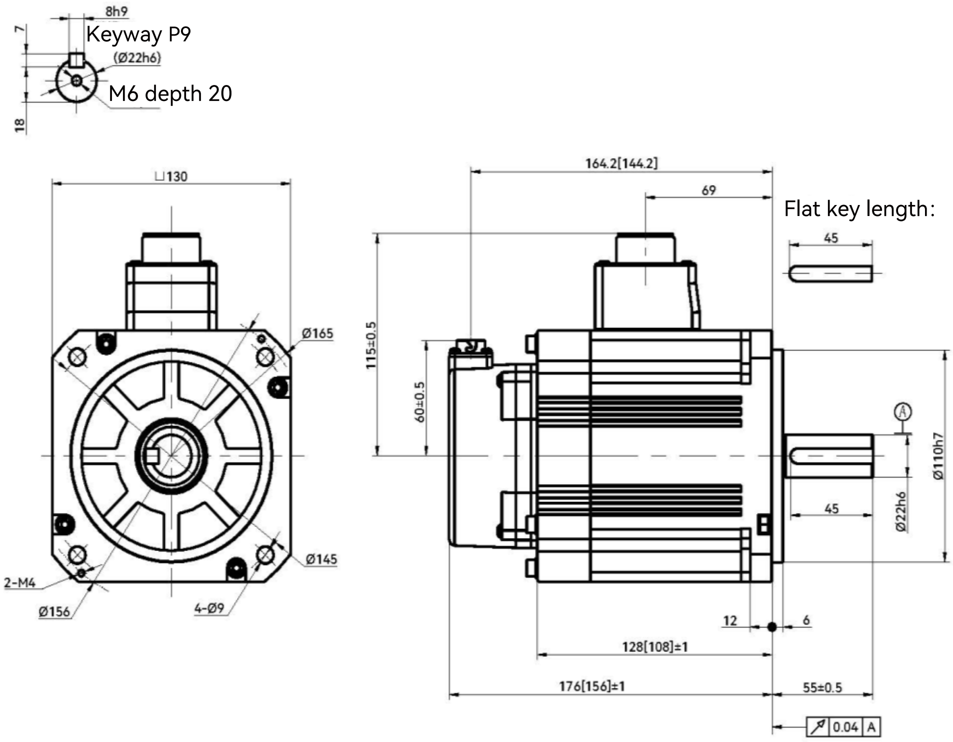


MA075A High inertia



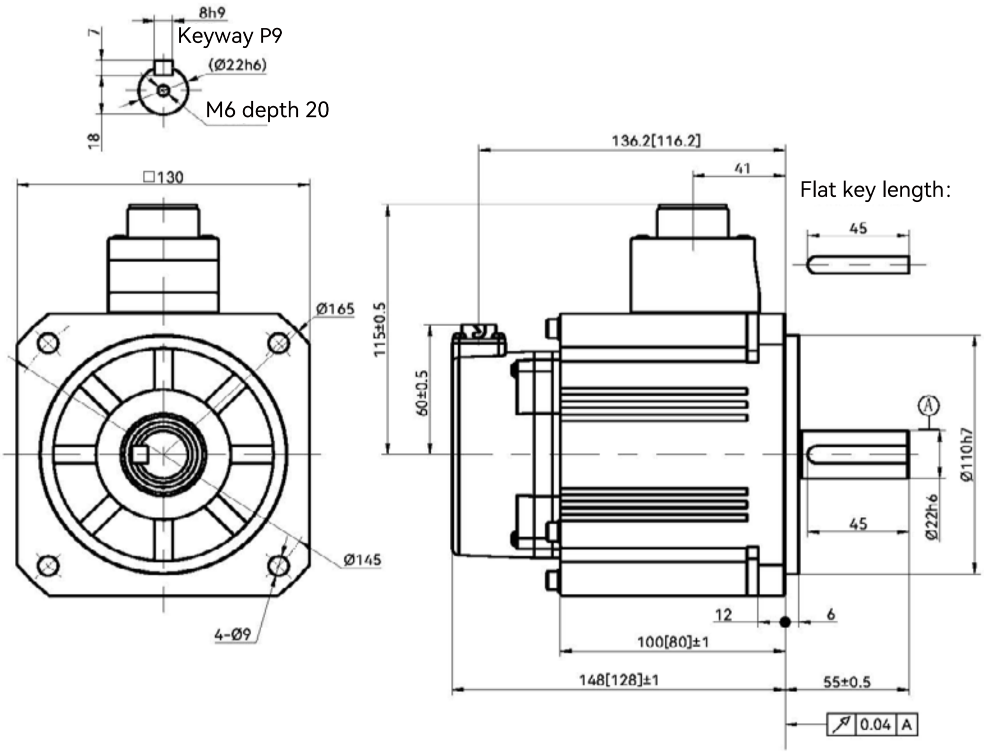
MH100A High inertia

Shaft-end dimension:

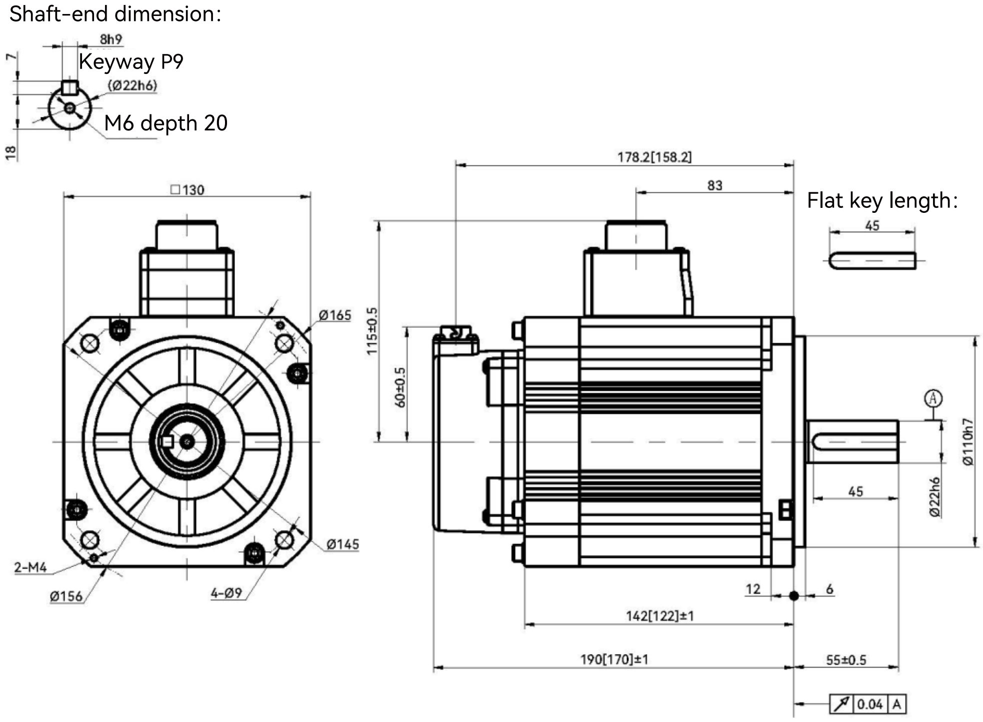


MM100A High inertia

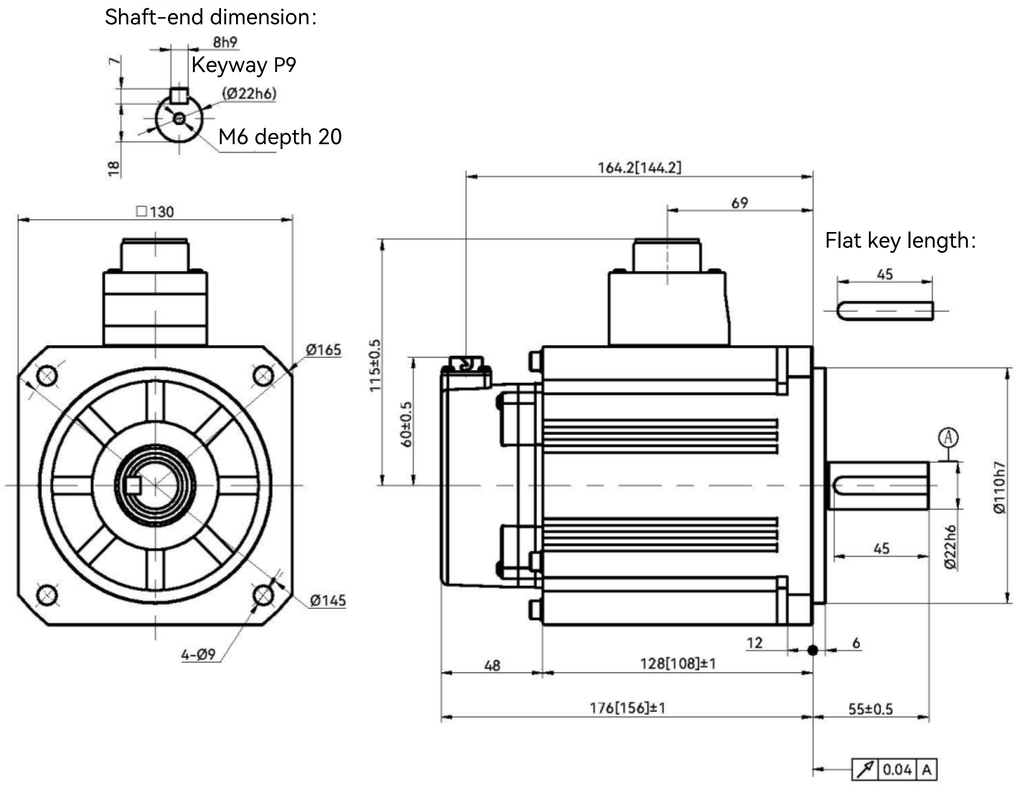
Shaft-end dimension:



MH150A High inertia



MM200A High inertia



1.3 External regenerative resistor selection

For drives rated 100W to 1000W, a regenerative resistor is optional and should be connected to terminals P and BR.

For drives rated 1500W to 3000W, a regenerative resistor is standard. Units are shipped with terminals P and C short-circuited, meaning the internal regenerative resistor is used. To use an external regenerative resistor, disconnect terminals P and C and connect the resistor to terminals P and D.

For drives rated 5000W to 7500W, a regenerative resistor is standard. Units are shipped with terminals P and C short-circuited, meaning the internal regenerative resistor is used. To use an external regenerative resistor, disconnect terminals P and C and connect the resistor to terminals P and BR.

Regenerative resistor selection for each power model is as follows:

Drive power	100W	200W	400W	750W	1000W	1500W	2000W	2500W
Optional/Standard regenerative resistor resistance and power	50Ω	50Ω	50Ω	50Ω	50Ω	40Ω	40Ω	40Ω
	50W	50W	50W	80W	80W	100W	100W	100W
External regenerative resistor resistance and power range	≥ 45Ω	≥ 45Ω	≥ 45Ω	≥ 40Ω	≥ 40Ω	≥ 30Ω	≥ 30Ω	≥ 30Ω
	≥ 50W	≥ 50W	≥ 50W	≥ 80W	≥ 80W	≥ 100W	≥ 100W	≥ 100W

Voltage class	380V			
Drive power	2000W	3000W	5000W	7500W
Standard regenerative resistor resistance and power	50Ω	50Ω	35	35
	80 W	80 W	100W	100W
External regenerative resistor resistance and power range	≥ 45Ω	≥ 40Ω	≥ 35	≥ 25
	≥ 100W	≥ 100W	≥ 100W	≥ 100W

Note:

When using an external regenerative resistor with 1500W~7500W drives, please set drive parameter P00.21 to 1.

The recommended regenerative resistor specifications in the above table cannot guarantee suitability for all application scenarios. If the regenerative resistor's temperature becomes excessively high, please replace it with a resistor of higher power rating, ensuring its resistance value remains within the allowable range specified in the table.

1.4 Matching models for drives and motors

Power supply input rating	Capacity	Servo motor model		Motor frame size Flange dimension (mm)	Drive model
220V	50W	High inertia	MH005A	40	SV-X5E(F)R010A-A
	100W	High inertia	MH010A		
		Flat type	MQ010A		
	200W	Low inertia	MA020A	60	SV-X5E(F)R020A-A
		High inertia	MH020A		
		Flat type	MQ020A		
	400W	Low inertia	MA040A	60	SV-X5E(F)R040A-A
		High inertia	MH040A		
		Flat type	MQ040A		
	750W	Low inertia	MA075A	80	SV-X5E(F)R075A-A
		High inertia	MH075A		
	1KW	High inertia	MH100C	80	SV-X5E(F)R100A-A
		Medium inertia	MM100A	130	SV-X5E(F)R100A-A
		High inertia	MH100A		
	1.5kW	Medium inertia	MM150A	130	SV-X5E(F)R150A-A
		High inertia	MH150A		
	2kW	Medium inertia	MM200A		SV-X5E(F)R200A-A
	850W	Large torque at low speed	MG085A		SV-X5E(F)R150A-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-X5E(F)R250A-A
380V	2kW	Medium inertia	MM200A	180	SV-X5ER200T-A
	3kW	Medium inertia	MM300A	180	SV-X5ER300T-A
	5kW	Medium inertia	MM500A	180	SV-X5ER500T-A
	7.5kW	Medium inertia	MM750A	180	SV-X5ER750T-A

1.5 Peripheral cable and circuit breaker selection

◆ Peripheral cable and connector accessory selection

Note: (The following cable selection refers to section 1.4 of this chapter for matching motor specifications)

(1) Motor flange face 40

Item	Purpose	Finished product name
1	Power cable for motor with brake	SVCAB-PWB010CA-***L-05
2	Power cable for motor without brake	SVCAB-PWR010CA-***L-05
3	Incremental encoder cable	SVCAB-ENC075CA-***L-05
4	Absolute encoder cable	SVCAB-ENC075CA-ABS-***L-05

(2) Motor flange face 60-80

Item	Purpose	Finished product name
1	Power cable for motor with brake	SVCAB-PWB075CA-***L-05
2	Power cable for motor without brake	SVCAB-PWR075CA-***L-05

3	Incremental encoder cable	SVCAB-ENC075CA-***L-05
4	Absolute encoder cable	SVCAB-ENC075CA-ABS-***L-05

(3) Motor flange face 100-130

Item	Purpose	Finished product name
1	Power cable for motor with brake	CAB-PWB100A-*M
2	Power cable for motor without brake	CAB-PWR100A-*M
3	Incremental encoder cable	CAB-ENC100A-*M
4	Absolute encoder cable	CAB-ENC100A-ABS-LW-*M

(4) Motor flange face 180

Item	Purpose	Finished product name
1	2-core dedicated brake power cable	CAB-PWD100A-*M
2	Power cable for motor without brake	CAB-PWR400C-*M
3	Incremental encoder cable	CAB-ENC100A-*M
4	Absolute encoder cable	CAB-ENC100A-ABS-LW-*M

◆ Circuit breaker selection

A circuit breaker must be connected on the input side to prevent accidents caused by an internal circuit short.

(1) Main circuit power supply: Single-phase input L1/L2

Servo drive model	L1C-L2C control power supply Recommended circuit breaker (A)	L1-L2 Main power supply Recommended circuit breaker (A)	Total power supply Recommended circuit breaker (A)
SV-X5E(F)R010A-A	-	6A	6A
SV-X5E(F)R020A-A	-	6A	6A
SV-X5E(F)R040A-A	-	10A	10A
SV-X5E(F)R075A-A	-	16A	16A
SV-X5E(F)R100A-A	-	16A	16A
SV-X5E(F)R150A-A	6A	20A	20A
SV-X5E(F)R200A-A	6A	25A	25A
SV-X5E(F)R250A-A	6A	25A	25A

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

Servo drive model	L1C-L2C control power supply Recommended circuit breaker (A)	L1-L2-L3 Main power supply Recommended circuit breaker (A)	Total power supply Recommended circuit breaker (A)
SV-X5E(F)R150A-A	6A	10A	10A
SV-X5E(F)R200A-A	6A	16A	16A
SV-X5E(F)R200T-A	6A	16A	16A
SV-X5E(F)R250A-A	6A	16A	16A
SV-X5E(F)R300A-A	6A	20A	20A

(3) Main circuit power supply: Three-phase input R/S/T

Servo drive model	L1C-L2C control power supply Recommended circuit breaker (A)	R/S/T Main power supply Recommended circuit breaker (A)	Total power supply Recommended circuit breaker (A)
SV-X5ER500T-A	6A	25A	25A
SV-X5ER750T-A	6A	32A	32A

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.

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**

① 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.

② A claw puller must be used when removing the pulley and coupling from the motor shaft.

◆ **Integration with the mechanical system**

① 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 eccentric and angular load.

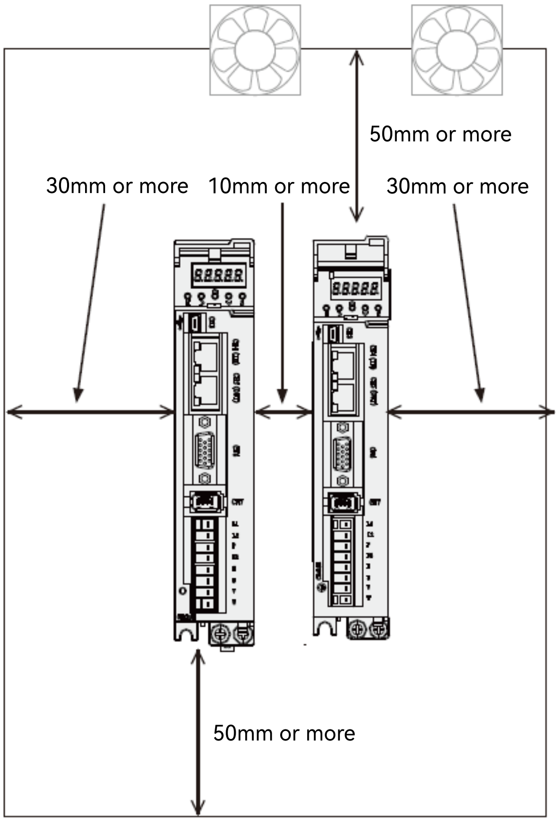
② Do not apply more than 6kgf of pressure to the encoder cable when installing the motor.

③ The bending radius of the power and encoder cables must be R20mm or more.

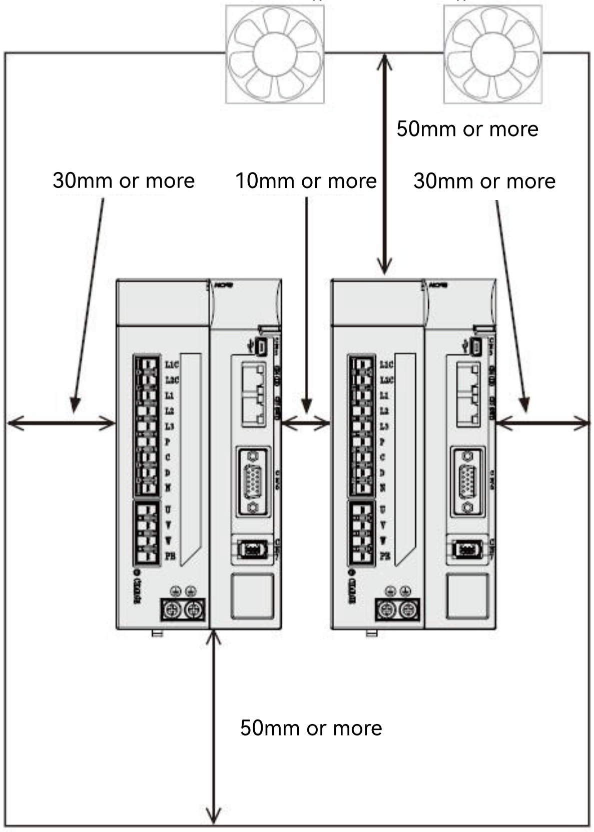
◆ **Installation direction and clearance**

When setting the drive, sufficient clearances must be reserved around it to ensure heat dissipation and convection in the protective enclosure or control cabinet. As shown in the figure below:

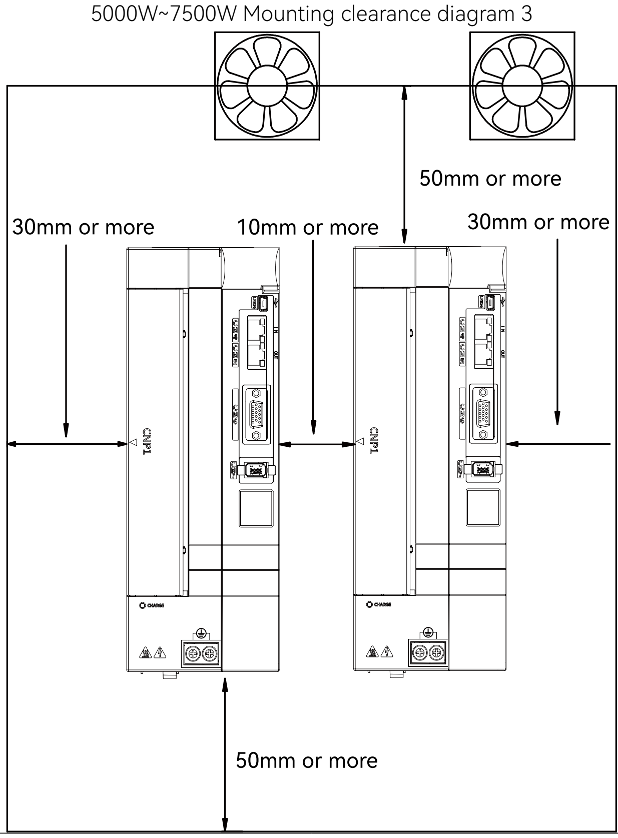
100W~1000W Mounting clearance diagram 1



1500W~3000W Mounting clearance diagram 2



5000W~7500W Mounting clearance diagram 3



• The drive shall be installed in the vertical direction. During installation, use two M4 screws to fix drives with an output power of 100W to 400W. Use two M5 screws to fix drives with an output power of 750W to 1000W. Use three M5 screws to fix drives with an output power of 1500W to 7500W.

• When installing the drive into a sealed cabinet such as a control cabinet, use a fan or cooler to ensure that the ambient temperature around the internal boards does not exceed 55° C.

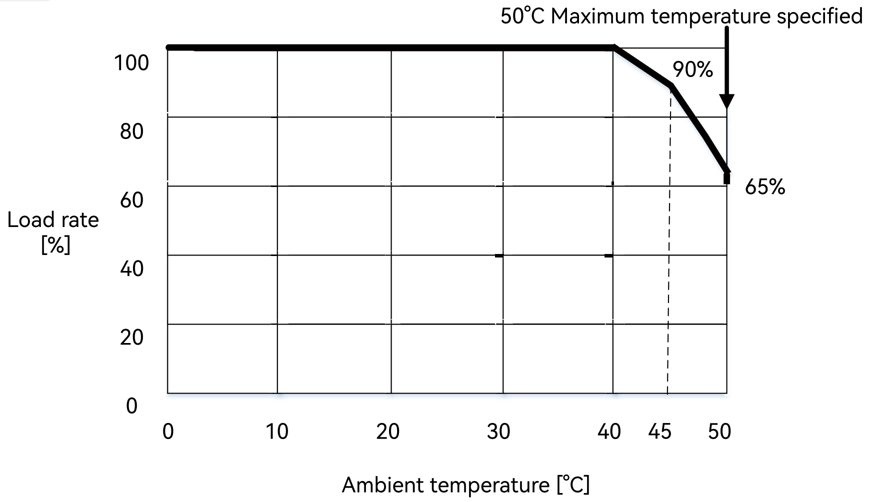
• The surface temperature of the heat sink will be more than 30° C higher than the surrounding temperature.

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

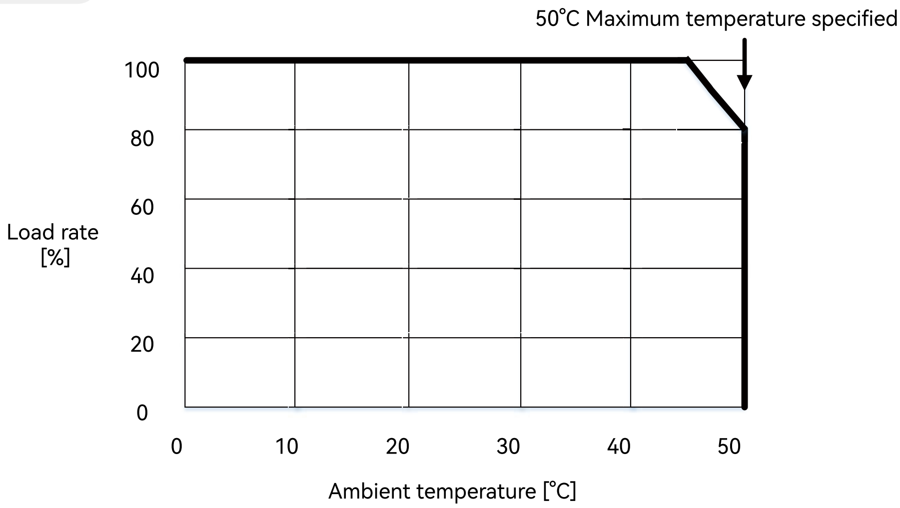
• The life span of the servo drive depends on the temperature around the internal electrolytic capacitors. When the electrolytic capacitors are near the end of their life span, the capacitance will decrease and internal resistance will increase. Consequently, it will lead to overvoltage alarms, malfunction caused by noise, and component damage. The life span of the electrolytic capacitors is approximately 5 to 6 years under the condition of an average annual temperature of 30° C, 80% load rate, and average operation time of less than 20 hours per day.

◆ Drive ambient temperature efficiency

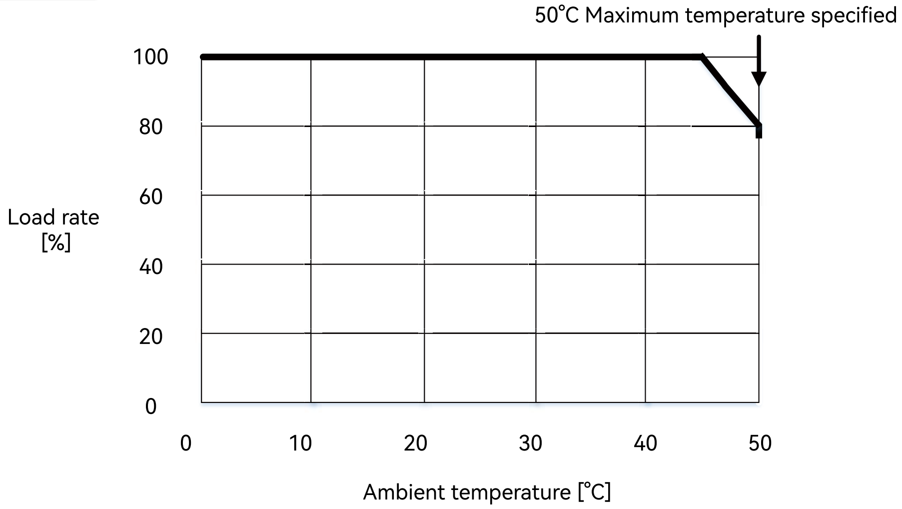
100W~400W Model



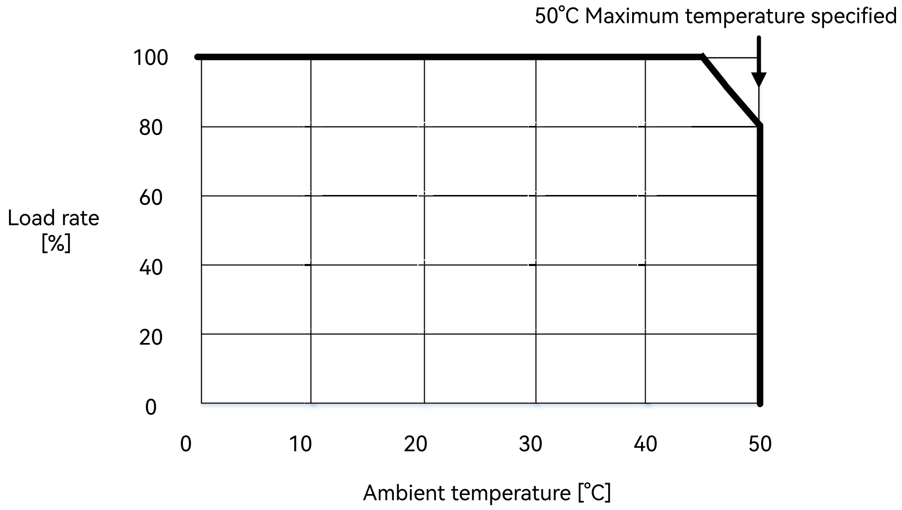
750W~1000W Model



1500W~3000W Model



5000W~7500W Model

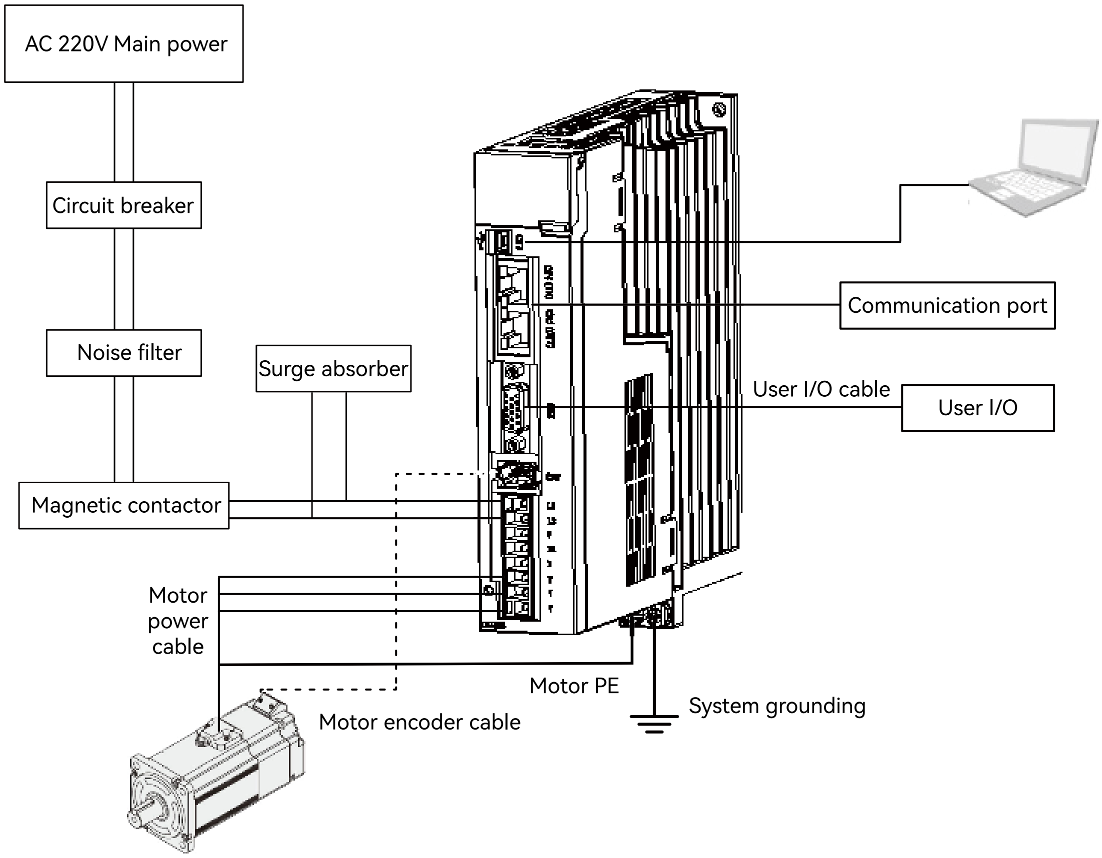


Chapter 2 Motor and Drive Wiring Instructions

2.1 System wiring diagram

Motor and drive wiring instructions

◆ **AC220V power supply input (100W~1000W)**



◆ **[Points for correct wiring]**

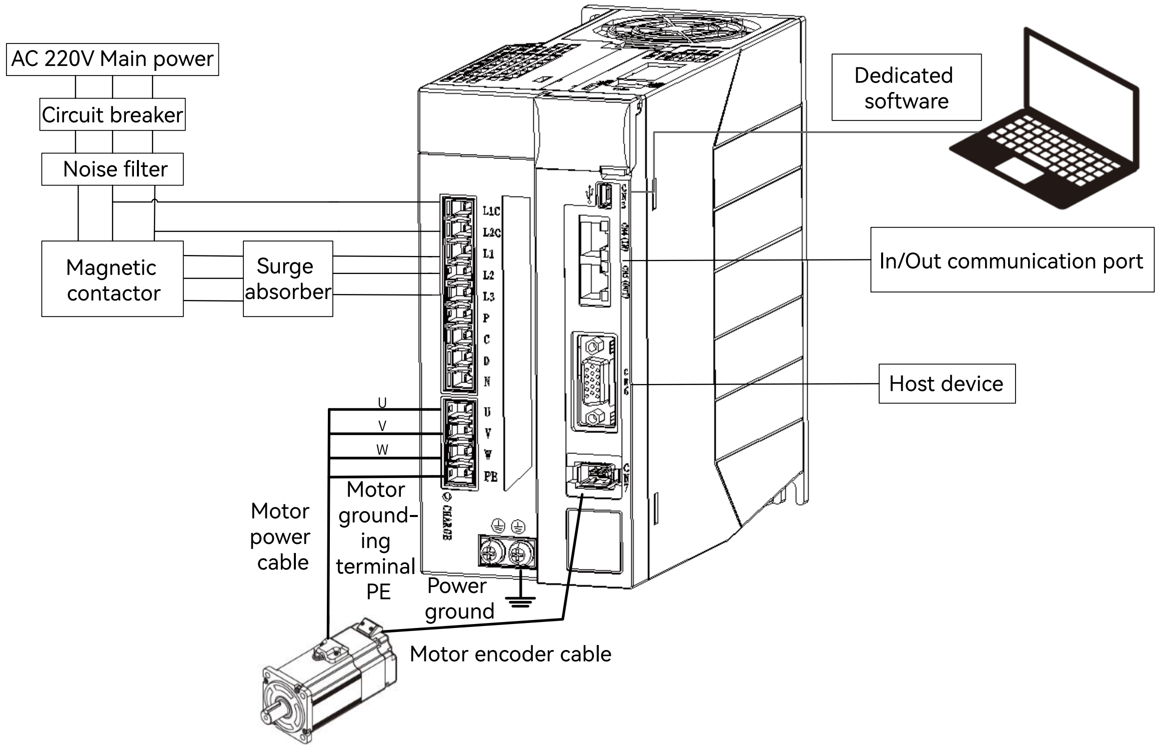
Control circuit power supply and main circuit power supply are both input via L1 and L2. Connect to single-phase AC220V.

Use a shielded twisted-pair cable when the user I/O cable length exceeds 50cm.

The encoder cable length shall not exceed 20m.

For common DC bus connection, drives must have the same voltage input level and be powered on simultaneously.

◆ AC220V/AC380V power supply input (1.5kW~3kW)



◆ [Points for correct wiring]

L1C and L2C are control circuit power supply inputs. Connect to single-phase AC220V. L1, L2, and L3 are main circuit power supply inputs. Connect to three-phase AC220V. For 380V models, connect L1C and L2C to single-phase AC380V, and L1, L2, L3 to three-phase AC380V.

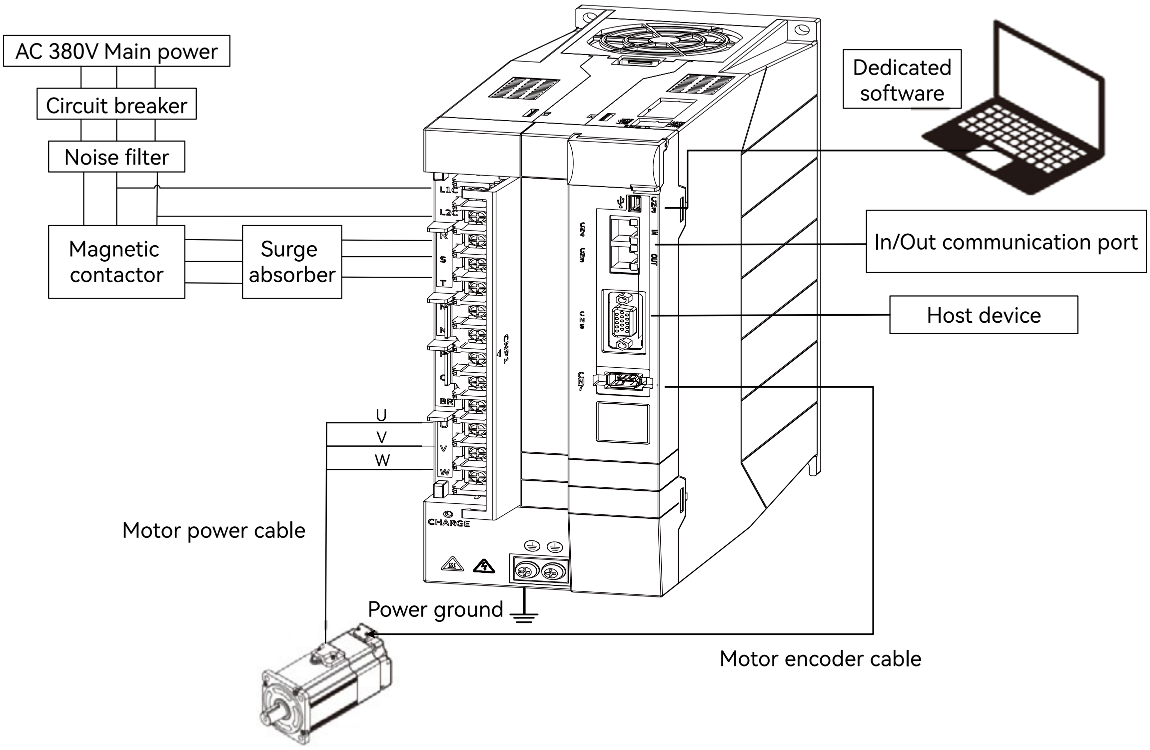
Use a shielded twisted-pair cable when the user I/O cable length exceeds 50cm.

The encoder cable length shall not exceed 20m.

For common DC bus connection, drives must have the same voltage input level and be powered on simultaneously.

Braking resistor wiring: If the PC terminal is shorted, the internal braking resistor is used. If an external braking resistor is required, disconnect the PC terminal and connect the PD port to the external braking resistor.

◆ **AC380V power supply input (5kW~7.5kW)**



◆ **[Points for correct wiring]**

Control circuit power supply and main power supply shall be wired from the same AC380V power supply.

Main power supply must use three-phase AC380V input.

Use a shielded twisted-pair cable when the user I/O cable length exceeds 50cm.

The encoder cable length shall not exceed 20m.

For common DC bus connection, drives must have the same voltage input level and be powered on simultaneously.

Braking resistor wiring: If the PC terminal is shorted, the internal braking resistor is used. If an external braking resistor is required, disconnect the PC terminal and connect the PBR port to the external braking resistor.

Table 2.1.1 Description of servo drive and servo motor connection

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 [2.1 System wiring diagram]
Installation environment	The drive can be installed in a pollution degree 2 or pollution degree 1 environment according to IEC60664-1.
Power supply 1: AC220~230V/380V~440V (Main circuit and control circuit power supply)	The product 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, AC200V input cables, FG cables, and main circuit power distribution cables in multi-axis configurations, select cable gauge by power rating: AWG18/600V for ≤ 750W, and AWG14/600V for ≥ 1kW.

Earth leakage circuit breaker	To protect the power cable, it is necessary to disconnect the circuit when overcurrent flows. According to [2.1 system wiring 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 the company .
Noise filter	It prevents noise interference from the power cable. To comply with EMC standards, use the noise filters recommended by the company .
Electromagnetic contactor	It performs main power switching (ON/OFF). Connect an overvoltage protector for use.
Surge absorber	To comply with EMC standards, use an overvoltage absorber recommended by the company .
Signal cable noise filter / Ferrite core	To comply with EMC standards, use the noise filter recommended by the company .
Regenerative resistor	There is no internal regenerative resistor in this product. 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

◆ AC 220V power supply input (750W or less)

Motor connector and pin arrangement (50~750W)

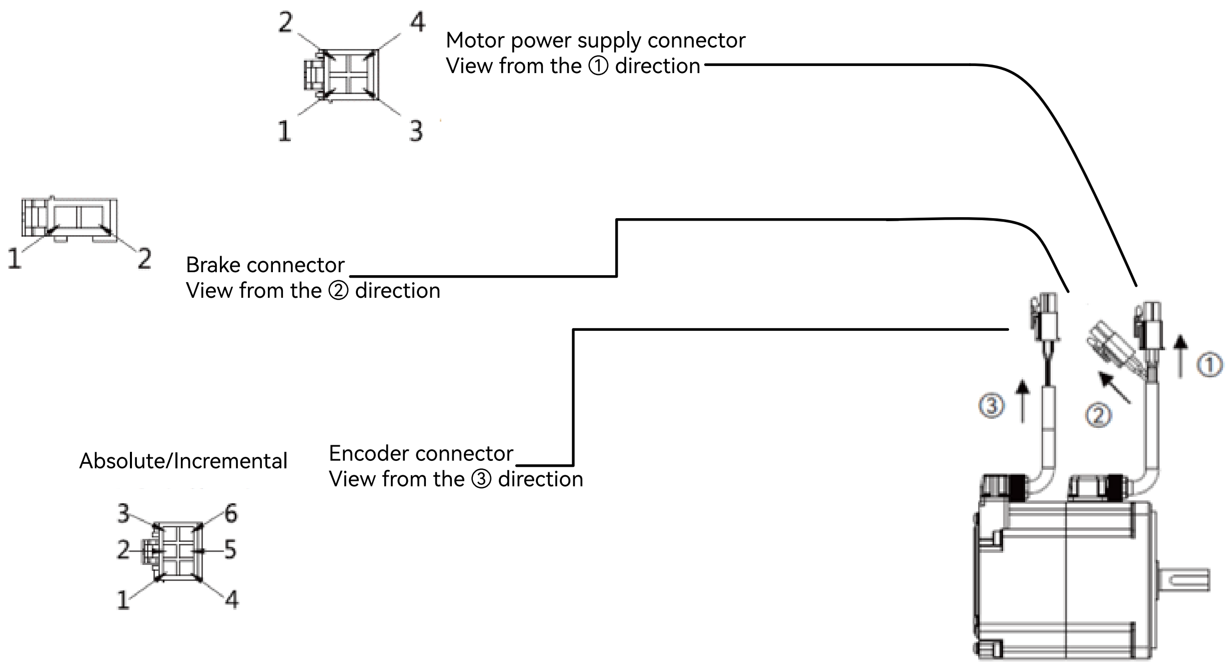


Table 2.2.1 List of cables（750W or less）

Name	Cable
Motor power input	AWG18
Brake [*1]	AWG22
Encoder (incremental)	Power: AWG22 Signal: AWG24
Encoder (absolute)	

Note1: Applicable to motors with brakes

Table 2.2.2 For power below 750W

Name	Terminal No.	Signal name	Description	Wiring color coding
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	Yellow/Green
Brake [*1]	1	BRK+	Brake power supply DC24 V	Blue (brown)
	2	BRK-	Brake power supply GND	Yellow (orange dot)
Encoder (incremental / absolute)	1	BAT+	Encoder power +	Yellow (red dot)
	2	+D	Serial communication data +	White (red dot)
	3	-D	Serial communication data -	White (black dot)
	4	VCC	Encoder power supply 5V output	Orange/Yellow (red dot)
	5	GND	Signal grounding	Orange/Yellow (black dot)
		SHIELD	Shielded cable	Black

Note 1: Applicable to motors with brakes.

◆ AC 220V power supply input (1KW~2.5KW)

Motor connector and pin arrangement

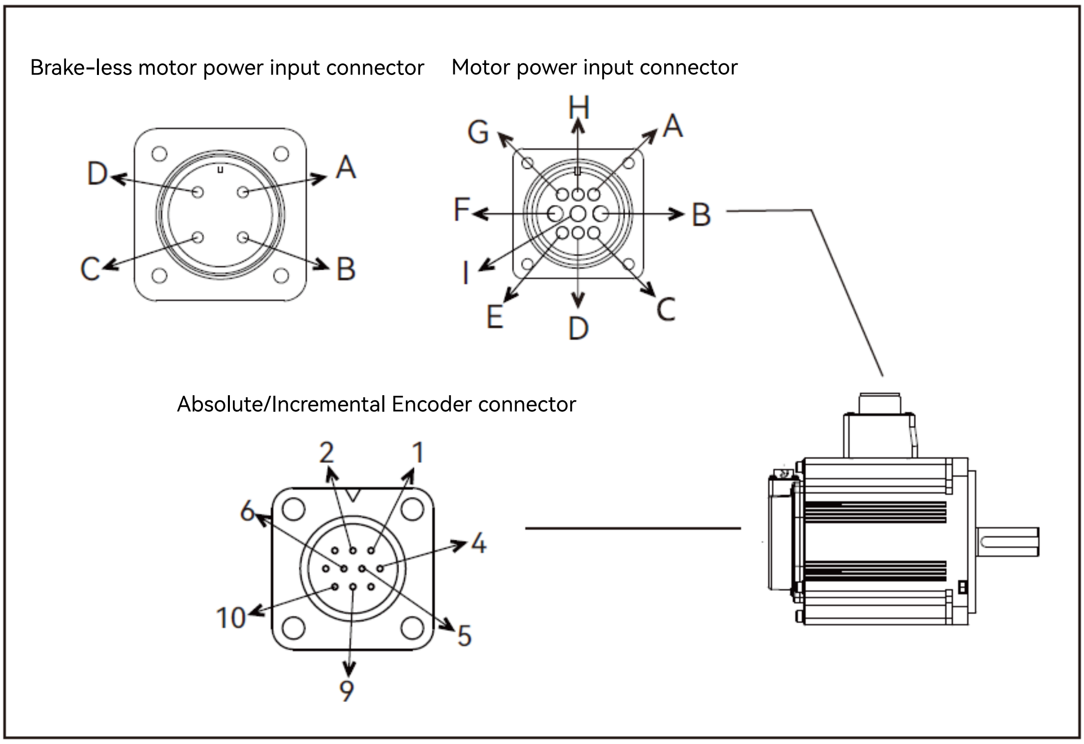


Table 2.2.3 List of cables（750W or more）

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

Note 1: Applicable to motors with brakes.

Table 2.2.4 For power of 750W and above

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

Note: 1. Applicable to motors with brakes.

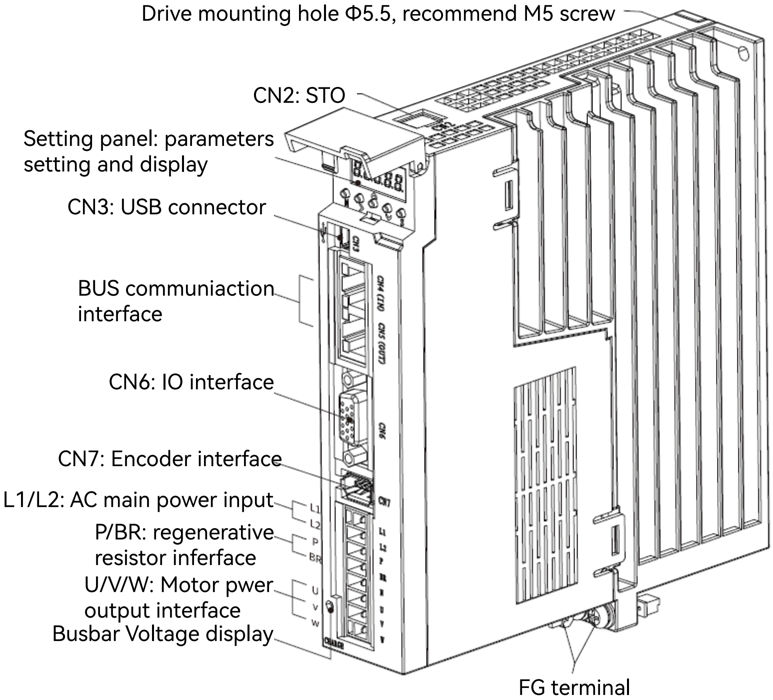
2. The external capacitors and batteries have GND as their reference potential.

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

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

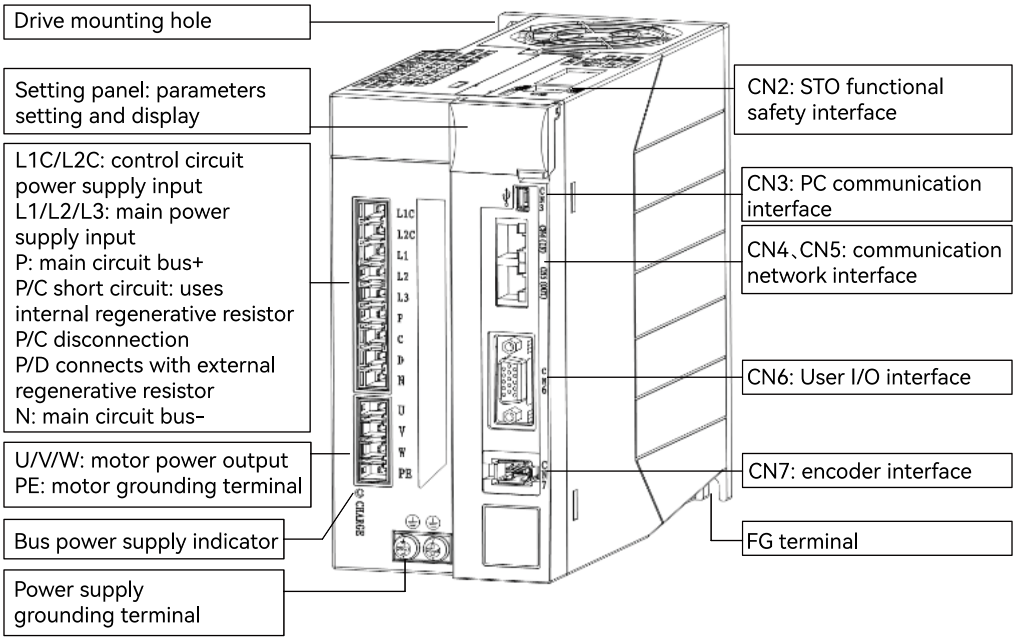
The main panel ports for 750W~1000W are the same as those for 100W~400W, but with different dimensions.



100W~1kW Drive connector terminal description

Name	Terminal	Pin No	Signal name	Description
AC control power input	8PIN	1	L1	AC control power
		2	L2	
Regenerative resistor interface	8PIN	3	P	Busbar voltage positive
		4	BR	Regenerative resistor interface (P ,BR)
Busbar vlotage	8PIN	5	N	Busbar voltage negative
Motor power ouput	8PIN	6	U	Motor power U-phase output
		7	V	Motor power V-phase output
		8	W	Motor power W-phase output
Encoder	CN7	1	VCC	Encoder power 5V output
		2	GND	Encoder ground
		3~4	NC	—
		5	+D	Encoder signals: data input and output
		6	-D	Encoder signals: data input and output
		-	FG	Shielded wire connected to connector housing
PC communication	CN3	1	VBUS	USB power
		2	D-	USB signal -
		3	D+	USB signal +
		4	NC	—
		5	GND	USB signal grounding
User I/O	CN6	Refer to User IO (CN6) Description		

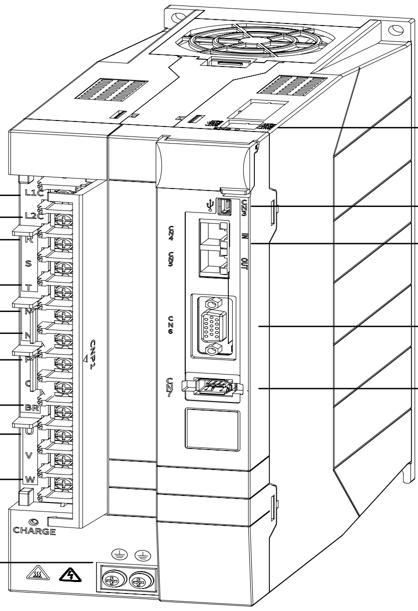
◆ Connector interface definition for a drive with the power of 1.5kW~3kW



1.5kW~3kW Drive connector terminal description

Name	Terminal	Pin No	Signal name	Description
Control power input	9PIN	1	L1C	Single-phase AC220V/AC380V control power input
		2	L2C	
Main power input		3	L1	Three-phase AC220V/380V main power input
		4	L2	
		5	L3	
Regenerative resistor interface		6	P	PC-short-circuited, using internal brake resistance PC-disconnected, PD connected to external brake resistance
		7	C	
		8	D	
Busbar vlotage		9	N	PN- Busbar voltage
UVW motor power output	4PIN	1	U	Motor power U-phase output
		2	V	Motor power V-phase output
		3	W	Motor power W-phase output
Motor grounding terminal		4	PE	Motor grounding terminal: PE
Encoder	CN7	1	VCC	Encoder power 5V output
		2	GND	Encoder ground
		3~4	NC	—
		5	+D	Encoder signals: data input and output
		6	-D	Encoder signals: data input and output
		-	FG	Shielded wire connected to connector housing
PC Communication	CN3	1	VBUS	USB power
		2	D-	USB signal -
		3	D+	USB signal +
		4	NC	—
		5	GND	USB signal grounding
User I/O	CN6	Refer to User IO (CN6) Description		

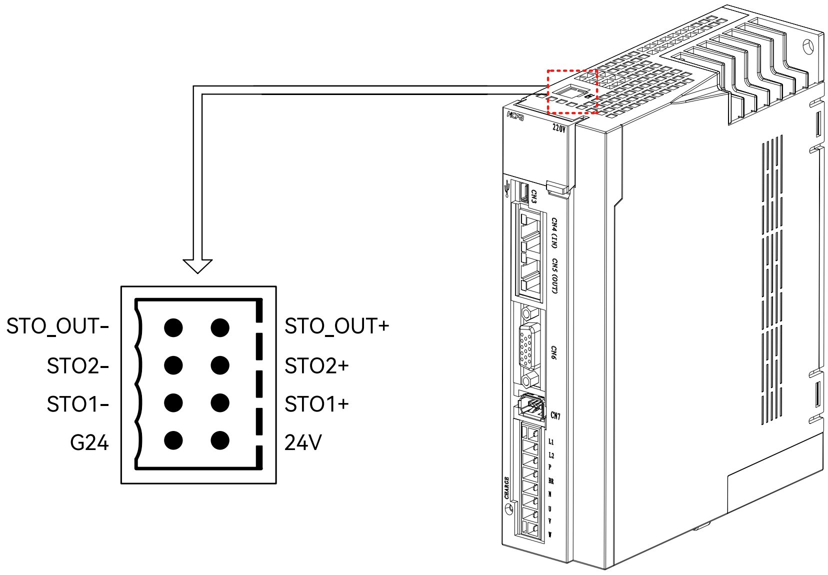
◆ Connector interface definition for a drive with the power of 5kW~7.5kW



Name	Terminal	Pin No	Signal name	Description
Control power input	2PIN	1	L1C	Single-phase 380V power input
		2	L2C	
Main power input	3PIN	1	R	Three-phase 380V main power input
		2	S	
		3	T	
Busbar voltage	2PIN	1	N1	Busbar voltage negative
		2	N2	
Braking resistor	3PIN	1	P	Busbar voltage positive
		2	C	Short-circuit PC to use the internal regenerative resistor Disconnect PC and connect P/BR to an external regenerative resistor
		3	BR	
UVW motor power output	3PIN	1	U	Motor power U-phase output
		2	V	Motor power V-phase output
		3	W	Motor power W-phase output
STO interface	CN2	For details, refer to the instructions for connector CN2		
Profinet bus communication port	CN4/CN5	For details, refer to the instructions for connectors CN4/CN5		
User I/O	CN6	For details, refer to the instructions for connector CN6 (user control terminals)		
Encoder interface	CN7	For details, refer to the instructions for connector CN7		

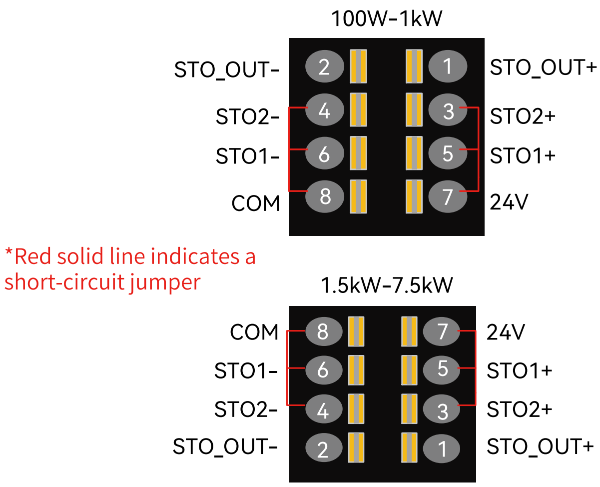
2.4 Instructions for using the CN2 interface

Safe torque off (STO) is a safety feature that prevents the drive from transmitting energy to the motor to generate current. If the STO function acts, the drive shuts down ready to output signal (S-RDY), becomes safe, and the panel displays "sto".



◆ CN2 pin diagram:

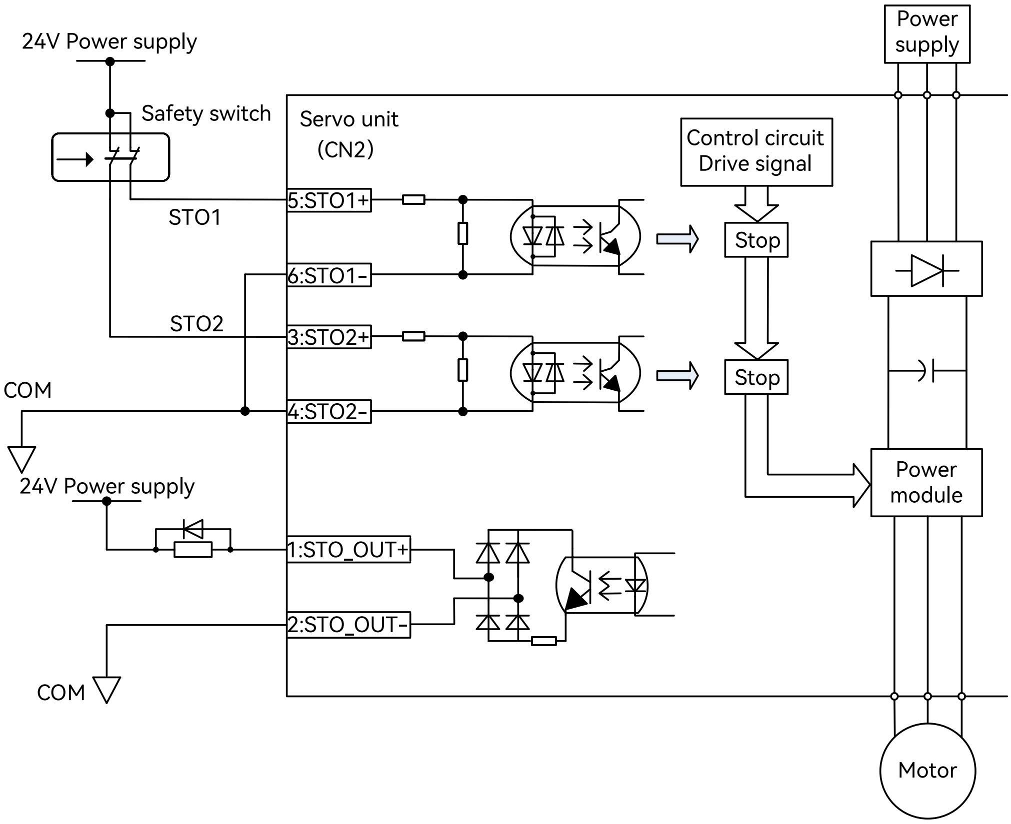
X5FR series drive is equipped with safety function terminal. If users do not use the safety function, please short connect the jumper according to the Fig. below; To use the security function, connect to the upper controller according to the STO security function wiring diagram.



◆ CN2 pin definition:

Name	Symbole	Pin No.	Signal name	Description
STO function	CN2	1	STO_OUT+	Monitor output that is used for monitoring safety function faults
		2	STO_OUT-	
		3	STO2+	2 separate sets of circuits Turn off the drive signal of the power module and cut off the power supply
		4	STO2-	
		5	STO1+	
		6	STO1-	
		7	24V	Internal 24V interface
		8	COM	

◆ STO function block diagram:



◆ Instructions for using the STO function:

STO1 status	STO2 status	STO_OUT status	Drive panel status
Closed	Closed	OFF	ready
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:

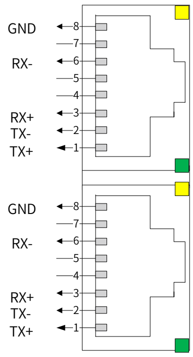
If an external force is applied along the vertical shaft, the motor will rotate. To maintain the position of the motor, an external brake needs to be applied to hold the position. In addition, it's important to note that the brake on motors with brakes is designed exclusively for holding and cannot be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

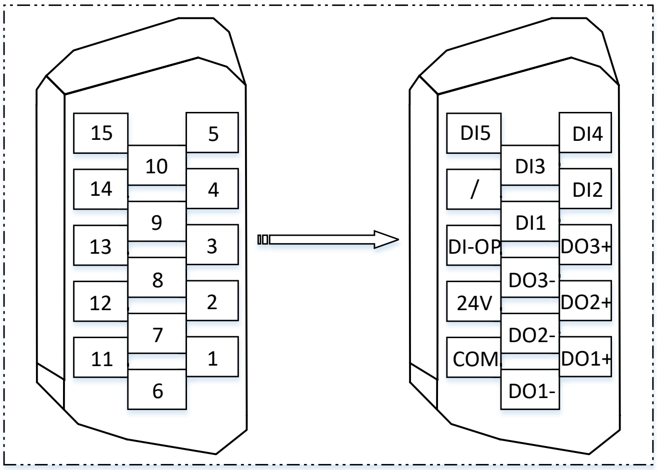
2.5 Instructions for using the CN4/CN5 interface

PROFINET use the standard RJ45 interface and here is the pin definition:



Pin	Definition
1	TX+
2	TX-
3	RX+
4	-
5	-
6	RX-
7	-
8	GND

2.6 Instructions for using the CN6 interface



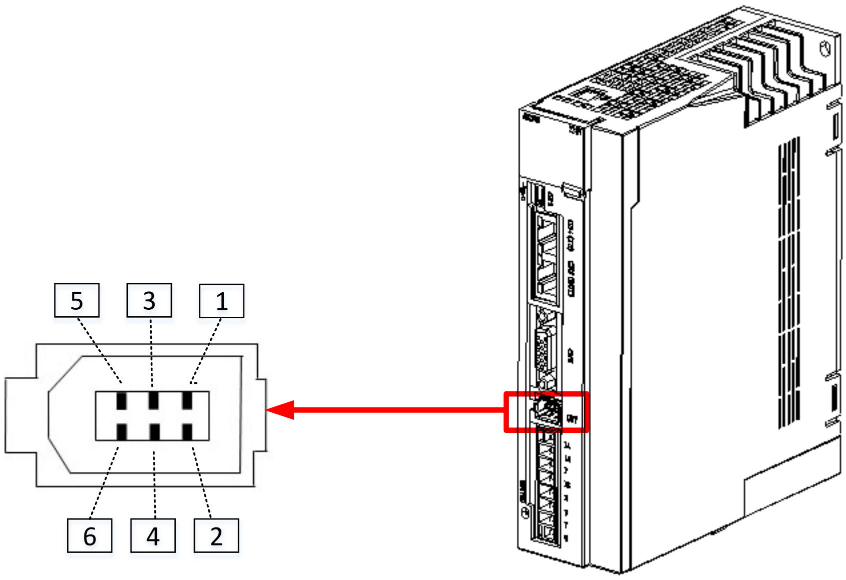
User control terminal (CN6) description

Name	Pin No.	Signal name	Description
Digital output (3)	6	DO1-	Digital output DO1 (Brake release)
	1	DO1+	
	7	DO2-	Digital output DO2
	2	DO2+	
	8	DO3-	Digital output DO3
	3	DO3+	
Digital input (5)	9	DI1	Digital input DI1 (Positive Overtravel)
	4	DI2	Digital input DI2 (Negative Overtravel)
	10	DI3	Digital input DI3 (Emergency Stop)
	5	DI4	Digital input DI4 (Home swtich)
	15	DI5	Digital input DI5 (Touch probe 1)
24V Power supply	11	COM	Drive power ground
	12	24V	Drive power 24V
DI Common end	13	DI-OP	DI power input
-	14	-	-

2.7 Instructions for using the CN7 interface

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

◆ CN7 interface diagram:

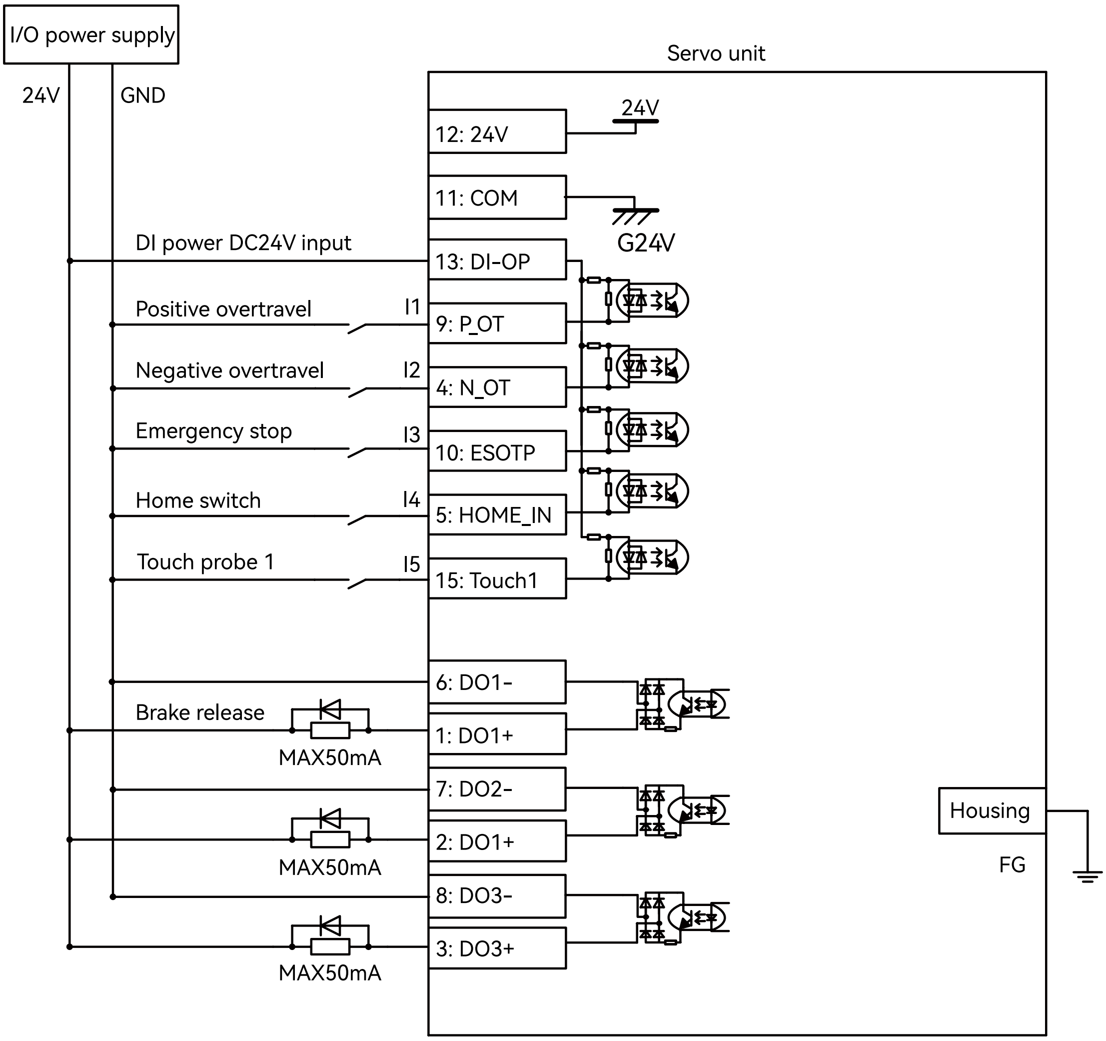


◆ CN7 pin definition:

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

2.8 Description for user I/0 wrining

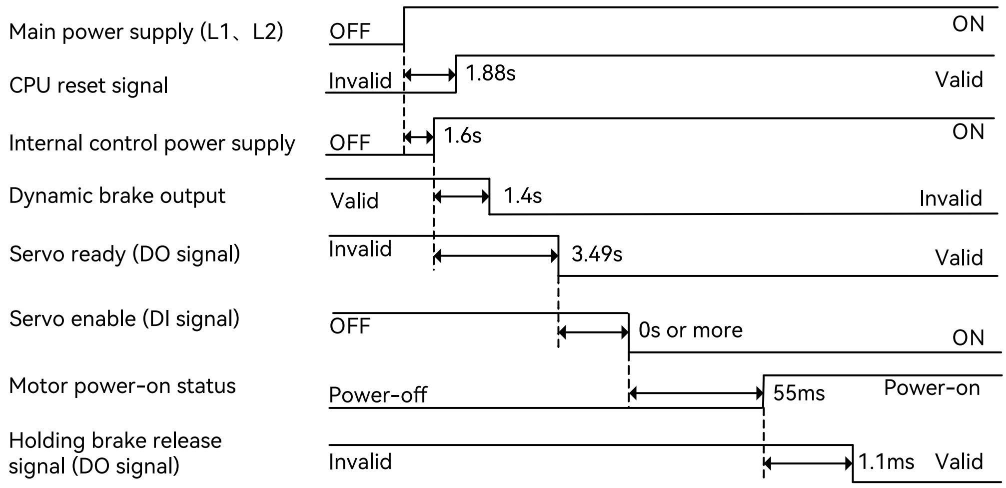
◆ **Using external 24V as an example**



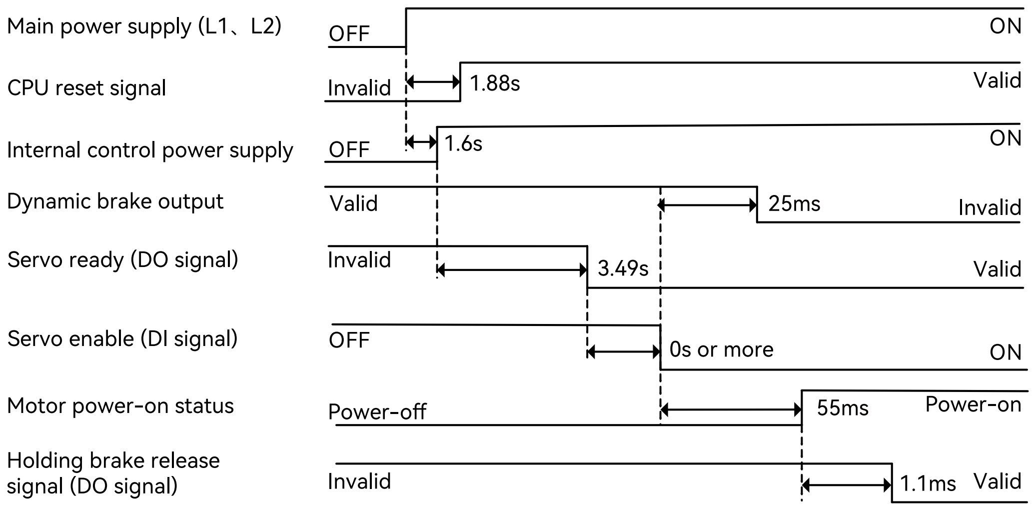
2.9 Timing diagram

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

P06.26=0 (no holding DB during power-on)

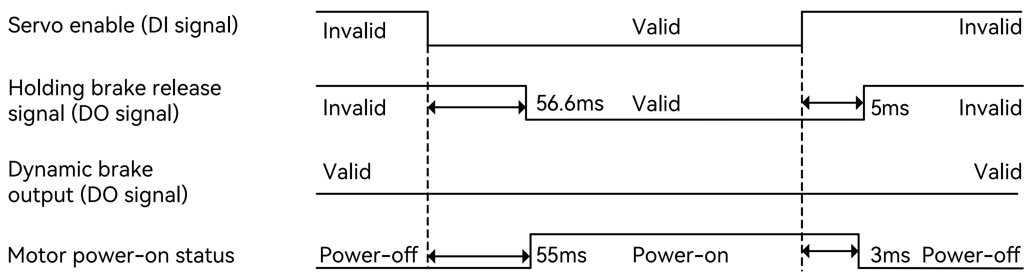


P06.26=4(holding DB during power-on)



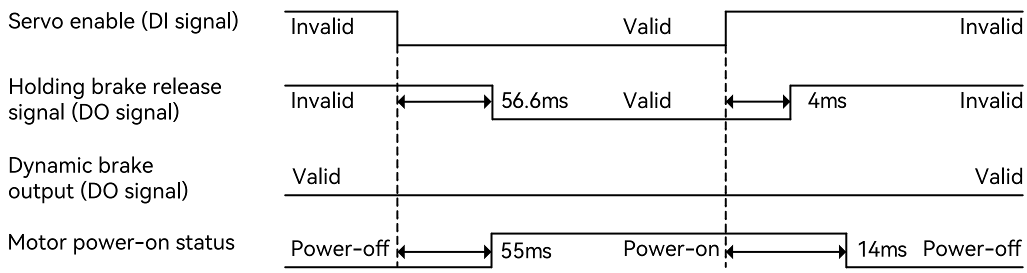
Servo enable on and off action during motor rotation

P06.26=0（coast to stop, remain free)



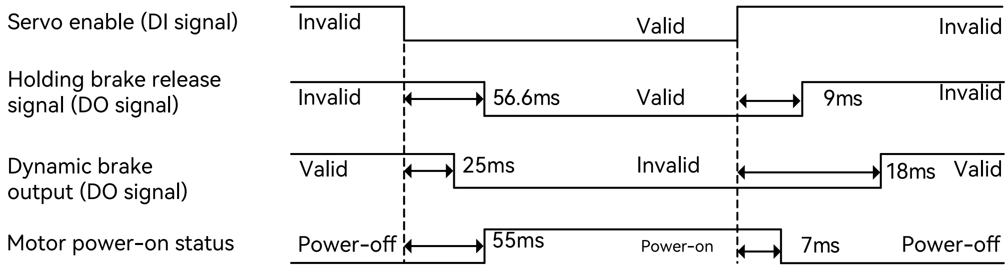
The timing of " Holding brake release signal" during the servo OFF is related to the setting of servo parameter P04.52 and P04.53 and the running speed of the motor, see the parameter description for details, and the minimum value is 5ms.

