SV-X5-Series

bus servo

EtherCAT

Instruction Manual

September 2024 V1.50
Version: ATC/MX5B2415

※ 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.

About the instruction manual

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

Confirmations during unpacking

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

Safety precautions

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

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

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

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

⃠ Indicates what must not be done.

❗ Indicates what must be done.

DANGER ⚠

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

CAUTION ⚠

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

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

Maintenance and inspection

< Warranty period>

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

< Warranty coverage >

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

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

② A failure caused by drops or damages during transportation.

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

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

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

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

Chapter 1 Model introduction, selection and installation

1.1 About the drive

1.1.1 Drive model

Drive nameplate

Model identification

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

- SV-X5: Product series
- E: Product classification
- B: 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 classification

Symbol	Type
E	Standard type
F	With STO

Product type

Symbol	Type
B	EtherCAT

Product power

Symbol	Power
010	100W
020	200W
040	400W
075	750W
100	1000W
150	1500W
200	2000W
250	2500W
300	3000W
500	5000W
750	7500W

Control power supply

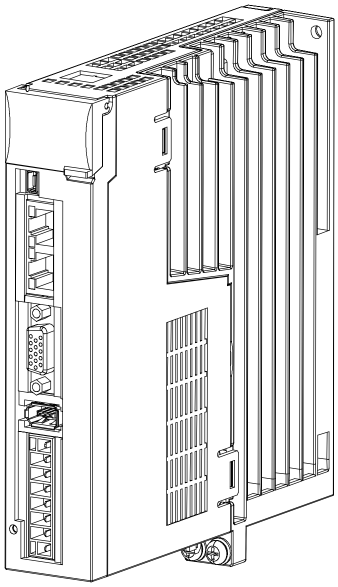
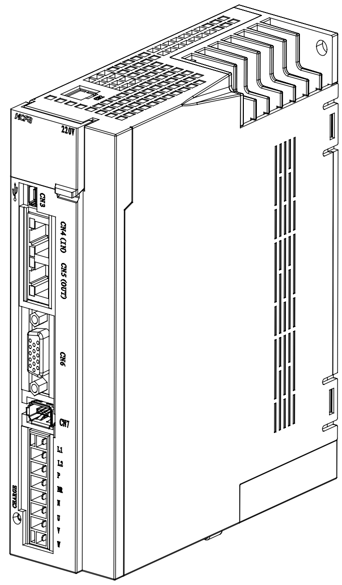
Symbol	Type
A	AC

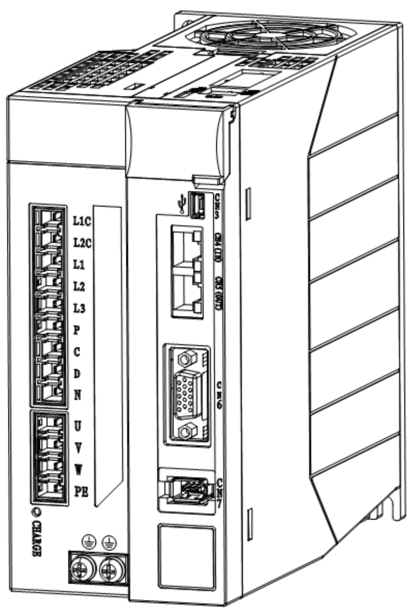
Voltage specifications

Symbol	Type
A	220V
T	380V

Note: 5KW-7.5KW is still under research and development, and will be launched later.

1.1.2 Part names

Drive diagram (100W~400W)	Drive diagram (750W~1000W)
	

Drive diagram (220V 1.5KW~2.5W/380V 2KW~3KW)


1.1.3 Comprehensive parameters

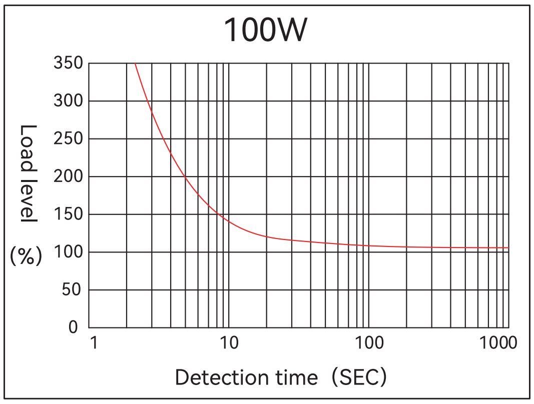
Item		Specifications							
SV-X5EB □□□ A-A0-00		010	020	040	075	100	150	200	250
Rated power (W)		100W	200W	400W	750W	1000W	1500 W	2000 W	2500W
Rated current (Arms)		1.2	2	3	4.5	6	10	12.5	15.6
Maximum output current (Arms)		3.6	6	9	13.5	18	30	37.5	37.5
Input power supply	Main circuit power supply	Single-phase 200 ~ 240V 50/60Hz					Single-phase/three-phase 200 ~ 240V 50/60Hz		
	Control power supply	Main power supply					Single-phase 200 ~ 240V 50/60Hz		
Dimension	W(mm)	35			52		80		
	H(mm)	174			174		174		
	D(mm)	152			152		184		

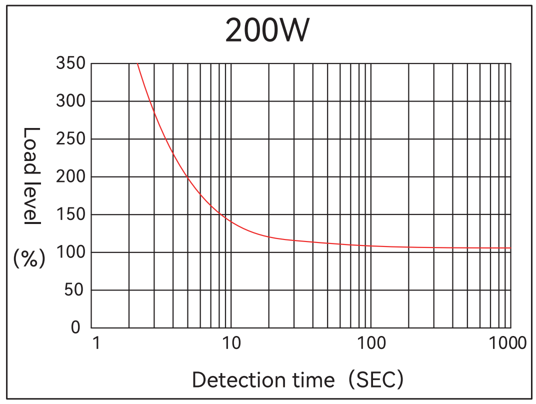
Item		Specifications			
SV-X5EB □□□ T-A0-00		200	300	500	750
Rated power (W)		2000W	3000W	5000W	7500W
Rated current (Arms)		9	12	-	-
Maximum output current (Arms)		17	24	-	-
Input power supply	Main circuit power supply	Three-phase 323 ~ 440V50/60Hz			
	Control power supply	Single-phase 323 ~ 440V50/60Hz			
Dimension	W(mm)	80			
	H(mm)	174			
	D(mm)	184			
Ambient temperature		Operating ambient temperature: 0~55℃ Storage ambient temperature: -20~65℃			
Ambient humidity		Ambient humidity for operation and storage: 20~85%RH or less (no condensation)			
Altitude		Below 1000m above sea level			
Vibration		5.8m/s (0.6G) or less, 10~60Hz (no continuous operation allowed at frequency of resonance)			
Support protocol		EtherCAT			
Supported service		CoE(PDO, SDO)			
Synchronization mode		DC_ synchronous			
Duplex mode		Full duplex			
Baud rate		100M bit/s			
Physical layer		100BASE-TX			
Transmission distance		Two nodes with a distance of not more than 100 meters			
Slave number		Less than 128 is recommended for actual network use.			
Configuration file		ESI or XML			
PDO number		Five sets of TxPDO numbers, five sets of RxPDO numbers			

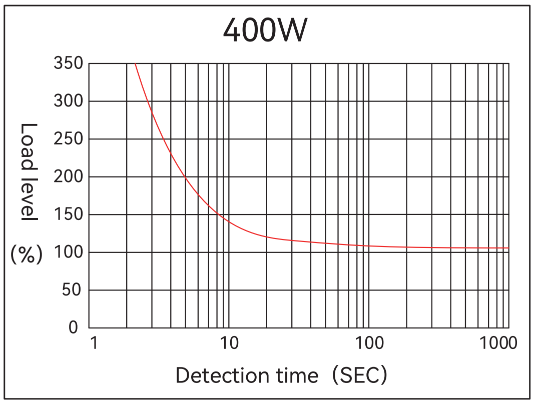
Supported control mode	Profile position mode Profile speed mode Profile torque mode Homing mode Cyclic synchronous position mode Cyclic synchronous velocity mode Cyclic synchronous torque mode
Digital input and output	DI: 5 DO: 3
USB communication	PC communication uses「HCS-studio」 background software.
STO function	Supported by the F model
Dynamic brake	Bulit-in
Communication network port	Two 8-pin RJ45 network interfaces
Synchronization cycle time	500us, 1ms, 2ms, 4ms, 8ms

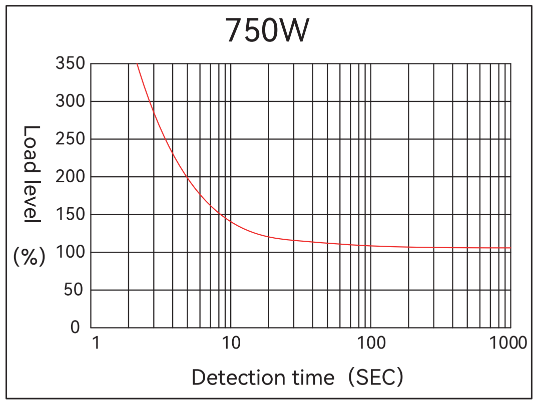
1.1.4 Overload detection characteristics

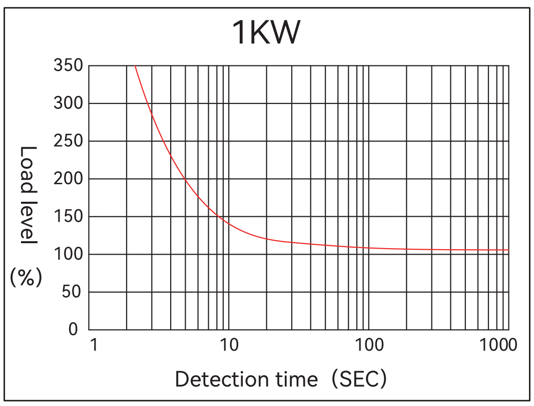
For the SV-X5 series drive, if the torque of the motor drive surpasses the value specified in the overload detection characteristics mentioned below, the protector will trigger, resulting in an overload abnormality alarm and an emergency stop of the motor.

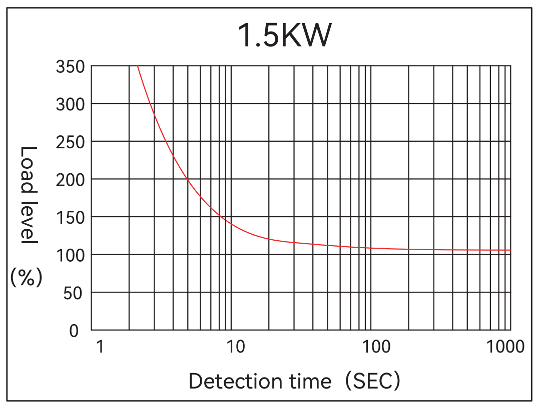


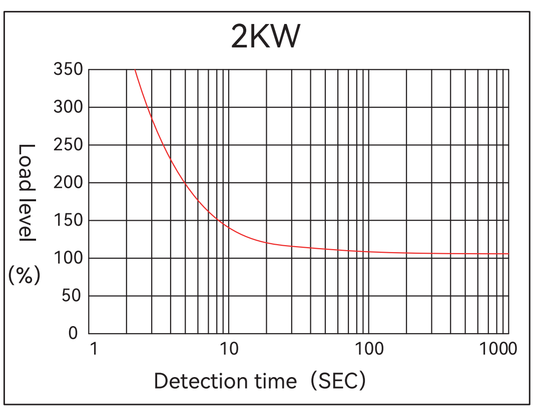


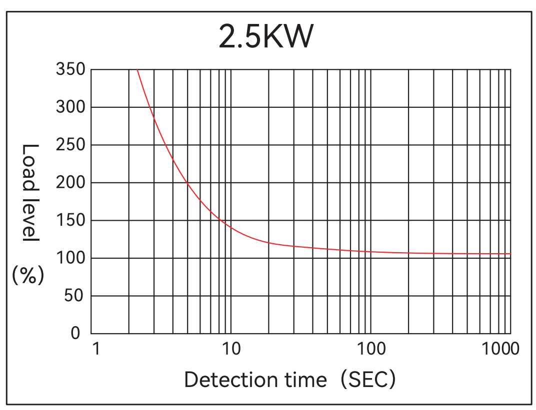






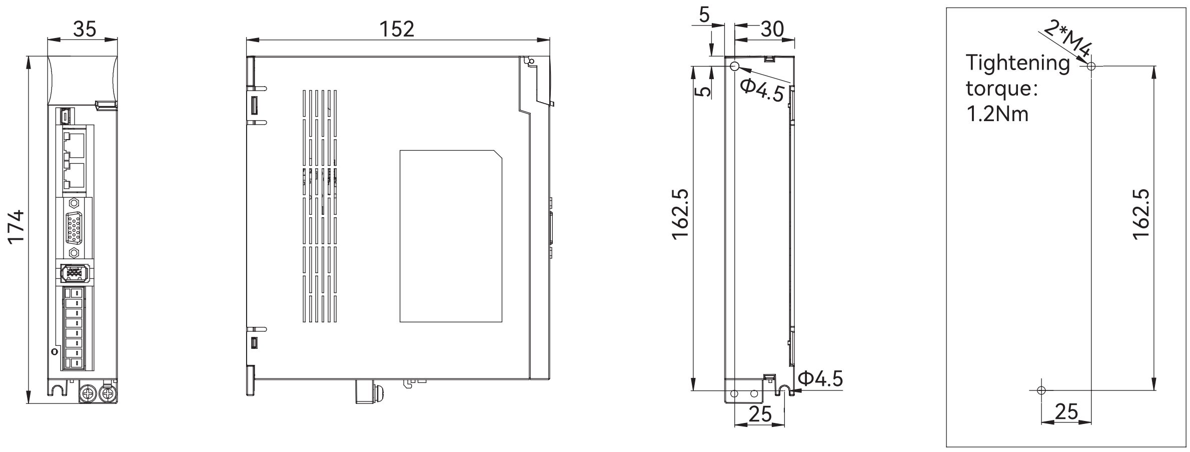




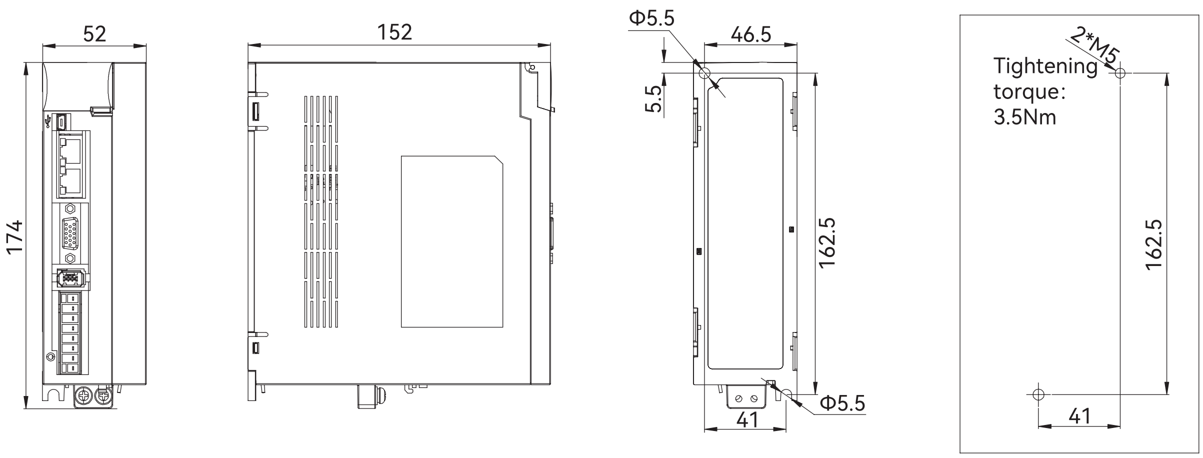


1.1.5 Drive dimension

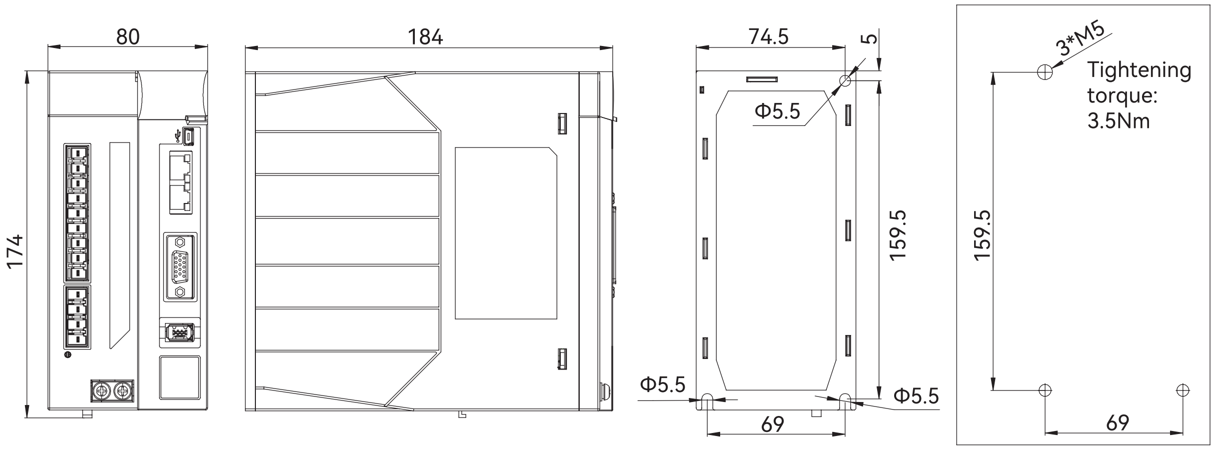
100W/200W/400W



750W/1KW



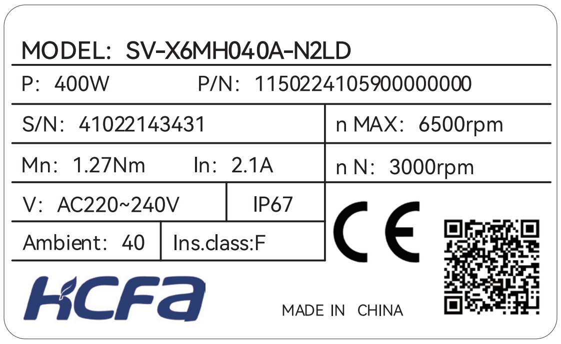
220V 1.5KW/2KW/2.5KW/ 380V 2KW/3KW



1.2 About the motor

1.2.1 Motor model

Motor nameplate



Model identification

SV-X2	MA	040	A	-	N	2	C	A	-	****
1	2	3	4		5	6	7	8		Special specifications

1	Product series
SV-X2 series	20BIT

2	Product inertia
MA	Low inertia
MM	Medium inertia
MMS	Medium inertia at high speed
MH	High inertia
MHH	Ultra -high inertia
MQ	Special flange/flat/small flange
MG	Large torque at low speed
MGS	Low-cogging cutting

3	Product power
005	50W
010	100W
015	150W
020	200W
040	400W
075	750W
080	800W
085	850W
100	1KW
130	1.3KW
150	1.5KW
180	1.8KW
200	2KW
230	2.3KW

4	Design sequence
A/B/C/S	A: Standard speed B/C/S: Design sequence different from standard speed
E/F	Design sequences for special flange sizes with the same specification
H/K	Design sequence for special inertia

5	Holding brake
N	w/o brake
B	w/ brake

6	Power supply voltage specifications
2	AC220V

7	Specifications
K	Wire lead type/key shaft/without oil seal
L	Wire lead type/key shaft/with oil seal
C (Regular model)	Connector type/key shaft/with oil seal *1
D	Connector type/key shaft/without oil seal *1
J	Compact (customized)

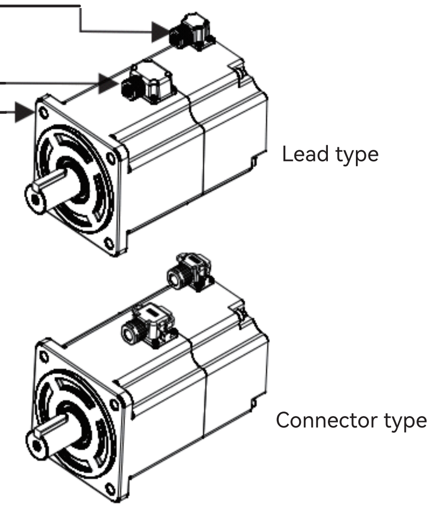
8	Encoder type
A	Multi-turn 20BIT absolute

9	Customized version
**	-

1.2.2 Motor part names

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

4 encoder cables + shield cable
Battery connection when using the absolute encoder
Power supply of the encoder
Data communication with the drive



Motor fixing screws (recommended)		
Motor model	Fixed hole diameter	Recommended screws
005A、010A	2-Φ4.5	M4X10
020A、040A、060A	4-Φ5.5	M5X12
075A、100E	4-Φ6.5	M5X16

1.2.3 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	w/o brake		kg	0.33	0.45	0.9	0.87	1.28	1.22
	w/ brake			0.55	0.66	1.3	1.27	1.67	1.61
Baic specifications	Rated output power		W	50	100	200	200	400	400
	Rated torque		N.m	0.16	0.32	0.64	0.64	1.27	1.27
	Instantaneous maximum torque		N.m	0.56	1.11	1.91	2.23	3.82	4.46
	Rated current		Arms	1.1	1.1	1.7	1.4	2.7	2.1
	Instantaneous maximum current		Arms	5.5	5.5	6.5	6.9	10.2	10.4
	Rated speed		rmp	3000					
	Maximum speed		rmp	6000		5000			
	Torque constant		N.m/ Arms	0.168	0.327	0.427	0.5	0.488	0.67
	Induced voltage constant per phase		mV/(r/min)	5	10.43	14.5	14.61	17.8	20.85
	Rate of change of rated power	w/o brake	kW/s	6.7	14.4	28.9	14.1	60	28.8
		w/ brake		6.1	13.8	23.8	13.2	54	27.8
	Mechanical time constant	w/o brake	ms	2.8	2.17	0.728	1.39	0.499	1.3
		w/ brake		3.09	2.26	0.848	1.49	0.554	1.35
	Electrical time constant		ms	1.12	1.32	6.17	3.9	6.36	4.21
	Motor rotor inertia	w/o brake	10^{-4}kg.m²	0.038	0.071	0.16	0.29	0.28	0.56
		w/ brake		0.042	0.074	0.17	0.31	0.29	0.58
	Allowable load	Radial load	N	68	68	245	245	245	245
		Axial load		58	58	98	98	98	98
	Encoder		17bit serial communication (EIA422)						
Brake specifications	Application		Holding brake (note: not for braking)						
	Power supply		-	Use a power supply with reinforced insulation due to SELV power supply or hazardous voltage.					
	Rated voltage		V	DC24V±10%					
	Rated current		A	0.25	0.3	0.36			
	Static friction torque		N.m	0.38 or more		1.6 or more			
	Absorption time		ms	35 or less		50 or more			
	Release time		ms	20 or less					
	Release voltage		V	DC1V or more					
Ambient operating condition	Rated time		Continuous						
	Ambient operating temperature		0℃ ~ 40℃ (with no condensation)						
	Ambient operating humidity		20 ~ 85%RH (with no condensation)						

	Ambient storage temperature	-20℃ ~ 65℃ (with no condensation) Maximum temperature: 80℃ for 72 hours
	Ambient storage humidity	20 ~ 85%RH (with no condensation)
	Operating & Storage atmosphere	Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust and dirt
	Heat resistance rating	Class B
	Insulation resistance	DC1000V-5MΩ or more
	Insulation withstand voltage	AC1500V for 1 minute
	Altitude	Below 1000m above sea level
	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 have different polarities. 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	MH075A High inertia	MM100A Medium inertia	MM100S Medium inertia	MH100A High inertia
Mounting flange dimension			mm	80		130			
Weight	w/o brake		kg	2.25	2.25	2.68	4.67	/	6.29
	w/ brake			3.01	3.01	3.45	6.27	/	7.89
Basic specifications	Rated output power		W	750	750	1000	1000	1000	1000
	Rated torque		N.m	2.39	2.39	3.185	4.77	4.77	4.77
	Instantaneous maximum torque		N.m	7.16	8.36	11.13	14.3	14.31	14.5
	Rated current		Arms	4.2	3.8	5.7	5.2	8.25	5.2
	Instantaneous maximum current		Arms	17.4	18.8	30	15.6	25	15.6
	Rated speed		rmp	3000			2000		
	Maximum speed		rmp	4500			3000	5000	3000
	Torque constant		N.m/ Arms	0.583	0.648	0.552	0.918	0.573	0.918
	Induced voltage constant per phase		mV/(r/min)	21.33	22.65	21.2	33.65	21.2	33.65
	Rate of change of rated power	w/o brake	kW/s	59.4	36.6	44.7	36.9	56	9.96
		w/ brake		53.8	34.4	42.8	30.8	49.3	9.46
	Mechanical time constant	w/o brake	ms	0.518	1.26	1.19	1.76	1.31	6.52
		w/ brake		0.572	1.34	1.24	2.11	1.48	6.86
	Electrical time constant		ms	11.4	6.54	4.72	9.5	12.53	9.5

	Motor rotor inertia	w/o brake	10^{-4}kg.m^2	0.96	1.56	2	6.18	9.16	22.9
		w/ brake		1.07	1.66-4	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 speci-fications	Application		Holding brake (note: not for braking)						
	Power supply		-	Use a power supply with reinforced insulation due to SELV power supply or hazard-ous 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		Below 1000m above sea level						
	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 have different polarities. 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		w/o brake	kg	/	7.37	6.98	4.67	5.87	6.98
		w/ brake		/	8.97	8.58	6.27	7.47	8.58
Basic specifications	Rated output power		W	1500	1500	2000	850	1300	1800
	Rated torque		N.m	7.16	7.16	9.55	5.41	8.28	11.5
	Instantaneous maximum torque		N.m	21.5	21.5	28.6	14.3	23.3	28.6
	Rated current		Arms	9.5	8	9.9	5.9	9.3	11.8
	Instantaneous maximum current		Arms	29	24	30	15.6	24	30
	Rated speed		rmp	2000			1500		
	Maximum speed		rmp	5000	3000				
	Torque constant		N.m/ Arms	0.672	0.895	0.9645	0.918	0.895	0.9645
	Induced voltage constant per phase		mV/(r/min)	25.9	34.84	37.95	33.65	34.84	40.18
	Rate of change of rated power	w/o brake	kW/s	75.4	15.4	75.4	47.4	74.8	109
		w/ brake		68.6	14.8	68.6	39.6	75.9	98.7
	Mechanical time constant	w/o brake	ms	3.16	5.15	1.24	1.76	1.41	0.91
		w/ brake		3.47	5.35	1.37	2.11	1.6	1
	Electrical time constant		ms	14.3	12.7	13.88	9.5	12.7	13.88
	Motor rotor inertia	w/o brake	$10^{-4}kg.m^2$	12.1	33.4	12.1	6.18	9.16	12.1
		w/ brake		13.3	34.6	13.3	7.4	10.4	13.3
	Allowable load	Radial load	N	490	490	490	490	490	490
		Axial load			196	196	196	196	196
	Encoder		17bit serial communication (EIA422)						
Brake specifications	Application		Holding brake (note: not for braking)						
	Power supply		-	Use a power supply with reinforced insulation due to SELV power supply or hazard-ous 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 less		
	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	Below 1000m above sea level
	Vibration rating	V15 (JEC2121)
	Vibration resistance	49m/s² (5G)
	Impact resistance	98m/s² (10G)
	Protection rating	IP65/ (IP67)
Note	・Grounded in accordance with the regulations, applicable to Class I .	
	・Applicable to「Overvoltage category II」	
	・Applicable to「Pollution degree 2」	
	Rated torque is the value shown when mounted on an L-beam approximately 2 times the size of the motor flange.	
	The brake connection cables have different polarities. Red cable: Connects to +24V Black cable: Connects to GND	