P06.26=0 (quick stop, remain free)



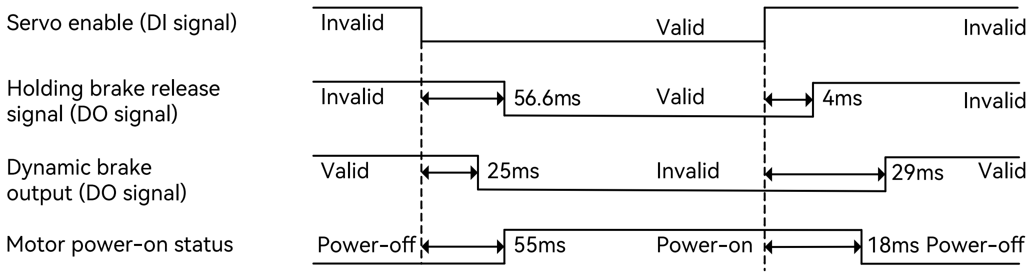
The timing of " Holding brake release signal" during the servo OFF is related to the motor running speed, see the parameter description for details, and the minimum value is 4ms.

DB stop P06.26=4 (DB stop, holding 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.

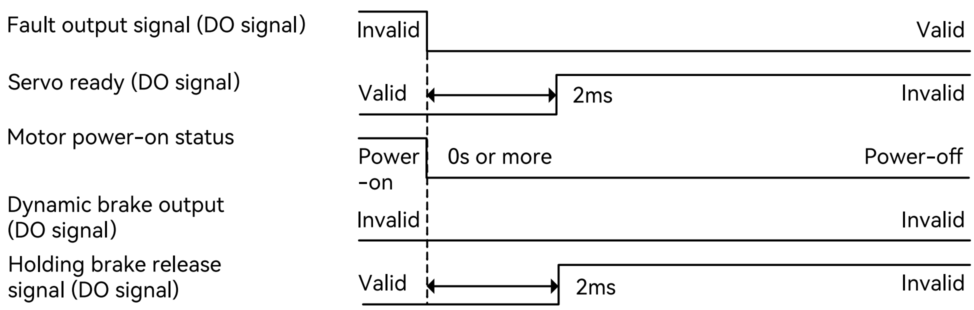
DB Stop P06.26=4 (quick stop, holding DB)



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.

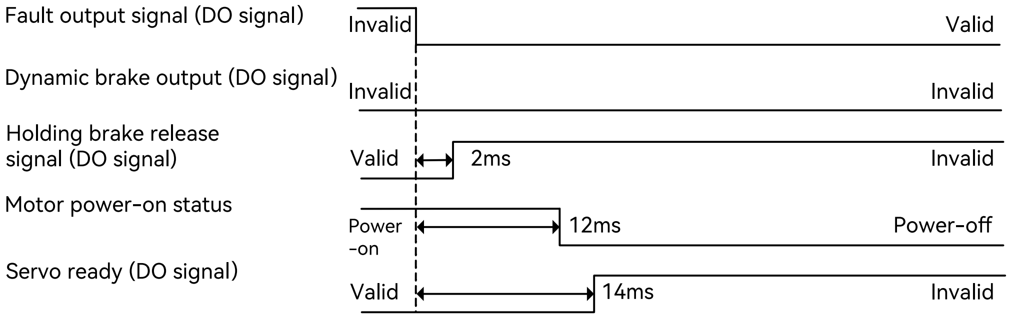
◆ When an abnormality (malfunction) occurs (servo-enable on command state)

P06.27=0 (coast to stop, remain free)



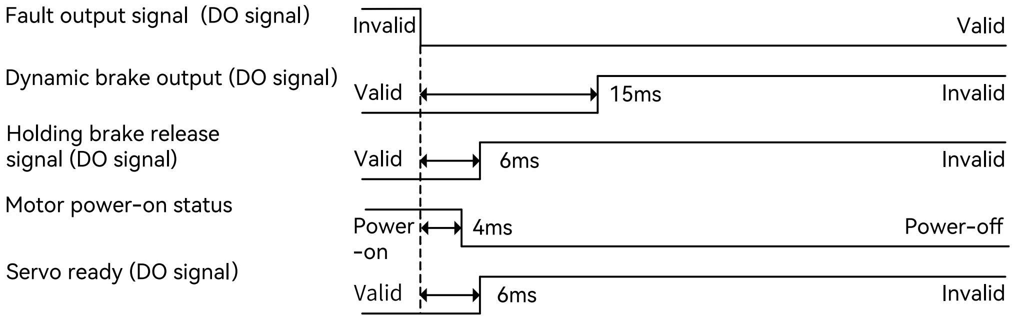
The timing of the "Holding brake release signal" during the faulty stop is related to the servo parameters P04.52 and P04.53 and the motor running speed, see the parameter description for details, and the minimum value is 2ms.

P06.27=1 (quick stop, remain free)



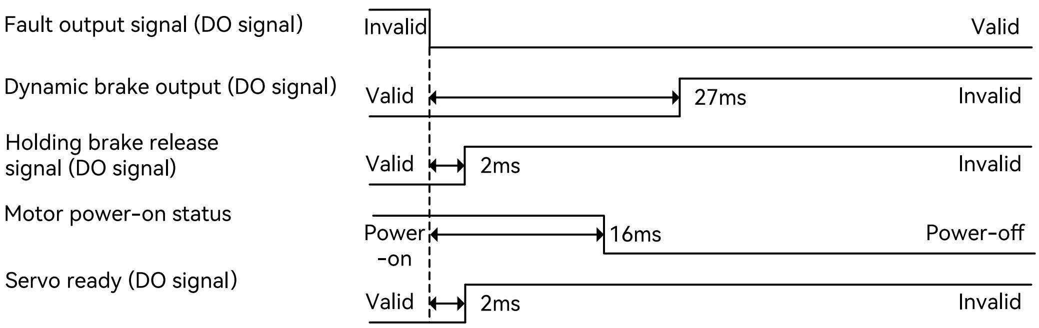
The timing of the "Holding brake release signal" during the faulty stop is related to the servo parameters P04.52 and P04.53 and the motor running speed, see the parameter description for details, and the minimum value is 2ms.

P06.27=4 (DB stop, DB holding)



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.

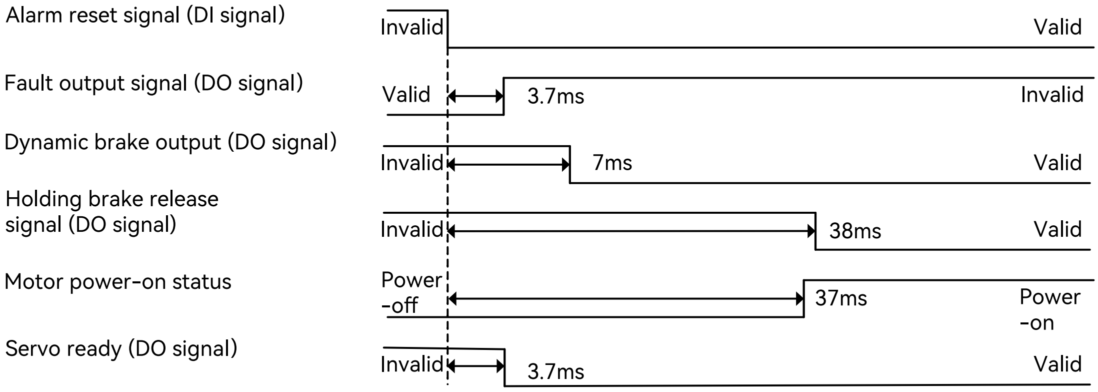
P06.27=5 (quick stop, holding DB)



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.

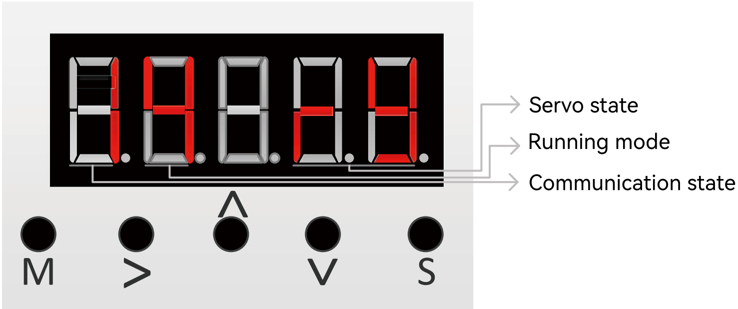
The timing of the "servo ready" during the faulty stop depends on the speed of the motor and the minimum value is 2ms.

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



Chapter 3 Tuning

Panel Display



Button description

M	Generally, it is used to exit the panel display of higher level and return to the panel display of lower level
S	Generally, it is used to enter into the panel display of memory, or to confirm the parameter modification.
∧	Multiply the corresponding authority value by step 1 to increment the numeric value.
∨	Multiply the corresponding authority value by step 1 to decrease the numeric value.
>	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 SHIFT key to switch the display of monitored parameters.

Display description

Name	Meaning	Description
Servo state display	Servo state	no ry: Servo not ready ry: Servo ready rn: Servo enable stats AL.XXX : Servo alarm Err. XXX: Servo error
Communication state display	Communication state	1: Initialization state 2: Connection state 4: Running state
Runnig mode display	Control mode	1: AC1（Speed control) 3: AC3（Servo internal position control) 4: AC4（PLC internal position control + servo speed control) 5: AC4 + DSC（Dynamic servo control)

3.1 Adjustment

Description

◆ Purpose:

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

Here are some examples:

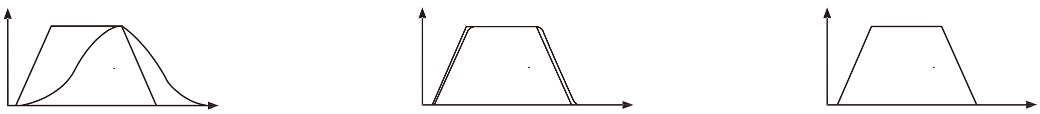


Fig. 3.1 Example of Gain Setting

Gain setting level: Low
Position loop gain: 20.0 1/s
Velocity loop gain: 50.0HZ
Velocity loop integration time: 50.0
Speed feedforward: 0
Interia: 1.00

Gain setting level: High
Position loop gain: 100.0 1/s
Velocity loop gain: 50.0HZ
Velocity loop integration time: 50.0
Speed feedforward: 0
Interia: 1.00

Gain setting level: High + Feedfoward
Position loop gain: 100.0 1/s
Velocity loop gain: 50.0HZ
Velocity loop integration time: 50.0
Speed feedforward: 50.0
Interia: 1.00

◆ Workflows:

In the trial run on the motor to confirm that the drive and motor match no error, users can debug the servo system control performance through the gain adjustment, gain adjustment of the general process shown in the following figure.

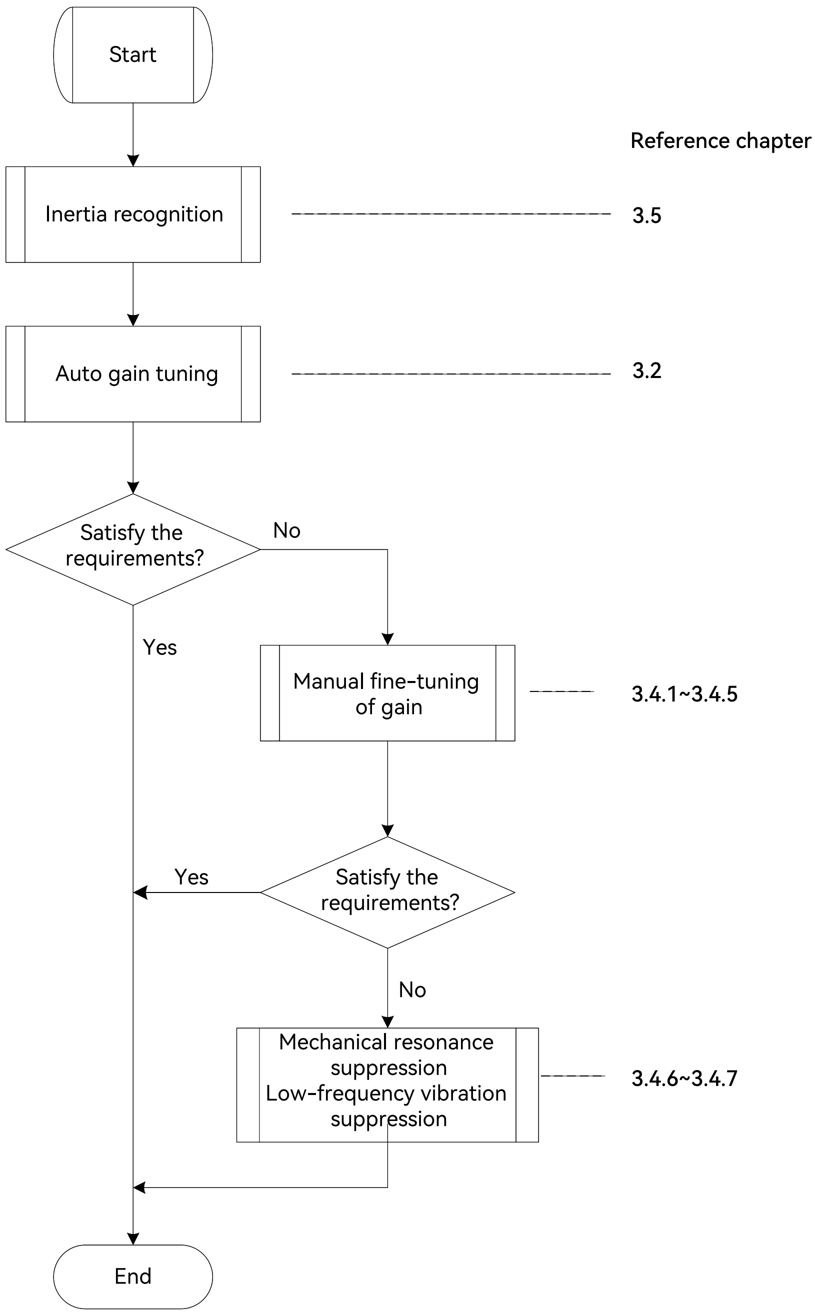


Fig. 3.2 Gain tuning process

3.2 Automatic gain adjustment

Fucntion 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~ 8, some complex transmission machinery

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

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

The flowchart of automatic gain tuning:

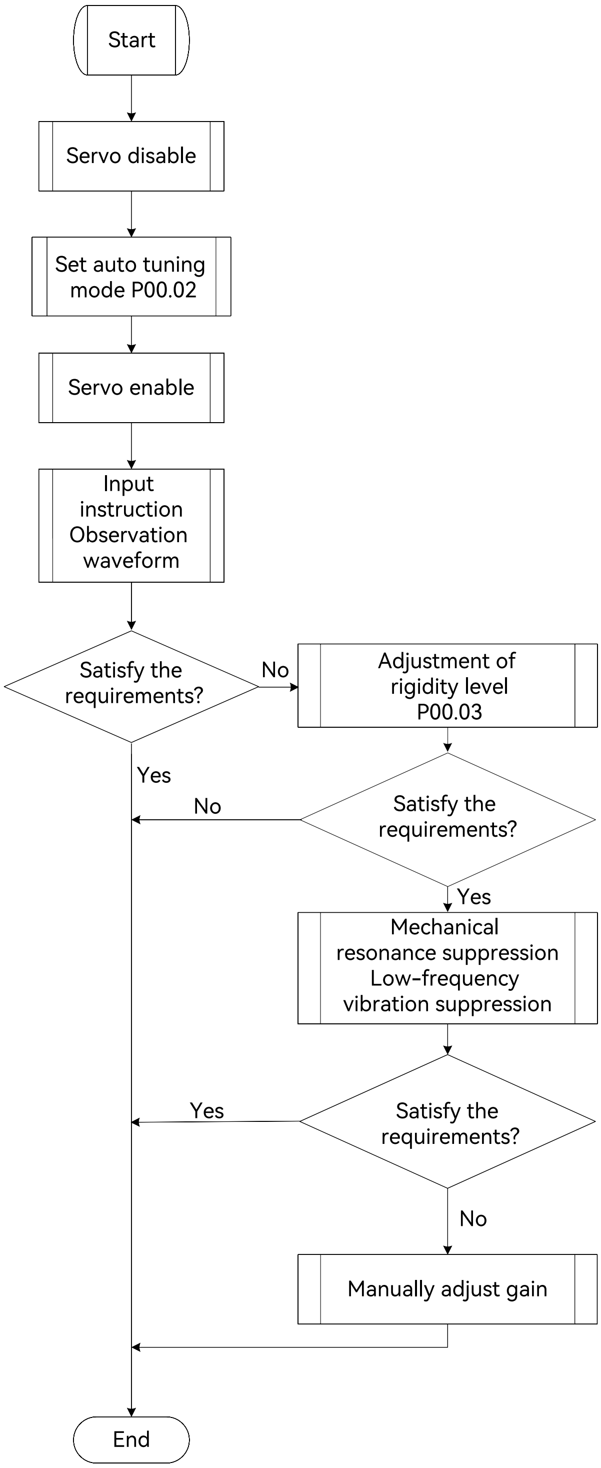


Fig. 3.3 Automatic gain adjustment flow

◆ **Relevant parameters:**

Function code		Name	Description	Unit	Value	Effective		Relevant mode
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	0~30.00	0.01	100	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	1.0 1/s ~ 2000.0 1/s	0.1 1/s	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	1.0 1/s ~ 2000.0 1/s	0.1 1/s	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
P01	03	Speed detection filtering 1	0.00ms ~ 100.00ms	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	10
			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: Actual speed with position instruction (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

3.3 Adaptive filter

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 3.4.6 for details).

◆ Relevant parameters:

Function code		Name	Setting range	Unit	Value
P02	02	Adaptive filter mode	0-4 0: Adaptive is invalid, the 3^{rd} and the 4^{th} filters are functioning but parameters are not updated; 1: One adaptive filter is valid. Only the 3^{rd} filter is functioning with updated parameters. 2: Two adaptive filter are valid. The 3^{rd} and the 4^{th} filters are functioning with updated parameters. 3: Resonance frequency testing, but parameters are not updated. 4: Clear adaptive records, the 3^{rd} & 4^{th} 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**

Function code		Name	Setting range	Unit	Value
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

3.4 Manual gain tuning

3.4.1 Overall description

◆ **Overview:**

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.

3.4.2 Position control tuning

For gain manual adjustment in position control mode, refer to the following procedure:

1. Set the correct load inertia value P00.04, or set it automatically with the load parameter auto-learning function.

2. Set the following parameters to the default values shown in the table below:

P01	00	Position loop gain 1	40.0 1/s
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	40.0 1/s
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%
P02	00	Position instruction smoothing filtering	0
P02	01	Position instruction FIR filtering	0

P00	02	Real-time auto-tuning mode	0
P02	02	Adaptive filtering 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	19	The 1st damping frequency	0
P02	20	The 2nd damping frequency	0
P02	22	Adaptive filtering mode	0
P01	18	Position control switching mode	0
P01	23	Speed control switching mode	0
P01	27	Torque control switching mode	0
P01	12	Speed feedforward gain	0
P01	13	Speed feed-forward filtering time	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 velocity feedforward, set P01.11 to a non-zero value.

3.4.3 Speed mode tuning

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.

3.4.4 Gain switching function

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

◆ **Procedure:**

Effects can be realized by switching the gain according to the internal state 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

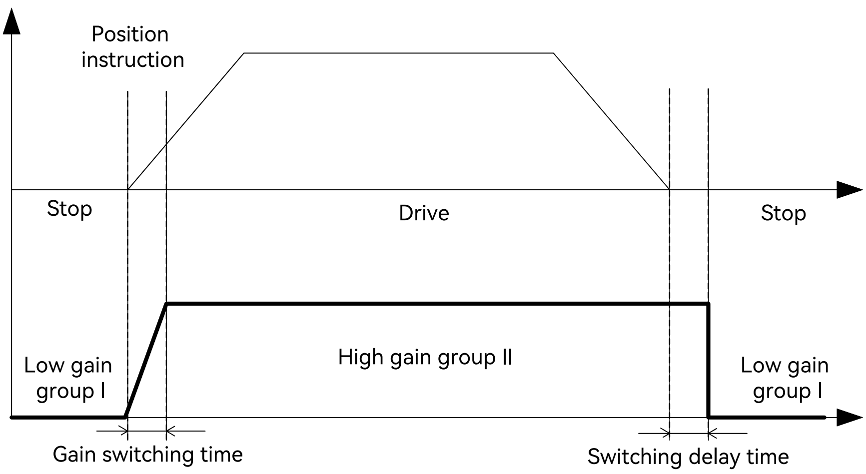


Fig.3.4 Example of gain switching

◆ 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)	Applicable (10rpm/s)
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	Applicable (1rpm/s)
10	With position instruction	P	G	Applicable	Applicable	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. Otherwise, the P/PI switching of the speed loop will be performed.

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 Fig.8.5.

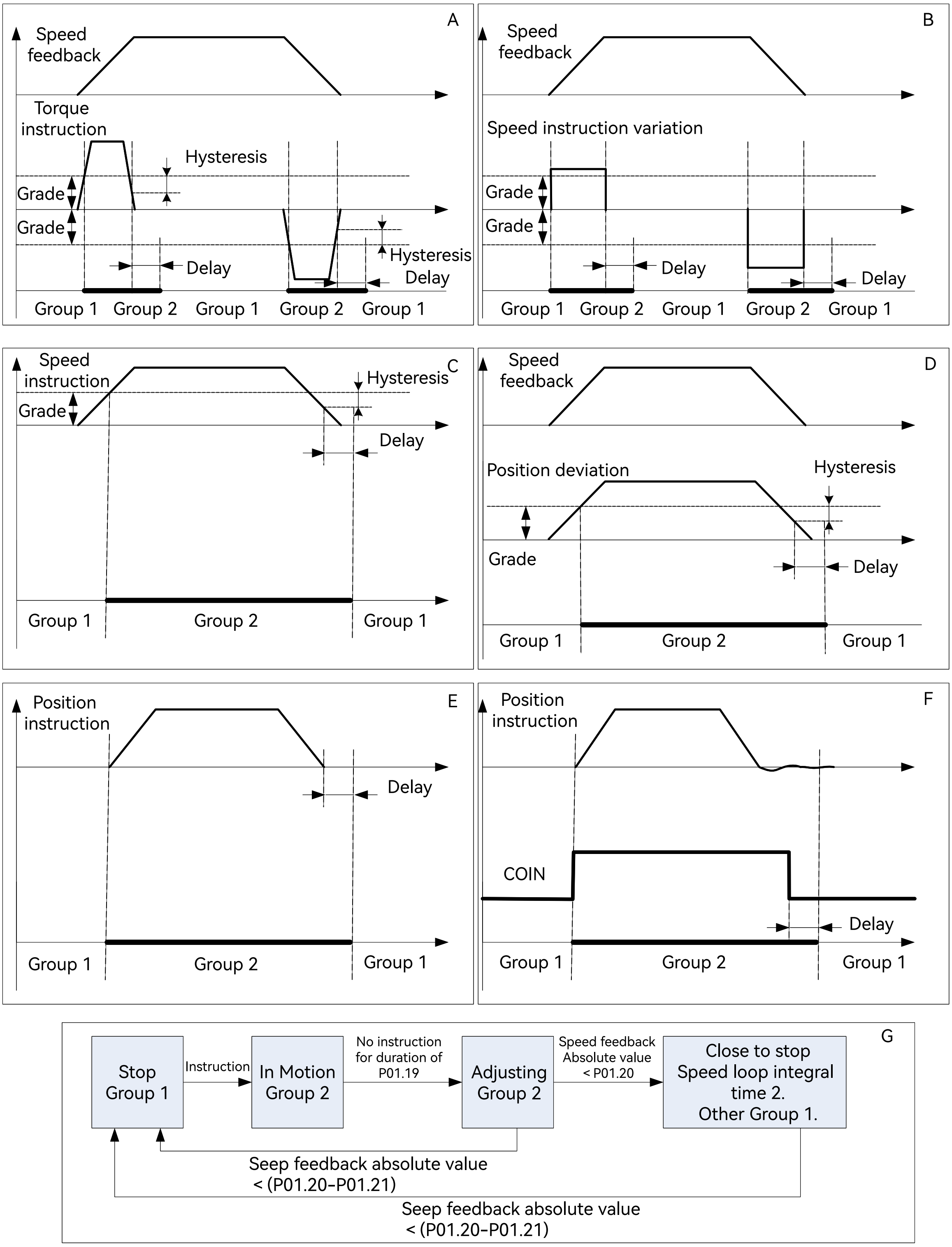


Fig. 3.5 Timing diagram of gain switching under various conditions

3.4.5 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 velocity instruction regulated according to the feedback to output the actual velocity 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	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 computer 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.

3.4.6 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 2 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 trap filters are manual settings and the 3rd and 4th trap filters are adaptive filters.

◆ Notch filter

When the adaptive filter does not enable adaptive parameter settings (P02.02 is not set to 1,2), all 4 trap 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	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.

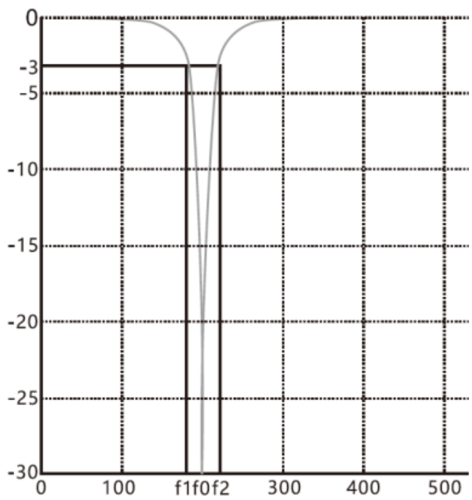


Fig.3.6 Notch filter amplitude-frequency characteristics

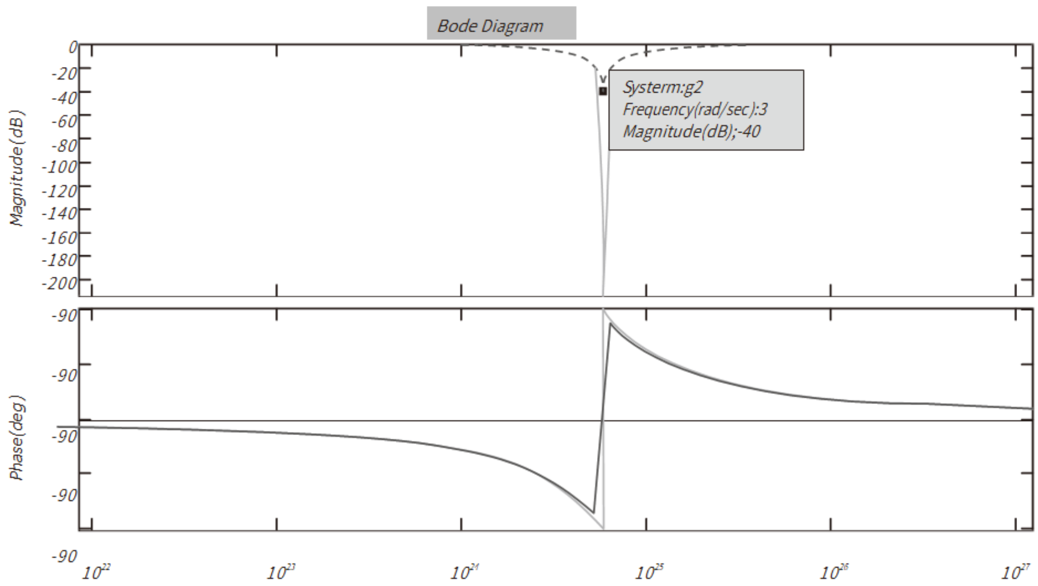


Figure 3.7 Frequency domain response curves when the depth of the notch filter is set to 1 and 0, respectively

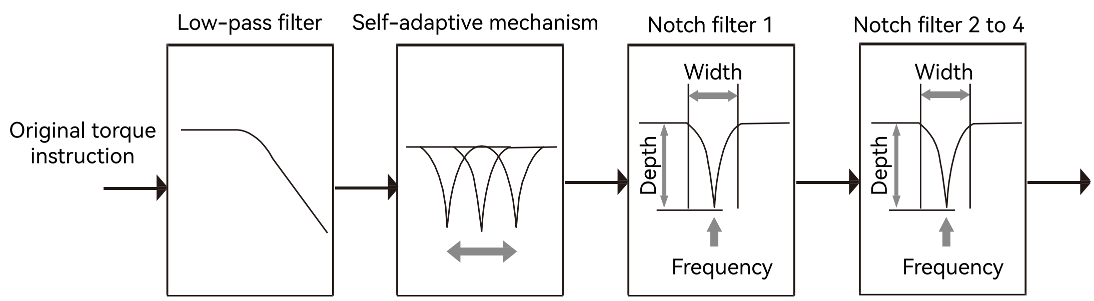


Fig. 3.8 The role of the notch filter in servo control

3.4.7 Low-frequency vibration suppression

◆ Overview

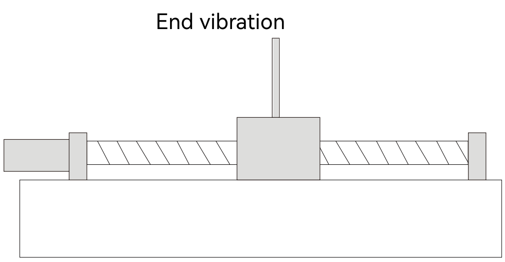


Fig. 3.9

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 amplitude and positioning time.

◆ Procedure

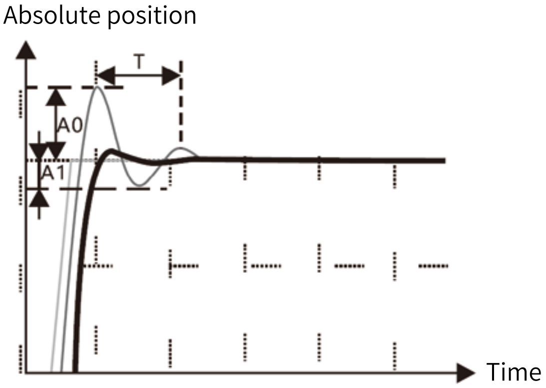


Fig. 3.10 Low frequency vibration waveform during positioning control

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 oscillations in the position deviation (or absolute position feedback), as shown in Figure 3.10. In this case, users can follow the steps shown in Figure 3.11 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 3.11. After the low-frequency suppression works, the positioning response waveform will be greatly improved, and the positioning adjustment time will be shortened obviously, as shown by the thick line in Figure 3.10.

Function code		Name	Setting range	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

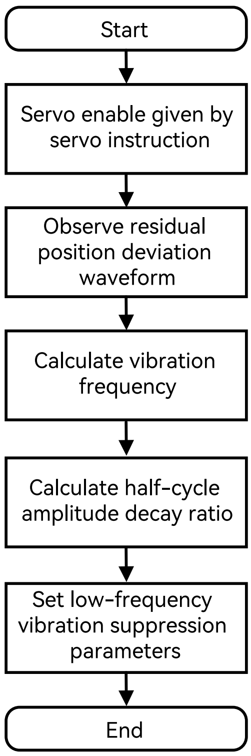


Fig. 3.11 Operation flow of low-frequency suppression function

3.5 Inertia recognition and encoder initial angle recognition

(1) Before entering the identification interface

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 identification is located in P20.03, press the key to find P20.03, and the display will be as follows.

The panel displays 

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 in the first row is changed to 1 or 2, and the SET key is pressed, the inertia identification will be activated and the display will be as follows.

The panel displays  , which indicates the value of the current inertia value (P00.04).

(3) After the identification is completed

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 E2PROM. In fact, the newly identified inertia value is recorded to the P00.04, and then the P00.04 is stored in the E2PROM.

After entering the identification interface, if the parameter value displayed in the first row is modified to 5 and the SET key is pressed, the initial angle identification of the encoder is activated and the panel displays the value of the current electrical angle (P21.09).

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 PROFINET Communication Overview

4.1 Supported telegram

The X5E(F)R supports AC1, AC4, AC3, and DSC applications. It supports standard telegram and Siemens telegram in Speed Control Mode and Basic Position Control Mode. From the viewpoint of the drive, received process data is the receive word, and process data to be sent is the send word. A detailed description is shown in the table below:

Telegram	Maximum number of PZDs (1 PZD = One word)	
Standard telegram 1	2	2
Standard telegram 3	5	9
Siemens telegram 102	6	10
Siemens telegram 105	10	10
Siemens telegram 111	12	12
Attach telegram 750	3	1
Other telegram needs to be developed		

4.1.1 Telegram display

Application level	AC1		AC4/AC5					
Telegram	1		3		102		105	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3								
PZD4			STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5			G1_STW	G1_ZSW	MOMRED	MELDW	MOMRED	MELDW
PZD6				G1_XIST1	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7						G1_XIST1	XERR	G1_XIST1
PZD8				G1_XIST2				
PZD9						G1_XIST2	KPC	G1_XIST2
PZD10								

Application level			Additional	
Telegram	111		750	
PZD1	STW1	ZSW1	M_ADD1	M_ACT
PZD2	POS_STW1	POS_ZSW1	M_LIMIT_POS	
PZD3	POS_STW2	POS_ZSW2	M_LIMIT_NEG	
PZD4	STW2	ZSW2		
PZD5	OVERRIDE	MELDW		
PZD6	MDI_TARPOS	XIST_A		
PZD7				
PZD8	MDI_VELOCITY	NIST_B		
PZD9				
PZD10	MDI_ACC	FAULT_CODE		
PZD11	MDI_DEC	WARN_CODE		
PZD12	USER_PZD	USER_PZD		

4.1.2 I/O data signal

Signal	Description	Receive/Send word	Data type	Description
STW1	Control word 1	Receive word	U16	
STW2	Control word	Receive word	U16	

ZSW1	Status word 1	Send word	U16	
ZSW2	Status word 2	Send word	U16	
NSOLL_A	Speed setting value A	Receive word	I16	4000hex ≒ Rated speed (P18.08)
NSOLL_B	Speed setting value B	Receive word	I32	40000000hex ≒ Rated speed (P18.08)
NIST_A	Actual speed A	Send word	I16	4000hex ≒ Rated speed (P18.08)
NIST_B	Actual speed B	Send word	I32	40000000hex ≒ Rated speed (P18.08)
MOMRED	Torque reduction value	Receive word	U16	4000hex = Maximum torque (P18.07)
M_ADD1	Torque added value	Send word	I16	4000hex = Maximum torque (P18.07)
M_LIMIT_POS	Forward torque Limit	Send word	I16	4000hex = Maximum torque (P18.07)
M_LIMIT_NEG	Backward torque Limit	Send word	I16	C000hex = Minimum torque
MELDW	Telegram word	Send word	U16	
G1_STW	Encoder 1 control word	Receive word	U16	
G1_ZSW	Encoder 1 status word	Send word	U16	
G1_XIST1	Encoder 1 actual position 1	Send word	U32	
G1_XIST2	Encoder 1 actual position 2	Send word	U32	
KPC	Position controller gain factor	Receive word	I32	
XERR	Position offset	Receive word	I32	
MDI_TARPOS	MDI position	Receive word	I32	1hex ≒ 1 LU
MDI_VELOCITY	MDI velocity	Receive word	I32	1hex ≒ 1000 LU/min
MDI_ACC	MDI acceleration factor	Receive word	I16	4000hex ≒ 100%
MDI_DEC	MDI deceleration factor	Receive word	I16	4000hex ≒ 100%
XIST_A	Actual position A	Send word	I32	1hex ≒ 1 LU
OVERRIDE	Position speed factor	Receive word	I16	4000hex ≒ 100%
FAULT_CODE	Faulty code	Send word	U16	
WARN_CODE	Warning code	Send word	U16	
user	User-defined receive word (P15.46)	Receive word	I16	4000hex ≒ 100%
user	User-defined send word (P15.47)	Send word	U16	4000hex ≒ 100%

4.1.3 Control word definition

◆ STW1 Control word

Signal	Description	
	1, 3 telegram	102, 105 telegram
STW1.0	1= ON (Enable the pulse) 0 = OFF1 (Ramp stop, eliminates pulses, ready to turn on)	
STW1.1	1 = No OFF2 (Allow to enable) 0 = OFF2 (Inertial stop, eliminate pulses, prohibit connection)	
STW1.2	1 = No OFF3 (Allow to enable) 0 = OFF3 (Quick stop, eliminate pulses, prohibit connection)	
STW1.3	1 = Allowed to run 0 = Prohibition on running	
STW1.4	1 = Running condition 0 = Freeze command	
STW1.5	1 = Running condition 0 = Freeze command	

STW1.6	1 = Enable setting value 0 = Prohibit setting value	
STW1.7	0-1 Rising edge, fault response	
STW1.8	Reserved	
STW1.9	Reserved	
STW1.10	1 = Control via PLC 0 = Non-PLC control	
STW1.11	Reserved	
STW1.12	Reserved	
STW1.13	Reserved	
STW1.14	Reserved	1=Torque control 0=Velocity control
STW1.15	Reserved	

◆ **STW1 Control word （For telegrams 111）**

Signal	Description
	111 Telegram
STW1.0	1 = ON (Enable the pulse) 0 = OFF1 (Ramp stop, pulse elimination, ready for connection)
STW1.1	1 = No OFF2 (Allow to enable) 0 = OFF2 (Inertial stop, pulse elimination, prohibit connection)
STW1.2	1 = No OFF3 (Allow to enable) 0 = OFF3 (Quick stop, pulse elimination, prohibit connection)
STW1.3	1 = Allowed to run 0 = Prohibit running
STW1.4	1 = Non-refusal to execute the task 0 = Refusal to execute the task
STW1.5	1 = Not suspend execution of the task 0 = Suspend execution of the task
STW1.6	0-1 Rising edge, activate running tasks
STW1.7	0-1 Rising edge, fault response
STW1.8	1 = Boot JOG1 0 = Close JOG1
STW1.9	1 = Boot JOG2 0 = Close JOG2
STW1.10	1 = PLC-controlled 0 = Non PLC-controlled
STW1.11	1 = Start homing 0 = Stop homing
STW1.12~15	Reserved

◆ **STW2 Control word**

Signal	Description	
	Telegram 1, 3, 111	Telegram 102, 105
STW2.0~STW2.7	Reserved	
STW2.8	Reserved	1= Run to the fixed baffle
STW2.9-STW2.11	Reserved	

STW2.12	Master life symbol, bit 0
STW2.13	Master life symbol, bit 1
STW2.14	Master life symbol, bit 2
STW2.15	Master life symbol, bit 3

◆ POS_STW1 Positioning control word

Signal	Description
POS_STW1.0	Program segment selection bit 0
POS_STW1.1	Program segment selection bit 1
POS_STW1.2	Program segment selection bit 2
POS_STW1.3	Program segment selection bit 3
POS_STW1.4	Program segment selection bit 4
POS_STW1.5~7	Reserved
POS_STW1.8	1 = Absolute positioning 0 = Relative positioning
POS_STW1.9~11	Reserved
POS_STW1.12	1= Continuous transmission
POS_STW1.13	Reserved
POS_STW1.14	1= Setup signal selected, 0= Positioning signal selected
POS_STW1.15	1 = MDI selection

◆ POS_STW2 Positioning control word

Signal	Description
POS_STW2.0	Reserved
POS_STW2.1	1 = Set reference point
POS_STW2.2	1 = Reference point block activation
POS_STW2.3~13	Reserved
POS_STW2.14	1 = Activate soft limit switch 0 = Close soft limit switch
POS_STW2.15	1 = Activate hard limit switch 0 = Close hard limit switch

4.1.4 Status word definition

◆ ZSW1 Status word

Signal	Description	
	Telegram 1, 3	Telegram 102, 105
ZSW1.0	1 = Ready for connected 0 = Ready for unconnected	
ZSW1.1	1 = Operation enable 0 = Operation disable	
ZSW1.2	1 = Operation enable 0 = Operation disable	
ZSW1.3	1 = Fault exists 0 = No fault	
ZSW1.4	1 = Inertial stops invaild 0 = Inertial stops vaild	

ZSW1.5	1 = Inertial stops invaild 0 = Inertial stops vaild	
ZSW1.6	1 = Prohibit connection vaild 0 = Prohibit connection invaild	
ZSW1.7	1 = Warning exists 0 = No warning	
ZSW1.8	1 = Velocity error within tolerance 0 = Velocity error out of tolerance	
ZSW1.9	1 = Control request 0 = No control request	
ZSW1.10	1 = Speed comparison value has been reached or exceeded 0 = Speed comparison value not met or exceeded	
ZSW1.11	0= Torque limit value reached 1= Torque limit value not reached	Reserved
ZSW1.12~15	Reserved	

◆ ZSW1 Status word（For telegrams 111）

Signal	Description
ZSW1.0	1 = Ready for connected 0 = Ready for unconnected
ZSW1.1	1 = Ready for operate 0 = Ready for non-operate
ZSW1.2	1 = Operation enable 0 = Operation disable
ZSW1.3	1 = Fault exists 0 = No fault
ZSW1.4	1 = Inertial stops invaild 0 = Inertial stops vaild
ZSW1.5	1 = Quick stops invaild 0 = Quick stops vaild
ZSW1.6	1 = Prohibit connection vaild 0 = Prohibit connection invaild
ZSW1.7	1 = Warning exists 0 = No warning
ZSW1.8	1 = Velocity error within tolerance 0 = Velocity error out of tolerance
ZSW1.9	1 = Control request 0 = No control request
ZSW1.10	1 = Speed comparison value has been reached or exceeded 0 = Speed comparison value not met or exceeded
ZSW1.11	0 = Torque limit value reached 1 = Torque limit value not reached
ZSW1.12	0-1 rising edge, positioning activated, mobile task confirmed
ZSW1.13	1 = The drive has stopped. 0 = The drive is running
ZSW1.14	1 = The drive is accelerating. 0 = The drive not accelerated
ZSW1.15	1 = The drive is decelerating. 0 = The drive not decelerated

◆ ZSW2 Status word

Signal	Description	
	Telegram1, 3, 111	Telegram 102, 105
ZSW2.0~ZSW2.7	Reserved	
ZSW2.8	1 = Run to the fixed baffle	Reserved
ZSW2.9	Reserved	
ZSW2.10	1 = Pulse enable	
ZSW2.11	Reserved	
ZSW2.12	Master life symbol, bit 0	
ZSW2.13	Master life symbol, bit 1	
ZSW2.14	Master life symbol, bit 2	
ZSW2.15	Master life symbol, bit 3	

◆ POS_ZSW1 Status word（For telegrams 111）

Signal	Description
POS_ZSW1.0~7	Reserved
POS_ZSW1.8	1 = Negative hard limit activate 0 = Negative hard limit inactivate
POS_ZSW1.9	1 = Positive hard limit activate 0 = Positive hard limit inactivate
POS_ZSW1.10	1 = JOG mode activated 0 = JOG mode inactivated
POS_ZSW1.11	1 = Back to reference point activate 0 = Back to reference point inactivate
POS_ZSW1.12	Reserved
POS_ZSW1.13	Reserved
POS_ZSW1.14	1 = Setting vaild
POS_ZSW1.15	1 = MDI activate 0 = MDI inactivate

◆ POS_ZSW2 Status word（For telegrams 111）

Signal	Description
POS_ZSW2.0	Reserved
POS_ZSW2.1	Reserved
POS_ZSW2.2	Reserved
POS_ZSW2.3	Reserved
POS_ZSW2.4	1 = Axis moves forward 0 = No movement
POS_ZSW2.5	1 = Axis moves backward 0 = No movement
POS_ZSW2.6	1 = Negative soft limit activate 0 = Negative soft limit inactivate
POS_ZSW2.7	1 = Positive soft limit activate 0 = Positive soft limit inactivate
POS_ZSW2.8~2.15	Reserved

◆ **MELDW Message word (For telegrams 102, 105)**

Signal	Description
MELDW.0	Reserved
MELDW.1	1 = Torque utilization [%] < Torque threshold 2
MELDW.2~MELDW.15	Reserved

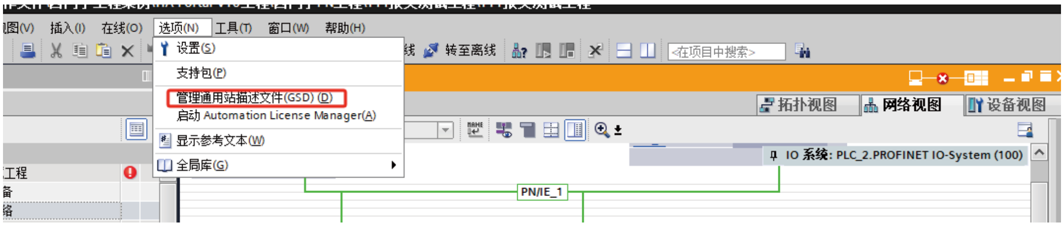
4.2 GSDfile

GSD file (Generic Station Description file) is the abbreviation of Generic Station Description file. The GSD file is used only when PROFIBUS DP or PROFINET IO communication is involved, and the X5E(F)R is a PROFINET bus-enabled IO, so a GSD file is required.

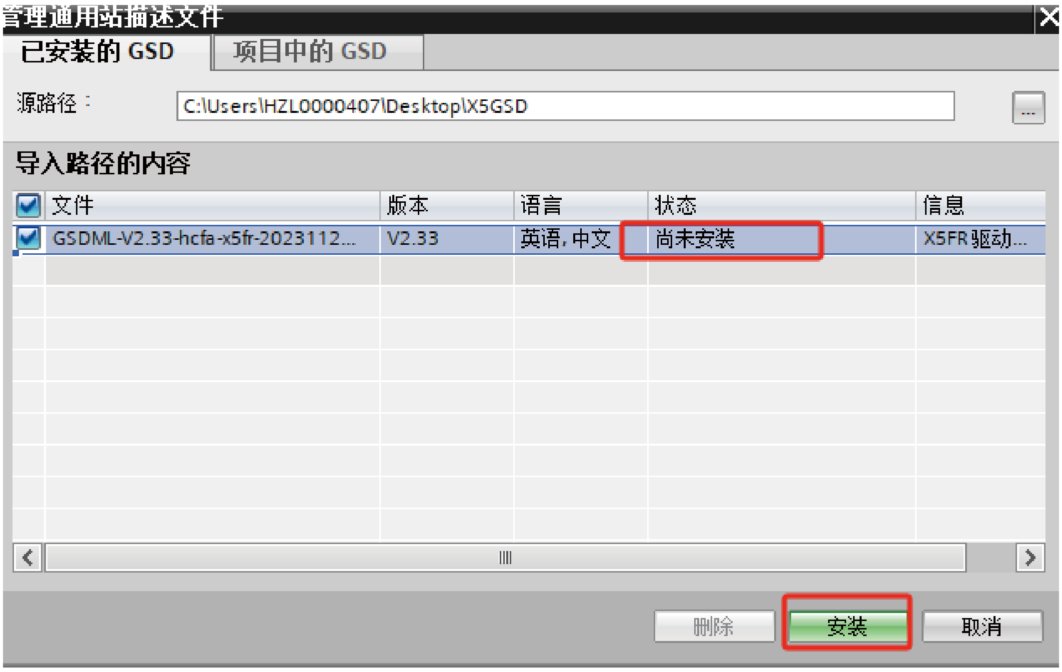
GSD file for X5E(F)R: GSDML-V2.33-HCFA-X5FR-20231125.XML

The GSD is installed as follows:

First, select the TIA Protal option to open the "Options → Manage General Station Description Files (GSDs)", as shown below:

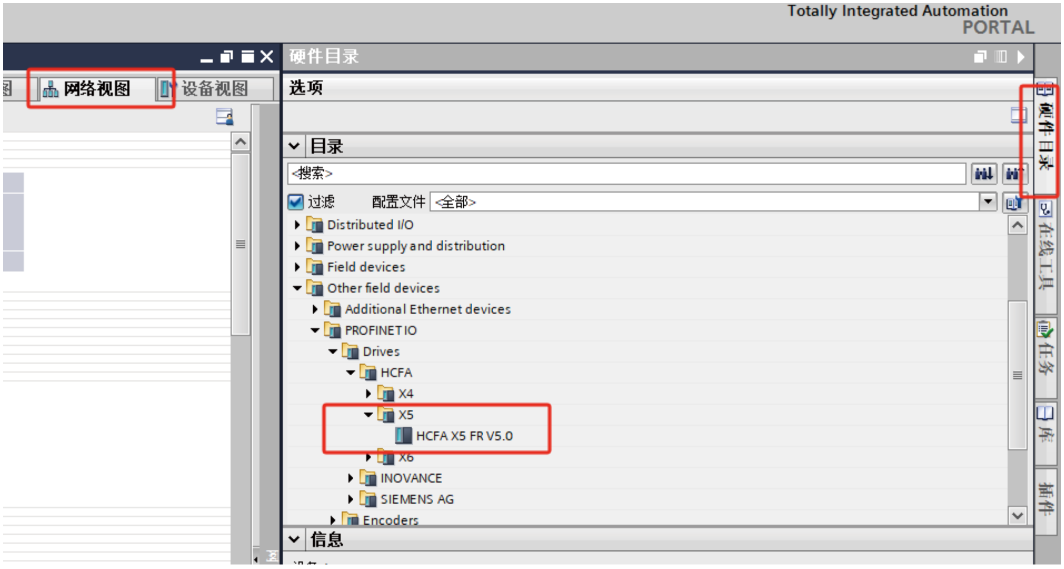


Locate the GSD file, select the GSD file, and if it shows that it is not yet installed, click the "Install" button to install it, as shown below :



A

fter the installation is complete, select "Devices and Networks → Network View → Hardware Catalog → Other field devices → PROFINET IO → Drive → X5" in the catalog tree.



4.3 AC1 speed mode

4.3.1 Overview

Siemens S7-1200, S7-1500 series PLC can be paired with X5E(F)R servo drive for speed control via PROFINET. PLC executes start-stop and speed feed, and speed control is calculated in X5E(F)R drive, which can be realized in the following two main ways:

Method 1: The PLC performs speed control by means of the FB285 (SINA_SPEED) function block, and the X5E(F)R uses the No. 1 standard telegram.

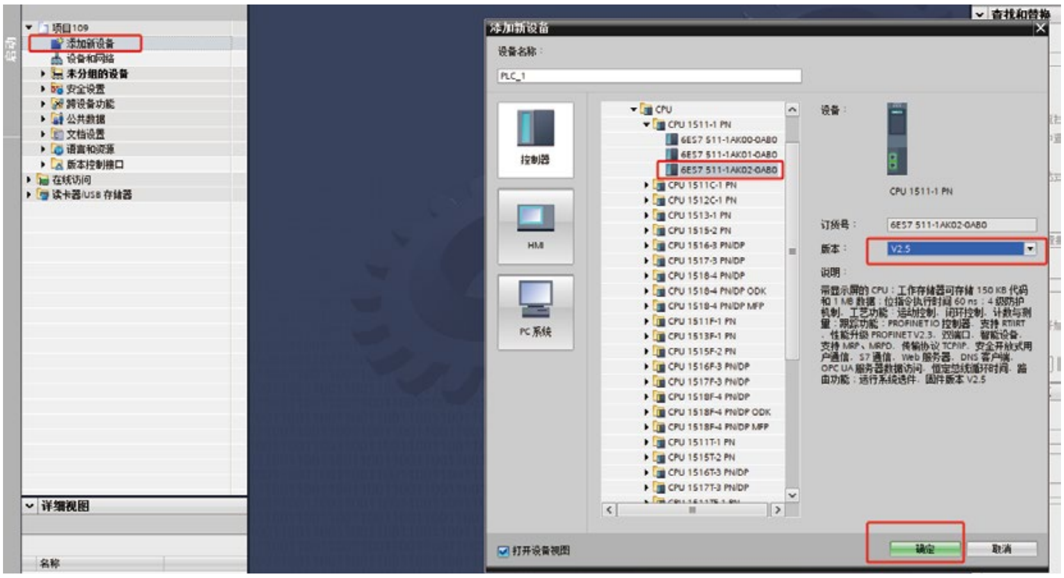
Method 2: Without using any special program block, the control word and status word of the telegram are used to control by programming, X5E(F)R uses No.1 standard telegram, using this method requires more familiarity with the structure of the telegram.

Method 3: The 1500 series can be equipped with speed axis.

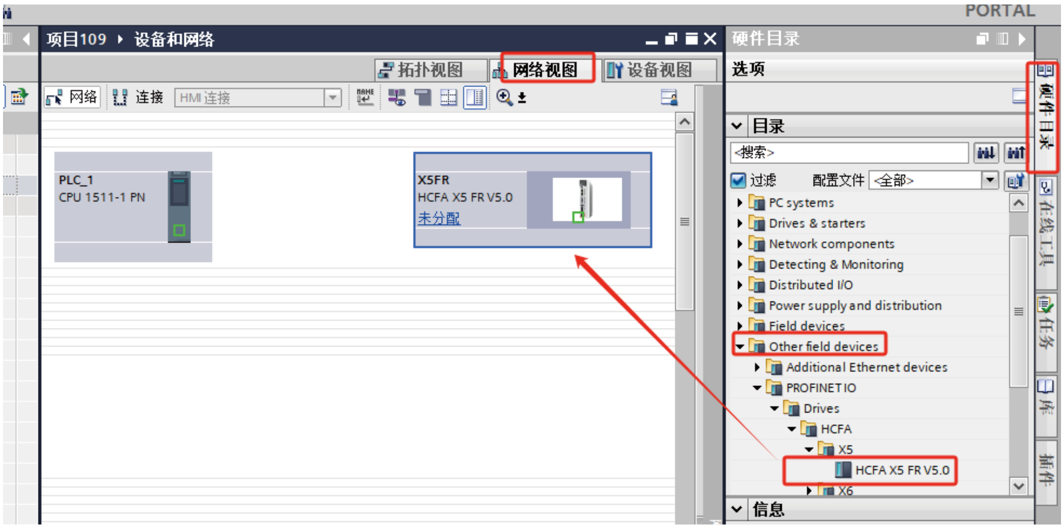
4.3.2 Configuration

1. Connect the USB, open the debugging software HCS-Studio (V2.10 or above), and then "New Project → Online (find the X5 icon, click ER, and then confirm) → Test Connection, then Settings → Find Network Configuration in Settings → Enter Name → Write and Activate", as shown below:

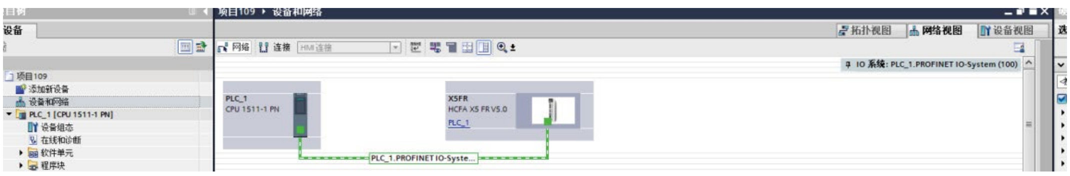
2. Open Protal, create a project, create a new project and double click on "Add new device (find the PLC used and select the PLC version)" from the catalog tree.



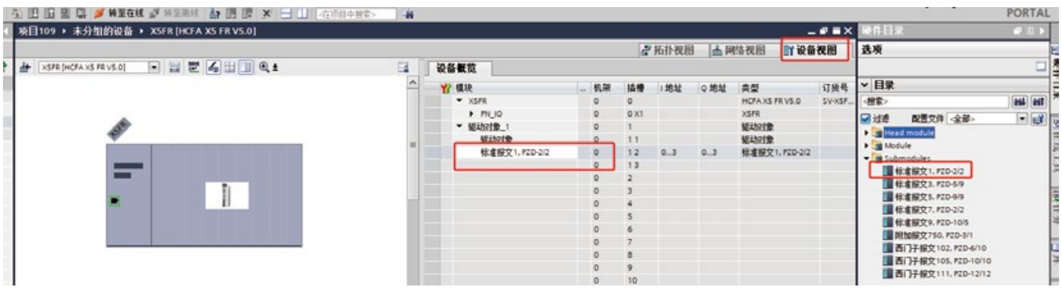
3. After installing the GSD file following the GSD file installation steps, drag the X5FR into the network view.



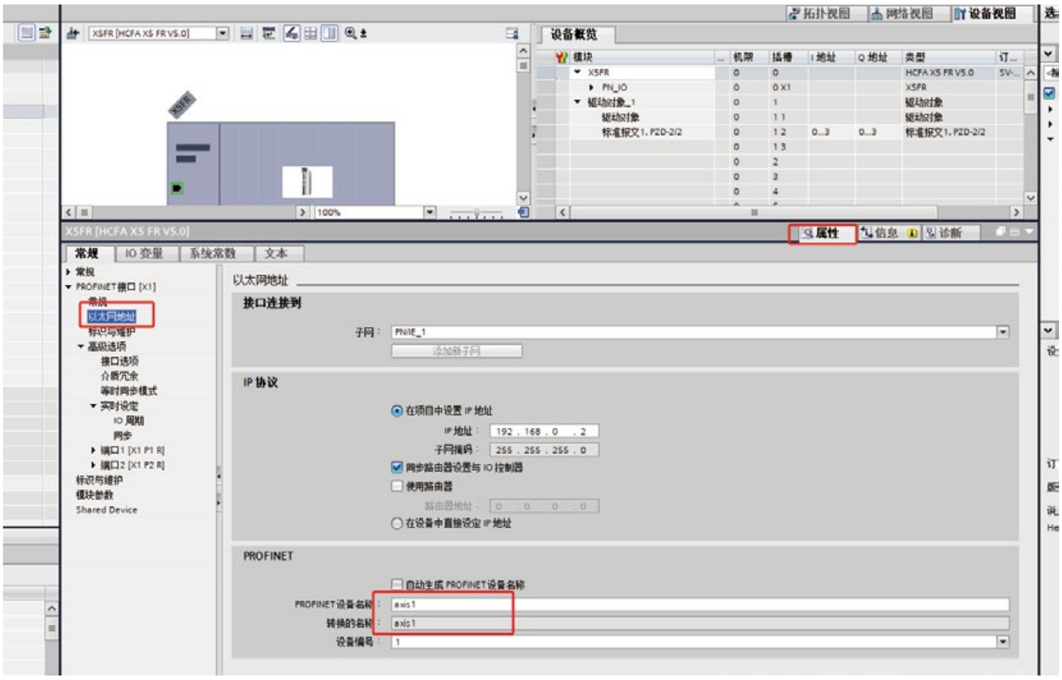
4. In the network graphic, click "Unassigned" and select "PLC_1.PROFINET Interface_1":



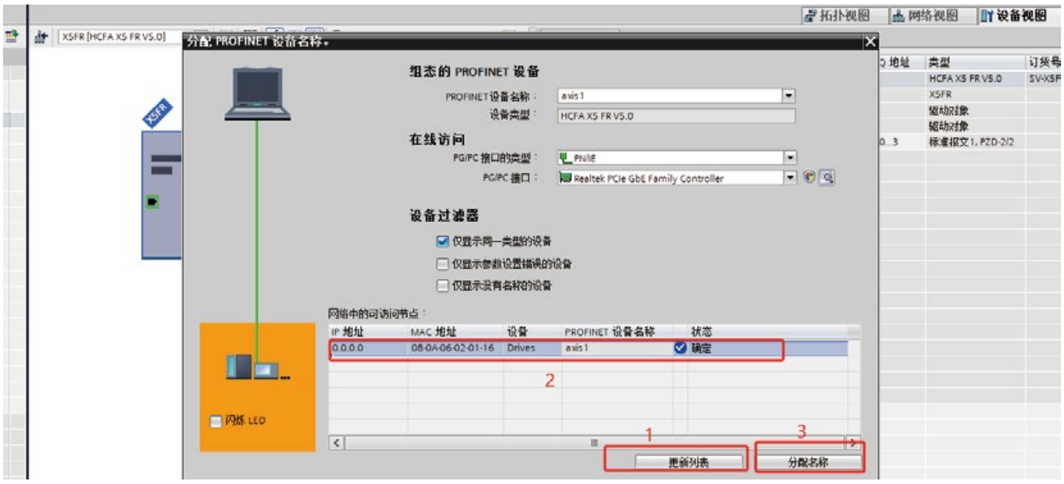
5. In the Device View of the HCFA X5FR, select "Standard telegram 1" from the sub-modules.



6. Click on the device X5FR and in the properties set the name to match the HCS-Studio network configuration settings.



Alternatively, users can right-click on the device in the device view of Boto and "Assign Device Name" (the first step is not necessary).



7. Compile and download to the PLC, then test the program. (The panel displays 41 ry when communication is successful).

4.3.3 Speed control via SINA_SPEED

1. SINA_SPEED FB description:

(1) Input:

Input signal	Type	Description
EnableAxis	BOOL	=1，Enbale the drive
AckError	BOOL	Drive fault response
SpeedSp	REAL	Setting speed [rpm]
RefSpeed	REAL	Reference speed of the drive [rpm], corresponding to the rated speed of the motor
ConfigAxis	WORD	The default setting is 16#003F, refer to the following table for instructions
HWIDSTW	HW_IO	X5E(F)R Hardware identifier for telegram 1 in device view
HWIDZSW	HW_IO	X5E(F)R Hardware identifier for telegram 1 in device view

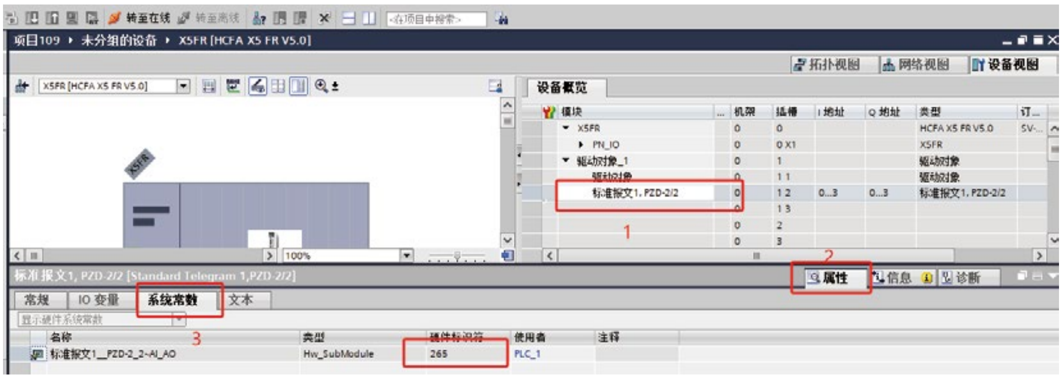
(2) Bits description of ConfigAxis

Bit	Default	Description
Bit 0	1	OFF2
Bit 1	1	OFF3
Bit 2	1	Enbale the drive
Bit 3	1	Enable / Disable ramp function generator enable
Bit 4	1	Continue / Disable ramp function generator enable
Bit 5	1	RPM Setpoint enable
Bit 6	0	-
Bit 7	0	-
Bit 8	0	-
Bit 9	0	-

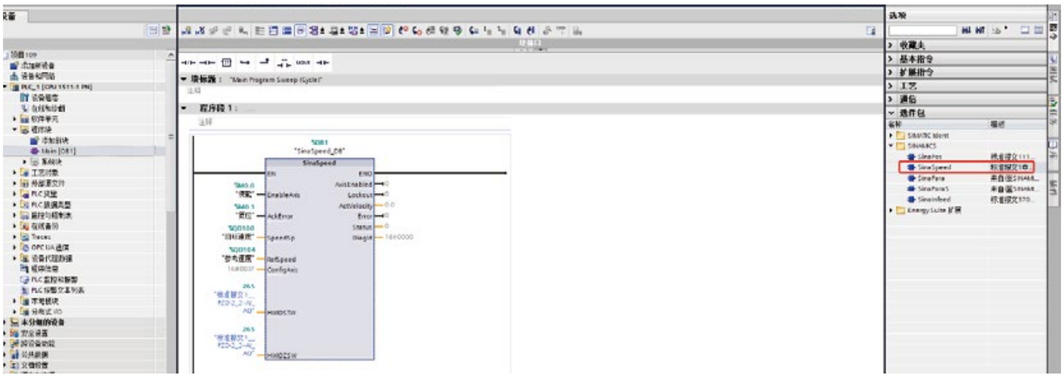
(3) Output:

Output signal	Type	Description
AxisEnabled	BOOL	The drive has been enabled
LockOut	BOOL	The drive is in the disabled state
ActVelocity	REAL	Actual speed [rpm]
Error	BOOL	1 = error exists
Status	INT	16#7002: No error, this function block is executing 16#8401: Drive error 16#8402: Drive prohibited startup 16#8600: DPRD_DAT error 16#8601: DPWR_DAT error
DiagID	WORD	Communication error, an error occurred while calling SFB.

2. To find the hardware identifier: Select Message 1 → Right-click Properties → System Constants → Hardware Identifier.



3. Drag SINA_Speed (FB285) function block into the programming network in OB1 and populate the HWIDSTW and HWIDZSW pins with the hardware identifiers.

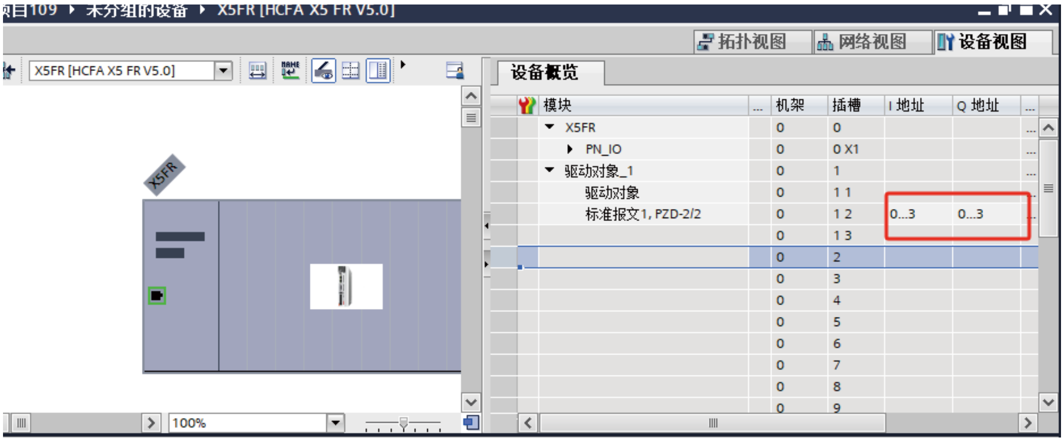


4. Compile and download to PLC for testing.

4.3.4 Direct control via IO address

This control method does not require a dedicated function block, and the speed is given directly. X5E(F)R uses standard telegram 1, and the project and network configuration procedure is the same as in Method 1. Based on PROFINET RT communication, the first control word of the output is used for start-stop control of the drive, and the second control word can be used to give the speed of the motor. the following is an example of programming in the PLC.

1. Check the IO address of X5E(F)R



2. Change the control word via the monitoring table

Configure the IO address in the monitoring table to send the control word and speed directly to the drive.

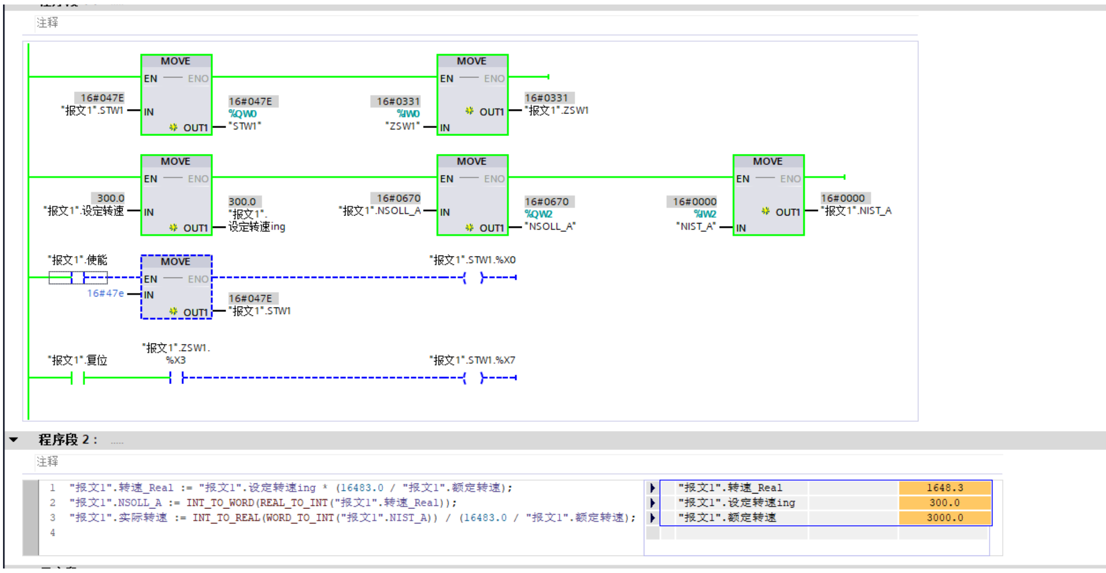
Start-stop control of the drive via the 1st control word (16#047E->16#047F).

The 2nd control word allows to specify the speed at which the motor should run (16#4000=3000rpm).

3. Assign value to IO channel via FB

Assign the 1st control word for start/stop control of the drive (16#047E->16#047F).

Assign a value to the 2nd control word specifies the speed at which the motor runs (16#4000=3000rpm).

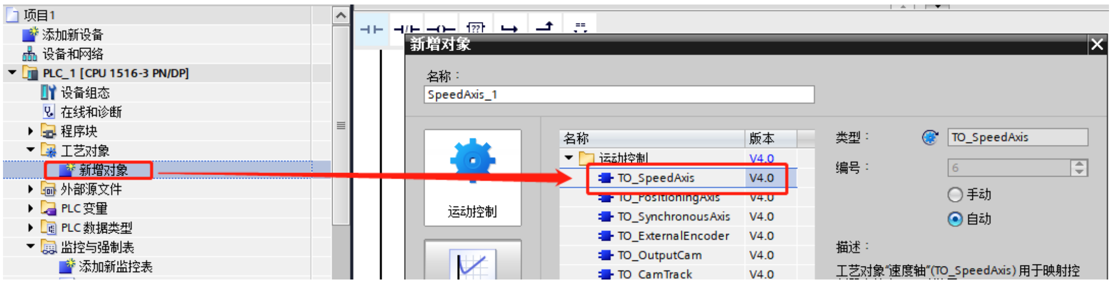


Note: IO channel control can also be accelerated and decelerated using P14.40, P14.42, and P14.44.

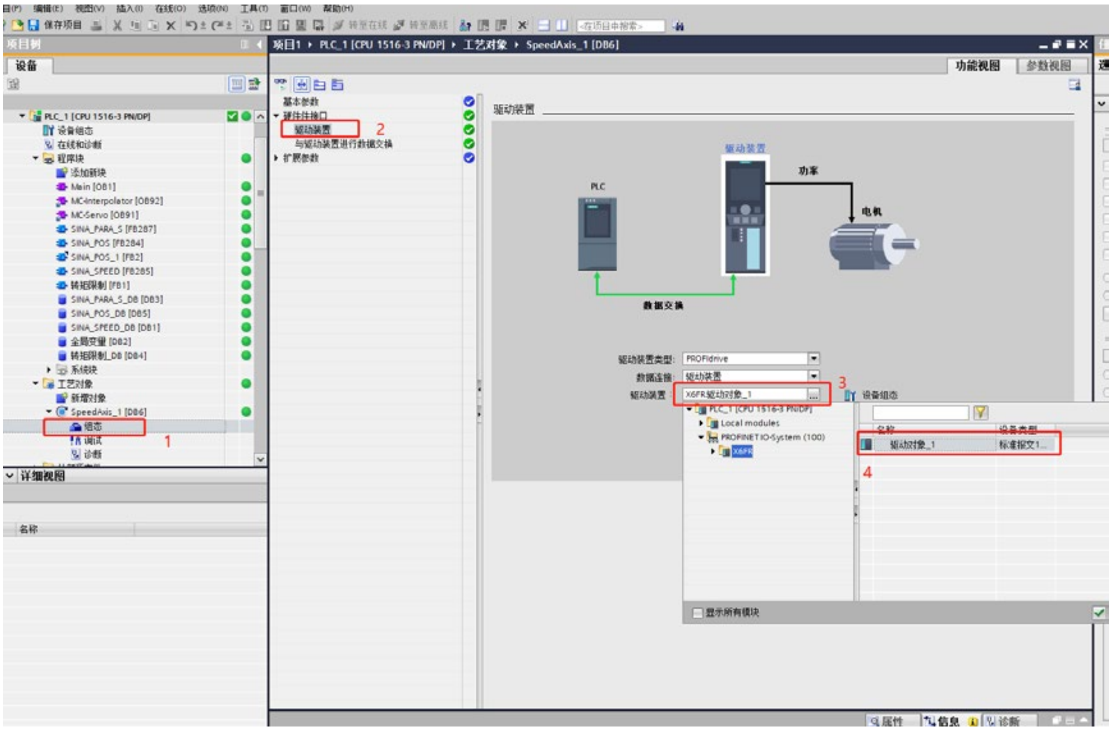
4.3.5 Speed control via TO

(1) Velocity control using the TO axis requires that the velocity axis be configured in the process object.

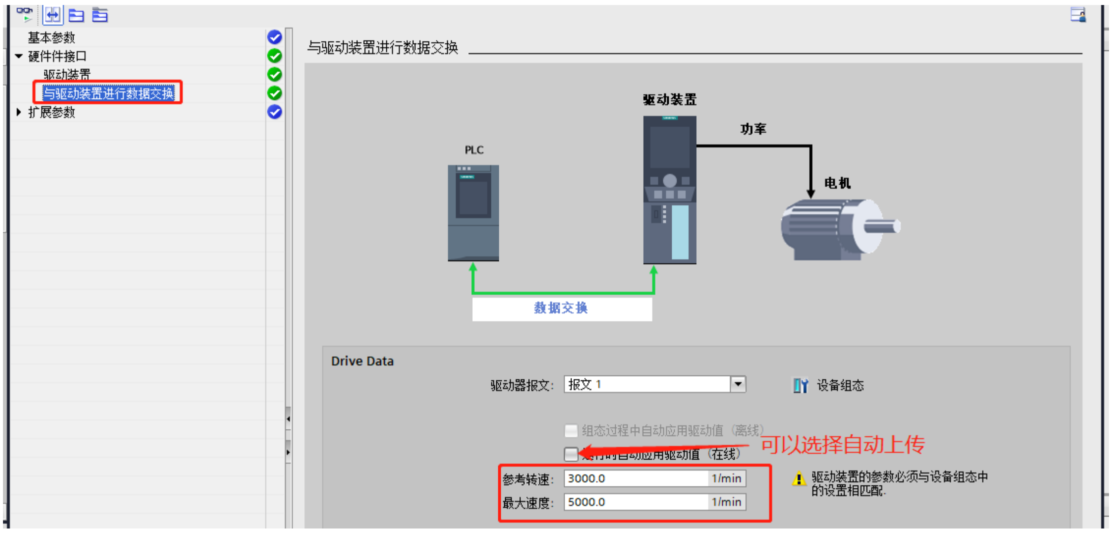
Note: Drive parameters P14.40 (Disengage TO control servo local acceleration time), P14.42 (Disengage TO control servo local deceleration time), and P14.44 (stop deceleration time in speed mode) must be set to 0 when the TO is used.



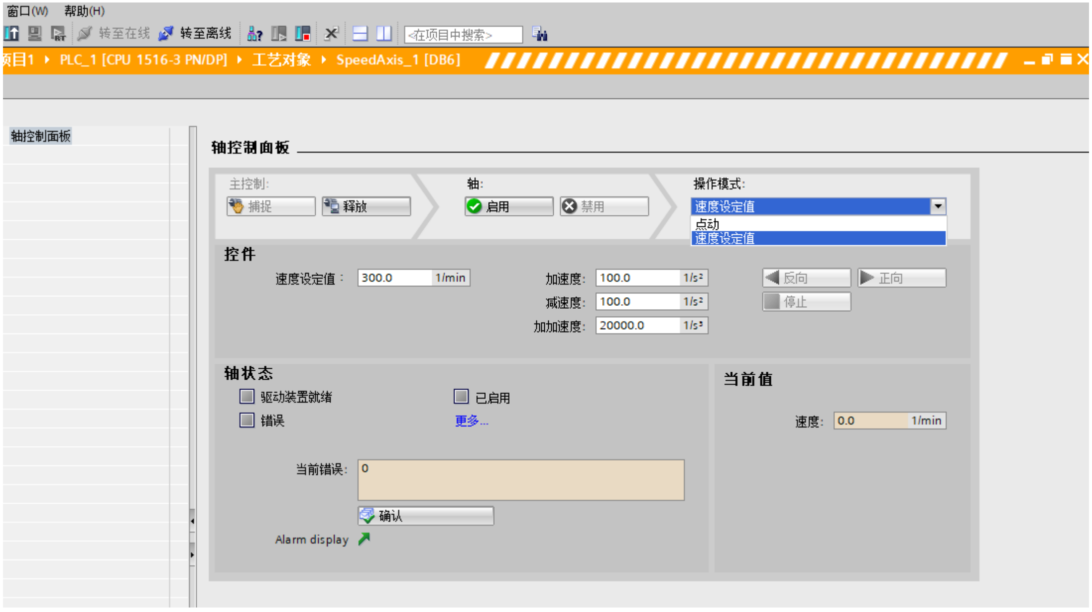
(2) In the "Hardware Interface" of the TO axis configuration, select "PROFIdrive" as the "Drive Type" input. Select the desired X5E(F)R as the "Drive".



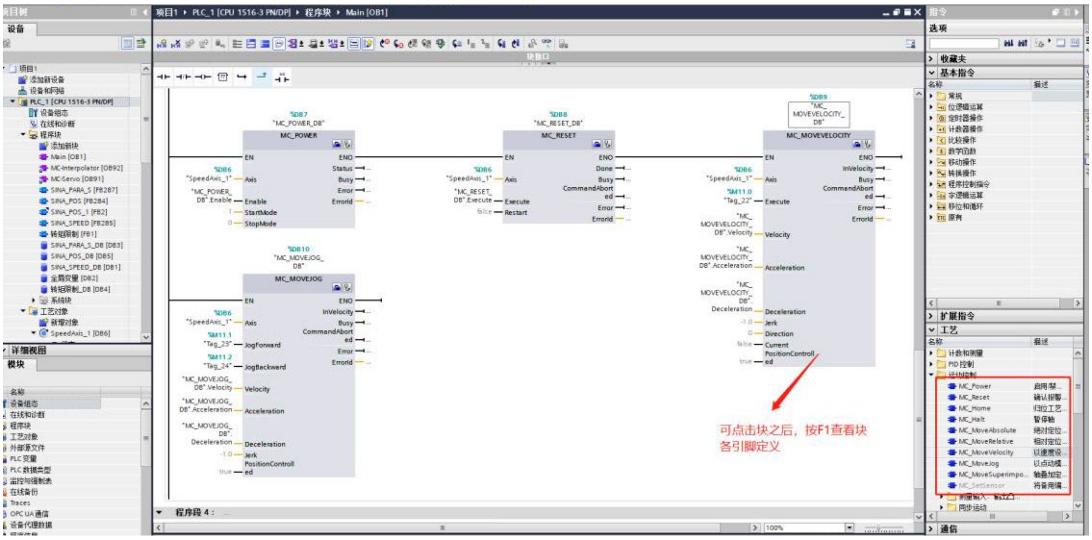
(3) Check the "Data exchange with drives" setting to ensure that data is exchanged correctly with the drives.



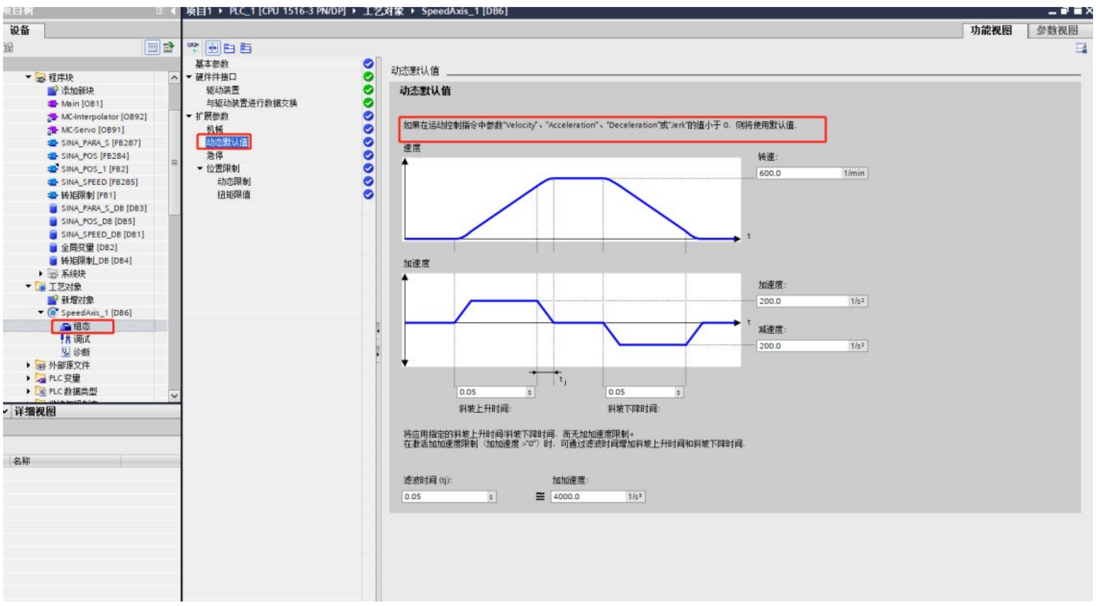
(4) Jog, monitor speed and current status in the commissioning in the axis control panel.



(5) Programs can be written by dragging the Enable, Reset, Pause, Speed, and Jog FBs in the program.

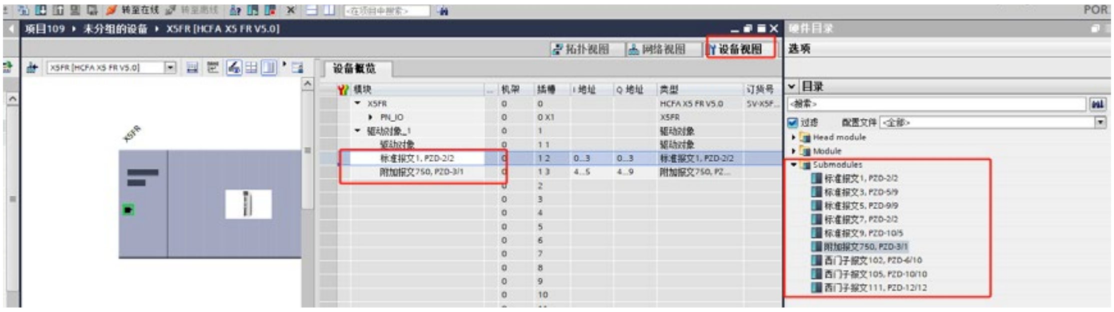


(6) If the parameters "Velocity", "Jerk", "Acceleration" and " Deceleration" in the motion control commands are less than 0, the default values for the axes are used.

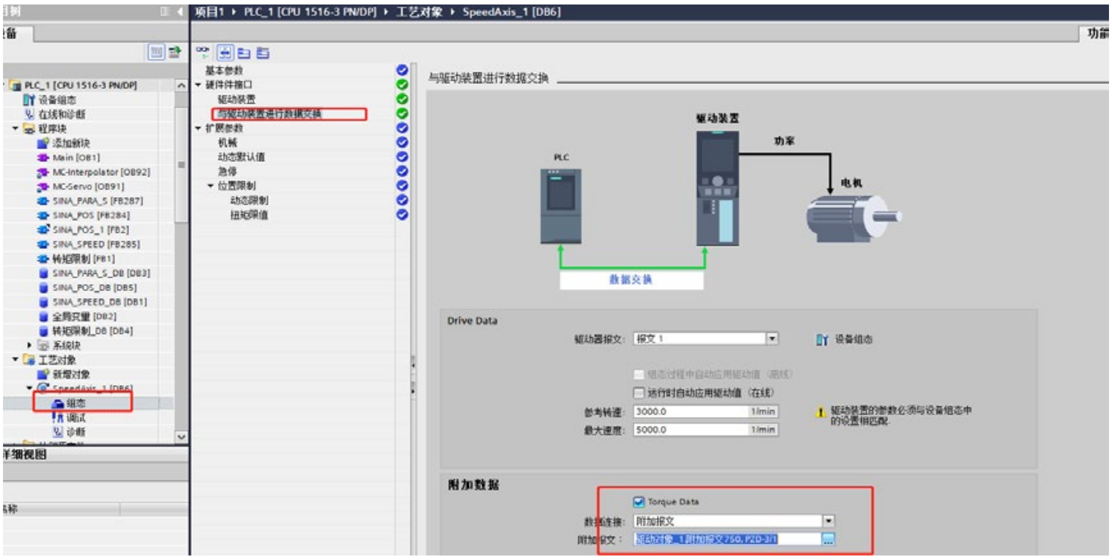


4.3.6 Telegram 1 configures the Axis+750 telegram to implement torque limit

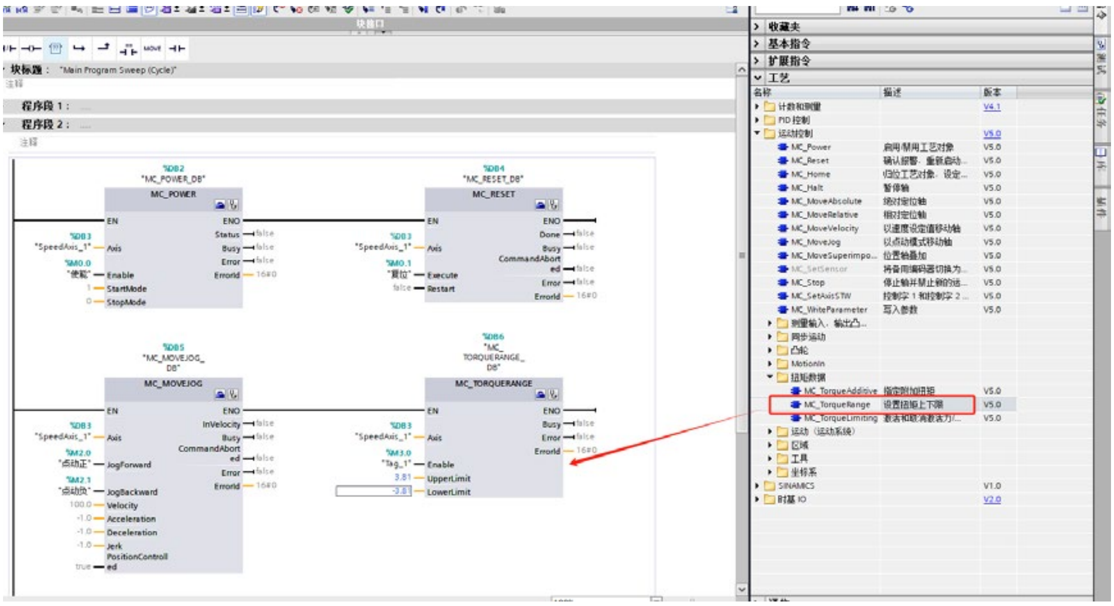
(1) In the Device View of the HCFA X5E(F)R, select "Standard telegram 1" and "Additional telegram 750 telegrams" from the submodules.



(2) Check additional telegrams on the speed axis 750.



(3) Drag out the torque limit FB ino the program area（MC_TORQUERANGE).



4.3.7 Notes on telegram 1

(1) The enable run acceleration time is related to P14.40 (Disengage TO control local acceleration time).

(2) The deceleration time for disable is related to P14.44 (stop deceleration time in speed mode).

(3) Acceleration and deceleration times for speed switching during operation are related to P14.40 (disengagement of TO control local acceleration time) and P14.42 (disengagement of TO control local deceleration time).

(4) The set time constants are all based on 1000rpm, which indicates that the acceleration or deceleration is the time to 1000rpm, not the time to the target speed. (e.g., if the target speed is 3000rpm and the set acceleration time is 1000ms, the time to reach the target speed is 3000ms.

(5) AckError fault reset, SpeedSp is the target speed setting value (unit 0.1RPM).

(6) Parameters P14.40, P14.42, P14.44 must be set to 0 for TO axis.

4.4 AC3 mode（EPOS)

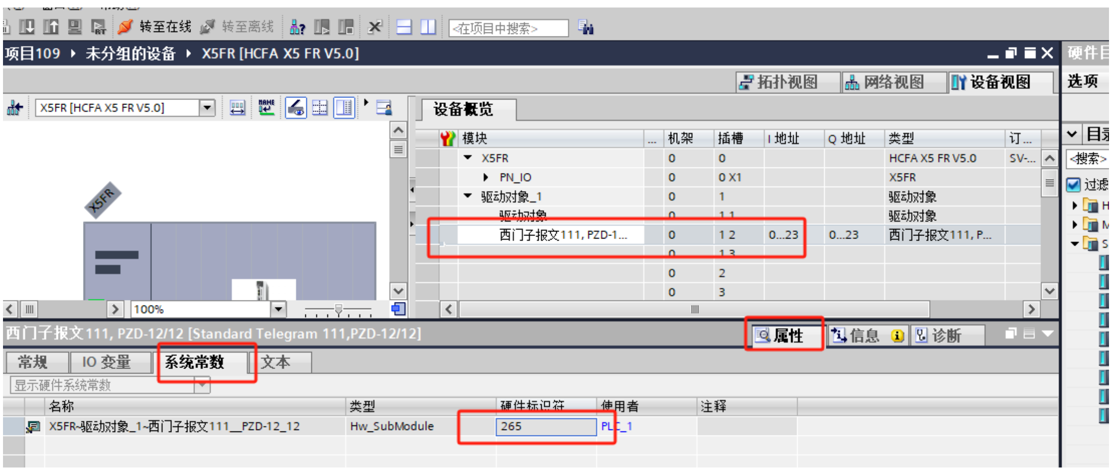
4.4.1 Overview

The S7-1500 and S7-1200 can be connected to the X5E(F)R servo drive via PROFINET communication, and the control mode of the X5E(F)R drive is set to "Essential Position Control (EPOS)", and the PLC can realize the EPOS basic positioning control of the X5E(F)R by using the 111 telegrams and function block FB284 in the drive library provided by TIA Portal. The PLC realizes EPOS basic positioning control of the X5E(F)R by means of telegram 111 and function block FB284 in the drive library provided by TIA Portal.

4.4.2 Configuration

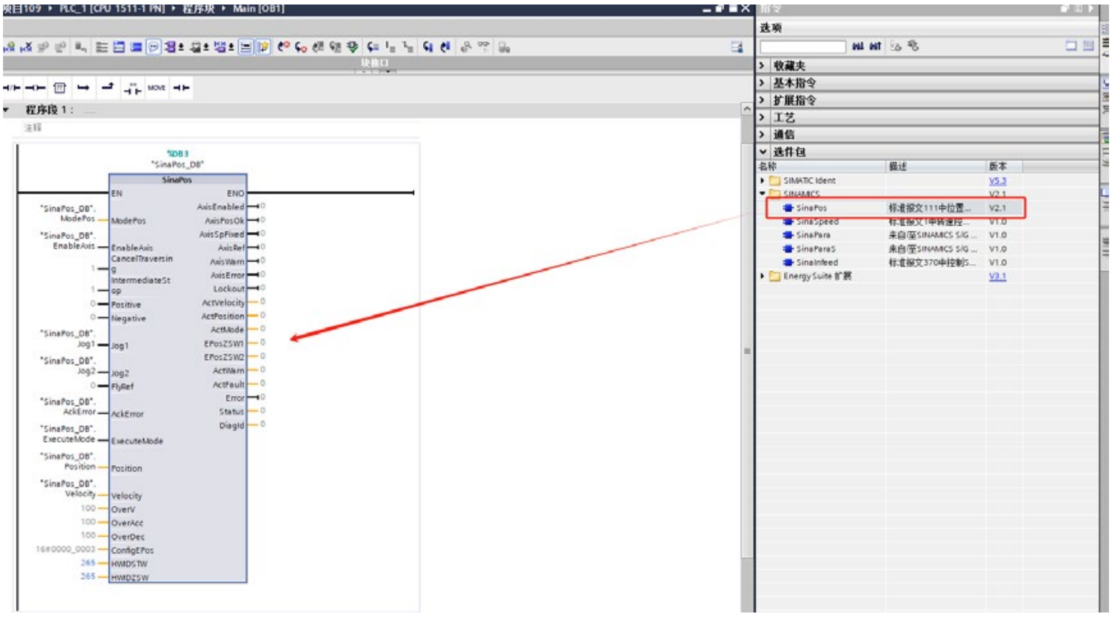
(1) As in 4.3.2 (AC1 Configuration Points), delete telegram 1 and select telegram 111 from the sub-mode.

(2) Find the hardware identifier: select telegram 1 → right-click Properties → System Constants → Hardware Identifier.



(3) Pull the SinaPos (FB284) function block into the programming network in OB1 and fill the HWIDSTW and HWIDZSW

pins with hardware identifiers.



(4) Compile and download the program into the PLC to test.

4.4.3 SinaPos introduction

Pin	Data type	Default	Description
		Input	
ModePos	INT	0	Running mode : 1 = Relative positioning 2 = Absolute positioning 3 = Continuous position operation 4 = Homing 5 = Set origin position 6 = Run position block 0 0 ~ 16（not supported) 7 = JOG 8 = Jog increment（not supported)
EnableAxis	BOOL	0	Servo running instruction: 0 = OFF1 1 = ON
CancelTransing	BOOL	1	0 = Refusal of activated runtime tasks 1 = Non-rejection
IntermediateStop	BOOL	1	Intermediate stop: 0 = Intermediate stop running tasks 1 = Not stop
Positive	BOOL	0	Positive
Negative	BOOL	0	Negative
Jog1	BOOL	0	Reverse jog (Signal source 1)
Jog2	BOOL	0	Forward jog (Signal source 2)
AckError	BOOL	0	Error reset
ExecuteMode	BOOL	0	Activate positioning job or receive setpoints
Position	DINT	0 [LU]	For run mode, the position value is set directly [LU]/MDI or the running block number

<table>
<tr><td>Velocity</td><td>DINT</td><td>0 [1000LU/min]</td><td>Speed setting for MDI operation mode [1000LU/min] (e.g. Gear Ratio: 131072/10,000, Velocity=1000,OVERV=100, Motor RPM = OVERV*Velocity*(1000LU/min)/(Gear Ratio/Resolution)) =100%*1000*(1000LU/min)/((131072/10000)/131072)) =100%*1000000(LU/min)/10000=100rpm)</td></tr>
<tr><td>OverV</td><td>INT</td><td>100[%]</td><td>Speed multiplier in all operating modes 0-199%</td></tr>
<tr><td>OverAcc</td><td>INT</td><td>100[%]</td><td>Acceleration scale in direct setting /MDI mode 0-100%</td></tr>
<tr><td>OverDec</td><td>INT</td><td>100[%]</td><td>Deceleration scale in direct setting /MDI mode 0-100%</td></tr>
<tr><td>ConfigEPOS</td><td>DWORD</td><td>0</td><td>The bits in STW1, STW2, EPosSTW1, and EPosSTW2 of the 111 telegram can be transmitted through this pin, and the correspondence of the transmitted bits is shown in the following table:
<table>
<tr><td>ConfigEPos bit</td><td>111 telegram bit</td></tr>
<tr><td>ConfigEPos.%X0</td><td>STW1.%X1=OFF2 Stop</td></tr>
<tr><td>ConfigEPos.%X1</td><td>STW1.%X2=OFF3 Stop</td></tr>
<tr><td>ConfigEPos.%X2</td><td>EPosSTW2.%X14= Activate software limits</td></tr>
<tr><td>ConfigEPos.%X3</td><td>EPosSTW2.%X15= Activate hardware limits</td></tr>
<tr><td>ConfigEPos.%X4</td><td>EPosSTW2.%X11</td></tr>
<tr><td>ConfigEPos.%X5</td><td>EPosSTW2.%X10</td></tr>
<tr><td>ConfigEPos.%X6</td><td>EPosSTW2.%X2 (eference point signa)</td></tr>
<tr><td>ConfigEPos.%X7</td><td>STW1.%X13</td></tr>
<tr><td>ConfigEPos.%X8</td><td>EPosSTW1.%X12 (continuous transmission)</td></tr>
<tr><td>ConfigEPos.%X9</td><td>STW2.%X0</td></tr>
<tr><td>ConfigEPos.%X10</td><td>STW2.%X1</td></tr>
<tr><td>ConfigEPos.%X11</td><td>STW2.%X2</td></tr>
<tr><td>ConfigEPos.%X12</td><td>STW2.%X3</td></tr>
<tr><td>ConfigEPos.%X13</td><td>STW2.%X4</td></tr>
<tr><td>ConfigEPos.%X14</td><td>STW2.%X7</td></tr>
<tr><td>ConfigEPos.%X15</td><td>STW1.%X12</td></tr>
<tr><td>ConfigEPos.%X16</td><td>STW1.%X14</td></tr>
<tr><td>ConfigEPos.%X17</td><td>STW1.%X15</td></tr>
<tr><td>ConfigEPos.%X18</td><td>EPosSTW1.%X6</td></tr>
<tr><td>ConfigEPos.%X19</td><td>EPosSTW1.%X7</td></tr>
<tr><td>ConfigEPos.%X20</td><td>EPosSTW1.%X11</td></tr>
<tr><td>ConfigEPos.%X21</td><td>EPosSTW1.%X13</td></tr>
<tr><td>ConfigEPos.%X22</td><td>EPosSTW2.%X3</td></tr>
<tr><td>ConfigEPos.%X23</td><td>EPosSTW2.%X4</td></tr>
<tr><td>ConfigEPos.%X24</td><td>EPosSTW2.%X6</td></tr>
<tr><td>ConfigEPos.%X25</td><td>EPosSTW2.%X7</td></tr>
<tr><td>ConfigEPos.%X26</td><td>EPosSTW2.%X12</td></tr>
<tr><td>ConfigEPos.%X27</td><td>EPosSTW2.%X13</td></tr>
<tr><td>ConfigEPos.%X28</td><td>STW2.%X5</td></tr>
<tr><td>ConfigEPos.%X29</td><td>STW2.%X6</td></tr>
<tr><td>ConfigEPos.%X30</td><td>STW2.%X8</td></tr>
<tr><td>ConfigEPos.%X31</td><td>STW2.%X9</td></tr>
</table>
Note: If a variable is assigned to this pin in the program, the drive must ensure that ConfigEPos.%X0 and ConfigEPos.%X1 are both 1 in order to run.</td></tr>
<tr><td>HWIDSTW</td><td>HW_IO</td><td>0</td><td>Symbol name or SIMATIC S7-1200 , S7-1500. HW ID (SetPoint) of the set value slot.</td></tr>
<tr><td>HWIDZSW</td><td>HW_IO</td><td>0</td><td>Symbol name or SIMATIC S7-1200, S7-1500. HW ID (Actual Value) of the actual value slot.</td></tr>
<tr><td colspan="4">Output</td></tr>
<tr><td>AxisEnabled</td><td>BOOL</td><td>0</td><td>Drive enbaled</td></tr>
</table>

AxisError	BOOL	0	Servo fault
AxisWarn	BOOL	0	Servo warning
AxisPosOk	BOOL	0	Axis reaches the target position
AxisRef	BOOL	0	Origin position setting
ActVelocity	DINT	0[LU/min]	Current speed [LU/min] (40000000h in hexadecimal corresponds to P18.08 rated speed) Example: Motor speed = Current speed *3000/1073741824 (40000000 converted to decimal)
ActPosition	DINT	0[LU/min]	Current position LU
ActMode	INT	0	Currently active operating mode
EPosZSW1	WORD	0	Status of EPOS ZSW1
EPosZSW2	WORD	0	Status of EPOS ZSW2
ActWarn	WORD	0	Current warning code
ActFault	WORD	0	Current error code
Error	BOOL	0	1= Error occurs
Status	Word	0	16#7002: No fault - program segment is running 16#8401: Drive fault 16#8402: Turn on prohibited 16#8403: Float back to reference point function cannot be activated 16#8600: DPRD_DAT error 16#8601: DPWR_DAT error 16#8202: Incorrect operation mode selected 16#8203: Incorrect setting value parameters 16#8204: Incorrect run segment number selected
DiagID	WORD	0	Expend communication fault

4.4.4 SinaPos running mode

(1) Running condition

① Axis passes through input pin EnableAxis = 1, OFF2 and OFF3 are internally set to 1. If the axis is ready and the drive is fault-free (AxisError = “0”), the axis is enabled after EnableAxis is set to 1, and the output pin AxisEnabled signal changes to 1.

② ModePos input pin is used for operation mode selection. It can be switched in different operation modes, e.g. continuous operation mode (ModePos=3) can be switched to absolute positioning mode (ModePos=2) during operation.

③ The input signals CancelTransing and IntermediateStop are valid for all operation modes except pointing, and must be set to “1” when running EPOS, as described below:

• Setting CancelTransing=0 causes the axis to slow down and stop according to the ramp stop and the working data is discarded. If CancelTransing=1 is set again, the axis does not continue to run and needs to be retriggered; after the axis has stopped, it is possible to switch between the operating modes.

• Setting IntermediateStop=0 uses the currently applied deceleration value to perform a ramp stop without discarding work data; if IntermediateStop=1 is reset, the axis will continue to run and can be treated as a pause for the axis. It is possible to switch the operation mode after the axis has come to a standstill.

④ Activating Hardware Limit Switch

• If hardware limit switches are used, the hardware limit function of X5E(F)R should be activated by setting the input pin ConfigEPos.%X3(POS_STW2.15) of FB284 function block to 1.

• The positive and negative hardware limit switches can be connected to DI1 to DI2 of the X5E(F)R drive.

⑤ Activating Software Limit Switches

• If software limit switches are used, it is necessary to activate the software limit function of the X5E(F)R by setting the input pin ConfigEPos.%X2 (POS_STW2.14) of the FB284 function block to 1 and P15.37=1.

• Set P15.37 (soft limit effective mode), P15.38 (negative soft limit position), and P15.40 (positive soft limit position) in X5E(F)R.

(2) Relative positioning operation mode

The “Relative Positioning” operation mode can be realized by the drive function “MDI Relative Positioning”, which uses the drive's internal position controller to realize relative position control.

Requirement

• ModePos=1 is selected for the operation mode.

• EnableAxis=1 for the drive's run command.

• The axis does not have to conduct homing. Or the absolute encoder is not calibrated.

• If the switching mode is greater than 2, the axis must be stationary and can be switched within the MDI operating mode at any moment (ModePos=1,2).

Step:

• Specify the target position and the dynamic response parameters with the input parameters Position, Velocity.

• Specify the speed and the multiplication rate of speed increase/decrease by inputting the parameters OverV, OverAcc, OverDec.

• The operation conditions “CancelTransing” and “IntermediateStop” must be set to “1”, Jog1 and IntermediateStop must be set to “1”. The operation conditions “CancelTransing” and “IntermediateStop” must be set to “1”, and Jog1 and Jog2 must be set to “0”.

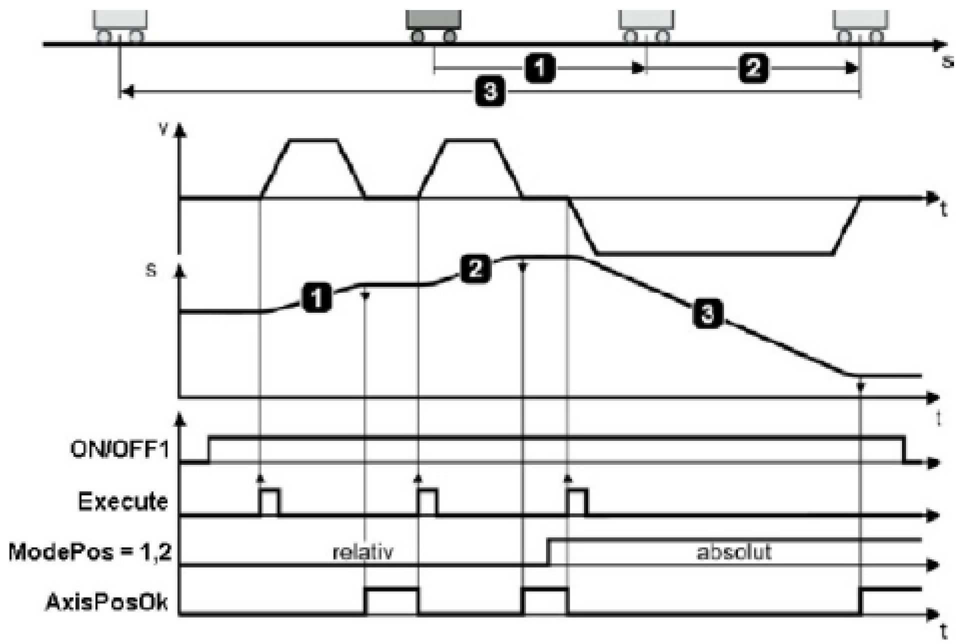
• The parameters Positive and Negative must be set to “0”.

• Trigger the positioning movement by the rising edge of ExecuteMode, activate the current state of the command or monitor it by EPosZSW1 and EPosZSW2, set 1 by AxisPosOk when the target position is reached, and output the parameter Error to 1 if there is an error in the positioning process.

Note:

The currently running command can be replaced by a new command through the rising edge of ExecuteMode, but it is only used in the operation mode ModePos 1,2,3. When ConfigEPos.%X8 is 1, it cannot be used in the relative positioning mode, and ERR59 will be alarmed.

The relative positioning mode control timing is shown below:



Servo parameter setting:

P15.00	Maximum speed
P15.02	Maximum acceleration
P15.04	Maximum deceleration
P15.08	Deviation excess threshold
P15.10	Position reaches threshold
P15.42	EPOS Electronic gear ratio numerator
P15.44	EPOS Electronic gear ratio denominator

(3) Absolute positioning operation mode

The "Absolute Positioning" mode of operation can be realized with the drive function "MDI Absolute Positioning", which uses the drive's internal position controller for absolute position control.

Requirements:

• Operation mode selection ModePos = 2

• Axis enable EnableAxis =1

• The axis encoder must be calibrated.

• If switching mode is greater than 3, the axis must be stationary and can be switched within the MDI operating mode at any moment (ModePos=1,2,3).

Step:

• Specify the target position and the dynamic response parameters by entering the parameters Position, Velocity.

• Specify the velocity and the multiplication rate of the acceleration and deceleration by inputting the parameters OverV, OverAcc and OverDec.

• The operation conditions"CancelTransing"and"IntermediateStop"must be set to"1", and Jog1 and Jog2 must be set to"0".

• In absolute positioning, the running direction can follow the shortest path to the target position, in which case the input parameters Positive and Negative must be set to "0".

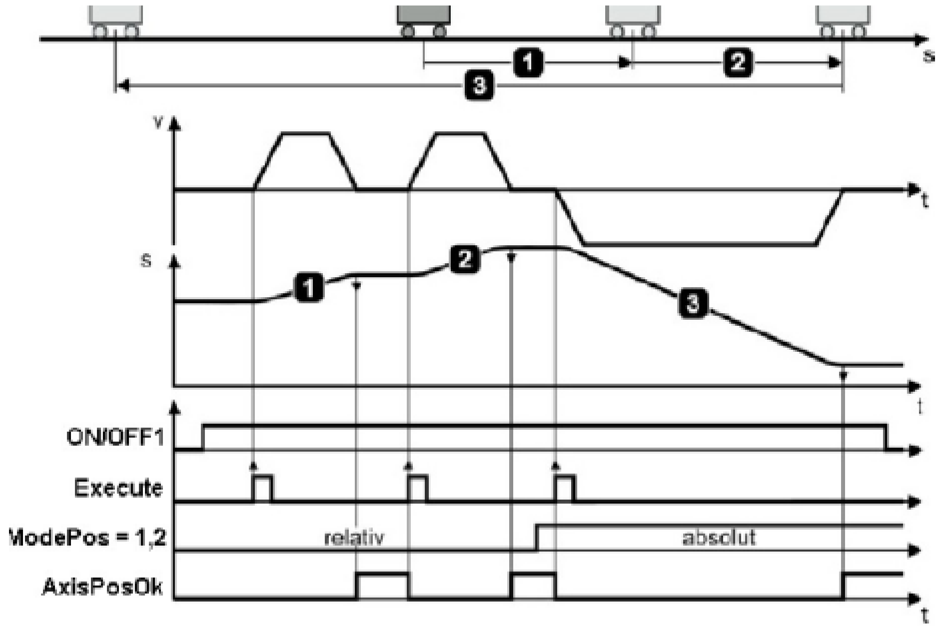
• Trigger the positioning movement by the rising edge of ExecuteMode, activate the current state of the command or monitor it by EPosZSW1 and EPosZSW2, set 1 by AxisPosOk when the target position is reached and set 1 by the output parameter Error if there is an error in the positioning process.

Note:

Currently running commands can be replaced by new commands via the rising edge of ExecuteMode, but only for operating modes ModePos 1,2,3.

When ConfigEPos.%X8 (EPosSTW1.%X12) is set to 1, the commands will take effect immediately after giving Position, Velocity, OverV, OverACC, OverDEC on the PLC side without triggering Executemode.

The absolute positioning mode control timing sequence is shown in the following figure:



Servo parameters setting:

P15.00	Maximum speed
P15.02	Maximum acceleration
P15.04	Maximum deceleration
P15.08	Deviation excess threshold
P15.10	Position reaches threshold
P15.42	EPOS Electronic gear ratio numerator
P15.44	EPOS Electronic gear ratio denominator

(4) Continuous operation mode

The "Continuous Running" mode allows the position controller of an axis to run at a constant speed in either forward or reverse direction, which is the "MDI setup" mode of operation for the drive.

(Note: Modulo axes are not supported).

Requirement:

• Running mode selection ModePos=3

• Drive run command AxisEnable=1

• The axis does not have to conduct homing. Or the absolute encoder is not calibrated.

• If the switching mode is greater than 3, the axis must be stationary and can be switched within the MDI running mode at any time (ModePos=1,2,3).

Step:

• Specify the running speed by entering the parameter Velocity.

• Specify the speed and the multiplication of the acceleration and deceleration by entering the parameters OverV, OverAcc, OverDec.

• The operation conditions"CancelTransing"and"IntermediateStop"must be set to"1", and Jog1 and Jog2 must be set to"0".

• The operation conditions"CancelTransing"and"IntermediateStop"must be set to"1", and Jog1 and Jog2 must be set to"0".

• The running direction is determined by Positive and Negative (one of the direction must be 1).

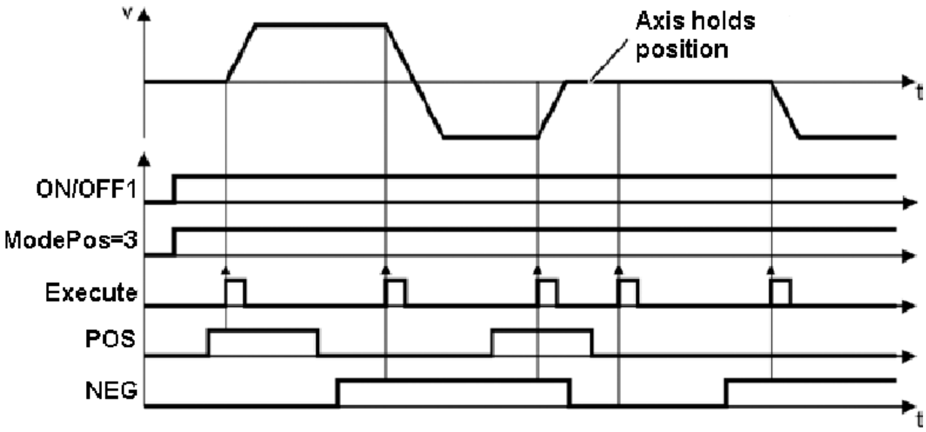
• The positioning movement is triggered by the rising edge of ExecuteMode to activate the current state of the command or to monitor it via EPosZSW1 and EPosZSW2. When an error occurs during the run, the output parameter Error is set to 1 and AxisPosOk is always 0.

Note:

Currently running commands can be replaced by new commands via ExecuteMode rising edge, but only for running modes ModePos 1,2,3.

When ConfigEPos.%X8 (EPosSTW1.%X12) is set to 1, it takes effect immediately after giving Velocity, OverV, OverACC, OverDEC on the PLC side only, and there is no need to trigger Executemode, and it can be shut down by the direction (Positive and Negative).

The continuous operation mode control timing sequence is shown below:



(5) Homing

This function allows an axis to perform a homing operation along the forward or reverse direction according to the preset homing speed and method, activating the active homing of the drive (Only supports servo side homing).

Requirement:

• Operation mode selection ModePos=4

• Drive operation command EnableAxis=1

• It is necessary to turn on the servo hardware limit, connect the limit signal and the home signal (the home signal can use the servo side DI function 28 or the telegram 111 control word EPosSTW2.%X2, choose one of the two).

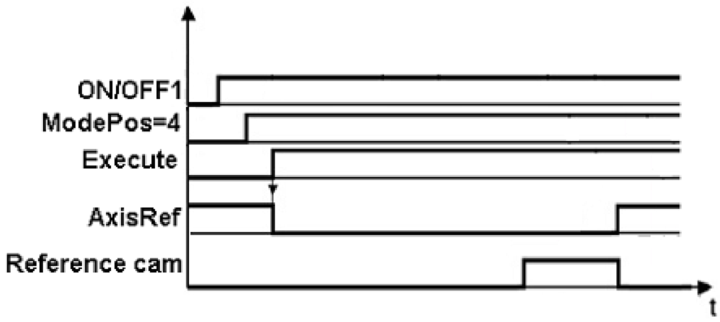
• Axis Standstill

Step:

• The operation conditions “CancelTransing” and “IntermediateStop” must be set to “1”, at same time Jog1 and Jog2 must be set to “0”.

• Execute the homing movement via ExecuteMode high level, activate the current state of the command or monitor it via EPosZSW1 and EPosZSW2, AxisRef is set to 1 when homing is completed, and the output parameter Error is set to 1 when an error occurs during the run.

The control timing sequence is shown as the following figure:



Servo parameters setiing:

P15.22	EPOS Homing method（35 methods）
P15.23	EPOS Homing high speed
P15.25	EPOS Homing low speed
P15.27	EPOS Homing acceleration and deceleration time
P15.31	EPOS Absolute offset of homing
15.33	EPOS reference coordinate value
P15.35	EPOS Homing timeout time
P15.42	EPOS Electronic gear ratio numerator
P15.44	EPOS Electronic gear ratio denominator

(6) Setting the homing position

This mode of operation allows the home position to be set for the axis when the axis is in any position.

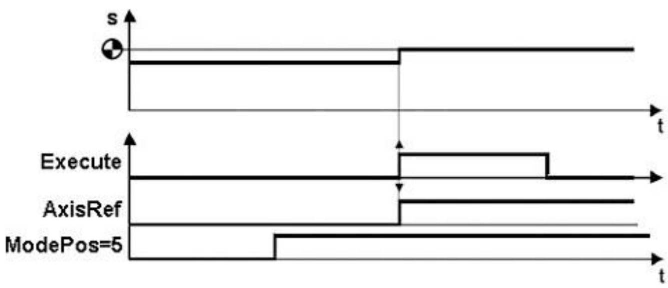
Requirements:

- Operation mode selection ModePos=5
- The axis is in closed-loop control and is in the standstill step:
- The home position of the axis is set by the rising edge of Execute when the axis in standstill state.

Note:

The home position can be set via parameter P15.33.

Set the homing control timing sequence as shown below:



(7) Jog

Jog mode is achieved by the drive' s JOG function.

Requirement:

- Run mode selection ModePos=7

・Drive run command AxisEnable=1

・Axis standstill

・Axis does not have to be zeroed-returned or an absolute encoder calibrated.

Step:

・The Jog speed is set in X5E(F)R. Users can specify the speed, the scale for the acceleration and deceleration by entering the parameters OverV, OverAcc, OverDec, which are not required to be used is set to 100%.

・The operation conditions “CancelTransing” and “IntermediateStop” are independent of the Jog mode and are set to “1” by default.

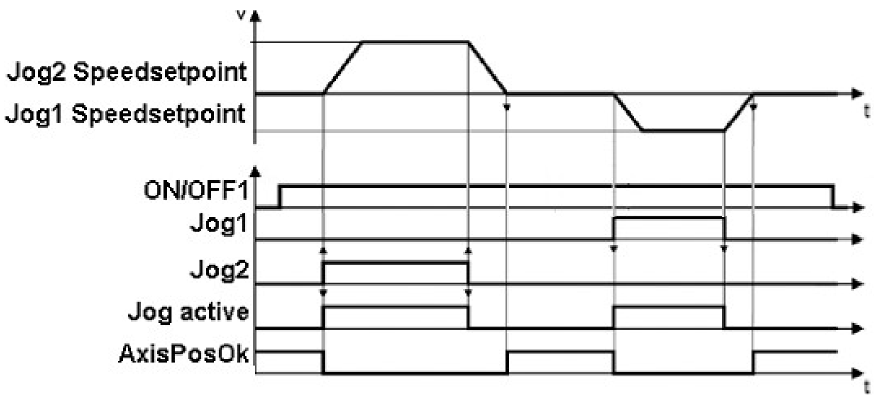
Note:

・Jog1 and Jog2 are used to control the EPOS Jog operation, the direction of motion is determined by the pointing speed set in the X5 PN drive, the default setting is Jog1=negative Jog, Jog2=positive Jog, it has nothing to do with the Positive and Negative parameters, the default setting is “0”. “.

・Activate the current status of the command or monitor it via EPosZSW1, EPosZSW2, Busy is 1 during the processing of the command in the function block, the “AxisPosOK” signal will not be activated, and the output parameter Error is set to 1 when an error occurs during the operation.

・The values of OverV, OverAcc and OverDec must be set. Otherwise, the motor will not rotate or stop.

The timing sequence of the tap control is shown below:



Servo parameters seeting

P15.14	JOG1 speed
P15.16	JOG2 speed
P15.18	JOG maximum acceleration
P15.20	JOG maximum deceleration
P15.42	EPOS Electronic gear ratio numerator
P15.44	EPOS Electronic gear ratio denominator

4.4.5 Modulo axis

When the modulo axis function is turned on, it will run to set the position of the modulo axis, and the position will be cleared to 0. This can be applied to rotary axes, which can be set in multiples of 360, and linear axes, which can be set according to the actual length.

When P15.52 = 1, the modal axis is turned on and the modal axis length is set via P15.48.

There are 3 combinations of modes in absolute position mode:

① Only when ModePos=2 will run in 0- shortest path of modulo axis.

② When ModePos=2 + Positive =1, Negative =0, it will run in absolute positive according to the given position value.

③ When ModePos=2 + Negative =1, Positive =0, it will run in absolute negative direction according to the given position value.

There is one combination of modes in relative position mode

When ModePos=1, it will run in the given position, and the running position will be reflected on the modal axis.

4.4.6 Introduction of telegram 111 limit activation

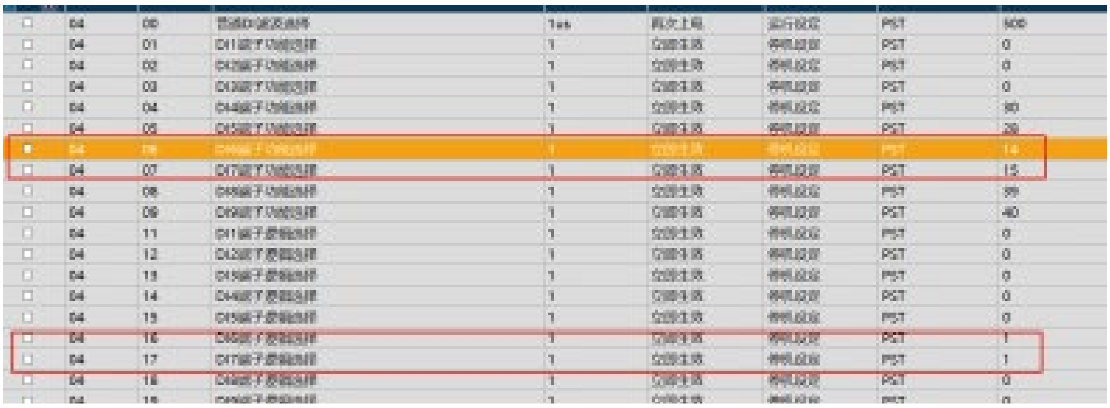
The telegram 111 specifies that BIT14 and BIT15 of EPOS_STW2d activate the soft limit and hard limit switches respectively; at the same time, X2 and X3 of ConfigEpos on the FB284 block are activated.

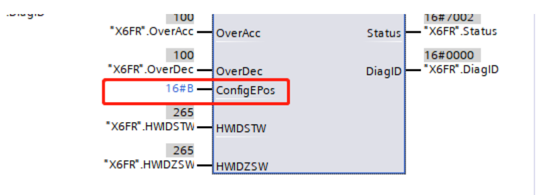
ConfigEPOS	DWORD	0	可以通过此管脚传输 111 报文的STW1，STW2，EPosSTW1，EPosSTW2中的位，传输位的对应关系如下表所示：

ConfigEPos位	111报文位
ConfigEPos.%X0	STW1.%X1=0FF2 停止
ConfigEPos.%X1	STW1.%X1=0FF3 停止
ConfigEPos.%X2	EPosSTW2.%X14=激活软件限位
ConfigEPos.%X3	EPosSTW2.%X15=激活硬件限位
ConfigEPos.%X4	EPosSTW2.%X11=参考点激活
ConfigEPos.%X5	EPosSTW2.%X10
ConfigEPos.%X6	EPosSTW2.%X2

(1) Activate hard limits

When ConfigEpos of FB284 block is configured as 16#B, that is to say, the hard limit switch is activated, and then configure the hard limit in the digital input/output of group P04 of DI parameter table, and the default configuration is that DI6 (P04.06=14) is the positive limit, and DI7 (P04.07=15) is the negative limit, and the high level is valid. The default is valid without connecting the DI switch; so the limit switch must be connected when using the default parameters to restore; users can also configure the DI and logic level of the limit according to their needs. As shown in the figure below:

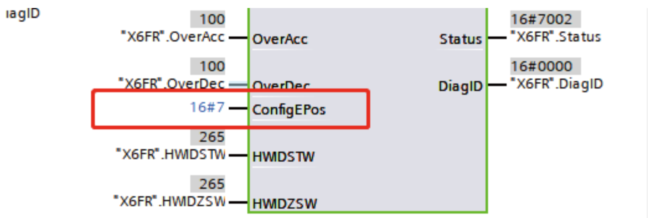




(2) Activate soft limits

ConfigEpos in FB284 block is configured as 16#7, P15.38 and P15.40 are positive and negative limit travels, the motor takes origin as reference point, when P15.37=1, the position will be detected at power-on, and AL086 or AL087 will be reported when current position exceeds the set position. When P15.37=2, the motor detects whether the current position exceeds the set travel only when the signal for returning to the original completion is valid and alarms AL086 or AL087 when it exceeds the set travel.

If ConfigEpos of FB284 block is configured as 16#7 and P15.37=2, soft limit will be enabled. P15.38 and P15.40 are the positive and negative limit travels, the motor will take the home position as the reference point, and it will alarm AL086 or AL087 if the set travel is exceeded.



☐	15	37	EPOS软限位生效方式	1	立即生效	运行设定	P	1
☐	15	38	EPOS软限位正向限制值(32位)	1	立即生效	运行设定	P	100000
☐	15	40	EPOS软限位负向限制值(32位)	1	立即生效	运行设定	P	-100000

4.4.7 EPOS Electronic gear ratio

Position measurement can be in command units or encoder pulse units, the relationship between command units and encoder pulse units is determined by the ratio of the numerator and denominator of the EPOS electronic gear ratios. The EPOS electronic gear ratios are set via P15.42 and P15.44, with a 23-bit motor, users need to set P15.42 to 8388608 in order to use the default values for group 15 normally, otherwise users need to set the parameters according to the gear ratios.

Number of turns = (position * gear ratio) / resolution.

Example: In the case of no gear ratio, with a 17 bit motor, resolution = 131072, EPOS electronic gear ratio numerator P15.42 is set to 131072, and EPOS electronic gear ratio denominator P15.44 = 10000, this would represent the 111 message control word “MDI_TARPOS” or FB284 Function block “Position” sets 10000LU The motor makes one revolution, if the screw pitch is 10mm/revolution, then 10000LU = 10mm.

☐	15	42	EPOS电子齿轮比分子(32位)	1	立即生效	运行设定	P	131072
☐	15	44	EPOS电子齿轮比分母(32位)	1	立即生效	运行设定	P	10000

Although the setting range of the numerator and denominator of the electronic gear ratio is wide, an electronic gear setting error Err.48 is reported when the ratio exceeds the range, so the electronic gear ratio must be set to meet the following range.

Encoder resolution / 1000000 ≤ Numerator / Denominator ≤ Encoder resolution / 2.5

4.4.8 Introduction of speed limit, Acc./Dec. and ramp stop

(1) Speed limit

The parameter of speed limit is P15.00, the unit is 1000LU/min, the actual speed of the speed limit motor, when the actual speed is greater than the speed limit, it will run according to the machine speed of the speed limit.

Actual limit motor speed (RPM) = 15.00*1000* Gear ratio / Resolution (LU/min)

The speed (Velocity) of FB284 corresponds to MDI_VELOCITY of 111 telegram, and 100% of the speed ratio (OverV) of FB284 corresponds to 16#4000 of 111 telegram OVERRIDE. The relationship between the actual motor speed and the speed set by FB284 is as follows.

Actual motor speed (RPM) = (Velocity*OverV%*1000* Gear ratio)/ Resolution (LU/min)

For example, in the case of a 17-bit motor with no gear ratio, resolution = 131072, EPOS electronic gear ratio numerator P15.42 is set to 131072, EPOS electronic gear ratio denominator P15.44 = 10000, and the rated speed of the motor is 3000 RPM, the Velocity and OverV setting of the FB284 corresponds to the rated speed of the motor

Velocity*OverV%=3000*Resolution / (Gear Ratio *1000)(1000LU/min)=3000*131072/(131072*1000/10000)=30000(1000LU/min)

(2) EPOS maximum acceleration and deceleration

In the position mode, the maximum EPOS acceleration (P15.02) is used for acceleration during positioning and the maximum EPOS deceleration (P15.04) is used for deceleration when reaching the target position, and the unit of acceleration and deceleration is LU/s2. The acceleration and deceleration time formulas are as follows:

Relative/absolute positioning acceleration (sec) = (Velocity*OverV*1000) / (60*P15.02*OverAcc)

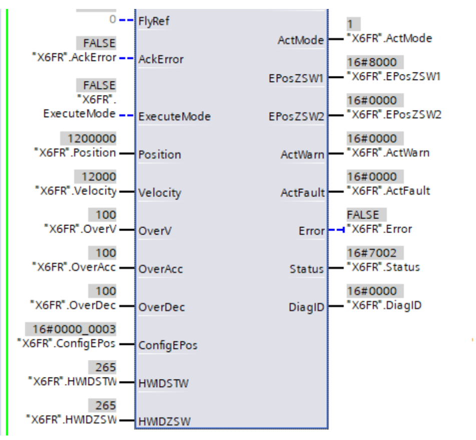
Relative/absolute positioning deceleration (sec) = (Velocity*OverV*1000) / (60*P15.04*OverDeC)

Note: The position instruction should plan for acceleration and deceleration, without planning it will decelerate according to the remaining amount of the position.

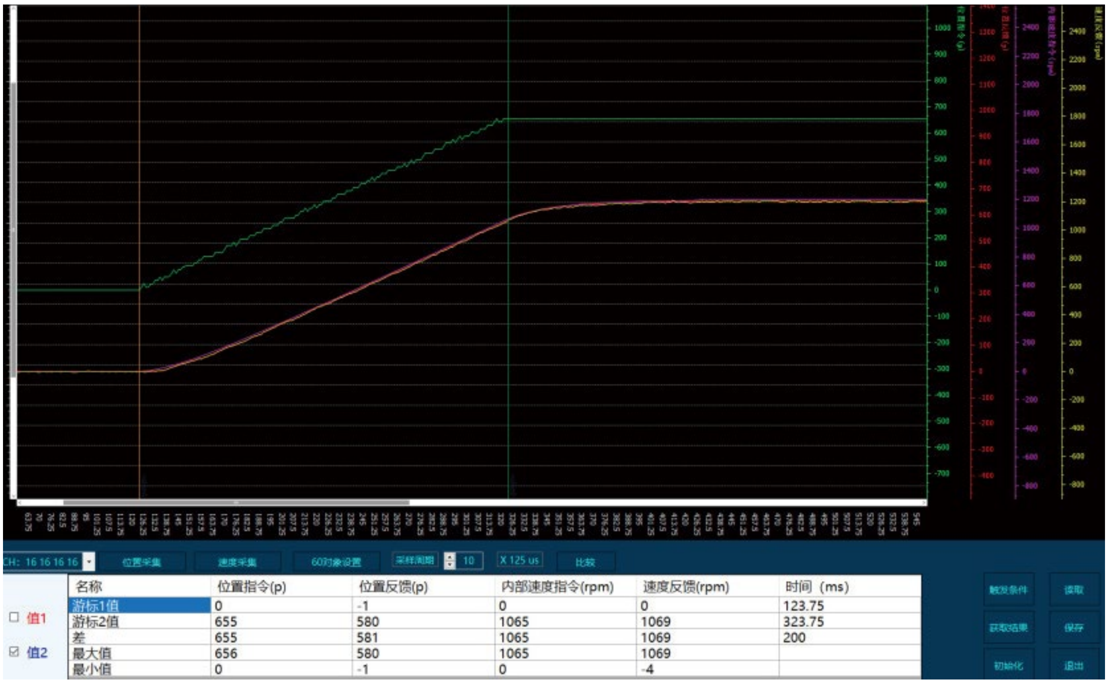
[Case] When P15.02=1000000(LU/s2), P15.04=5000000(LU/s2), gear ratio is 131072/10000, Position of FB284 is set to 1200000, Velocity is set to 12000, and OverV, OverAcc and OverDeC are set to 100% by default. The parameters are shown in the following figure.

☐	15	02	EPOS最大加速度(32位)	1LU/S2	立即生效	停机设定	P	1000000
☐	15	04	EPOS最大减速度(32位)	1LU/S2	立即生效	停机设定	P	2000000

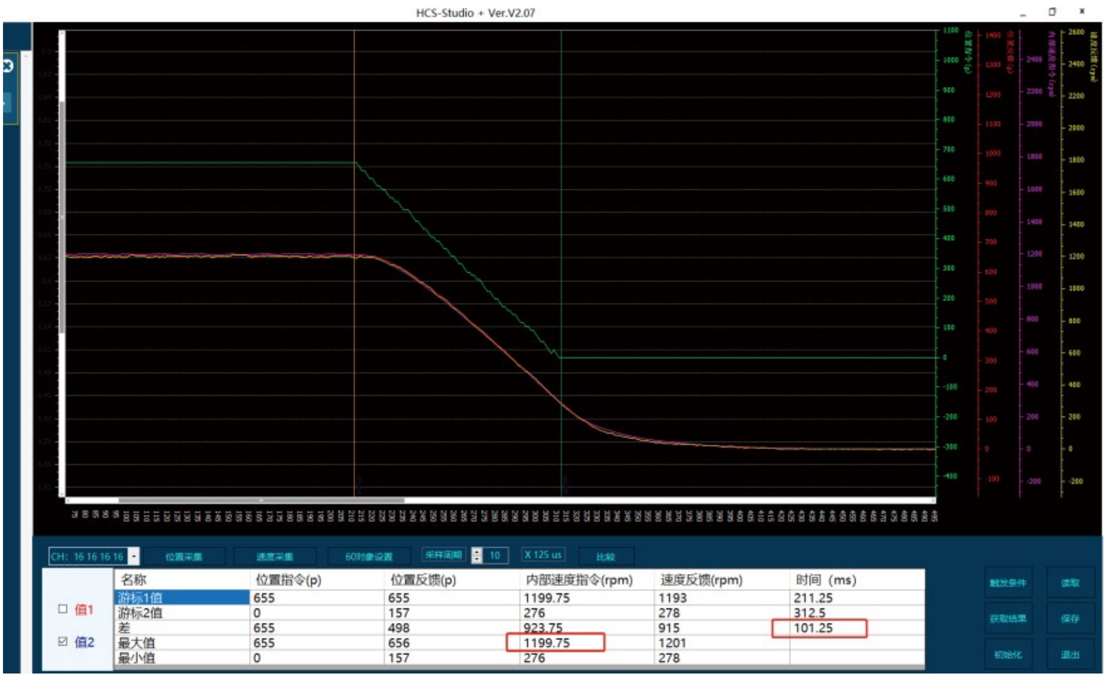
☐	15	42	EPOS电子齿轮比分子(32位)	1	立即生效	运行设定	P	131072
☐	15	44	EPOS电子齿轮比分母(32位)	1	立即生效	运行设定	P	10000



After relative positioning, the motor actually rotates 100 revolutions, the motor speed is 1200rpm,acceleration time (s) = (12000*1000)/(60*1000000) = 0.2(s)



Deceleration time (s) = (12000*1000)/(60*2000000)=0.1(s)



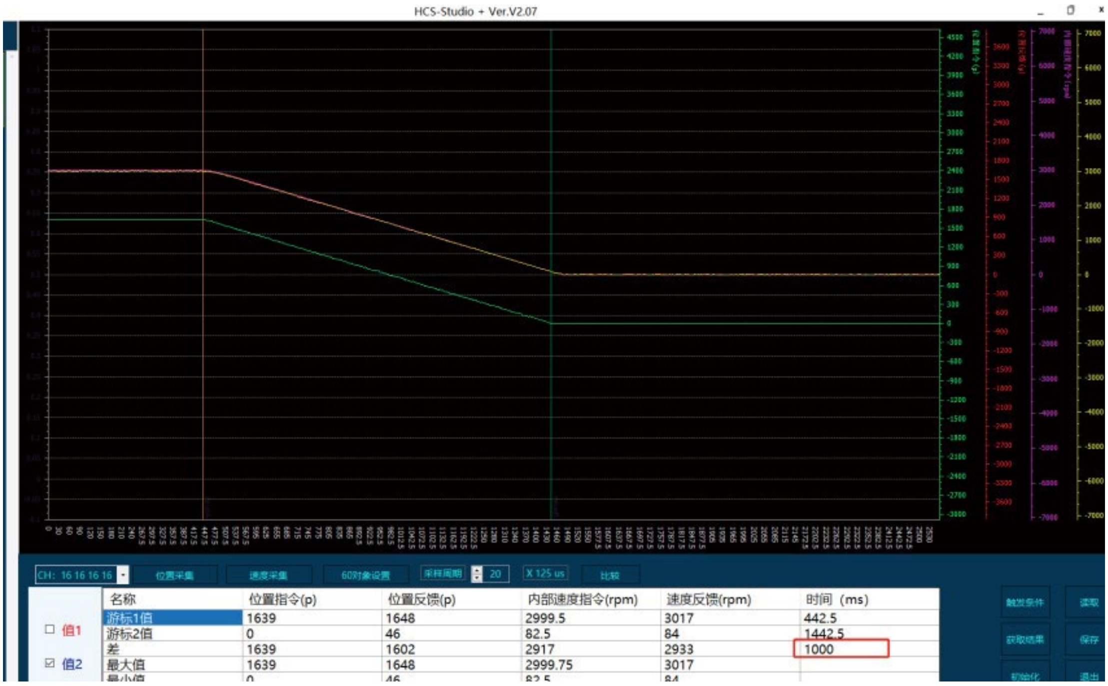
(3) Ramp stop

Ramp Stop is primarily used for Enable, CancelTransing, and IntermediateStop stops, and the position mode is valid for Touch Limit stops. The parameter for Ramp Stop is 15.06 (EPOS Maximum Ramp Speed) in LU/s2.

Maximum ramp stop time (s) = (Velocity*1000) / (60*P15.06)

[Case Introduction] Tested using relative positioning, drive parameters P15.06 = 500000 (LU/s2), P15.42 = 131072, P15.44 = 10000, FB284 Velocity = 30000 (1000Lu/min), then the motor speed is 3000RPM.

Ramp stopping time (s) = 30000*1000/(60*500000) = 1(s) The stopping time using CancelTransing is shown below.



Similarly, the time taken to trigger the disable and interrupt IntermediateStop pins is 1s.

Summary:

Number of revolutions for relative positioning = (Position* Gear Ratio) / Encoder Resolution

Relative/absolute positioning speed (RPM) = (Velocity*1000* Gear Ratio) / Encoder Resolution)

Acceleration for relative/absolute positioning (s) = (Velocity*OverV*1000) / (60*P15.02*OverAcc)

Deceleration for relative/absolute positioning (s) = (Velocity*OverV*1000) / (60*P15.04*OverDeC)

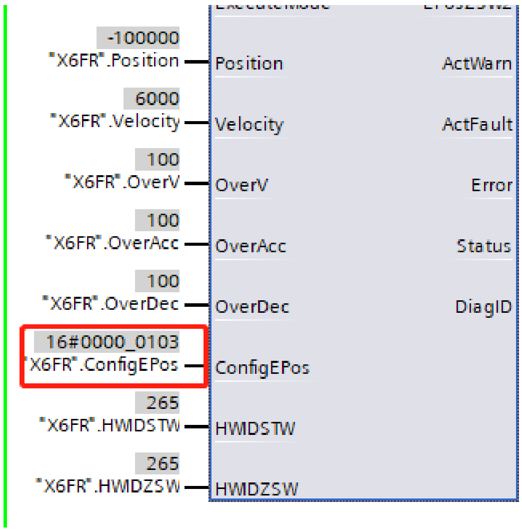
Ramp stopping time (s) = (Velocity*1000) / (60*P15.04*OverDeC) 1000) / (60*P15.06)

4.4.9 Introduction of telegram 111 continuous transmission mode

(1) Configure mode 2 (absolute positioning mode) on the FB284 function block by setting ConfigEpos.%X8 (EPosSTW1.%X12) to 1. This will take effect as soon as Position, Velocity, OverV, OverACC, OverDEC are given to the PLC side, and there is no need to trigger the Executemode on the PLC side. There is no need to trigger Executemode.

(2) Configure mode 3, set ConfigEpos.%X8 (EPosSTW1.%X12) to 1 to configure the direction, then only need to give Velocity, OverV on the PLC side, OverACC,OverDEC will take effect immediately without triggering the Executemode, and the direction stop can be realized.

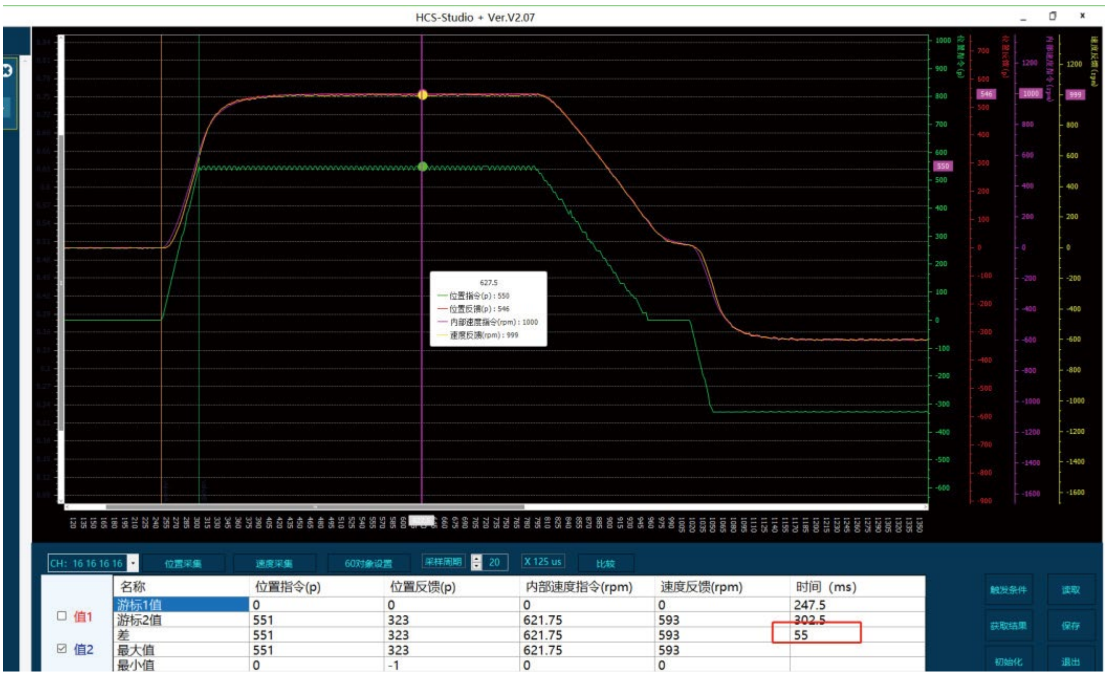
[Case] Using FB284 block configuration mode 2, when ConfigEpos is set to 16#103, first homing, then Position=100000, Velocity=10000, and then Position=-100000, Velocity=6000 immediately after the positioning is completed, as shown in the figure.



Servo parameters setting

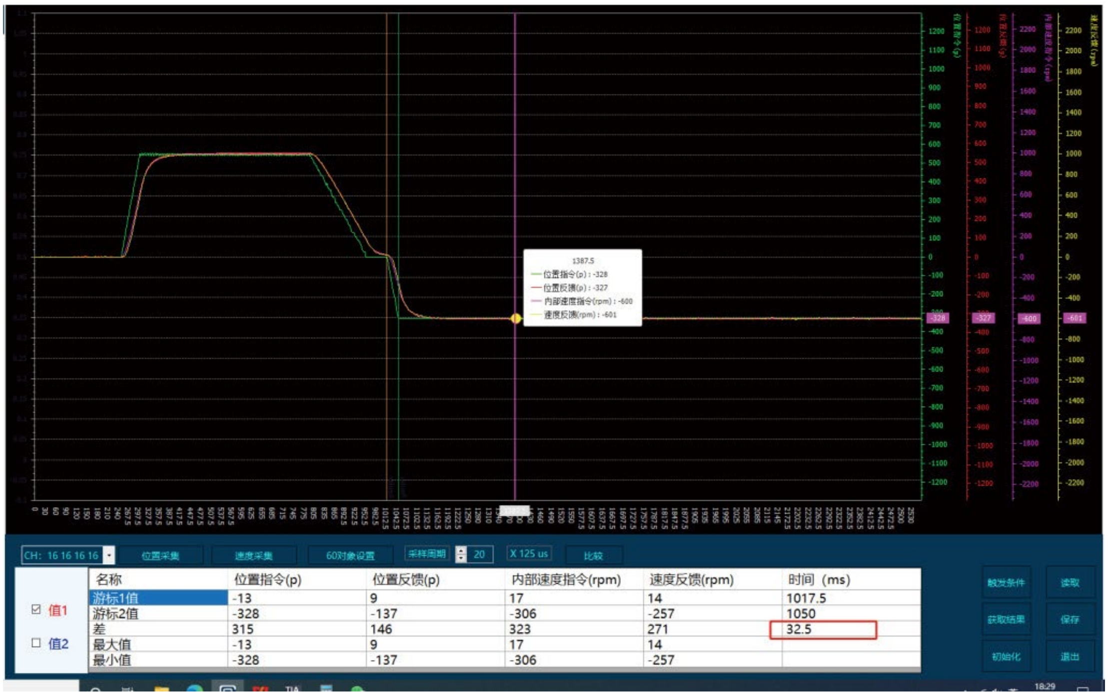
选择修改	分类	编号	参数名称	单位	生效时间	类别	模式	值
☐	15	00	EPOS最大速度(32位)	1000LU/min	立即生效	停机设定	P	50000000
☐	15	02	EPOS最大加速度(32位)	1LU/S2	立即生效	停机设定	P	3000000
☐	15	04	EPOS最大减速度(32位)	1LU/S2	立即生效	停机设定	P	1000000
☐	15	06	EPOS最大斜坡速度(32位)	1LU/S2	立即生效	停机设定	P	2000000
☐	15	08	EPOS位置偏差过大阈值(32位)	1	立即生效	停机设定	P	40000
☐	15	42	EPOS电子齿轮比分子(32位)	1	立即生效	运行设定	P	131072
☐	15	44	EPOS电子齿轮比分母(32位)	1	立即生效	运行设定	P	10000

Relative/absolute positioning acceleration (s) = (10000*1000) / (60*3000000) (s) =55.6 (ms)



Relative/absolute positioning acceleration (s) = (10000*1000) / (60*1000000) (s) = 166.7 (ms)

Relative/absolute positioning acceleration (s) = (6000*) / (60*3000) (s) = 33.3 (ms)



4.4.10 Jog velocity introduction

When using the 111 telegram to configure ModePos=7 in the FB284 module, the jog speed is set using drive parameters P15.14 (Epos Jog1 jog speed) and P15.16 (Epos Jog2 jog speed), and the acceleration and deceleration times for jogs are set using parameters P15.18 (Epos Jog Max Acceleration Time) and P15.18 (Epos Jog Max Deceleration Time). The actual speed of the Jog is related to the speed ratio (OverV), and the acceleration and deceleration speed of the jog is related to the acceleration and deceleration speed ratios (OverAcc and OverDec), so the values of OverV, OverAcc, and OverDec must be configured.

Jog Actual Speed (RPM) = (P15.14 or P15.16*OverV%* Gear Ratio)/Encoder Resolution

Jog Acceleration Time (s) = (P15.14 or P15.16*OverV%) / (P15.18*60*OverAcc%)

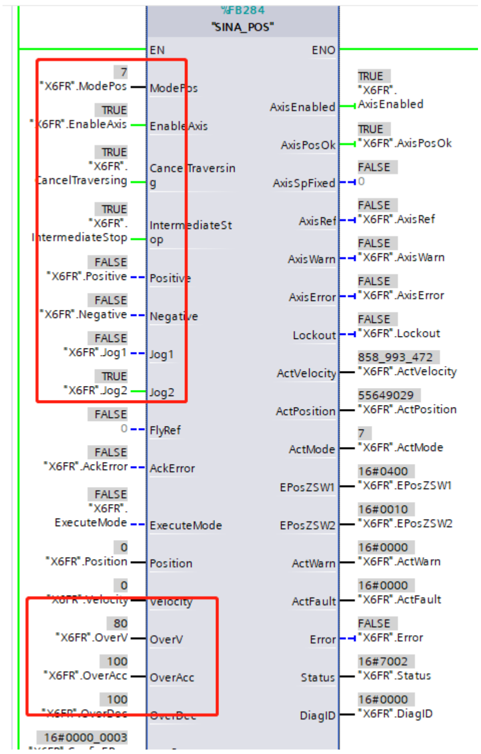
Jog Deceleration Time (s) = (P15.14 or P15.16*OverV%) / (P15.20*60*OverAcc%)

[Example] P15.42=131072, P15.44=10000, Jog2 speed P15.14=30000000Lu/min, Tap acceleration time P15.18=500000, Tap deceleration time P15.20=5000000. overV=80, OverAcc=100 and OverDec=100.