1.2.4 Allowable load of the output shaft

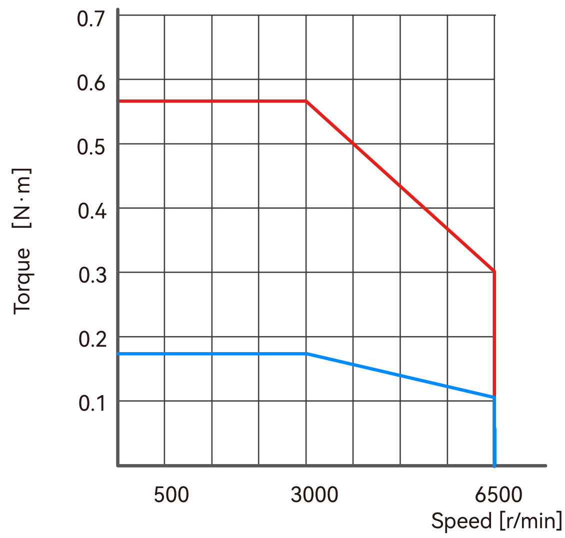
Allowable load	Unit	50W	100W	200W	400W	750W	1kW
Radial direction	N	68.6	68.6	245	245	392	392
Axial direction	N	58.8	58.8	98	98	147	147

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

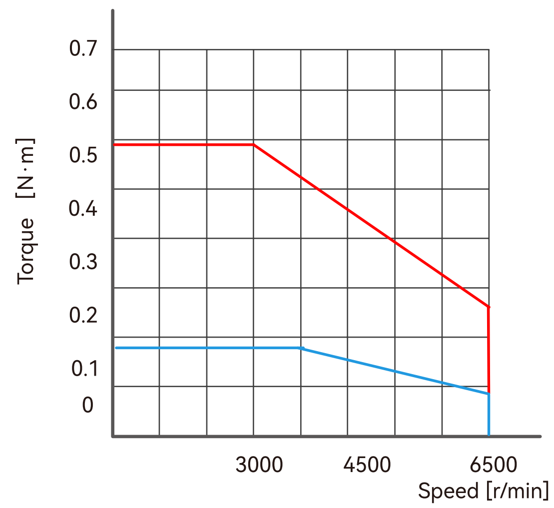
1.2.5 N-T characteristics chart

Instantaneous working area   Continuous working area

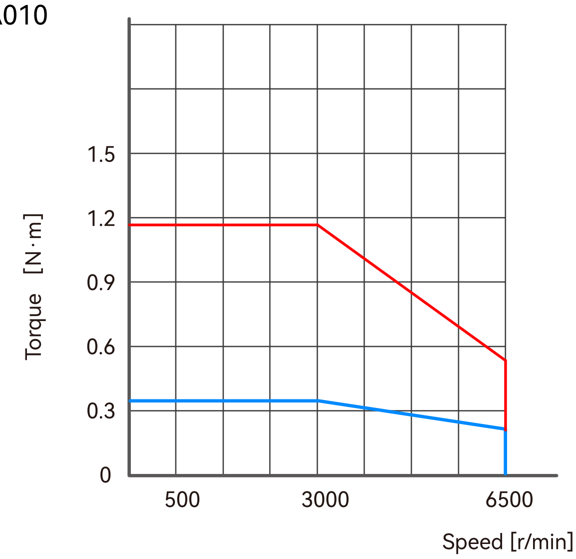
MA005



MH005



MA010



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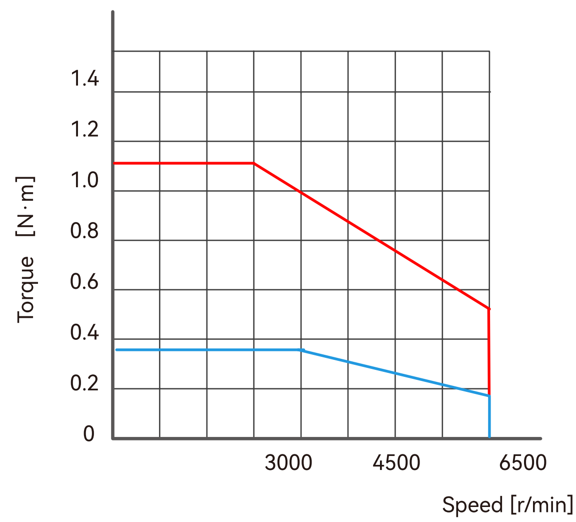

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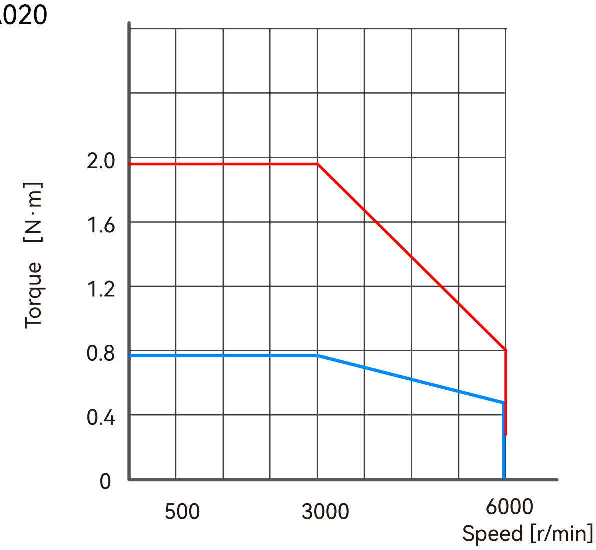
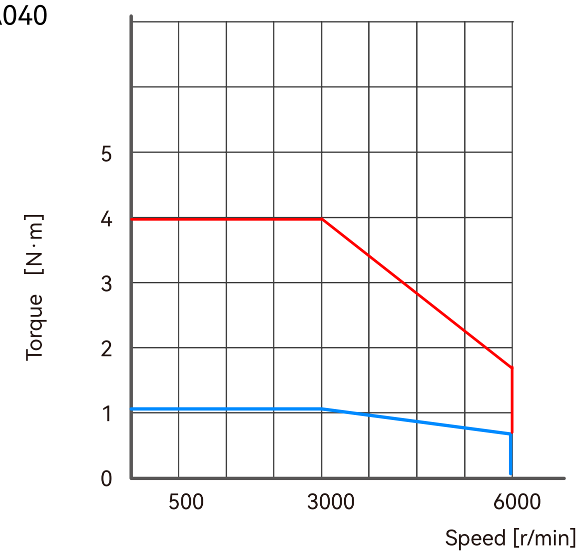
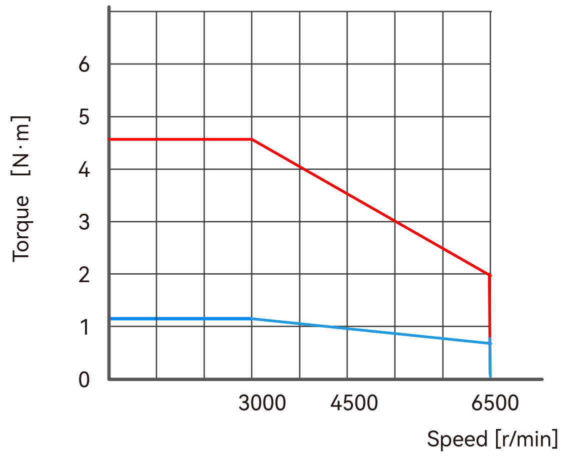


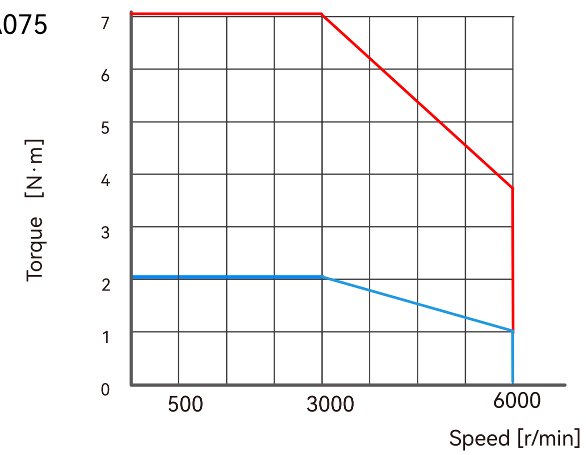
MA040



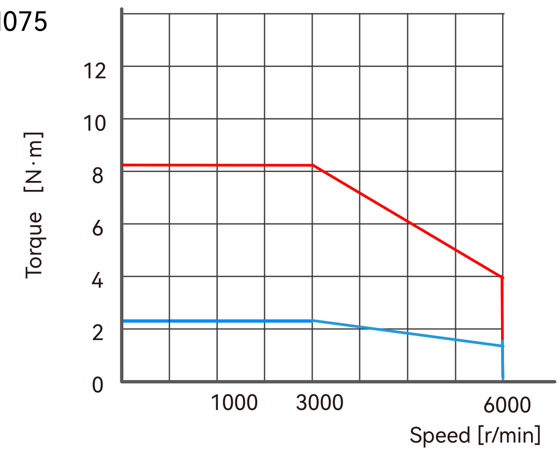
MH040



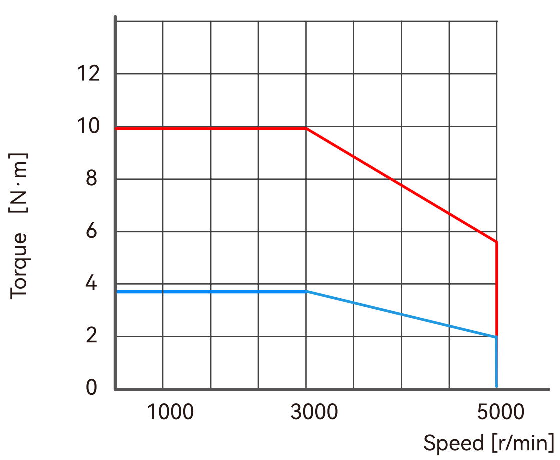
MA075



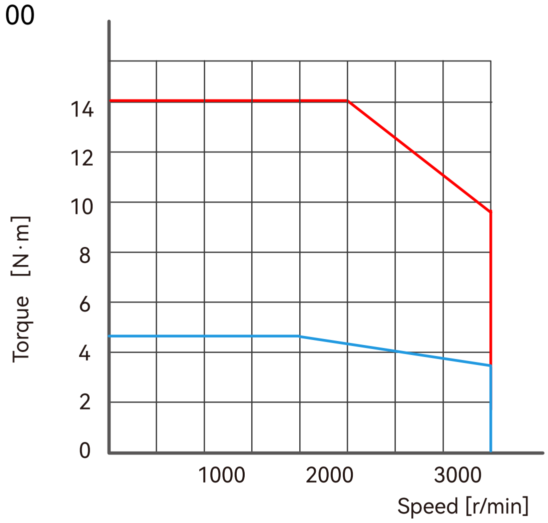
MH075



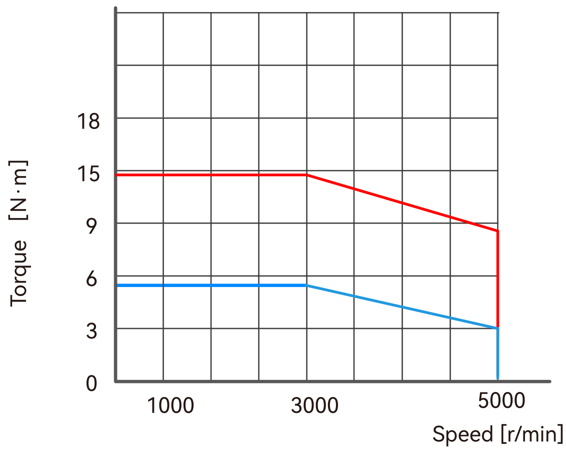
MA100



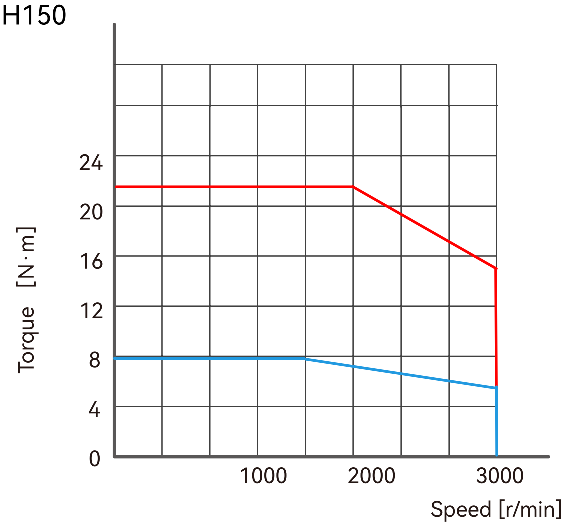
MH100



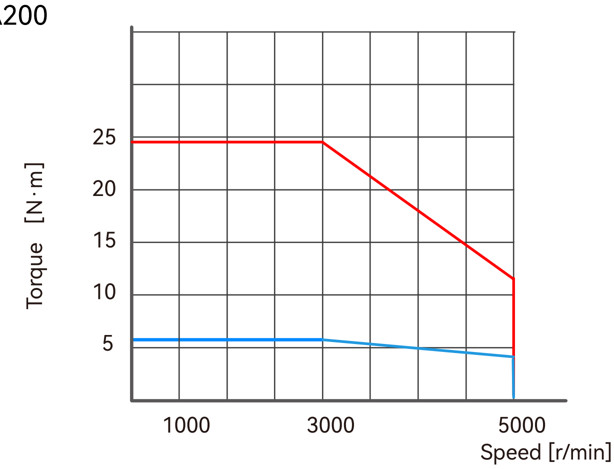
MA150



MH150



MA200

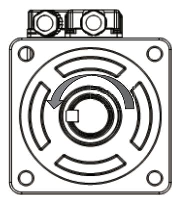


1.2.6 Encoder specifications

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

Note 1) Upward counting direction

CCW



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

【Note】

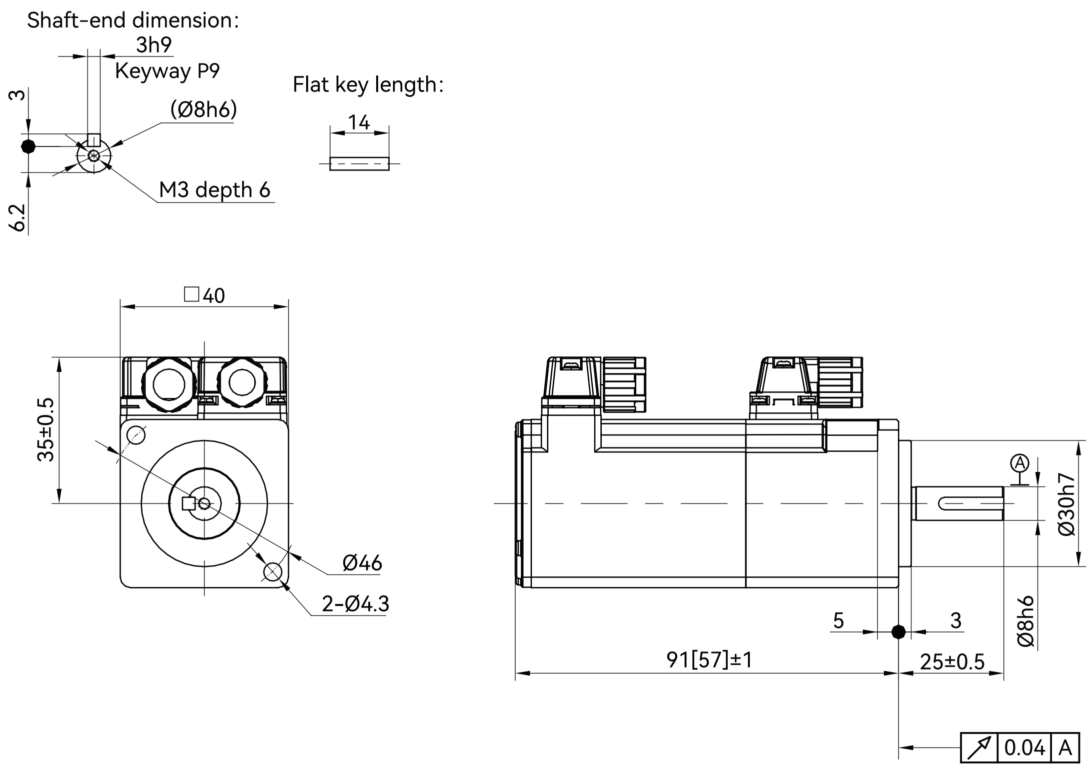
※ If the motor rotation is used at 180 degrees or less, the one-turn rotation resolution will deteriorate.

※ For a motor with a brake, please observe the brake voltage specifications.

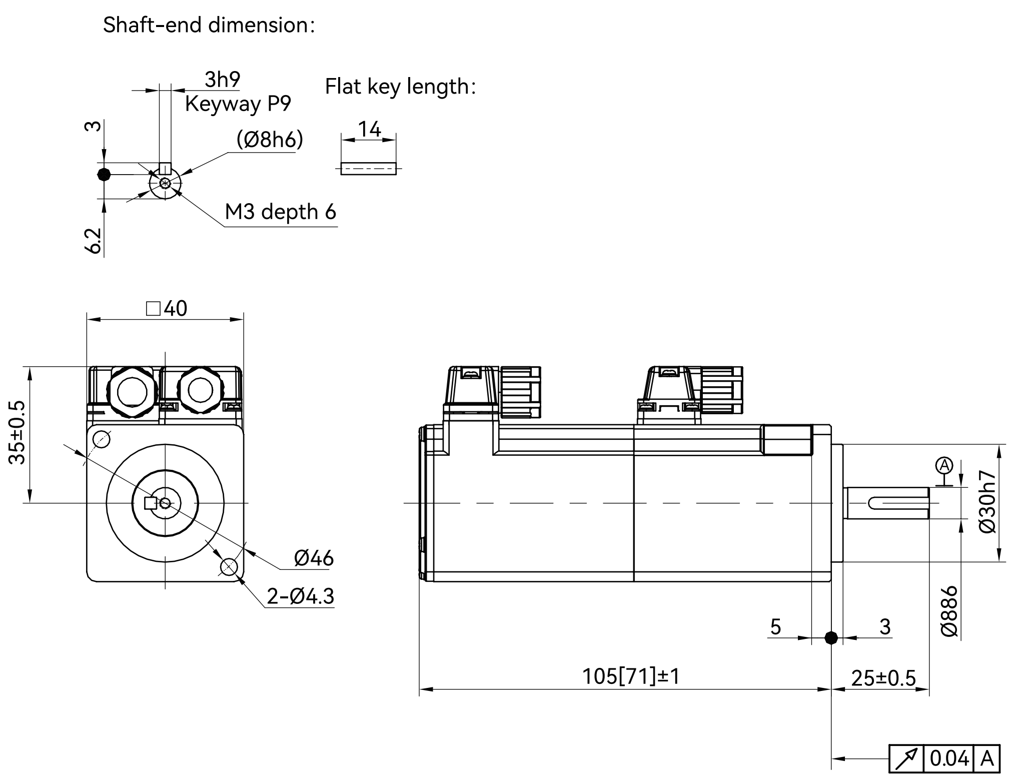
※ If the brake voltage is less than 12V or is used in reverse polarity, the one-turn rotation resolution will deteriorate.

1.2.7 Motor dimension

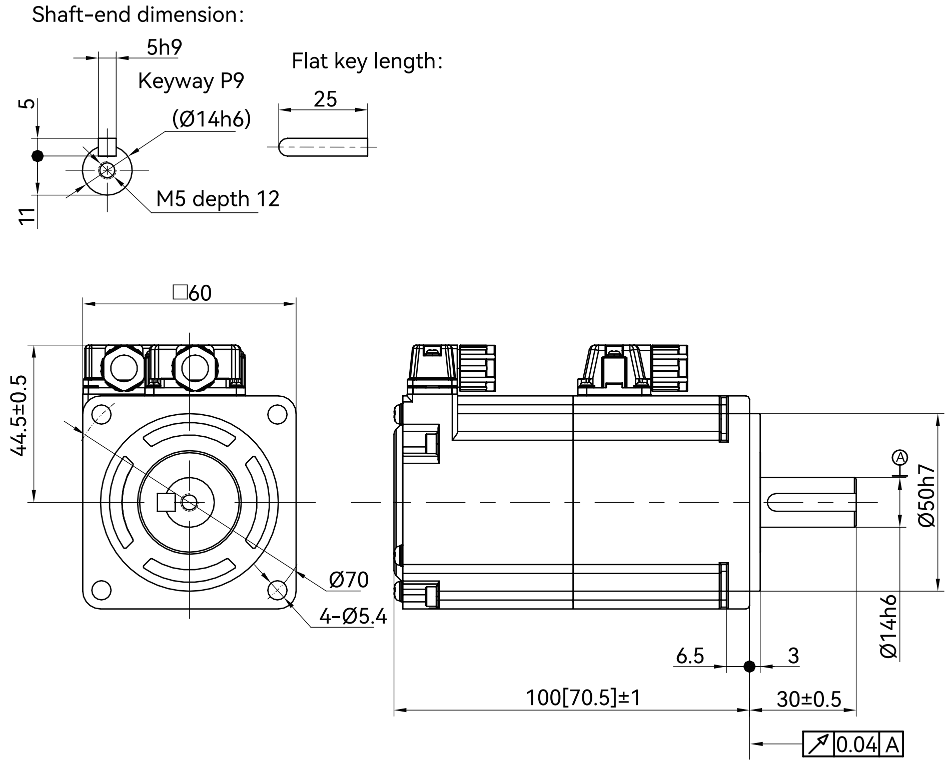
MH005A high inertia



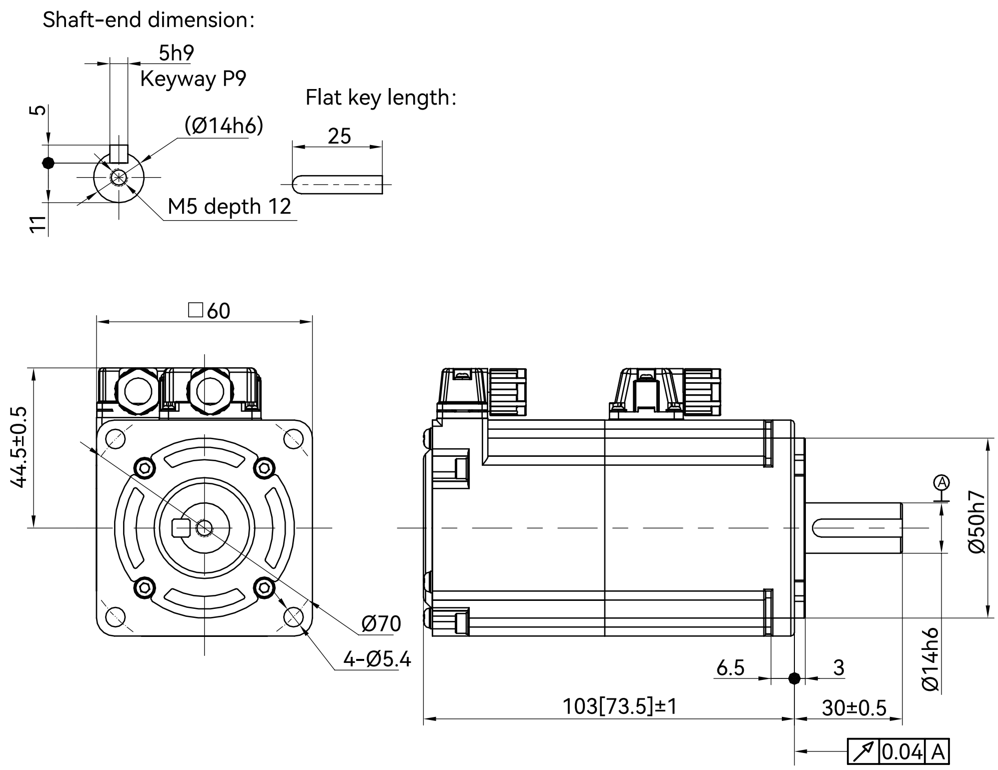
MH010A high inertia



MH020A high inertia

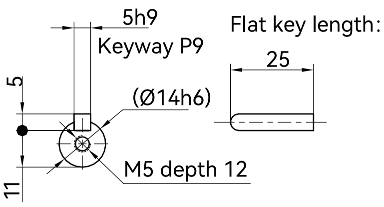


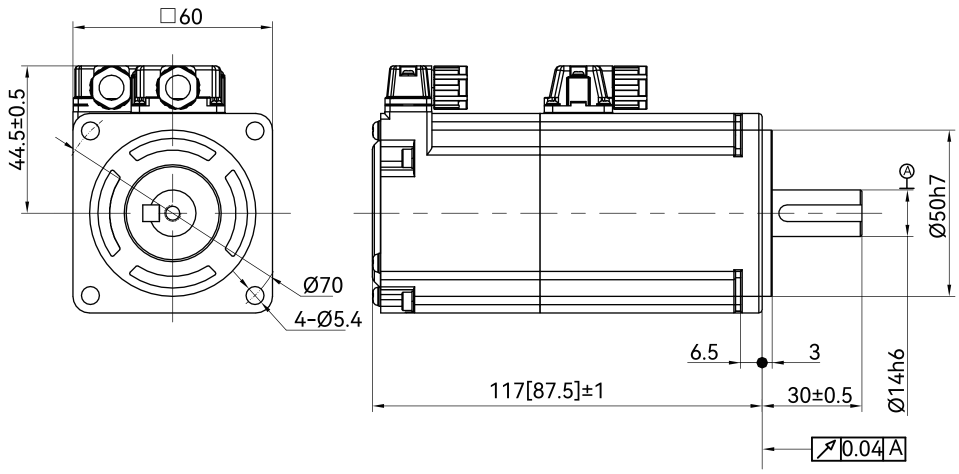
MA020A high inertia



MH040A high inertia

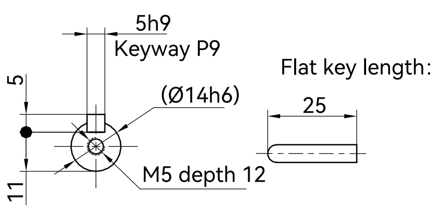
Shaft-end dimension:

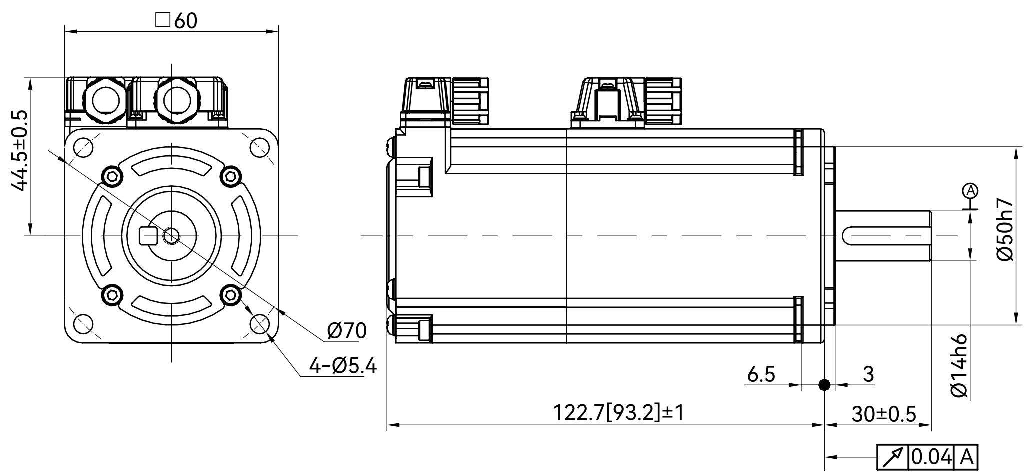




MA040A high inertia

Shaft-end dimension:

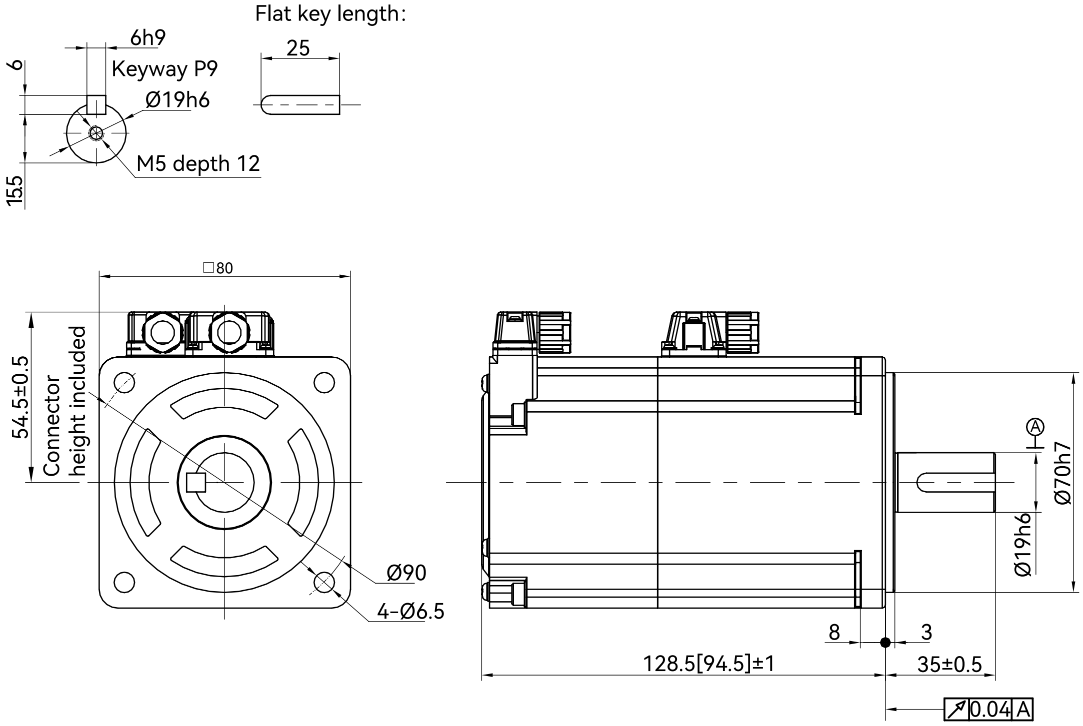




MH075A high inertia

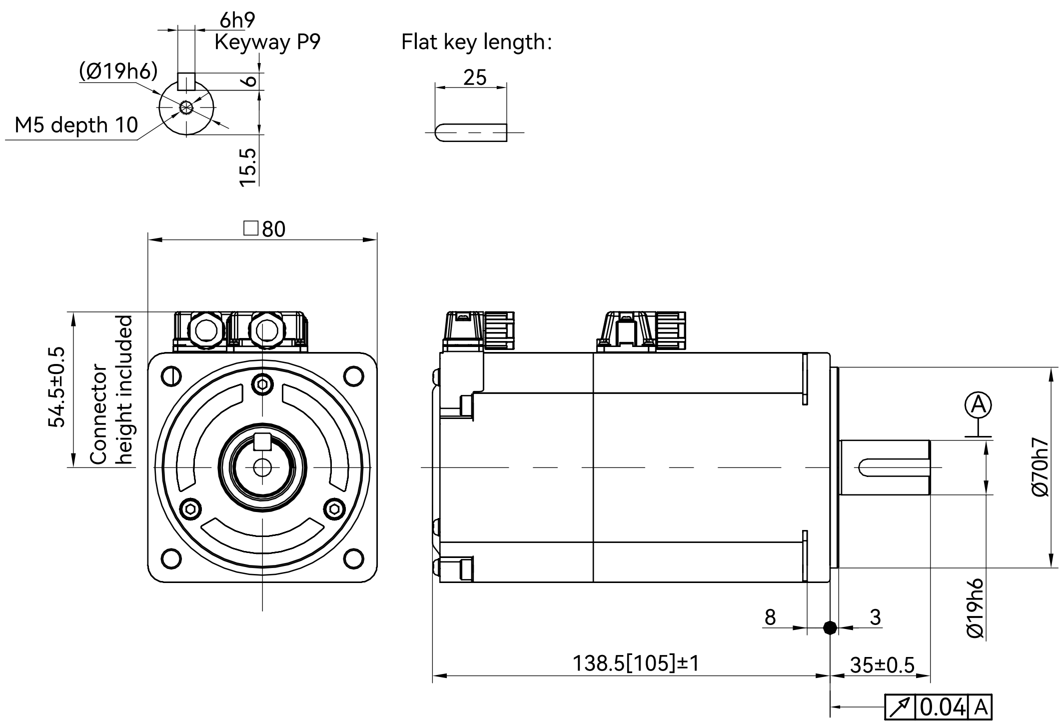
Shaft-end dimension:

Flat key length:

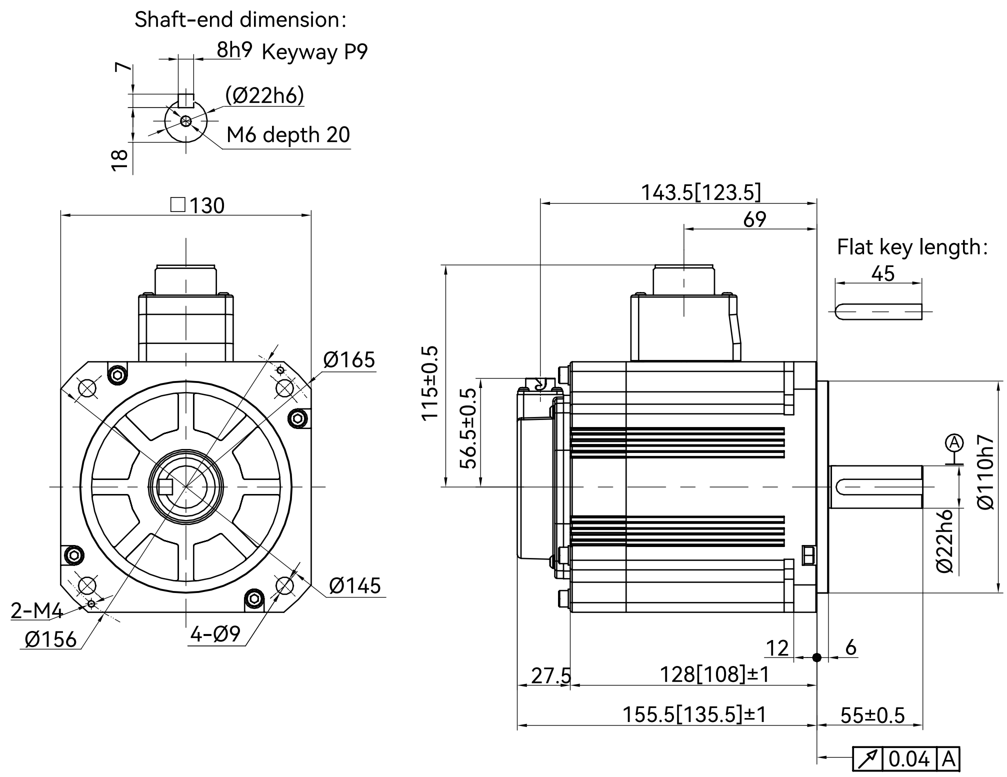


MA075A high inertia

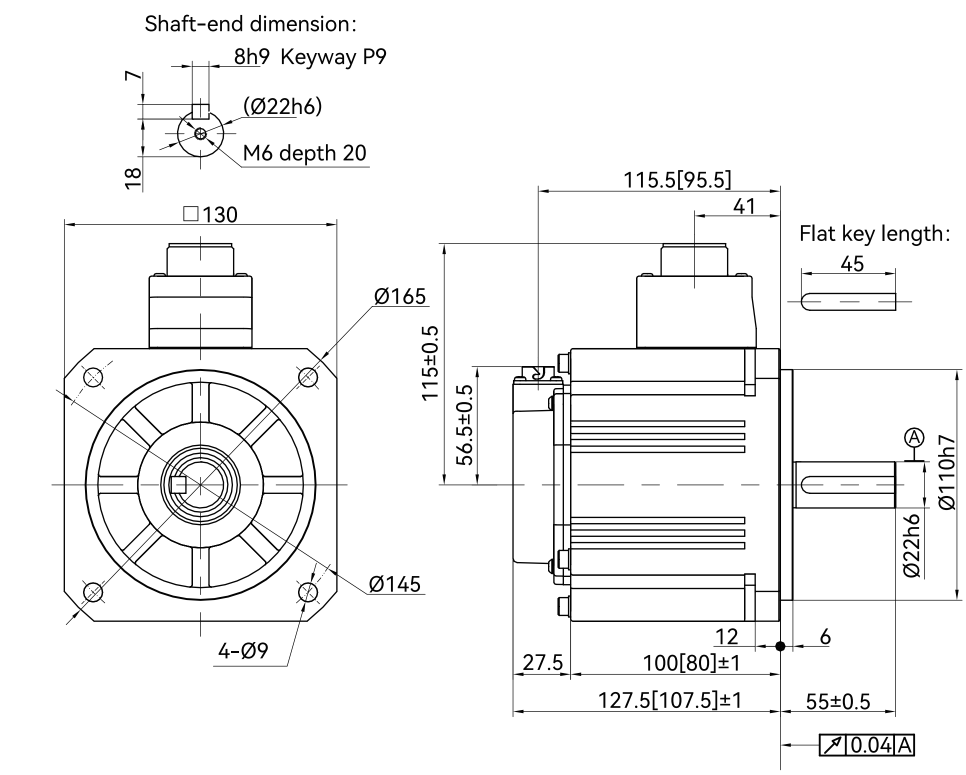
Shaft-end dimension:



MH100A high inertia

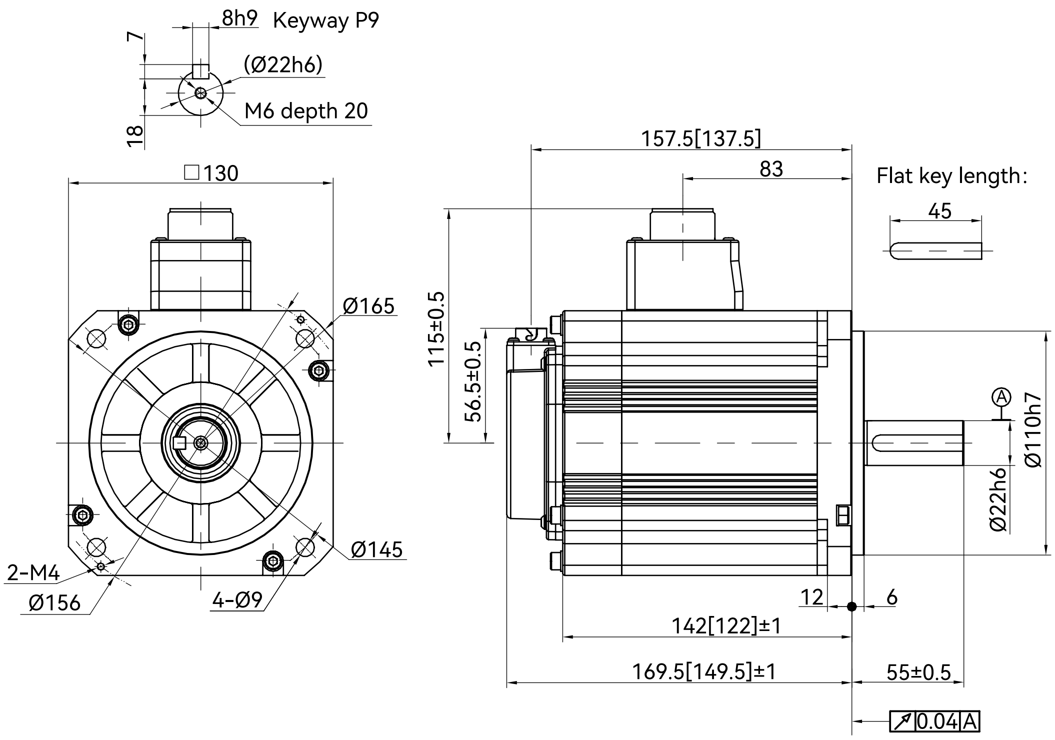


MM100A high inertia



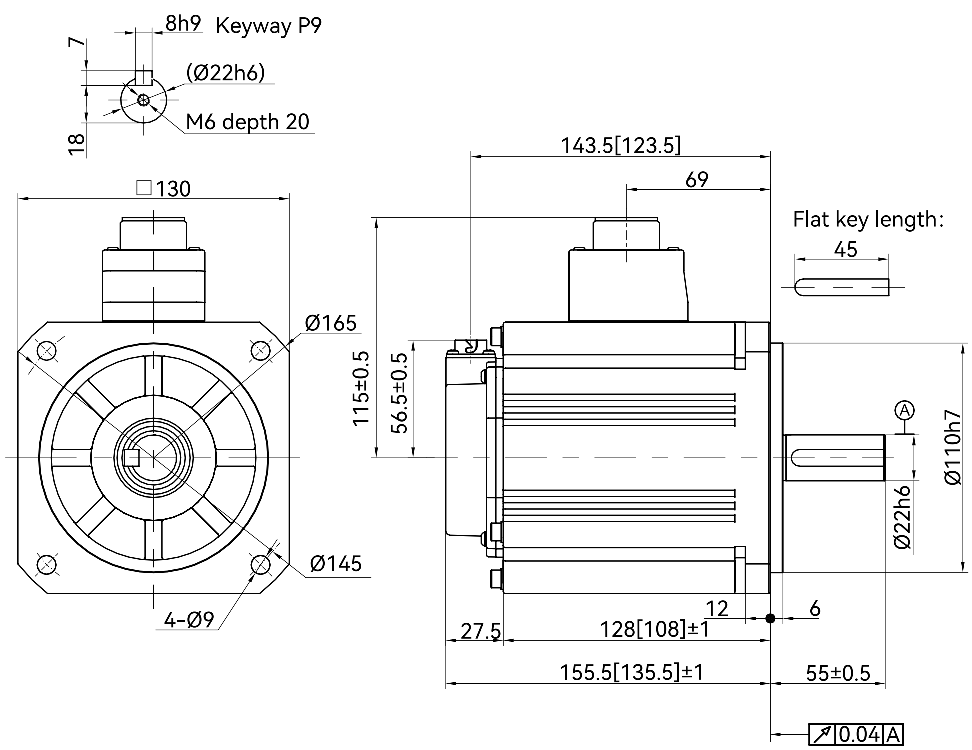
MH150A high inertia

Shaft-end dimension:



MM200A high inertia

Shaft-end dimension:



1.3 External regenerative resistor selection

For a drive with a power of 100W~1000W, an optional regenerative resistor is available, and the regenerative resistor should be connected to terminals P, and BR.

For a drive with a power of 1500W~2500W, the regenerative resistor is a standard feature, and the factory machine is shorted to terminals P, and C by default, i.e., the internal regenerative resistor is used. If the external regenerative resistor is required, disconnect terminals P, and C and connect the resistor to terminals P, and D.

The corresponding braking resistor selection for each power model is as follows:

Voltage class	220V							
Power	100W	200W	400W	750W	1000W	1500W	2000W	2500W
Resistance and corresponding power of optional/standard regenerative resistor	50Ω	50Ω	50Ω	50Ω	50Ω	40Ω	40Ω	40Ω
	50W	50W	50W	80W	80W	100W	100W	100W
Power range of external regenerative resistor	≥ 45Ω	≥ 45Ω	≥ 45Ω	≥ 40Ω	≥ 40Ω	≥ 30Ω	≥ 30Ω	≥ 30Ω
	≥ 50W	≥ 50W	≥ 50W	≥ 80W	≥ 80W	≥ 100W	≥ 100W	≥ 100W

Voltage class	380V	
Power	2000W	3000W
Resistance and corresponding power of standard regenerative resistor	50Ω	50Ω
	80 W	80 W
Power range of external regenerative resistor	≥ 45Ω	≥ 40Ω
	≥ 100W	≥ 100W

Note:

1. For the drive with a power of 1500W~2500W, when using an external regenerative resistor, please set the drive parameter P00.21 to 1.

2. The recommended regenerative resistor specifications in the above table are not guaranteed to meet all usage occasions. If the regenerative resistor's heating temperature is too high, please replace it with a higher power resistor and make sure that the resistor value complies with the permissible range of resistance value in the above table.

1.4 Matching models for drives and motors

<table>
<tr><th>Power supply input rating</th><th>Capacity</th><th colspan="2">Servo motor model</th><th>Motor frame number</th><th>Power supply input rating</th></tr>
<tr><td rowspan="22">220V</td><td>50W</td><td>High inertia</td><td>MH005A</td><td rowspan="3">40</td><td rowspan="3">SV-X5EB010A-A</td></tr>
<tr><td rowspan="2">100W</td><td>High inertia</td><td>MH010A</td></tr>
<tr><td>Flat type</td><td>MQ010A</td></tr>
<tr><td rowspan="3">200W</td><td>Low inertia</td><td>MA020A</td><td rowspan="3">60</td><td rowspan="3">SV-X5EB020A-A</td></tr>
<tr><td>High inertia</td><td>MH020A</td></tr>
<tr><td>Flat type</td><td>MQ020A</td></tr>
<tr><td rowspan="3">400W</td><td>Low inertia</td><td>MA040A</td><td rowspan="3">60</td><td rowspan="3">SV-X5EB040A-A</td></tr>
<tr><td>High inertia</td><td>MH040A</td></tr>
<tr><td>Flat type</td><td>MQ040A</td></tr>
<tr><td rowspan="2">750W</td><td>Low inertia</td><td>MA075A</td><td rowspan="2">80</td><td rowspan="2">SV-X5EB075A-A</td></tr>
<tr><td>High inertia</td><td>MH075A</td></tr>
<tr><td rowspan="3">1KW</td><td>High inertia</td><td>MQ100E</td><td>80</td><td rowspan="3">SV-X5EB100A-A
SV-X5EB100A-A</td></tr>
<tr><td>Medium inertia</td><td>MM100A</td><td rowspan="2">130</td></tr>
<tr><td>High inertia</td><td>MH100A</td></tr>
<tr><td rowspan="2">1.5KW</td><td>Medium inertia</td><td>MM150A</td><td rowspan="8">130</td><td rowspan="2">SV-X5EB150A-A</td></tr>
<tr><td>High inertia</td><td>MH150A</td></tr>
<tr><td>2KW</td><td>Medium inertia</td><td>MM200A</td><td>SV-X5EB200A-A</td></tr>
<tr><td rowspan="2">850W</td><td>Large torque at low speed</td><td>MG085A</td><td rowspan="4">SV-X5EB150A-A</td></tr>
<tr><td>Large torque at low speed</td><td>MG085B</td></tr>
<tr><td rowspan="2">1.3KW</td><td>Large torque at low speed</td><td>MG130A</td></tr>
<tr><td>Large torque at low speed</td><td>MG130B</td></tr>
<tr><td>1.8KW</td><td>Large torque at low speed</td><td>MG180A</td><td>SV-X5EB250A-A</td></tr>
<tr><td rowspan="2">380V</td><td>2KW</td><td>Medium inertia</td><td>MM200A</td><td>180</td><td>SV-X5EB200T-A</td></tr>
<tr><td>3KW</td><td>Medium inertia</td><td>MM300A</td><td>180</td><td>SV-X5EB300T-A</td></tr>
</table>

1.5 Selection of peripheral cables and connector accessories

◆ Selection of peripheral cables and connector accessories

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

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

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

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

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

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

◆ Circuit breaker selection

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

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

Model	L1C-L2C control power Circuit breaker (A) recommended	L1-L2 main power supply Circuit breaker (A) recommended	Main power supply Circuit breaker (A) recommended
SV-X5EB010A-A	-	6A	6A
SV-X5EB020A-A	-	6A	6A
SV-X5EB040A-A	-	10A	10A
SV-X5EB075A-A	-	16A	16A
SV-X5EB100A-A	-	16A	16A
SV-X5EB150A-A	6A	20A	20A
SV-X5EB200A-A	6A	25A	25A
SV-X5EB250A-A	6A	25A	25A

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

Model	L1C-L2C control power Circuit breaker (A) recommended	L1-L2-L3 main power supply Circuit breaker (A) recommended	Main power supply Circuit breaker (A) recommended
SV-X5EB150A-A	6A	10A	10A
SV-X5EB200A-A	6A	16A	16A
SV-X5EB250A-A	6A	16A	16A

(3) 380V model

Model	L1C-L2C control power Circuit breaker (A) recommended	L1-L2-L3 main power supply Circuit breaker (A) recommended	Main power supply Circuit breaker (A) recommended
SV-X5EB200T-A	6A	16A	16A
SV-X5EB300T-A	6A	20A	20A

1.6 Installation of the drive and motor

1.6.1 Installation environment

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

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

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

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

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

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

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

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

1.6.2 Dustproof and waterproof

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

1.6.3 Installation direction and clearance

◆ Impact, weight-bearing

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

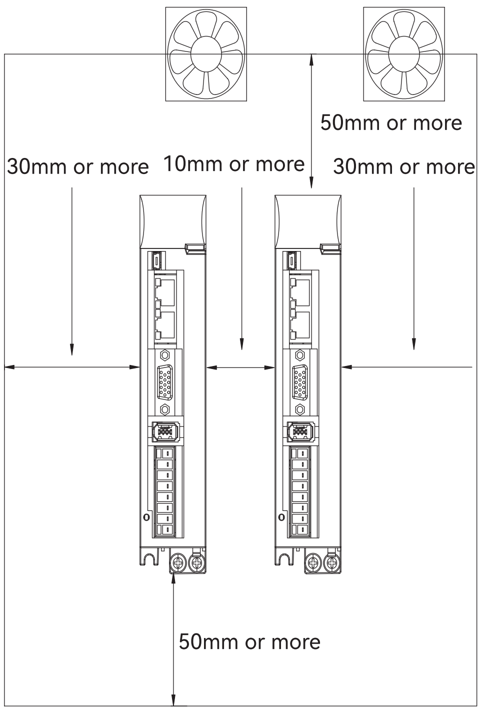
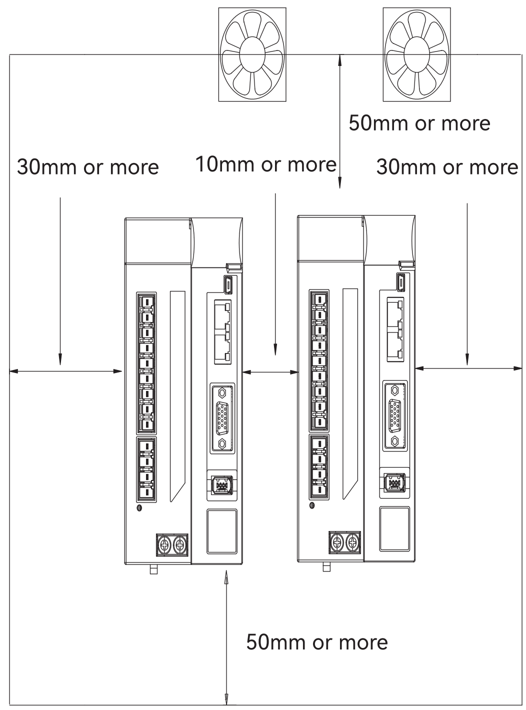
① The motor specifications state the permissible load value of the motor shaft. Exceeding the permissible load value may shorten the lifetime of the internal bearings of the motor and cause damage to the motor shaft. Use a shaft coupling that can fully absorb the eccentricity load.

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

③ Bend the power and encoder cables to a radius of R20mm or more.

◆ Installation direction and clearance

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

100W~1000W Mounting clearance diagram 1	1500W~3000W Mounting clearance diagram 2
	

• The drive can be installed only in the vertical direction. During installation, use two M4 screws to fix the drive with an output power of 100W~400W. Use two M5 screws to fix the drive with an output power of 750W~1000W. Use three M5 screws each to secure the drive with an output power of 1500W~3000W.

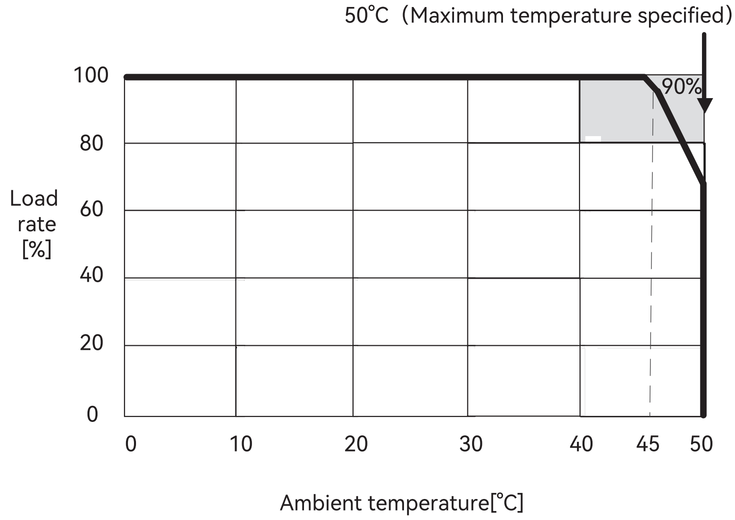
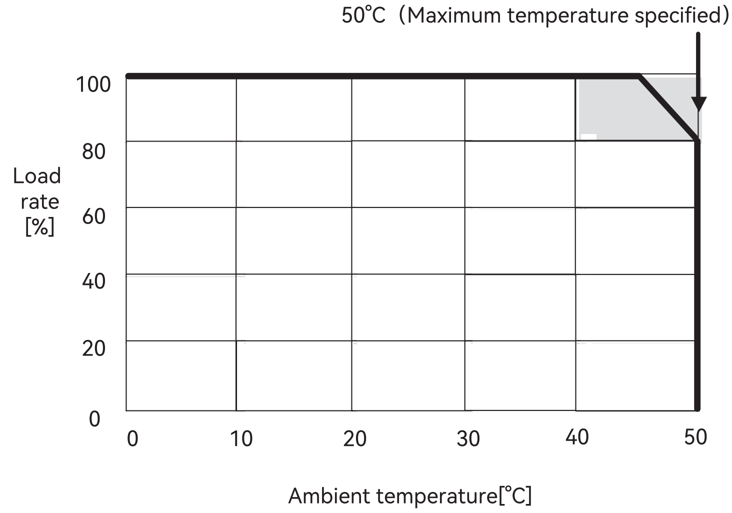
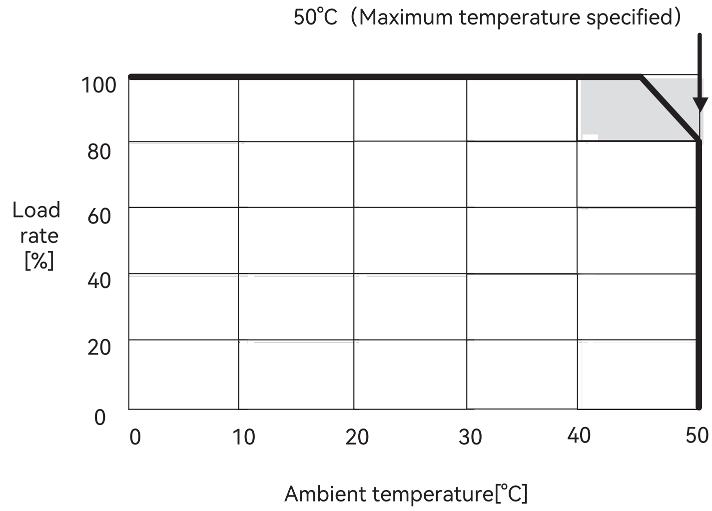
• When installing the drive into the sealed cabinet such as a control cabinet, it is necessary to use fans or cooling machines to ensure that the ambient temperature around plates is lower than 55℃. A fan or cooler is required for cooling.