Servo parameter setting

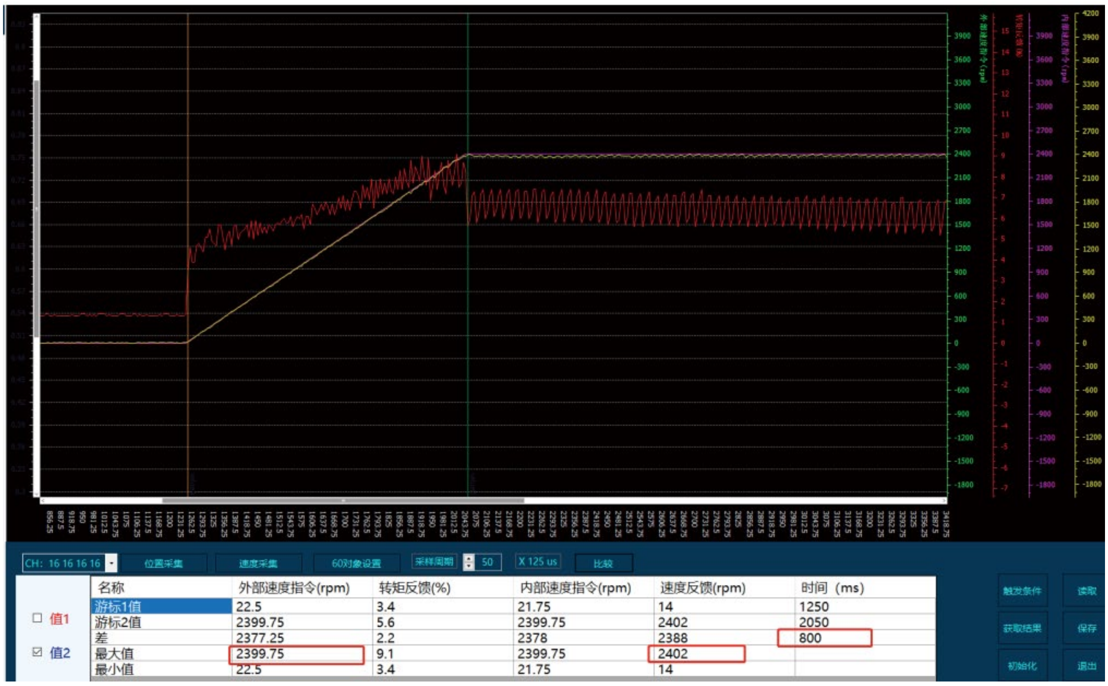
☐	15	14	EPOS JOG速度1(32位)	1LU/min	立即生效	运行设定	PS	-300000
☐	15	16	EPOS JOG速度2(32位)	1LU/min	立即生效	运行设定	PS	30000000
☐	15	18	EPOS JOG最大加速度(32位)	1LU/S2	立即生效	运行设定	PS	500000
☐	15	20	EPOS JOG最大减速度(32位)	1LU/S2	立即生效	运行设定	PS	1000000
☐	15	22	EPOS原点回归类型	1	立即生效	运行设定	P	1
☐	15	23	EPOS原点回归高速速度(32位)	1LU/min	立即生效	运行设定	P	5000000
☐	15	25	EPOS原点回归低速速度(32位)	1LU/min	立即生效	运行设定	P	300000
☐	15	27	EPOS原点复归加减速时间(32位)	1LU/S2	立即生效	运行设定	P	1000000
☐	15	31	EPOS原点复归绝对偏移(32位)	1	立即生效	运行设定	P	0
☐	15	33	EPOS参考坐标值(32位)	1	立即生效	运行设定	P	0
☐	15	35	EPOS原点复归超时时间(32位)	1ms	立即生效	运行设定	P	65535
☐	15	37	EPOS软限位生效方式	1	立即生效	运行设定	P	0
☐	15	38	EPOS软限位正向限制值(32位)	1	立即生效	运行设定	P	2147483647
☐	15	40	EPOS软限位负向限制值(32位)	1	立即生效	运行设定	P	-2147483648
☐	15	42	EPOS电子齿轮比分子(32位)	1	立即生效	运行设定	P	131072
☐	15	44	EPOS电子齿轮比分母(32位)	1	立即生效	运行设定	P	10000

FB284 Setting the speed ratio and acceleration/deceleration ratio

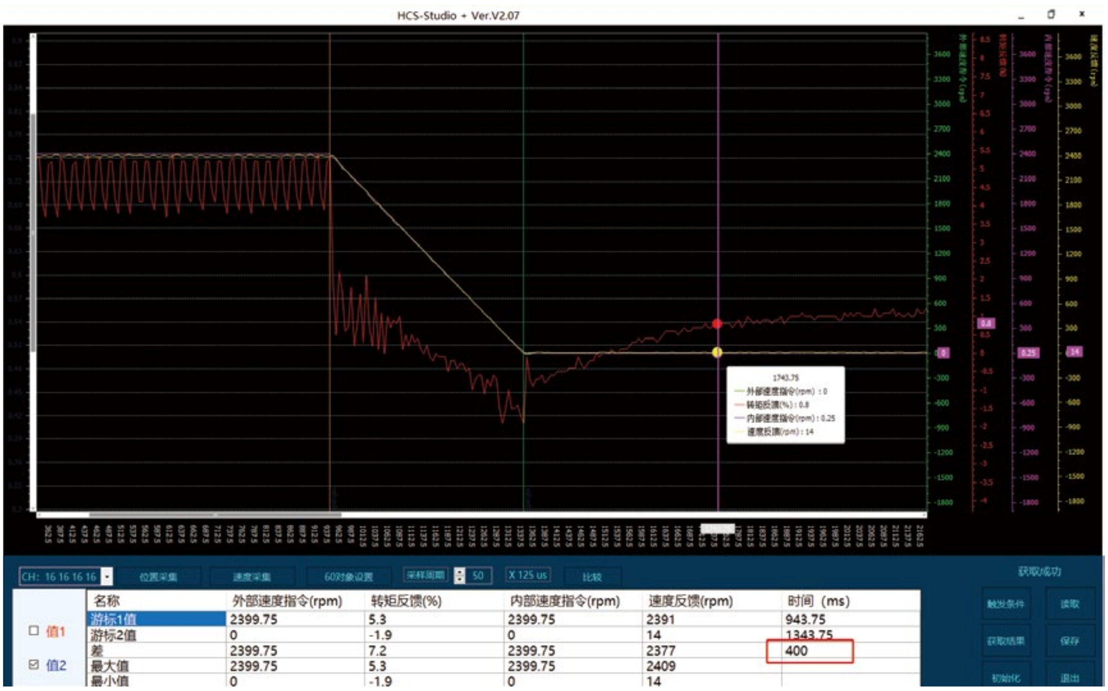


When Jog2 is triggered, Theoretical Jog Actual Speed = (30000000*131072/10000*80%)/131072=2400(RPM), Jog Acceleration Time(s) = (30000000*80%) / (500000*60*100%) = 0.8(s), Jog Deceleration Time(s) = (30000000*80%) / (1000000*60*100%) = 0.4(s).

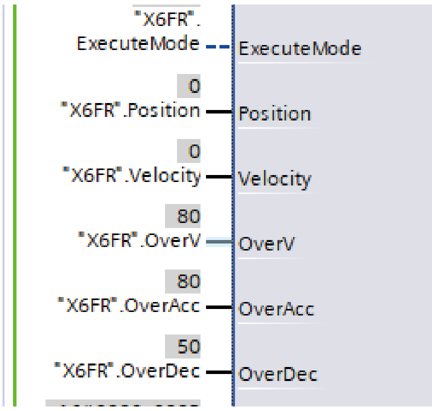
As shown in the figure, the Jog speed is 2400RPM and the acceleration time is 800ms.



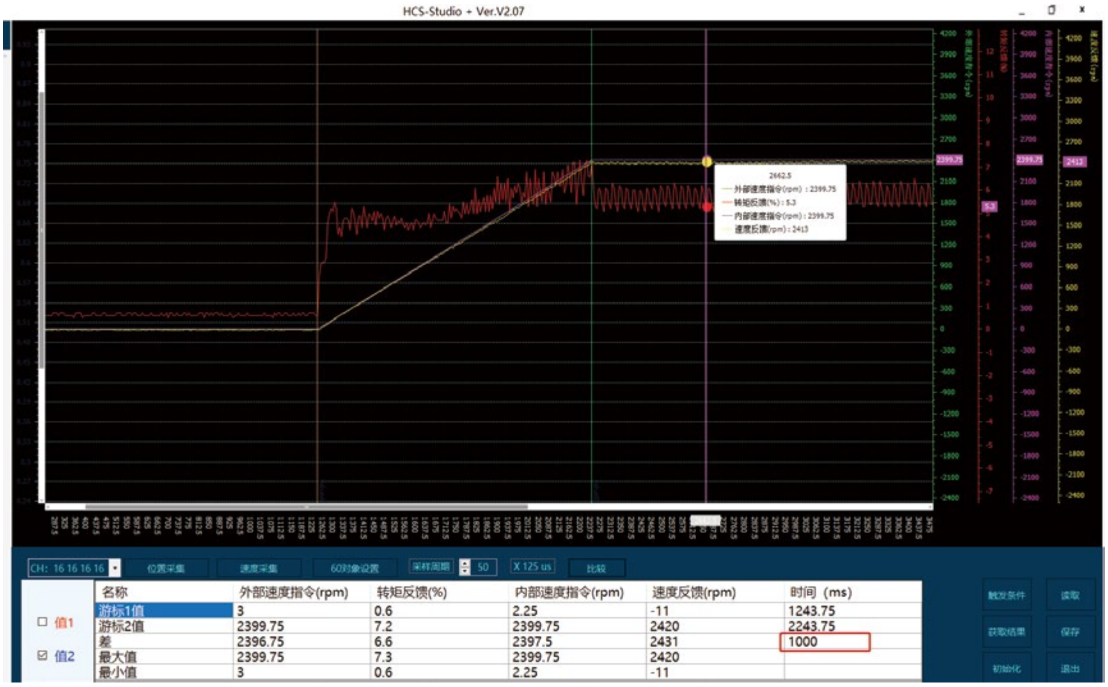
Deceleration time of disable Jog2 is 400ms.



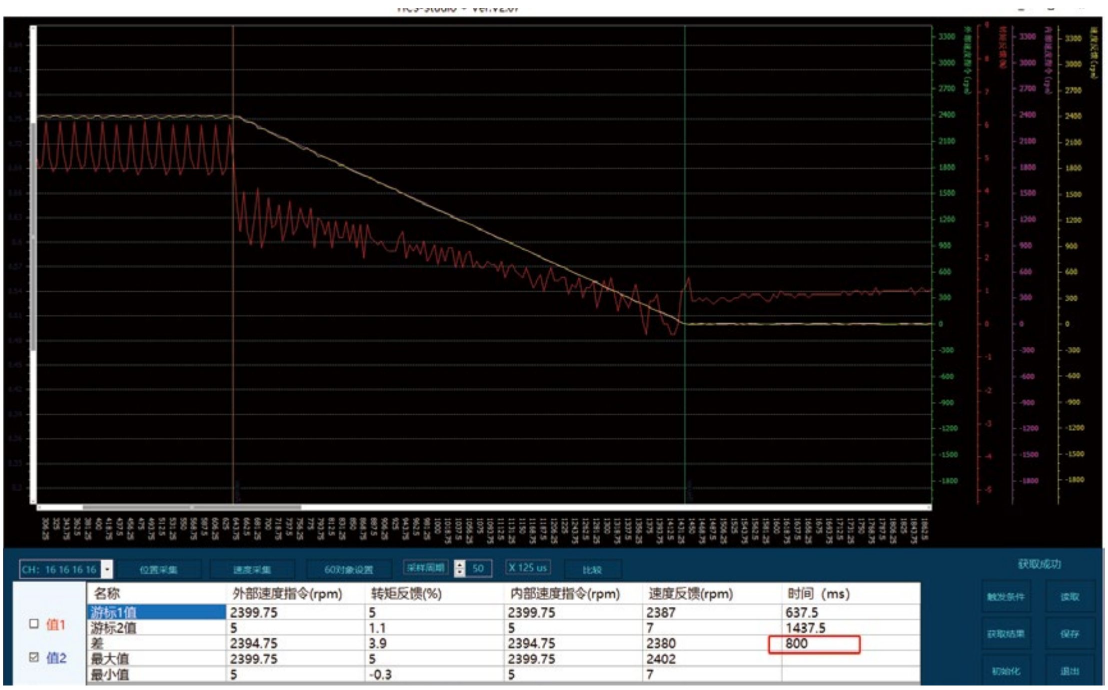
Based on the above, change OverAcc and OverDec to 80 and 50 respectively, Jog acceleration time (s) = (30000000*80%) / (500000*60*80%) = 1 (s), jerk deceleration time (s) = (30000000*80%) / (1000000*60*50%) = 0.8 (s).



The waveform of the jog acceleration time is shown as follow:



The waveform of the jog deceleration time is shown as:



4.4.11 Introduction of telegram 111 homing

There are two types of homing in the 111 telegram, one is active homing (mode 4 on FB284 block), the upper computer just triggers the homing signal, and the homing mode is planned internally by the servo, and the homing mode is set by the servo parameter P15.22, and the specific homing mode, please refer to the introduction of 4.4.12 Homing Mode. The other type of passive homing is to set the current position to the value of the reference point (P15.33). The home switch of active homing can be connected to PLC or servo side, and the limit switch can only be connected to servo. If the home switch is connected to the DI of the PLC, it is necessary to associate the value DI with ConfigEPos.%X6 (EPosSTW2.%X2). EPosSTW2.%X2 corresponds to the function 28 of the internal DI of the servo so that users can only choose one of the two.

(1) Active homing

When using active homing, the default high level of the limit is valid, when no limit is connected, using active homing with the default parameters will report a homing error, so when using active homing, users need to connect the limit switch or use the homing method without limit and set the logic level of the limit to be low and valid. Set the 15.22 homing method, as well as the homing speed, acceleration/deceleration, absolute offset and reference point. The active homing has nothing to do with the speed ratio and acceleration/deceleration ratio on the FB284.

High homing speed recovery (RPM) = (P15.23* Gear ratio) / Encoder resolution

Low homing speed (RPM) = (P15.25* Gear ratio) / Encoder resolution

Acceleration/deceleration time for homing (s) = (P15.23 or P15.25) / (60*P15.27)

[Case] As shown in the figure, the resolution of 23-bit optical motor encoder is 8388608. According to the DI function parameter selection and logic level of P04 group, connect the reversion switch and limit switch to DI1, DI2 and DI4 respectively, and connect DI4 to normally open, and connect DI1 and DI2 to normally close. Set the P15.22 homing method to 28, and the gear ratio to 8388608/10000. Other parameters are default.

Encoder resolution:

18	21	编码器分辨率(32位)	1PPR	再次上电	停机设定	PST	8388608
18	23	Z 对应电电角度	0.1°	再次上电	停机设定	PST	0

DI functions and logic levels:

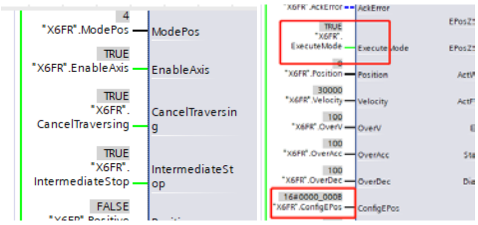
□	04	01	DI1端子功能选择	1	立即生效	停机设定	PST	14
□	04	02	DI2端子功能选择	1	立即生效	停机设定	PST	15
□	04	03	DI3端子功能选择	1	立即生效	停机设定	PST	30
□	04	04	DI4端子功能选择	1	立即生效	停机设定	PST	28

□	04	11	DI1端子逻辑选择	1	立即生效	停机设定	PST	1
□	04	12	DI2端子逻辑选择	1	立即生效	停机设定	PST	1
□	04	13	DI3端子逻辑选择	1	立即生效	停机设定	PST	0
□	04	14	DI4端子逻辑选择	1	立即生效	停机设定	PST	0

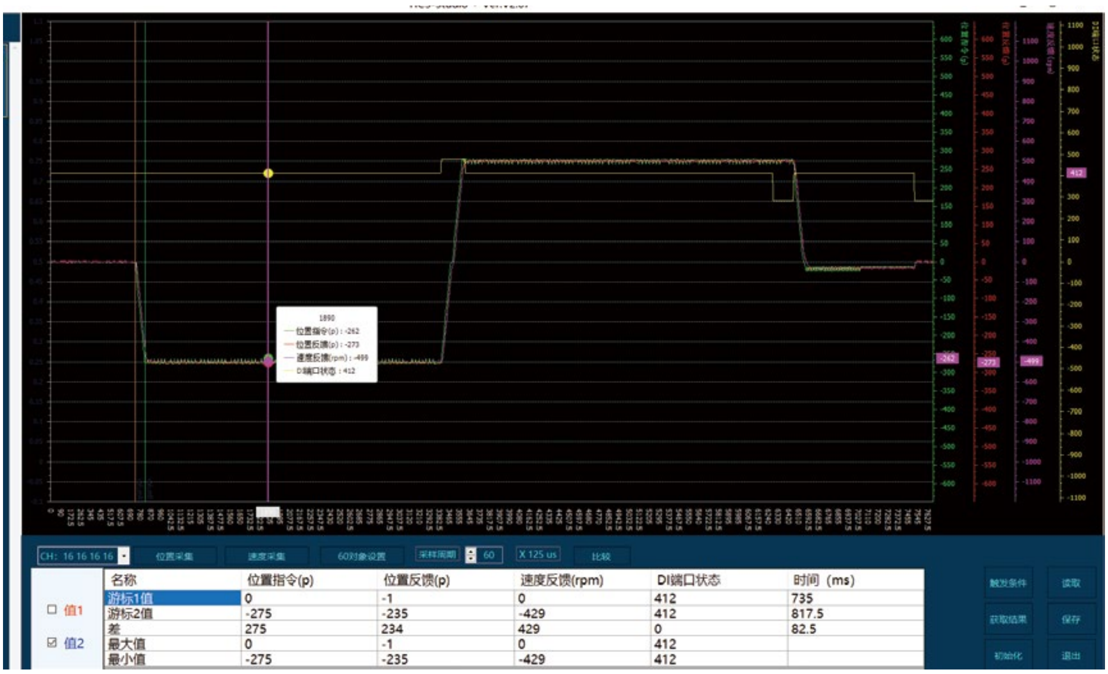
Homing method and gear ratios:

□	15	20	EPOS JOG最大减速度(32位)	1LU/S2	立即生效	运行设定	PS	500000
□	15	22	EPOS原点回归类型	1	立即生效	运行设定	P	28
□	15	23	EPOS原点回归高速速度(32位)	1LU/min	立即生效	运行设定	P	5000000
□	15	25	EPOS原点回归低速速度(32位)	1LU/min	立即生效	运行设定	P	300000
□	15	27	EPOS原点复归加减速时间(32位)	1LU/S2	立即生效	运行设定	P	1000000
□	15	29	EPOS原点复归相对偏移(32位)	1	立即生效	运行设定	P	0
□	15	31	EPOS原点复归绝对偏移(32位)	1	立即生效	运行设定	P	0
□	15	33	EPOS参考坐标值(32位)	1	立即生效	运行设定	P	0
□	15	35	EPOS原点复归超时时间(32位)	1ms	立即生效	运行设定	P	65535
□	15	37	EPOS软限位生效方式	1	立即生效	运行设定	P	0
□	15	38	EPOS软限位正向限制值(32位)	1	立即生效	运行设定	P	2147483647
□	15	40	EPOS软限位负向限制值(32位)	1	立即生效	运行设定	P	-2147483648
□	15	42	EPOS电子齿轮比分子(32位)	1	立即生效	运行设定	P	8388608
□	15	44	EPOS电子齿轮比分母(32位)	1	立即生效	运行设定	P	10000

Use the servo DI terminal homing configuration (ConfigEPos.%X5 (EPosSTW2.%X2) can not be set to 1 otherwise it will result in a homing error).

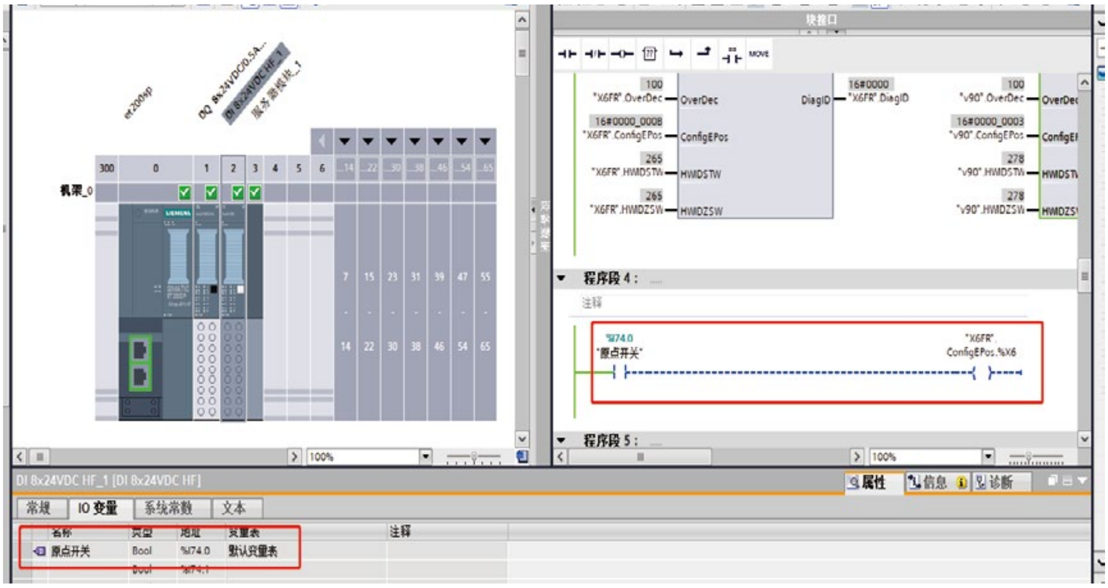


The waveform of the starting motor position stopped between the home switch and the negative limit is shown below. The motor runs in the negative direction at a high speed, decelerates and stops when it encounters the ON state of NL, and then runs in the positive direction at a high speed. The motor runs in the positive direction, decelerates and stops when it encounters the ON → OFF state of HSW, and then switches to low speed and runs in the negative direction. Decelerates and stops when HSW is OFF → ON in low-speed negative operation, and the stopping position is used as the home position. This corresponds to the home return method No. 28.



High-speed homing speed is 500RPM homing low speed is 30RPM and homing acceleration time = 5000000/(60*1000000)=0.0833s,

Homing via PLC DI terminal , (DI function must be configured with 28, otherwise it can not return to the original, the servo terminal DI can not be connected).



(2) Passive homing

When FB284 configuration mode 5 is activated with ExecuteMode (POS_STW2.1 direct setting of reference point set to 1), the current value is directly set to the value of P15.33.

4.4.12 Telegram 111 homing method

111 telegram homing method is set by servo internal parameter P15.22. 35 homing methods are defined in the servo, as shown in Table 4-1 below:

HSW: Origin position sensor signal

NL: Negative limit signal

PL: Positive limit signal

ON: Valid state of the signal

OFF: Invalid state of the signal

OFF → ON: Jump edge from invalid state to valid state of the signal

ON → OFF: Jump edge from valid state to invalid state of the signal

The following describes the various origin mode operation trajectories and signal state changes. The meaning of the symbols is shown in Figure 4-1.

Table 4-1 List of supported homing methods

Homing mode	Description
0	No homing mode assigned
1	The axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the NL, and then reverses back to find the nearest Z pulse position and sets it as the origin.
2	The axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the PL, and then reverses back to find the nearest Z pulse position and sets it as the origin.
3	If the HSW is invalid when starting, the axis runs in a positive direction, otherwise, it runs in a negative direction. After encountering the ON → OFF state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.
4	If the HSW is invalid when starting, it runs in a positive direction, otherwise, it runs in a negative direction. After encountering the OFF → ON state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position as the origin.

5	If the HSW is invalid when starting, the axis runs in a negative direction, otherwise, it runs in a positive direction. After encountering the ON → OFF state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.
6	If the HSW is invalid when starting, the axis runs in a negative direction, otherwise, it runs in a positive direction. After encountering the ON → OFF state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.
7	If the HSW is invalid when starting, the axis runs in a positive direction, otherwise, it runs in a negative direction. After encountering the ON → OFF state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.
8	If the HSW is invalid when starting, the axis runs in a positive direction, otherwise, it runs in a negative direction. After encountering the OFF → ON state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.
9	The axis runs in the positive direction when starting, regardless of whether HSW is valid or invalid. After encountering the OFF → ON state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.
10	The axis runs in the positive direction when starting, regardless of whether HSW is valid or invalid. After encountering the ON → OFF state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.
11	If the HSW is invalid when starting, the axis runs in a negative direction, otherwise, it runs in a positive direction. After encountering the ON → OFF state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.
12	If the HSW is invalid when starting, the axis runs in a negative direction, otherwise, it runs in a positive direction. After encountering the OFF → ON state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.
13	The axis runs in the negative direction when starting, regardless of whether HSW is valid or invalid. After encountering the OFF → ON state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.
14	The axis runs in the negative direction when starting, regardless of whether HSW is valid or invalid. After encountering the ON → OFF state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.
15	Reserved
16	Reserved
17	Similar to Mode 1, but instead of finding the Z pulse, the OFF → ON state position of NL encountered during negative operation is used as the origin.
18	Similar to Mode 2, but instead of finding the Z pulse, the OFF → ON state position of PL encountered during positive running is used as the origin.
19	Similar to Mode 3, but instead of finding the Z pulse, the ON → OFF state position of HSW encountered during negative running is used as the origin.
20	Similar to Mode 4, but instead of finding the Z pulse, the OFF → ON state position of HSW encountered during positive running is used as the origin.
21	Similar to Mode 5, but instead of finding the Z pulse, the ON → OFF state position of HSW encountered during positive running is used as the origin.
22	Similar to Mode 6, but instead of finding the Z pulse, the OFF → ON state position of HSW encountered during negative running is used as the origin.
23	Similar to Mode 7, but instead of finding the Z pulse, the ON → OFF state position of HSW encountered during negative running is used as the origin.
24	Similar to Mode 8, but instead of finding the Z pulse, the OFF → ON state position of HSW encountered during positive running is used as the origin.
25	Similar to Mode 9, but instead of finding the Z pulse, the OFF → ON state position of HSW encountered during negative running is used as the origin.

26	Similar to Mode 10, but instead of finding the Z pulse, the ON → OFF state position of HSW encountered during positive running is used as the origin.
27	Similar to Mode 11, but instead of finding the Z pulse, the ON → OFF state position of HSW encountered during positive running is used as the origin.
28	Similar to Mode 12, but instead of finding the Z pulse, the OFF → ON state position of HSW encountered during negative running is used as the origin.
29	Similar to Mode 13, but instead of finding the Z pulse, the OFF → ON state position of HSW encountered during positive running is used as the origin.
30	Similar to Mode 14, but instead of finding the Z pulse, the ON → OFF state position of HSW encountered during negative running is used as the origin.
31	Reserved
32	Reserved
33	Find the nearest Z pulse as the origin when running in a negative direction
34	Find the nearest Z pulse as the origin when running in a positive direction
35	Set the current position as the origin

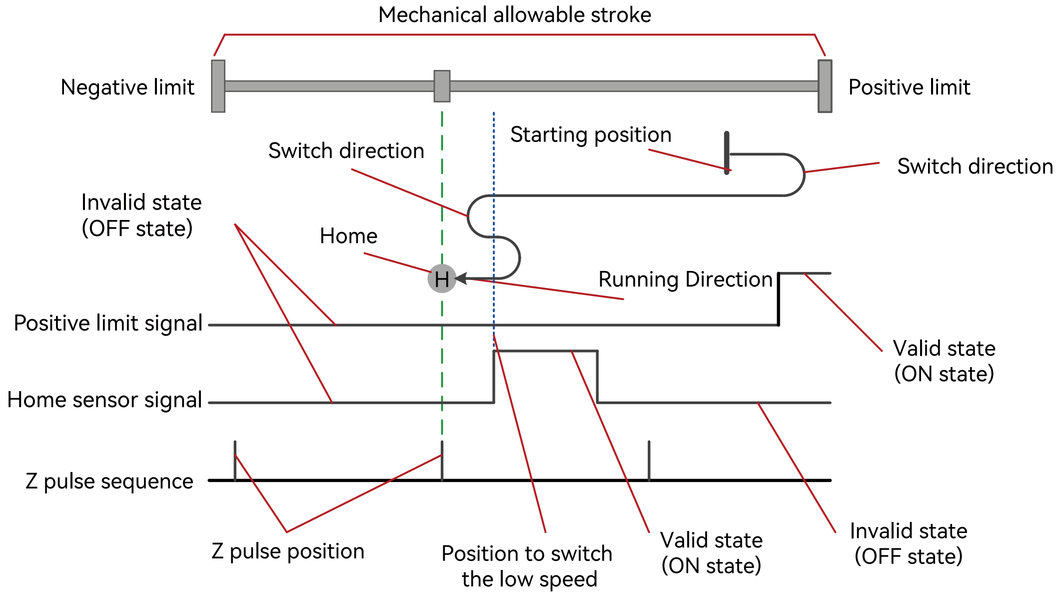


Figure 4-1 Significance of the various icons in the origin model illustration

In general, it is recommended to use Home Mode 3~6, 19~22, when the OFF/ON state of HSW divides the entire allowable travel range of the machine into two parts, because in these eight modes, whenever NL or PL is encountered, the machine stops and alarms, and does not automatically reverse the search for the home position.

It is recommended that the home position modes 7~14 and 23~30 be used when the ON state of the HSW divides the entire allowable travel range of the machine into three parts, in which case the ON state interval occupies a very small portion of the entire allowable travel range of the machine (i.e., the ON state is a short-term transient state).

The above is only a suggestion, not a mandatory requirement.

1, Mode 1, find Negative Limit and Z pulse

If the NL is invalid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the NL, and it runs in a positive direction at a low speed. After encountering the ON → OFF state of the NL, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.

If the NL is valid when starting, the axis runs in a positive direction at a low speed. After encountering the ON → OFF state of the NL, keep the axis running to find the nearest Z pulse position and set it as the origin.

As shown in Figure 4-2, refer to table 4-1.

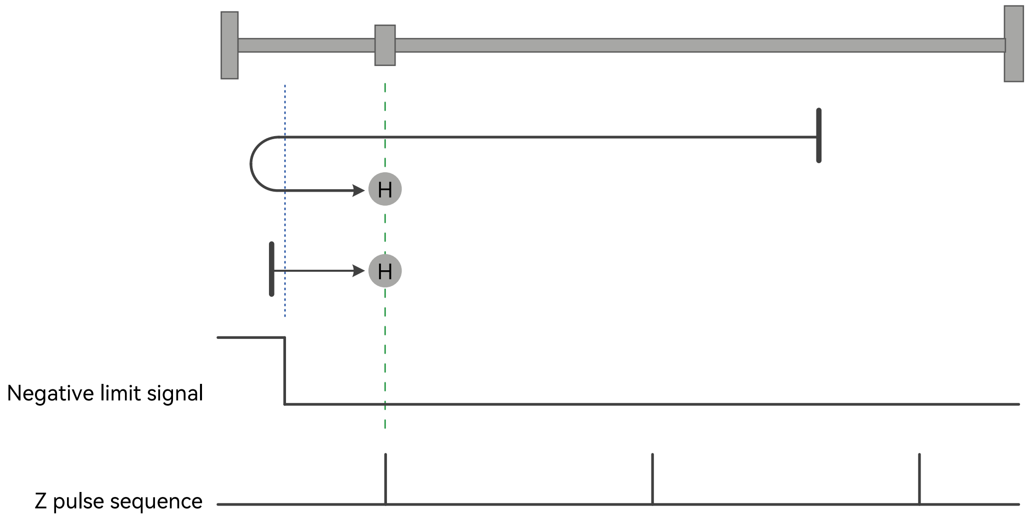


Figure 4-2 Homing mode 1 trajectory and signal status

2, Mode 2, find Positive Limit and Z pulse

If the PL is invalid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the PL, and it runs in a negative direction at a low speed. After encountering the ON → OFF state of the PL, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.

If the PL is valid when starting, the axis runs in a negative direction at a low speed. After encountering the ON → OFF state of the PL, keep the axis running to find the nearest Z pulse position and set it as the origin.

As shown in Figure 4-3, refer to table 4-1.

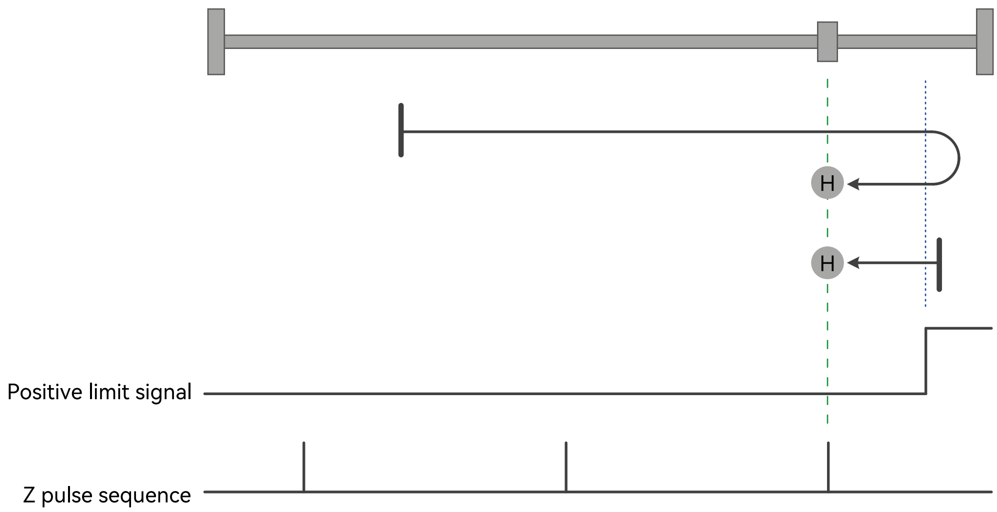


Figure 4-3 Homing mode 2 trajectory and signal status

3, Mode 3, find the HSW ON→OFF position and Z pulse when running in a negative direction

If the HSW is invalid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW, and it runs in a negative direction at a low speed. After encountering the ON → OFF state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW, then reverses back to the HSW valid position at high speed and runs in a negative direction at a low speed after decelerating to stop. After encountering the ON → OFF state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.

In this homing method, no matter encountering NL or PL at the ON state, stopthe homing process and ALarm.

As shown in Figure 4-4, refer to table 4-1

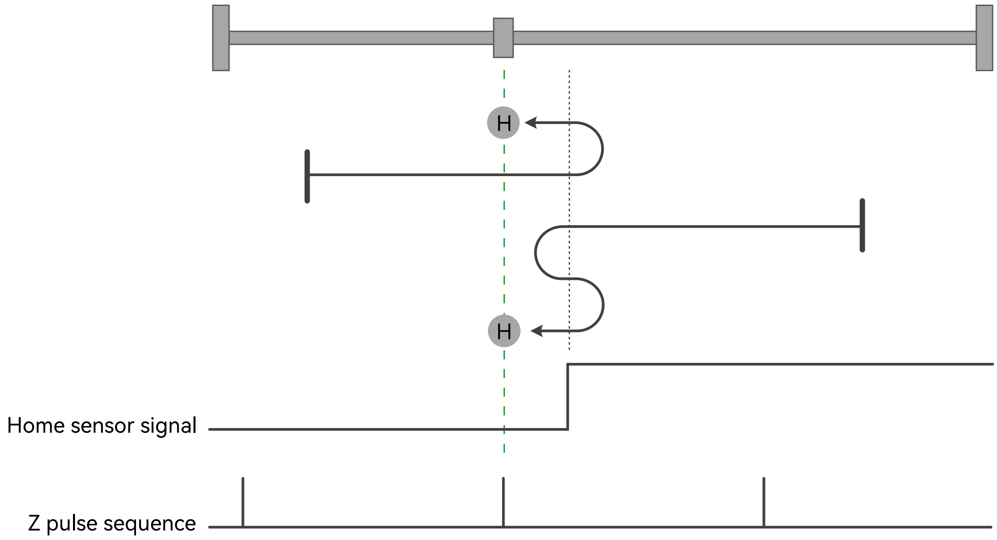


Figure 4-4 Homing mode 3 trajectory and signal status

4, Mode 4, find HSW OFF→ON position and Z pulse when running in positive direction.

If the HSW is invalid when starting, it runs in positive direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW, then reverses back to the HSW invalid position at high speed and decelerates to stop, then runs in a positive direction at low speed. After encountering the OFF → ON state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position as the origin. If the HSW is valid when starting, it runs in negative direction at a high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and runs in a positive direction at a low speed. After encountering the OFF → ON state of the HSW, runs in the positive direction at low speed to find the nearest Z pulse position as the origin. In this homing method,no matter encountering NL or PL at ON state, stops the homing process and Alarm.

As shown in Fig.4.5, refer to table 4-1.

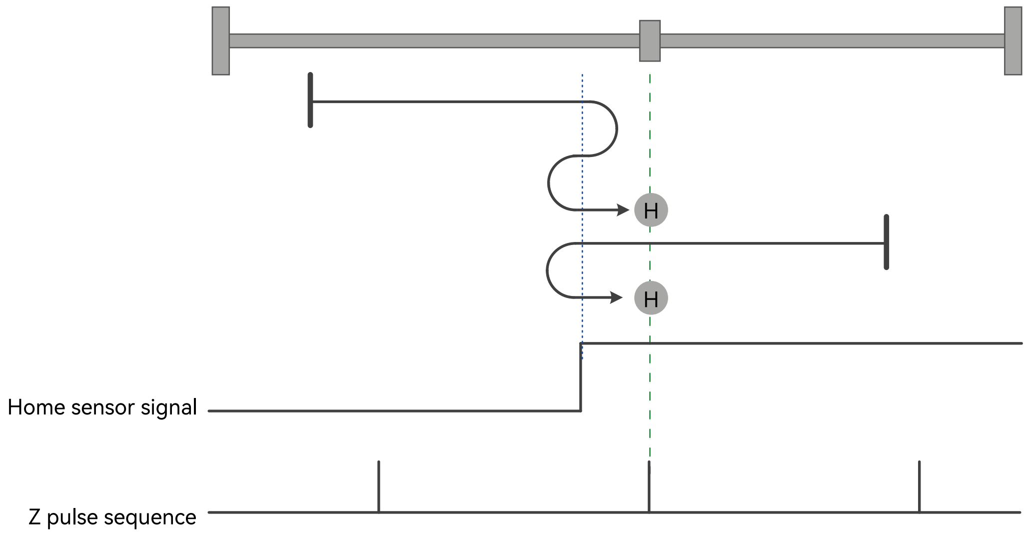


Figure 4-5 Homing mode 4 trajectory and signal status

5, Mode 5, find the HSW ON→OFF position and Z pulse when running in a positive direction.

If the HSW is invalid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW, and it runs in a positive direction at a low speed. After encountering the ON → OFF state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW, then reverses back to the HSW valid position at high speed and runs in a positive direction at a low speed after it decelerates to stop. After encountering the ON → OFF state of the HSW, the axis runs in a positive direction at a low speed to find the nearest Z pulse position and set it as the origin.

In this homing method, no matter encountering NL or PL at the ON state, stop the homing process and ALarm.

As shown in Figure 4-6, refer to table 4-1

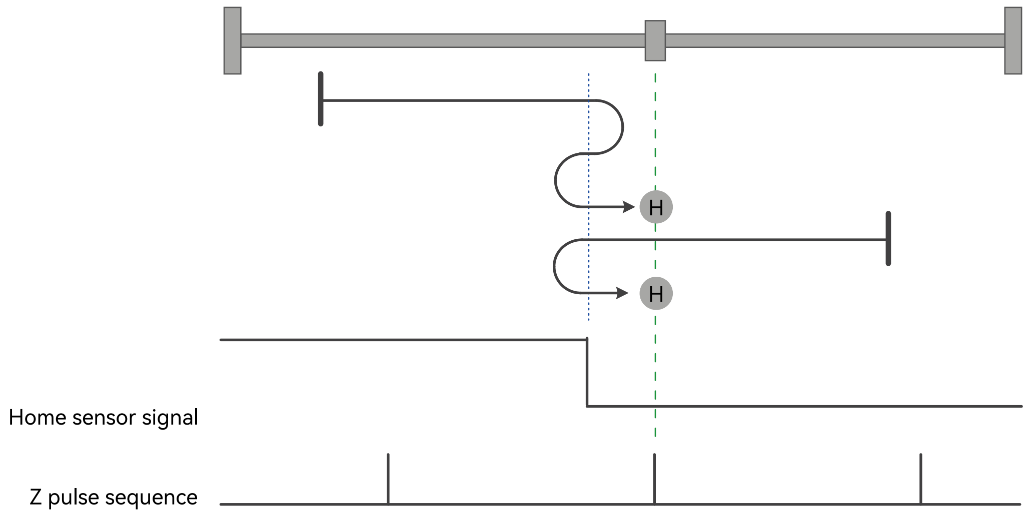


Figure 4-6 Homing mode 5 trajectory and signal status

6, Mode 6, find the HSW OFF → ON position and Z pulse when running in a negative direction.

If the HSW is invalid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW, then reverses back to the HSW invalid position at high speed and decelerates to stop, then runs in a negative direction at a low speed . After encountering the OFF → ON state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW, and it runs in a negative direction at a low speed. After encountering the OFF → ON state of the HSW, the axis runs in a negative direction at a low speed to find the nearest Z pulse position and set it as the origin.

In this homing method, no matter encountering NL or PL at the ON state, stop the homing process and ALarm.

As shown in Figure 4-7, refer to table 4-1

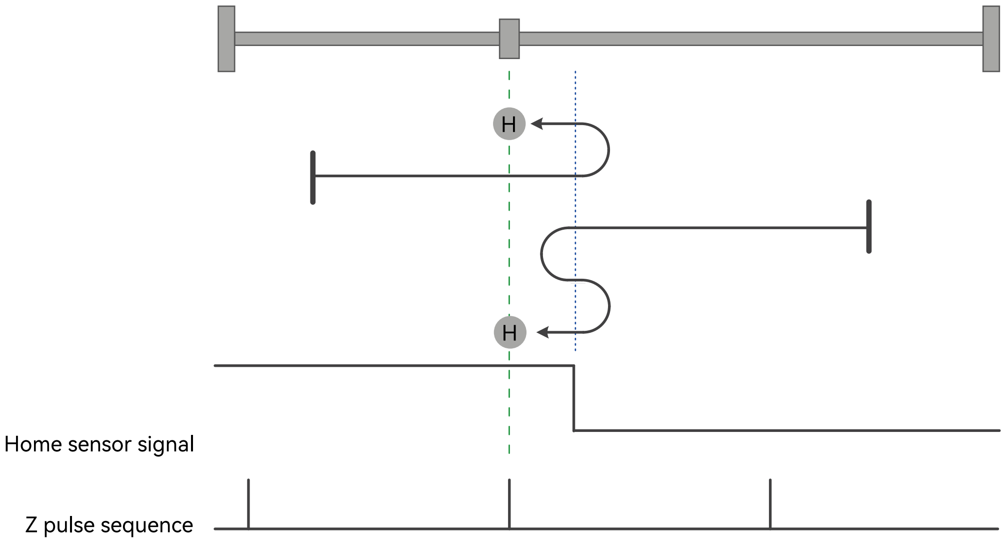


Figure 4-7 Homing mode 6 trajectory and signal status

7, Mode 7, find the HSW ON → OFF position and Z pulse when running in a negative direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the ON state of PL and runs in a negative direction at a high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then it runs in a negative direction at a low speed. Finds the nearest Z pulse position, and sets it as the origin after encountering the ON → OFF state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the ON → OFF state of HSW.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering ON → OFF state of HSW and reverses back to the HSW valid position at high speed, and the axis decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then it runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for the second time, stops the homing process and Alarm

Figure 4-8, refer to table 4-1

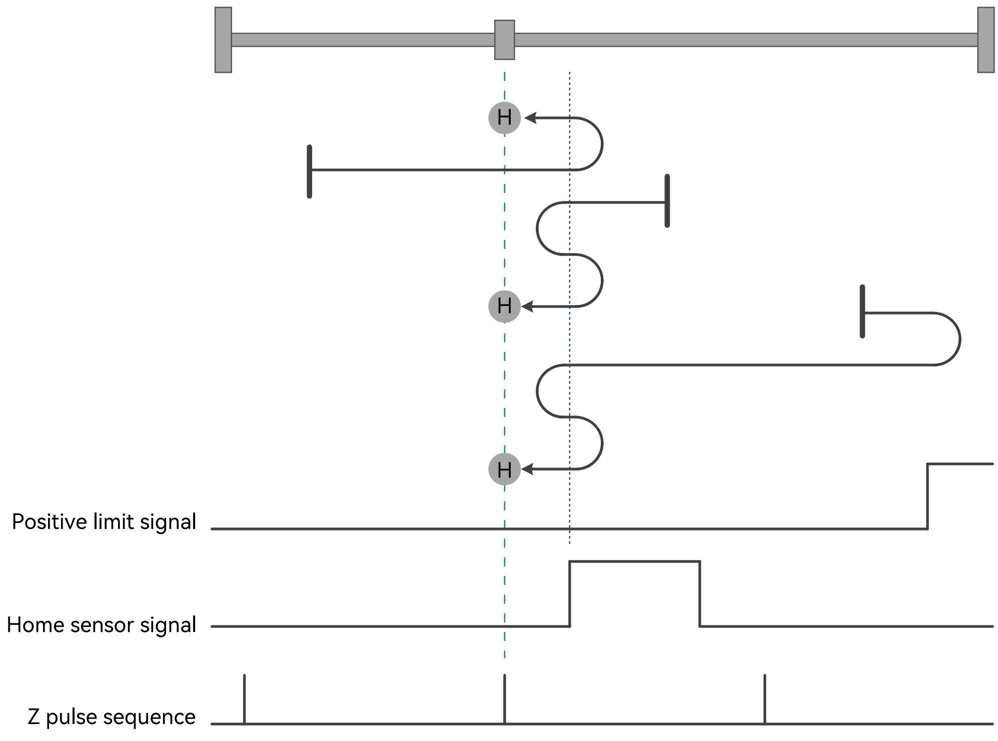


Figure 4-8 Homing mode 7 trajectory and signal status

8, Mode 8, find the HSW OFF → ON position and Z pulse when running in a positive direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON state of PL and runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and reverses back to the HSW invalid position at high speed, and it decelerates to stop, then the axis runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and the axis runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for a second time, stops the homing process and Alarm.

As shown in Figure 4-9, refer to table 4-1.

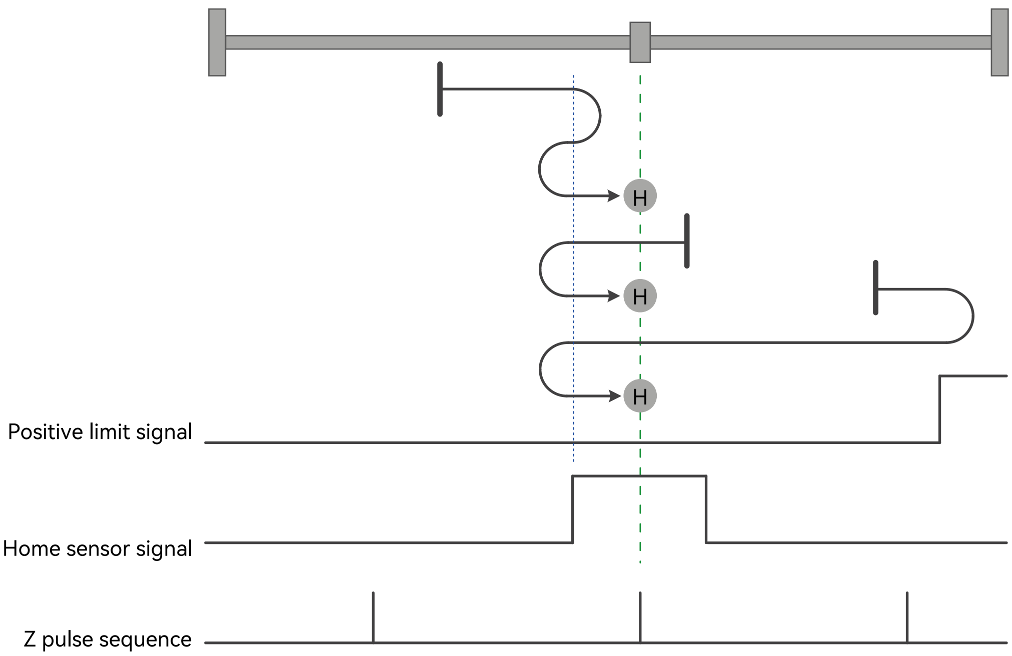


Figure 4.9 Homing mode 8 trajectory and signal status

9, Mode 9, find the HSW OFF → ON position and Z pulse when running in a negative direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the ON state of PL and runs in a negative direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and reverses back to the HSW invalid position at high speed, and it decelerates to stop, then runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and the axis runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for a second time, stops the homing process and Alarm

As shown in Figure 4-10, refer to table 4-1

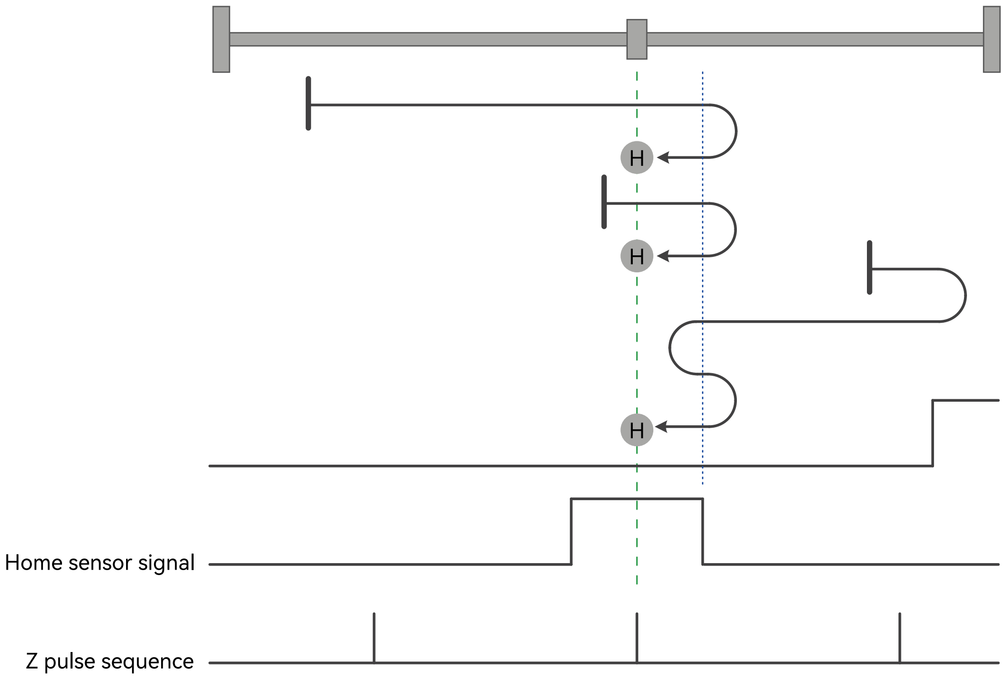


Figure 4-10 Homing mode 9 trajectory and signal status

10, Mode 10, find the HSW ON → OFF position and Z pulse when running in a positive direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the ON state of PL and it runs in a negative direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the ON → OFF state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed, and decelerates to stop (If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then it runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed, and decelerates to stop (If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then it runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for a second time, stops the homing process and Alarm

As shown in Figure 4-11, refer to table 4-1.

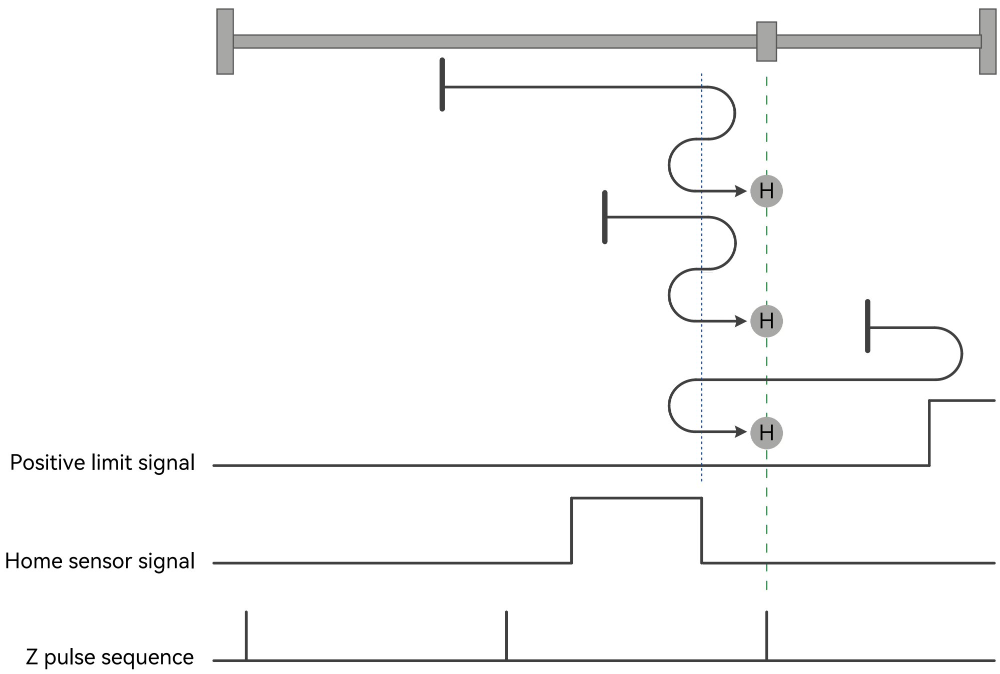


Figure 4-11 Homing mode 10 trajectory and signal status

11, Mode 11, find the HSW ON → OFF position and Z pulse when running in a positive direction while encountering NL

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop (If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of HSW.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering ON → OFF state of HSW, reverses back to the HSW valid position at high speed, and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm

As shown in Figure 4-12, refer to table 4-1.

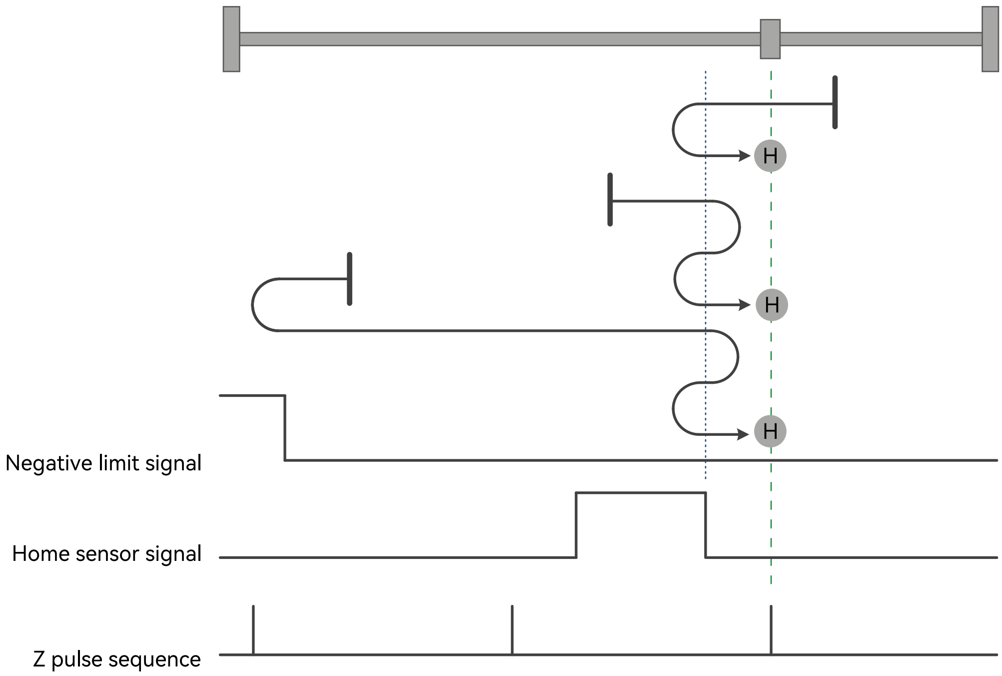


Figure 4-12 Homing mode 11 trajectory and signal status

12, Mode 12, find the HSW OFF → ON position and Z pulse when running in a positive direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and reverses back to the HSW invalid position at high speed and decelerates to stop, then the axis runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and the axis runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the OFF → ON state of HSW.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encounters the OFF → ON state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm

As shown in Figure 4-13, refer to Table 4-1

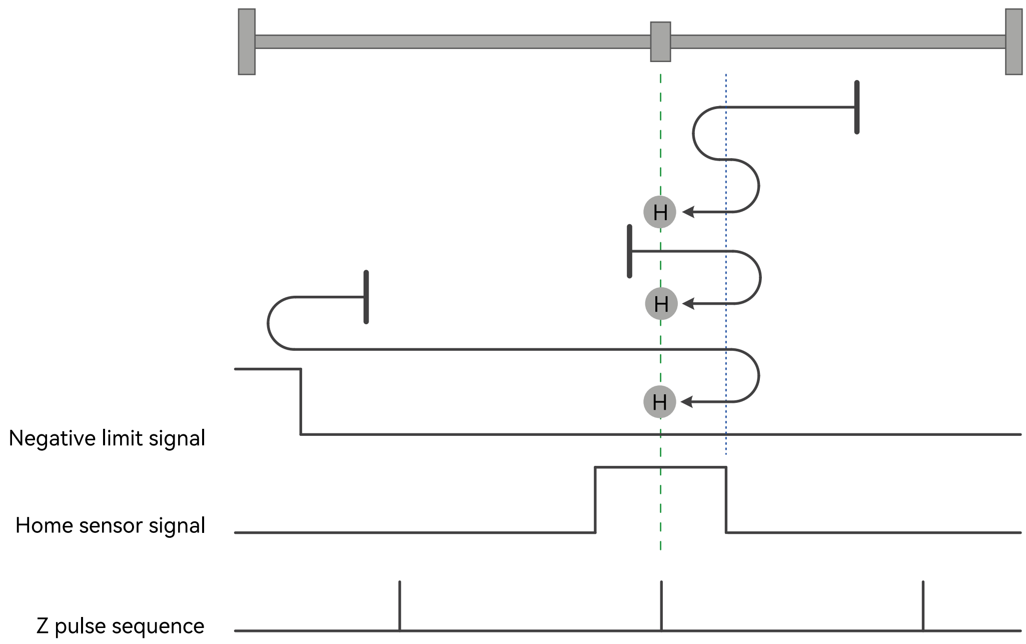


Figure 4-13 Homing mode 12 trajectory and signal status

13, Mode 13, find the HSW OFF → ON position and Z pulse when running in a positive direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at low speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a positive direction at a low speed, Find the nearest Z pulse position and set it as the origin after the axis encounters the OFF → ON state of HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and reverses back to the HSW invalid position at high speed and decelerates to stop, then runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the OFF → ON state of HSW.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a positive direction at a low speed. Find the nearest Z pulse position and set it as the origin after the axis encountering the OFF → ON state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm

As shown in Figure 4-14, refer to Table 4-1.

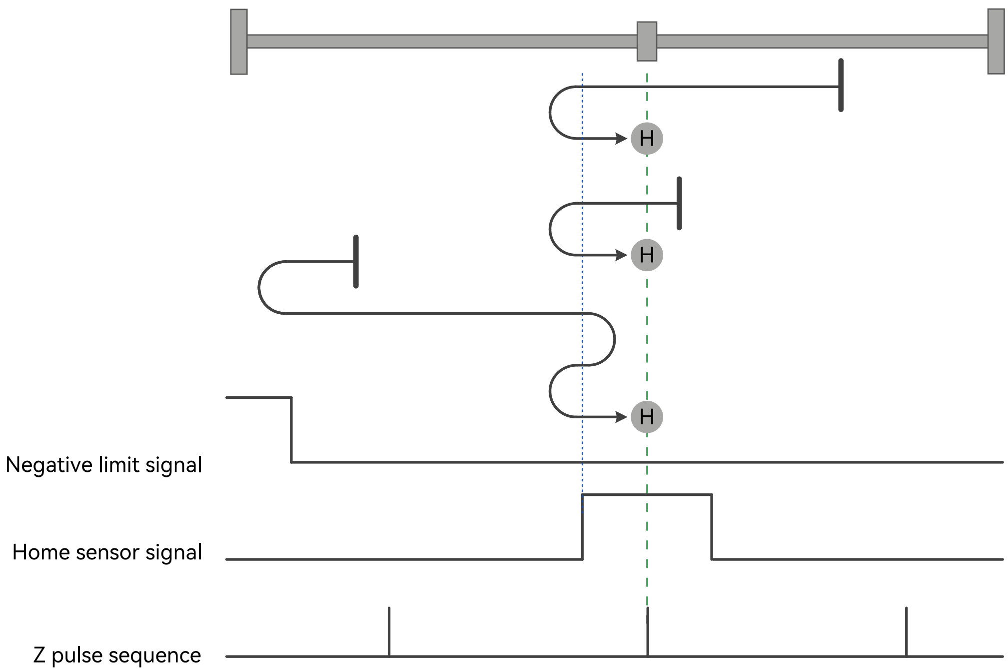


Figure 4-14 Homing mode 13 trajectory and signal status

14, Mode 14, find the HSW ON → OFF position and Z pulse when running in a negative direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering ON → OFF state of the HSW and reverses back to the HSW valid position at high speed and decelerates to stop (If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of the HSW.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and runs in a negative direction at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of HSW.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to HSW valid position at high speed and decelerates to stop, then runs in a negative position at a low speed. Find the nearest Z pulse position and set it as the origin after encountering the ON → OFF state of HSW.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for a second time, stops the homing process and Alarm

As shown in Figure 4-15, refer to Table 4-1.

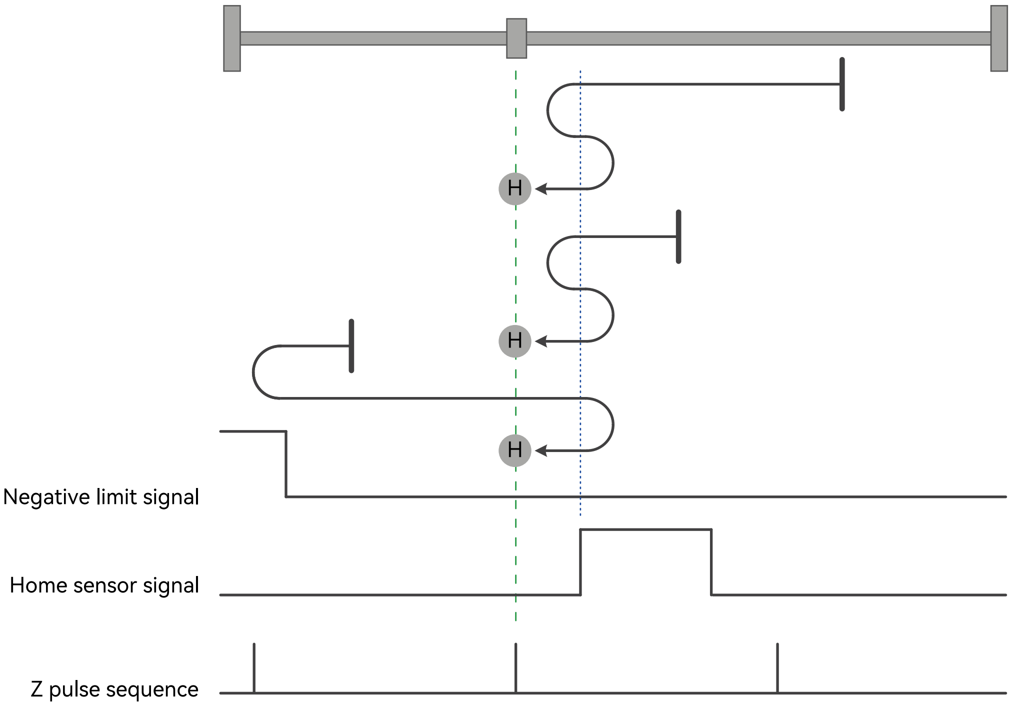


Figure 4-15 Homing mode 14 trajectory and signal status

15, Mode 15，Reserved，do not set.

16, Mode 16，Reserved，do not set.

17, Mode 17, find NL

If the NL is invalid when starting, the axis runs in a negative direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of NL and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the NL and sets the stop position as the origin.

If the NL is valid when starting, the axis runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of NL, set stop position as the origin.

As shown in Figure 4-16, refer to Table 4-1

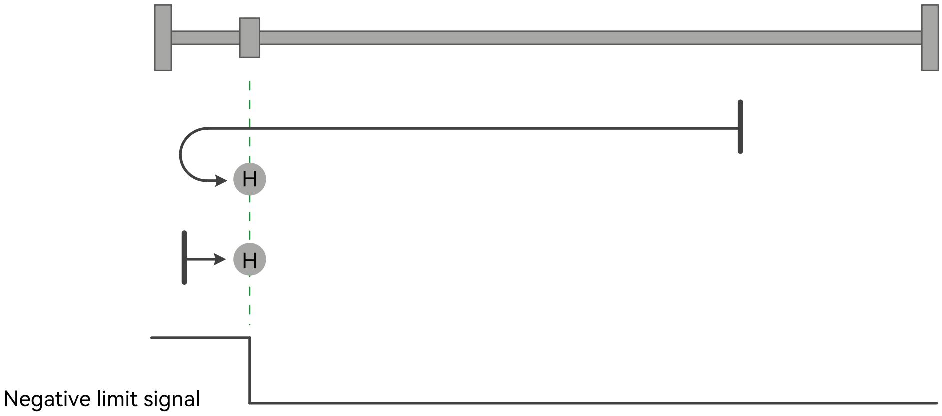


Figure 4-16 Homing mode 17 trajectory and signal status

18, Mode 18, find PL

If the PL is invalid when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of PL and runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the PL and sets the stop position as the origin.

If the PL is valid when starting, the axis runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of PL, setting stop position as the origin.

As shown in Figure 4-17, refer to Table 4-1.

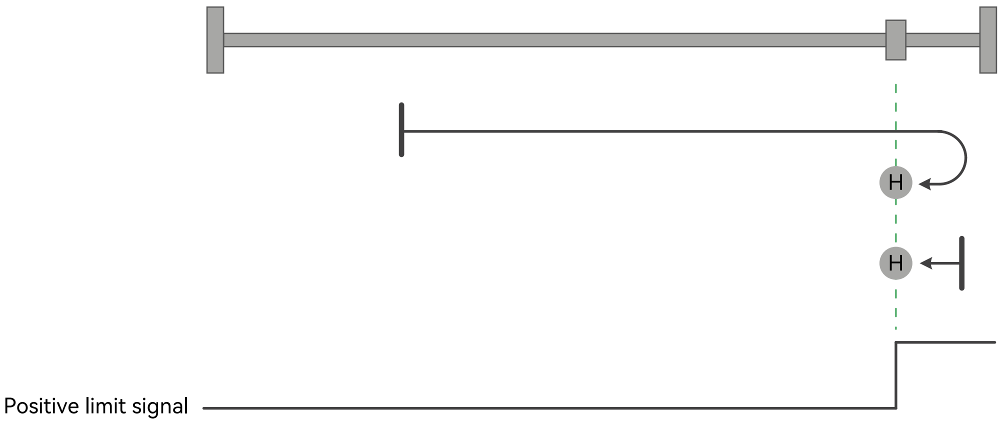


Figure 4-17 Homing mode 18 trajectory and signal status

19, Mode 19, find the HSW ON→OFF position when running in a negative direction

If the HSW is invalid when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a negative direction at a high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and reverses back to the HSW valid position at high speed and decelerates to stop, then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

In this homing method, no matter encountering the PL or NL in the ON state, the homing process will stop, and Alarm.

As shown in Figure 4-18, refer to Table 4-1.

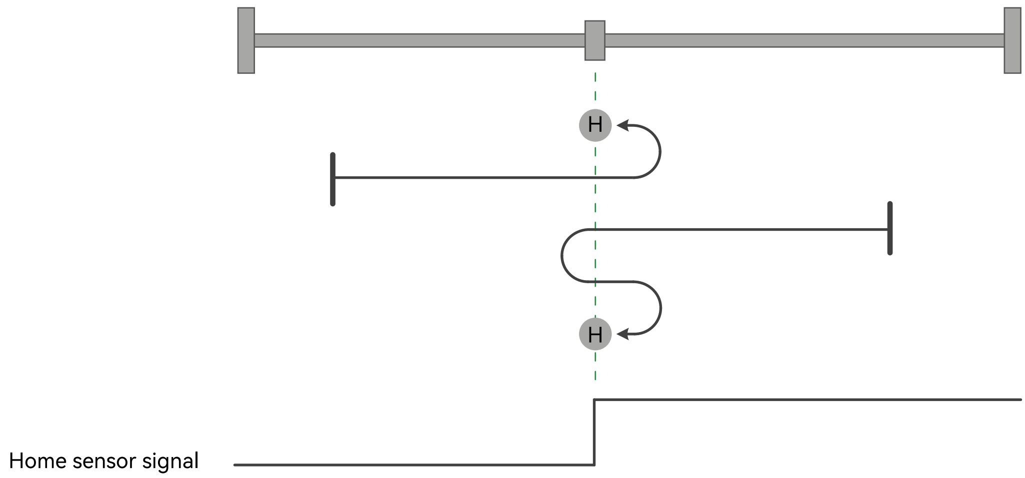


Figure 4-18 Homing mode 19 trajectory and signal status

20, Mode 20, find the HSW OFF→ON position when running in a positive direction

If the HSW is invalid when starting, the axis runs in a positive direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and reverses back to the HSW invalid position at high speed and decelerates to stop, then runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

IF the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

In this homing method, no matter encountering the PL or NL in the ON state, the homing process will stop, and Alarm.

As shown in Figure 4-19, refer to Table 4-1.

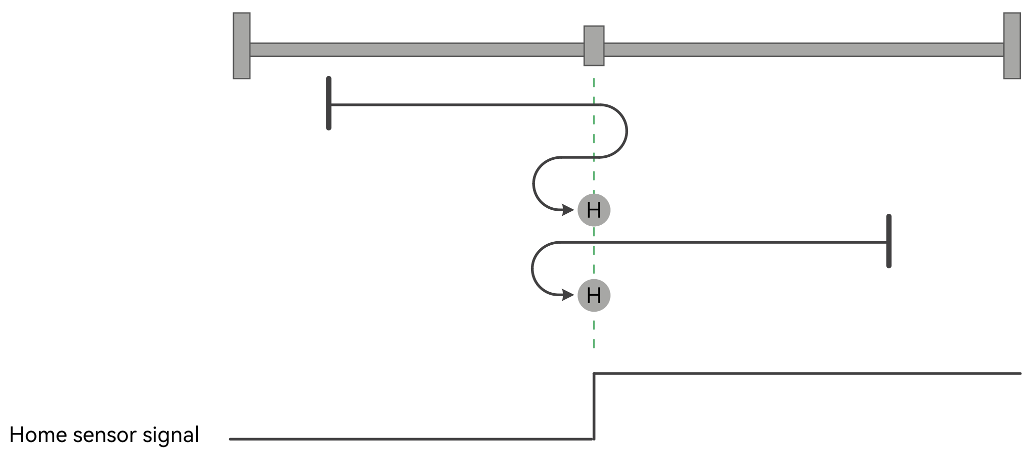


Figure 4-19 Homing mode 20 trajectory and signal status

21, Mode 21, find the HSW ON→OFF position when running in a positive direction

If the HSW is invalid when starting, the axis runs in a negative direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and reverses back to the HSW valid position at high speed and decelerates to stop, then the axis runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

In this homing method, no matter encountering the PL or NL in the ON state, the homing process will stop, and Alarm

As shown in Figure 4-20, refer to Table 4-1.

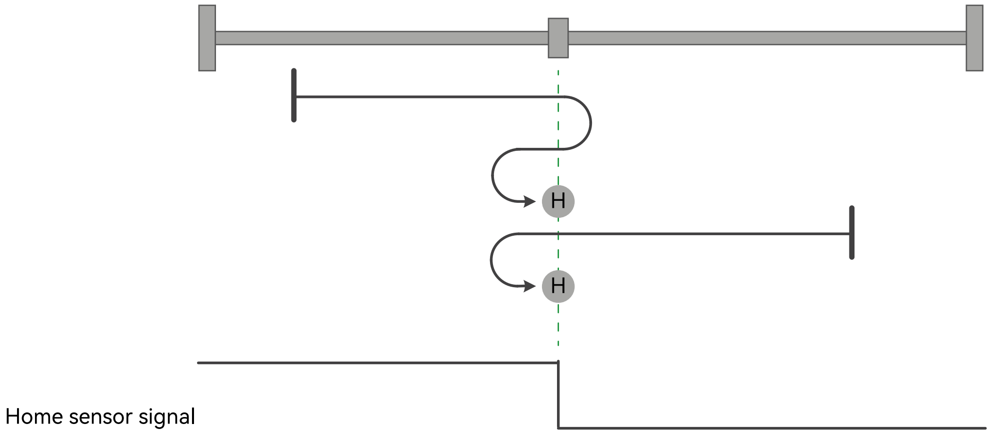


Figure 4-20 Homing mode 21 trajectory and signal status

22, Mode 22, find the HSW OFF→ON position when running in a negative direction

If the HSW is invalid when starting, the axis runs in a negative direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and reverses back to the HSW invalid position at high speed and decelerates to stop, then the axis runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

In this homing method, no matter encountering the PL or NL in the ON state, the homing process will stop, and Alarm

As shown in Figure 4-21, refer to Table 4-1.

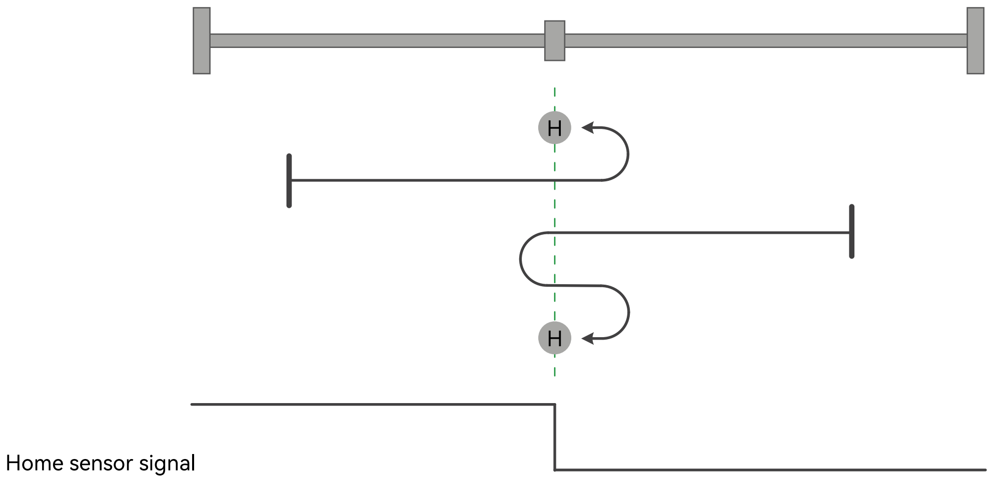


Figure 4-21 Homing mode 22 trajectory and signal status

23, Mode 23, find the HSW ON → OFF position when running in a negative direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON state of PL and runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for the second time, stops the homing process and Alarm

As shown in Figure 4-22, refer to Table 4-1

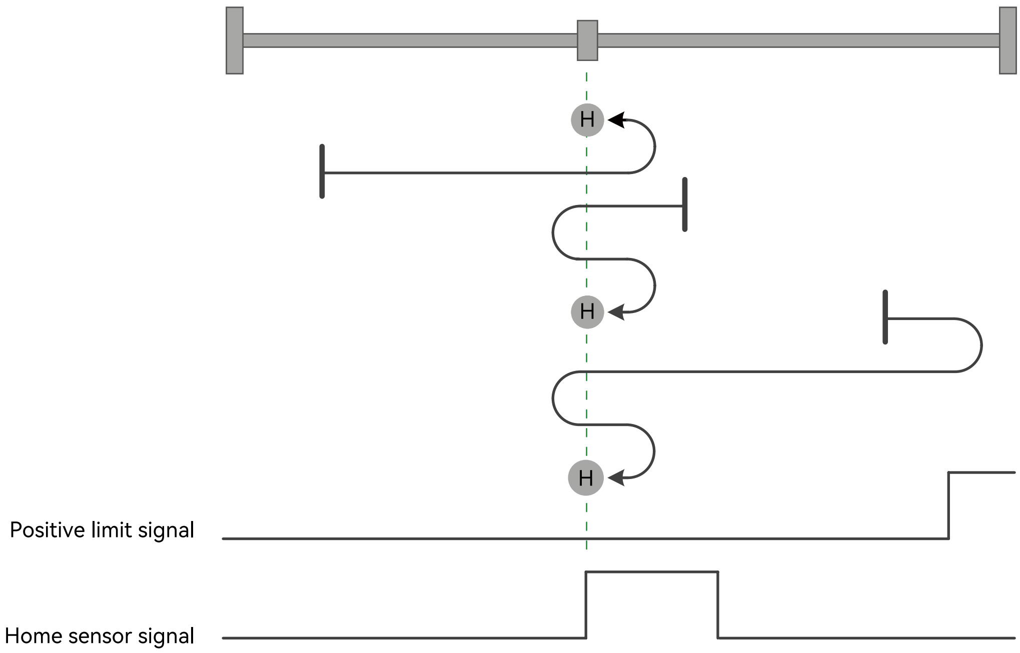


Figure 4-22 Homing mode 23 trajectory and signal status

24, Mode 24, find the HSW OFF → ON position when running in a positive direction, while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering ON state of PL and the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and the axis runs in a positive direction at a low speed.The axis decelerates to stop after encountering the OFF → ON state of HSW, set the stop position as origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering OFF → ON state of the HSW and reverses back to the HSW invalid position at high speed and The axis decelerates to stop, then the axis runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW, set the stop position as origin.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering ON → OFF state of HSW and the axis runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW, set the stop position as origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encountering the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for the second time, stops the homing process and Alarm.

As shown in Figure 4-23, refer to Table 4-1.

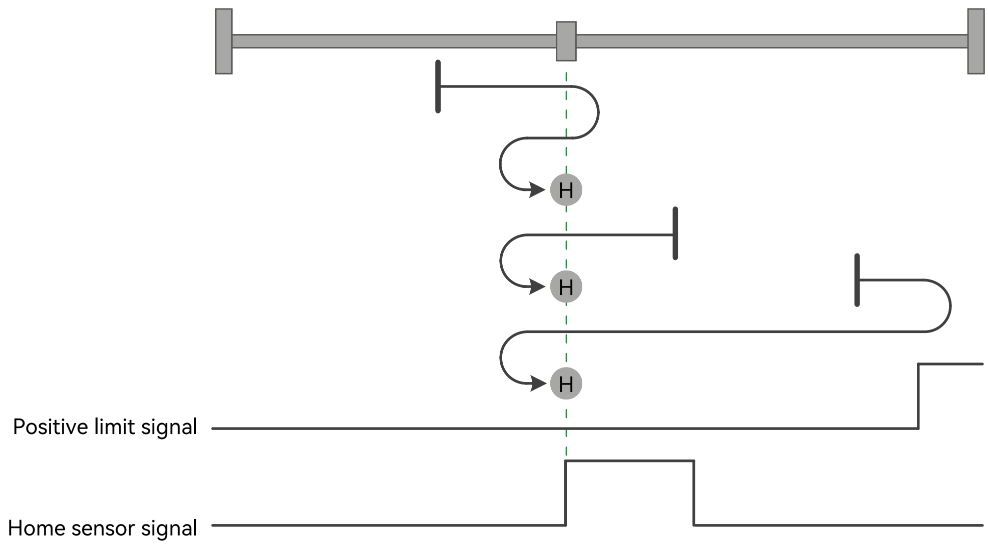


Figure 4-23 Homing mode 24 trajectory and signal status

25, Mode 25, find the HSW OFF → ON position when running in a negative direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON state of PL and runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and reverses back to the HSW invalid position at high speed, and decelerates to stop, then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for the second time, stops the homing process and Alarm

As shown in Figure 4-24, refer to Table 4-1.

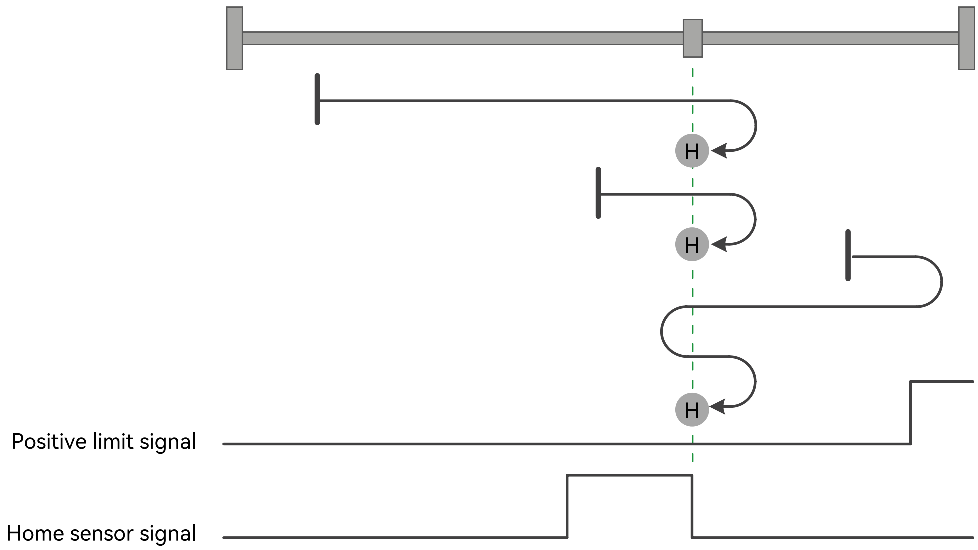


Figure 4-24 Homing mode 25 trajectory and signal status

26, Mode 26, find the HSW ON → OFF position when running in a negative direction while encountering PL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON state of PL and runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for the second time, stops the homing process and Alarm

As shown in Figure 4-25, refer to Table 4-1.

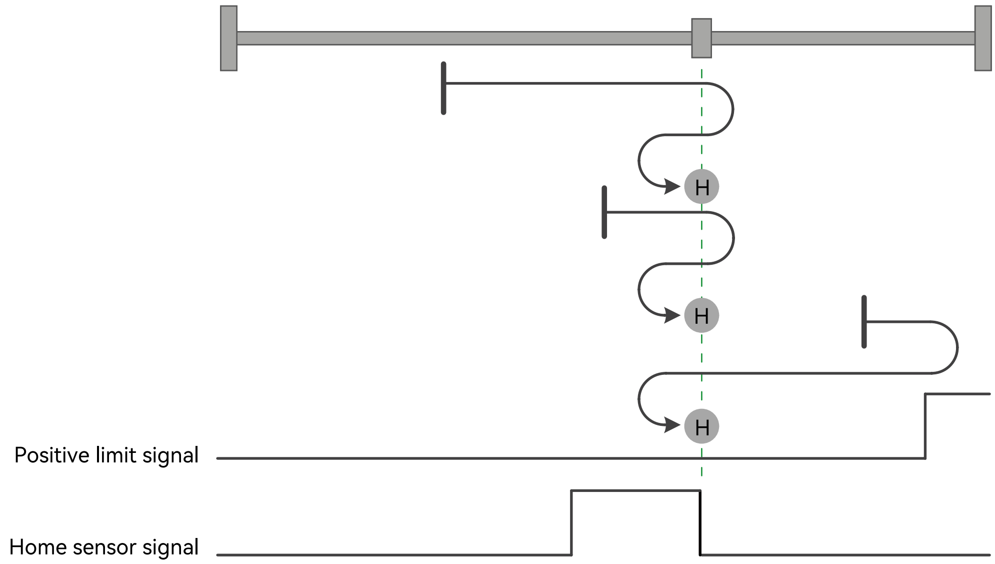


Figure 4-25 Homing mode 26 trajectory and signal status

27, Mode 27, find the HSW ON → OFF position when running in a positive direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and runs in a positive direction at high speed. The axis decelerates to stop after encountering ON → OFF state of the HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a positive direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm.

As shown in Figure 4-26, refer to Table 4-1.

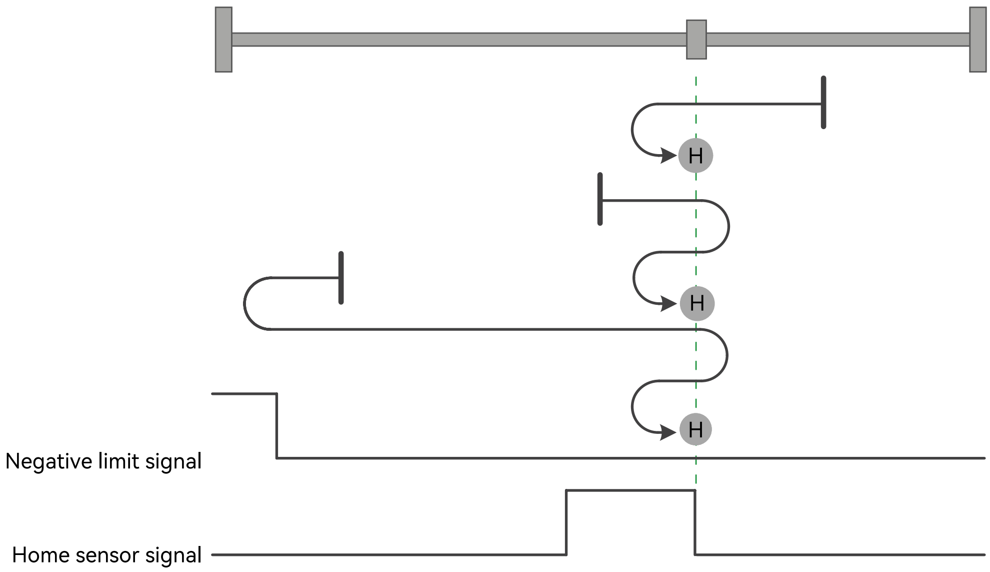


Figure 4-26 Homing mode 27 trajectory and signal status

28, Mode 28, find the HSW OFF → ON position when running in a positive direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and reverses back to the HSW invalid position at high speed and decelerates to stop, then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and the axis runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a positive direction at high speed. The axis decelerates to stop after encountering ON → OFF state of HSW and the axis runs in a negative direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm.

As shown in Figure 4-27, refer to Table 4-1.

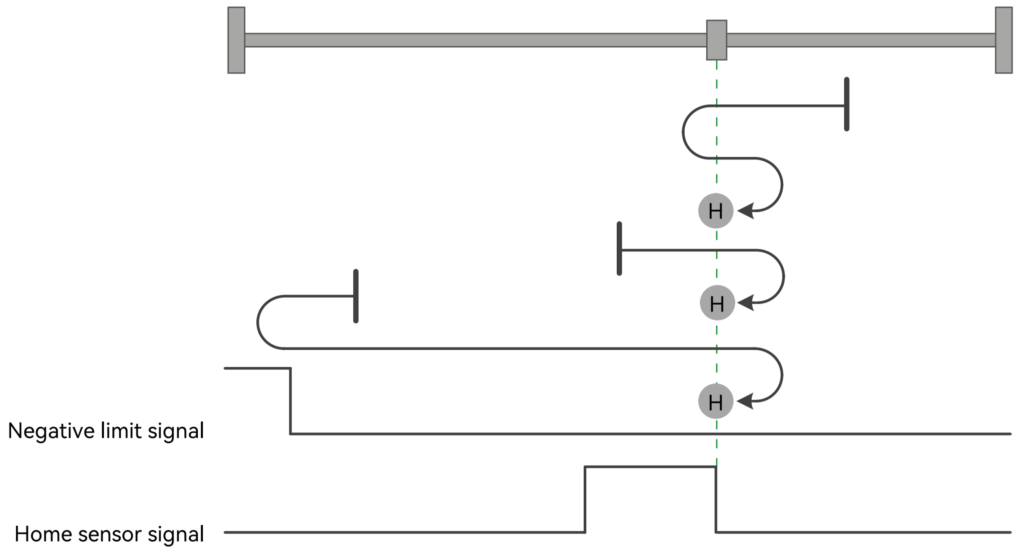


Figure 4-27 Homing mode 28 trajectory and signal status

29, Mode 29, find the HSW OFF → ON position when running in a positive direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at a high speed. The axis decelerates to stop after encountering the ON state of NL and runs in a positive direction at a high speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and reverses back to the HSW invalid position at high speed and decelerates to stop, then the axis runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and runs in a positive direction at a low speed. The axis decelerates to stop after encountering the OFF → ON state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops homing process and the Alarm.

As shown in Figure 4-28, refer to Table 4-1.

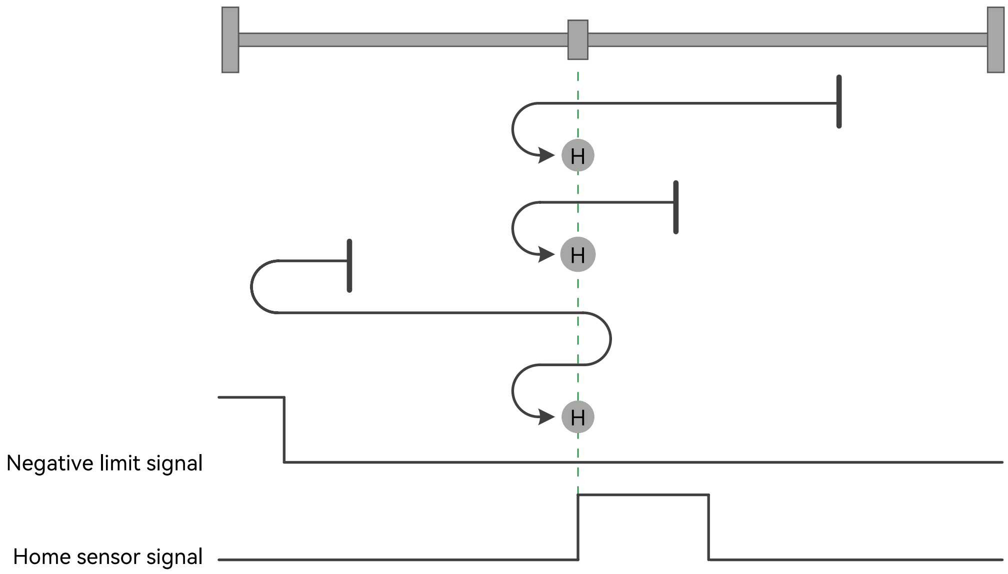


Figure 4-28 Homing mode 29 trajectory and signal status

30, Mode 30, find the HSW ON → OFF position when running in a negative direction while encountering NL automatically reverses

If the HSW is invalid and the origin is at the positive side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

If the HSW is invalid and the origin is at the negative side of the sensor when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON state of NL and runs in a positive direction at high speed. The axis decelerates to stop after encountering the OFF → ON state of HSW and runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and sets the stop position as the origin.

If the HSW is valid when starting, the axis runs in a negative direction at high speed. The axis decelerates to stop after encountering the ON → OFF state of HSW and reverses back to the HSW valid position at high speed and decelerates to stop(If the HSW valid area is narrow, it might enter the other side of the HSW invalid position area), then runs in a negative direction at a low speed. The axis decelerates to stop after encountering the ON → OFF state of the HSW and sets the stop position as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm.

As shown in Figure 4-29, refer to Table 4-1.

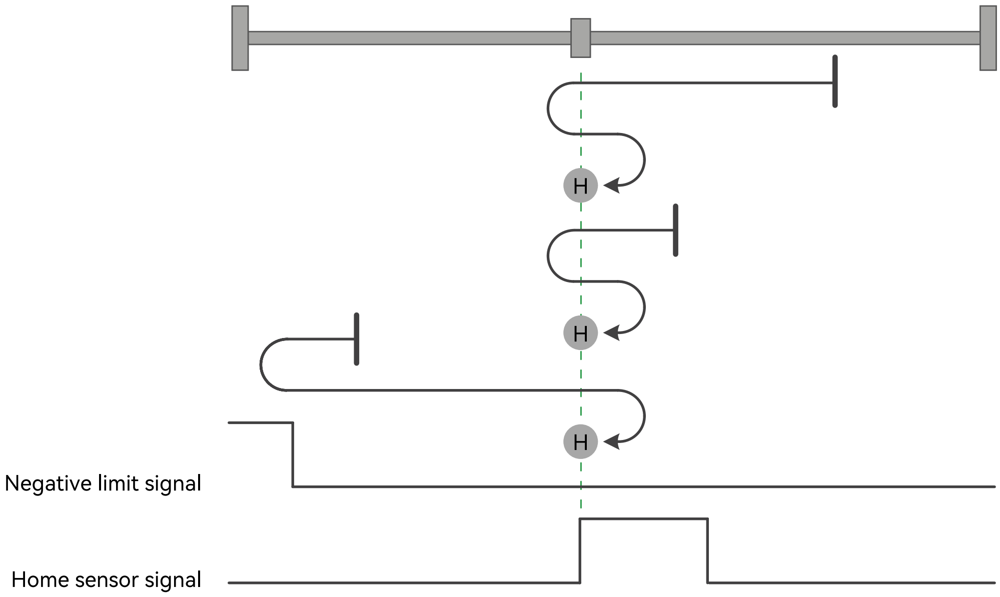


Figure 4-29 Homing mode 30 trajectory and signal status

31, Mode 31, reserved, do not set.

32, Mode 32, reserved, do not set.

33, Mode 33, find the nearest Z pulse when running in a negative direction

Find the nearest Z pulse position and set it as the origin when starting, the axis runs in a negative direction at a low speed. If the axis encounters the ON state of NL before the Z pulse position, then decelerates to stop and finds the nearest Z pulse position in a positive direction then sets as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the NL; Encountering the ON state of the PL or encountering the ON state of the NL for the second time, stops the homing process and Alarm

As shown in Figure 4-30, refer to Table 4-1.

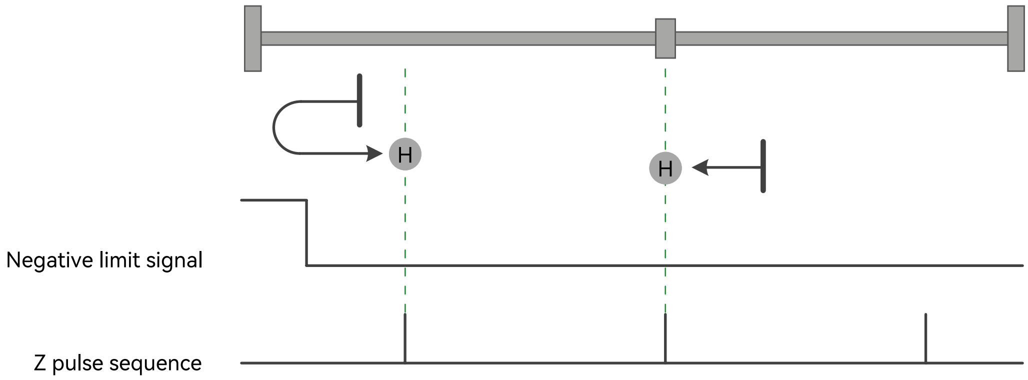


Figure 4-30 Homing mode 33 trajectory and signal status

34, Mode 34, find the nearest Z pulse when running in a positive direction

Find the nearest Z pulse position and set it as the origin when starting, the axis runs in a positive direction at a low speed. If the axis encounters the ON state of PL before the Z pulse position, then decelerates to stop and finds the nearest Z pulse position in a negative direction then set as the origin.

In this homing method, automatically reverses after the axis runs in a positive direction and encounters the ON state of the PL; Encountering the ON state of the NL or encountering the ON state of the PL for the second time, stops the homing process and Alarm.

As shown in Figure 4-31, refer to Table 4-1.

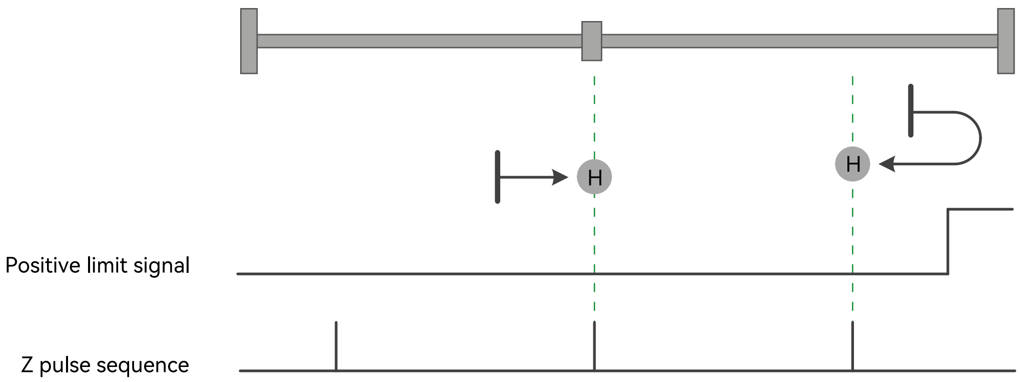


Figure 4-31 Homing mode 34 trajectory and signal status

4.4.13 Telegram 111 speed feedback

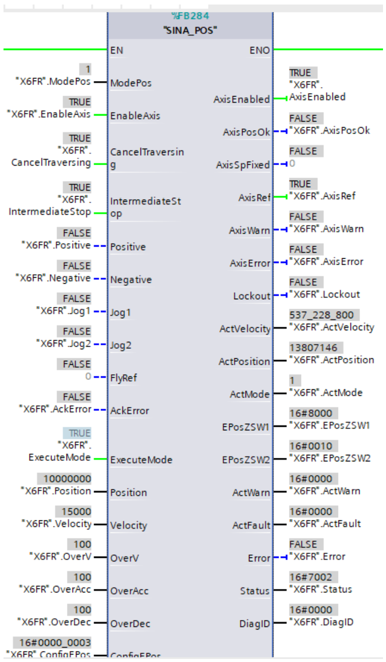
The 16#40000000 of the 111 speed feedback NIST_B corresponds to the rated speed of the motor, then the rated speed of the motor of X5E(F)R is 18.08=16#40000000, and the ActVelocity on the FB284 block is the NIST_B of 111, so the 16#40000000 of the ActVelocity is P18.08 (the rated speed of motor of the drive parameter). P18.08 (drive parameter motor rated speed).

[Case] The resolution of the motor is 131072, the rated speed of the motor is 3000RPM, and the EPOS gear ratio is 131072/10000, as shown in the figure below.

Set the relative positioning, Velocity is 15000, so the motor set speed = (15000*1000*131072/10000)/131072 = 1500RPM, the feedback speed ActVelocity is 537228800, the actual motor feedback speed = ActVelocity * Rated speed / 1073741824= 53 7228800*3000/1073741824=1501(RPM)

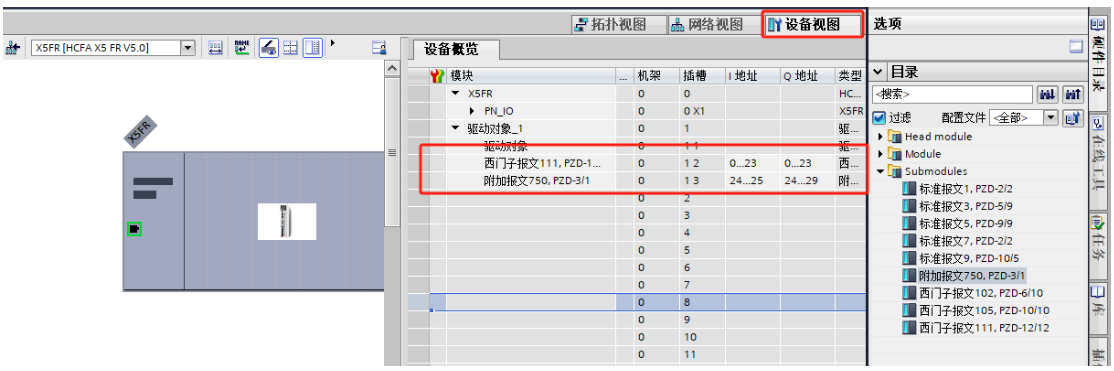
So the actual motor feedback speed = ActVelocity* Rated Speed / 1073741824

Note: Drive parameter for rated speed is P18.08



4.4.14 Telegram 111 torque Limit

Telegram 111 Torque Limit requires the addition of the additional telegram 750 telegram, which implements the torque limit by setting the torque upper and lower limits. The message configuration is as follows:



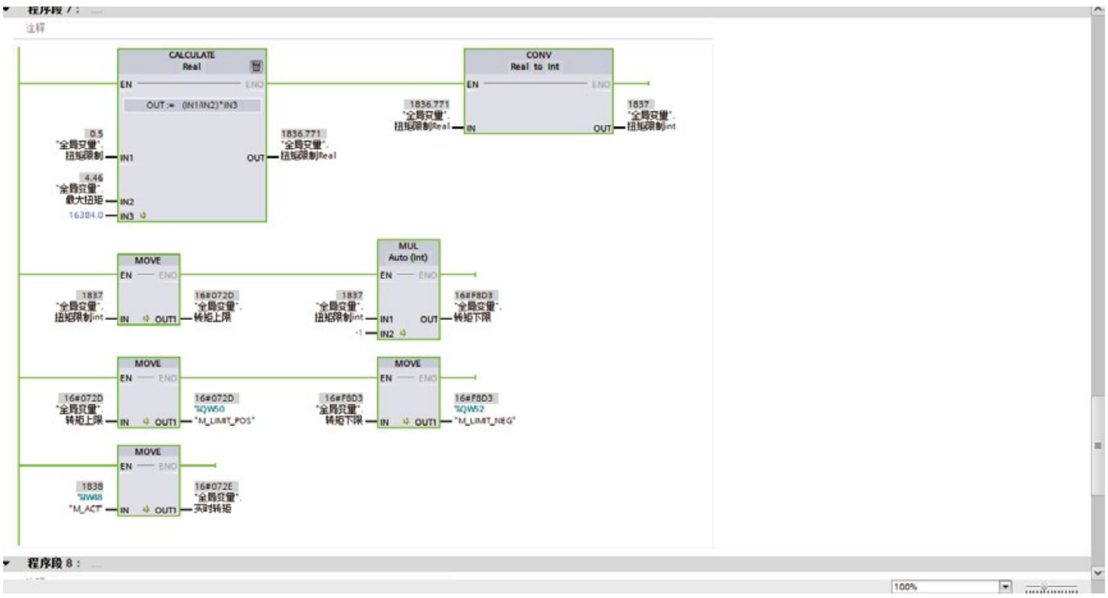
Application level	Additional	
Telegram	750	
PZD1	M_ADD1（Additional torque）	M_ACT（Actual torque）
PZD2	M_LIMIT_POS (Positive torque limit)	
PZD3	M_LIMIT_NEG（Negative torque limit）	

As shown in the above figure, when the range of the Q address of the 750 telegram is 24~29 and the Q address corresponds to the control word of the telegram, QW24 corresponds to the address of M_ADD1 (Additional Torque), QW26 corresponds to the address of M_LIMIT_POS (Positive Torque Limit) and QW28 corresponds to the address of M_LIMIT_NEG (Negative Torque Limit). When the I address of the 750 telegram is in the range of 24 to 25 and the I address corresponds to the status word of the telegram, IW24 corresponds to the address of M_ACT (actual torque). The QW26 and QW28 addresses are given to set the torque value that does not exceed the rated torque. When the torque value is reached, the motor stops at the current position and does not run forward, and the torque feedback value can be read through IW24. When 750 is configured, the addresses of M_LIMIT_POS (positive torque limit) and M_LIMIT_NEG (negative torque limit) have no value, and the torque is limited to 0. Therefore, it is necessary to assign a value to these two channels in order to make the motor rotate.

Note: The assigned positive torque limit cannot be negative and the negative torque limit cannot be positive, otherwise tripping will occur.

When using torque limit in position mode to reach motor operation, it cannot be in the given position, otherwise it will report excessive position deviation (ERR043).

[Case 1] Write values directly to the telegram channel.



[Case 2] How to write torque-limited FB blocks

Write the torque limiting FB block as follows.

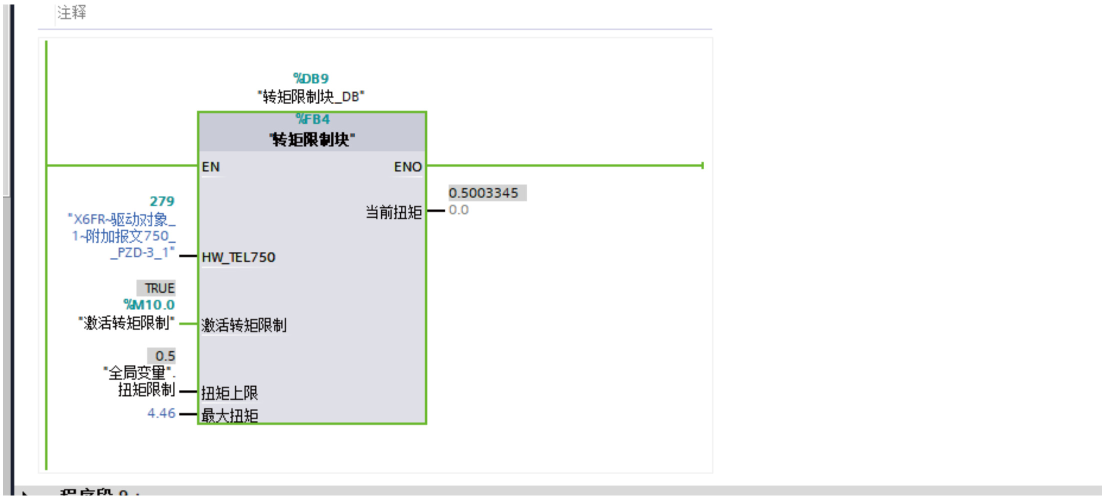
转矩限制块

名称	数据类型	默认值	保持	从 HMI/OPC...	从 H...	在 HMI ...	设定值	监控	注释
Input									
HW_TEL750	HW_SUBMODULE	0	非保持	☑	☑	☑			
激活转矩限制	Bool	false	非保持	☑	☑	☑			
扭矩上限	Real	1.0	非保持	☑	☑	☑			
最大扭矩	Real	1.0	非保持	☑	☑	☑			
<新增>									
Output									
当前扭矩	Real	0.0	非保持	☑	☑	☑			
<新增>									
InOut									
<新增>									
Static									
RDPZD_TEL750	Struct		非保持	☑	☑	☑			
M_ACT	Int	0	非保持	☑	☑	☑			
WRPZD_TEL750	Struct		非保持	☑	☑	☑			
M_ADD1	Int	0	非保持	☑	☑	☑			
M_LIMIT_POS	Int	0	非保持	☑	☑	☑			
M_LIMIT_NEG	Int	0	非保持	☑	☑	☑			
<新增>									

```
#RET_VAL := DPRD_DAT(LADDR := #HW_TEL750, RECORD => #RDPZD_TEL750);

#RET_VAL := DPWR_DAT(LADDR := #HW_TEL750, RECORD := #WRPZD_TEL750);
IF #激活转矩限制 THEN//最大转矩是驱动器18.07的值
    #WRPZD_TEL750.M_LIMIT_POS := REAL_TO_INT(ABS(#扭矩上限 / #最大扭矩) * 16384.0);
    #WRPZD_TEL750.M_LIMIT_NEG := REAL_TO_INT(ABS(#扭矩上限 / #最大扭矩) * -16384.0);
ELSE
    #WRPZD_TEL750.M_LIMIT_POS := 16#4000;
    #WRPZD_TEL750.M_LIMIT_NEG := 16#C000;
END_IF;
#当前扭矩 := INT_TO_REAL(#RDPZD_TEL750.M_ACT) / 16384.0 * #最大扭矩;
```

The telegram 111 activates the torque limit as follows in Jog mode and blocks the motor.



The torque command is 39.4%.

P.a	p.b	名称	单位	值
21	00	驱动器状态	1	2
21	41	当前故障码	1	0
21	01	速度反馈	RPM	0
21	03	速度指令	RPM	30
21	07	绝对位置	指令单位	12474979
21	15	输入指令脉冲累计	指令单位	254326
21	17	反馈脉冲累计	编码器单位	163512049
21	13	位置偏差累计	编码器单位	0
21	32	绝对位置编码器圈数	编码器单位	0
21	34	绝对位置编码器单圈值	编码器单位	99335
21	04	转矩指令	0.10%	394
21	05	相电流有效值	0.01A	82
21	06	母线电压	0.1V	3155
21	09	电气角度	0.1度	2841

The rated torque of the motor is 1.27 and the current torque value = 1.27*39.4% = 0.50038Nm, which is equal to the actual torque in the figure above.

☐	18	06	额定转矩	0.01Nm	再次上电	停机设定	PST	127
☐	18	07	最大转矩	0.01Nm	再次上电	停机设定	PST	446

4.4.15 Position arrival

Position arrival is mainly used under relative position and absolute positioning, other mode signals have no effect. When the position arrival signal fluctuates when the position mode is traveled at low speed, users can set P04.48=5 and P04.58 to be less than the speed at which the motor is running. The setting parameters are shown in the figure below.

sbModePos	Bool	0	TRUE	☐	☑	☑	☑	☐
▼ sxSendBuf	Struct			☐	☑	☑	☑	☐
STW1	Word	WORD#16#0000	16#043F	☐	☑	☑	☑	☐
EPosSTW1	Word	WORD#16#0000	16#8000	☐	☑	☑	☑	☐
EPosSTW2	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
STW2	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
OverrideV	Word	WORD#16#0000	16#4000	☐	☑	☑	☑	☐
Position	DWord	DWORD#16#000(	16#000F_4240	☐	☑	☑	☑	☐
Velocity	DWord	DWORD#16#000(	16#0000_0BB8	☐	☑	☑	☑	☐
OverrideA	Word	WORD#16#0000	16#4000	☐	☑	☑	☑	☐
OverrideD	Word	WORD#16#0000	16#4000	☐	☑	☑	☑	☐
Reserve	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
▼ sxRecvBuf	Struct			☐	☑	☑	☑	☐
ZSW1	Word	WORD#16#0000	16#2737	☐	☑	☑	☑	☐
EPosZSW1	Word	WORD#16#0000	16#8000	☐	☑	☑	☑	☐
EPosZSW2	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
ZSW2	Word	WORD#16#0000	16#0400	☐	☑	☑	☑	☐
NotUsed	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
Position	DWord	DWORD#16#000(	16#0AA7_1204	☐	☑	☑	☑	☐
Velocity	DWord	DWORD#16#000(	16#0000_0000	☐	☑	☑	☑	☐
ErrNr	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
WarnNr	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐
Reserve	Word	WORD#16#0000	16#0000	☐	☑	☑	☑	☐

Set the gear ratio large, and when the position arrival signal is always active, set 15.10 (EPOS position arrival threshold) small.

☐	15	10	EPOS位置到达阈值(32位)	1	立即生效	停机设定	P	100

4.4.16 User-defined area

The last PZD control word and status word of message 111 are the user-defined PZD receive word and user-defined PZD transmit word, respectively. The user-defined PZD receive word and user-defined PZD transmit word are set by P15.46 and P15.47.

(1) User-defined PZD receive word (P15.46):

0 = No content

3 = DO forced output: DO1-DO8 function parameter is 0 can directly control the output through the low 8 bits, when DO1-DO8 function parameter is not 0, it can force the output through the low 8 bits and the high 8 bits together.

4 = Torque limitation (Maximum torque (P18.07)=16#4000, same as 750 telegram to realize torque limitation)

(2) User-defined PZD send word

0 = No content

1 = Actual torque: Maximum torque (P18.07) = 16#4000

3 = DI status: Change according to actual level and also according to logic level;

On the FB284 function block, the sxSendBuf and sxRecvBuf arrays are the control and status words for the 111 telegram mapping, so the twelfth word of sxSendBuf and sxRecvBuf corresponds to the user-defined zone.

sbModePos	Bool	0	TRUE
sxSendBuf	Struct		
STW1	Word	WORD#16#0000	16#043F
EPosSTW1	Word	WORD#16#0000	16#8000
EPosSTW2	Word	WORD#16#0000	16#0000
STW2	Word	WORD#16#0000	16#0000
OverrideV	Word	WORD#16#0000	16#4000
Position	DWord	DWORD#16#000(	16#000F_4240
Velocity	DWord	DWORD#16#000(	16#0000_0BB8
OverrideA	Word	WORD#16#0000	16#4000
OverrideD	Word	WORD#16#0000	16#4000
Reserve	Word	WORD#16#0000	16#0000
sxRecvBuf	Struct		
ZSW1	Word	WORD#16#0000	16#2737
EPosZSW1	Word	WORD#16#0000	16#8000
EPosZSW2	Word	WORD#16#0000	16#0000
ZSW2	Word	WORD#16#0000	16#0400
NotUsed	Word	WORD#16#0000	16#0000
Position	DWord	DWORD#16#000(	16#0AA7_1204
Velocity	DWord	DWORD#16#000(	16#0000_0000
ErrNr	Word	WORD#16#0000	16#0000
WarnNr	Word	WORD#16#0000	16#0000
Reserve	Word	WORD#16#0000	16#0000

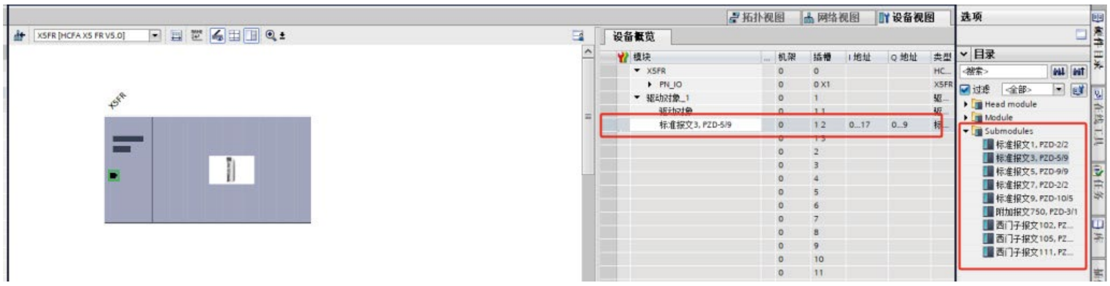
4.5 S7-1500PS7-1500 PLC configuration AC4 mode

4.5.1 Overview

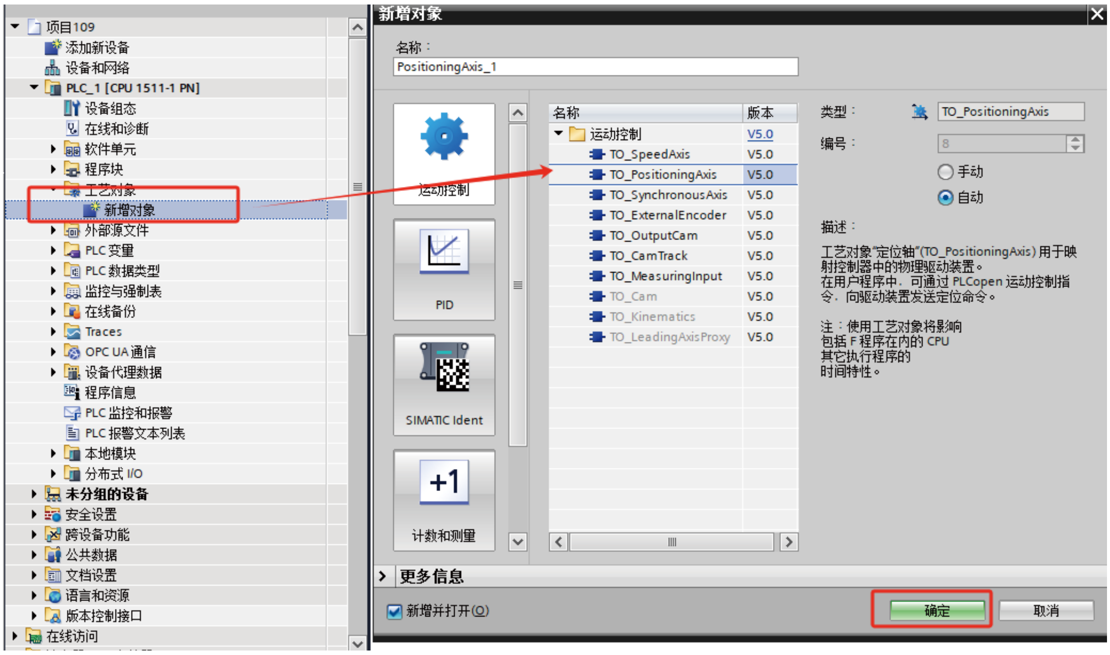
The AC4 mode performs position control within the PLC, while the servo drive performs speed control only. Therefore, AC4 mode requires the configuration of process objects for position control. The S7-1500 PLC process objects support 3, 102, 105 and 750 messages and two synchronization modes (RT and IRT).

4.5.2 Configuration

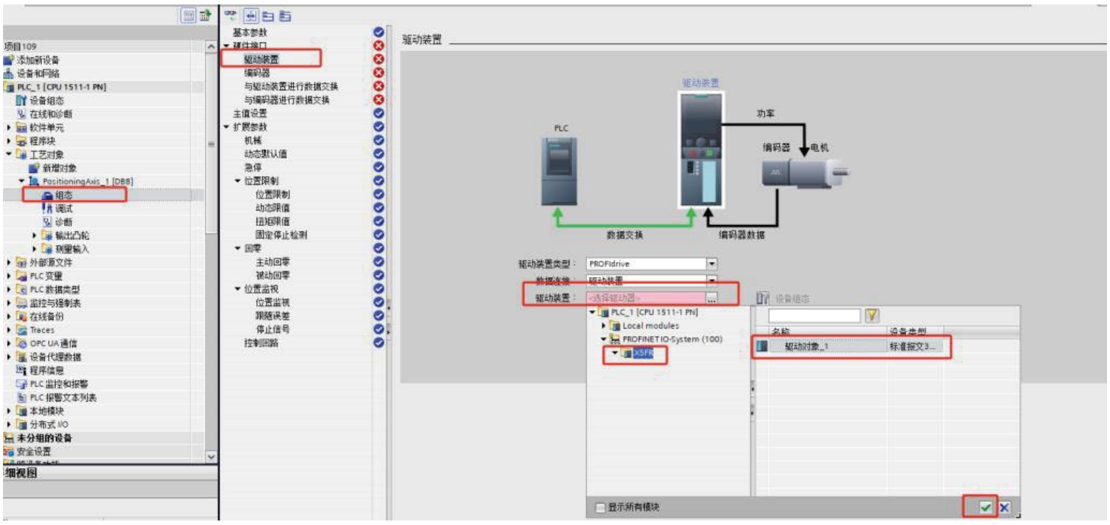
(1) As consistent with 4.3.2 (AC1 Configuration Points), delete message 1 and select message 3 from the sub-mode (using message 3 as an example).



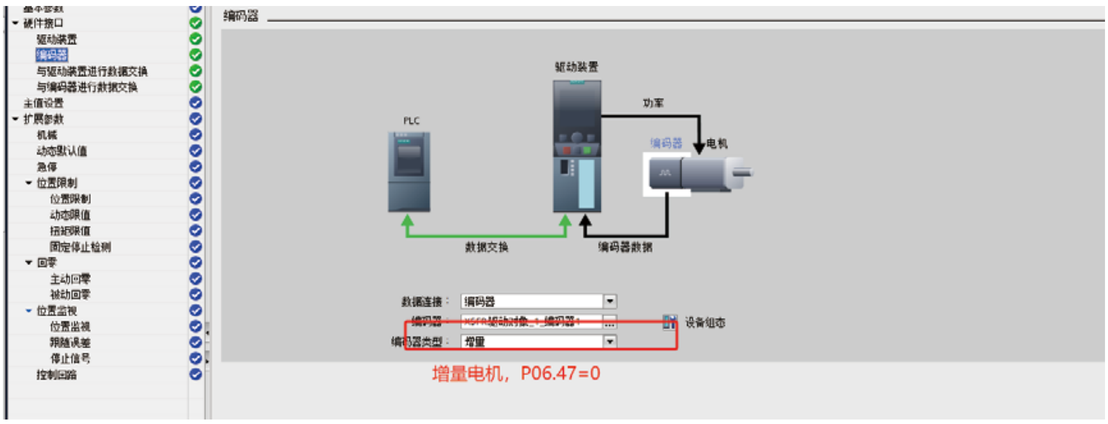
(2) To add a configuration positioning axis, add a new object by double-clicking "Add New Object" in the project tree, and select "TO_PositioningAxis" from the "Motion Control" list. from the "Motion Controls" list:

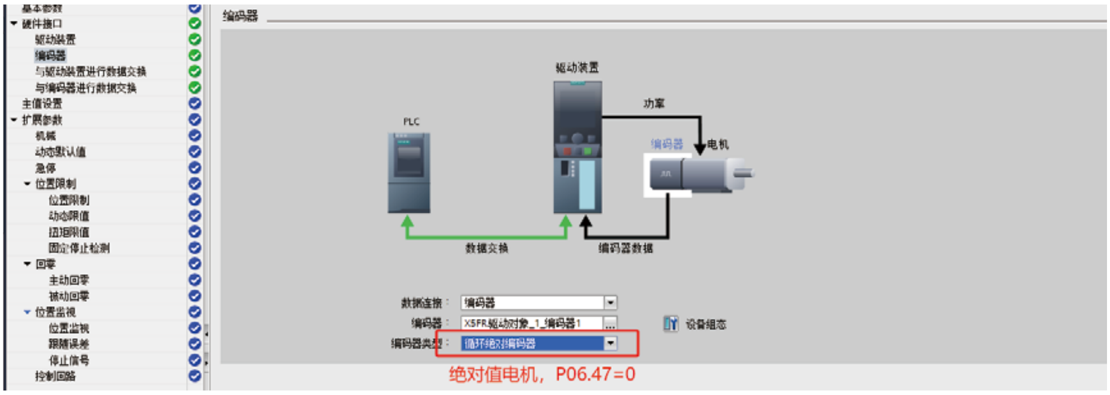


(3) In the "Hardware interface" of the TO axis configuration, select the input "PROFIdrive" as "Drive type". As "Drive", select the X5FR, in this case the "Right" drive:

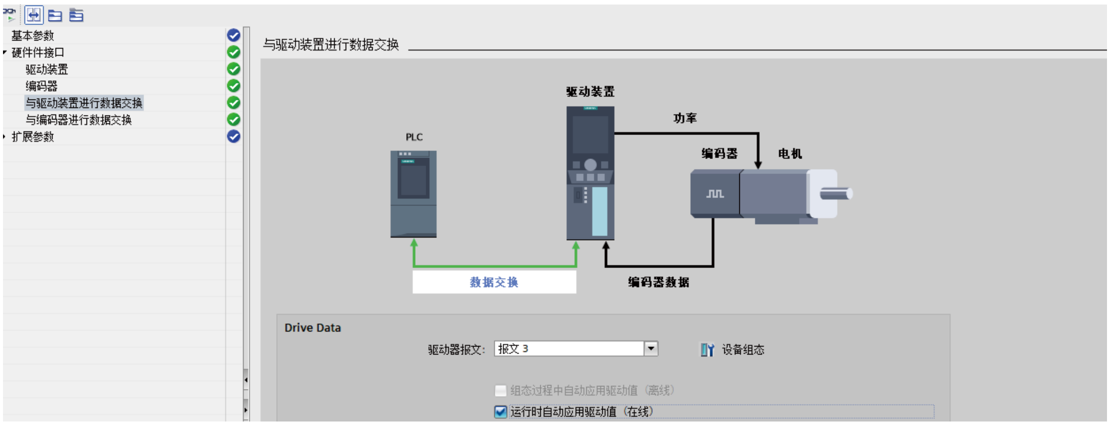


(4) Configure the encoder type: select incremental or absolute encoder.





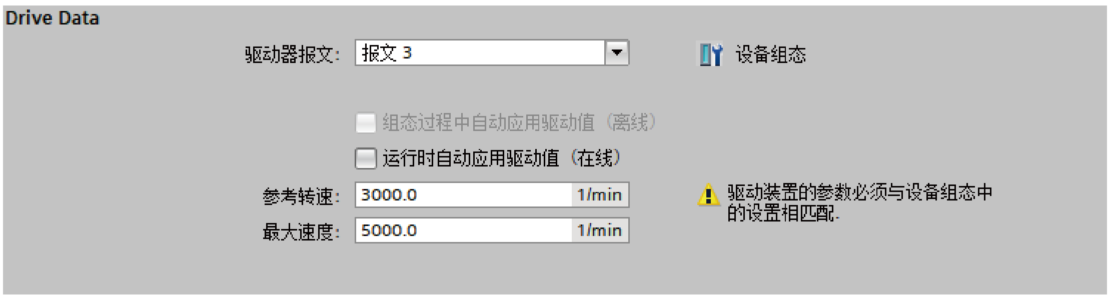
(5) Set "Data exchange with inverter" to exchange data with the drive: Users can check the box to automatically apply the drive value during operation.



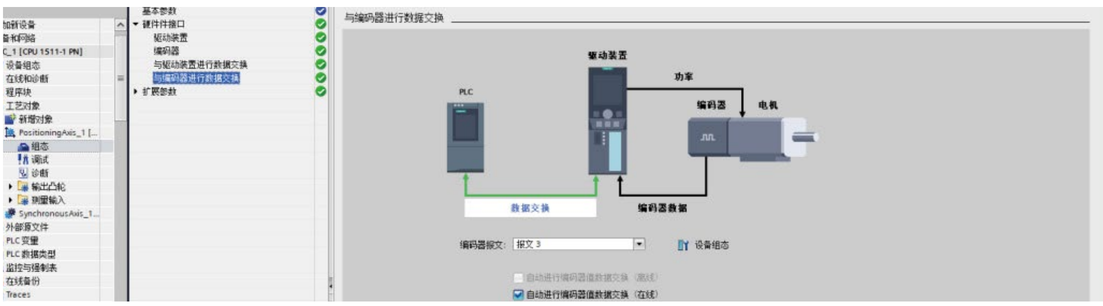
It can also be set manually (if auto upload is incorrect, please set manually)

☐	18	07	最大转矩	0.01Nm	再次上电
☐	18	08	额定转速	1rpm	再次上电
☐	18	09	最大转速	1rpm	再次上电

Set the rated and maximum speeds according to 18.08 and 18.09 respectively (note: 102 and 105 telegram reference torques are set according to P18.07).

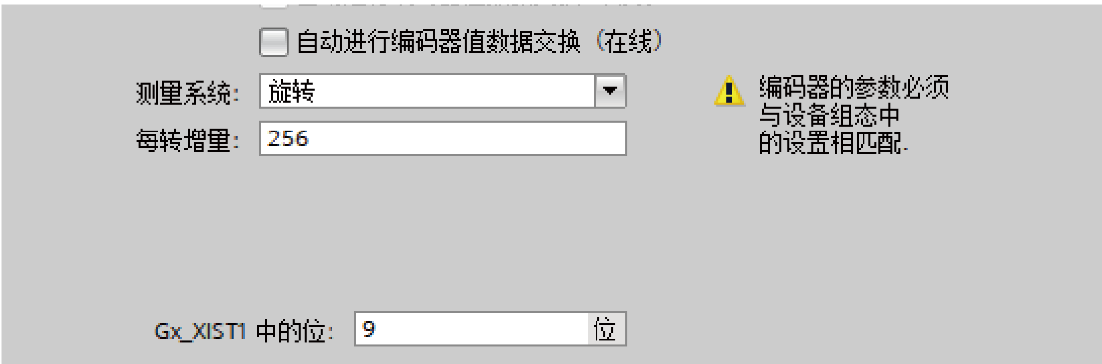


(6) Setting "Data exchange with encoder" also enables automatic encoder data exchange.

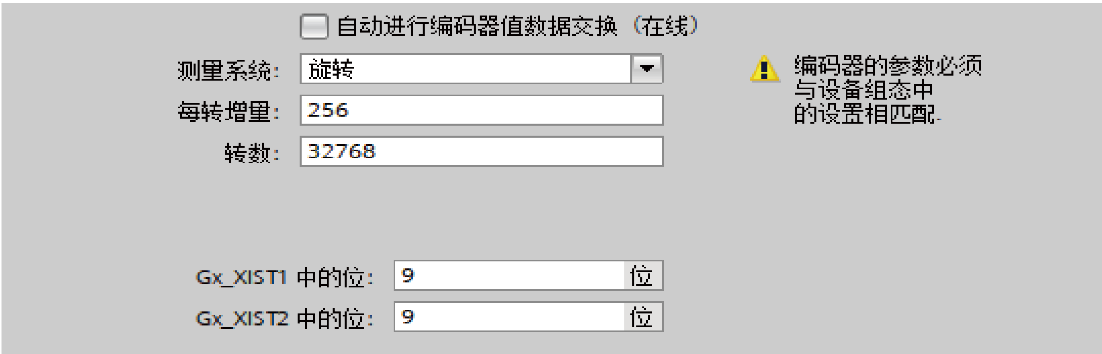


Manually set the 17-position motor:

P06.47 = 0 incremental system



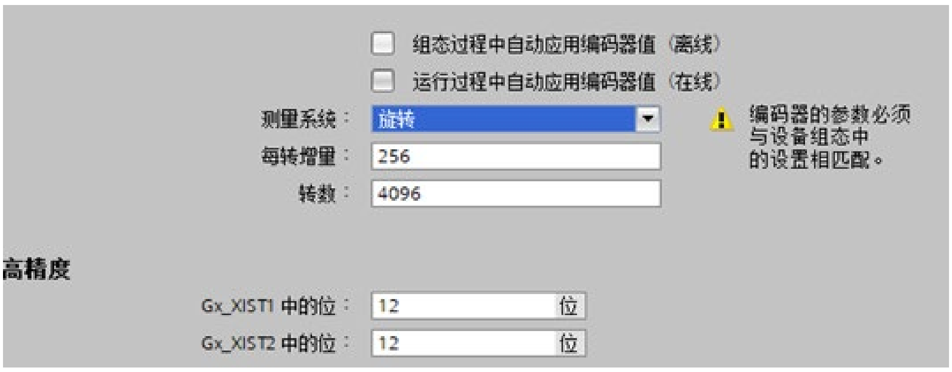
P06.47 = 1 absolute system (note: cyclic absolute must be selected for encoder type)



Manually set the 20-position motor:

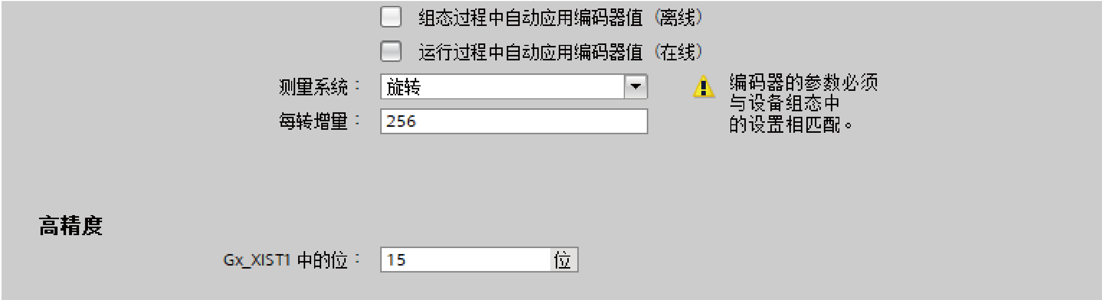
P06.47 = 0 incremental system

P06.47 = 1 absolute system (note: cyclic absolute must be selected for encoder type)

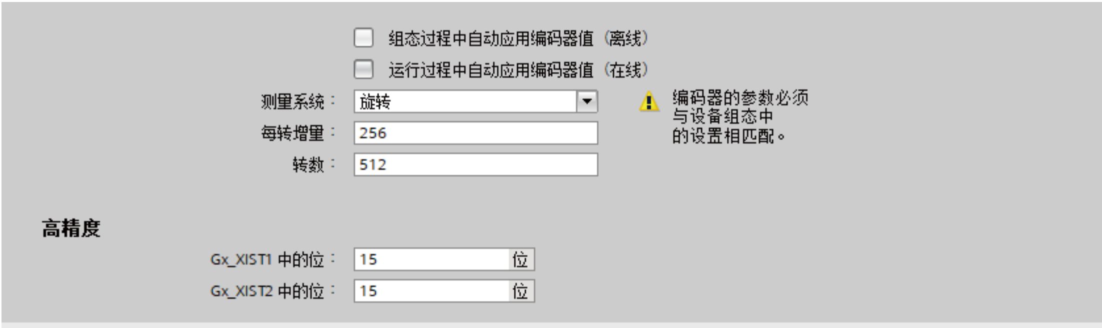


Manual setting of the 23-position motor:

P06.47 = 0 incremental system



P06.47 = 1 absolute system (Note: Cyclic absolute must be selected for encoder type)



(7) Write a motion control program, compile and download the project to the PLC and test the program.

4.5.3 Configuring IRT mode

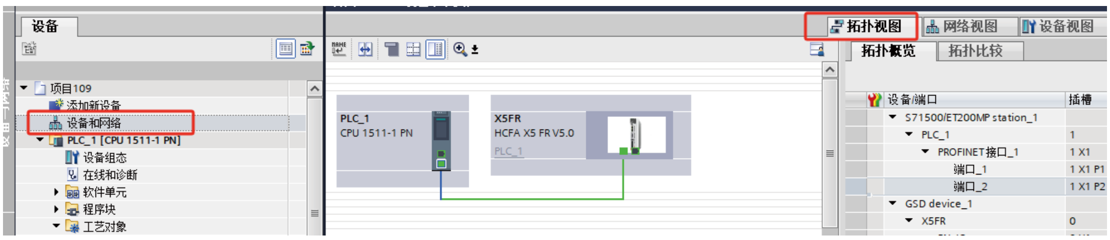
NOTE: When using IRT isochronous mode, it is absolutely necessary and important to configure the topology to which the devices are connected!

If there is a need for IRT then do the following, if not then no configuration is required.

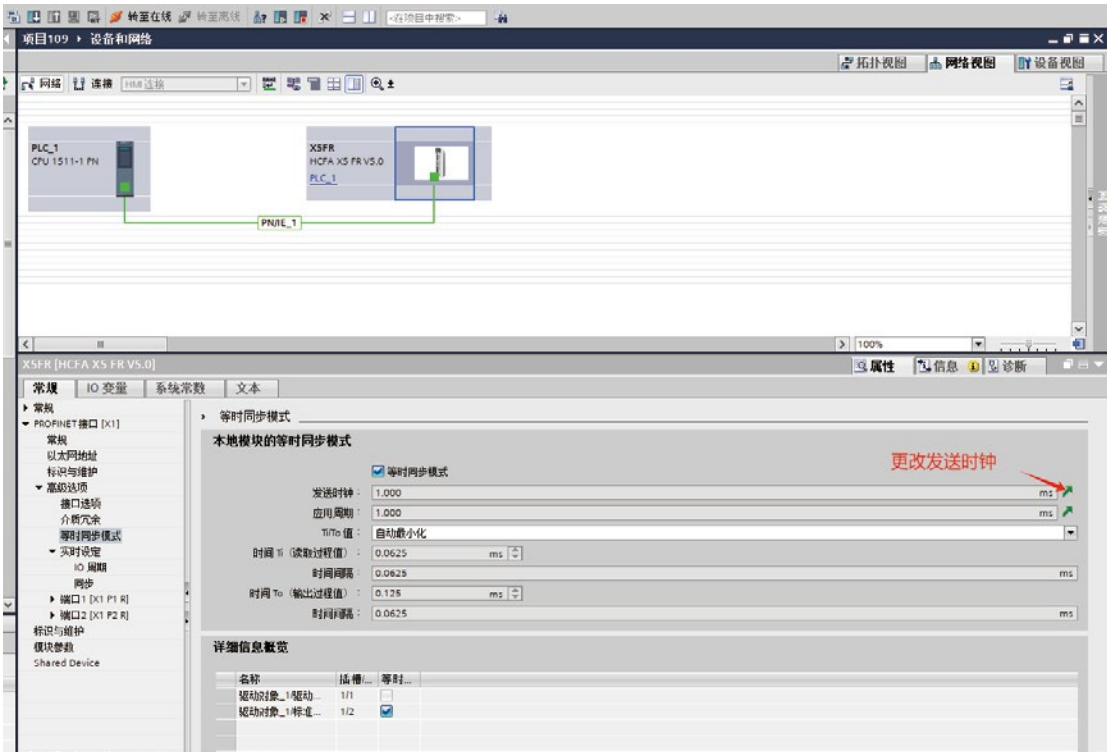
To configure the topology between the X5FR and the S7-1500 CPU, proceed as follows:

(1) Click on "Devices and Networks" in the project tree, and then click on "Topology View" to switch to the topology view, and then drag and drop to connect the topology view, which should be consistent with the actual network cable connection.

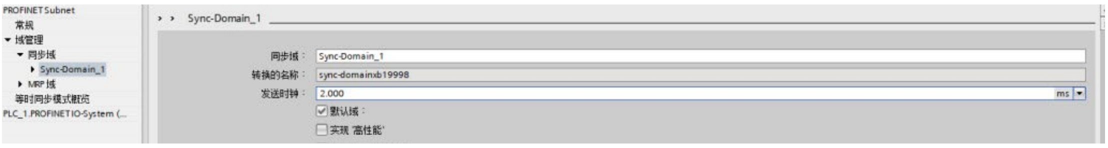
Note: The topology configured in the project must match the actual connection.



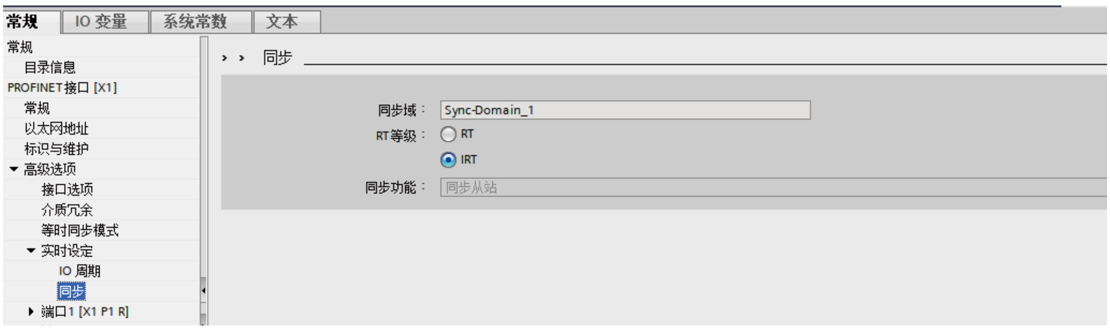
(2) Open the device properties by double-clicking on the X5FR image. Select the Isochronous Mode checkbox in the Isochronous Mode option to activate IRT mode:



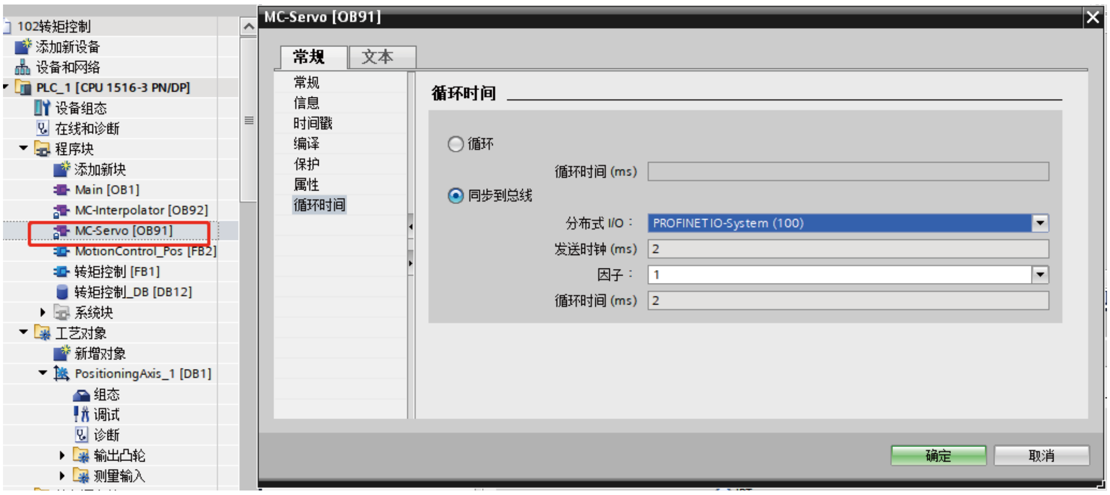
Change the transmit clock to 500us minimum, the actual setting is based on the PLC performance.



When changing from IRT mode to IR mode, it is necessary to select RT here (Conversely, no selection is required).



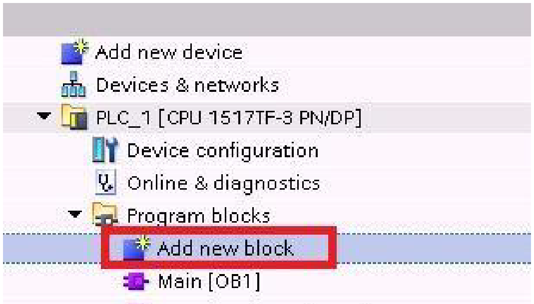
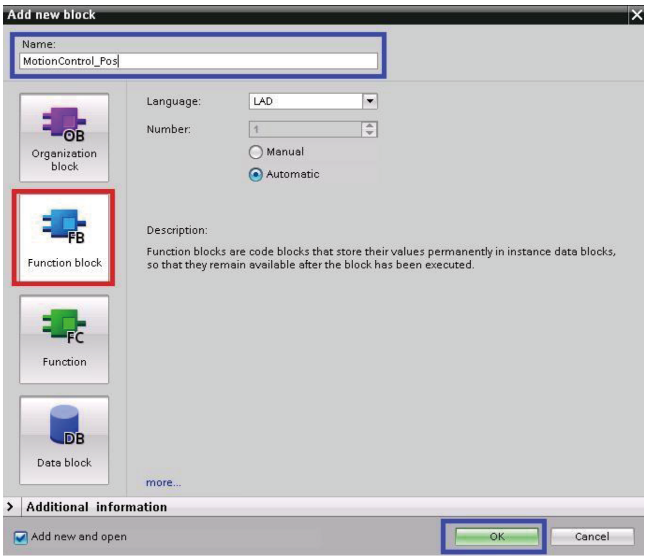
Right-click on "MC Servo [OB91]", open the properties of the OB91 block, select the "Synchronization with bus" option, and choose "PROFINET IO system (100)" for Distributed I/O:

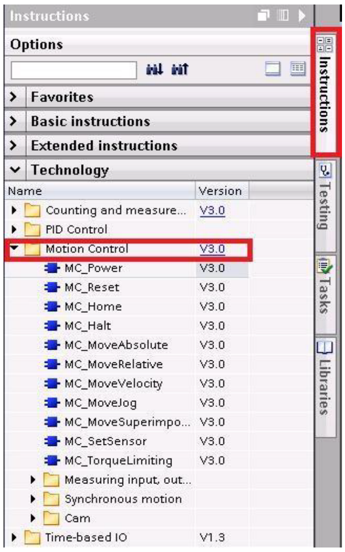
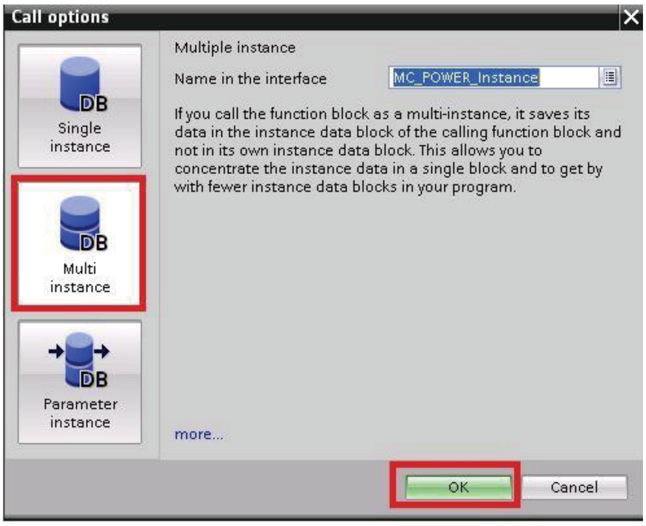


Note: If the CPU performance is low, users need to consider adjusting the Factor parameter to 4 or 8 to reduce the CPU load.

4.5.4 Writing motion control program

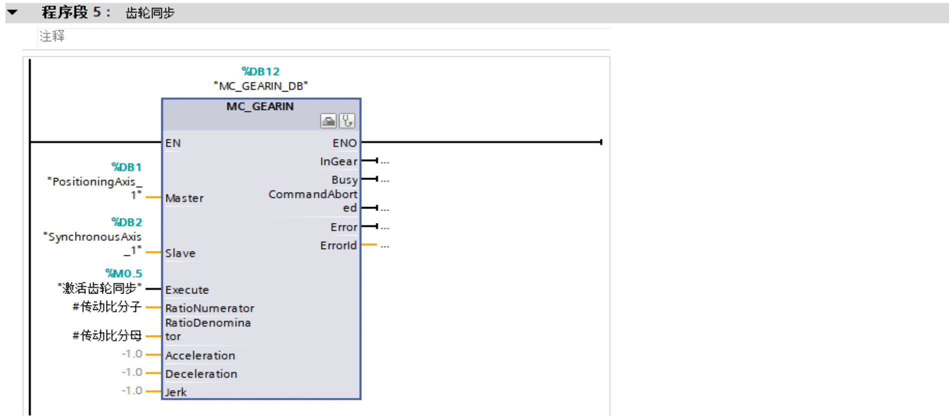
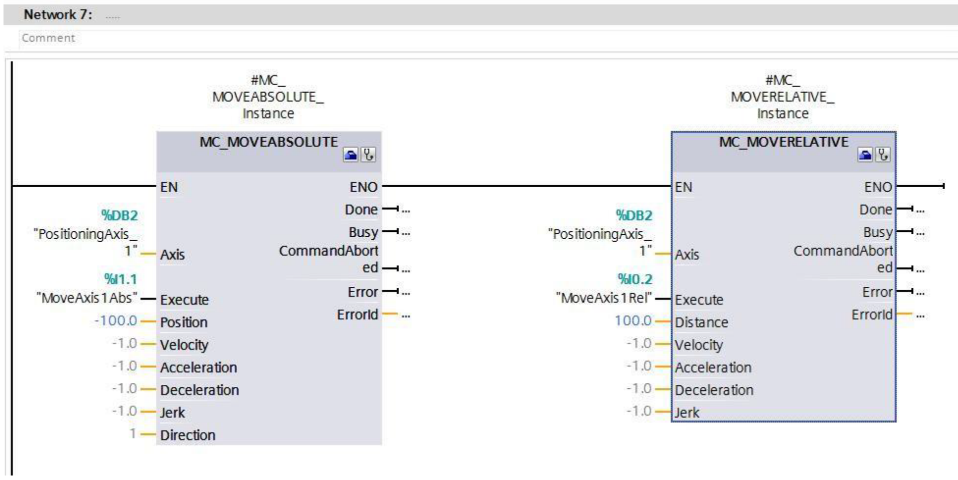
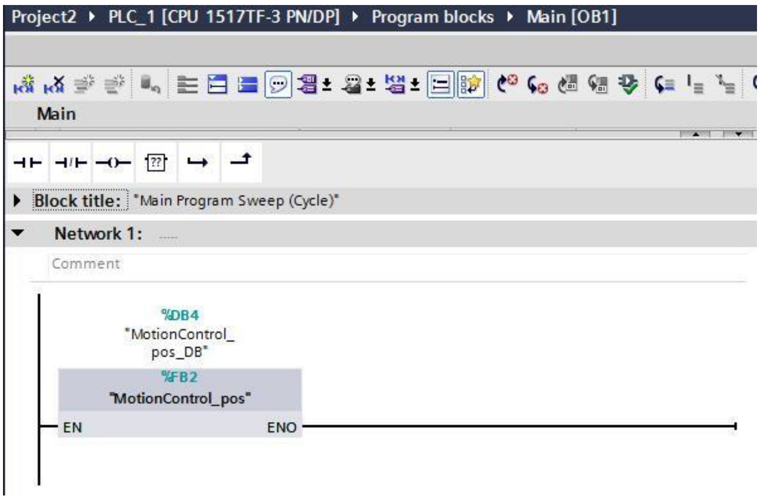
The steps for writing a motion control program are as follows:

No.	Description
1	Add a FB (function block) to the program and name it "MotionControl_Pos": 
1	

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>2</td><td>Select the Commands option and open the Motion Control folder:

</td></tr>
<tr><td>3</td><td>Use the Multiple instance Data block of control instructions in FB to add the desired instructions to the function block:


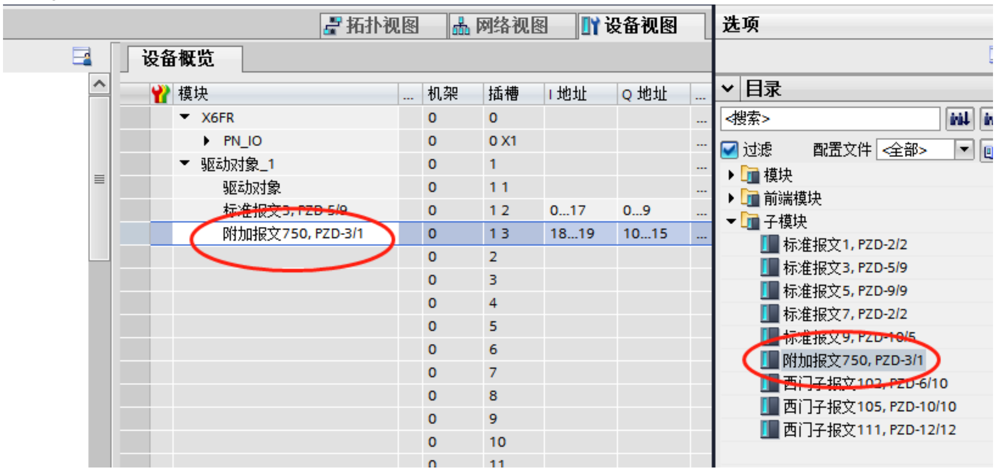
The following instruction is used in the example:
-MC_Power, MC_Home, MC_MoveRelative, MC_MoveAbsolute, MC_MoveJog, MC_Halt, MC_Reset
-MC_GEARIN</td></tr>
</table>

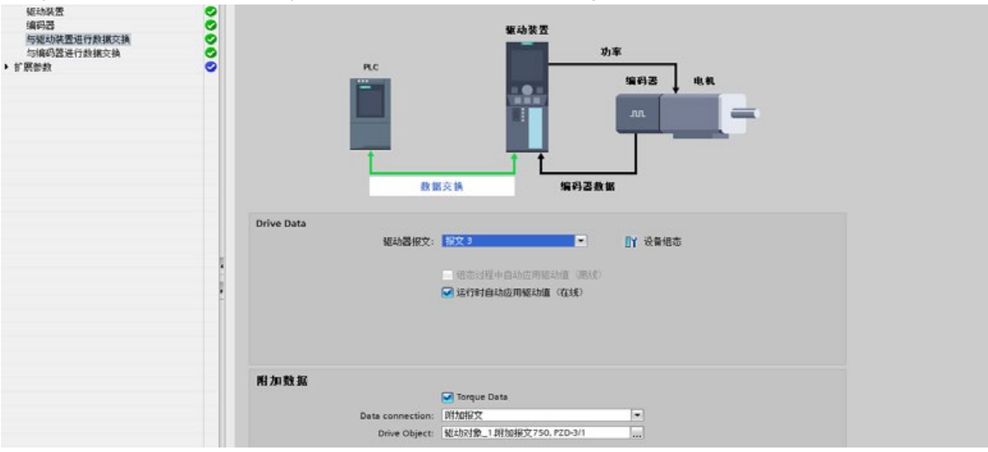
No.	Description
4	Enable, fault reset, homing, pause, and tap controls for the process object (axis) are programmed as follows: 

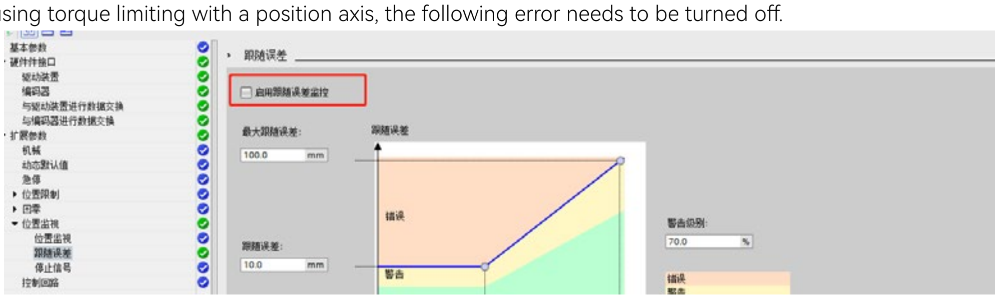
No.	Description
5	The gear synchronization control of the process object is programmed as follows. 
6	Write absolute and relative positioning control programs for axes: 
8	Call the FB function block "MotionControl_Pos" in OB1: 
9	Compile and download the project to the PLC then test the program later.