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

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

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

◆ Ambient temperature efficiency of the drive

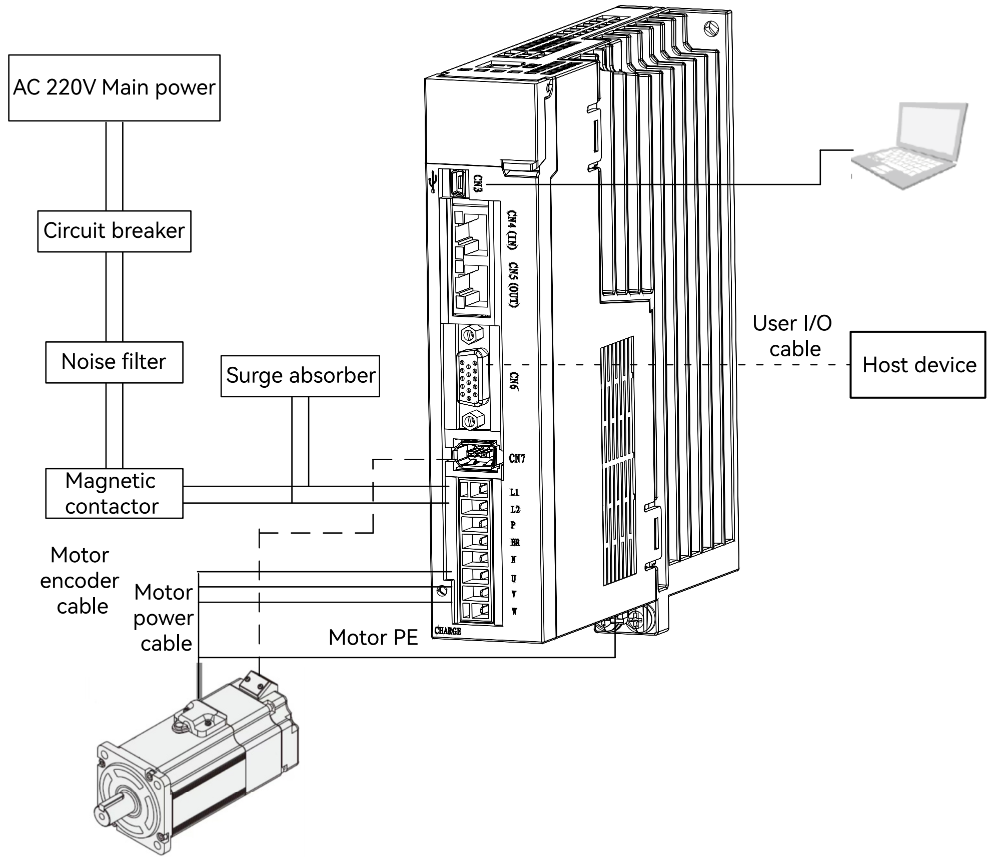
100W~400W (220V model)	
750W~2.5KW (220V model)	
2KW~3KW (380V model)	

Chapter 2 Motor and drive wiring instructions

2.1 System wiring diagram

Instructions for connecting a servo motor with a servo drive

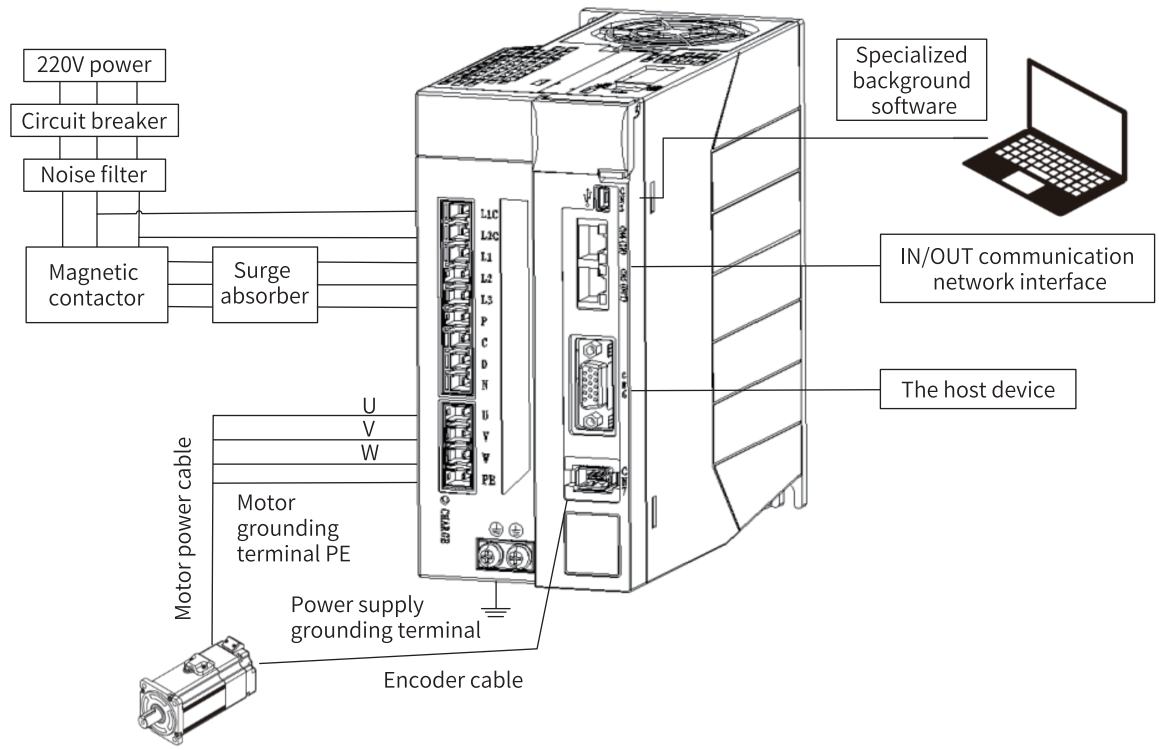
◆ Power input AC220V (100W~1000W wiring diagram)



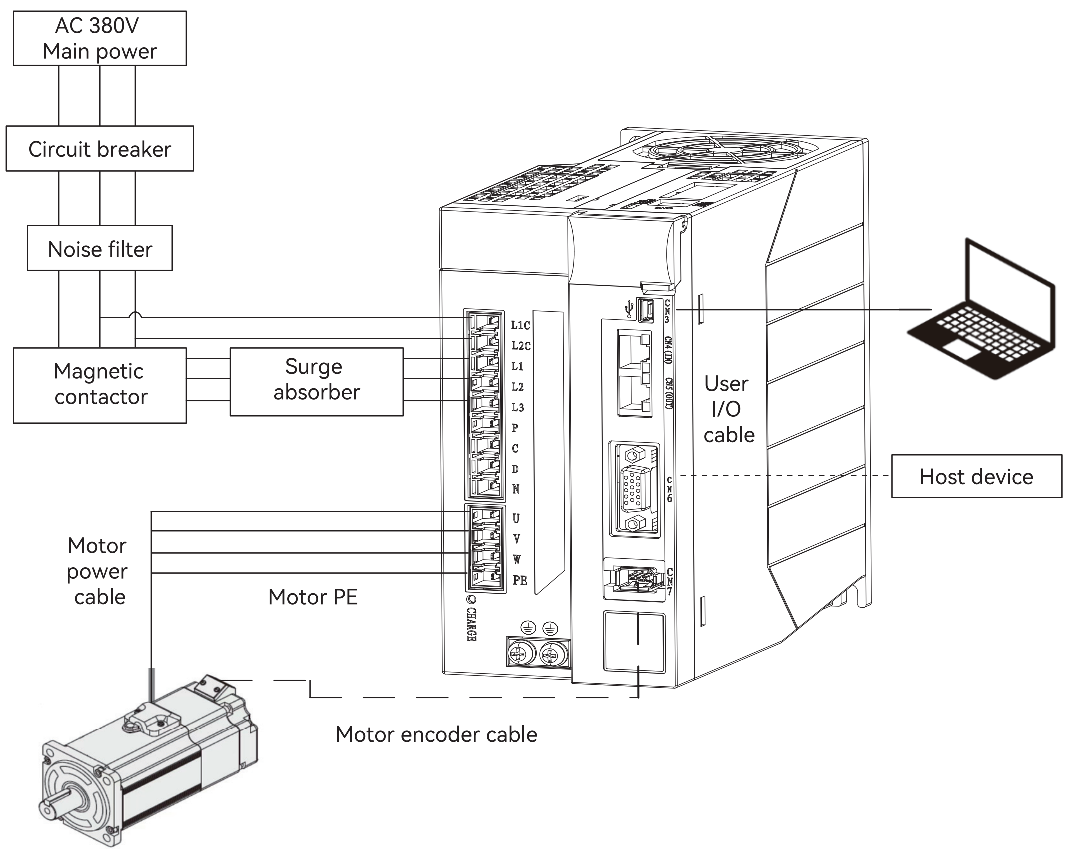
◆ Points for correct wiring

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

◆ Power input AC220V (1500W~2500W wiring diagram)



◆ Power input AC220V (2000W~3000W wiring diagram)



◆ Points for correct wiring

(1) L1C, L2C is the control circuit power input, please connect to single-phase AC220V; L1, L2, L3 is the main circuit power input, please connect to three-phase AC220V or three-phase AC380V.

(2) Please use a twisted-pair shielded cable if the I/O cable is longer than 50cm.

(3) The encoder cable should be shorter than 20m.

(4) Common DC busbar solution must be at the same voltage input level and be powered up at the same time.

(5) Braking resistor wiring: If the PC terminal is shorted, an internal braking resistor is used; if an external braking resistor is required, the PC is disconnected and PD is connected 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 「Figure 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: AC200 ~ 230V (Main circuit and control circuit power supply)	The drive can be used in overvoltage category II power supply environments according to IEC60664-1.
Power supply 2: DC24V I/O power supply Motor brake release power supply	The following conditions must be met to select the specifications for the DC24V external power supply. Use a SELV power supply (※) with a capacity of 150W or less, which is a CE-compliant condition. ※SELV: safety extra low voltage (Safety extra low voltage/non-hazardous voltage. Hazardous voltage requires reinforced insulation)
Wiring	For motor power cables, AC220V input cables, FG cables, and main circuit power distribution cables of multi-axis configurations, use AWG18/600V voltage-resistant cables for the power of 750W or less, and AWG14/600V voltage-resistant cables for the power of 1KW or more.
Earth leakage circuit breaker	In order to protect the power cable, it is necessary to disconnect the circuit when overcurrent flows. According to 「Figure 2.1 System wiring diagram」, be sure to use a IEC-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 HCFA.
Noise filter	Prevents noise interference from the power cable. To comply with EMC standards, use the noise filters recommended by HCFA.
Electromagnetic contactor	Perform main power switching (ON/OFF). Connect an overvoltage protector for use.
Surge absorber	To comply with EMC standards, use an overvoltage protector recommended by HCFA.
Signal cable noise filter / Ferrite core	To comply with EMC standards, use the noise filter recommended by HCFA.
Regenerative resistor	There is no internal braking 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 [External regenerative resistor selection]. Use the built-in thermostat and set the overheat protection circuit.
Earth grounding	The products are equipped with protection setting 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

◆ Power supply input AC220V (750W or less)

Motor connector and pin arrangemen(50~750W)

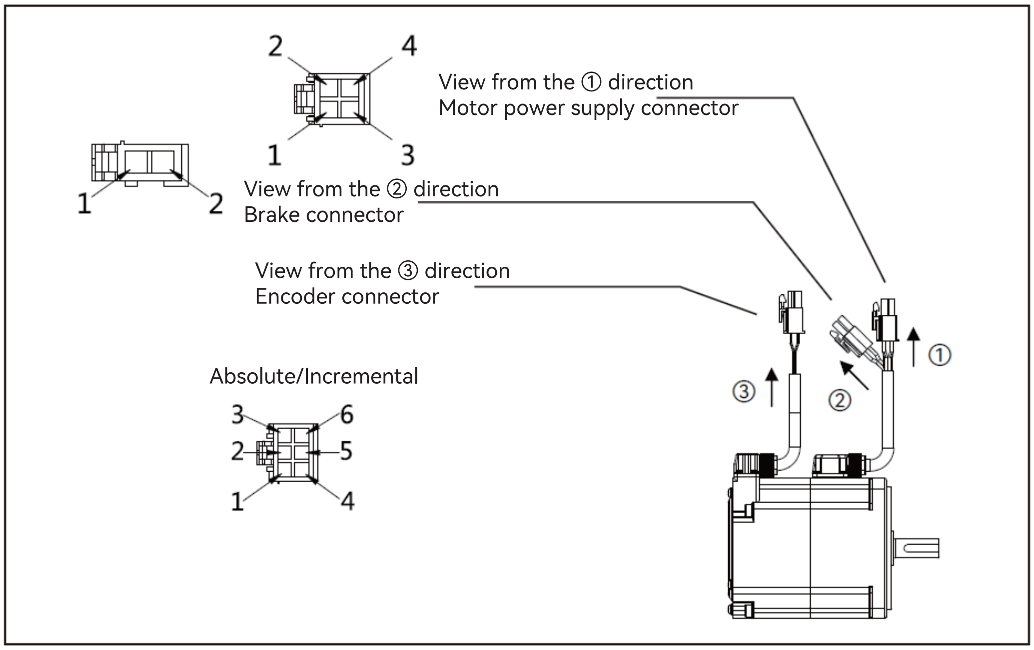


Table 2.2.1 List of cables (750W or less)

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

Note 1: Applicable to motors with brakes.

Table 2.2.1 For motor with the power of 750W or less

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 supply +	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 (red dot)
	5	GND	Signal grounding	Orange (black dot)
	6	SHIELD	Shielded cable	Black

Note 1: Applicable to motors with brakes.

◆ Power supply input AC220V (1KW~2.5KW)

Motor connector and pin arrangement

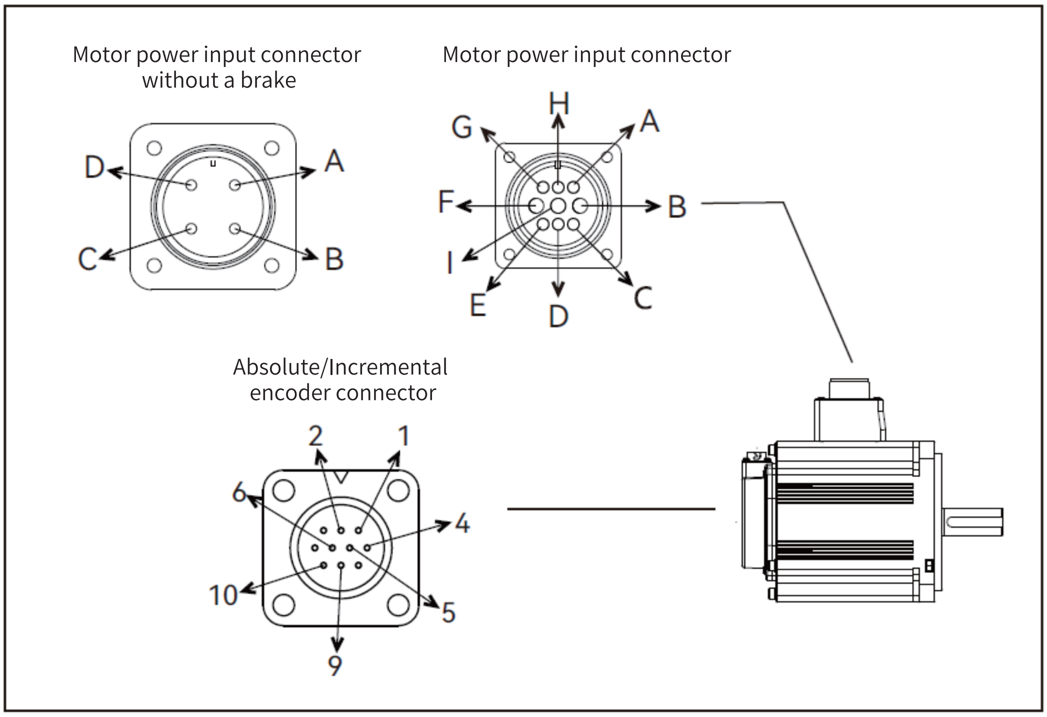


Table 2.2.2 List of cables (750W or more)

Name	Cable
Motor power input	AWG19
Brake [*1]	AWG21
Encoder (incremental)	AWG24
Encoder (absolute)	

Note 1: Applicable to motors with brakes.

Table 2.2.2 For motor with the power of 750W or more

Name	Terminal No.	Signal name	Description	Note
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 output	
	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	

Name	Terminal No.	Signal name	Description	Note
Encoder (absolute)	1	VCC	Encoder power supply 5V output	
	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	Shield cable	

Note: 1. Applicable to motors with brakes.

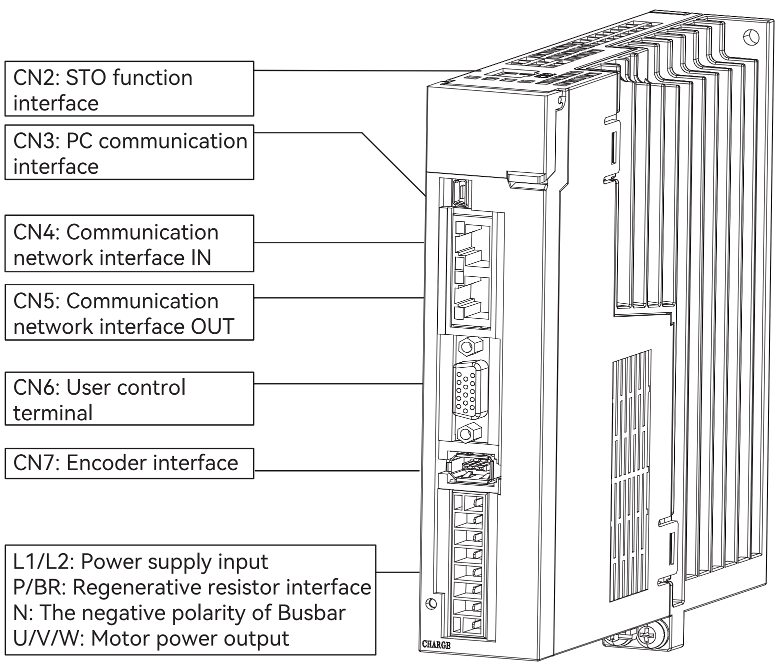
2. The external capacitors and batteries have GND as their reference potential.

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 the power of 100W~400W

The 750W~1000W main panel interfaces are the same as the 100W~400W main panel interfaces with different dimensions.

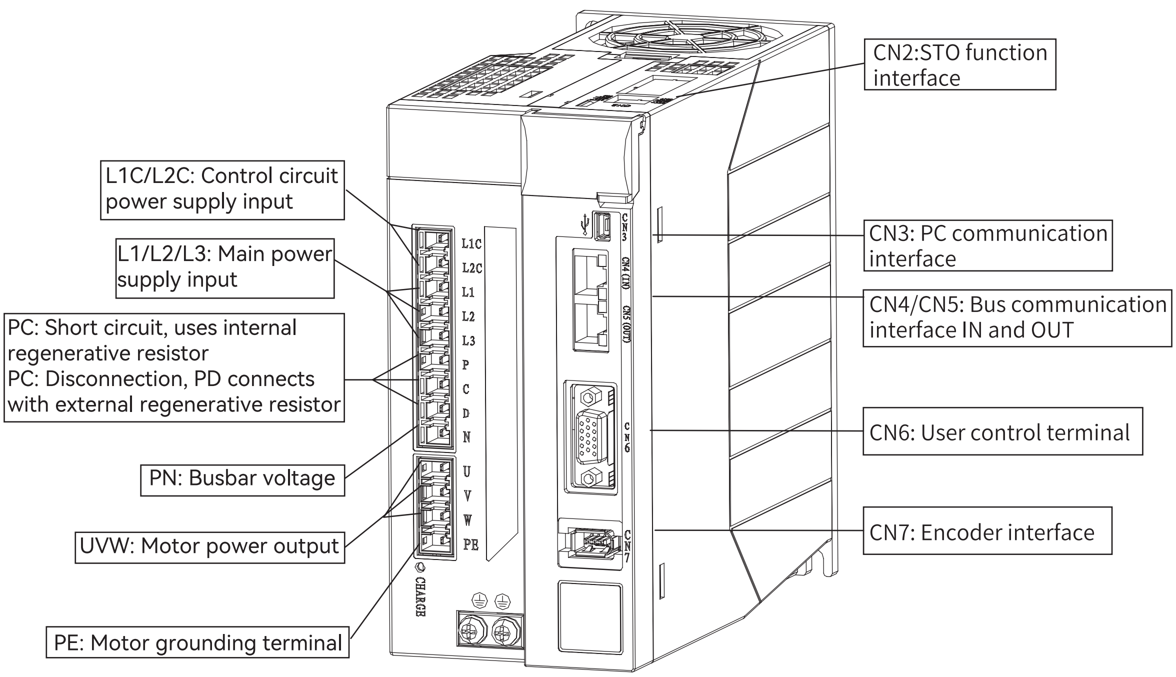


Connector terminal definition for a drive with the power of 100W~1000W

Name	Terminal No.	Terminal pin No.	Signal name	Description
AC control power input	8PIN	1	L1	AC control power input
		2	L2	
Regenerative resistor connection	8PIN	3	P	The positive polarity of the busbar voltage
		4	BR	Regenerative resistor connection interface (P ,BR)
The negative polarity of the busbar	8PIN	5	N	The negative polarity of the busbar voltage

Name	Terminal No.	Terminal pin No.	Signal name	Description
Motor power output	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 supply 5V output
		2	GND	Encoder power supply ground
		3~4	NC	—
		5	+D	Encoder signal: data input and output
		6	-D	Encoder signal: data input and output
		-	FG	Shield wire is connected to the connector housing
PC communication	CN3	1	VBUS	USB power supply
		2	D-	USB data-
		3	D+	USB data +
		4	NC	—
		5	GND	USB signal ground
User I/O	CN6	Refer to description of user-control terminal (CN6)		

◆ Connector interface definition for a drive with the power of 1500W~3000W



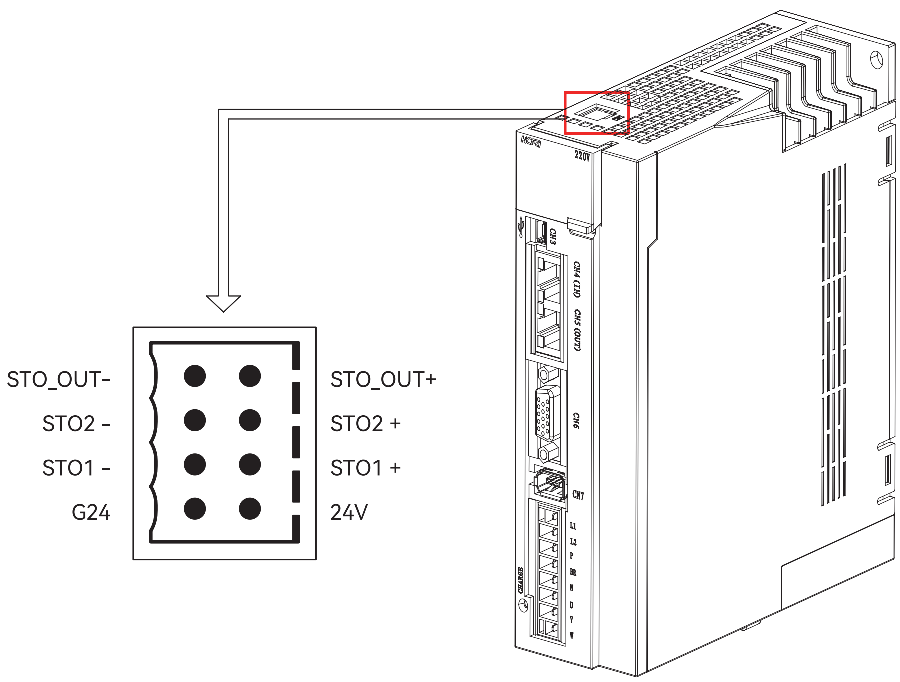
Connector terminal definition for a drive with the power of 1500W~3000W

Name	Terminal No.	Terminal Pin No.	Signal name	Description
Control power input	9PIN	1	L1C	Single-phase 220V control power input
		2	L2C	
Main power supply input		3	L1	Single-phase/ Three-phase 220V/Three-phase 380V main power supply input
		4	L2	
		5	L3	
Regenerative resistor connection		6	P	PC - shorted, use an internal braking resistor PC-disconnected, connect PD to external braking resistor
		7	C	
		8	D	
The negative polarity of the busbar		9	N	PN-busbar voltage

Name	Terminal No.	Terminal Pin No.	Signal name	Description
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 ground terminal PE
Encoder	CN7	1	VCC	Encoder power supply 5V output
		2	GND	Encoder power supply ground
		3~4	NC	—
		5	+D	Encoder signal: data input and output
		6	-D	Encoder signal: data input and output
		-	FG	Shield wire is connected to the connector housing
PC communication	CN3	1	VBUS	USB power supply
		2	D-	USB data -
		3	D+	USB data +
		4	NC	—
		5	GND	USB signal ground
User I/O	CN6	Refer to description of user-control terminal (CN6)		

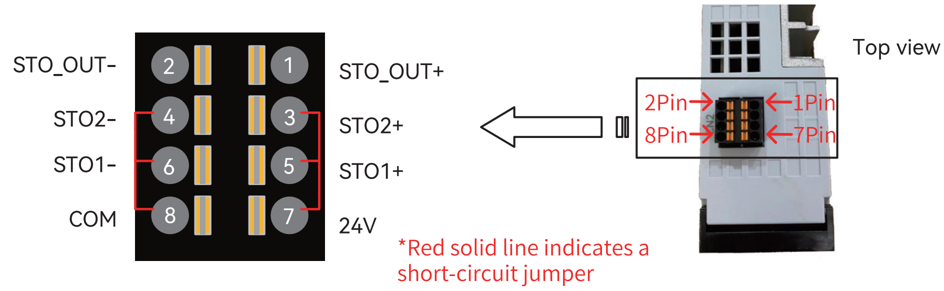
2.4 Instructions for using the CN2 interface

Safe Torque Off (STO) is a safety function that prevents the drive from transferring energy to the motor to generate current. If the STO function is activated, the drive stops and prepares to output a signal (S-RDY) to enter the safe status, and the panel will display "sto".