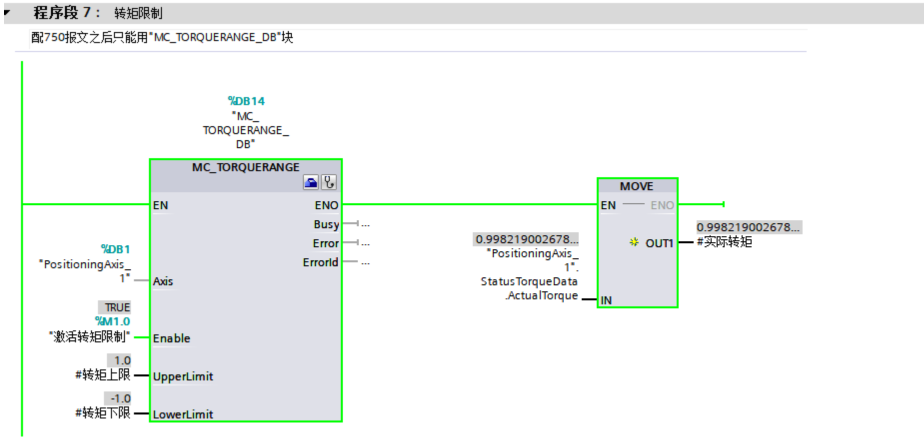
4.5.5 Telegram 3 + Telegram 750 Torque limit

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>1.</td><td>Add 750 telegram

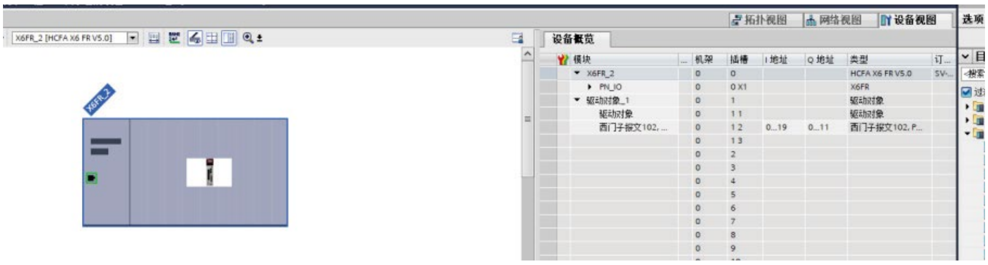
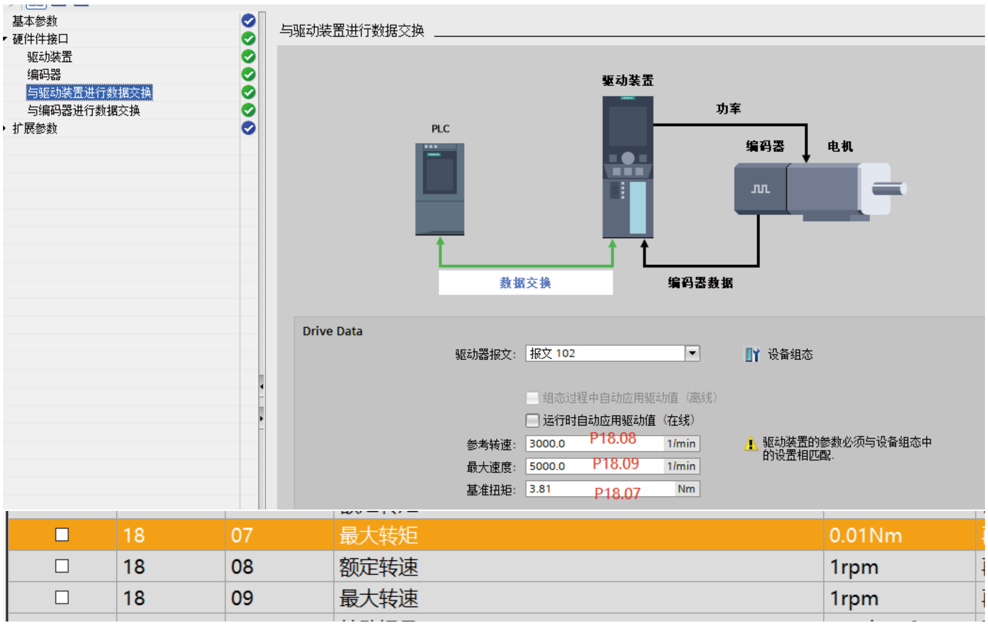

</td></tr>
<tr><td>2.</td><td>Add 750 telegram to the process object (additional telegrams added later need to be re-added here, and will be automatically added to the process object if added with the main telegram))

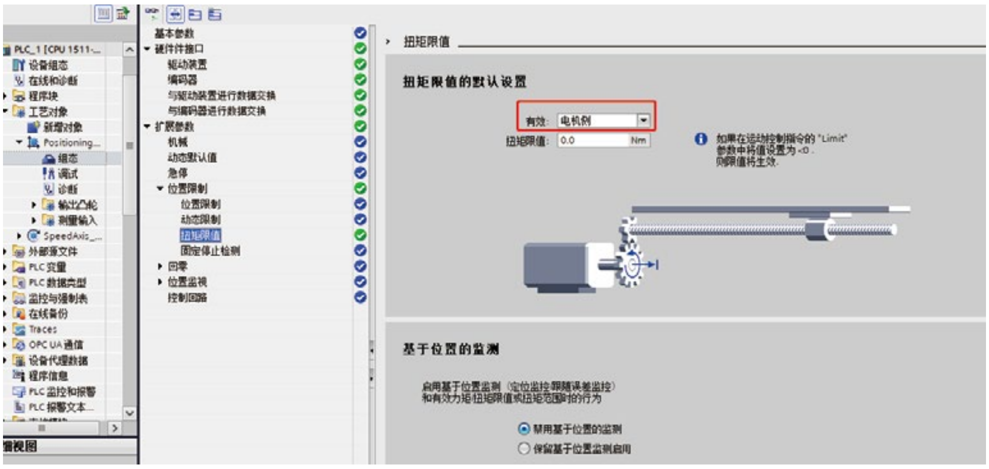

</td></tr>
<tr><td>3</td><td>When using torque limiting with a position axis, the following error needs to be turned off.

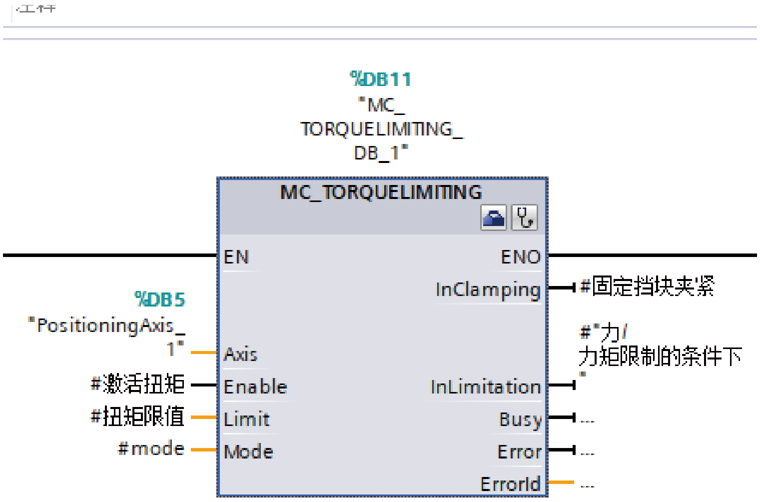

</td></tr>
</table>

No.	Description
4	Write the torque limiting program in the program block. 

4.5.6 Telegram 102/105 torque control

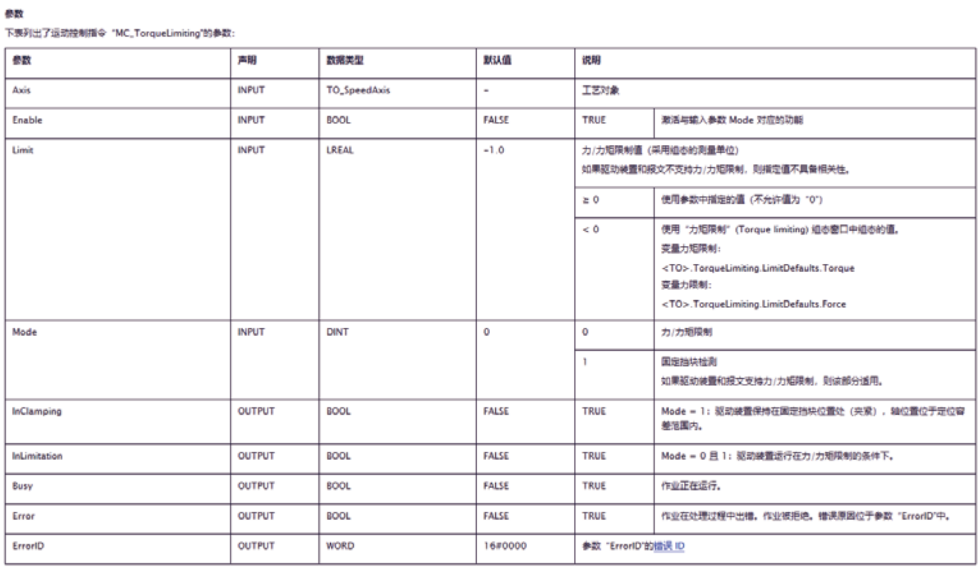
No.	Description
1	Configure 102 telegram in the message channel. 
2	The other configurations are the same as the 3 telegrams, except that there is one more reference torque when "Automatically apply drive values at runtime" is unchecked. 

No.	Description
3	Set the torque limit in the position limit is valid on the "motor side" and position monitoring is disabled. 
4	Usage of“MC_TORQUELIMITING”



Description: The motion control instruction "MC_TorqueLimiting" activates and specifies the parameters for torque/torque limiting and fixed block detection. Fixed block detection enables motion operations such as "motion to fixed block" and position control. In the axis configuration, it is possible to configure whether the force/torque limit is related to the drive side or the load side (step 3). The "MC_TorqueLimiting" block is only supported with messages 102 and 105.

Parameter:

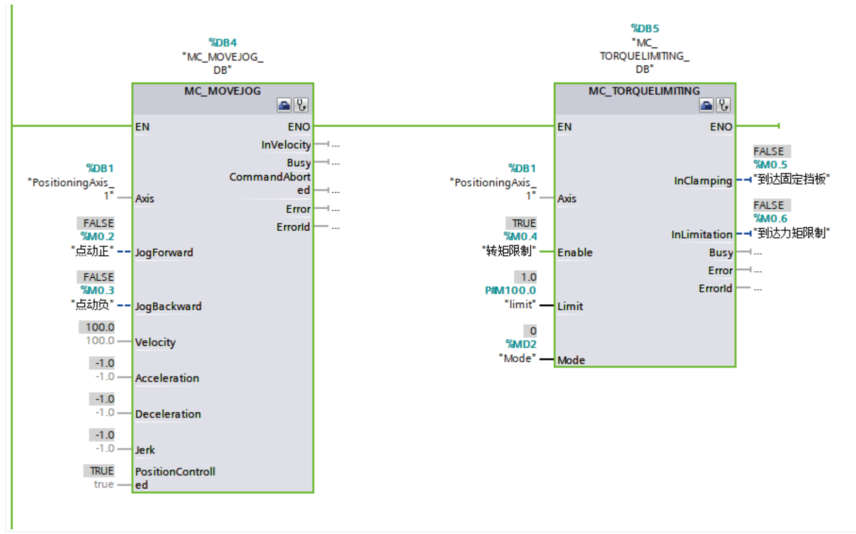


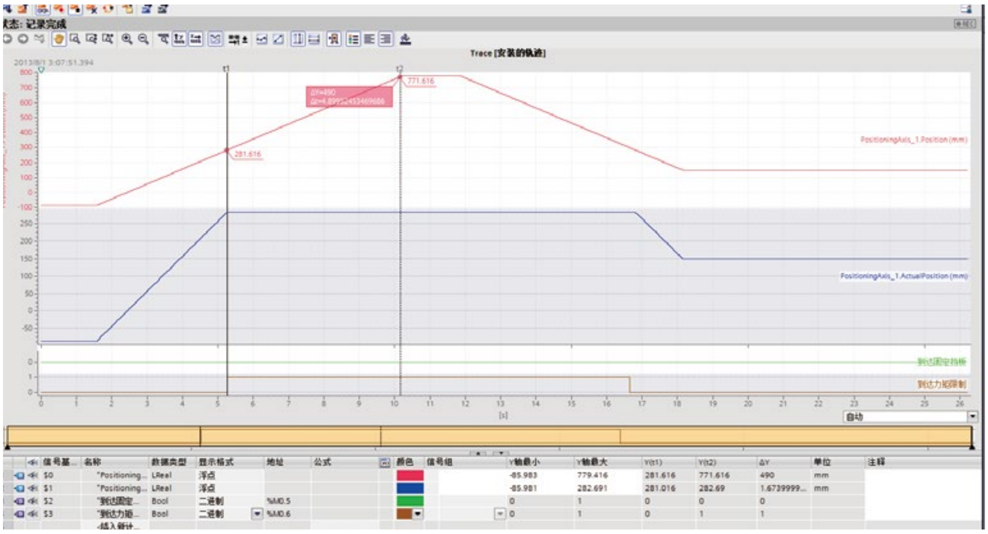
参数

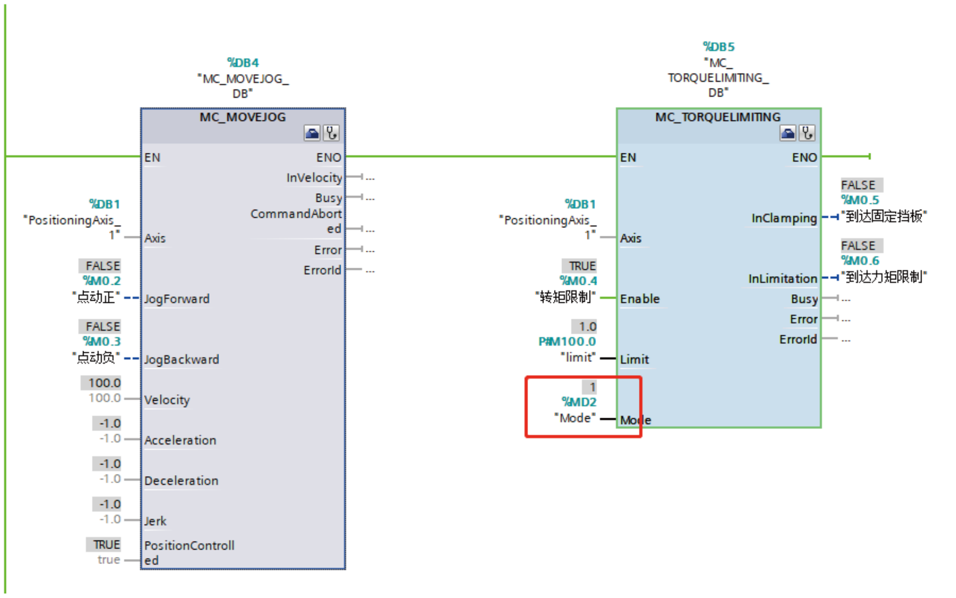
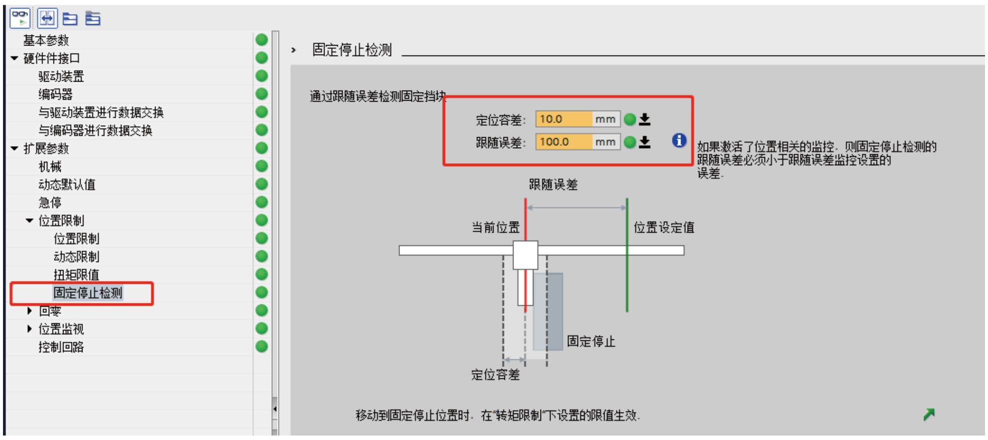
下表列出了运动控制指令 "MC_TorqueLimiting"的参数:

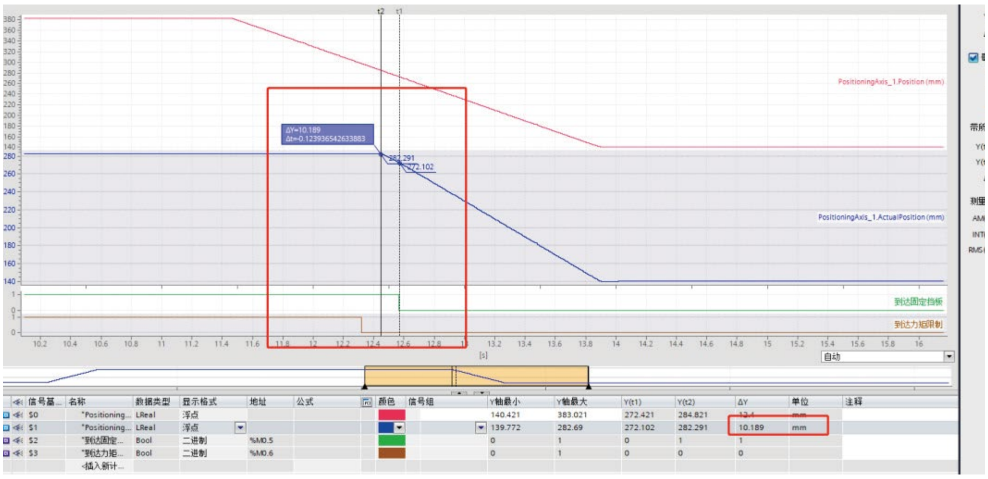
参数	声明	数据类型	默认值	说明	
Axis	INPUT	TO_SpeedAxis	-	工艺对象	
Enable	INPUT	BOOL	FALSE	TRUE	激活与输入参数 Mode 对应的功能
Limit	INPUT	LREAL	-1.0	力/力矩限制值（采用组态的测量单位） 如果驱动装置和报文不支持力/力矩限制，则指定值不具备相关性。	
				≥ 0	使用参数中指定的值（不允许值为 "0"）
				< 0	使用 "力矩限制" (Torque limiting) 组态窗口中组态的值。 变量力矩限制: <TO>.TorqueLimiting.LimitDefaults.Torque 变量力限制: <TO>.TorqueLimiting.LimitDefaults.Force
Mode	INPUT	DINT	0	0	力/力矩限制
				1	固定挡块检测 如果驱动装置和报文支持力/力矩限制，则该部分适用。
InClamping	OUTPUT	BOOL	FALSE	TRUE	Mode = 1：驱动装置保持在固定挡块位置处（夹紧），轴位置位于定位容差范围内。
InLimitation	OUTPUT	BOOL	FALSE	TRUE	Mode = 0 且 1：驱动装置运行在力/力矩限制的条件下。
Busy	OUTPUT	BOOL	FALSE	TRUE	作业正在运行。
Error	OUTPUT	BOOL	FALSE	TRUE	作业在处理过程中出错。作业被拒绝。错误原因位于参数 "ErrorID"中。
ErrorID	OUTPUT	WORD	16#0000	参数 "ErrorID"的错误 ID	

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>5</td><td>When using the Jog+ Force/Torque Limit mode, mode=0.

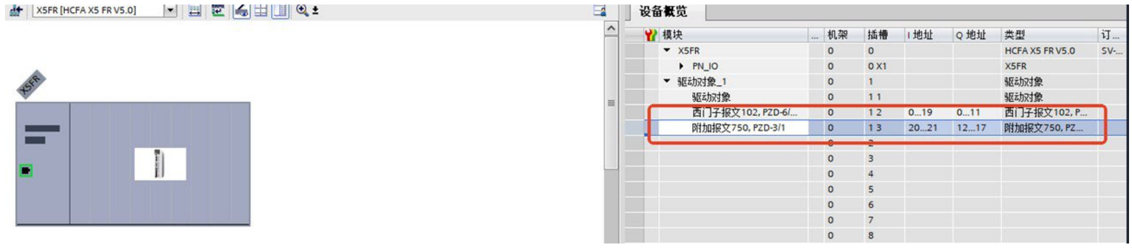
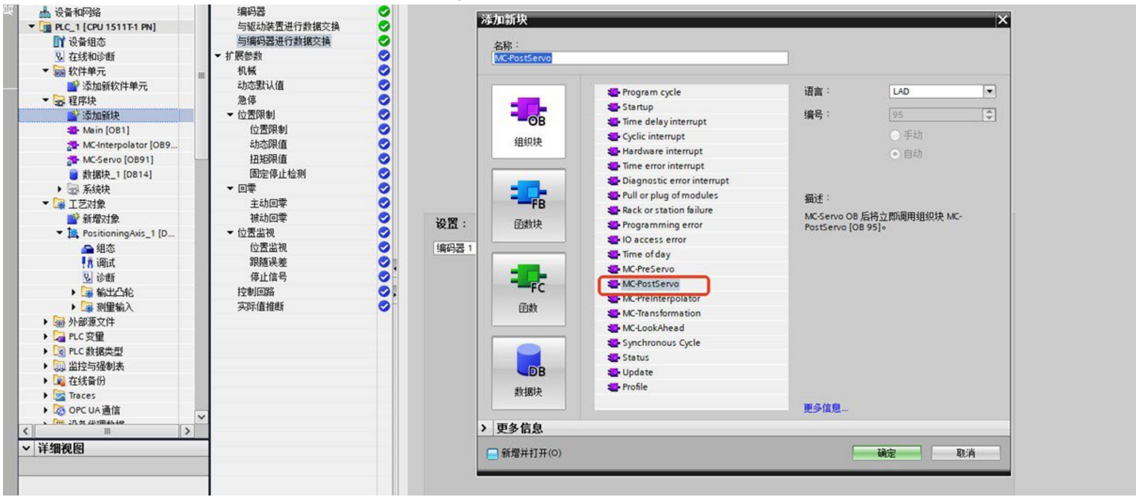
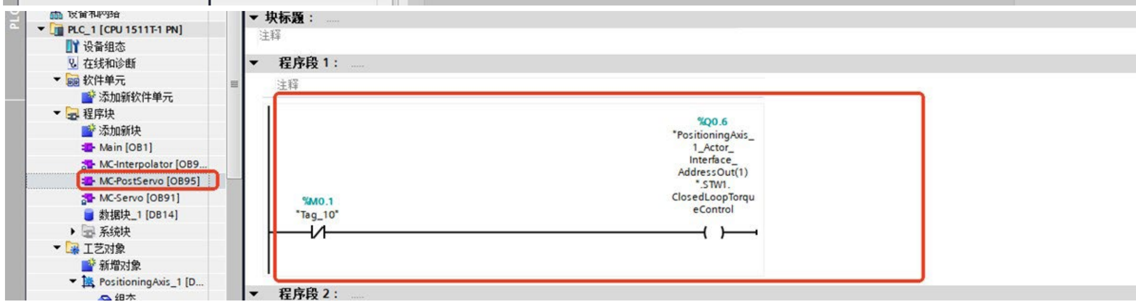

</td></tr>
<tr><td>6</td><td>When the torque limit is reached, InClamping does not act, and InLimitation is set to 1. If the point switch is not turned on, the shaft position command is always increasing; the position feedback does not increase, so the reverse movement requires that the axis position deviation be sent out before the motor can be reversed.


</td></tr>
</table>

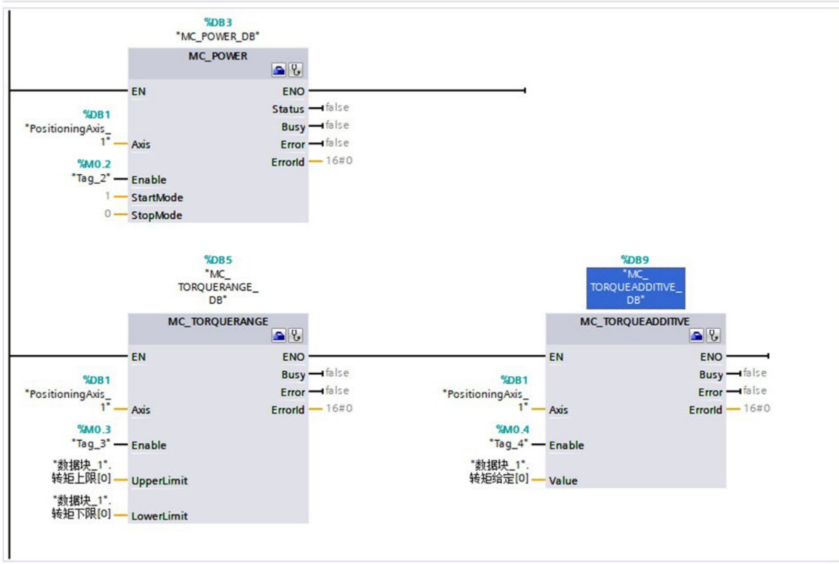
No.	Description
7	When using the fixed baffle mode，mode=1. 
8	Set the positioning tolerance and following tolerance for fixed stop detection.  Positioning tolerance: When the output InClamping signal, when the drive device reverses beyond the set positioning tolerance, it is regarded as fixed block detachment or folding back. Following tolerance: If the drive unit stops running due to the mechanically fixed block during the motion operation, the following tolerance will increase, and when it accumulates to the set following tolerance, the InClamping signal will be output (reaching the fixed baffle). Note: The following error of the configuration must be greater than the position tolerance of the configuration.

No.	Description
9	As shown in the figure above, the following error is set to 100mm, and when the accumulated following error reaches the set following error, the InClamping signal is output and the position command (Position) is not increased. 
10	When reversing away from the fixed baffle, the InClamping signal changes from high to low when the motor runs away from the fixed baffle by more than 10mm. 

4.5.7 Telegram 102/105 + Telegram 750 Torque control

No.	Description
1.	Configure Telegram 102 + Telegram 750 in the telegram channel. 
2.	Add a position axis in the technology object, same as in section 4.5.2. 
3	Add the OB95 block (MC-PostServo) in the program block, and set STW1.bit14 to 1 within MC-PostServo.  

No.	Description
4	Write the program: enable the axis via the MC_POWER_DB block, set the torque limit range via the MC_TORQUERANGE_DB block, and set the running torque via the MC_TORQUEADDITIVE_DB block. The speed limits are set via the internal parameters P03.27 (Internal positive speed limit) and P03.28 (Internal negative speed limit).



Note: (1) Torque mode is supported starting from version P21.64=1018.

(2) To use torque mode, set parameter 06.33 to 0 to disable the overspeed protection detection. Otherwise, an overspeed alarm will be triggered after prolonged operation.

(3) STW1.bit14 must be set within MC-PostServo (OB95) to enable torque mode.

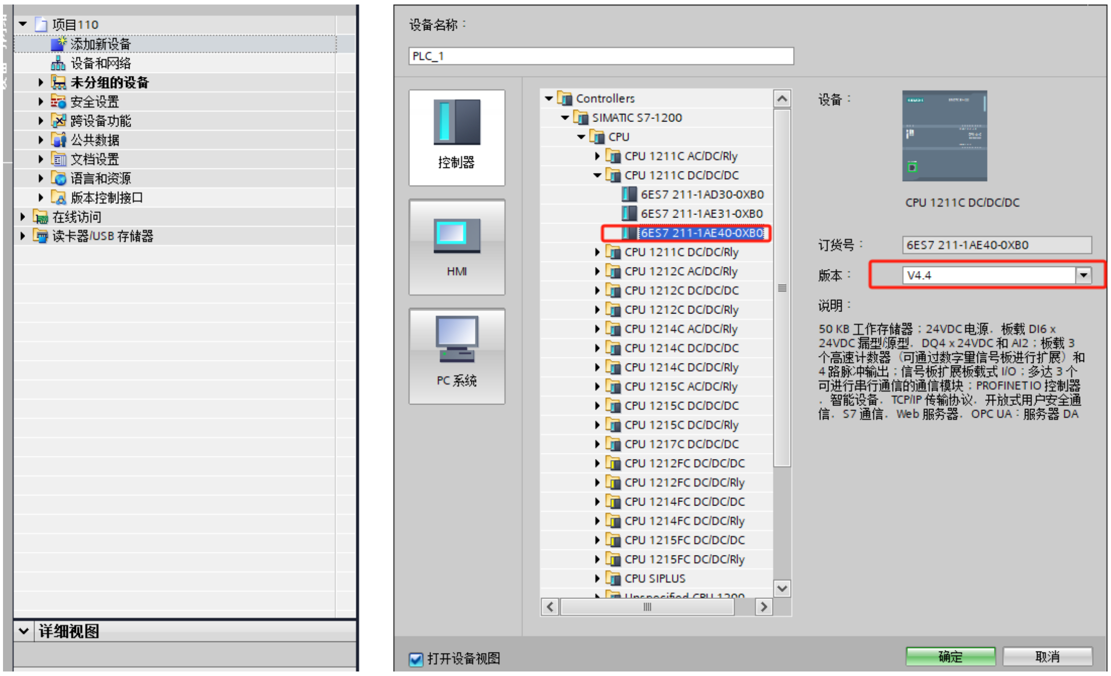
4.6 S7-1200PLC configuring AC4 mode

4.6.1 Overview

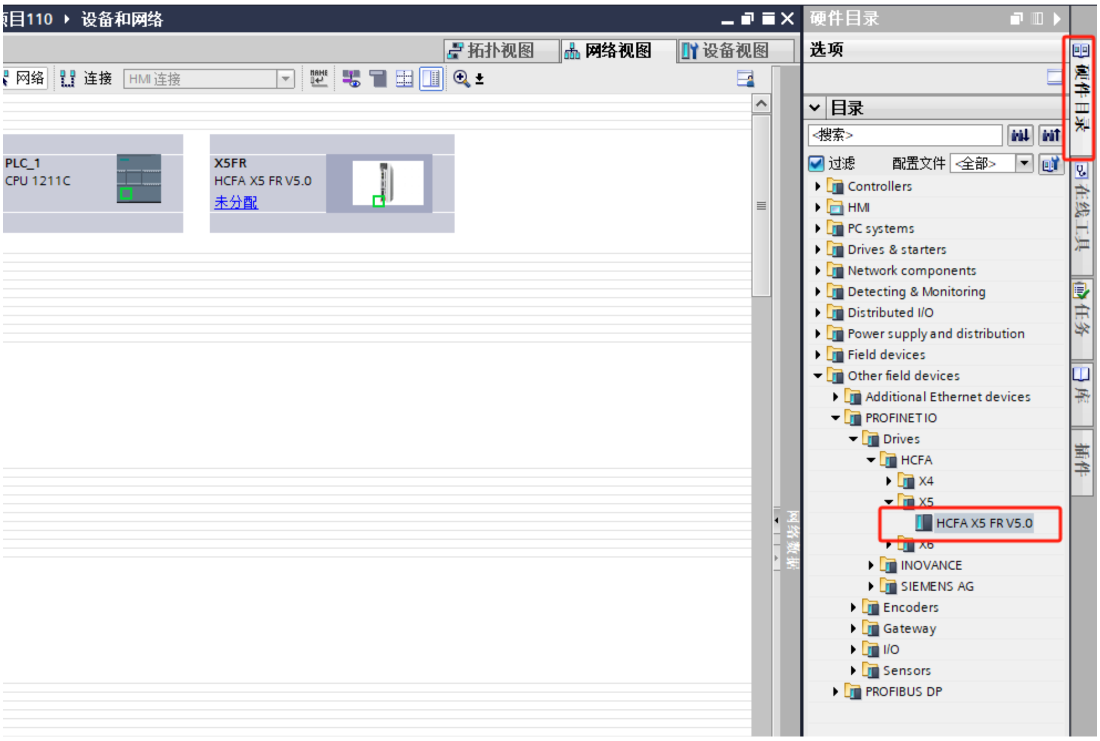
AC4 mode is to do position control within the PLC, servo drive only speed control, so the use of AC4 mode needs to be matched with the process object, to execute position control, S7-1200PLC process object support for 3 and support RT mode.

4.6.2 Configuration

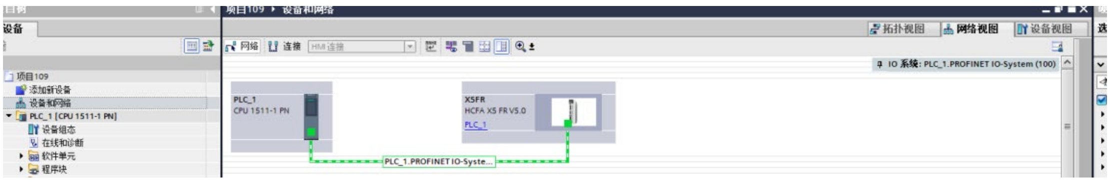
1. Open Protal, create a project, create a new project and double click on "Add New Device (find the PLC used and select the PLC version)" from the catalog tree.



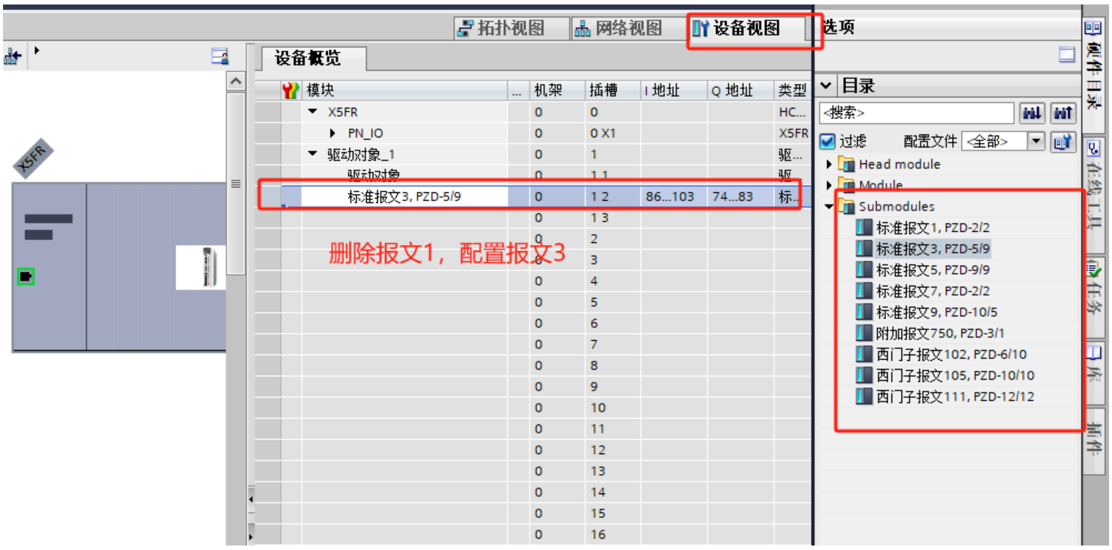
2. Follow the GSD file installation, after installing the GSD file, drag X5FR into the network view.



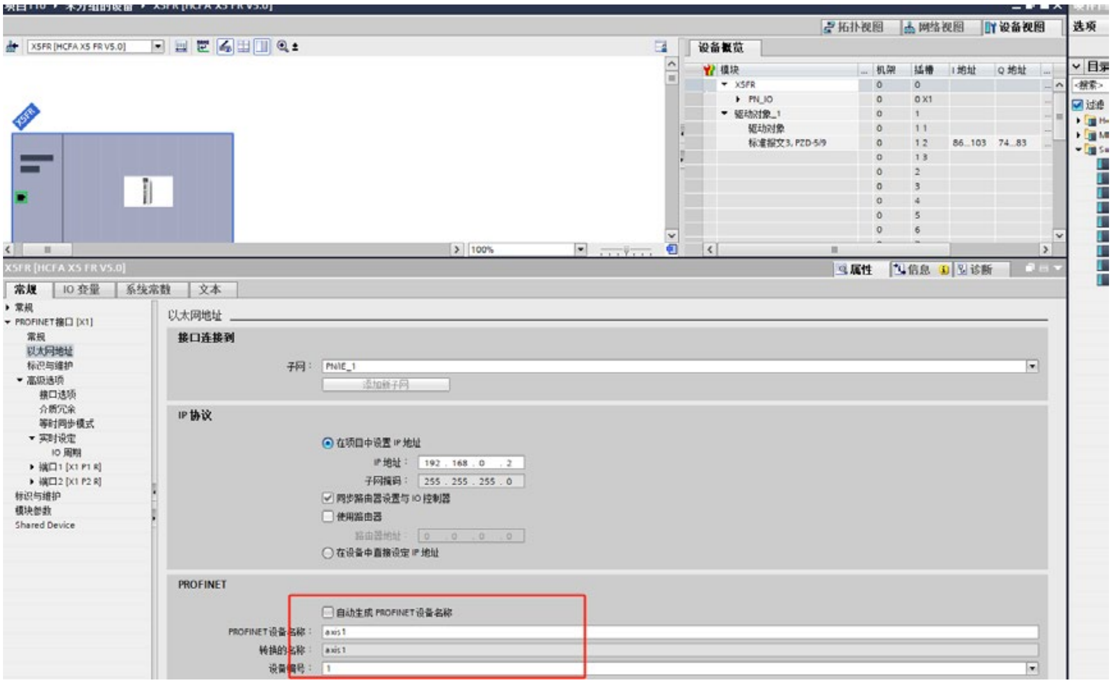
3. In the network view, click "Unassigned" and select "PLC_1.PROFINET Interface_1":



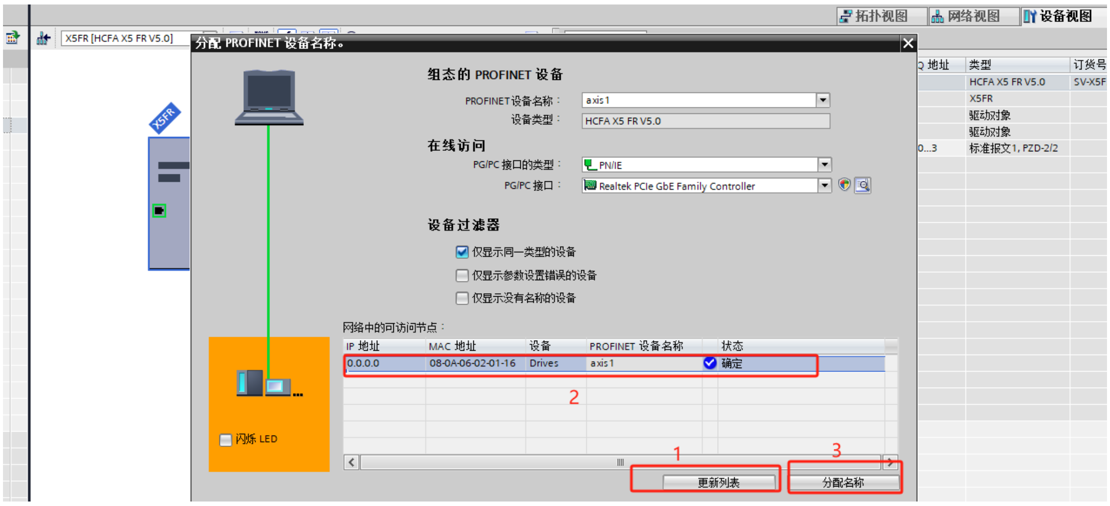
4. In the "Device overview" of the HCFA X5FR, select "Standard telegram 3" from the sub-modules.



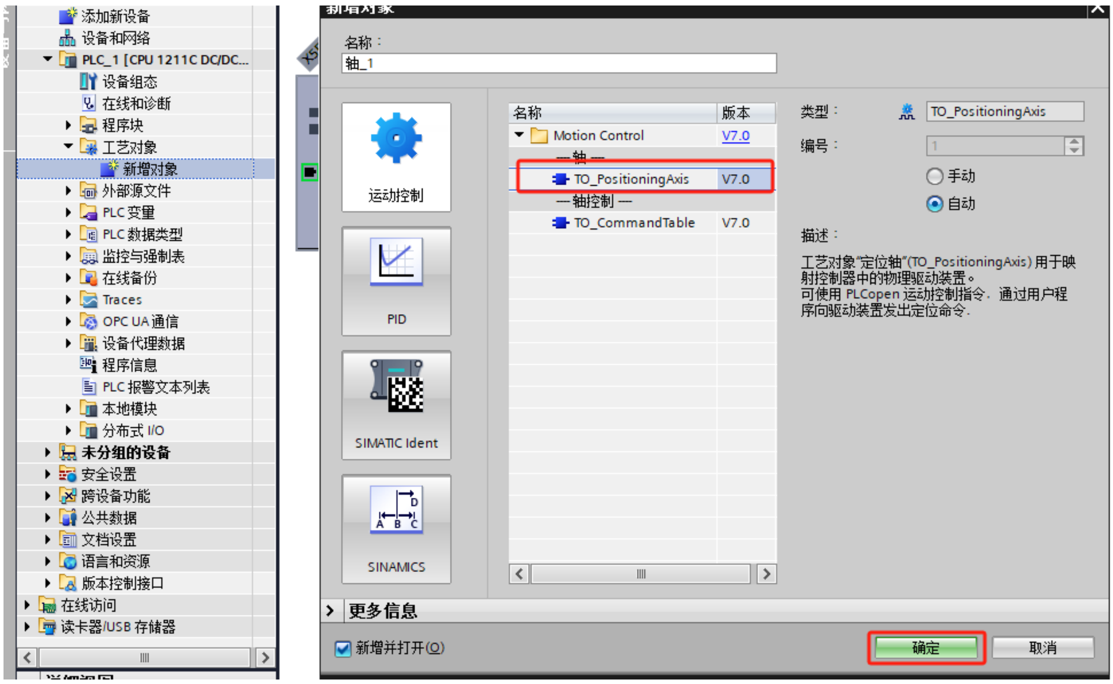
5. Match the name to the HCS-Studio network configuration settings.



Alternatively, users can right-click on the device in the device view of Portal and "Assign Device Name" (the first step is not necessary).



6. Establishment of process objects: In the left side of the "process object" list, double-click the "Insert New Object". In the "New Object" box that pops up, select "TO_PositioningAxis" and name the new object, and then click the "OK" button to insert a new process object.



7. Process object configuration - basic parameters (general)

(1) On the "General" page of the "Basic parameters", users can configure the names of the axes to be added to the process object.

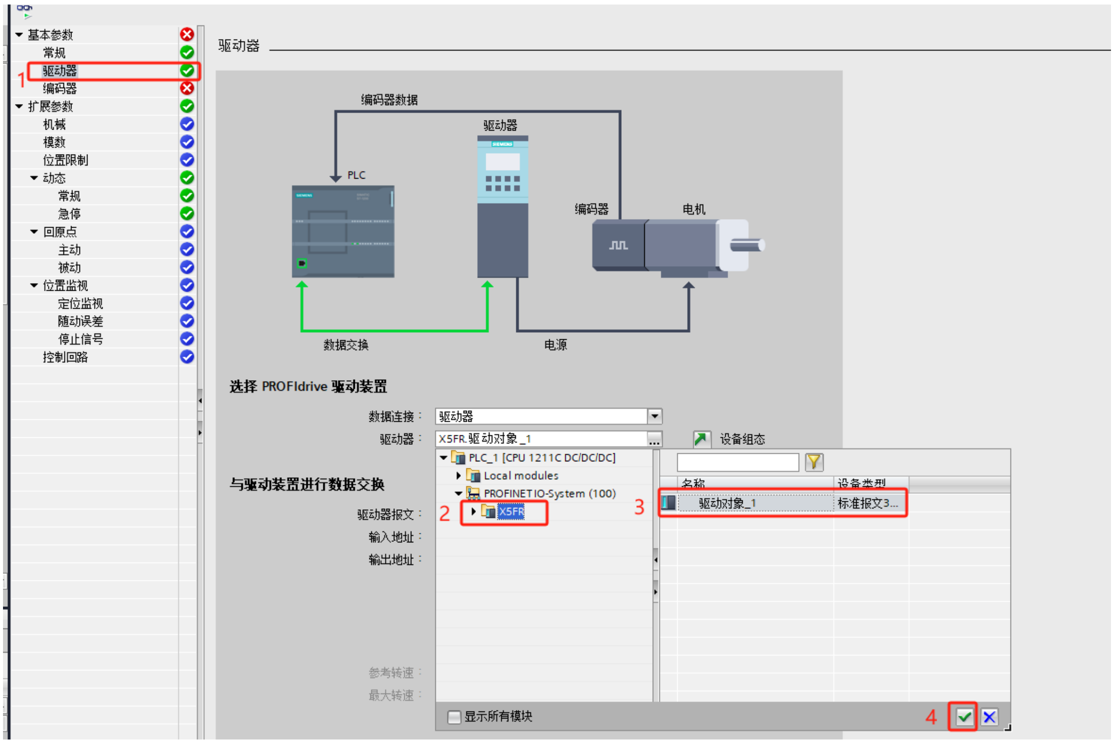
(2) Select "PROFIdrive" for the drive type.

(3) The unit of measurement is mm by default. Users can select other units such as m, in, ft, pulse and degree from the drop-down list.

8. Configuration of process objects - basic parameters (drives)

(1) In the "Drive" page of "Basic parameters", users need to select the drive.

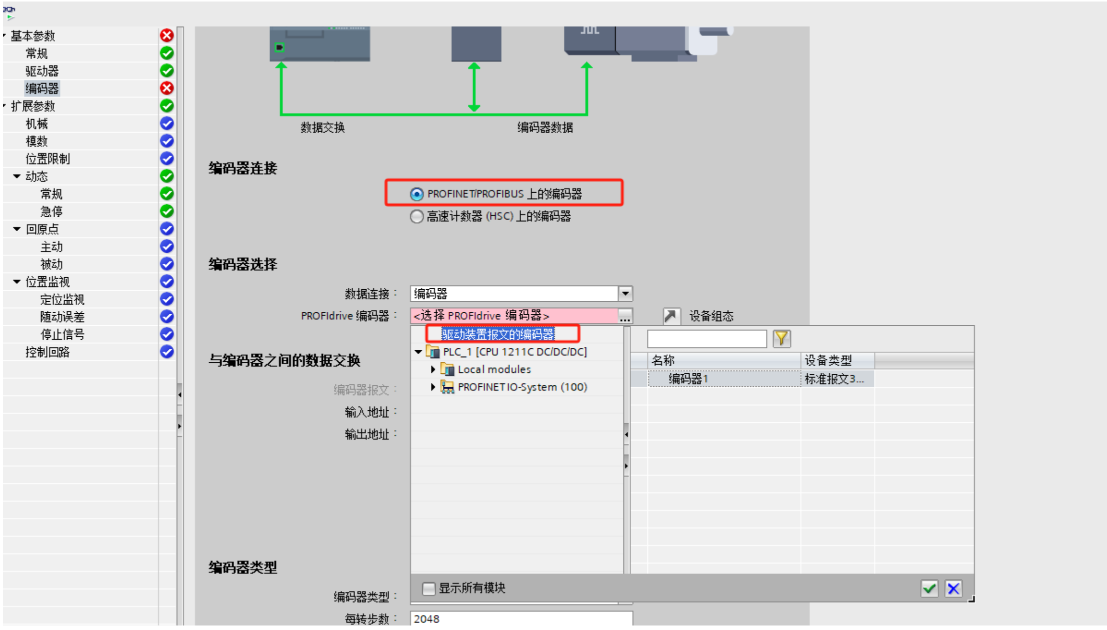
(2) After selecting the drive, users can configure the parameters for data exchange. The default is automatic uploading, and in case of uploading error, please set the reference speed and maximum speed manually. Example: Maximum speed, in this example is 3000.0 r/min.



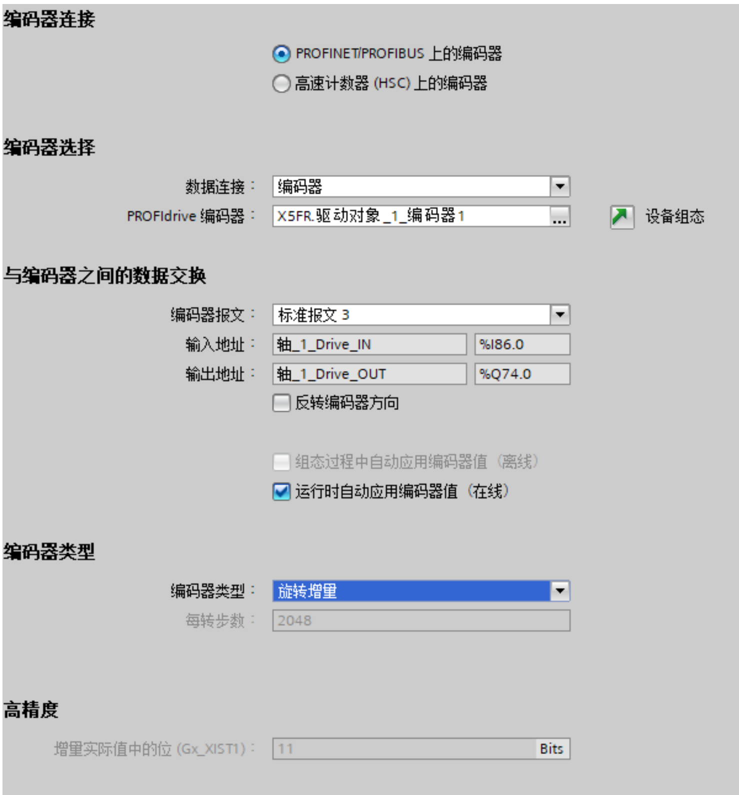
If upload unsuccessful,please manually set the parameters to see the rated speed of the motor (18.08) and the maximum speed (18.09).

9. Configuration of the process object - basic parameters (encoder)

(1) In the "Encoder" page of the basic parameters, select the encoder connection method. For this example, select "Encoder on drive".

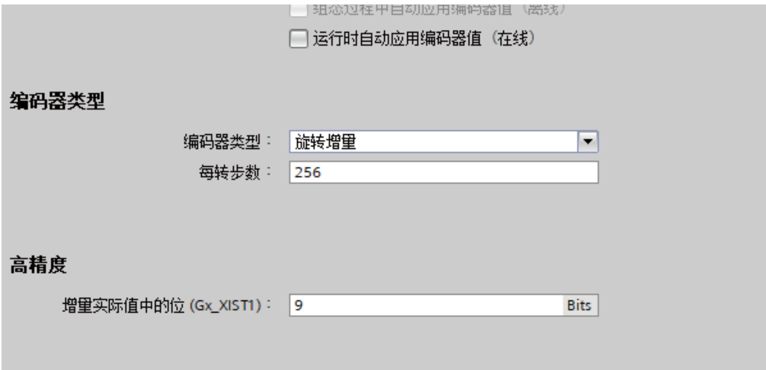


(2) After selecting the encoder connection method, it needs to configure the encoder type (rotary incremental or rotary absolute), as well as the encoding parameter settings, users can check the automatic uploading, the following figure shows the automatic uploading of incremental motor.

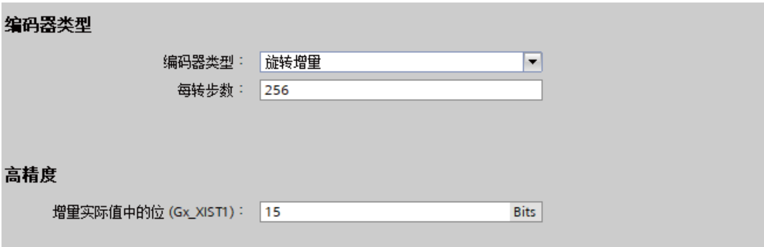


Manual setting of encoder parameters

The 17-bit motor incremental system is set as follows.

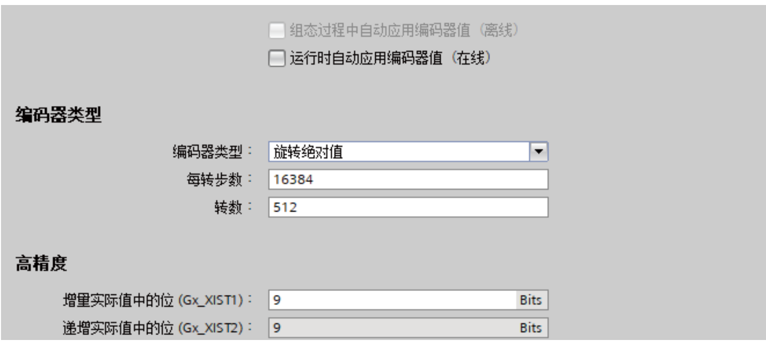


The 23-bit motor incremental system is set as follows.



The 17-bit motor absolute system is set up as follows.

The 23-bit motor absolute system is set up as follows.



4.7 S7-1200/S7-1500 non-periodic parameter read/write

There are two types of off-cycle parameters, one is the profile parameter and the other is the servo local parameter, the profile parameter can be read directly, the servo local parameter needs to be read by the SINA_PARA_S module or the "SINA_PARA" module.

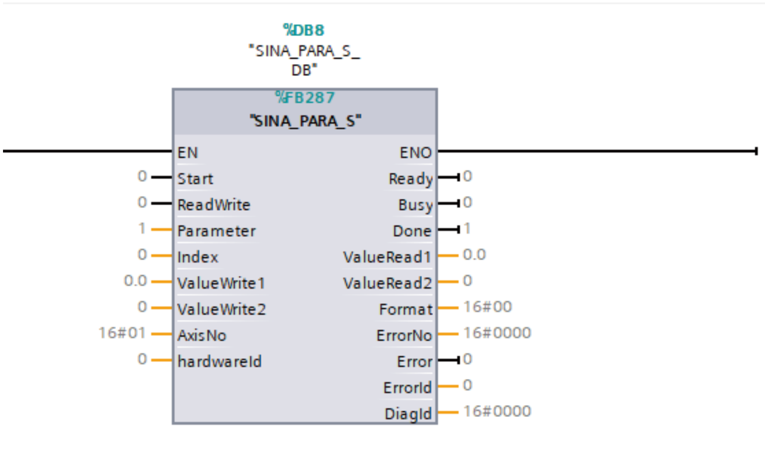
After installing the Startdrive software, the Drive_lib library will be automatically installed in Portal. SINA_PARA" (FB286) and "SINA_PARA_S" (FB287) are included in the library, which can be used to read/write the parameters of the drive. Users only need to specify the parameter number, parameter subscript and parameter value to be written (only for write operation), and then after executing the block, the corresponding read/write operation will be executed automatically.

X5E(F)R servo local parameter is a single parameter, index needs to be 0, AxixNo fixed to 1. servo local parameter in reading parameter number needs to be converted to hexadecimal and then add (0x1000) and then read.

4.7.1 "SINA_PARA_S" (FB287) reads and writes a single parameter

(1) FB287 Function block description

"SINA_PARA_S" (FB287) reads and writes a parameter to the drive, and at the "ReadWrite" input, specifies whether to write the parameter or read it from the X5E(F)R drive, with each read/write initiated by the initiated by the rising edge of Start.



Input and output pins

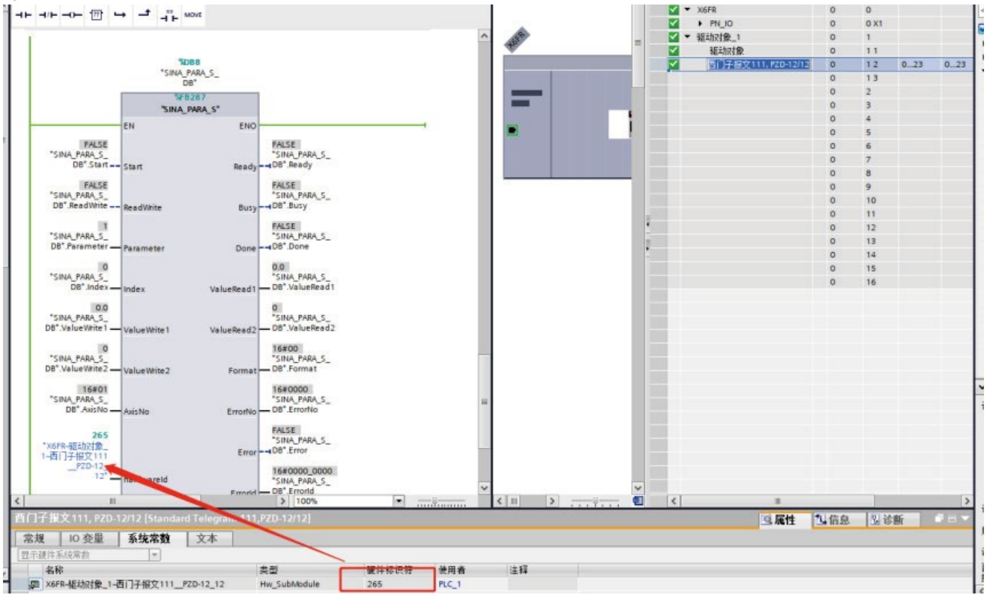
Input parameters:			
Input siganl	**Type**	**Default**	**description**
Start	BOOL	0	Start job (0 = no job or job canceled; 1 = job started and executed)
ReadWrite	BOOL	0	Job type: 0 = read, 1 = write
Parameter	INT	1	Parameter number
Index	INT	0	Parameter index
ValueWrite 1	REAL	0	Parameter values (REAL format)
ValueWrite 2	DINT	0	Parameter values (DINT format)
AxisNo	INT	1	Axis number / Axis ID in multi-axis systems
hardwareId	HW IO	0	ID Hardware ID of the actual value message slot of the module access point/axis or drive
Output parameters:			
Output siganl	**Type**	**Default**	**description**
Ready	BOOL	0	Feedback signals connected in the LAcycCom environment; 1 = end of job or job canceled (one cycle)
Busy	BOOL	0	Job in progress (if "Busy" = 1)
Done	BOOL	0	If the job is ended correctly, it means that the edge changes from 0 to 1

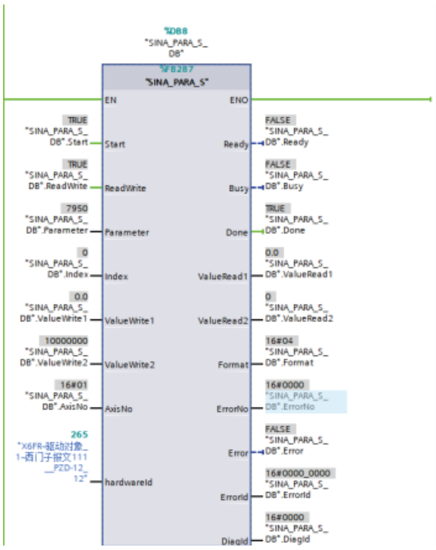
ValueRead 1	REAL	0	Reading the value of the parameter (REAL format) (16-bit parameter for X5E(F)R)
ValueRead 2	DINT	0	Reading the value of the parameter (DINT format) (32-bit parameter for X5E(F)R)
Format	INT	0	Format of the read parameter
ErrorNo	INT	0	Error number in accordance with PROFIdrive protocol
Error	BOOL	0	Activation group fault -> "Error" =1
Status	DWORD	0	The 1st word: Binary code indicates which parameter access fault has occurred. The 2nd word: Fault type
DiagId	WORD	0	Extended communication error -> SFB call error

(2) Example of writing a single drive parameter

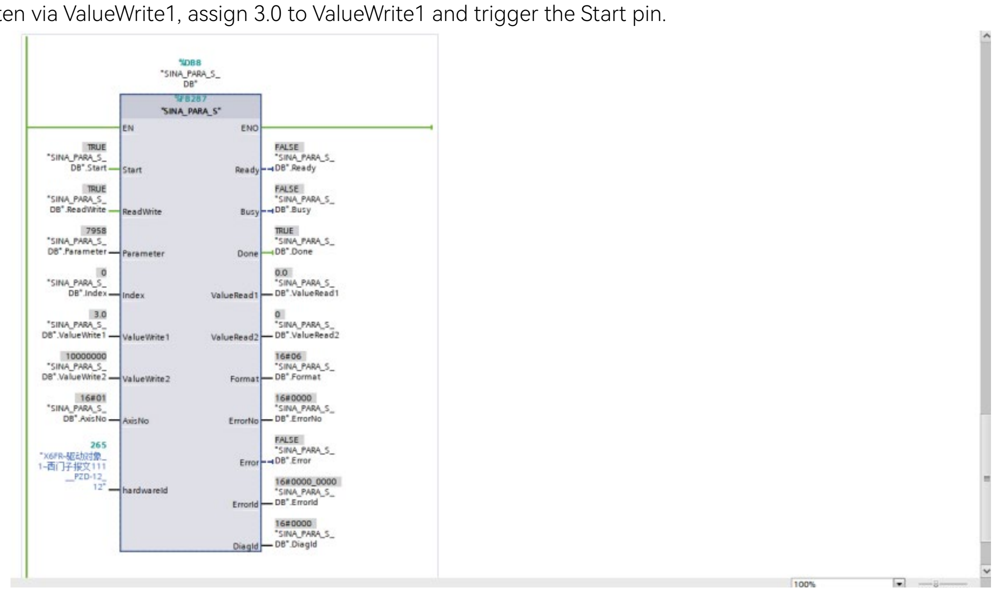
The method of writing P15.14 (32-bit parameter) = 10000000 and P15.22 (16-bit parameter) = 3.0 parameters via FB287 is shown in the table below.

Example of writing a single drive parameter

No.	Description
1	The hardware ID of X5E(F)R can be obtained in the hardware configuration by calling the FB287 function block and assigning values to each pin. 

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>2</td><td>
Parameter number (0x1f0E) (P15.14) fill in the FB287 input pin "Parameter", the drive parameters correspond to the FB287 input pin "Parameter" conversion method, for example P15.14, 15 is converted to hex 0x0F, 14 is converted to hex 0x0E and then add 0x1000 finally, that is, 0x1F0E is the parameter number, and then converted to decimal 7950. In addition, the servo local single parameter, index needs to be 0; AxixNo fixed to 1.
Set pin "ReadWrite" to 1.
Because 15.14 is a 32-bit parameter, fill in the value of the parameter to be written (10000000) to the input pin ValueWrite2.
After the setting is completed, trigger the Start pin, Start detects the rising edge and writes the parameter, Done means the writing is completed.


</td></tr>
<tr><td>3</td><td>
Using software to check P15.14 write parameters


</td></tr>
<tr><td>4</td><td>
Write the parameter P15.22 and the converted value 7958 to the input pin "Parameter". P15.22 is a 16-bit number and is written via ValueWrite1, assign 3.0 to ValueWrite1 and trigger the Start pin.


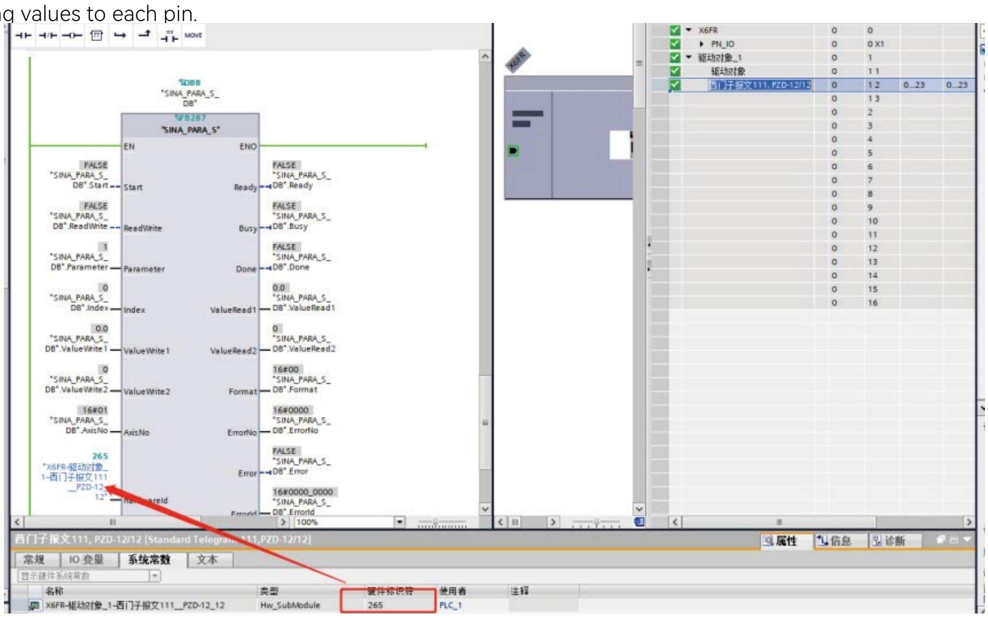
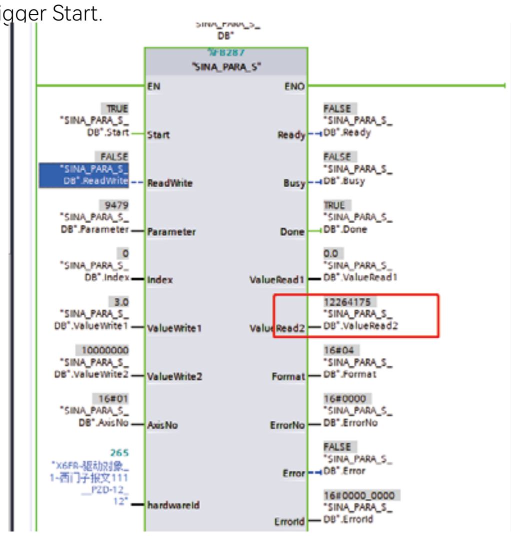
</td></tr>
<tr><td>6</td><td>
Check whether parameter P15.22 is written through servo software.

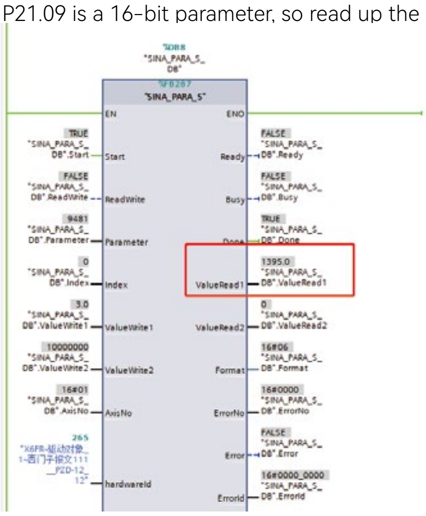

</td></tr>
</table>

(3) Example of reading a single drive parameter

The method of reading P21.07 (32-bit parameter) and P21.06 (16-bit parameter) parameters via FB287 is shown in Table 3-1.

Table 3-1 Example of writing single drive parameters

No.	Description
1	The hardware ID of X5E(F)R can be obtained in the hardware configuration by calling the FB287 function block and assigning values to each pin. 
2	Parameters 21.07 and 21.09 via servo software 
3	Read the parameters of 21.07 through FB287. Set pin "ReadWrite" to 0. Convert P21.07, 21 is converted to 16#15, 07 is converted to 16#07, then 16#1507 is added to 16#1000, so P21.06 is converted to 16#2507, decimal 9479, and 9479 is assigned to "Parameter". Then trigger Start.  Consistent with the software read, FB287 is not real-time, 21 groups of parameters are changing in real time, may not be the same moment of the parameters, resulting in the two parameters are not the same. 32-bit parameters are read up and stored in ValueRead2.

No.	Description
4	Parameter P21.09, after the conversion of the value of 9481 written into the input pin "Parameter, and then trigger the Start pin, P21.09 is a 16-bit parameter, so read up the number of existing ValueRead1. 

4.7.2 "SINA_PARA"（FB286）Read and write multiple parameters

With this function block, up to 16 parameters can be read or written to the X5E(F)R drive.

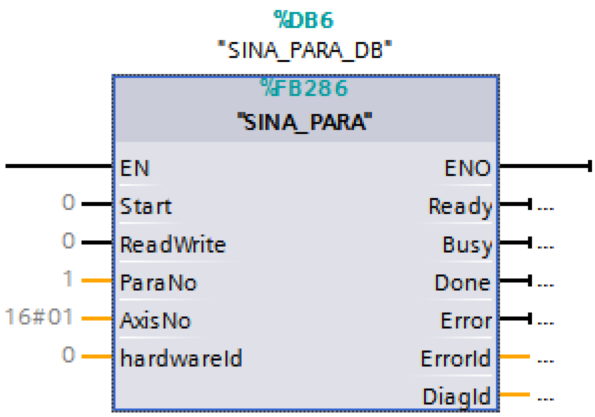
At the ReadWrite input, specify whether to write the number specified at the ParaNo input or read it from the SINAMICS drive.

A parameter read or write is initiated by the edge-triggered Start input.

The parameter data must be entered into a global data block that creates an array of 16 entries of type UDT "SinaParameter". This array must be interconnected with the "INOUT" parameter "Parameter".

The data to be read/written are entered or displayed in REAL or DINT format.

(1) FB286 fucntion block description



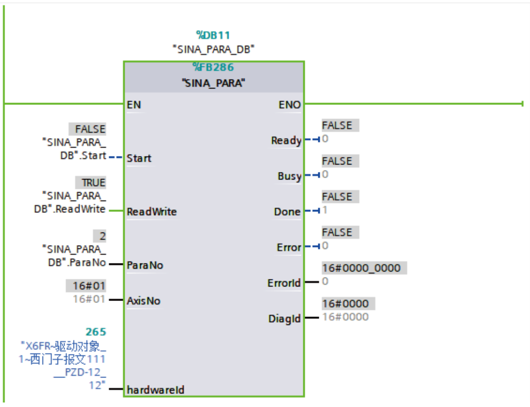
Input and output pins:

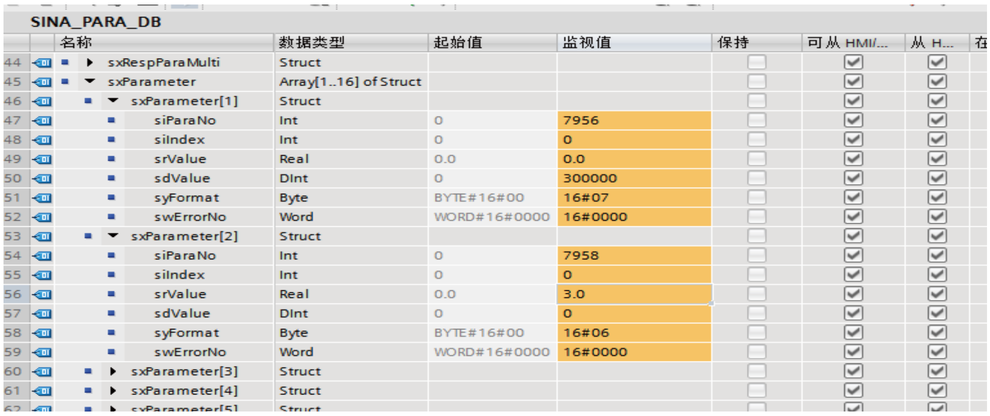
Input parameter			
Input siganl	**Type**	**Default**	**Description**
Start	BOOL	0	Start job (0 = no job or job canceled; 1 = job started and executed)
ReadWrite	BOOL	0	Job type 0 = read, 1 = write
ParaNo	INT	1	Number of parameters → 1 to 16
AxisNo	INT	1	Axis number/axis ID in a multi-axis system
hardwareId	HW IO	0	Module access point/axis or drive
Output parameter			
Output siganl	**Type**	**Default**	**Description**
Ready	BOOL	0	Feedback signal for connections in the LAcycCom environment; 1 = End of job or job canceled (one cycle) See Connections to LAcycCom libraries.
Busy	BOOL	0	"Busy" → 1, the job is being processed.
Done	BOOL	0	Job completed, indicating edge from 0 → 1
Error	BOOL	0	Group fault active "Error" → 1
Status	DWORD	0	The 1st word: Binary code indicates which parameter access fault has occurred. The 2nd word: Fault type
DiagId	WORD	0	Extended communication error → SFB call error

(2) Example of writing multiple drive parameters

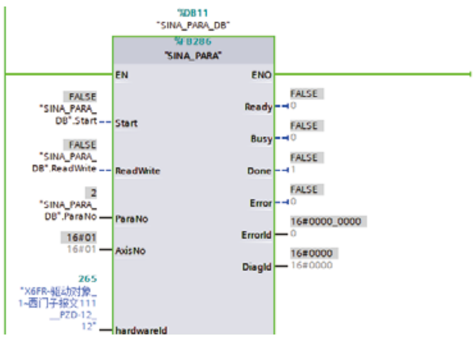
The method of writing P15.20 and P15.22 parameters via FB286 is shown in Table 2-1.

Table 2-1 Example of writing multiple drive parameters

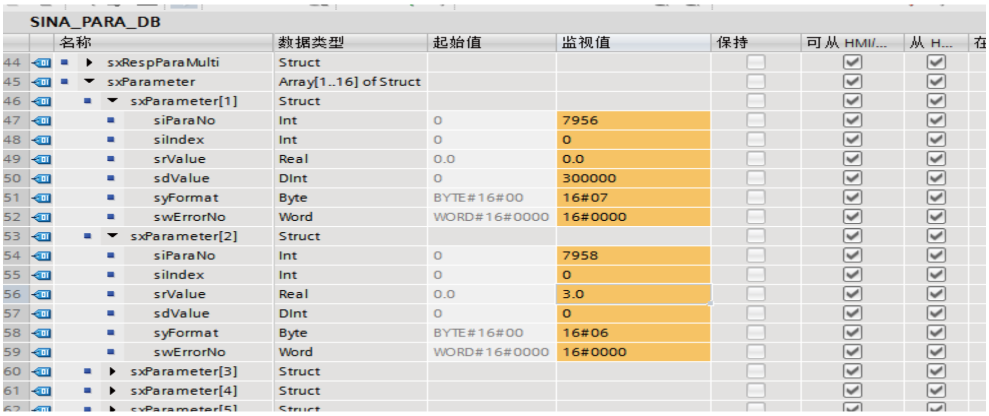
No.	Description
1	Drag the FB286 block into the program, set ReadWrite to 1, and assign ParaNo to 2. A ParaNo of 2 can write two parameters at the same time. 

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>2</td><td>Read and write drive parameters via the sxParameter array in the DB data block of SINA_PARA.
Set the relevant parameters in the sxParameter[1] and sxParameter[2] data structures as follows in this example:
sxParameter[1].siParaNo=0x1F14 (P15.20 parameter number)
sxParameter[1].sdValue=300000 (value to be written in P1520)
sxParameter[2].siParaNo=0X1F16 (P15.22 parameter number)
sxParameter[2].srValue=3.0 (value to be written in P15.22)
Note: Servo local parameter in reading the parameter number need to convert the serial number to hexadecimal and then add (0x1000) and then read. The 32-bit length is read and written by the sdValue variable, while the 16-bit length is read and written by the srValue variable. If the parameter has a subscript, it needs to be set in sindex. The background data block is set as follows:
For example, P1520, 15 is converted to hex 0x0F, 20 is converted to hex 0x14 and then add 0x1000 to end up as, i.e. 0x1F14 is the parameter number. In addition servo local all for a single parameter, index need to be 0; AxixNo fixed to 1.
Note:
If the parameter has subscript, it needs to be set in sindex. The background data block is set as follows:

<table>
<tr><th colspan="9">SINA_PARA_DB</th></tr>
<tr><th></th><th>名称</th><th>数据类型</th><th>起始值</th><th>监视值</th><th>保持</th><th>可从 HMI/...</th><th>从 H...</th><th>在</th></tr>
<tr><td>44</td><td>sxRespParaMulti</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>45</td><td>sxParameter</td><td>Array[1..16] of Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>46</td><td>sxParameter[1]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>47</td><td>siParaNo</td><td>Int</td><td>0</td><td>7956</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>48</td><td>siIndex</td><td>Int</td><td>0</td><td>0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>49</td><td>srValue</td><td>Real</td><td>0.0</td><td>0.0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>50</td><td>sdValue</td><td>DInt</td><td>0</td><td>300000</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>51</td><td>syFormat</td><td>Byte</td><td>BYTE#16#00</td><td>16#07</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>52</td><td>swErrorNo</td><td>Word</td><td>WORD#16#0000</td><td>16#0000</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>53</td><td>sxParameter[2]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>54</td><td>siParaNo</td><td>Int</td><td>0</td><td>7958</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>55</td><td>siIndex</td><td>Int</td><td>0</td><td>0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>56</td><td>srValue</td><td>Real</td><td>0.0</td><td>3.0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>57</td><td>sdValue</td><td>DInt</td><td>0</td><td>0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>58</td><td>syFormat</td><td>Byte</td><td>BYTE#16#00</td><td>16#06</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>59</td><td>swErrorNo</td><td>Word</td><td>WORD#16#0000</td><td>16#0000</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>60</td><td>sxParameter[3]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>61</td><td>sxParameter[4]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>62</td><td>sxParameter[5]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
</table></td></tr>
<tr><td>3</td><td>Trigger Start pin 0->1 and hold it until the write parameter is completed, and output pin Done is set after the write parameter is completed.</td></tr>
</table>

(3) Example of reading multiple drive parameters

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>1</td><td>Drag the FB286 block in the program, set ReadWrite to 0, and assign ParaNo to 2. A ParaNo of 2 allows two parameters to be written at the same time.

</td></tr>
</table>

D • PROFINET Communication Overview

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>2</td><td>Read and write drive parameters via the sxParameter array in the DB data block of SINA_PARA.
Set the relevant parameters in the sxParameter[1] and sxParameter[2] data structures as follows in this example:
sxParameter[1].siParaNo=0x1F14 (P15.20 parameter number)
sxParameter[1].sdValue=300000 (value to be written in P1520)
sxParameter[2].siParaNo=0X1F16 (P15.22 parameter number)
sxParameter[2].srValue=3.0 (value to be written in P15.22)
Note: Servo local parameter in reading the parameter number need to convert the serial number to hexadecimal and then add (0x1000) and then read. The 32-bit length is read and written by the sdValue variable, while the 16-bit length is read and written by the srValue variable. If the parameter has a subscript, it needs to be set in sindex. The background data block is set as follows:
For example, P1520, 15 is converted to hex 0x0F, 20 is converted to hex 0x14 and then add 0x1000 to end up as, i.e. 0x1F14 is the parameter number. In addition servo local all for a single parameter, index need to be 0; AxixNo fixed to 1.
Note:
If the parameter has subscript, it needs to be set in sindex. The background data block is set as follows:

SINA_PARA_DB
<table>
<tr><th></th><th>名称</th><th>数据类型</th><th>起始值</th><th>监视值</th><th>保持</th><th>可从 HMI/...</th><th>从 H...</th><th>在</th></tr>
<tr><td>44</td><td>sxRespParaMulti</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>45</td><td>sxParameter</td><td>Array[1..16] of Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>46</td><td>sxParameter[1]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>47</td><td>siParaNo</td><td>Int</td><td>0</td><td>7956</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
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<tr><td>49</td><td>srValue</td><td>Real</td><td>0.0</td><td>0.0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>50</td><td>sdValue</td><td>DInt</td><td>0</td><td>300000</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>51</td><td>syFormat</td><td>Byte</td><td>BYTE#16#00</td><td>16#07</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>52</td><td>swErrorNo</td><td>Word</td><td>WORD#16#0000</td><td>16#0000</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>53</td><td>sxParameter[2]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>54</td><td>siParaNo</td><td>Int</td><td>0</td><td>7958</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>55</td><td>siIndex</td><td>Int</td><td>0</td><td>0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>56</td><td>srValue</td><td>Real</td><td>0.0</td><td>3.0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>57</td><td>sdValue</td><td>DInt</td><td>0</td><td>0</td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
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<tr><td>60</td><td>sxParameter[3]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>61</td><td>sxParameter[4]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
<tr><td>62</td><td>sxParameter[5]</td><td>Struct</td><td></td><td></td><td>☐</td><td>☑</td><td>☑</td><td></td></tr>
</table></td></tr>
<tr><td>3</td><td>Trigger Start pin 0->1 and hold, the length of the bit 32 bits into the sdValue variable, the length of the 16 bits into the srValue variable read and write, read the parameters to complete the output pin Done set.</td></tr>
</table>

Chapter 5 S7-200 SMART with X5E(F)R

5.1 Overview

STEP 7-Micro/WIN SMART V2.4 and S7-200 SMART PLC (firmware version V2.4) have added the function of PROFINET communication, which allows users to communicate with X5E(F)R Servo Drives via the PROFINET interface for speed control and basic positioning control (telegram 1 and 111 are supported). This interface can support eight connections (IO devices or drives).

1. There are two main speed control methods realized as follows:

X5E(F)R using standard telegram 1. The PLC controls the speed of the X5E(F)R via the SINAMICS library function block SINA_SPEED, which is provided in the commissioning software.

The X5E(F)R uses standard telegram No. 1 without any special program block, and is controlled by programming using the control and status words of the telegram, which requires familiarity with the structure of the telegram.

2. The realized position control methods are mainly realized through the SINA_POS program block.

This paper describes these control methods in detail respectively.

The software to be installed is as follows:

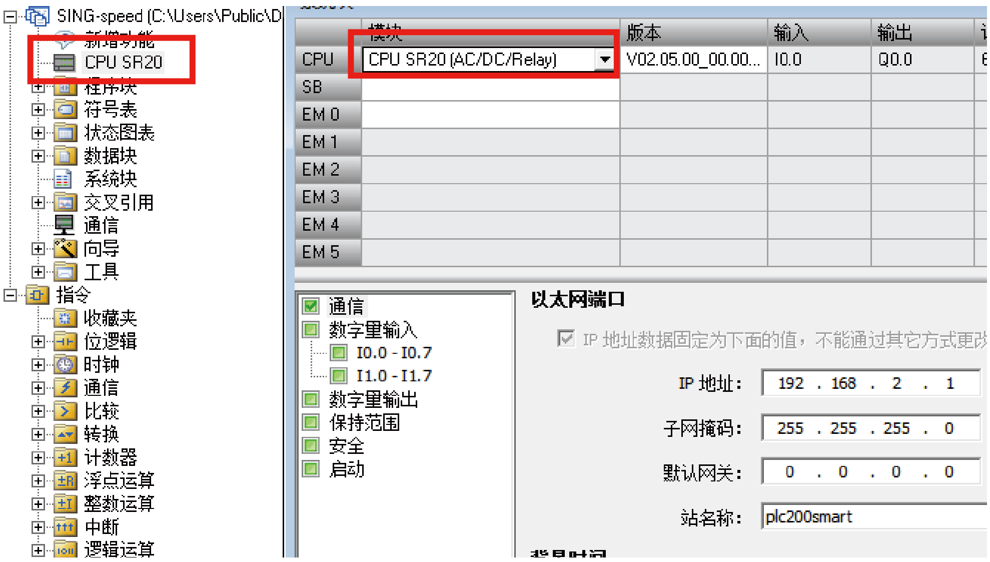
STEP 7-Micro/WIN SMART V2.4 or above commissioning software

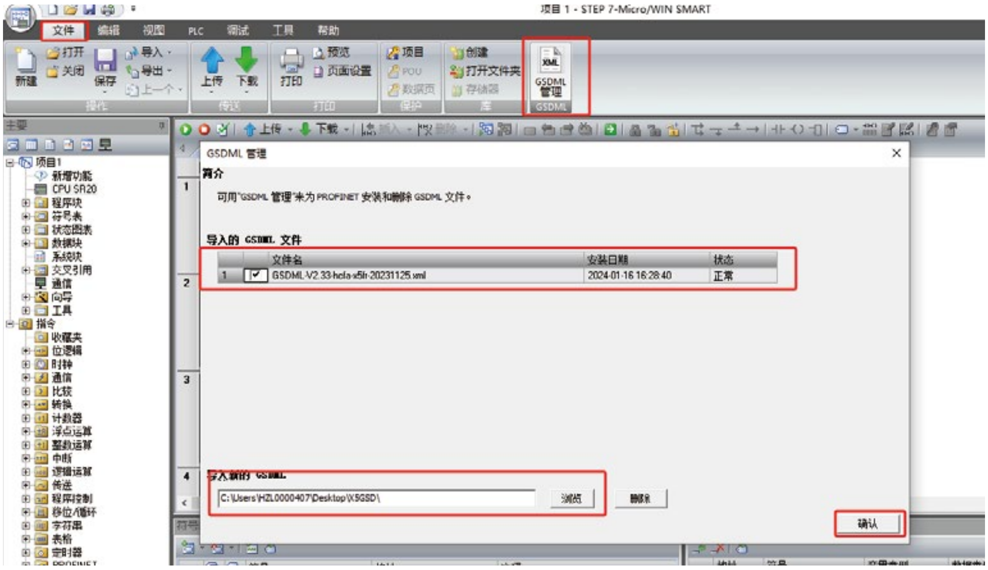
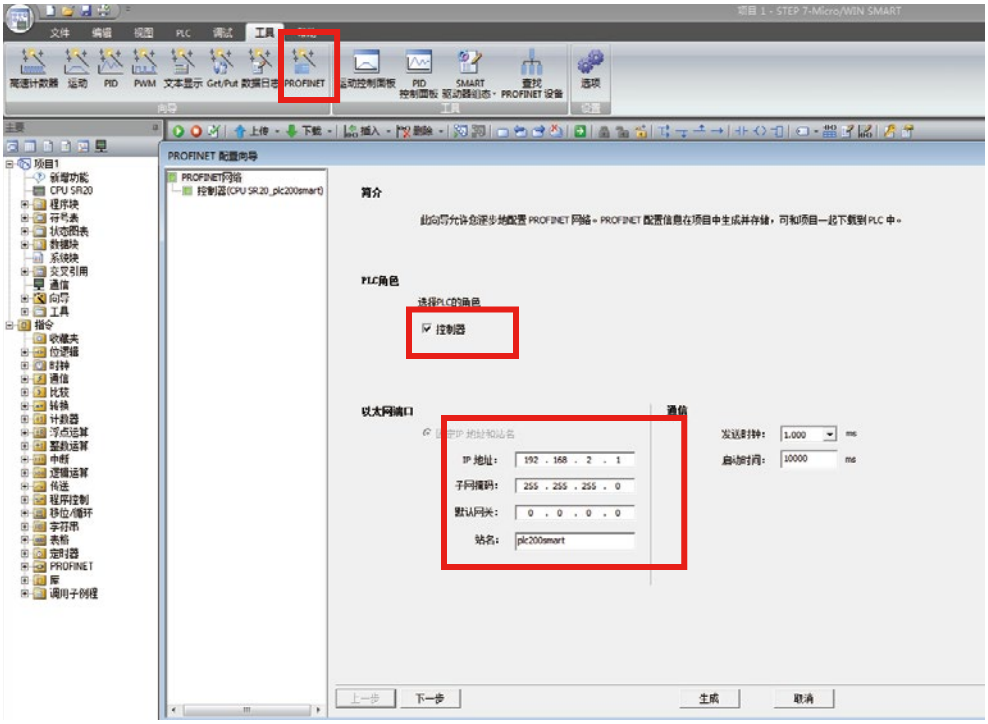
STEP 7 Micro/WIN V2.4 SINAMIC control library update tool

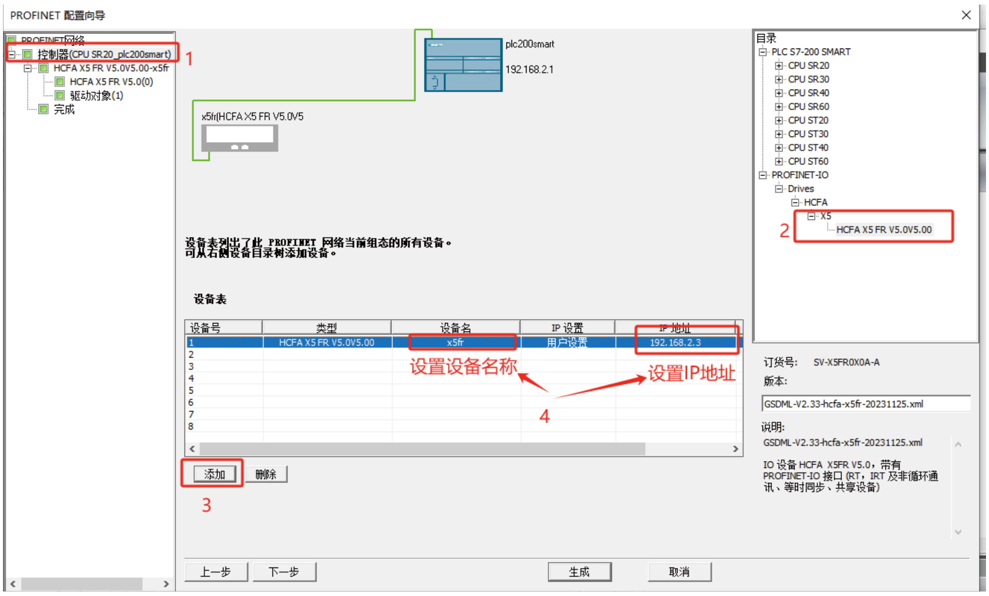
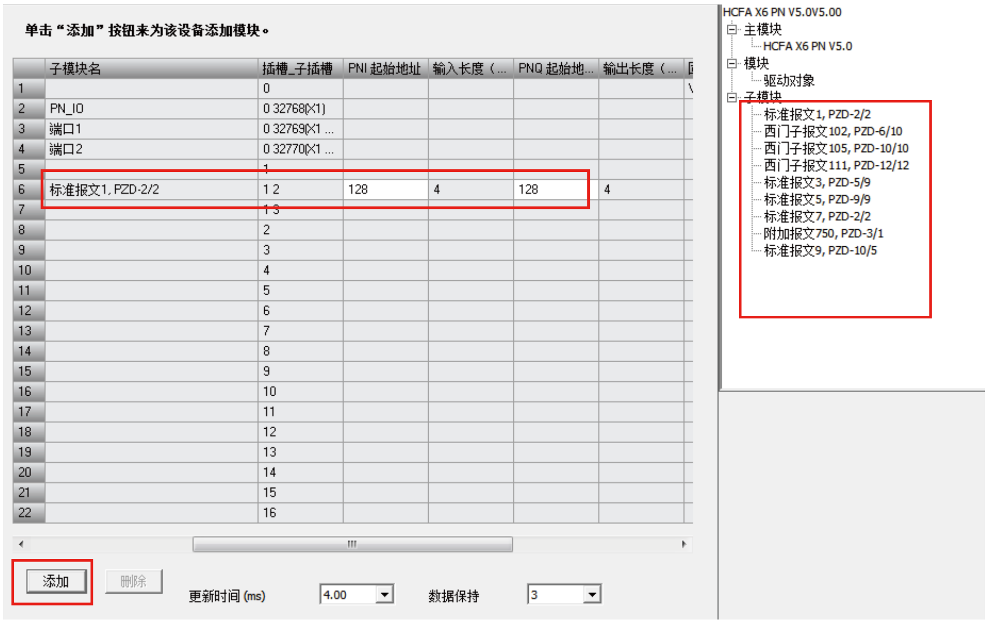
https://support.industry.siemens.com/cs/cn/en/view/109766118/zh

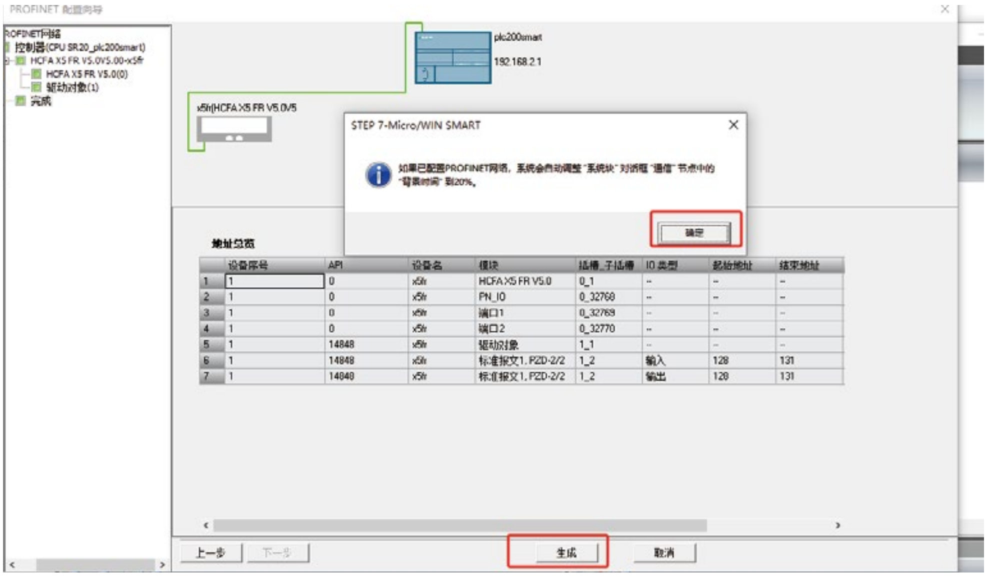
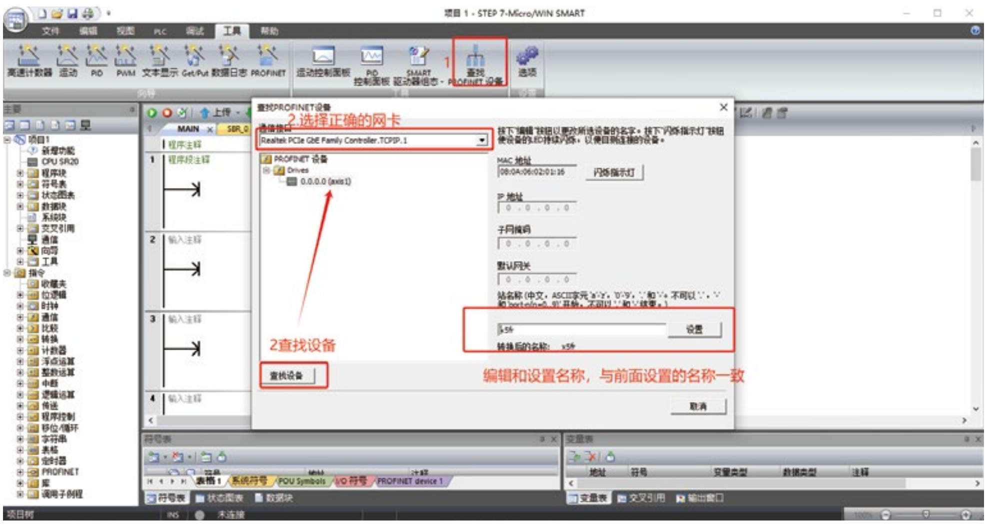
5.2 Using standard message 1 and the SINA_SPEED function block

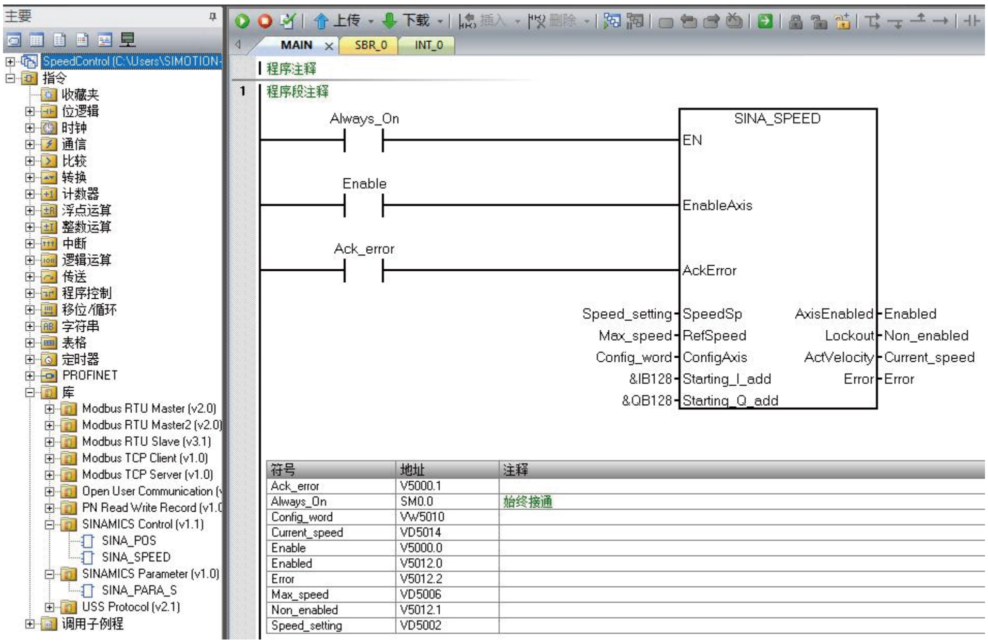
The X5E(F)R communicates with the PLC using PROFINET RT and telegram 1. The STEP 7-Micro/WIN SMART V2.4 software configures the S7-200 SMART project as shown in the following table.

No.	Description
1	Create a new project and select the PLC model to be used, in this article we are using SR20. : 

No.	Description
2	Installation of the latest GSD file for X5E(F)R 
3	Configure the PROFINET communication station and message information through the wizard function, first select the PLC role. Check the controller, then set the IP and station name, and then click the Next button. 

No.	Description
4	Add the X5E(F)R drive, set the IP address and device name of the X5E(F)R (the IP address and device name are the same as those set within the drive), add the site by clicking on the Add button, then click the Next button: 
5	Drag the standard telegram 1 into the module list in the view of the configuration telegram, with a minimum update time of 4 ms. 

No.	Description
6	Then click the Next button until it's finished. 
7	Assign the device name (note: the device name here should be the same as in the project device name (step 4)). 

No.	Description
8	In the main program, write the following program, pay attention to the address of St_I_add and St_Q_add must correspond to the IO address of message 1 (see after the message configuration in step 4): 
9	The symbol table addresses used in the program are defined as shown below:

Enable	V5000.0
Ack_error	V5000.1
Speed_setting	VD5002
Max_speed	VD5006
Config_word	VW5010
Enabled	V5012.0
Non_enabled	V5012.1
Current_speed	VD5014
Error	V5012.2

No.	Description
10	SINA_SPEED function block description:

SINA_SPEED function block description:

Input parameter:

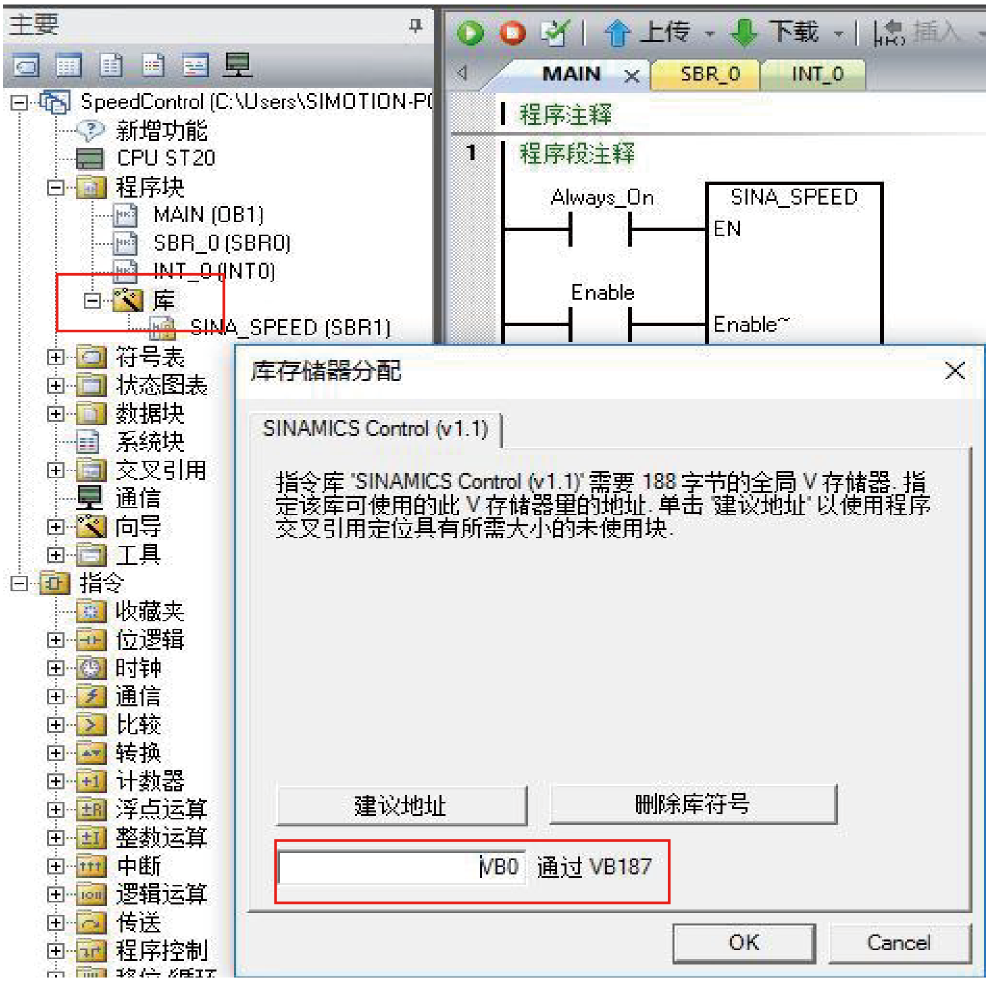
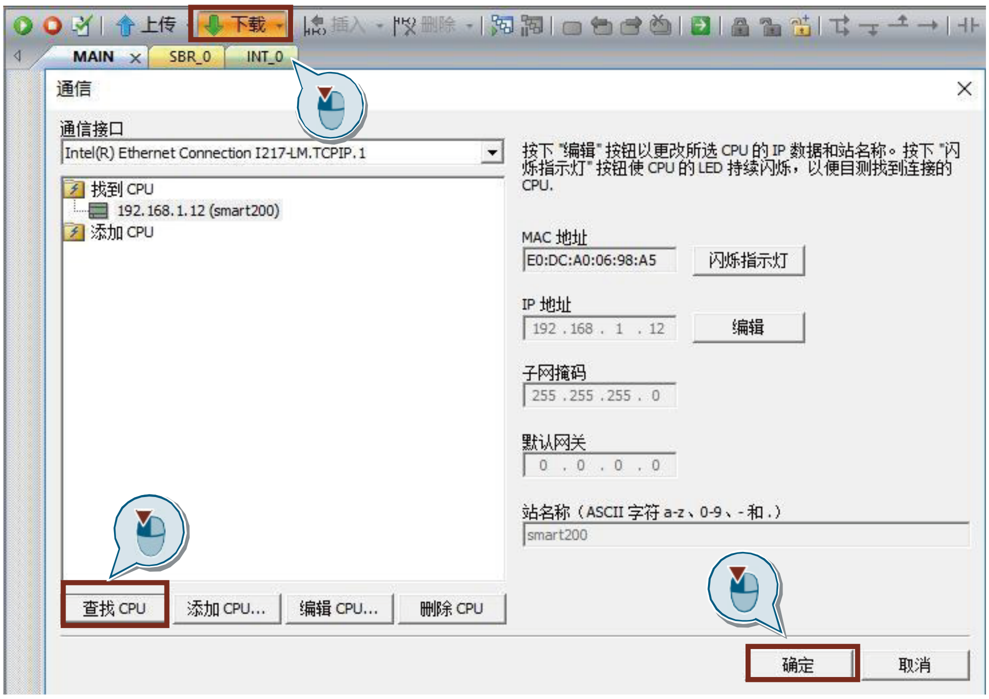
Input signal	Type	Description
EnableAxis	BOOL	= 1, drive enable
AckError	BOOL	Drive fault response
SpeedSp	REAL	Speed setting [rpm]
RefSpeed	REAL	Reference speed [rpm] of the drive, corresponding to the motor rated parameter.
ConfigAxis	WORD	The default setting is 16#003F, see the following table for explanation.
Starting_I_add	DWORD	X5E(F)R Pointer to the start address of the I memory area.
Starting_Q_add	DWORD	X5E(F)R Q Pointer to the start address of the memory area.

ConfigAxis'bit description

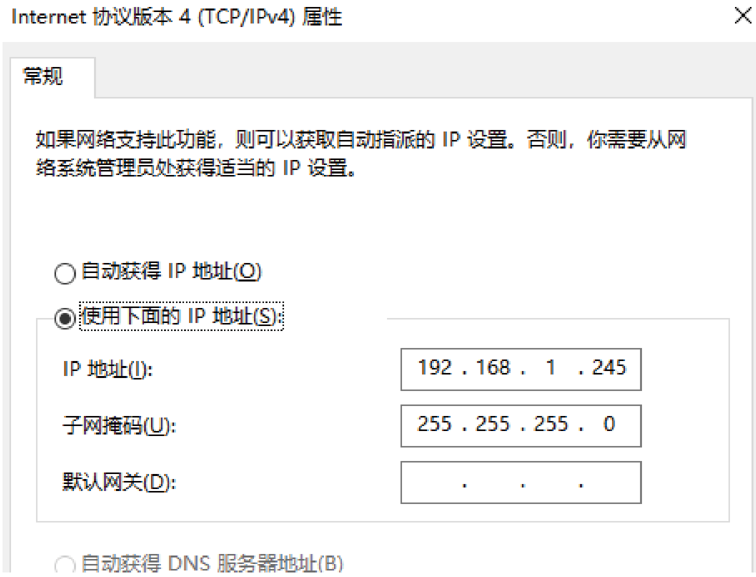
Bit	Defualt	Description
bit 0	1	OFF2
bit 1	1	OFF3
bit 2	1	Drive Enable
bit 3	1	Enable/Disable Ramp Function Generator Enable
bit 4	1	Continue/Freeze Ramp Function Generator Enable
bit 5	1	RPM Setpoint Enable
bit 6	0	Reserve
bit 7	0	Reserved
bit 8	0	Reserve
bit 9	0	Reserved

Output parameters:

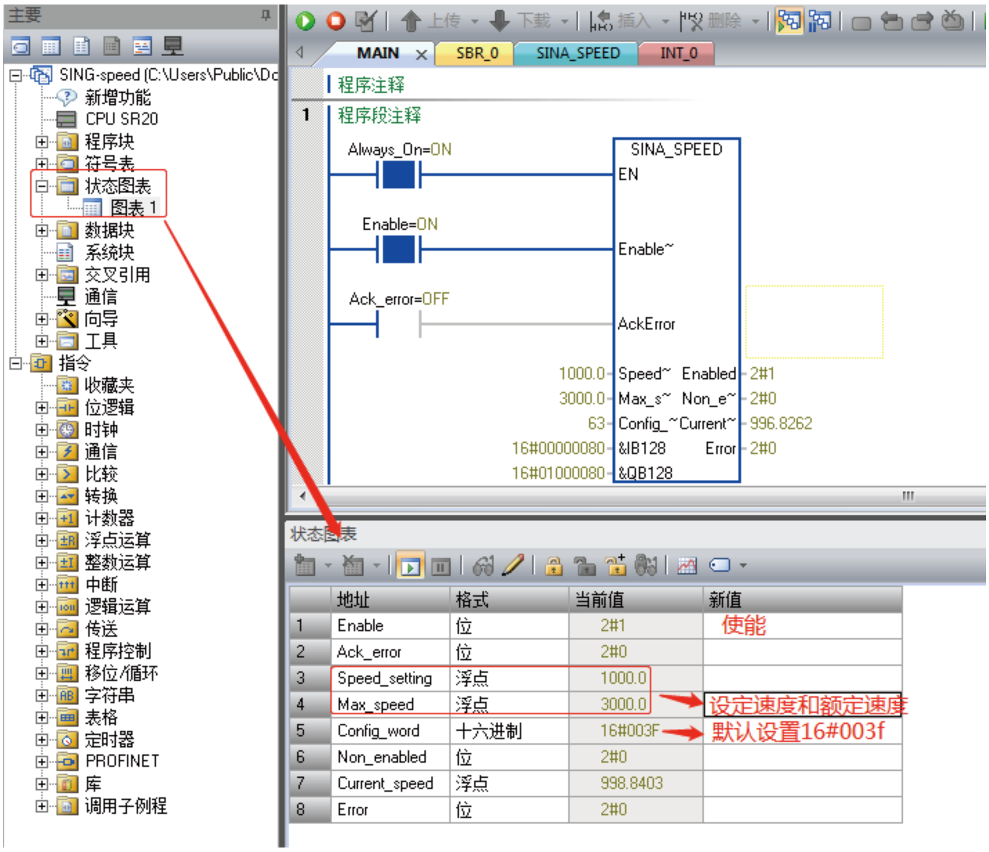
Output signal	Type	Description
AxisEnabled	BOOL	Drive is enabled
LockOut	BOOL	Drive is prohibited from being switched on
ActVelocity	REAL	Actual speed [rpm]
Error	BOOL	1 = error exists

No.	Description
11	Allocate the V address area used by the program library: 
12	The program can then be downloaded via the Download Program button: 

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>12</td><td>Note: Users need to set their computer's IP in the same network segment as follows


</td></tr>
<tr><td>13</td><td>Click download:


</td></tr>
</table>

No.	Description
14	Simply test the functionality through the status chart function. 

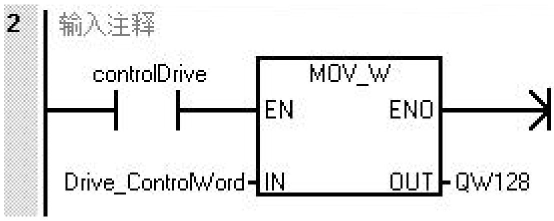
5.3 PLC directly controls the X5E(F)R via the IO address.

This control method does not require a dedicated program block, and the speed is given directly. X5E(F)R uses standard telegram 1, and the project and network configuration procedure is the same as the method in 5.2 Network Configuration. Based on PROFINET RT communication, the first control word of the output is used for start-stop control of the drive, and the second control word allows users to specify the speed at which the motor is running. An example of programming in the PLC is shown in the table below.

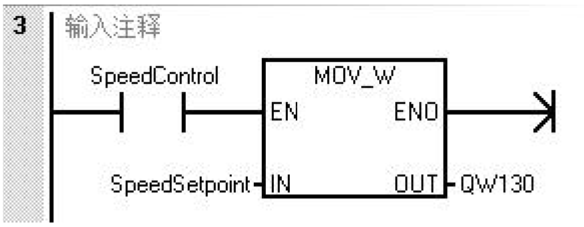
<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>1</td><td>
The output address of the X5E(F)R can be accessed from the "Device view".

The MOVE command is called in OB1 to send the control word for the drive and the speed given:

Start-stop control of the drive via the first control word (16#047E->16#047F)



The second control word allows users to specify the speed at which the motor will run (hex 16#4000, i.e. decimal 16384 corresponds to the 3000 speed parameter value).



For example, if SpeedSetpoint is set to 8192 in decimal (i.e. 16#2000 in hexadecimal), this means that the speed is given as 1500rpm.

(i.e., 16#2000 in hexadecimal), then the speed is given as 1500 rpm.
</td></tr>
</table>

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>2</td><td>It is also possible to run a test through the monitor table, starting with the control word 16#047E and the speed given:

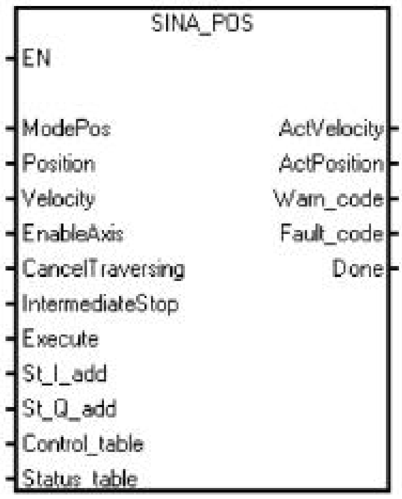
<table>
<tr><td></td><td>状态图表</td><td></td><td></td><td></td></tr>
<tr><td></td><td>地址</td><td>格式</td><td>当前值</td><td>新值</td></tr>
<tr><td>1</td><td>controlDrive</td><td>位</td><td>2#1</td><td></td></tr>
<tr><td>2</td><td>Drive_ControlWord</td><td>十六进制</td><td>16#047E</td><td></td></tr>
<tr><td>3</td><td>IW128</td><td>二进制</td><td>2#1110_1011_0011_0001</td><td></td></tr>
<tr><td>4</td><td>IW130</td><td>十六进制</td><td>16#0000</td><td></td></tr>
<tr><td>5</td><td>SpeedControl</td><td>位</td><td>2#1</td><td></td></tr>
<tr><td>6</td><td>SpeedSetpoint</td><td>十六进制</td><td>16#2000</td><td></td></tr>
</table>
The drive can be started and speed controlled by giving control word 16#047F again.

<table>
<tr><td></td><td>状态图表</td><td></td><td></td><td></td></tr>
<tr><td></td><td>地址</td><td>格式</td><td>当前值</td><td>新值</td></tr>
<tr><td>1</td><td>controlDrive</td><td>位</td><td>2#1</td><td></td></tr>
<tr><td>2</td><td>Drive_ControlWord</td><td>十六进制</td><td>16#047F</td><td></td></tr>
<tr><td>3</td><td>IW128</td><td>二进制</td><td>2#1110_1111_0011_0111</td><td></td></tr>
<tr><td>4</td><td>IW130</td><td>十六进制</td><td>16#1FFA</td><td></td></tr>
<tr><td>5</td><td>SpeedControl</td><td>位</td><td>2#1</td><td></td></tr>
<tr><td>6</td><td>SpeedSetpoint</td><td>十六进制</td><td>16#2000</td><td></td></tr>
</table>
</td></tr>
</table>

5.4 S7-200 Smart with X5E(F)R for basic positioning control

5.4.1 SINA_POS introduction

After installing the STEP 7 Micro/WIN V2.4 SINAMIC control library update tool, the SINAMICS library is provided in the STEP 7-Micro/WIN SMART debugging software, and the SINA_POS function block of the library is shown in the figure below:



This function block can be used in conjunction with the basic positioning function in the X5E(F)R drive, which must be activated on the drive side with the Siemens 111 communication telegram.

Description of SINA_POS input and output parameters

	Type	Description
ModePos	INT	Mode of operation: 1 = Relative positioning 2 = Absolute positioning 3 = Continuous operation mode (at specified speed) 4 = Active homing 5 = Direct setting of the home position 6 = Run program segment 1 to 16 (not supported) 7 = Tap at specified speed 8 = Tap at specified distance (not supported)
Position	DINT	Position setting value [LU] when ModePos=1 or 2 Program segment number when ModePos=6
Velocity	DINT	Speed setting value [1000LU/min] when ModePos=1,2,3 (e.g. Gear Ratio: 131072/10000, Velocity=1000, OVERV=100, motor speed is 100%*1000*(1000LU/min)/10000=100%*1000000(LU/min)/10000=100(R/min))
EnableAxis	BOOL	Servo run command: 0 = Stop (OFF1) 1 = Start
CancelTraversing	BOOL	0 = Cancel the current running task 1 = Do not cancel the current running task
IntermediateStop	BOOL	Suspends the task from running: 0 = Pause the currently running task 1 = Do not pause the currently running task
Execute	BOOL	Mode of activation request
St_I_add	DWORD	PROFINET communication message Q Pointer to the start address of the storage area, e.g. &QB128
St_Q_add	DWORD	PROFINET communication message Q Pointer to the start address of the storage area, e.g. &QB128
Control_table3	DWORD	Pointer to start address of Control_table, e.g. &VD8000
Status_table4	DWORD	Pointer to the start address of the Status_table, e.g. &VD7500
ActVelocity	DWORD	Actual speed (40000000h in hexadecimal corresponds to the rated speed); e.g. motor speed = current speed * 3000/1073741824 (40000000 converted to decimal)
ActPosition	DWORD	Actual position [LU]
Warn_code	WORD	Warning code message from X5E(F)R
Fault_code	WORD	Error code message from X5E(F)R
Done	BOOL	Arget position reached when operation mode is relative or absolute motion

Control_table parameters definition:

Byte shift	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	AckError	V90 -	Jog2	Jog1	Negative rotation	Positive rotation
1	Reserved							
2 3	OverV: Percentage of set velocity 0 ~ 199%							
4 5	OverAcc：0~100% of set acceleration when ModePos=1,2,3							
6 7	OverDec：0~100% of set deceleration when ModePos=1,2,3							

8	ConfigEpos
9	
10	
11	

ConfigEpos: This parameter can be used to control the functions related to basic positioning, and the correspondence of the bits is shown in the table below.

ConfigEPos bit	Function description
ConfigEPos.%X0	OFF2
ConfigEPos.%X1	OFF3
ConfigEPos.%X2	Activate software limits
ConfigEPos.%X3	Activate hardware limits
ConfigEPos.%X6	Home position switch signal
ConfigEPos.%X7	External program block switching (not supported)
ConfigEPos.%X8	ModPos=2, 3 Setting value changes continuously (no retriggering required)

Note: If a variable is assigned to this in the program, the initial value must be 3 (i.e. ConfigEPos.%X0 and ConfigEPos.%X1 equal to 1, OFF2 and OFF3 stops are not activated).

Status_table parameter definition:

Byte shift	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Overrange_ Error Input data out of range	AxisError A drive error has occurred	AxisWarn A drive warning has occurred	Lockout Drive disabled	AxisRef Reference point set	AxisPosOk Reach the target position	AxisEnabled Servo enabled
1	Error ID5: Identify the type of error							
2	Actmode: Currently active operating mode							
3								
4	POS ZSW1: POS ZSW1 status word 1							
5								
6	POS ZSW2: POS ZSW2 status word 1							
7								

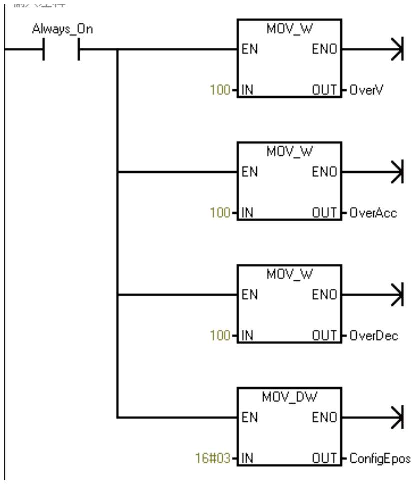
5.4.2 Project Configuration

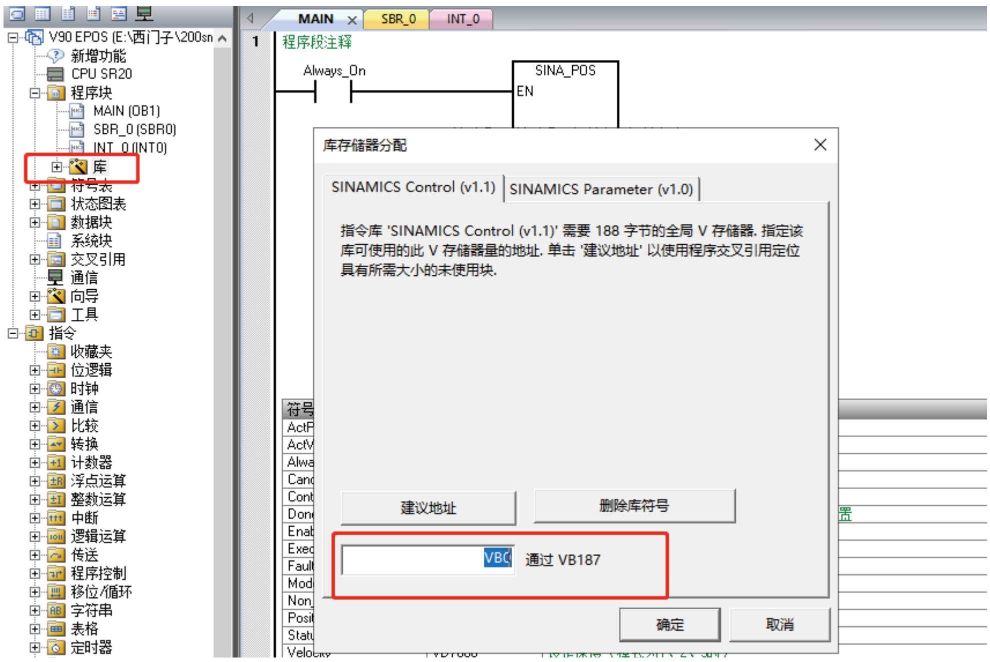
No.	Description
1	The project and network configuration steps are the same as those in 5.2 Network Configuration, except that the message is replaced by a 111 telegram.

No.	Description
2	The symbol table addresses used in the program are defined as follows:

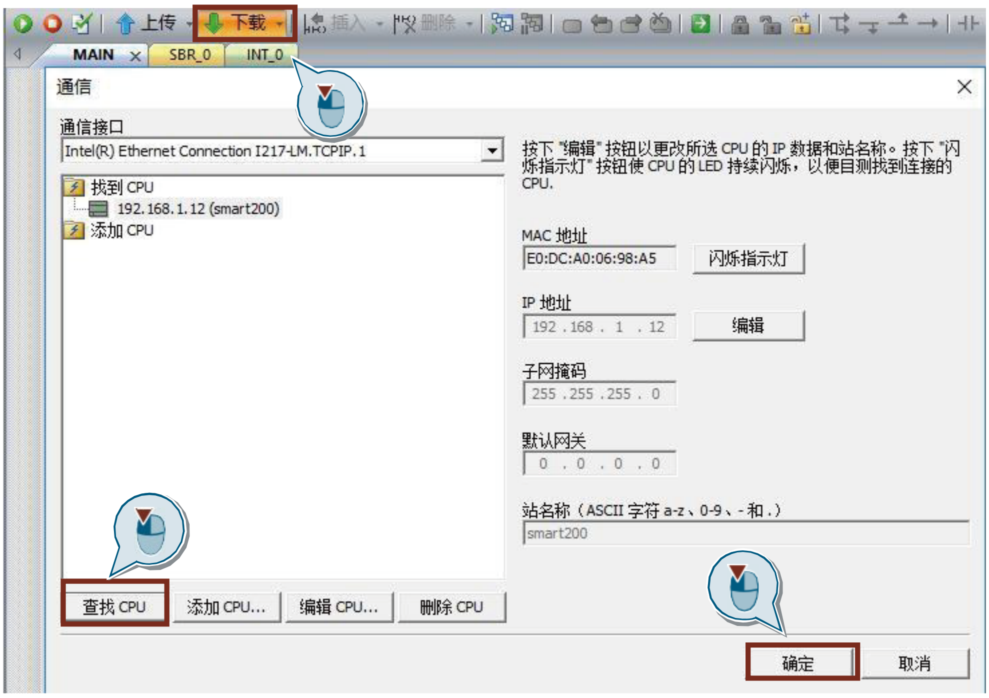
Input pin	Address	Description
ModePos	VW7000	Mode
Position	VD7002	Target position (when mode is 1 and 2)
Velocity	VD7006	Set speed (when mode is 1, 2 and 3)
EnableAxis	V7010.0	Enable
CancelTraversing	V7010.1	Reject task
Non_pause	V7010.2	Pause
Execute	V7010.3	Activate mode
Control_table3	VD8000	Control_table Pointer to starting address
Positive	V8000.0	Positive direction for ModePos=3
Negative	V8000.1	Negative direction when ModePos=3
Jog1	V8000.2	
Jog2	V8000.3	
AckError	V8000.5	Fault reset
OverV	VW8002	Speed Percentage
OverAcc	VW8004	Acceleration percentage
OverDec	VW8006	Deceleration percentage
ConfigEpos	VD8008	
Output pin	**Address**	**Description**
Done	V7032.0	Reaching the target position when the operation mode is relative or absolute motion
AxisEnabled	V7500.0	Enabled
AxisRef	V7500.2	Homing finished
Lockout	V7500.3	To disable switching on
AxisWarn	V7500.4	Axis warning

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>2</td><td>
<table>
<tr><th>Output pin</th><th>Address</th><th>Description</th></tr>
<tr><td>AxisError</td><td>V7500.5</td><td>Axis fault</td></tr>
<tr><td>ActVelocity</td><td>VD7020</td><td>Current speed</td></tr>
<tr><td>ActPosition</td><td>VD7024</td><td>Current position</td></tr>
<tr><td>Status_table4</td><td>VD7500</td><td>Status_table Pointer to start address</td></tr>
<tr><td>Warn_code</td><td>VW7028</td><td>Warning code</td></tr>
<tr><td>Fault_code</td><td>VW7030</td><td>Fault code</td></tr>
<tr><td>Actmode</td><td>VW7502</td><td>Current mode</td></tr>
<tr><td>POS_ZSW1</td><td>VW7504</td><td></td></tr>
<tr><td>POS_ZSW2</td><td>VW7506</td><td></td></tr>
</table>
Note: X0 and X1 of ConfigEpos must be 1</td></tr>
<tr><td>3</td><td>Assign values to OverV, OverAcc, OverDec, and ConfigEpos.

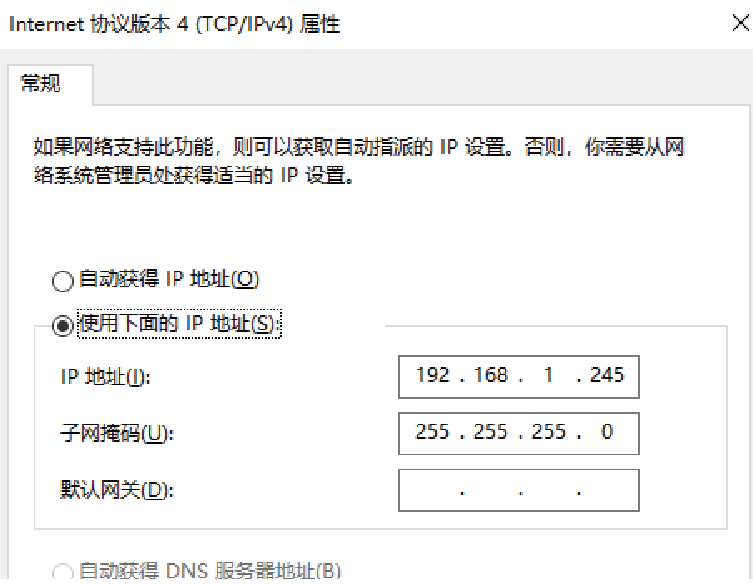

</td></tr>
<tr><td>4</td><td>Allocates the V address area used by the program library:


</td></tr>
</table>

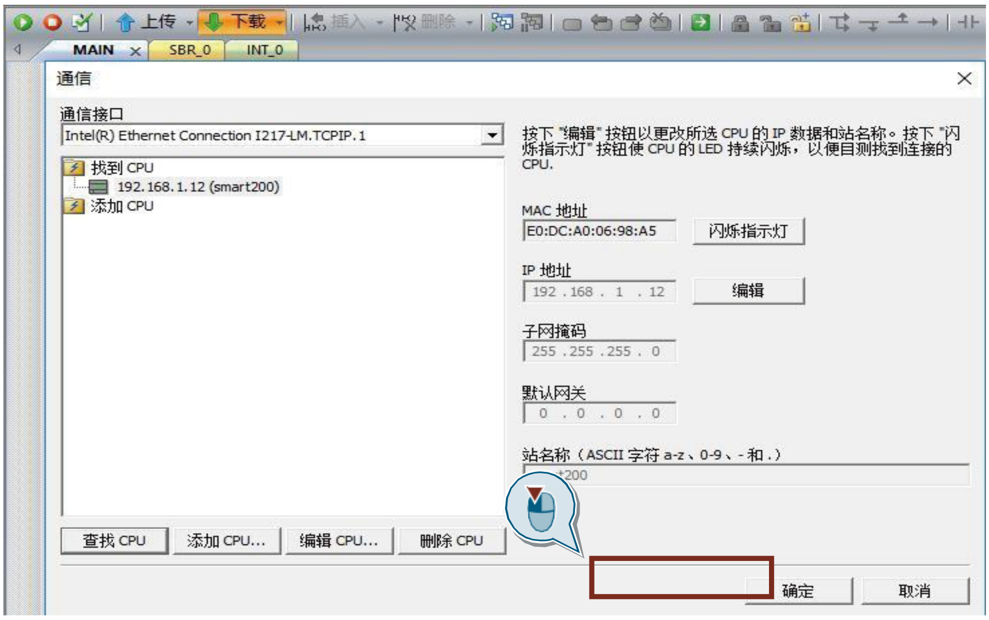
<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>5</td><td>
The program can then be downloaded using the Download Program button:

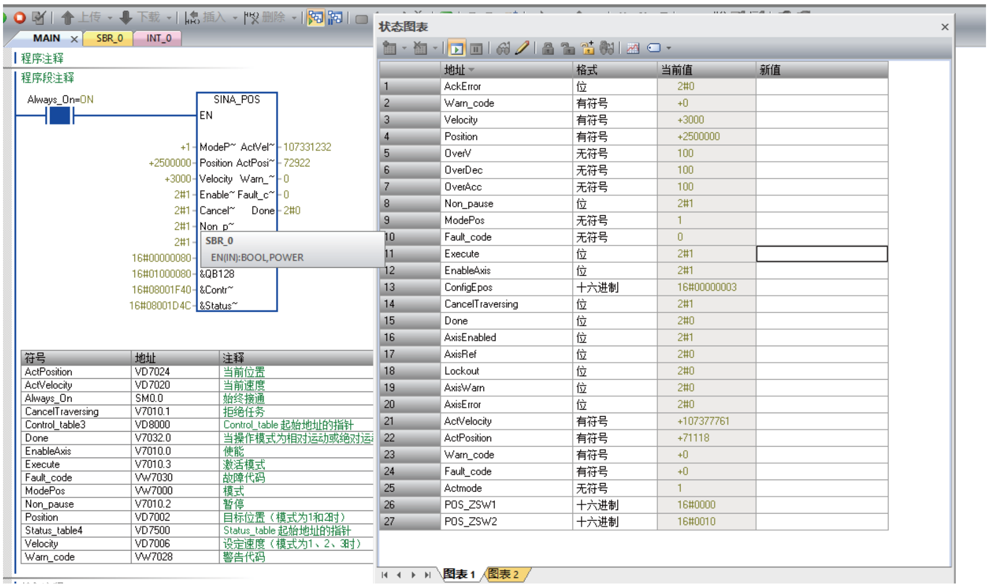


Note: Need to set the computer's IP in the same network segment as follows



</td></tr>
</table>

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>12</td><td>Click the download button:


Note: After the 200 SMART and servo are communicating, the lower corner of the panel should show 43. If the PLC is not connected to the servo, check to see if the device name corresponds to the one set in the project.</td></tr>
<tr><td>13</td><td>It is sufficient to perform the relevant functional tests through the status chart function:


Note: For each mode variable assignment, please refer to the relative positioning, absolute positioning, continuous operation, homing, direct home position setting, and pointing variable assignment table in the operation mode introduction of the function block below.</td></tr>
</table>

5.4.3 SINA_POS functional description

The basic positioning (EPOS) of the X5E(F)R can be used for absolute and relative positioning of linear or rotary axes. The function block SINA_POS in the SINAMICS library supplied with the STEP 7-Micro/WIN SMART V2.4 debugging software enables basic positioning control of the V90 PN. The main operation modes are Jog, Homing, MDI and program segment. The basic functions are largely the same as those of the FB284 module of the S7-1500 series, and users can refer to the introduction of the FB284 module of the S7-1500 series.

◆ Running condition

① Axis is internally set to 1 by input pin EnableAxis = 1, OFF2 and OFF3. If the axis is ready and the drive is fault-free (AxisError = "0"), the axis is enabled after EnableAxis is set to 1, and the output pin AxisEnabled signal becomes 1.

② ModePos Input pin is used for operation mode selection. The input pin is used to select the operation mode. It can be switched in different operation modes, such as: continuous operation mode (ModePos=3), and can be switched to absolute positioning mode (ModePos=2) during operation.

③ Input signals CancelTransing, IntermediateStop are valid for all operation modes except Jogging, and must be set to "1" when running EPOS, the setting instructions are as follows:

• Set CancelTransing=0, the axis decelerates and stops according to the ramp stop and discards the working data, if users reset CancelTransing=1 again the axis will not continue to run and needs to be retriggered; after the axis stops users can switch between the operating modes.

• Set IntermediateStop=0 to use the currently applied deceleration value for the ramp stop, without losing work data; if IntermediateStop=1 is reset, the axis will continue to run, which can be regarded as a pause of the axis. It is possible to switch the operation mode after the axis has come to a standstill.

④ Activating hardware limit switch

• If a hardware limit switch is used, users need to set the input pin of the FB284 function block to "ConfigEPos.%X3" to "ConfigEPos.%X3".

ConfigEPos.%X3 (POS_STW2.15) to 1 to activate the hardware limit function of X5E(F)R.

• Positive and negative hardware limit switches can be connected to DI1 to DI2 of the X5E(F)R drive.

⑤ Activating Software Limit Switches

• If software limit switches are used, it is necessary to activate the software limit function of the X5E(F)R by setting the input pin ConfigEPos.%X2 (POS_STW2.14) of the FB284 function block to 1 and P15.37 =1.

• Set P15.37 (soft limit effective mode), P15.38 (negative soft limit position), and P15.40 (positive soft limit position) in X5E(F)R.

◆ Relative positioning mode

The "Relative Positioning" mode of operation can be realized with the drive function "MDI Relative Positioning", which uses the internal position controller of the X5E(F)R drive for relative position control.

Requirements:

• Operation mode selection ModePos=1

• Drive run command EnableAxis=1

• The axis does not have to conduct homing. Or the absolute encoder is not calibrated.

• If the switching mode is greater than 2, the axis must be stationary and can be switched within the MDI operating mode at any time (ModePos=1). Switching within the MDI operating mode is possible at any time (ModePos=1,2).

Steps:

• Specify the target position and dynamic response parameters by entering the parameters Position, Velocity.

• Input parameters OverV, OverAcc, OverDec to specify the speed and the multiplier of speed increase/decrease.

• The operation conditions "CancelTransing" and "IntermediateStop" must be set to "1". Jog1 and Jog2 must be set to "0".

• In relative positioning, the direction of motion is determined by the positive or negative value set in Position.

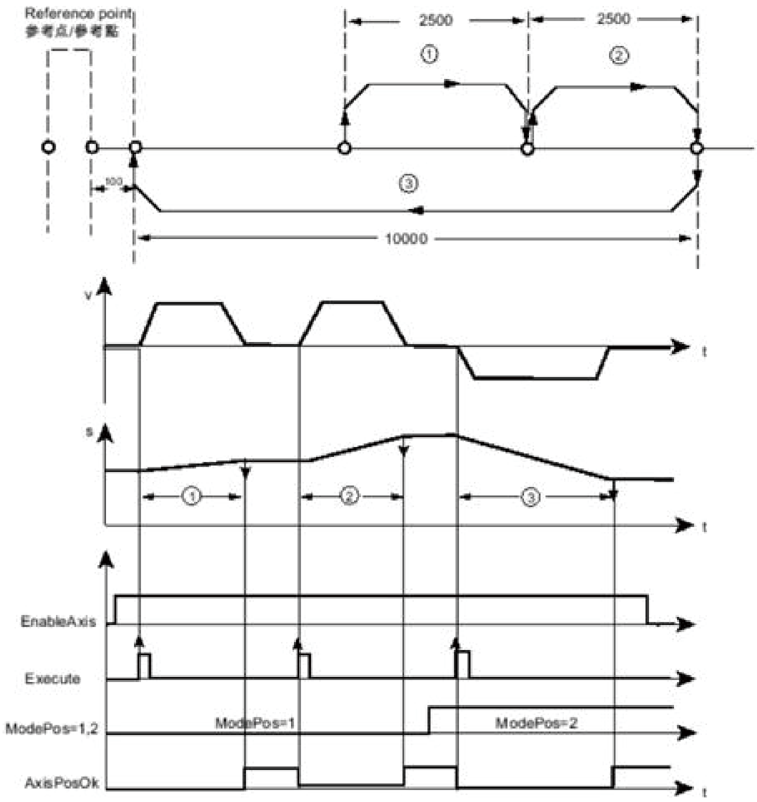
The positioning movement is triggered by the rising edge of Execute, the current state of the activation command or monitored by PosZSW1 and PosZSW2 in Status_table, and if the target position is reached, the AxisPosOK bit in Status_table is output as 1. If an error occurs during operation, the AxisError bit in Status_table is set to "1". If an error occurs during operation, the AxisError bit in Status_table is 1.

Note The currently running command can be replaced by a new command via the rising edge of Execute, but only for operating modes ModePos 1,2,3.

Caution:

The currently running command can be replaced by a new command via the ExecuteMode rising edge, but is only used for run mode ModePos 1,2,3. When ConfigEPos.%X8 is 1, the relative positioning mode cannot be used, and ERR59 will be reported.

An example of control timing is shown in Figure 5-1.



Relative positioning mode control timing

◆ Relative positioning operation mode programming example

For the programming of the SINA_POS positioning control command and the definition of the variables used, refer to serial number 2 in Table 5.4.2. The relative positioning operation mode variable assignments are shown below.

Relative Positioning Operation Mode Variable Assignment

Symbol	Address	Value
ModePos (Mode)	VW7000	1
Position (Position)	VD7002	250000
Velocity (Speed)	VD7006	5000
Enable	V7010.0	1
CancelTraversing (Task cancel)	V7010.1	1
Non_Pause	V7010.2	1
Execute (Mode of activation request)	V7010.3	0 → 1 (Trigger the rising edge after the rest of the configuration is completed)
OverV (Speed ratio)	VW8002	100
OverAcc	VW8004	100
OverDec	VW8006	100
ConfigEpos	VD8008	3 (The initial value must be 3)

Servo parameter setting:

P15.00	Maximum speed
P15.02	Maximum acceleration
P15.04	Maximum deceleration
P15.08	Excessive deviation threshold
P15.10	Position reach threshold
P15.42	EPOS electronic gear ratio numerator
P15.44	EPOS electronic gear ratio denominator

◆ Absolute positioning mode

The absolute positioning operation mode can be realized by driving the absolute positioning function, which uses an internal position controller driven by the X5E(F)R for absolute position control.

Requirements:

• Operation mode selection ModePos = 2

• Axis enable EnableAxis =1

• The axis encoder must be calibrated.

• If the switching mode is greater than 2, the axis must be at standstill and can be switched within the MDI operating mode at any time (ModePos=1,2).

Steps:

• Specify the target position and dynamic response parameters by inputting the parameters Position, Velocity.

• Specify the speed and the multiplier of the acceleration and deceleration by inputting the parameters OverV, OverAcc, OverDec.

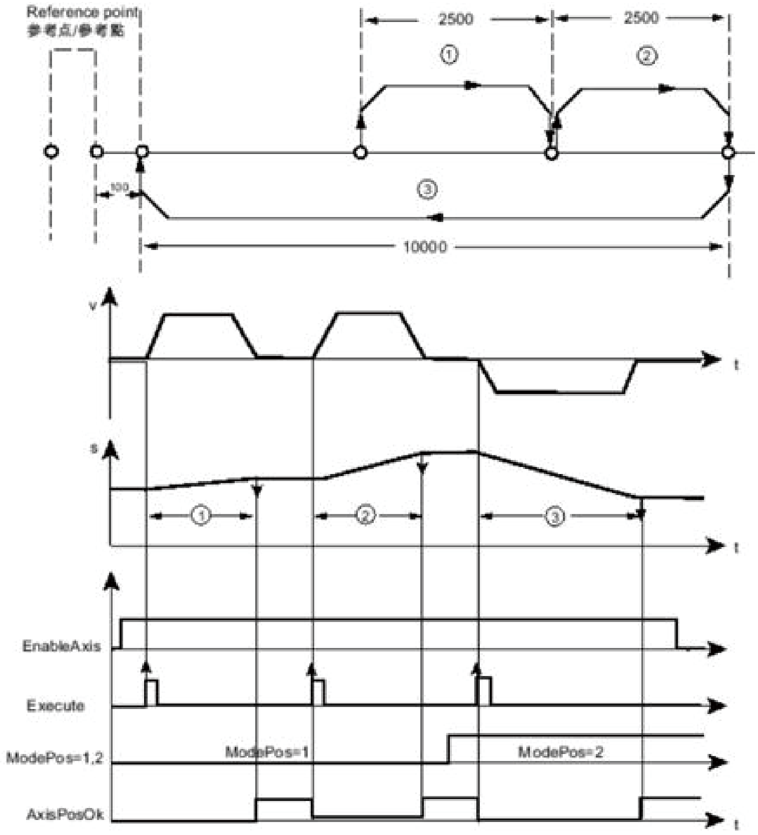
• Run conditions "CancelTransing" and "IntermediateStop" must be set to "1", Jog1 and Jog2 must be set to "0".

• In absolute positioning, the running direction can follow the shortest path to the target position, in this case the input parameters Positive and Negative must be "0", in case of modulo axes, the direction can be specified by Positive or Negative.

• When ConfigEPos.%X8 (EPosSTW1.%X12) is 0, the positioning motion is triggered by the rising edge of Execute, the current state of the command is activated or monitored by the PosZSW1 and PosZSW2 in the Status_table, and the AxisPosOK bit in the Status_table is 1 if the target position is reached. AxisPosOK bit in Status_table is 1. If an error occurs during operation, AxisError bit in Status_table is 1. The currently running command can be replaced by a new command by means of the rising edge of ExecuteMode, but only for the operating modes ModePos 1,2,3.

When ConfigEPos.%X8 (EPosSTW1.%X12) is set to 1, the commands take effect immediately after giving Position, Velocity, OverV, OverACC, OverDEC on the PLC side without triggering Executemode.

An example of control timing is shown in the figure.



Absolute positioning mode control timing

Absolute positioning operation mode variable assignment

Symbol	Address	Value
ModePos (Mode)	VW7000	2
Position (Position)	VD7002	25000
Velocity (Speed)	VD7006	500
Enable	V7010.0	1
CancelTraversing (Task cancel)	V7010.1	1
Non_Pause	V7010.2	1
Execute (Mode of activation request)	V7010.3	0 → 1 (After the rest of the configuration is complete, the rising edge of the trigger)
OverV (Speed ratio)	VW8002	100
OverAcc	VW8004	100
OverDec	VW8006	100
ConfigEpos	VD8008	16#3 (The initial value must be 3)

Servo parameter setting:

P15.00	Maximum speed
P15.02	Maximum acceleration
P15.04	Maximum deceleration
P15.08	Excessive deviation threshold
P15.10	Position reach threshold
P15.42	EPOS electronic gear ratio numerator
P15.44	EPOS electronic gear ratio denominator

◆ Continuous operation mode (running at specified speed)

Continuous operation mode allows the axis to run at a constant speed in either forward or reverse direction.

Requirements:

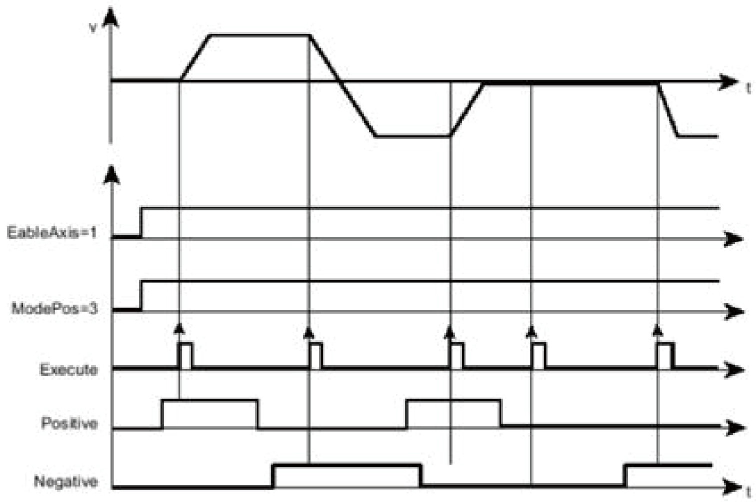
- Operation mode selection ModePos=3
- Axis enable EnableAxis=1
- The axis does not have to conduct homing. Or the absolute encoder is not calibrated.
- If the switching mode is greater than 3, the axis must be at standstill.

Steps:

- Specify the running speed by entering the parameter Velocity.
- Specify the speed, percentage of speed increase/decrease by input parameters OverV, OverAcc, OverDec.
- Running conditions CancelTraversing and IntermediateStop must be set to 1, Jog1 and Jog2 must be set to 0.
- Running direction is determined by Positive and Negative.
- When ConfigEPos.%X8 (EPosSTW1.%X12) is 0, the positioning movement is triggered by the rising edge of Execute, the current state of the command is activated or monitored via PosZSW1 and PosZSW2 in the Status_table, and the axis is stopped by the aborted task, the AxisPosOK bit of Status_table is 1. If an error occurs during operation, AxisError in Status_table is 1. The currently running command can be replaced by a new command via the rising edge of Execute, but the new command may be replaced via the rising edge of Execute. AxisPosOK bit in Status_table is 1. If an error occurs during operation, AxisError bit in Status_table is 1. Currently running commands can be replaced by new commands via the rising edge of Execute, but only for operating modes ModePos 1,2,3.

When ConfigEPos.%X8 (EPosSTW1.%X12) is set to 1, it takes effect immediately after giving Velocity, OverV, OverACC, OverDEC on the PLC side only, without triggering Executemode, and it can be shut down by the direction (Positive and Negative).

An example of control timing is shown in Figure



Continuous operation mode control timing

Continuous operation mode variable assignment

Symbol	Address	Value
ModePos（Mode）	VW7000	3
Velocity	VD7006	5000
Enable	V7010.0	1

CancelTraversing（Task cancel）	V7010.1	1
Non_Pause	V7010.2	1
Execute（Mode of activation request）	V7010.3	1
OverV（Speed ratio）	VW8002	100
OverAcc	VW8004	100
OverDec	VW8006	100
ConfigEpos	VD8008	16#3
Positive	V8000.0	1
Negative	V8000.1	0

Servo parameter setting:

P15.00	Maximum speed
P15.02	Maximum acceleration
P15.04	Maximum deceleration
P15.08	Excessive deviation threshold
P15.10	Position reach threshold
P15.42	EPOS electronic gear ratio numerator
P15.44	EPOS electronic gear ratio denominator

◆ Active Homing

This function allows the axis to perform a homing operation along the forward or reverse direction according to the preset homing speed and mode, activating the active homing of the drive.

Requirements:

• Operation mode selection ModePos=4

• Axis enable EnableAxis=1

• The homing switch must be connected to an input point of the PLC, and its signal status must be set via the SINA_POS function block. ConfigEPos.%X6 is sent to the drive with the axis at standstill.