◆ CN2 Safety function terminal:

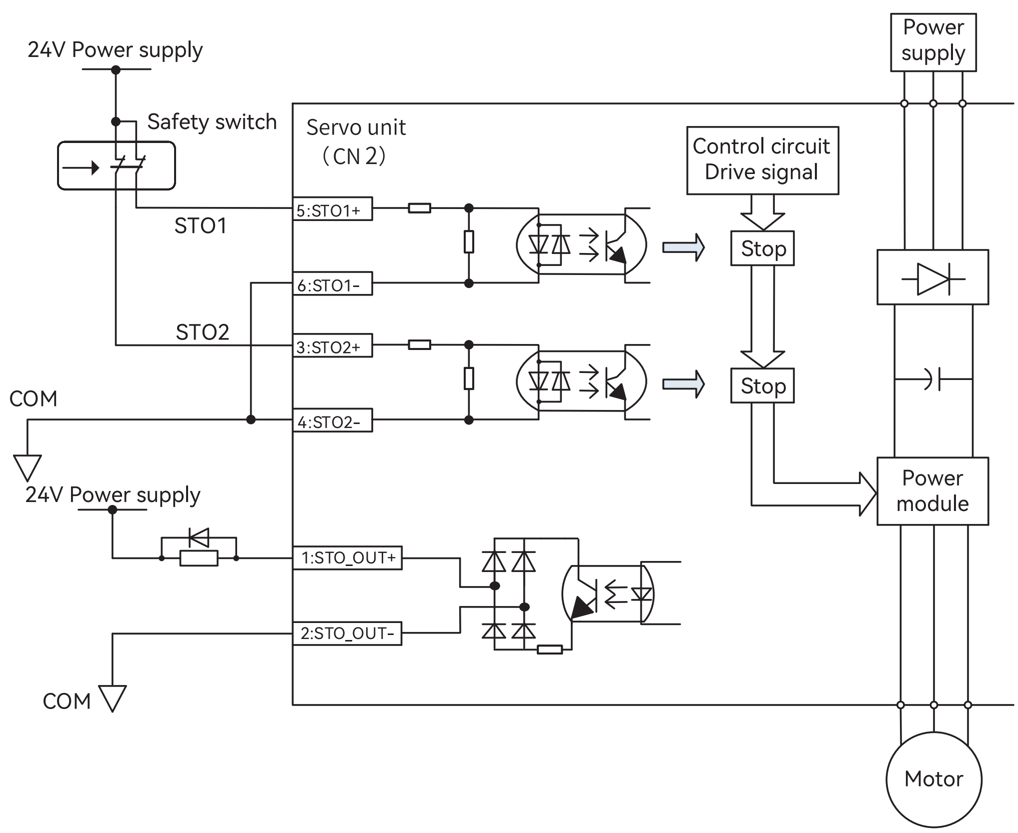
X5FB series drives are equipped with safety function terminals, if the safety function is not used, please short circuit jumpers according to the following diagram. If the safety function is needed, please follow the wiring diagram of the STO safety function to connect with the host device.



◆ CN2 pin definition

Name	Symbol	Terminal No.	Signal name	Description
STO function	CN2	1	STO_OUT+	Monitor output for safety function signals
		2	STO_OUT-	
		3	STO2+	Two 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 switch	STO2 switch	STO_OUT status	Servo drive 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:

1. 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.

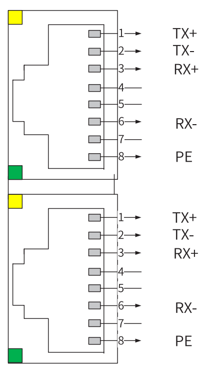
2. If no external force is applied and the dynamic brake fails to stop the motor at the set position, the motor will coast to stop, which will result in a longer stopping distance. It is important to be aware of this situation when using the motor to prevent any potential issues.

3. The STO function cuts power to the motor, but not the servo drive, which means that no electric insulation is carried out. To ensure safety during servo drive or equipment maintenance, disconnect the main power supply.

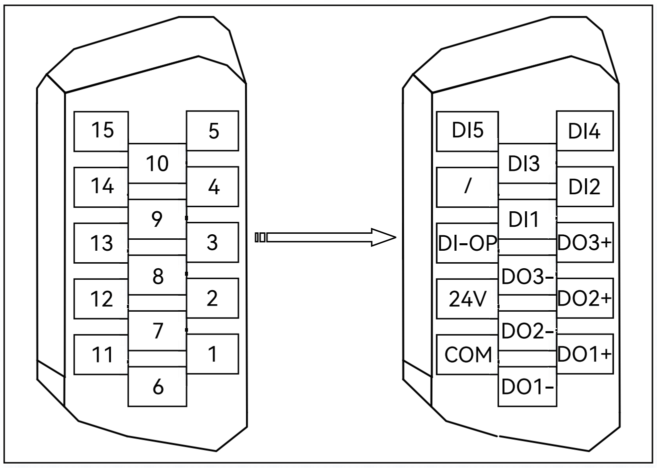
2.5 Instructions for using the CN4/CN5 interface

EtherCAT network interface definition: The standard 8-pin RJ45 network interface is used, and the definition is as shown in the figure:

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



2.6 Instructions for using the CN6 interface



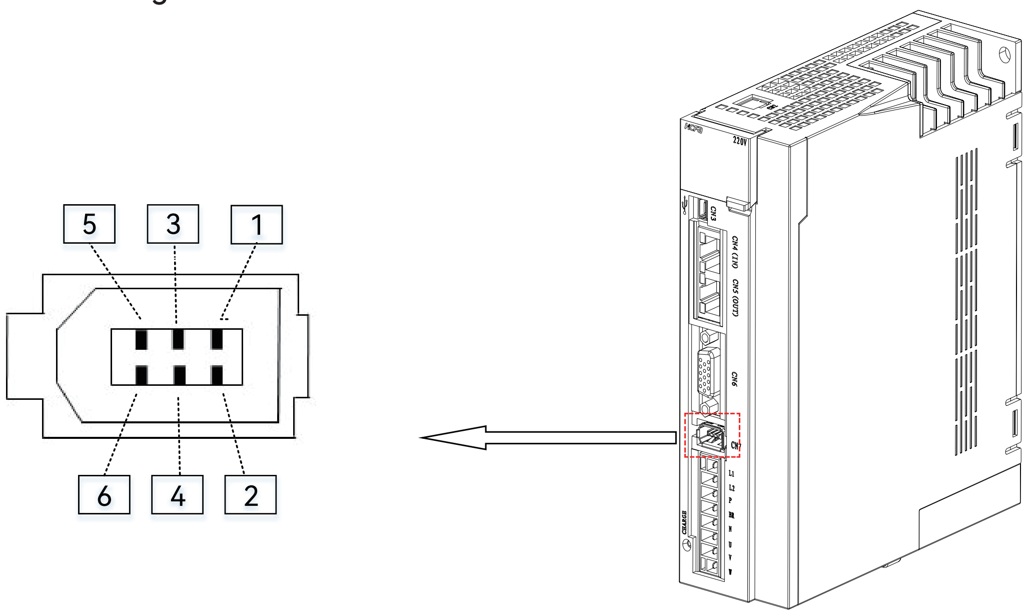
Description of user-control terminal (CN6)

Name	Terminal No.	Signal name	Definition (default)
Digital signal output DO 1-3	6	DO1-	DO1 (brake release)
	1	DO1+	
	7	DO2-	DO2 (fault output)
	2	DO2+	
	8	DO3-	DO3 (positioning completed)
	3	DO3+	
Digital signal input DI 1-5	9	DI1	DI1 (positive over-travel)
	4	DI2	DI2 (negative over-travel)
	10	DI3	DI3 (origin switch)
	5	DI4	DI4 (probe 1)
	15	DI5	DI5 (probe 2)
Power supply 24V	11	COM	Power supply ground
	12	24V	Power supply 24V
DI common terminal	13	DI-OP	DI power supply input
-	14	-	-

2.7 Instructions for using the CN7 interface

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

◆ CN7 interface diagram:

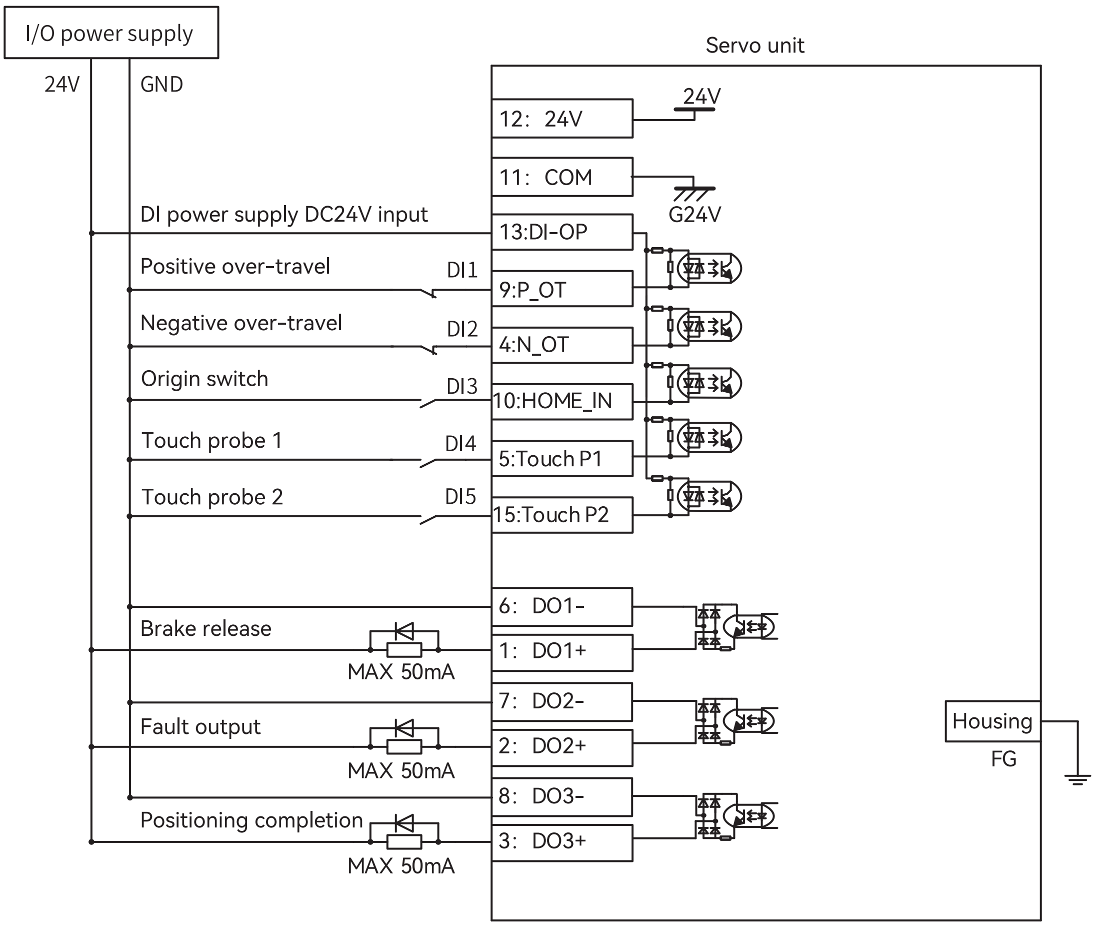


◆ CN7 pin definition

Encoder	CN7	1	VCC	Encoder power supply 5V output
		2	GND	Signal ground
		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 Instructions for user I/O wiring

◆ Take the example of using external 24V

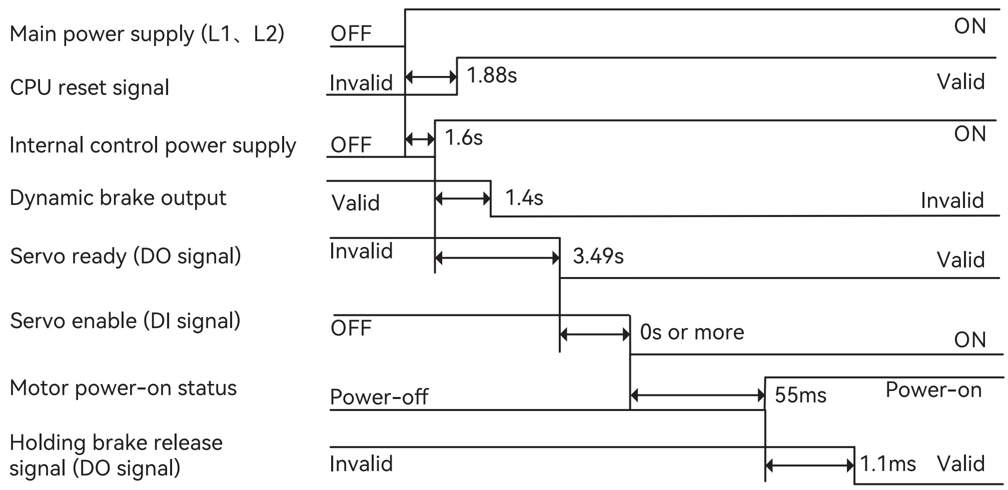


Note: 1. Probe function: DI4 is designated as Probe 1, i.e. P04.04 factory value is 39. DI5 is designated as Probe 2, i.e. P04.05 factory value is 40.

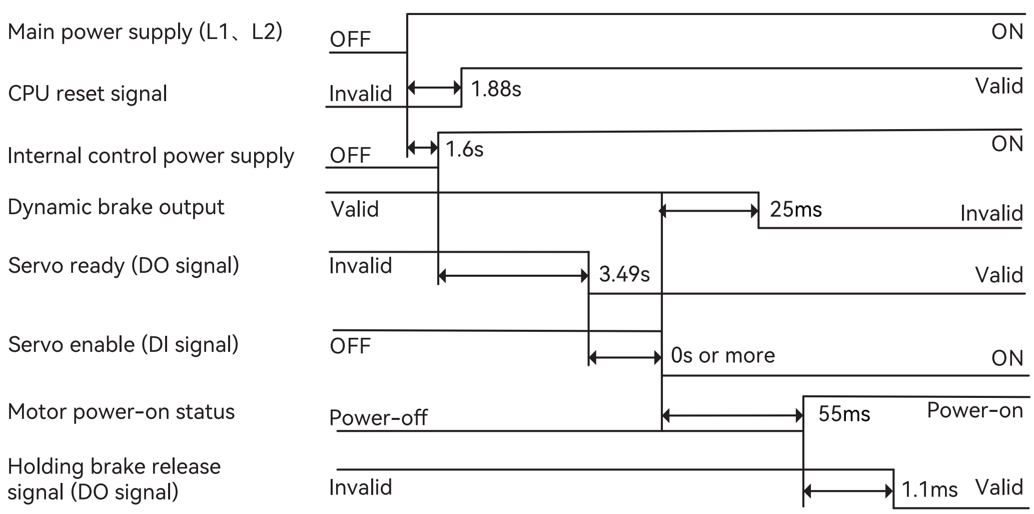
2.9 Timing diagram

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

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

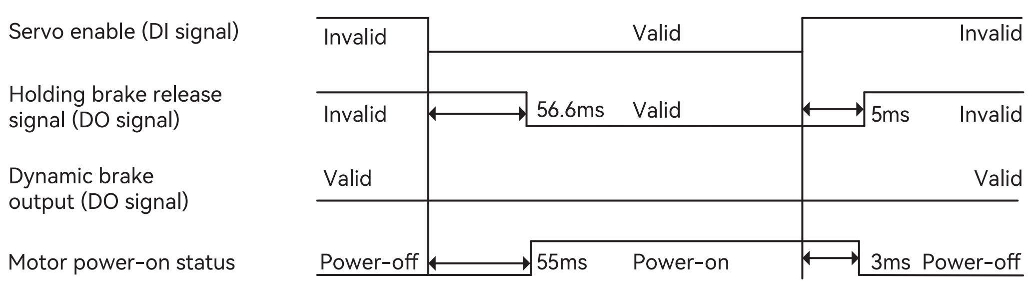


P06.26=3 ~ 5 (hold DB during power-on)



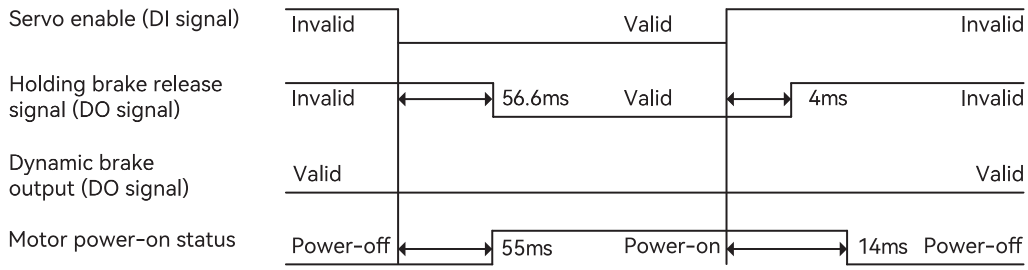
◆ Servo-enable on/off action during motor rotation

P06.26=0 (coast to stop, remain free)



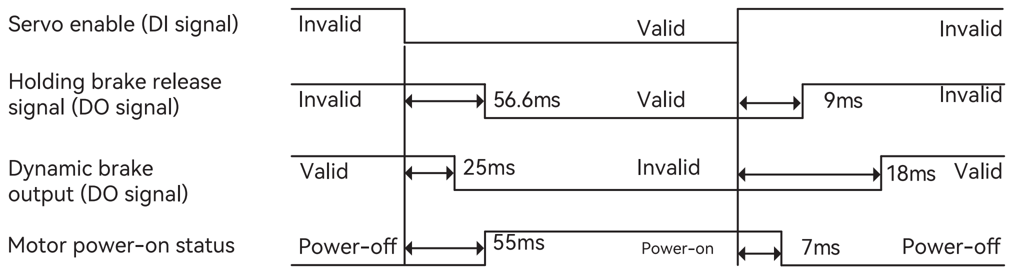
The timing of " Holding brake release signal" during the servo OFF is related to the setting of servo parameter P04.52 and P04.53 and the running speed of the motor, see the parameter description for details, and the minimum value is 5ms.

P06.26=1/2 (quick stop, remain free)



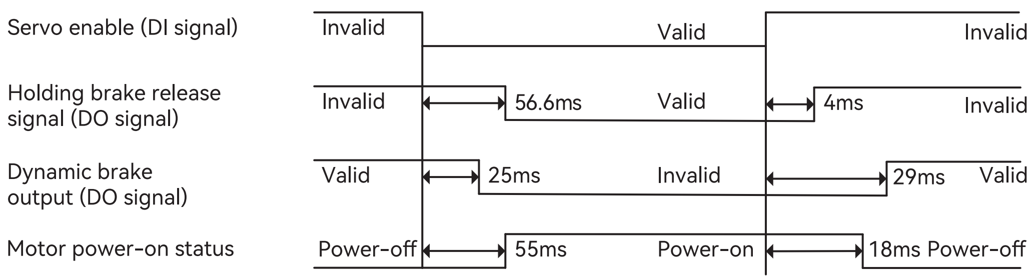
The timing of " Holding brake release signal" during the servo OFF is related to the motor running speed, see the parameter description for details, and the minimum value is 4ms.

DB stop P06.26=3 (DB stop, hold DB)



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

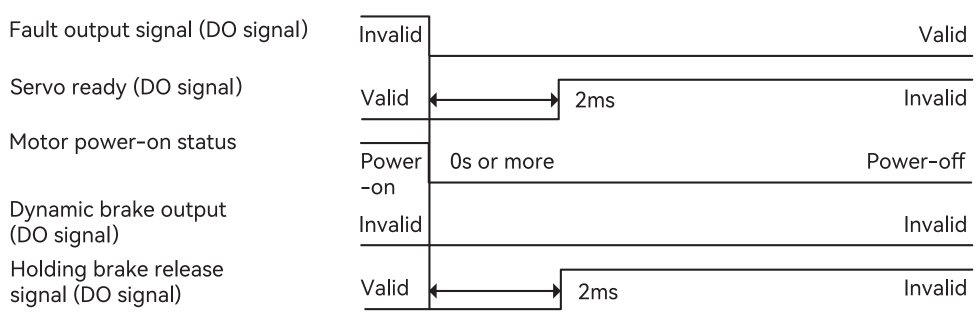
DB stop P06.26=4/5 (quick stop, hold DB)



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

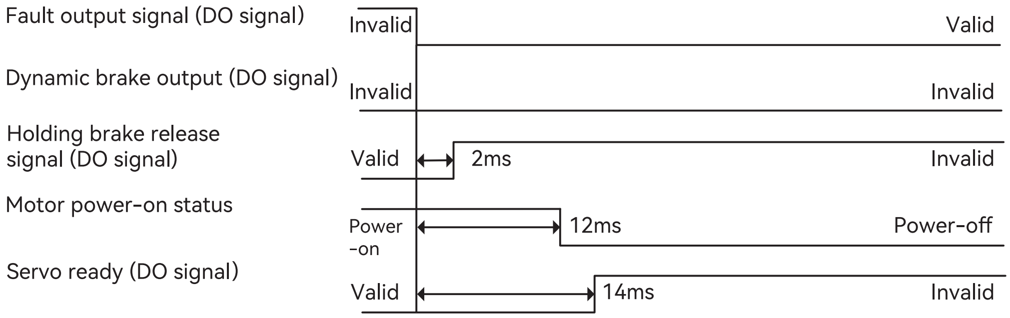
◆ When an abnormality (fault) occurs (instruction status of servo-enable is on)

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



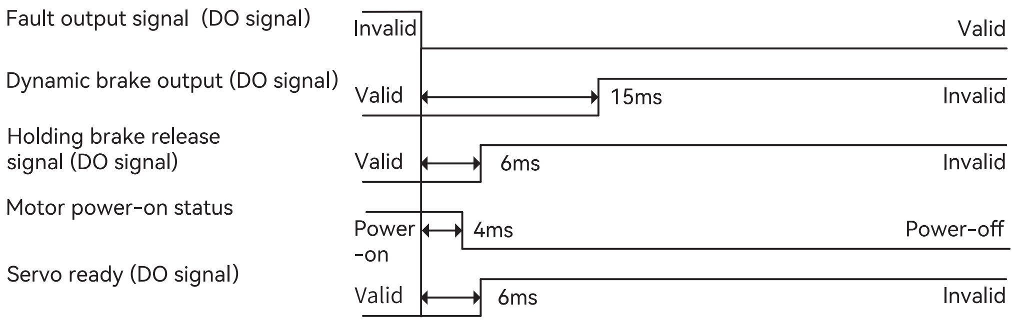
The timing of the "Holding brake release signal" during the faulty stop is related to the servo parameters P04.52 and P04.53 and the motor running speed, see the parameter description for details, and the minimum value is 2ms.

P06.27=1/2 (quick stop, remain free)



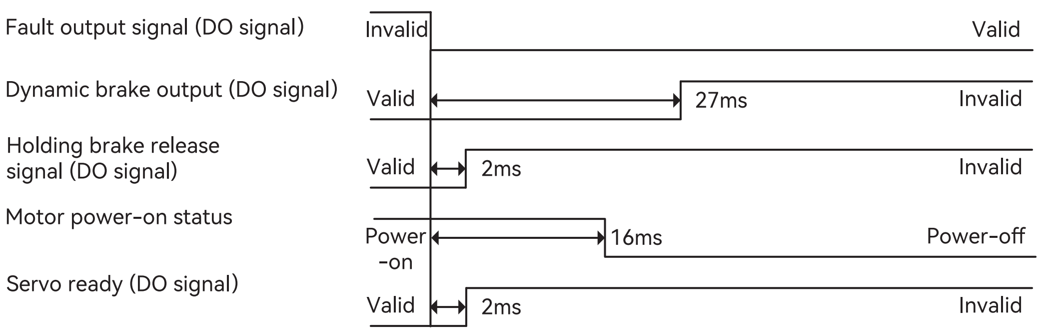
The timing of the "Holding brake release signal" during the faulty stop is related to the motor running speed, see the parameter description for details, and the minimum value is 2ms.

P06.27=3 (DB stop, hold DB)



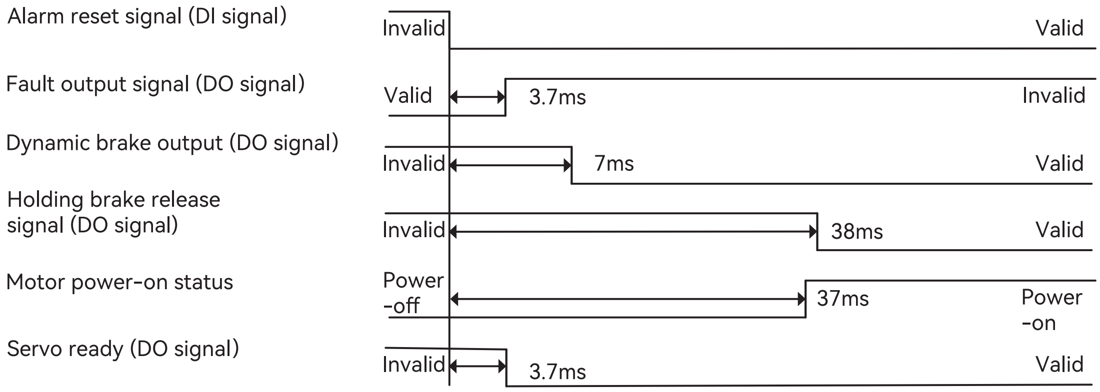
The timing of the "Holding brake release signal" during the faulty stop is related to the motor running speed, see the parameter description for details, and the minimum value is 6ms. The timing of the "servo ready" during the fault stop depends on the speed of the motor and the minimum value is 6ms.

P06.27=4/5 (quick stop, hold DB)



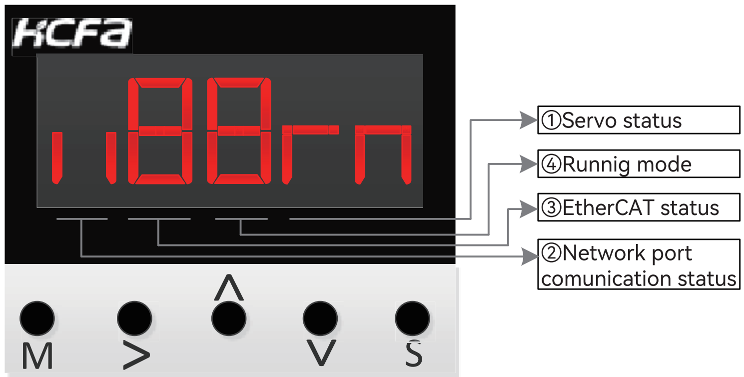
The timing of the "Holding brake release signal" during the faulty stop is related to the motor running speed, see the parameter description for details, and the minimum value is 2ms. The timing of the "servo ready" during the faulty stop depends on the speed of the motor and the minimum value is 2ms.