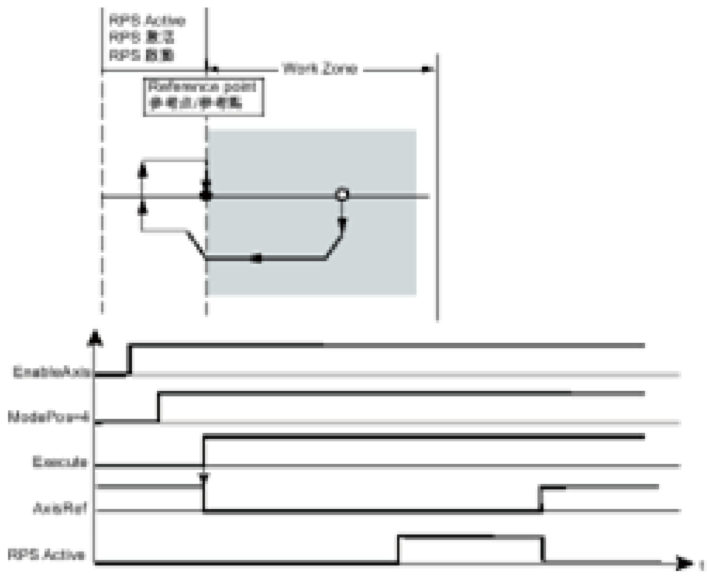
Steps:

• Running conditions CancelTraversing and IntermediateStop must be set to 1, Jog1 and Jog1 and Jog2 must be set to 0.

• Operation direction is determined by Positive and Negative.

The homing movement is triggered by the rising edge of Execute, which should be held high during the homing. The current status of the activation command is monitored by PosZSW1 and PosZSW2 in Status_table. AxisRef in Status_table is set to 1 after the homing is completed, and AxisError in Status_table is set to 1 when an error occurs during the operation.

An example of the control timing is shown in figure :



Homing timing diagram

Active homing operation mode variable assignment

Symbol	Address	Value
ModePos (mode)	VW7000	4
Enable	V7010.0	1
CancelTraversing (Task cancel)	V7010.1	1
Non_Pause	V7010.2	1
Execute (Mode of activation request)	V7010.3	1
OverV	VW8002	100
OverAcc	VW8004	100
OverDec	VW8006	100
ConfigEpos	VD8008	ConfigEpos.%X6=Activate hardware limit position 1, ConfigEpos=16#000b
Positive	V8000.0	0
Negative	V8000.1	0
Negative	V8000.1	0

Servo parameter setting:

P15.22	EPOS Homing methods (35 methods)
P15.23	EPOS High homing velocity
P15.25	EPOS Low homing velocity
P15.27	EPOS homing acceleration and deceleration time
P15.31	EPOS homing absolute cffset
P15.33	EPOS reference coordinate value
P15.35	EPOS homing timeout time
P15.42	EPOS electronic gear ratio numerator
P15.44	EPOS electronic gear ratio denominator

Note: Relative Offset and Absolute Offset select one of these to use Relative Offset has a value to perform a relative offset. Absolute Offset has a value to execute Absolute Offset. The default positive and negative limits are DI1 and DI2 and the default is high.

◆ Direct set homing position

This mode of operation allows the home position to be set for the axis when the axis is in any position.

Requirements:

- Operation mode selection ModePos=5
- The axis can be in the enabled state, but must be stationary during the Execute mode step:
- Set the home position of the axis via the rising edge of Execute when the axis is stationary.

Note The home position can be performed using parameter P1533.

Control timing shown as follow:

Directly set homing reference

Continuous operation mode variable assignment

Symbol	Address	Value
ModePos (mode)	VW7000	5
Enable	V7010.0	1
CancelTraversing (Task cancel)	V7010.1	1
Non_Pause	V7010.2	1
Execute (Mode of activation request)	V7010.3	1
OverV	VW8002	100
OverAcc	VW8004	100
OverDec	VW8006	100
ConfigEpos	VD8008	16#3
Positive	V8000.0	0
Negative	V8000.1	0
Negative	V8000.1	0

◆ Run program segment (not supported yet)

◆ Jog at specified speed

Jog mode is realized through the Jog function of the drive.

Requirement:

Operation mode selection ModePos=7

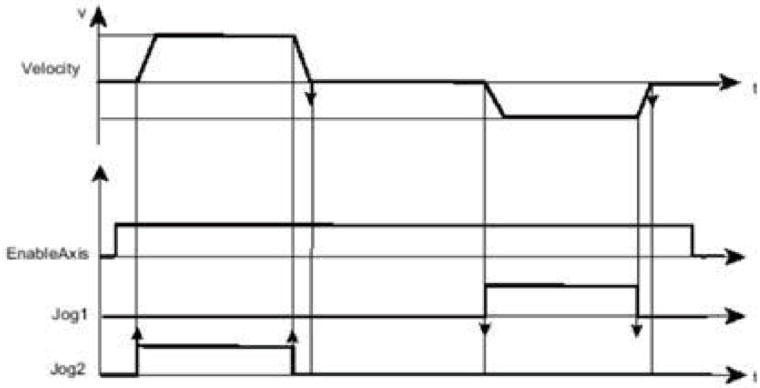
- Axis enabled EnableAxis =1
- Axis at standstill
- The axis does not have to conduct homing. Or the absolute encoder is not calibrated.

Steps:

• The jog speed is set in the drive, the OverV parameter of the speed is scaled in percent for the pointing speed setting, and the OverAcc and OverDec acceleration and deceleration are scaled in percent.

• The operating conditions CancelTraversing and IntermediateStop are independent of the jog mode of operation and are set to 1 by default.

Control Timing Example



JOG Timing diagram

Assign a value to the JOG Mode variable according to the specified velocity

Symbol	Address	Value
ModePos (mode)	VW7000	7
Enable	V7010.0	1
OverV	VW8002	100
OverAcc	VW8004	100
OverDec	VW8006	100
ConfigEpos	VD8008	16#3
Jog1	V8000.2(Jog1)	1
Jog2	V8000.3(Jog2)	0

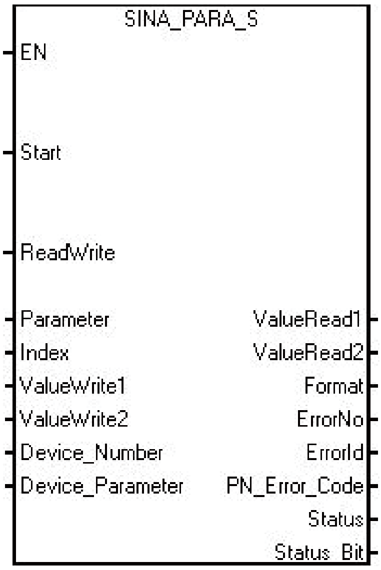
Servo parameter setting

P15.14	JOG1 velocity
P15.16	JOG2 velocity
P15.18	JOG Max. acceleration
P15.20	JOG Max. deceleration
P15.42	EPOS electronic gear ratio numerator
P15.44	EPOS electronic gear ratio denominator

5.5 S7-200 SMART Read/Write X5E(F)R non-cyclic parameters

The PLC can read or modify the parameters in the X5E(F)R via the SINAMICS library function block SINA_PARA_S, which is available in the debugging software.

5.5.1 SINA_PARA_S function block description



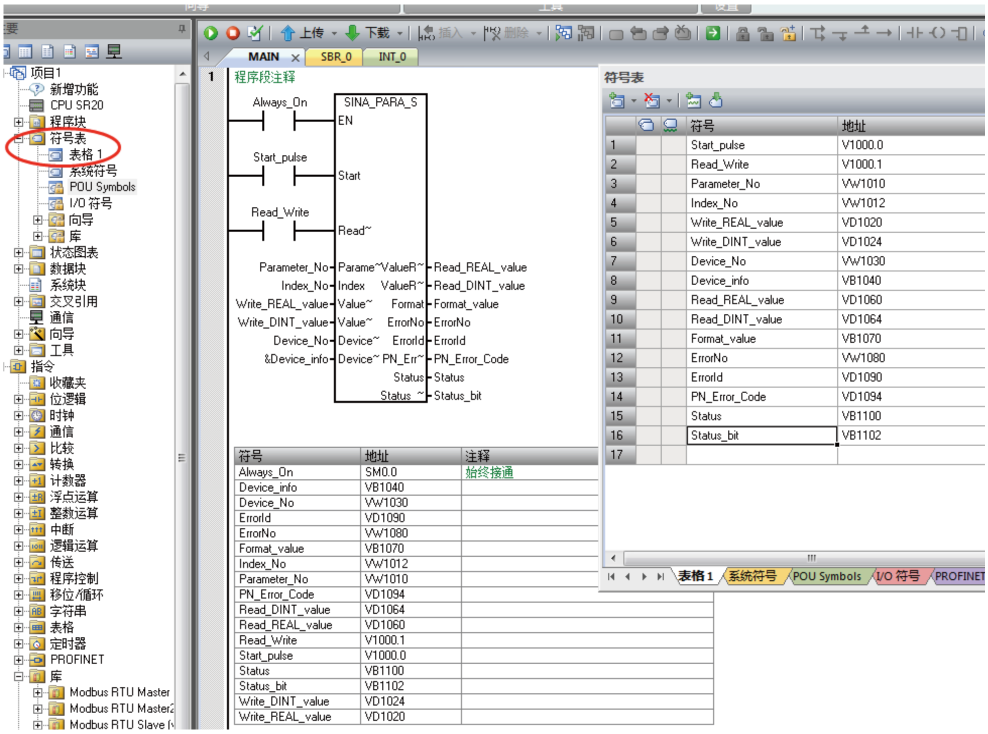
Input/Output parameter:

Input signal	Type	Description
Start	BOOL	Start task (0 = no task; 1 = start task)
ReadWrite	BOOL	0 = read, 1 = write
Parameter	INT	Parameter number
Index	INT	Parameter index
ValueWrite1	REAL	Parameter value in REAL format
ValueWrite1	DINT	Parameter value in DINT format
DeviceNo	WORD	Device number
Device_Par ameter	DWORD	Pointer to the starting address of "Device_Parameter". "Device_Parameter" refers to the parameter of the PROFINET slave, as seen in the following figure. Byte offset: 0: Axis number, X5ER/FR is fixed to 1. 1: Reserved 2-5: API number 6-7: Slot number 8-9: Sub-slot number
Output signal	**Type**	**Description**
ValueRead1	REAL	Parameter values read from the drive (REAL format) (drive 16-bit parameters)
ValueRead2	DINT	Parameter values read from the drive (DINT format) (drive 32-bit parameters)

Format	BYTE	Format of the parameter to be read. 02: Integer 8 03: Integer 16 04: Integer 32 05: Unsigned 8 06: Unsigned 16 07: Unsigned 32 08: Floating Point 10: Octal String (16-bit) 13: Time Difference (32-bit) 41: Byte 42: Word 43: Double Word 44: Errors
ErrorNo	WORD	Error number according to PROFIdrive profile
ErrorID	DWOR D	Error ID. The 1st word: Binary code indicates which parameter access fault has occurred. The 2nd word: Type of fault
PN_Error_Code	DINT	Error code according to PROFINET protocol. For more information, see the technical specifications for PROFINET IO (version 2.3).
Status	BYTE	The status of the current operation: Bit0-Bit4: Error code, for more information, see the system-defined error codes for the instructions RDREC and WRREC. Bit5: =1, error Bit6: Request in progress
Status_bit	BYTE	Status table: Bit0: Ready Bit1: Busy Bit2: Completed Bit3: Error

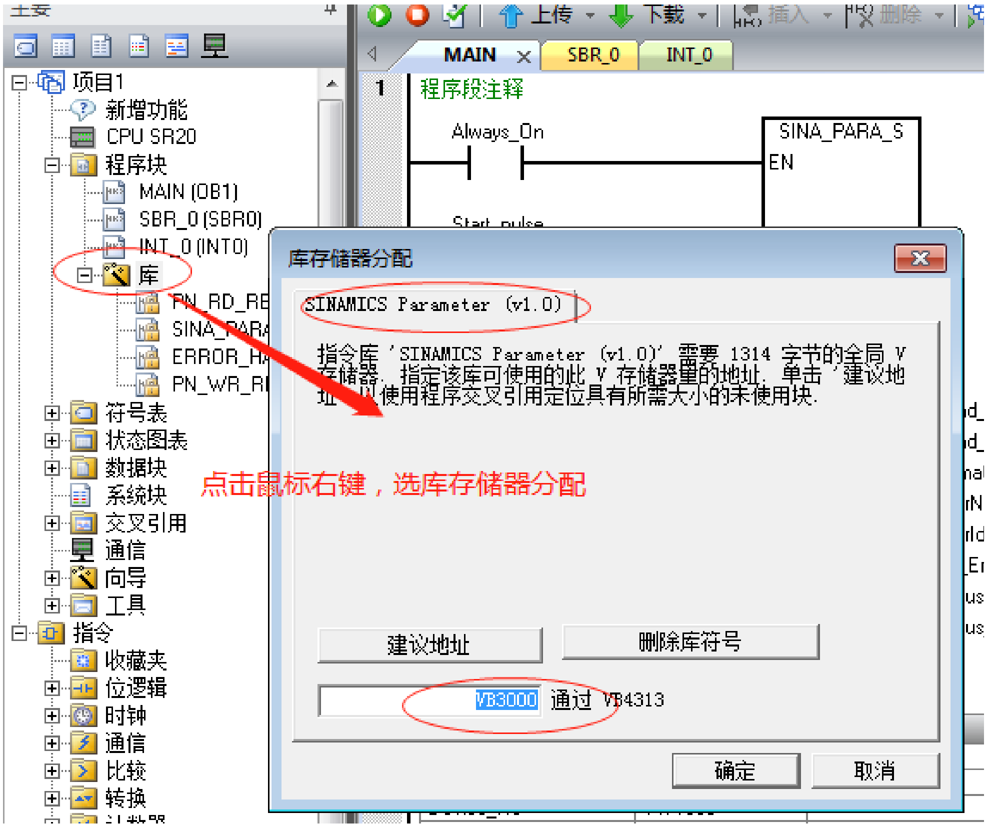
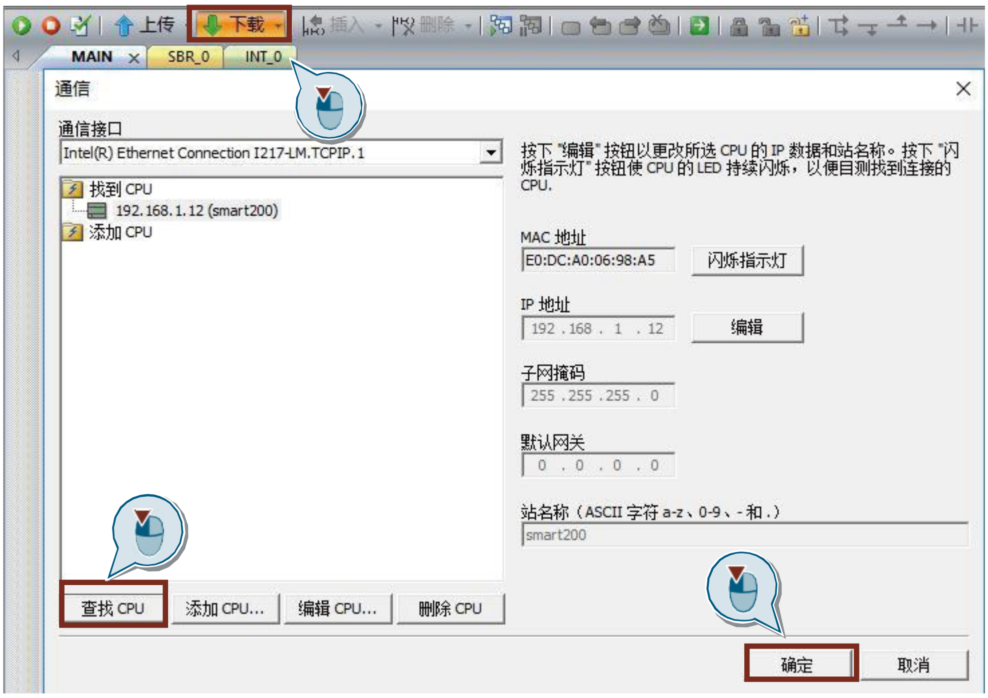
5.5.2 Project configuration steps

No.	Description
1	Configure the telegram according to the 5.2 project configuration.
8	Then, in the main program, find the SINA_PARA_S block and write the program. Note that the addresses of St_I_add and St_Q_add must correspond to the IO addresses in the message:

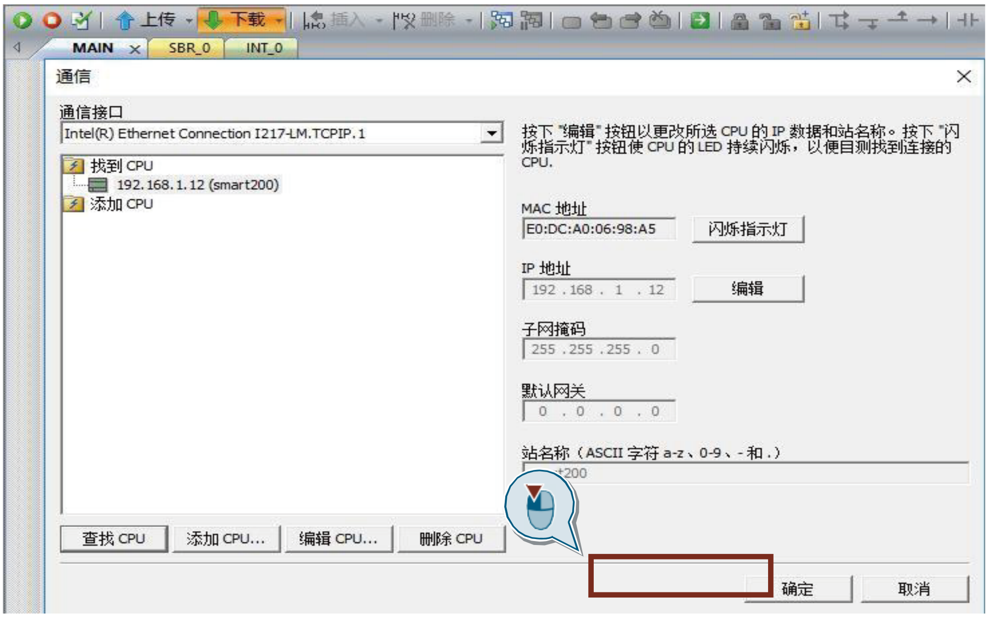


The symbol table addresses used in the program are defined in the following table:

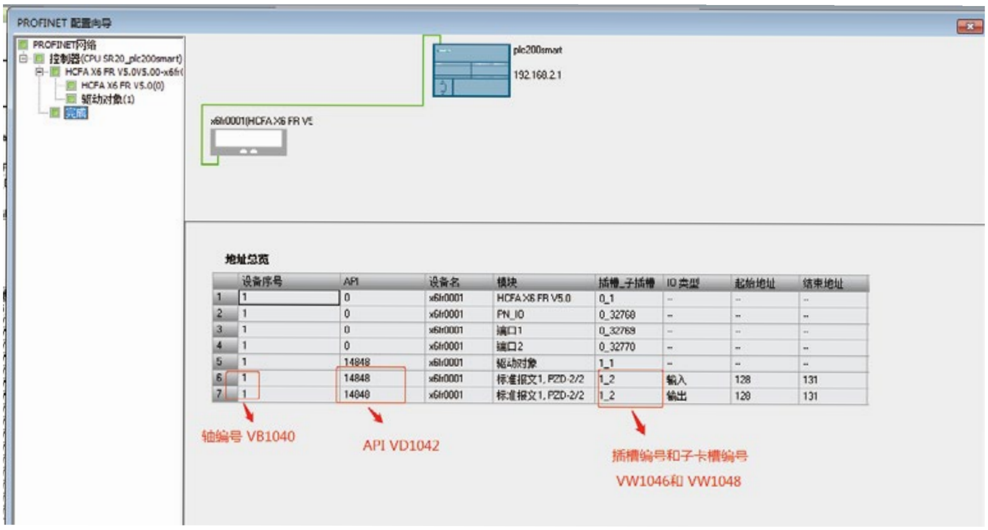
Variable	Address	Description
Start_pulse	V1000.0	Activate read/write
Read_Write	V1000.1	Read and write
Parameter_No	VW1010	Drive parameter number
Index_No	VW1012	Parameter subscript
Write_REAL_value	VD1020	Write data type is REAL (16-bit drive parameter)
Write_DINT_value	VD1024	Write data type is DINT (32-bit drive parameter)
Device_No	VW1030	Device number
Device_info	VB1040	Axis number
APINumber	VD1042	API number
SlotNumber	VW1046	Slot number
SubSlotNumbe	VW1048	Sub-slot number
Read_REAL_value	VD1060	Read data type REAL (16-bit drive parameter)
Read_DINT_value	VD1064	Read data type is DINT (32-bit drive parameter)
Format_value	VB1070	Format of the read parameters
ErrorNo	VW1080	Error number according to PROFIdrive profile
ErrorId	VD1090	Error ID
PN_Error_Code	VD1094	
Status	VB1100	
Status_bit	VB1102	

No.	Description
9	Assign the V address area used by the program library: 
10	The program can then be downloaded using the Download Program button: 

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>11</td><td>
Click the download button:



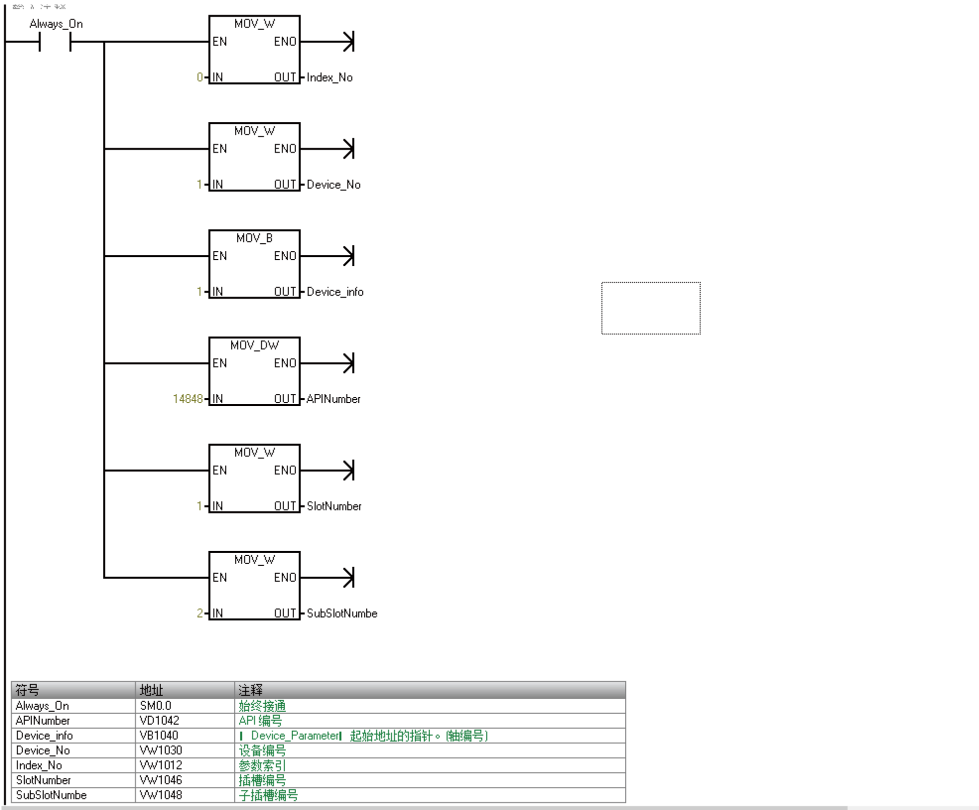
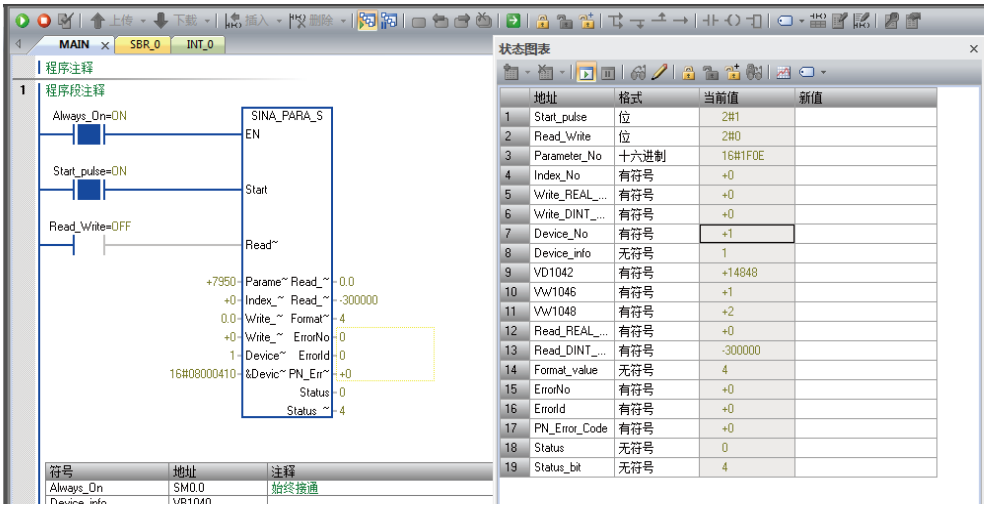
Note: After SMART200 and X6ER/FR communicate normally, the servo panel should show 43 (with message 111) or 41 (with message 1); if there is a case that SMART200 and X6ER/FR can not be connected normally, users can check whether the name of the device corresponds to the name of the setting through the following.
</td></tr>
<tr><td></td><td>
View axis numbers, API numbers, slot numbers, and sub-slot numbers



</td></tr>
</table>

No.	Description
	Read the servo local parameters from the status chart: Note: servo local all for a single parameter, index need to be 0, Device_No fixed to 1. servo local parameters in the read parameter number need to be converted to hexadecimal and then add (0x1000) and then read. For example, P15.14, 15 is converted to hex 0x0F, 14 is converted to hex 0x0E and then 0x1000 is added to 0x1F0E, that is, 0x1F0E is the parameter number, which is converted to decimal 7950. Read P15.14: EPOSJOG speed 1 (32 bits)

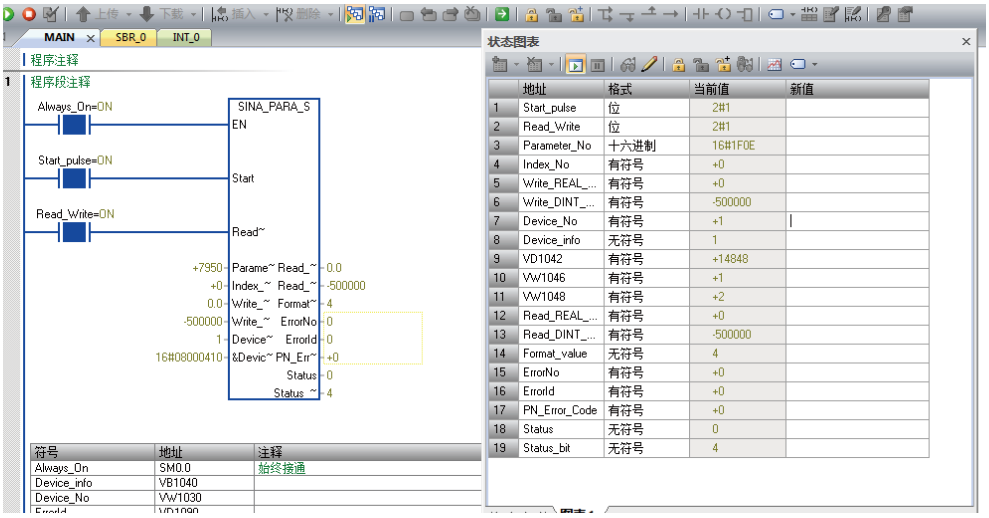
Symbol	Address	Value
Start_pulse	V1000.0	1
Read_Write	V1000.1	0
Parameter_No	VW1010	16#1F0E
Index_No	VW1012	0
Write_REAL_value	VD1020	
Write_DINT_value	VD1024	
Device_No	VW1030	1
Device_info	VB1040 (AxisNumber)	1
	VD1042 (APINumber)	14848
	VW1046 (SlotNumber)	1
	VW1048 (SubSlotNumbe)	2
Read_REAL_value	VD1060	
Read_DINT_value	VD1064	
Format_value	VB1070	
ErrorNo	VW1080	
ErrorId	VD1090	
PN_Error_Code	VD1094	
Status	VB1100	
Status_bit	V1102.0	Ready
	V1102.1	Busy
	V1102.2	Done
	V1102.3	Error

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>Assigns values to the device number, parameter subscript, axis number, API number, slot number, and subslot number.

</td></tr>
<tr><td>12</td><td>Monitoring via status charts


Process:
Assign Parameter_No to 7950 (16#1F0E).
Set variable "Read_Write" to 0 to read drive parameters.
Set the variable "Start_pulse" to 1 to start the task.
Result
If the parameter data type is REAL, the variable "Read_REAL_value" displays the value (drive 16-bit parameter).
If the parameter data type is DINT, the variable "Read_DINT_value" displays the value (drive 32-bit parameter).</td></tr>
</table>

No.	Description
15	Write servo local parameter by status chart: Note: servo local all for a single parameter, index need to be 0, Device_No fixed to 1. servo local parameters in the read parameter number need to be converted to hexadecimal serial number and then add (0x1000) and then read. For example, P15.14, 15 is converted to hex 0x0F, 14 is converted to hex 0x0E and then 0x1000 is added to 0x1F0E, that is, 0x1F0E is the parameter number, which is converted to decimal 7950. Write P15.14: EPOSJOG speed 1 (32 bits)

Symbol	Address	Value
Start_pulse	V1000.0	1
Read_Write	V1000.1	1
Parameter_No	VW1010	16#1F0E
Index_No	VW1012	0
Write_REAL_value	VD1020	
Write_DINT_value	VD1024	5000000
Device_No	VW1030	1
Device_info	VB1040 (AxisNumber)	1
	VD1042 (APINumber)	14848
	VW1046 (SlotNumber)	1
	VW1048 (SubSlotNumbe)	2
Read_REAL_value	VD1060	
Read_DINT_value	VD1064	
Format_value	VB1070	
ErrorNo	VW1080	
ErrorId	VD1090	
PN_Error_Code	VD1094	
Status	VB1100	
Status_bit	V1102.0	Ready
	V1102.1	Busy
	V1102.2	Done
	V1102.3	Error



No.	Description
15	Process: Assign Parameter_No to 7950 (16#1F0E). Set the variable "Read_Write" to 1 to modify the drive parameters. Drive parameters are 16-bit parameters written with variable "Write_REAL_value". Write the drive parameters as 16-bit parameters with the variable "Write_DINT_value". Set the variable "Start_pulse" to 1 to start the task. If the variable "Format_value" displays the following data when reading parameters: 16#02, 16#05, 16#41, 16#42, 16#03, 16#06, 16#0A, or 16#08, modify the variable "Write_REAL_value". REAL_value". If the variable "Format_value" displays the following data in step 2: 16#43, 16#04, 16#07, or 16#0D, modify the parameter in the variable "Write_DINT_value".

Chapter 6 Parameters Description

6.1 General Parameters List

Related modes: P: Position mode; S: Speed mode; T: Torque mode.

The " ● " in the list indicates that it is used in this mode, and "-" indicates that it is not used 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	●	●	●
	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	●	-	-
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	●	-	-
	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	-	●	-

Group No.		Name	Relevant mode		
			P	S	T
P01 Gain tuning	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	●	●	●
	40	Model vibration suppression effect	-	-	-
	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	●	-	-
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	●	●	●
	09	The second notch filter depth	●	●	●
	10	The third notch filter frequency	●	●	●
	11	The third notch filter width	●	●	●
	12	The third notch filter depth	●	●	●
	13	The fourth notch filter width	●	●	●
	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	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P02 Vibration suppression	32	Resonance point 1 bandwidth	●	●	●
	33	Resonance point 1 amplitude	●	●	●
	34	Resonance point 2 frequency	●	●	●
	35	Resonance point 2 bandwidth	●	●	●
	36	Resonance point 2 amplitude	●	●	●
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	-	●	-
	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	●	●	●
	09	DI9 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	●	●	●
	26	DO6 terminal function selection	●	●	●
	27	DO7 terminal function selection	●	●	●
	28	DO8 terminal function selection	●	●	●
	29	DO9 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	●	●	●
	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	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P04 Digital input and output	52	Speed setting for holding brake to take action in motion	●	●	●
	53	Waiting time for holding brake to take action in motion	●	●	●
	54	DB status after stop	●	●	●
	55	Torque set value arrival	●	●	●
	56	Torque arrival detection width	●	●	●
	57	Z-phase pulse width adjustment	●	●	●
	58	Zero-speed signal output threshold	●	●	●
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	●	●	●
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	●	●	-

Group No.		Name	Relevant mode		
			P	S	T
P06 Expansion parameters	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	High-speed DI filtering setting	●	●	●
	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	●	●	●
	50	Emergency stop (quick stop) stopping method	●	●	●
	51	Stopping method of halt	●	●	●
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	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P07 Auxiliary function parameters	21	Function selection 7	●	●	●
	22	Function selection 8	●	●	●
	23	Fault reset timing	●	●	●
	24	Positive soft limit (32-bit)	●	●	●
	26	Negative soft limit (32-bit)	●	●	●
P08 Internal position instruction	00	Dealing of residual segments after pausing and restarting	●	-	-
	01	Position instruction type	●	-	-
	02	Waiting time unit	●	-	-
	03	The 1st segment displacement (32-bit)	●	-	-
	05	The 1st segment maximum speed (32-bit)	●	-	-
	07	The 1st segment acceleration ratio	●	-	-
	08	The 1st segment deceleration ratio	●	-	-
	09	The 2nd segment displacement (32-bit)	●	-	-
	11	The 2nd segment maximum speed (32-bit)	●	-	-
	13	The 2nd segment acceleration ratio	●	-	-
	14	The 2nd segment deceleration ratio	●	-	-
	15	The 3rd segment displacement (32-bit)	●	-	-
	17	The 3rd segment maximum speed (32-bit)	●	-	-
	19	The 3rd segment acceleration ratio	●	-	-
	20	The 3rd segment deceleration ratio	●	-	-
	21	The 4th segment displacement (32-bit)	●	-	-
	23	The 4th segment maximum speed (32-bit)	●	-	-
	25	The 4th segment acceleration ratio	●	-	-
	26	The 4th segment deceleration ratio	●	-	-
	27	The 5th segment displacement (32-bit)	●	-	-
	29	The 5th segment maximum speed (32-bit)	●	-	-
	31	The 5th segment acceleration ratio	●	-	-
	32	The 5th segment deceleration ratio	●	-	-
	33	The 6th segment displacement (32-bit)	●	-	-
	35	The 6th segment maximum speed (32-bit)	●	-	-
	37	The 6th segment acceleration ratio	●	-	-
	38	The 6th segment deceleration ratio	●	-	-
	39	The 7th segment displacement (32-bit)	●	-	-
	41	The 7th segment maximum speed (32-bit)	●	-	-
	43	The 7th segment acceleration ratio	●	-	-
	44	The 7th segment deceleration ratio	●	-	-
	45	The 8th segment displacement (32-bit)	●	-	-
	47	The 8th segment maximum speed (32-bit)	●	-	-
	49	The 8th segment acceleration ratio	●	-	-
	50	The 8th segment deceleration ratio	●	-	-
	51	The 9th segment displacement (32-bit)	●	-	-
	53	The 9th segment maximum speed (32-bit)	●	-	-
	55	The 9th segment acceleration ratio	●	-	-
	56	The 9th segment deceleration ratio	●	-	-
	57	The 10th segment displacement (32-bit)	●	-	-
	59	The 10th segment maximum speed (32-bit)	●	-	-
	61	The 10th segment acceleration ratio	●	-	-

Group No.		Name	Relevant mode		
			P	S	T
P08 Internal position instruction	62	The 10th segment deceleration ratio	●	-	-
	63	The 11th segment displacement (32-bit)	●	-	-
	65	The 11th segment maximum speed (32-bit)	●	-	-
	67	The 11th segment acceleration ratio	●	-	-
	68	The 11th segment deceleration ratio	●	-	-
	69	The 12th segment displacement (32-bit)	●	-	-
	71	The 12th segment maximum speed (32-bit)	●	-	-
	73	The 12th segment acceleration ratio	●	-	-
	74	The 12th segment deceleration ratio	●	-	-
	75	The 13th segment displacement (32-bit)	●	-	-
	77	The 13th segment maximum speed (32-bit)	●	-	-
	79	The 13th segment acceleration ratio	●	-	-
	80	The 13th segment deceleration ratio	●	-	-
	81	The 14th segment displacement (32-bit)	●	-	-
	83	The 14th segment maximum speed (32-bit)	●	-	-
	85	The 14th segment acceleration ratio	●	-	-
	86	The 14th segment deceleration ratio	●	-	-
	87	The 15th segment displacement (32-bit)	●	-	-
	89	The 15th segment maximum speed (32-bit)	●	-	-
	91	The 15th segment acceleration ratio	●	-	-
	92	The 15th segment deceleration ratio	●	-	-
	93	The 16th segment displacement (32-bit)	●	-	-
	95	The 16th segment maximum speed (32-bit)	●	-	-
	97	The 16th segment acceleration ratio	●	-	-
	98	The 16th segment deceleration ratio	●	-	-
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	●	●	●
	12	Select to enable AO function or CAN communication	●	●	●
	13	CAN communication Configuration1	●	●	●
	14	CAN communication Configuration2	●	●	●
	15	CAN communication Configuration3	●	●	●
P14 PN communication configuration	00	MAC1	●	●	●
	01	MAC2	●	●	●
	02	MAC3	●	●	●
	03	-	●	●	●
	04	Device name 1st and 2nd characters	●	●	●
	05	Device name 3rd and 4th characters	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P14 PN communication configuration	06	Device name 5th and 6th characters	●	●	●
	07	Device name 7th and 8th characters	●	●	●
	08	Device IPA	●	●	●
	09	Device IPB	●	●	●
	10	Device Network Mask A	●	●	●
	11	Device Network Mask B	●	●	●
	12	Network Manager A (Gateway)	●	●	●
	13	Network Manager B (Gateway)	●	●	●
	14	Data Write Switch	●	●	●
	15	922 telegram Monitoring	●	●	●
	16	Additional Message Monitoring	●	●	●
	17	925 Heartbeat Alarm Threshold	●	●	●
	22	979_0 Sensor header (32 bits)	●	●	●
	24	979_1 Sensor Type (32 bits)	●	●	●
	26	979_2 sensor resolution (32 bits)	●	●	●
	28	979_3 Sensor G1_XIST1 Factor (32 bits)	●	●	●
	30	979_4 Sensor G1_XIST2 Factor (32 bits)	●	●	●
	32	979_5 Sensor Multiturn (32 bits)	●	●	●
	34	Synchronization Period	●	●	●
	37	Immediate update switch	●	-	-
	40	Disengage To control servo local acceleration time (32 bits)	●	●	●
	42	Disengage To control servo local deceleration time (32 bits)	●	●	●
	44	Deceleration time unit in speed mode: 0-1000 ms (32 bits)	●	●	●
	46	bit10 Hysteresis judgment value(unit:rpm)	-	●	-
	47	Speed error range(unit:rpm)	-	●	-
	48	Speed error range time (unit:ms)	-	●	-
	49	ARM and 200p dropout detection function control switch	●	●	●
	50	Synchronization cycle is current loop multiple detection switch	●	●	●
P15 EPOS parameters	00	EPOS Maximum Velocity (32-bit)	●	-	-
	02	EPOS Maximum Acceleration (32-bit)	●	-	-
	04	EPOS Max Deceleration(32bit)	●	-	-
	06	EPOS Maximum Ramp Speed (32 bits)	●	-	-
	08	EPOS Position Deviation Excess Threshold (32 bits)	●	-	-
	10	EPOS Position Reach Threshold (32 bits)	●	-	-
	14	EPOS JOG Speed 1 (32 bits)	●	●	-
	16	EPOS JOG speed 2 (32 bits)	●	●	-
	18	EPOS JOG Maximum Acceleration (32 bits)	●	●	-
	20	EPOS JOG Maximum Deceleration (32 bits)	●	●	-
	22	EPOS Homing method	●	-	-
	23	EPOS High homing Speed(32 bits)	●	-	-
	25	EPOS Low homing Speed(32bit)	●	-	-
	27	EPOS Homing Acceleration and Deceleration Time (32 bits)	●	-	-
	31	EPOS Homing Absolute Offset (32 bits)	●	-	-
	33	EPOS reference coordinate value (32 bits)	●	-	-
	35	EPOS Homing Timeout (32 bits)	●	-	-
	37	EPOS Soft Limit Effective Mode	●	●	●
	38	EPOS Soft Limit Positive Limit Value (32 bits)	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P15 EPOS parameters	40	EPOS soft limit negative limit value (32 bits)	●	●	●
	42	EPOS electronic gear ratio numerator (32 bits)	●	●	●
	44	EPOS electronic gear ratio denominator (32 bits)	●	●	●
	46	111 message user-defined PZD12 receive word	●	●	●
	47	111 telegram user-defined PZD12 transmit word	●	●	●
	48	Modulo axis pulse limit (32 bits)	●	●	●
	52	Epos modulo axis on switch	●	●	●
	53	Uncycled data save switch	●	●	●
	54	EPOS moving signal output threshold	●	●	●
P18 Motor	00	Motor model code (32 bits)	●	●	●
P20 panel and communication control	00	Key JOG trial	●	●	●
	01	Fault reset	●	●	●
	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 Select Multi-Segment Command Sequence Code	●	●	-
	12	Homing start by communication	●	-	-
P21 state parameters	00	Servo status	●	●	●
	01	Motor speed feedback	●	●	●
	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	●	●	●
	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	●	●	●

Group No.		Name	Relevant mode		
			P	S	T
P21 state 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)	●	●	●
	61	Analog-Digital Absolute Position Counter (32-bit)	●	●	●
	63	Servo stack version number	●	●	●
	64	Profinet servo exclusive version number	●	●	●
	65	Current network status display	●	●	●
	66	MAC1	●	●	●
	67	MAC2	●	●	●
	68	MAC3	●	●	●
	69	MAC4	●	●	●

6.2 Parameter description

6.2.1 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 ~ 8	8	--	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: Full closed-loop mode (reserved)

7: CANOpen mode

8: Profinet 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.

Configure to mode 8 when using Profinet communication control.

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

P00.14	Pulse number per turn of motor rotation (32-bit))	Range	Default	Unit	Effective	Relevant mode		
		16 ~ 2147483646	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 ~ 2147483646	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 ~ 2147483646P

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	3000	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 ~ 65535	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

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

1.0Hz ~ 2000.0Hz.

The higher the gain, the faster the position 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.

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 ~ 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 ~ 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

Set the filter level for speed detection.

0 ~ 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 feedforward control options	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	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 feedforward 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 feedforward control selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	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 feedforward 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 feedforward 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), return to the 1st gain in the specified delay time. 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), return to the 1st gain in the specified delay time. 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, return to the 1st gain in the specified delay time.

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

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 ~ 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 ~ 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 ~ 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 ~ 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 ~ 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 ~ 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

0 ~ 500HZ

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

0.00 ~ 100.00ms

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

0 ~ 10000

P01.40	Modeling the effectiveness of vibration control	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate			

0: Invalid

1: Valid

P01.41	Model tracking option	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	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

5: Reserved

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

1.0 ~ 2000.0 /S

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

50.0 ~ 200.0%

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

0.0 ~ 200.0%

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

0.0 ~ 1000.0%

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

0.0 ~ 1000.0%

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

1.0 ~ 2000.0 /S

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

50.0 ~ 200.0%

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

1.0 ~ 200.0HZ

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

1.0 ~ 200.0HZ

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

1.0 ~ 200.0HZ

P01.52	Vibration suppression compensation coefficient	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 1000	100	1%	Immediate	P		

10% ~ 1000%

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

0 ~ 3000.0HZ

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

500 ~ 1500

6.2.3 P02 Vibration suppression

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

Set the position command first-order low-pass filter time constant when in position control mode.

0.0ms ~ 6553.5ms

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

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

0.0ms ~ 128.0ms

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 ~ 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

6.2.4 P03 Speed & torque control

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: Forward and reverse internal torque limiting (default)

1: Positive and negative external torque limiting (selected using P_CL, N_CL)

2: TLMTP as positive and negative torque limiting

3: TLMTP, TLMTN as positive and negative limiting

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 for 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 external torque limit for positive rotation takes effect; this setting value must not be greater than the P03.09 (internal torque limit value for positive rotation) setting value. When this setting value is greater than the parameter P03.09 setting value, the torque limit value will be the value set in P03.09.

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 for reversing, in the range of 0.0% to 500.0% (based on the rated motor torque).

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

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

Set the external torque limit value for positive 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 external torque limit for forward rotation takes effect.

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 for reverse rotation, range 0.0% to 500.0% (based on motor rated torque).

When DI is configured with function 17 (N_CL) and the DI input is valid, reverse external torque limiting takes effect.

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

0ms ~ 65535ms/1000rpm

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		
		-3000 ~ 3000	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	1000	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

P03.43	Segment 8 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

6.2.5 P04 Digital Inputs and outputs

P04.00	Normal DI filter selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	500	1us	Restart	P	S	T

0 ~ 10000

This filtering parameter is available only for DI terminal 1 to DI terminal 6, and the filtering settings for DI terminal 7 to DI terminal 9 are shown in P06.44.

P04.01	DI1 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.

P04.02	DI2 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.

P04.03	DI3 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 63	28	--	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	39	--	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	40	--	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	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.

P04.07	DI7 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.

P04.08	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.

P04.09	DI9 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	1	--	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	1	--	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	0	--	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	0	--	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	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.

P04.23	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	0	--	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	0	--	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.

P04.26	DO6 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	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.

P04.27	DO7 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	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.

P04.28	DO8 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	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.

P04.29	DO9 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	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.

P04.31	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	1	--	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)

P04.36	DO6 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)

P04.37	DO7 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)

P04.38	DO8 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)

P04.39	DO9 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	FunINL 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: When 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

P04.54	Z pulse OCZ output enable	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Immediate	P	S	T

0-Not Supported

1-Invalid

2-Enable OCZ output

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 + P04.56/4), 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% ~ 300.0% (based on motor rated torque)

P04.57	Z-phase pulse width adjustment	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 100	0	--	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.

6.2.6 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	1000	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 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 ~ 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.

6.2.7 P06 Expansion parameters

P06.00	Electronic gear numerator 2 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483646	1	--	Immediate	P		

1 ~ 2147483646

P06.02	Electronic gear numerator 3 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483646	1	--	Immediate	P		

1 ~ 2147483646

P06.04	Electronic gear numerator 4 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483646	1	--	Immediate	P		

1 ~ 2147483646

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 ~ 2	2	--	Immediate	P	S	

Unit’s digit: (potential energy compensation option)

0: Automatic update, power-failure storage

1: Auto-update, re-initialize to set value at power-failure

2: No automatic update

Ten's digit: (friction compensation option)

0: Automatic update, power-failure storage

1: Auto-update, re-initialize to set value at power-failure

2: No automatic update

3: Potential energy compensation is automatically updated and saved at power-failure; friction compensation is not automatically updated.

P06.12	Forward rotation frictional torque compensation	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 3000	0	0.1%	Immediate	P	S	

00.1% torque unit

(-300.0 ~ 300.0)

P06.13	Reverse rotation friction torque compensation	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 3000	0	0.1%	Immediate	P	S	

00.1% torque unit

(-300.0 ~ 300.0)

P06.14	Viscous friction compensation	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 3000	0	0.1%	Immediate	P	S	

0.1% torquve 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	1	Immediate	P	S	T

0: Coast to stop and stay 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 ~ 1	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: Disable, the third type of fault stops in the same way as the second type of fault stops.

1: Enable, the third type of fault is handled according to the servo internal quick stop, the deceleration time is set according to P06.25 to coast to stop and remain free.

P06.25	Instantaneous power failure deceleration time	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 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: Stop by bit, not to hold DB

1~3: Reserved

4: Stop by bit, 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 stop, remain free

1: Zero speed stop, remain free

2~3: Reserved

4: DB stop, hold DB

5: Zero speed stop, hold DB

Note: Encoder alarm Err.13, Err.14 fault stop mode:

P06.27 set 0~1: Coast to stop and remain free

P06.27 set 4~5: DB stop and 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, 1: Zero-speed stop (3 times the torque). Overtravel does not disable the enable signal (overtravel warning AL.086 or AL.087 is triggered).

2: Fault stop mode (handled according to P06.27). An overtravel fault disables the enable signal. To clear, first reset the fault, ensure no command is given, then re-enable. (Overtravel fault ER.086 or ER.087 is triggered.)

Note: If both the positive and negative hard limits are active simultaneously, fault ER.099 is triggered.

This parameter is available starting from version P21.64=1018.

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)

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 ~ 4000K

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

Note: According to the actual application, after checking whether the external wiring is shielded, grounded, etc., then set this parameter appropriately.

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.

(Pulse inhibit function can only be configured to the following DI terminals: DI7, DI8, DI9)

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.

(The deviation clearing function can only be configured to the following DI terminals: DI7, DI8, DI9)

P06.44	Probe DI Filter Setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	50	1us	Restart	P	S	T

1us/Unit

(DI4 and DI5 probe filter time)

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: 0 ~ 30000ms.

If the torque is saturated for a long time and the duration exceeds this range, error Err.17 is reported.

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 ;

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 under-voltage 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	--	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.

6.2.8 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 ~ 69,

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;

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

P07.12	User password screen-lock time	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 30	5	1 min	Immediate	P	S	T

1 ~ 30 mintues

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:

Bit 1: Interrupt positioning instruction setting

0: No adjustment with electronic gear;

1: Adjust with electronic gear

Bit 2: Interrupt positioning instruction direction setting

0: Follow the current operation direction

1: Decided by instruction sign

Other bits are reserved.

P07.17	Maximum division number per motor rotation	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,

Bit 1: Reserved

Bit 2: Reserved

Bit 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	1010	--	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: Not allowed to reset automatically

P07.22	Function selection 8	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	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: Restable when SON is valid

1: Unresettable when SON is valid

P07.24	Positive soft limit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	2147483646	--	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		
		-2147483646 ~ 2147483646	-2147483646	--	Restart	P	S	T

It is valid during reverse soft limit, position control, speed control, and torque control modes.

6.2.9 P08 Internal position instruction

P08.00	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

P08.01	Position instruction type	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P		

0: Relative position instruction

1: Absolute position instruction

P08.02	Waiting time unit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P		

0: ms

1: s

P08.03	The 1st segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.05	The 1st segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.07	The 1st segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.08	The 1st segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.09	The 2nd segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.11	The 2nd segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.13	The 2nd segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.14	The 2nd segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.15	The 3rd segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.17	The 3rd segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.19	The 3rd segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.20	The 3rd segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.21	The 4th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.23	The 4th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.25	The 4th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.26	The 4th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.27	The 5th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.29	The 5th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.31	The 5th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.32	The 5th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.33	The 6th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.35	The 6th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.37	The 6th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.38	The 6th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.39	The 7th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.41	The 7th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.43	The 7th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.44	The 7th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.45	The 8th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.47	The 8th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.49	The 8th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.50	The 8th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.51	The 9th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.53	The 9th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.55	The 9th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.56	The 9th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.57	The 10th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.59	The 10th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.61	The 10th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.62	The 10th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.63	The 11th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.65	The 11th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.67	The 11th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.68	The 11th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.69	The 12th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.71	The 12th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.73	The 12th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.74	The 12th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.75	The 13th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.77	The 13th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.79	The 13th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.80	The 13th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.81	The 14th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.83	The 14th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.85	The 14th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.86	The 14th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.87	The 15th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.89	The 15th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.91	The 15th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.92	The 15th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

P08.93	The 16th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	10000	--	Immediate	P		

-1073741824 ~ 1073741824LU

P08.95	The 16th segment maximum speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	600000	1LU/min	Immediate	P		

1 ~ 80000000(LU/min)

P08.97	The 16th segment acceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual acceleration: current rate*P15.02)

P08.98	The 16th segment deceleration ratio	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 100	100	1%	Immediate	P		

0 to 100% (actual deceleration: current rate * P15.04)

6.2.10 P09 Communication setting

P09.00	Servo axis address number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 247	1	--	Immediate	P	S	T

1 to 247, 0 is the broadcast address. Used for communication, supports Modbus, CANOpen and so on.

P09.01	Modbus baudrate	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 control 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

P09.06	Communication control 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

P09.07	Communication control 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

P09.08	Communication control 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

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

P09.10	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 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

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.

P09.12	Select to enable AO function or CAN communication	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal numbers, from right to left:

Digit 1:

0: Enable CANOpen communication

1: Enable AO function

Other bits are reserved.

P09.13	CAN communication configuration 1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	5	--	Restart	P	S	T

Hexadecimal numbers, from right to left:

Digit 1, CAN communication baud rate:

0: 20k; 1: 50k; 2: 100k; 3: 125k;

4: 250k; 5: 500k; 6: 800k; 7: 1M

Digit 2: Electronic gear ratio selection

0: Drive setting; 1: Master setting.

Digit 3: Speed unit setting

0: Use internal unit

1: Use user unit

Digit 4: Acceleration unit setting

0: Use internal unit

1: Use user unit

P09.14	CAN communication configuration 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal number, from right to left.

Bit 1, bus fault detection, 0: disabled, 1: enabled.

Bit 2, Absolute system origin completion flag storage setting.

0: not stored; 1: stored.

P09.15	CAN communication configuration 3	Range	Default	Unit	Effective	Relevant mode		
		-20 ~ 20	0	--	Immediate	P	S	T

Fine-tuning the synchronization jitter delay

6.2.11 P14 PN communications parameter

P14.00	MAC1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	2048	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.01	MAC2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	1538	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.02	MAC3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	272	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.03	Unused	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Display only	P	S	T

0 ~ 65535

P14.04	Device name 1st and 2nd characters	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	30774	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

ASCII: special characters need to be used in conjunction with alphabetic and numeric characters, and special characters cannot be at the beginning or end, and individual characters can only be alphabetic characters.

(Characters: a ~ z Decimal: 97 ~ 122 Hexadecimal: 0x61 ~ 7A)

(Characters: 0 to 9 Decimal: 48 to 57 Hexadecimal: 0x30 to 0x39)

(Character: – Decimal: 45 Hexadecimal: 0x2D)

(Character: . Decimal: 46 Hexadecimal: 0x2E)

P14.05	Device name 3rd and 4th characters	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	28782	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

ASCII: special characters need to be used in conjunction with alphabetic and numeric characters, and special characters cannot be at the beginning or end, and individual characters can only be alphabetic characters.

(Characters: a ~ z Decimal: 97 ~ 122 Hexadecimal: 0x61 ~ 7A)

(Characters: 0 to 9 Decimal: 48 to 57 Hexadecimal: 0x30 to 0x39)

(Character: – Decimal: 45 Hexadecimal: 0x2D)

(Character: . Decimal: 46 Hexadecimal: 0x2E)

P14.06	Device name 5th and 6th characters	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	12336	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

ASCII: special characters need to be used in conjunction with alphabetic and numeric characters, and special characters cannot be at the beginning or end, and individual characters can only be alphabetic characters.

(Characters: a ~ z Decimal: 97 ~ 122 Hexadecimal: 0x61 ~ 7A)

(Characters: 0 to 9 Decimal: 48 to 57 Hexadecimal: 0x30 to 0x39)

(Character: – Decimal: 45 Hexadecimal: 0x2D)

(Character: . Decimal: 46 Hexadecimal: 0x2E)

P14.07	Device name 7th and 8th characters	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	12331	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

ASCII: special characters need to be used in conjunction with alphabetic and numeric characters, and special characters cannot be at the beginning or end, and individual characters can only be alphabetic characters.

(Characters: a ~ z Decimal: 97 ~ 122 Hexadecimal: 0x61 ~ 7A)

(Characters: 0 to 9 Decimal: 48 to 57 Hexadecimal: 0x30 to 0x39)

(Character: – Decimal: 45 Hexadecimal: 0x2D)

(Character: . Decimal: 46 Hexadecimal: 0x2E)

P14.08	Device IPA	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	49320	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.09	Device IPB	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	88	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.10	Device network mask A	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	65535	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.11	Device network mask B	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	65280	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.12	Network manager A (gateway)	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.13	Network manager B (gateway)	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P14.14	Data write switch	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

0x1000 -Device IP read (P14.08 to 14.13)

0x200: -Device IP write

0x3000 -Device NAME read (P14.04 ~ 14.07)

0x3000 -Device NAME write

0x5000 -Device MAC read (P14.00 ~ 14.02)

0xA55A -Device MAC write

0x6000 -Device name and IP cleared

(Note: Device name and device IP address to be written with servo not enabled and AR not enabled)

P14.15	922 Telegram monitoring	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

0 ~ 65535

Displays the current message (e.g., 1, 3, 7, 9, 102, 111)

P14.16	Additional message monitoring	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

0 ~ 65535

Additional messages (e.g., 750)

P14.17	925 Heartbeat alarm threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

0 ~ 65535

P14.22	979_0 Sensor header (32 bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	--	Display only	P	S	T

0 ~ 2147483647

[0:3] Parameter structure version low bit (default value:2)

[4:7] Parameter structure version high (default value:1)

[8:11] Number of sensors (default value:1)

[12:15]Length of array corresponding to each sensor (default value:5)

P14.24	979_1 Sensor type (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	--	Display only	P	S	T

0 ~ 2147483647

[0] - 0: Rotary encoder 1:Linear encoder

[1] - 0: G1_XIST1 relative position 1:G1_XIST1 absolute position

[29] - 0:979 The parameter value Gx is static and does not change when switching from the "Parking" state to the "normal" state.

1:The value of the 979 parameter is changed during a state change from the "Parking" state to the "Normal" state.

[30] - 0:If the 979 parameter is currently invalid (979[1]bit31=0), it can be validated in the future (=1). The change from invalid to valid is only possible when the measuring system is working in the "parking" state.

[31] - 0:979 Parameter value Gx is not valid.

1:979 Parameter value Gx is valid.

P14.26	979_2 Sensor resolution (32 bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	--	Display only	P	S	T

0 ~ 2147483647

Rotary Encoder: Number of pulses per revolution

Linear encoders: Signal cycle length (Unit is in nanometers)

P14.28	979_3 Sensor G1_XIST1 factor (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	--	Display only	P	S	T

0 ~ 2147483647

Bits of quadrant information and subdivision in Gx_XIST1

P14.30	979_4 Sensor G1_XIST2 factor (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	--	Display only	P	S	T

0 ~ 2147483647

Number of bits of quadrant information and subdivision in Gx_XIST1

P14.32	979_5 Sensor multiturn (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	0	--	Display only	P	S	T

0 ~ 2147483647

0: Incremental encoder (absolute value reading from G2_XIST2 is not supported)

1: Single-turn absolute value

XXX: Multi-turn absolute value (usually 4096)

P14.34	Synchronization cycle	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

0 ~ 65535

(Unit: us)

P14.37	Immediately updated switches	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Display only	P		

0 ~ 1

P14.40	Disengage To control servo local acceleration time (32 bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 200000	0	--	Immediate	P	S	T

0 ~ 200000(Unit:ms)

P14.42	Disengage To control servo local deceleration time (32 bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 200000	0	--	Immediate	P	S	T

0 ~ 200000(Unit:ms)

P14.44	Deceleration time in speed mode Unit:0-1000 ms (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 200000	0	--	Immediate	P	S	T

0 ~ 200000(Unit:ms)

P14.46	bit10 Hysteresis judgment value (Unit:rpm)	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ 7530H	300	--	Restart		S	

0 ~ 30000(Unit:rpm)

P14.47	Speed Error range (Unit:rpm)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	5	--	Restart		S	

0 ~ 65535(Unit:ms)

P14.48	Speed Error range time (msUnit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	5	--	Restart		S	

0 ~ 65535(Unit:ms)

P14.49	ARM and 200p dropout detection function control switch	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

0 ~ 1

P14.50	Synchronized cycle is current loop multiplier detection switch or not	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Display only			

0 ~ 1

6.2.12 P15 EPOS parameters

P15.00	EPOS Maximum velocity (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 80000000	50000000	1LU/min	Restart	P		

1 ~ 80000000(Unit: 1000LU/min)

Actual limited motor speed (rpm) = 15.00*1000*gear ratio/resolution (LU/min)

P15.02	EPOS Maximum acceleration (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 2000000000	5000000	1LU/S2	Restart	P		

1 ~ 2000000000(Unit: LU/S2)

Relative/absolute positioning acceleration (sec) = (Velocity*OverV*1000) / (60*P15.02*OverAcc)

P15.04	EPOS Maximum deceleration (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 2000000000	5000000	1LU/S2	Restart	P		

1 ~ 2000000000(Unit: LU/S2)

Relative/absolute positioning deceleration (sec) = (Velocity*OverV*1000) / (60*P15.02*OverAcc)

P15.06	EPOS Maximum ramp speed (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 2000000000	5000000	1LU/S2	Restart	P		

1 ~ 2000000000(Unit: LU/S2)

Maximum ramp stop time (s) = (Velocity*1000) / (60*P15.06)

P15.08	EPOS Position deviation threshold (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	40000	--	Restart	P		

0 ~ 2147483647

Instruction unit

((P15.08*Gear Ratio) compared to P00.19 (EncoderUnit), using the smallest value as the comparison value)

P15.10	EPOS position reaches threshold (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483647	100	--	Restart	P		

0 ~ 2147483647

P15.14	EPOS JOG speed 1 (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		-2000000000 ~ 2000000000	500000	1LU/min	Restart	P	S	

-200000000 ~ 200000000(Unit: LU/min)

Jog Actual Speed (RPM) = (P15.14 or P15.16 * OverV% * Gear Ratio) / Encoder Resolution

P15.16	EPOS JOG speed 2 (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2000000000 ~ 2000000000	500000	1LU/min	Restart	P	S	

-200000000 ~ 200000000(Unit: LU/min)

Jog Actual Speed (RPM) = (P15.14 or P15.16 * OverV% * Gear Ratio) / Encoder Resolution

P15.18	EPOS JOG maximum acceleration (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 2000000000	100000	1LU/S2	Restart	P	S	

1 ~ 2000000000(Unit: LU/S2)

Jog acceleration time (s) = (P15.14 or P15.16*OverV%)/(P15.18*60*OverAcc%)

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.20	EPOS JOG maximum deceleration (32 bits)	1 ~ 2000000000	100000	1LU/S2	Restart	P	S	

1 ~ 2000000000(Unit: LU/S2)

Jog deceleration time (s) = (P15.14 or P15.16*OverV%)/(P15.20*60*OverAcc%)

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.22	EPOS Homing method	1 ~ 35	1	--	Restart	P		

0 ~ 35

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.23	EPOS High speed hooming (32-bit)	0 ~ 4000000000	5000000	1LU/min	Restart	P		

0 ~ 4000000000(Unit: LU/min)

High homing speed (RPM) = (P15.23*gear ratio)/encoder resolution

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.25	EPOS Low speed homing (32-bit)	0 ~ 4000000000	30000	1LU/min	Restart	P		

0 ~ 4000000000(Unit: LU/min)

Low homing speed (RPM) = (P15.25*gear ratio)/encoder resolution

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.27	EPOS Homing acceleration and deceleration time (32-bit)	0 ~ 2000000000	100000	1LU/S2	Immediate	P		

1 ~ 200000000(Unit: LU/S2)

Acceleration and deceleration time to return to original speed (s) = (P15.23 or P15.25)/(60*P15.27)

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.31	EPOS Homing absolute offset (32-bit)	-2147483648 ~ 2147483647	0	--	Restart	P		

-2147483648 ~ 2147483647

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.33	EPOS Reference coordinate value (32 bit)	-2147483648 ~ 2147483647	0	--	Restart	P		

-2147483648 ~ 2147483647

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.35	EPOS Homing timeout time (32-bit)	0 ~ 2147483647	65535	1ms	Restart	P		

0 ~ 2147483647

Parameter	Name	Range	Default	Unit	Effective	Relevant mode		
P15.37	EPOS software limit effective	0 ~ 2	0	--	Restart	P	S	T

0 ~ 2

0: No soft limit detection

1: Soft limit is detected at power-up and ConfigEPos.%X2 (POS_STW2.14) is set to 1.

2: Soft limit is detected after home return is completed and ConfigEPos.%X2 (POS_STW2.14) is set to 1.

P15.38	EPOS Software limit positive limit value (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	2147483647	--	Restart	P	S	T

-2147483648 ~ 2147483647

P15.40	EPOS Software limit negative limit value (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	-2147483648	--	Restart	P	S	T

-2147483648 ~ 2147483647

P15.42	EPOS Electronic gear ratio numerator (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 1073741824	131072	--	Immediate	P	S	T

1 ~ 1073741824

If 15.44 and 15.42 are set incorrectly.

Re-energizing will alarm 48 or enabling will also alarm 48.

P15.44	EPOS Electronic Gear ratio denominator (32 bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 1073741824	10000	--	Immediate	P	S	T

1 ~ 1073741824

If 15.44 and 15.42 are set incorrectly.

Re-energizing will alarm 48 or enabling will also alarm 48.

P15.46	111 telegram user-defined PZD12 receive word	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Restart	P	S	T

0 ~ 5

0: No content

3: DO forced output: If the function parameters for DO1-DO8 are 0, the outputs can be directly controlled via the low-order 8 bits. If the function parameters for DO1-DO8 are not 0, forced output can be achieved by using both the low-order and high-order 8 bits in combination.

4: Torque limit (Maximum torque (P18.07) = 16#4000. Implements torque limiting in the same way as Telegram 750).

5: External servo hard limits not used. Uses Telegram 111 to set the positive/negative hard limits. In Telegram 111, QW22: bit0: Positive limit, 1=set, 0=reset; bit1: Negative limit, 1=set, 0=reset. Hard limits must be enabled in the ConfigEpos configuration. For proper operation, servo DI functions 14 and 15 must be configured.

Note: Option 5 is supported starting from version P21.64=1018.

P15.47	111 telegram user-defined PZD12 send word	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3	0	--	Restart	P	S	T

0 ~ 3

0: No content

1: Actual torque (Maximum torque (P18.07) = 16#4000)

3: DI status (servo DI status uploaded to PLC, uploaded P21.21 status)

P15.48	Modulo axis pulse limit (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 2147483647	36000	--	Immediate	P	S	T

1 ~ 2147483647

P15.52	Epos Modulo axis switch	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

0 ~ 1

0: Disable modulo mode

1: Enable modulo mode

P15.53	Uncycled data save switch	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Restart	P	S	T

0 ~ 1

0: Parameters not save to eeprom

1: Parameters save to eeprom

P15.54	EPOS Mobile signal output threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6000	3	--	Restart	P	S	T

0 ~ 6000

6.2.13 P18 Motor model

P18.00	Motor model code (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		00000000H ~ EFFFFFFFH	1964114433	--	Restart	P	S	T

6.2.14 P20 Key and communication control interface

P20.00	Key JOG trial	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	0	--	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

P20.03	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 set values (without factory parameters)

2: Clear fault record

7: Absolute encoder reset, reset clear 21.32

8: Absolute encoder reset, reset clear 21.32 and 21.07

11: Re-recognize model

The rest: 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 ~ 32	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

6.2.15 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 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		
		-2147483646 ~ 2147483646	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: -2147483646 ~ 2147483646

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 ~ 360.0 degrees

P21.11	Load inertia identification value	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01 kg c m^2	Display only	P	S	T

0.01 kg c m^2 ~ 655.35 kg c m^2

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		
		-2147483646 ~ 2147483646	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: -2147483646 ~ 2147483646

P21.15	Input pulse counter (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	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: -2147483646 ~ 2147483646

P21.17	Feedback pulse counter (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	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: -2147483646 ~ 2147483646

P21.19	Position deviation counter instruction unit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	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 ~ 511	0	--	Display only	P	S	T

Real-time display of the status of DI1 to DI9 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 DI9.

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.

P21.23	Digital output signal monitoring	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 511	0	--	Display only	P	S	T

Real-time display of the status of DO1 to DO9 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 DO9.

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 DO9 respectively.

P21.24	Encoder status	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Encoder status

P21.25	Total power-on time (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483646	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: 0.0:214748364.6s

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		
		-2147483646 ~ 2147483646	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		
		-2147483646 ~ 2147483646	0	1Unit	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

Display customized edition series number

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 ~ 2147483646	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

Real-time display of internal warning codes.

P21.54	Current segment number of internal instruction	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Display only	P	S	T

Displays the serial number of the currently executing segment of the internal multi-segment position instruction.

P21.55	Customized serial code	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Customized serial code

P21.56	Absolute position counter high 32 bits (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	0	--	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		
		-2147483646 ~ 2147483646	0	--	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.

P21.61	Modulo absolute position counter (32 bits)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P	S	T

1073741824 ~ -1073741824

P21.63	Servo stack version number	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Displays the servo stack version number

P21.64	Profinet Servo Exclusive Version Number	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Profinet Servo Exclusive Version Number

P21.65	Display of current network status	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Display only	P	S	T

1: Communication unestablished

4: Communication established

P21.66	MAC1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Display only	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P21.67	MAC2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Display only	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P21.68	MAC3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Display only	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

P21.69	MAC4	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Display only	P	S	T

Decimal: 0 to 65535

Hexadecimal: 0x0 to 0xFFFF

The panel is displayed in hexadecimal.

6.2.16 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	ER_RST	Alarm reset signal (edge-triggered function)	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	PER_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

Setting value	Symbol	Name	Description
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 reverse drive Invalid-Normal range, allow negative 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_ER	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.

Setting value	Symbol	Name	Description
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	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.
39	Touch1	Touch probe 1	Invalid - No effect Valid – Probe function 1 execution signals
40	Touch2	Touch probe 2	Invalid - No effect Valid – Probe function 2 execution signals

6.2.17 Digital output (DO) 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_ER	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.

Setting value	Symbol	Name	Description
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 3 reaches the corresponding range.
22	PCOM4	Position 4 comparison trigger signal	Trigger signal is output when position 4 reaches the corresponding range.

Chapter 7 Errors & Alarms and Troubleshooting

7.1 List of alarm and fault codes

Table 7-1, List of factory-defined fault codes

Error code	Name	Stop mode	Reset (Y/N)	Alarm Records (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	Incremental optical encoder Z disconnection or abnormal number of absolute encoder turns	Stop immediately	Y	Y
Err.013	Abnormal encoder communication	Configurable	Y	Y
Err.014	Abnormal encoder data	Configurable	Y	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	Decelerate to stop	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.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	Configurable	Y	Y
Err.047	Overloaded motor	Configurable	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

Error code	Name	Stop mode	Reset (Y/N)	Alarm Records (Y/N)
Err.057	DB overload	Configurable	Y	Y
Err.058	STO Safe Torque Off	Stop immediately	Y	Default N, optional
Err.059	Prohibit EPOS relative positioning	Stop immediately	Y	Y
Err.060	First startup after writing a customized version of the program	Stop immediately	No	N
Err.065	Prohibited operation in PROFINET communication mode	Configurable	Y	Y
Err.066	Parameter setting is prohibited in PROFINET communication mode operation.	Configurable	Y	Y
Err.067	arm and 200P parallel port error	Decelerate to stop	Y	Y
Err.069	Overlarge mixed deviation	Configurable	Y	Y
Err.071	MAC address error	Configurable	Y	Y
Err.077	PROFINET communication interruption	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	Under-voltage alarm	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

7.2 Error and alarm causes and handling measures

Table 7-2 describes the causes of alarms and faults, and measures to deal with them; the dark background cells in the table are bus-specific faults.

Table 7-2 List of causes and treatment measures for manufacturer-defined faults

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 supply voltage is within the specified range and restore the factory parameters (P20.06 set to 1). 2. Please restore the factory parameters first if the software has been upgraded. 3. If alarm Err.001 persists after restoring factory parameters, check whether the values of some parameters in the P18 and P19 groups (motor parameters and drive parameters, with emphasis on the P18 group) exceed the limits.

Error code and name	Cause	Handling measure
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. 4. When this fault occurs during enabling, check the rated current of the drive and the motor to see if the motor current exceeds the drive current.
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.

Error code and name	Cause	Handling measure
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.
Err.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: Incremental photoelectric encoder Z broken wire or absolute value encoder turns abnormal	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.

Error code and name	Cause	Handling measure
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 (Note: This fault does not store the record by default, it can be set whether to store or not through P07.19.)	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.

Error code and name	Cause	Handling measure
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 theacceleration and deceleration times.
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.

Error code and name	Cause	Handling measure
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;
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	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.

Error code and name	Cause	Handling measure
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: DB overload	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.
Er.058: STO safety protection	Enable STO function; Abnormal power supply to STO circuit or abnormal wiring	STO terminal recovery, automatically clear the fault; check whether the STO power supply wiring is normal If users confirm the above still report faults, replace the machine
Er.059: EPOS prohibit relative positioning	Relative positioning is selected when setting the continuous transmission method in EPOS mode (POS_STW1.12=1)	Detect EPOS telegram, clear the continuous transmission bit to zero or disable the use of relative positioning in continuous transmission mode.

Error code and name	Cause	Handling measure
Err.060: The first start up after writing customized software	First startup after downloading a customized program into a drive that already has a standard program.	Restore factory values for loading customized parameters.
Err.065: Prohibited operation in PROFINET communication mode	Panel JOG and inertia recognition is prohibited in PROFINET communication mode.	JOG and inertia recognition of the operation panel is prohibited under normal communication between PLC and servo, so please perform JOG and inertia recognition of the panel in the offline state.
Err.066: Parameter setting is prohibited in PROFINET communication mode operation.	Writing of device name, IP and MAC is not allowed during PROFINET communication mode operation.	Writing of device name and IP and MAC is not allowed during BUS operation.
Err.067: FMC parallel port error between arm and 200P	FMC parallel port error between arm and 200P	Contact factory technician
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. Check or replace external encoder and wiring; 3. Check and repair mechanical transmission sections
Err.071: MAC address error	1. MAC address is lost. 2. The MAC address saved by the servo itself is inconsistent with that of the 200P	1. Rewrite the MAC address of this drive 2. Contact the manufacturer for technical support
Err.075: DSC configuration error	The DSC function is not allowed in non-IRT mode.	1. Configure IRT mode correctly 2. Do not use DSC mode, use PLC internal position control
Err.077: PROFINETCommunication interruption	1. Network cable contact problem 2. PLC does not work properly 3. whether it is a shielded cable 4. IRT mode setting cycle is too short	1. Check whether the network cable contact is normal 2. Check whether PLC works normally 3. Please replace the shielded network cable 4. Check whether the synchronization period of IRT mode is too short, resulting in connection lost, increase the synchronization period.
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.

Error code and name	Cause	Handling measure
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.

Error code and name	Cause	Handling measure
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.
Err.099	Positive and negative overtravel are simultaneously active.	Check whether the limit switches and the limit logic for positive and negative limits are simultaneously active.

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