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



Chapter 3 Tuning

Panel display



Key description

M	Exit the higher level panel display and return to the lower level panel display.
S	Access the panel display of the memory, or confirm parameter modifications.
∧	Multiply the corresponding authority value by step 1 to increase the number value.
∨	Multiply the corresponding authority value by step 1 to decrease the number value.
>	Move to modify the digital bit. For 32-bit numbers, press and hold the key to display the high bit on a page, and press and hold it again to display the sign bit on another page. In the zero-level panel, pressing this key can switch the display of the monitored parameter.

Display description

Name	Meaning	Description
1: Servo status display	Display servo status	no ry: Servo not ready ry: Servo is ready rn: Servo is enabled AL XX: Servo reports an alarm Er XX: Servo reports a fault
2: Communication network port status display	Display two communication network interface physical connection status	No display: No network interface is connected 1: OUT network interface is connected 1: IN network interface is connected 11: Both IN and OUT network interfaces are connected
3: EtherCAT status display	Displays the status of the EtherCAT network, the normal power-up sequence should be: 1-2-4-8	1: Network initialization (init) 2: Network pre-operation (Pre-op) 4: Network safe operation (Safe-op) 8: Network operation (Op)
4: Operation mode display	Display servo operation mode	0: No operation mode 1: Profile position mode (PP) 3: Profile velocity mode (PV) 4: Profile torque mode (PT) 6: Homing method (HM) 8: Cycle sync position mode (CSP) 9: Cycle sync velocity mode (CSV) A: Cycle sync torque mode (CST)

3.1 Gain tuning

Overall description

◆ Purpose:

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

See the example below:

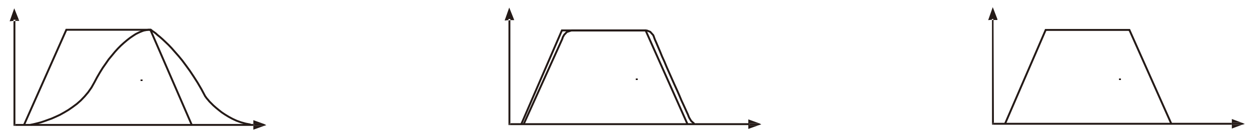


Figure 3.1 Example of gain definition

Gain setting grade: Low Position loop gain: 20.0 1/s Speed loop gain: 50.0HZ Speed loop integral time: 50.0 Speed feedforward: 0 Inertia ratio: 1.00	Gain setting grade: High Position loop gain: 100.0 1/s Speed loop gain: 50.0HZ Speed loop integral time: 50.0 Speed feedforward: 0 Inertia ratio: 1.00	Gain setting grade: High + feedforward Position loop gain: 100.0 1/s Speed loop gain: 50.0HZ Speed loop integral time: 50.0 Speed feedforward: 50.0 Inertia ratio: 1.00

◆ Procedure:

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

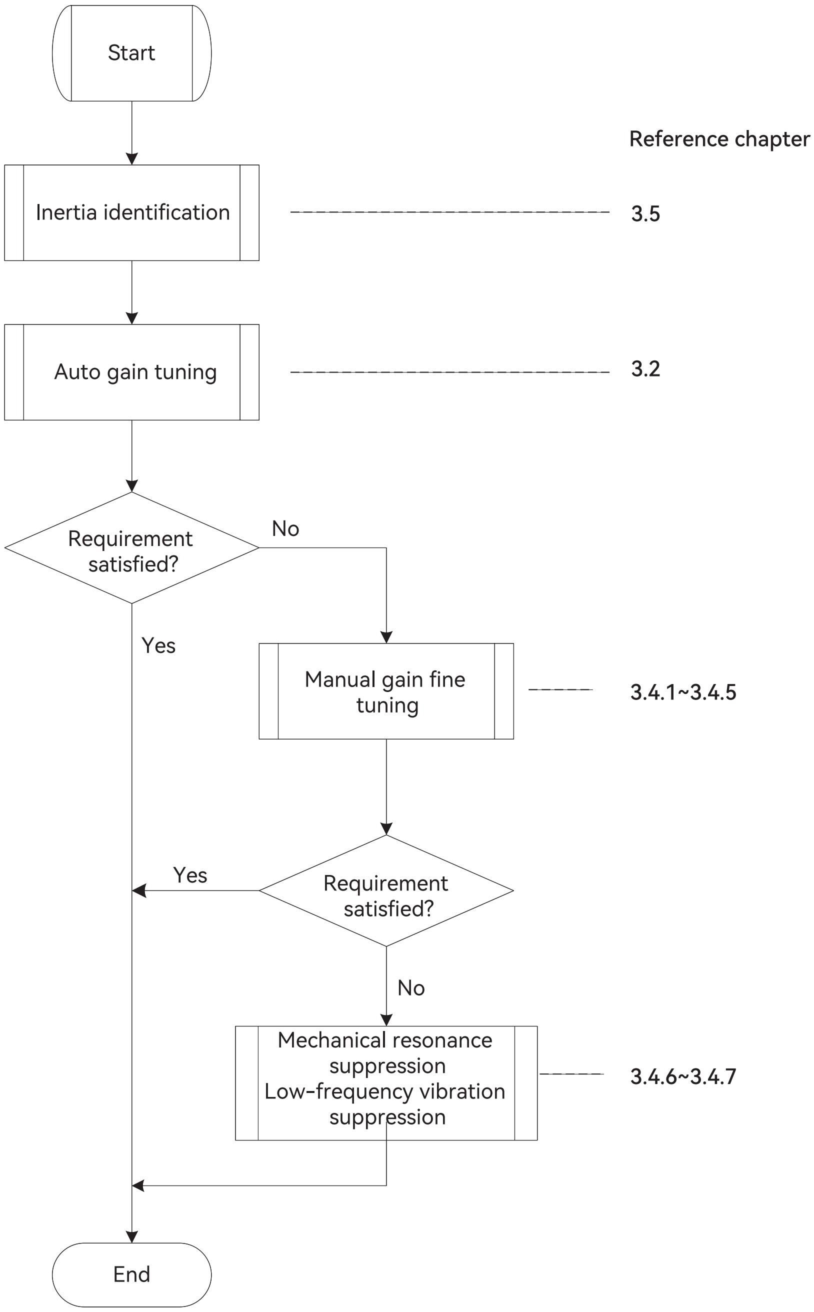


Figure 3.2 Gain tuning flowchart

3.2 Automatic gain tuning

Function description

◆ Overview:

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

◆ Procedure:

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

The automatic gain tuning process is shown below.

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

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

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

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

Level 5 to 8, some complex transmission machinery

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

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

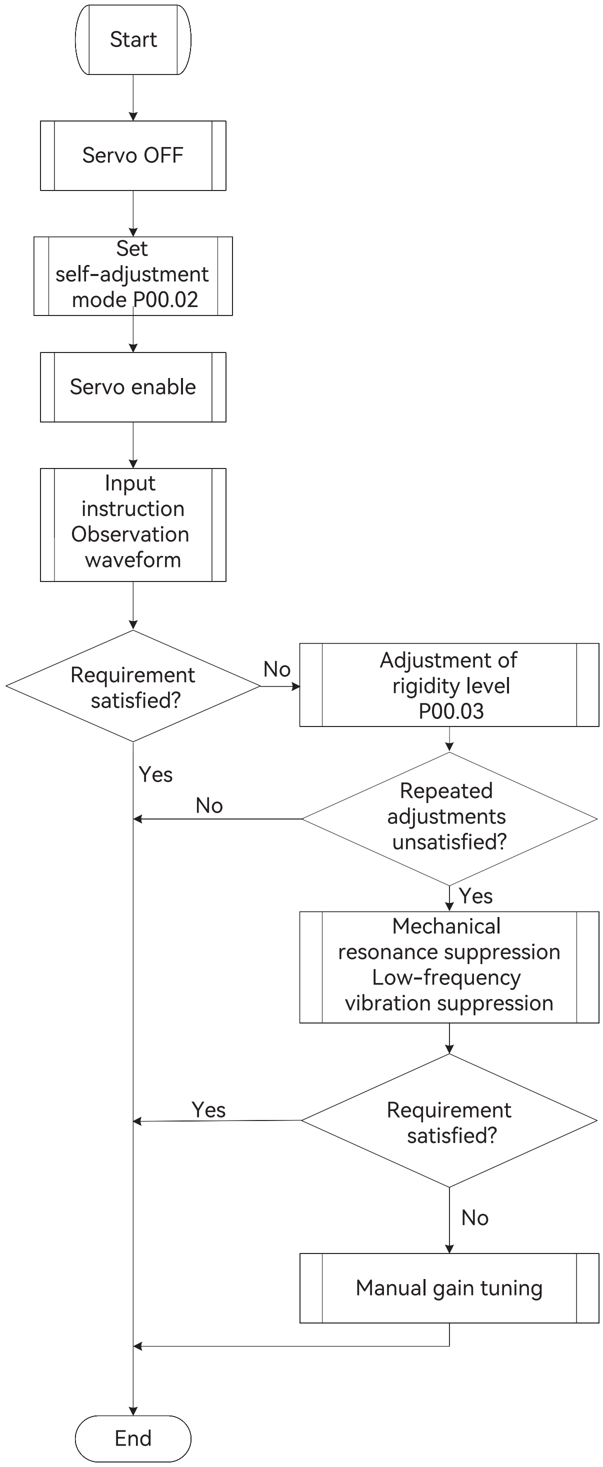


Figure 3.3 Automatic gain tuning flowchart

◆ 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	1.01/s ~ 2000.0 1/s	0.11/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	1.01/s ~ 2000.0 1/s	0.11/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: The 2nd gain fixed 2: Utilize DI input (GAIN-SWITCH) 3: Large torque instruction 4: Sharply-changed speed instruction 5: Large speed instruction 6: Large position deviation (P) 7: With position instruction (P) 8: Uncompleted positioning (P) 9: Large actual speed (P) 10: With position instruction (P) and actual speed (P)	1	10
P01	19	Position control switching delay	0~1000.0ms	0.1ms	5.0ms
P01	20	Position control switching class	0~20000 (Unit: based on gain switching mode description)	1	50
P01	21	Position control switching hysteresis	0~20000 (Unit: based on gain switching mode description)	1	33
P01	22	Position gain switching time	0~1000.0ms	0.1ms	3.3ms

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 instruction. 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	Description	Unit	Value
P02	02	Adaptive filter mode	0-4 0: Adaptive is invalid, the 3rd and the 4th filters are functioning but parameters are not updated; 1: One adaptive filter is valid. Only the 3rd filter is functioning with updated parameters. 2: Two adaptive filter are valid. The 3rd and the 4th filters are functioning with updated parameters. 3: Resonance frequency testing, but parameters are not updated. 4: Clear adaptive records, the 3rd & 4th filters are not functioning.	1	0

Function code		Name	Description	Unit	Value
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	Description	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 X5EB 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 re-adjust 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 Tuning in the position mode

Refer to the following procedure for manual gain tuning during position control mode:

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

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

P01	00	Position loop gain 1	40.01/s	**P00**	02	Real-time self-tuning mode	0
P01	01	Speed loop gain 1	20.0HZ	**P02**	02	Adaptive filter mode	0
P01	02	Speed loop integral time 1	30.00ms	**P02**	04	The 1st notch frequency (manual)	5000
P01	03	Speed detection filtering 1	0.00ms	**P02**	07	The 2nd notch frequency (manual)	5000
P01	04	Torque instruction filtering 1	1.00ms	**P02**	10	The 3rd notch frequency	5000
P01	05	Position loop gain 2	40.01/s	**P02**	13	The 4th notch frequency	5000
P01	06	Speed loop gain 2	20.0HZ	**P02**	19	Position instruction FIR filtering 2	0
P01	07	Speed loop integral time 2	30.00ms	**P02**	20	The 1st damping frequency	0
P01	08	Speed detection filtering 2	0.00ms	**P02**	22	The 2nd damping frequency	0

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

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

3.4.3 Tuning in the speed mode

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

3.4.4 Gain switching function

◆ Procedure:

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

1. Suppress vibration during stop while improving the dynamic response of servo following performance as much as possible.
2. Increase the gain of the whole timing to shorten the positioning time.
3. Switch gain according to external signals.

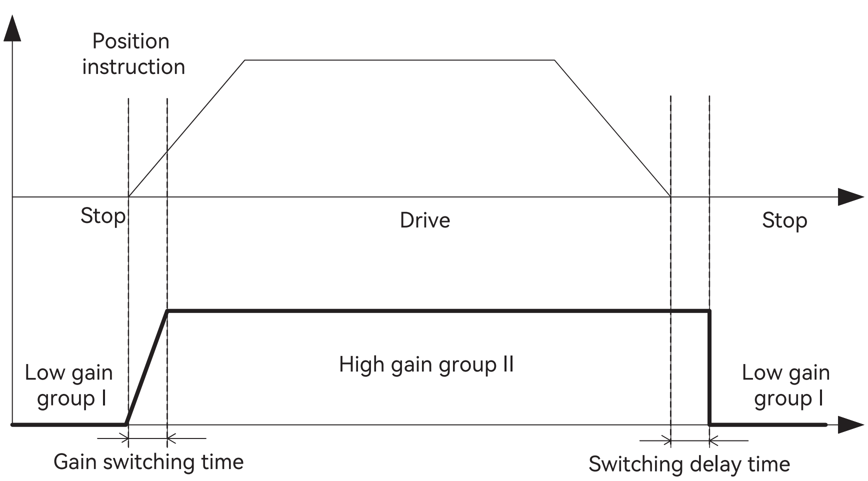


Figure 3.4 Gain switching example

◆ Procedure:

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

1. Firstly, the gain switching function is not enabled, the 1st gain is fixed, and the 1st gain is tuned 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 (%)
5	Large speed instruction	PS	C	Applicable	Applicable (1rpm/s)	Applicable (1rpm/s)
6	Large position deviation	P	D	Applicable	Applicable (1 Encoder resolution unit)	Applicable (1 Encoder resolution unit)
7	With position instruction	P	E	Applicable	Inapplicable	Inapplicable
8	Uncompleted positioning	P	F	Applicable	Inapplicable	Inapplicable
9	Large actual speed	P	C	Applicable	Applicable (1rpm/s)	Applicable (1rpm/s)
10	With position instruction	P	G	Applicable	Applicable (1rpm/s)	Applicable (1rpm/s)

◆ **View the following timing diagrams in numbered order in the figure 3.5:**

1. When the gain switching condition is "Utilize DI input (GAIN-SWITCH)", only when the function code DI function GAIN-SWITCH switching selection (P01.17) is set to 1 will the gain switching of groups 1 and 2 be carried out. Otherwise, the P/PI switching of the speed loop will be carried out.

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

3. When P01.18 is equal to 10, the definition of each parameter is different from other modes, so please refer to the G diagram in figure 3.5 for comprehension.

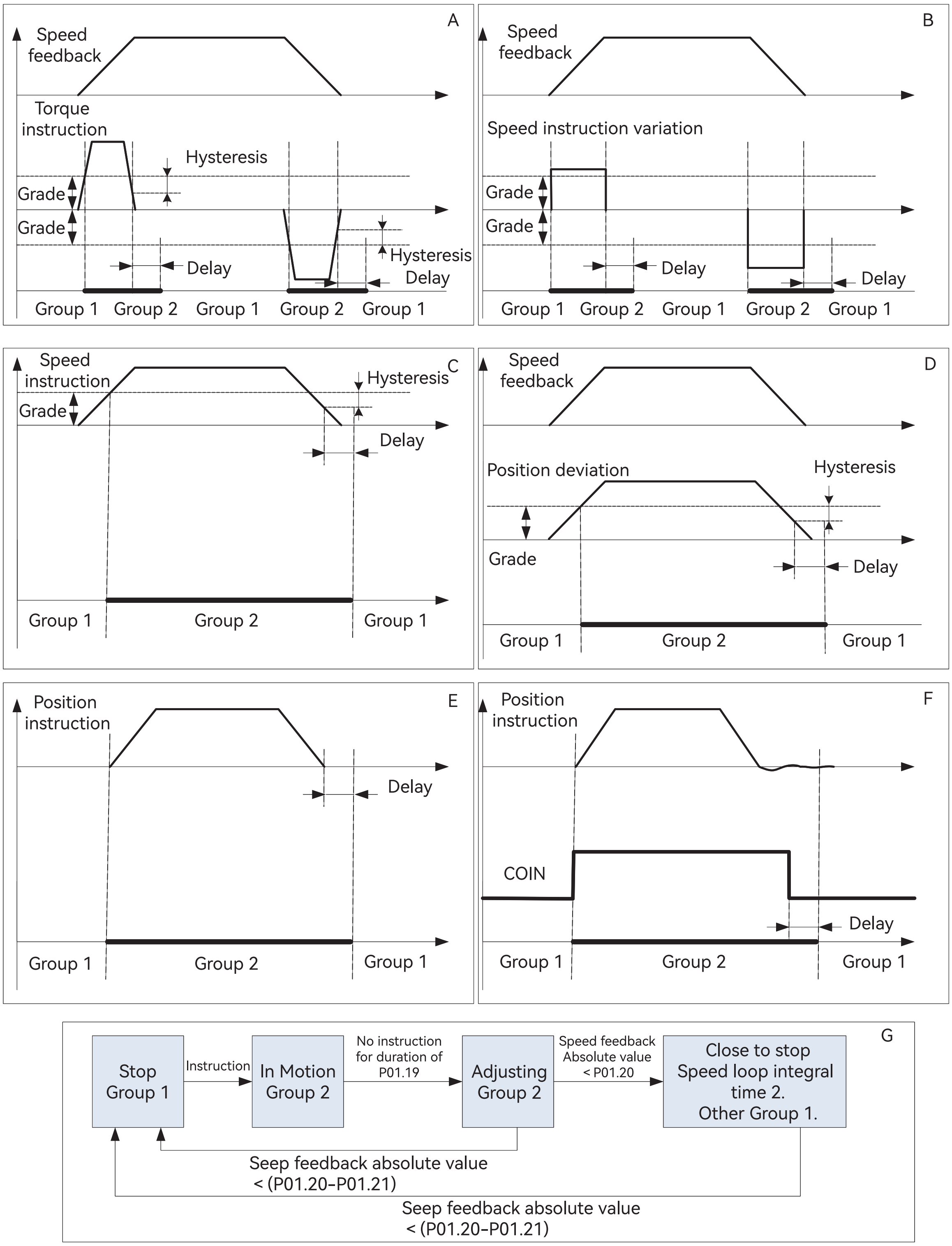


Figure 3.5 Timing diagram of gain switching under various conditions

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

The position deviation follows the calculation formula:

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

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

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

1: Turn down the feedforward gain;

2: Increase the time constant of the feedforward filter.

◆ Relevant parameters:

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

The torque feedforward can use the analog input external feedforward, which can be used in the case of the upper device calculating the torque feedforward. In this case, it is necessary to set the torque feedforward selection (P01.14) to 2 and specify the input channel of TFFD in the analog input-related setting, 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 two ways to suppress mechanical resonance:

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

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

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

2. Notch filter

The torque instruction filters are digital band-reject filters. The X5E servo drive has a total of 4 sets of series-connected notch filters to choose from. The 1st and 2nd notch filters are manual setting and the 3rd and 4th notch filters are adaptive filters.

◆ Notch filter

When the adaptive filter does not enable adaptive parameter setting (P02.02 is not set to 1,2), all 4 notch filters can be manually tuned. 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	Function code
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.

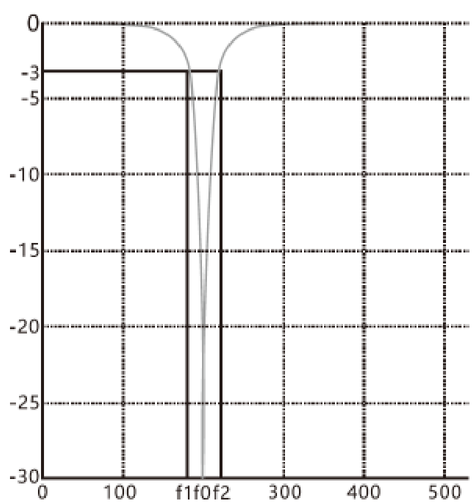


Figure 3.6 Notch filter amplitude-frequency characteristics

C • Tuning

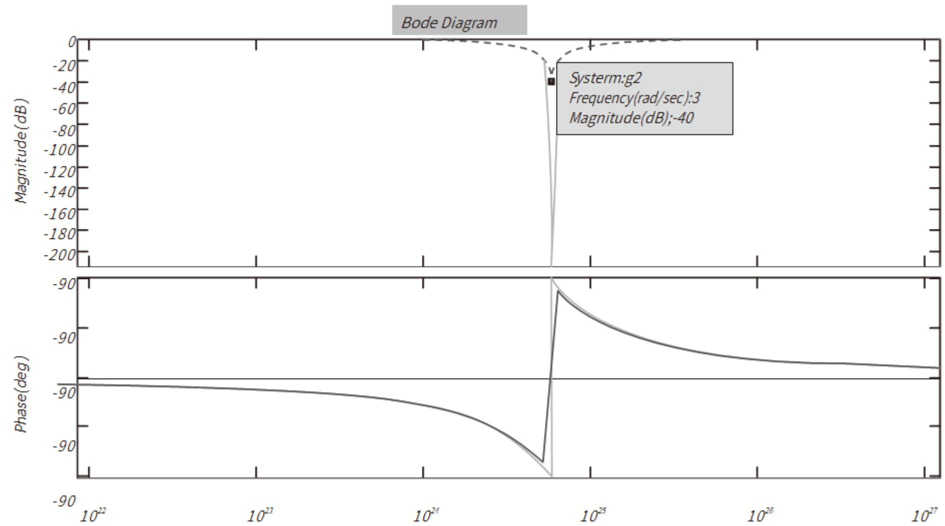


Figure 3.7 The frequency domain response curve when the notch filter depth is set to 1 and 0, respectively

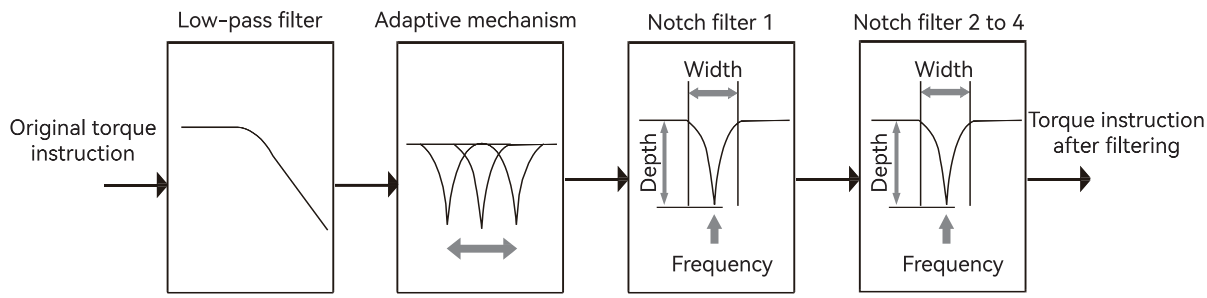


Figure 3.8 The role of the notch filter in servo control

3.4.7 Low-frequency vibration suppression

◆ Overview

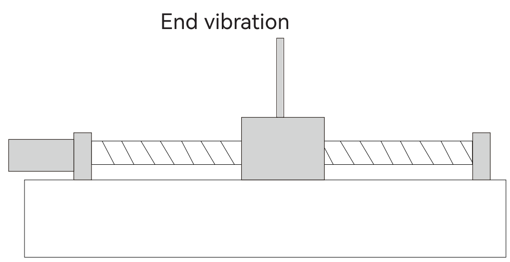


Figure 3.9

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:**

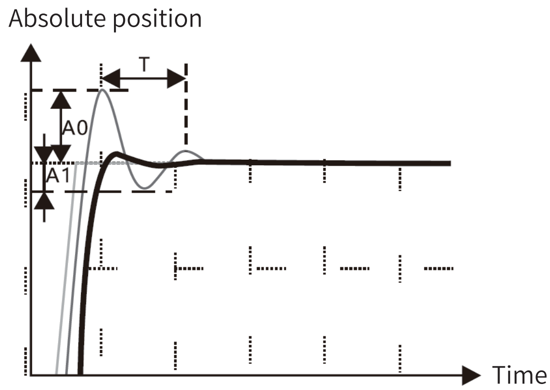


Figure 3.10 Low-frequency vibration waveforms under positioning control

In practical applications, it is possible to encounter a situation where there is a long end mechanism on the actuating part and there is an obvious oscillation when the position instruction stops, which is reflected in the position control waveform with periodic vibration in the position deviation (or absolute position feedback), as shown in Figure 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 oscillations, 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 tuning 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

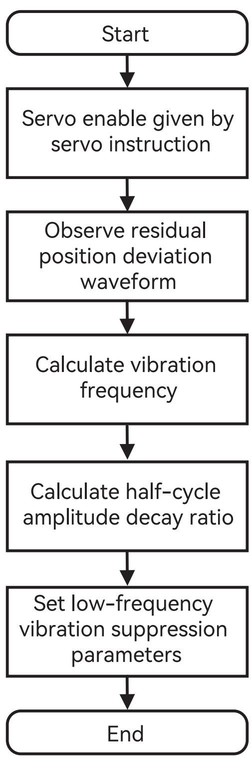


Figure 3.11 Low frequency suppression function operation flowchart

3.5 Inertia identification and initial angle identification

(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 first row displays 0

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.

The second row displays P20.03

(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 first row displays 00.69 , which indicates the value of the current inertia value (P00.04).

The second row displays i.tUNE , which indicates that inertia identification is in progress. After the identification is completed, the first row displays the inertia value of this identification, and the second row displays i.End , which indicates the ending of the identification.

(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 first row displays the value of the current electrical angle (P21.09).

The second row displays A.tUNE , which indicates that initial angle identification is in progress. After the identification is completed, the first row displays the currently identified initial angle value. The second row displays A.End , which indicates that the initial angle identification is completed.

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 EtherCAT communication overview

4.1 EtherCAT protocol introduction

EtherCAT is an advanced Ethernet technology developed by Beckhoff that offers high-speed and real-time communication. It is cost-effective, easy to implement, and features a simple network structure. EtherCAT utilizes standard Ethernet physics and is ideal for high-speed IO interconnections and data exchange in industrial applications. The primary communication modes include master-slave communication and single-master-multi-slave communication. The master can be implemented using the regular network card of a computer or a special master PLC, while the slaves are typically comprised of the modules provided by Beckhoff or the integrated slave ASIC provided by authorized third parties.

Its basic features are:

★ Fast:

Precise synchronization achieved by distributed clocks

★ Fast data refresh rate

30 μs for 1000 digital I/Os.

100 μs for 100 servo axes

★ Precise synchronization by distributed clocks

★ Highly efficient, maximized utilization of Ethernet bandwidth for user data transfer

★ Good synchronization performance, slave devices at each node can be synchronized with an accuracy of less than 1 us

4.2 EtherCAT communication basis

4.2.1 Control modes supported by EtherCAT

The X5E drive EtherCAT is based on the CANOpen application layer profile, CiA 402 servo, and motion control profile. Various modes below CiA 402 are supported, see Table 4-1.

Table 4-1 CiA402 modes supported by servo drives with EtherCAT function

CiA402 control mode	Support
Cyclic synchronous position mode (CSP)	Yes
Cyclic synchronous velocity mode (CSV)	Yes
Cyclic synchronous torque mode (CST)	Yes
Homing mode (HM)	Yes
Profile position mode (PP)	Yes
Profile velocity mode (PV)	Yes
Profile torque mode (PT)	Yes

4.2.2 EtherCAT frame structure

The frame structure of EtherCAT consists of an Ethernet Header + more than 1 Ethernet sub-message + Frame Check Sequence (FCS) as follows

14byte	46~1500byte	4byte
Ethernet Header	Ethernet Data	FCS

Figure 4-1 EtherCAT frame structure

4.2.3 EtherCAT state machine

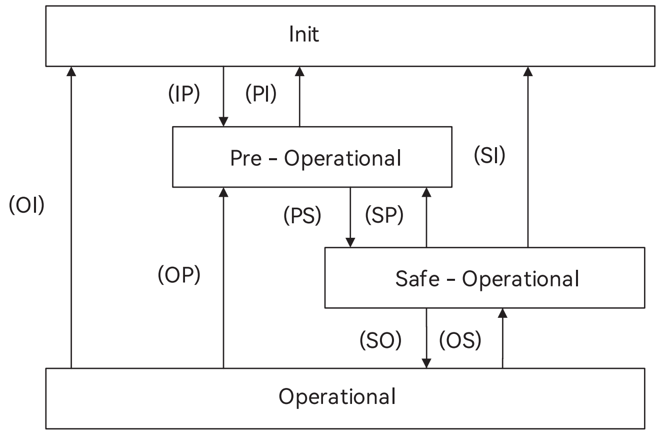


Figure 4-2 EtherCAT state machine

EtherCAT slave devices are required to realize the above four basic states to facilitate data interaction between the master and the slave to manage the state machine of the slave application. See Figure 4-2.

Init(I): Initialization state.

Pre-Operational (P): Pre-operational state.

Safe-Operational(S): Safe-Operational state.

Operational(O): Operational state.

Switching from station initialization to operational state follows the following pattern: Pre-Operational - Safe-Operational - Operational. The operating state can be directly switched to the other states.

The EtherCAT states and their conversion operations are shown in Table 4-2.

Table 4-2 EtherCAT state description

State and state conversion	Operation
Init	There is no communication at the application layer, and the slave can only read and write the ESC chip registers.
Init To Pre-OP (IP)	The master configures the slave station address register. If mailbox communication is supported, configure the mailbox related registers. If a distributed clock is supported, configure the DC related registers. The master writes to the status control register to request the Pre-OP state.
Pre-OP	Application layer mailbox communication
Pre-OP To Safe-OP (PS)	The master uses the mailbox to initialize the process data mapping. The master configures the SM channel used for process data. The master configures the FMMU. The master writes to the state control register to request Safe-OP status.
Safe-OP	The application layer supports mailbox communication. There is process data communication, but only read-in data is allowed and no output signals are generated.
Safe-OP To Op (SO)	The master sends valid output data. The master writes to the state control register to request Op status.
Op	All inputs and outputs are valid.

A status overview is shown in table 4-3.

Table 4-3 EtherCAT status overview

State	Communication action		
	SDO	TxPDO	RxPDO
Init	NO	NO	NO

Pre-OP	YES	NO	NO
Safe-OP	YES	YES	NO
Op	YES	YES	YES

4.2.4 PDO (Process Data Object)

Cyclic process data is utilized for cyclic control data interaction between the master and slave. The servo drive uses the SM2 (0x1C12) channel to map RxPDO data and the SM3 (0x1C13) channel to map TxPDO data.

The servo drive supports five groups of PDO mapping, and each group of PDO supports up to 20 mapped objects. The first four groups of PDOs support remapping, and the fifth group of PDOs has fixed mapping (OMRON PLC is recommended). See Table 4-4 for details.

5个RPDO	1600h~1603h	Changeable mapping
	1604h	Fixed Mapping
5个TPDO	1A00h~1A03h	Changeable mapping
	1A04h	Fixed mapping

Table 4-4 Default configuration of PDO mapping for EtherCAT

PDO	Mapping object	PDO configuration
1600h (RPDO1) (9Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target position (607Ah)	607A0020
	Touch probe function (60B8h)	60B80010
1601h (RPDO2) (19Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target torque (6071h)	60710010
	Target position (607Ah)	607A0020
	Max. motor velocity (6080h)	60800020
	Touch probe function (60B8h)	60B80010
	Target velocity (60FFh)	60FF0020
1602h (RPDO3) (15Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Max. torque (6072h)	60720010
	Target position (607Ah)	607A0020
	Touch probe function (60B8h)	60B80010
	Target velocity (60FFh)	60FF0020
1603h (RPDO4) (21Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target torque (6071h)	60710010
	Max. torque (6072h)	60720010
	Target position (607Ah)	607A0020
	Max. motor velocity (6080h)	60800020
	Touch probe function (60B8h)	60B80010
	Target velocity (60FFh)	60FF0020
1604h (RPDO5) (23Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target torque (6071h)	60710010
	Target position (607Ah)	607A0020

PDO	Mapping object	PDO configuration
1604h (RPDO5) (23Byte)	Max. profile velocity (607Fh)	607F0020
	Touch probe function (60B8h)	60B80010
	Positive torque limit value(60E0h)	60E00010
	Negative torque limit value (60E1h)	60E10010
	Target velocity(60FF)	60FF0020
1A00h (TXPDO1) (25Byte)	Error code (603Fh)	603F0010
	Status word (6041h)	60410010
	Position actual value (6064h)	60640020
	Modes of operation display (6061h)	60610008
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Following error actual value (60F4h)	60F40020
	Digital inputs (60FDh)	60FD0020
	Servo internal error code (213Fh)	213F0010
1A01h (TXPDO2) (29Byte)	Error code (603Fh)	603F0010
	Status word (6041h)	60410010
	Modes of operation display (6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value ((606Ch)	606C0020
	Torque actual value (6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Touch probe pos1 neg value (60BBh)	60BB0020
	Digital inputs (60FDh)	60FD0020
1A02h (TXPDO3) (25Byte)	Error code (603Fh)	603F0010
	Status word (6041h)	60410010
	Modes of operation display (6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value (606Ch)	606C0020
	Torque actual value (6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Digital inputs (60FDh)	60FD0020
1A03h (TXPDO4) (25Byte)	Error code (603Fh)	603F0010
	Status word (6041h)	60410010
	Modes of operation display (6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value (606Ch)	606C0020
	Torque actual value (6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Digital inputs (60FDh)	60FD0020

PDO	Mapping object	PDO configuration
1A04h (TXPDO5) (33Byte)	Status word (6041h)	60410010
	Modes of operation display (6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value (606Ch)	606C0020
	Torque actual value (6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Touch probe pos2 pos value (60BCh)	60BC0020
	Following error actual value (60F4h)	60F40020
	Error code (603Fh)	603F0010
	Digital inputs (60FDh)	60FD0020

4.2.4.1 Sync Manager PDO assign object

Only one RxPDO and one TxPDO configuration are supported in the X5E drive. As shown in Table 4-5:

Table 4-5 Servo drive EtherCAT-supported PDO

Index	Sub-index	Mapping object
0x1C12	0	Any group of RxPDO 1600~1604
0x1C13	0	Any group of TxPDO 1A00~1A04

4.2.4.2 PDO mapping management

The PDO mapping content contains the information needed to receive or send PDOs, including index, subindex, and data length. Sub-index 0 indicates the number of PDO mapping objects, sub-index 1 to N indicates the content represented by the 1st to Nth elements of the PDO, each PDO mapping object can map at most one data object containing 4 bytes, and a PDO can contain at most 4*n data lengths.

The mapping content consists of 2 bytes for the index of the object, one byte for the sub-index, and one byte for the data length, as shown in Table 4-6 below:

Table 4-6 Mapping content structure

Byte	Byte 3~2	Byte 1	Byte 0
Meaning	Index	Sub-index	Data length

The index and sub-index determine the position of the object in the object dictionary. The data length indicates how many bits make up the object. The length information is typically categorized as byte (8 bits), word (16 bits), and double word (32 bits), representing the actual length of the object in a hexadecimal string.

Object length	Bit length
08h	8bit
10h	16bit
20h	32bit

For example, an object mapping content of 60400010h means that the index of the object is 0x6040, the sub-index is 0x00, and the length is 16bit i.e. one word.

4.2.5 SDO (Service data object)

SDO parameters are CoE-defined non-cyclic data communications. The master achieves non-cyclic data interactions through the read/write mailbox data SM channel. The X5E drive can modify drive parameters through SDO.

4.2.6 Distributed clock (DC)

The DC enables all EtherCAT setting to have the same system time, thus controlling the synchronized execution of tasks for each device. Slave devices can be used to trigger synchronized data updates from each slave simultaneously based on a synchronization signal generated by the synchronized system clock. The X5E drive supports synchronized clock modes, currently the SYNC0-generated synchronization signal mode and Free Run mode.

4.2.7 CiA402 control process introduction

The state machine associated with the power control of the servo drive is shown in Figure 4-3 below.

The power states for each phase of the PDS state machine are shown in Table 4-27 below.

Table 4-27 PDS state machine power states for each phase

PDS Phase	Control power	Power supply	Drive status
Phase 1	OK	NO	NO
Phase 2	OK	OK	NO
Phase 3	OK	OK	OK

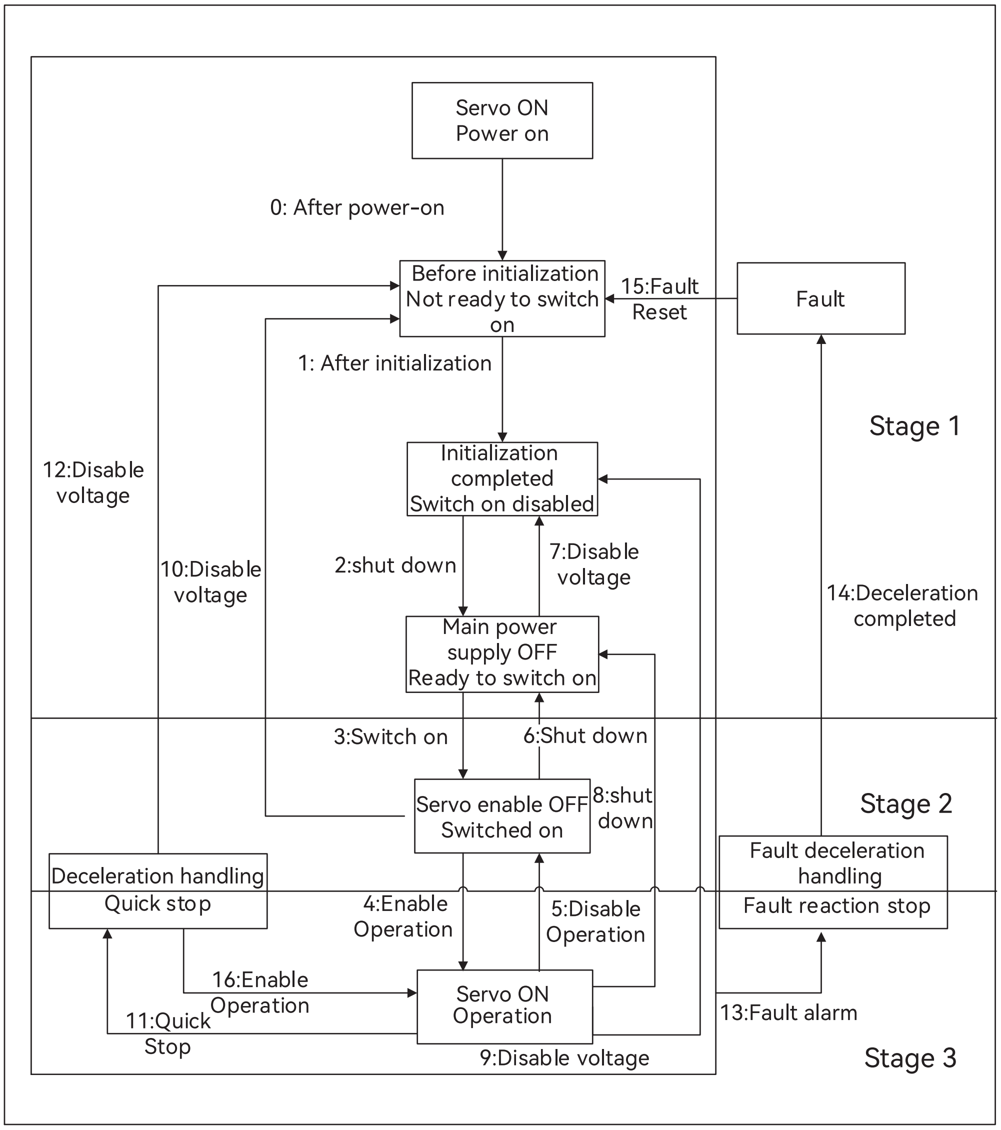


Figure 4-3 CiA402 control process state machine

4.2.8 EtherCAT slave address setting

EtherCAT slave address is set in parameter P09.18.

When P09-18 is set to 0, the slave ALIAS address is determined by the address written to ESC by the host device, and for other values ALIAS is determined by the value of P09-18 for the slave address. The ALIAS address is ignored when the host device uses automatic incremental addressing.

Users can manually set the servo parameter P09.18 (2109-13h) with servo operation panel or the host device software Servo Studio. In the same network, the same node address is not allowed.

4.2.9 ESI file

The ESI file (or XML form) records the information of the X5EB servo drive EtherCAT slave, and the master generates ENI according to the ESI, and then constitutes the EtherCAT network. For common PLC controllers (e.g. Beckhoff and OMRON etc.), the ESI file (or XML form) provided by HCFA needs to be saved in the folder specified by the master first in order to have normal communication.

Chapter 5 Modes of operation

When using the X5EB servo drive, it is sometimes necessary to manually configure the servo drive parameters and set the control mode through the servo drive operation panel or the upper device software HCS Studio, as shown in Table 5-1 below.

Table 5-1 Pre-setting for using X5E servo drive

Address	Name	Parameter content	Default
P00.01 (2100-02h)	Modes of operation	0: Position mode 1: Speed mode 2: Torque mode 7: EtherCAT mode	7
P09.18 (2109-13h)	EtherCAT servo station number address	0~65535	0

5.1 Profile position mode (PP)

In the profile position mode, the drive controls the motor for both absolute and relative position positioning. The host device can set the target position, start speed, stop speed, and acceleration (deceleration) speed. When the PP mode is enabled, set object 6060H to 1.

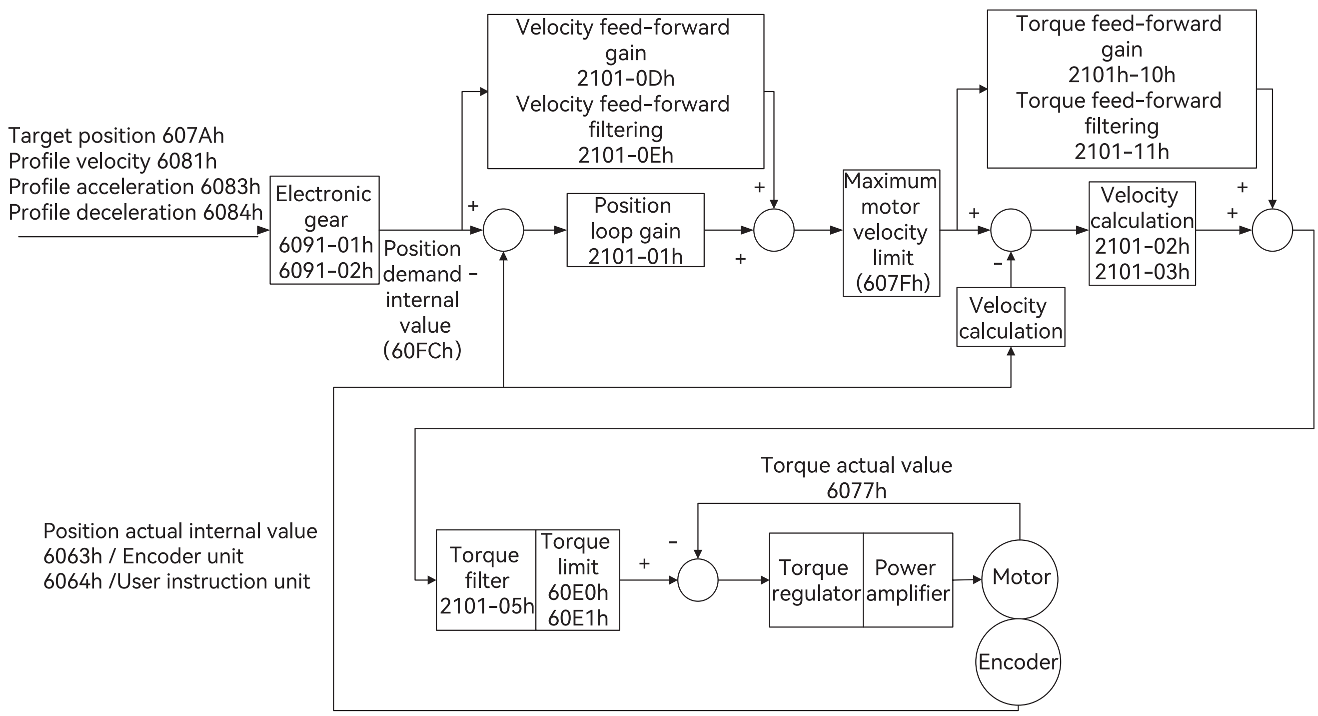


Figure 5-1 Control block diagram of the PP mode

E

• Modes of operation

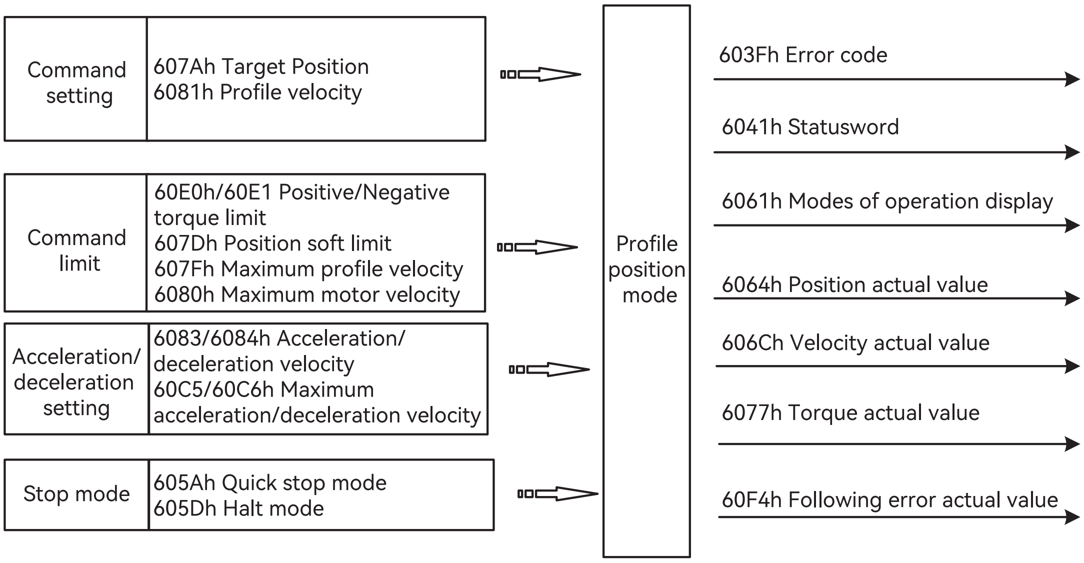


Figure 5-1 Input and output of the PP mode

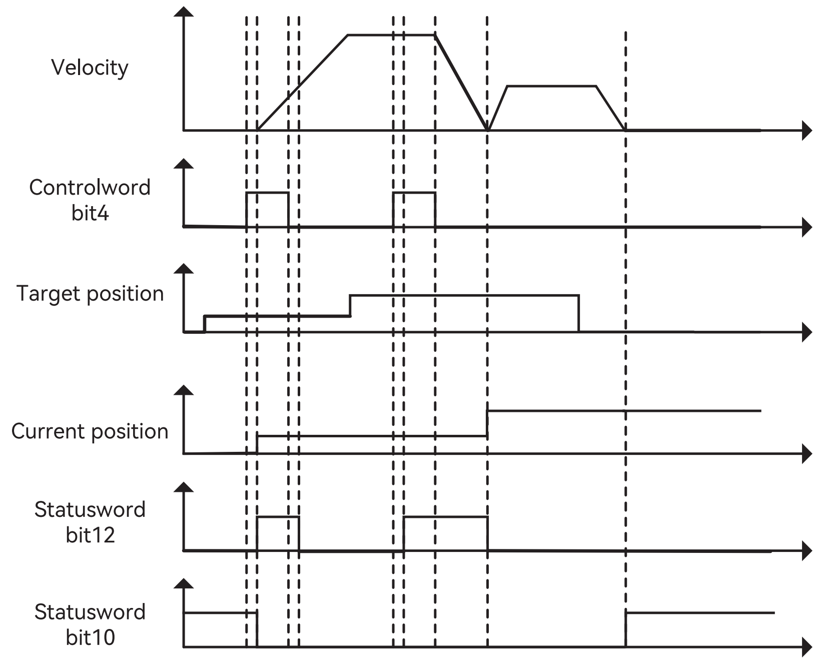
5.1.1 Controlword setting in the PP mode

The meaning of each bit of Controlword (6040h) in the PP mode is shown in Table 5-2 where the background is marked in dark color for the PP-specific control commands.

Table 5-2 Controlword description in the PP mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1
2	Quick stop	Servo enable must be set to 1 Set to 0 to enable quick stop
3	Operation enable	Servo enable must be set to 11
4	Update position instruction	In 0 → 1 change, load the next set of position instruction parameters (including target position or position increment, start speed, running speed, acceleration and deceleration speed)
5	Immediate update	0: Wait for the current position instruction to finish execution before executing a new instruction 1: Abort the instruction being executed and execute the latest position instruction
6	Position instruction type	0: Absolute instruction 1: Relative position instruction
7	Fault reset	In 0 → 1 change, one fault reset is executed; if multiple resets are required, multiple 0 → 1 changes are generated. When this position is equal to 1, other control instructions are invalid
8	Pause	0: Invalid 1: Valid. Stop executing the instruction when it is valid
9	PP mode reserved	Unavailable
10	Reserved	Unavailable
11~15	Manufacturer customization	Unavailable

When 6040h Controlword bit5 is 0, if the positioning data in the action is changed, it will wait until the current position instruction is executed before executing the new instruction as follows:



When 6040h Controlword bit5 is 1, if the positioning data in the action is changed, the instruction being executed is aborted and the latest instruction is executed immediately as follows:

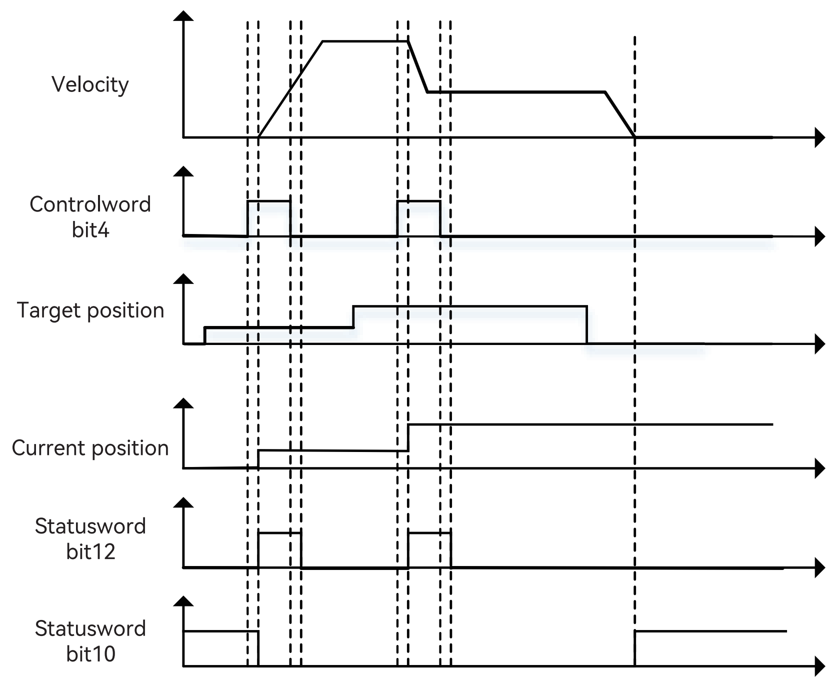


Figure 5-2 Instruction and status update illustration in PP mode

5.1.2 Statusword setting in the PP mode

The meaning of each bit of Statusword (6041h) in the PP mode is shown in Table 5-3 where the background is marked in dark color for the PP-specific control commands.

Table 5-3 Statusword description in the PP mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
2	Operation enabled	0: Invalid 1: Valid When valid, it means the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable
9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect.
10	Position arrival	60400010h bit 8 (pause)=0, 0: Position is not reached 1: Position is reached 60400010h bit 8 (pause) = 1 0: Deceleration in progress 1: Speed=0
11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached
12	New position instruction reception status	0: Position instruction can be updated 1: Position instructions cannot be updated
13	Position deviation error	0: Position deviation value is within the set range (6065h) 1: Position deviation value exceeds the set range (6065h)
14	Manufacturer customization	Unavailable
15	Homing completed	0: Invalid 1: Homing completed For absolute value system, after setting the second digit from the right of the hexadecimal value of P09.14 to 2, the value of bit15 will be stored after a successful homing (power-down holding), and the stored value can be cleared by setting P20.06 to 7.

5.1.3 Object dictionary list in the PP mode

A list of the dictionary objects involved in the PP mode is shown in Table 5-4.

Table 5-4 Object dictionary related to the PP mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6062h		Position demand value	ro	integer32	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
6065h		Following error window	rw	unsigned32	1000000
6067h		Position window	rw	unsigned32	100
6068h		Position window time	rw	unsigned16	1
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
607Ah		Target position	rw	integer32	0
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min. software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
607Eh		Polarity	rw	unsigned8	0
6081h		Profile velocity	rw	unsigned32	100
6083h		Profile acceleration	rw	unsigned32	100
6084h		Profile deceleration	rw	unsigned32	100
60F4h		Following error actual value	ro	integer32	0
60FCh		Position demand internal value	ro	integer32	0

5.1.4 Example of using the PP mode

The host device is connected to the servo drive. When running the host device, the startup and operation procedure of the PP mode is shown in the table below.

Table 5-6 The startup and operation procedure of the PP mode

Address	Name	Value setting (decimal value)
60600008h	Modes of operation	1
607A0020h	Position setting	User setting
60810020h	Speed setting	Default gear ratio 1:1, write 1310720 for 600rpm
60400010h Controlword	Enable	Any number → 6 → 7 → 15
	Alarm clearing	Any number → 128 (valid at the rising edge, clear if possible)
	Absolute position setting (non-immediate update)	6 → 7 → 15 → 31
	Absolute position setting (immediate update)	6 → 7 → 47 → 63
	Relative position setting (non-immediate update)	6 → 7 → 79 → 95

60400010h Controlword	Relative position setting (immediate update)	6 → 7 → 111 → 127
60830020h	Profile acceleration	Default value 13107200 Instruction unit/s^2
60840020h	Profile deceleration	Default value 131072000 Instruction unit/s^2

5.2 Profile velocity mode (PV)

In the profile velocity mode, the host device can set the target speed and acceleration (deceleration) speed. When the PV mode is enabled, set the object 6060H to 3. See Figure 5-3 and Figure 5-4 for the control block diagram and input and output.

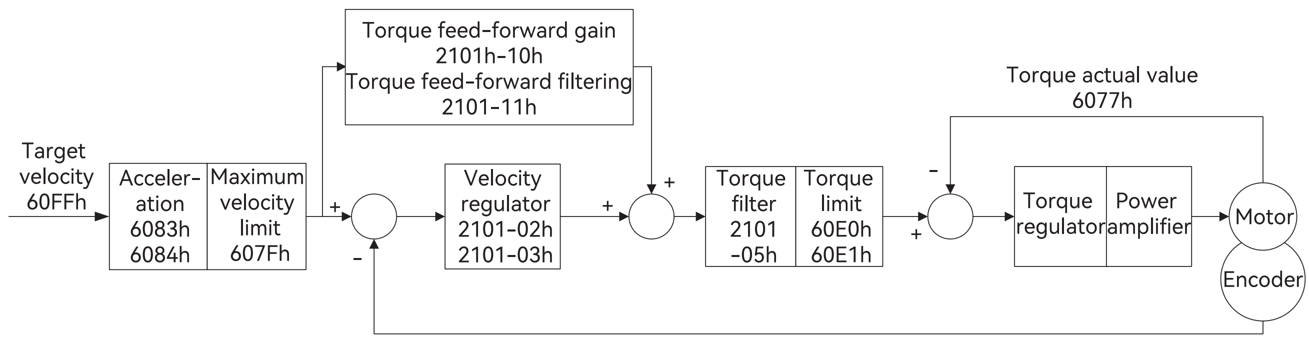


Figure 5-3 Control block diagram of the PV mode

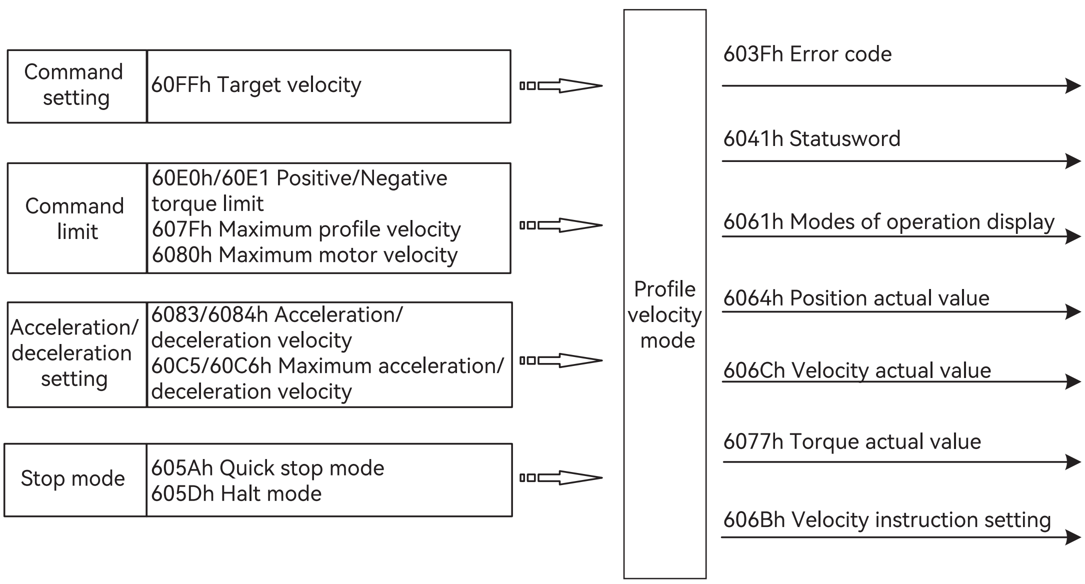


Figure 5-4 Input and output of the PV mode

5.2.1 Controlword setting in the PV mode

The meaning of each bit of Controlword (6040h) in the PV mode is shown in Table 5-7 where the background is marked in dark color for the PV-specific control commands.

Table 5-7 Controlword description in the PV mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1
2	Quick stop	Servo enable must be set to 1 Set to 0 to enable quick stop
3	Operation enable	Servo enable must be set to 1

4 ~ 6	PV mode reserved	Unavailable
7	Fault reset	In 0 → 1 change, one fault reset is executed; if multiple resets are required, multiple 0 → 1 changes are generated. When this position is equal to 1, other control instructions are invalid.
8	Pause	0: Invalid 1: Valid Stop executing the instruction when it is valid.
9	PV mode reserved	Unavailable
10	Reserved	Unavailable
11~15	Manufacturer customization	Unavailable

5.2.2 Statusword setting in the PV mode

The meaning of each bit of Statusword (6041h) in the PV mode is shown in Table 5-8 where the background is marked in dark color for the PV-specific control commands.

Table 5-8 Statusword description in the PV mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid, 1: Valid. When valid, it means that the servo can be enabled
2	Operation enabled	0: Invalid 1: Valid When valid, it means that the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid. When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable
9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect.
10	Position arrival	60400010h bit 8 (pause)=0, 0: position is not reached 1: position is reached 60400010h bit 8 (pause) = 1 0: Deceleration in progress 1: Speed=0
11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached

12	Zero velocity status	0: Velocity is not equal to 0, 1: Velocity is equal to 0
13	PV mode reserved	Unavailable
14 ~ 15	Manufacturer customization	Unavailable

5.2.3 Object dictionary list in the PV mode

A list of the dictionary objects involved in the PV mode is shown in Table 5-9.

Table 5-9 Object dictionary related to the PV mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
606Dh		Velocity window	rw	unsigned16	100
606Eh		Velocity window time	rw	unsigned16	1
606Fh		Velocity threshold	rw	unsigned16	10
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min. software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
607Eh		Polarity	rw	unsigned8	0
6083h		Profile acceleration	rw	unsigned32	13107200
6084h		Profile deceleration	rw	unsigned32	13107200
6094h	01h	Velocity encoder factor: numerator	rw	unsigned32	1
	02h	Velocity encoder factor: denominator	rw	unsigned32	1
60C5h		Max. acceleration	rw	unsigned32	1000000000
60C6h		Max. deceleration	rw	unsigned32	1000000000
60FFh		Target velocity	rw	integer32	0

5.2.4 Example of using the PV mode

1. Set servo drive parameters for running the host device, the startup and operation procedure of the PV mode is shown in the table below.

Table 5-11 The startup and operation procedure of the PV mode

Address	Name	Value setting (decimal value)
60600008h	Modes of operation	3
60FF0020h	Speed setting	Default gear ratio 1:1, write 1310720 (instruction unit/s) for 600rpm
60400010h Controlword	Enable	Any number → 6 → 7 → 15
	Alarm clearing	Any number → 128 (valid at the rising edge, clear if possible)
	Motor rotation	After the speed instruction is set and enabled, the motor rotates.
60830020h	Profile acceleration	Default value 13107200 Instruction unit/s^2
60840020h	Profile deceleration	Default value 131072000 Instruction unit/s^2

5.3 Profile torque mode (PT)

In the profile torque mode, the host device can set the target torque and rate of change of torque instruction (torque slope). When the PT mode is enabled, set the object 6060H to 4. See Figure 5-5 and Figure 5-6 for the control block diagram and input and output.

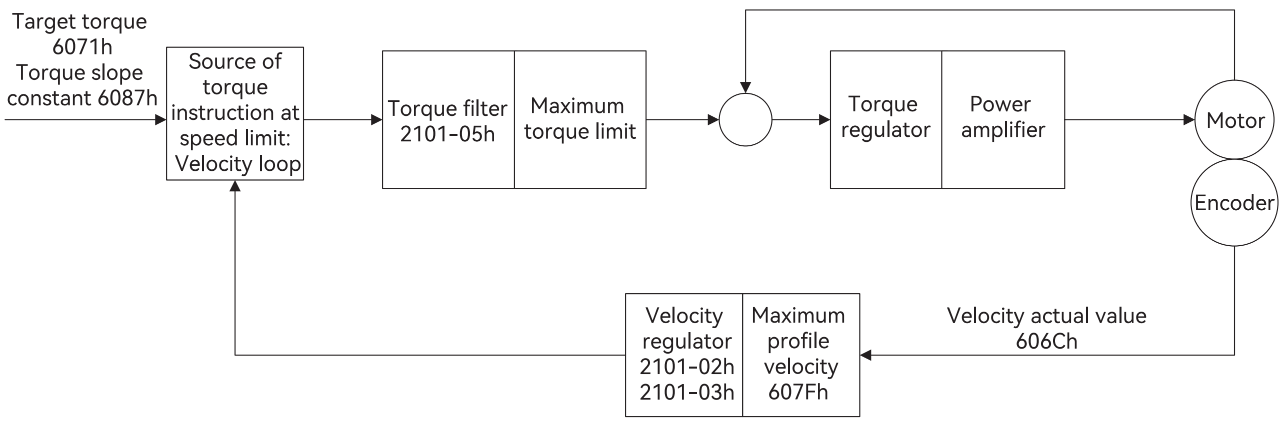


Figure 5-5 Control block diagram of the PT mode

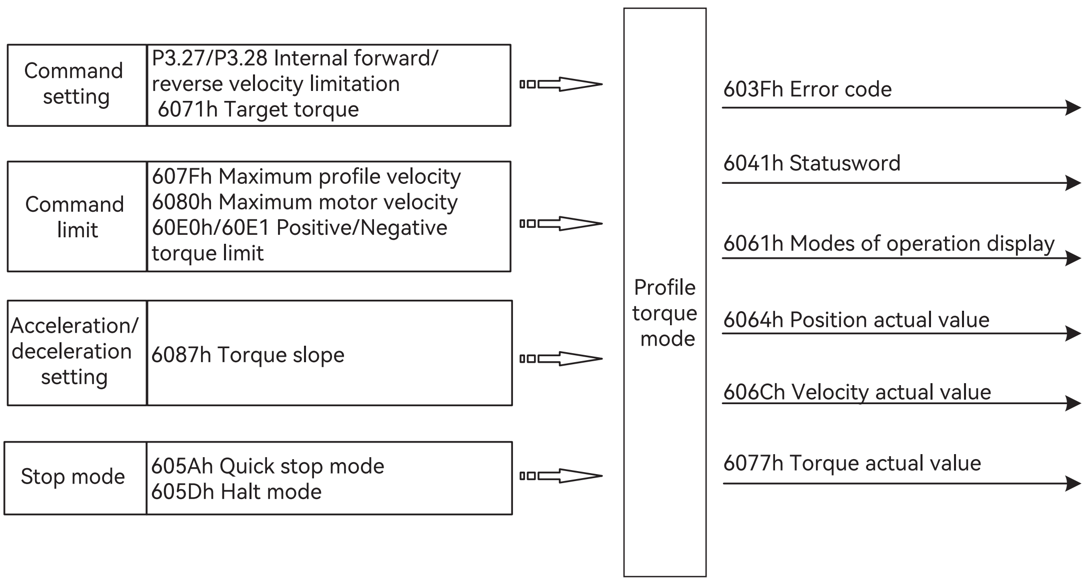


Figure 5-6 Input and output of the PT mode

5.3.1 Controlword setting in the PT mode

The meaning of each bit of Controlword (6040h) in the PT mode is shown in Table 5-12 where the background is marked in dark color for the PT-specific control commands.

Table 5-12 Controlword description in the PT mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1
2	Quick stop	Servo enable must be set to 1 Set to 0 to enable quick stop
3	Operation enable	Servo enable must be set to 1
4 ~ 6	PT mode reserved	Unavailable

7	Fault reset	In 0 → 1 change, one fault reset is executed; if multiple resets are required, multiple 0 → 1 changes are generated. When this position is equal to 1, other control instructions are invalid.
8	Pause	0: Invalid 1: Valid Stop executing the instruction when it is valid.
9	PT mode reserved	Unavailable
10	Reserved	Unavailable
11~15	Manufacturer customization	Unavailable

5.3.2 Statusword setting in the PT mode

The meaning of each bit of Statusword (6041h) in the PT mode is shown in Table 5-13 where the background is marked in dark color for the PT-specific control commands.

Table 5-13 Statusword description in the PT mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
2	Operation enabled	0: Invalid 1: Valid When valid, it means that the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable
9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect.
10	Position arrival	0: Torque is not reached 1: Torque is reached
11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached
12、13	PT mode reserved	Unavailable
14、15	Manufacturer customization	Unavailable

The 6041h statusword Bit10 torque arrival is related to the P04.55 and P04.56 parameter setting:

When the torque feedback (absolute value) ≥ P04.55 + P04.56, the torque arrival signal is output and bit10 is set to 1.

When torque feedback (absolute value) <P04.55-P04.56×0.25, torque arrival signal is not output and bit10 is cleared to 0.

5.3.3 Object dictionary list in the PT mode

A list of the dictionary objects involved in the PT mode is shown in Table 5-14.

Table 5-14 Object dictionary related to the PT mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
606Ch		Velocity actual value	ro	integer32	0
6071h		Target torque	rw	integer16	1000
6074h		Torque demand value	ro	integer16	0
6077h		Torque actual value	ro	integer16	0
607Dh	01h	Min. software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
6080h		Max. motor velocity	rw	unsigned32	5000
6087h		Torque slope	rw	unsigned32	0

5.3.4 Example of using the PT mode

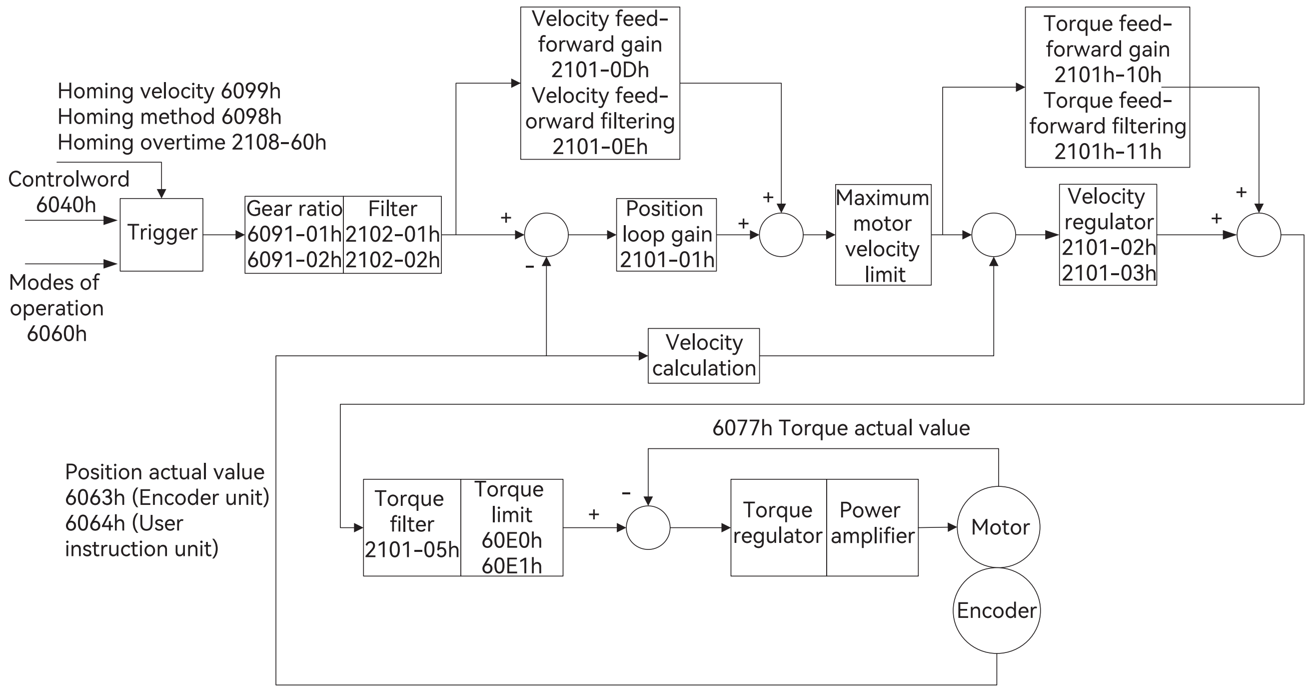
1. Set servo drive parameters for running the host device, the startup and operation procedure of the PT mode is shown in the table below.

Table 5-16 The startup and operation procedure of the PT mode

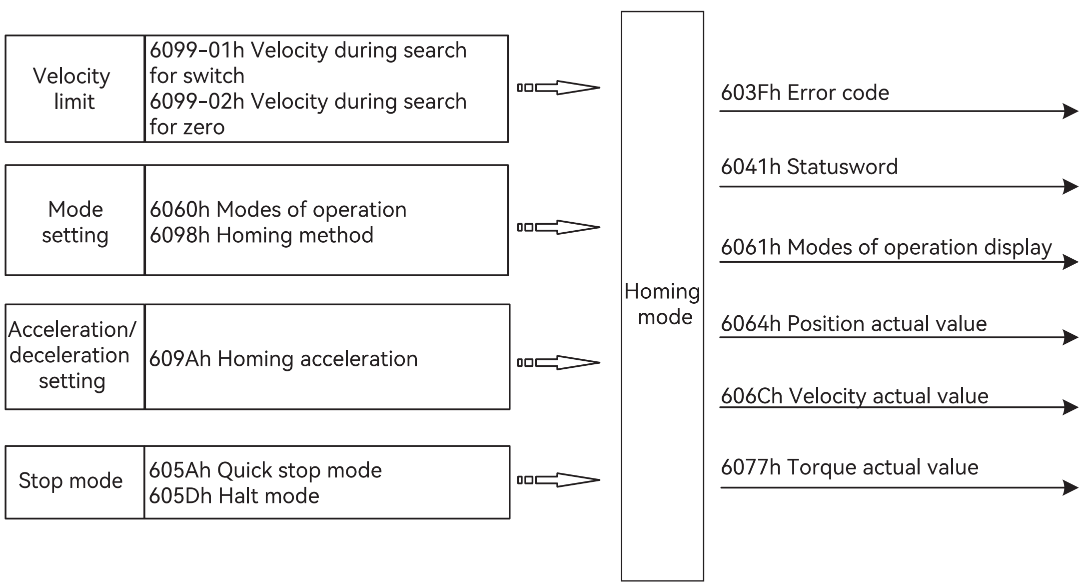
Address	Name	Value setting (decimal value)
60600008h	Modes of operation	4
60800020h	Speed setting	User setting
60710010h	Profile torque setting	User setting
60400010h Controlword	Enable	Any number → 6 → 7 → 15
	Alarm clearing	Any number → 128 (valid at the rising edge)
	Motor rotation	Enable after giving instructions
60870020h	Torque slope	User setting (acceleration and deceleration in torque mode)

5.4 Homing mode (HM)

The CiA402 protocol defines 31 ways of homing according to the origin switch signal, limit switch signal and encoder Z signal. To enable this mode, set object 6060H to 6.



Homing mode control block diagram



Input and output of homing mode

5.4.1 Controlword setting in the HM mode

The meaning of each bit of Controlword (6040h) in the HM mode is shown in Table 5-17 where the background is marked in dark color for the HM-specific control commands.

Table 5-17 Controlword description in the HM mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1

2	Enable voltage	Servo enable must be set to 1 Set to 0 to enable quick stop
3	Operation enable	Servo enable must be set to 1
4	Homing enable	0: Invalid 1: Valid When valid, the homing process is started, and must be kept valid throughout the process. Switching to invalid will stop the homing process.
5、6	Homing mode reserved	Unavailable
7	Fault reset	In 0 → 1 change, one fault reset is executed. When this position is equal to 1, other control instructions are invalid
8	Pause	0: Invalid 1: Valid Stop executing the instruction when it is valid.
9	HM mode reserved	Unavailable
10	Reserved	Unavailable
11~15	Manufacturer customization	Unavailable

5.4.2 Statusword setting in the HM mode

The meaning of each bit of Statusword (6041h) in the HM mode is shown in Table 5-18 where the background is marked in dark color for the HM-specific control commands.

Table 5-18 Statusword description in the HM mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
2	Operation enabled	0: Invalid 1: Valid When valid, it means that the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable
9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect.

10	Position arrival	60400010h bit 8 (pause)=0, 0: Position is not reached 1: Position is reached 60400010h bit 8 (pause)=1, 0: Deceleration in progress 1: Speed=0
11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached
12	Homing completion output	0: Homing is not completed 1: Homing is completed
13	Homing error	0: No error 1: Error
14	Manufacturer customization	Unavailable
15	Homing completed	0: Invalid 1: Homing completed For absolute value system, after setting the second digit from the right of the hexa-decimal value of P09.14 to 2, the value of bit15 will be stored after a successful homing (power-down holding), and the stored value can be cleared by setting P20.06 to 7.

5.4.3 Object dictionary list in the HM mode

A list of the dictionary objects involved in the HM mode is shown in Table 5-19.

Table 5-19 Object dictionary related to the HM mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6062h		Position demand value	ro	integer32	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
6065h		Following error window	rw	unsigned32	1000000000
6067h		Position window	rw	unsigned32	100
6068h		Position window time	rw	unsigned16	1
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min. software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
6098h		Homing mode	rw	integer8	0
6099h	01h	Velocity of searching for deceleration point signals in the HM mode	rw	unsigned32	218453
	02h	Velocity of searching for origin switch signals in the HM mode	rw	unsigned32	21845
609Ah		Homing acceleration	rw	unsigned32	1310720

5.4.4 Example of using the HM mode

1. Set X5E servo drive parameters, configure homing DI-related parameters for running the host device (the fourth group of parameters: digital input and output, specific reference to chapter 7.2, where P6.28 = 0). The startup and operation procedure of the HM mode is shown in the table below.

Table 5-21 The startup and operation procedure of the HM mode

Address	Name	Value setting (decimal value)
60600008h	Modes of operation	6
60980008h	Homing mode	1~35
60400010h Controlword	Alarm clearing	Any number → 128 (valid at the rising edge)
	Homing	6 → 7 → 15 → 31 (Homing enable BIT4valid at the rising edge)
60990120h	Velocity of searching for deceleration point signals in the HM mode	Default: 218453 (instruction unit/s)
60990220h	Velocity of searching for origin switch signals in the HM mode	Default: 21845 (instruction unit /s)
609A0020h	Homing acceleration	Default: 1310720 (instruction unit /s^2)

5.4.5 Homing mode introduction

The CiA402 internally defines 31 homing modes, as described in Table 5-22 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 5-22.

Table 5-22 List of supported homing modes

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.

Homing mode	Description
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.

Homing mode	Description
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

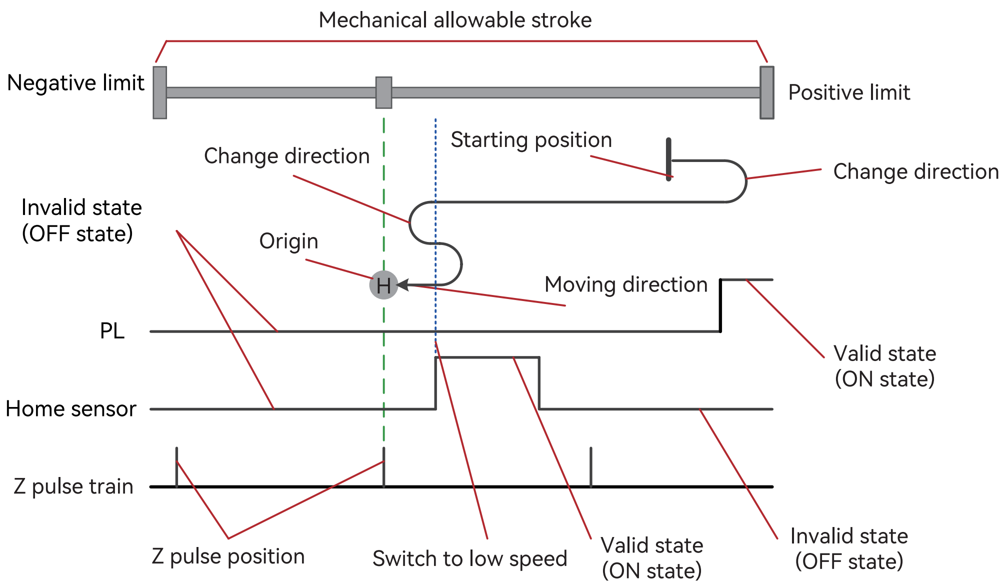


Figure 5-8 The meaning of the various symbols in the homing mode illustration

Generally, it is recommended to apply homing modes 3~6, 19~22, to situations where the OFF/ON state of the HSW exactly divides the entire mechanical allowable travel range into two sections, because under these 8 modes, whenever NL or PL is encountered, it stops and alarms, and does not automatically reverse to find the origin.

It is recommended that the homing modes 7~14 and 23~30 be applied in the case where the ON state of HSW divides the entire allowable travel range of the machine into exactly three sections, where the ON state interval occupies only 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 are only suggestions and are not mandatory.

1. Mode 1, find NL 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 5-9, refer to Table 5-22.

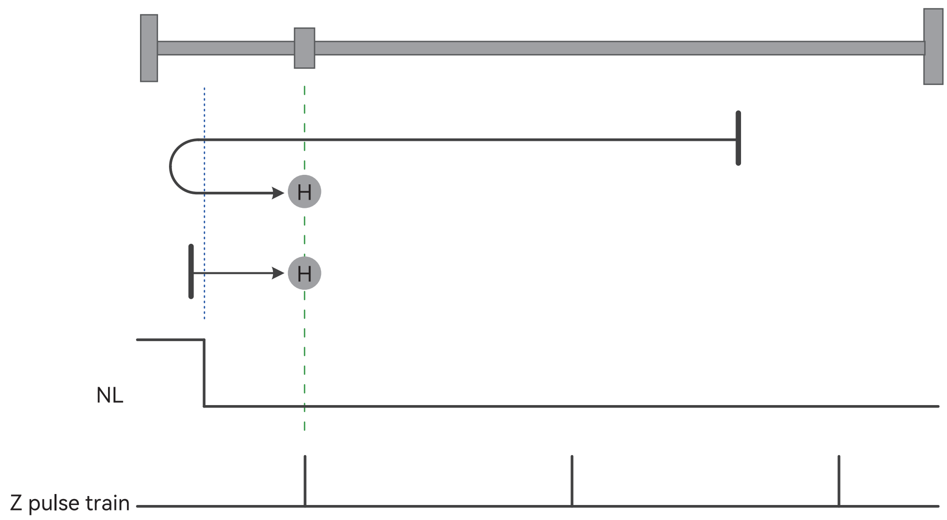


Figure 5-9 Homing mode 1 trajectory and signal state

2. Mode 2, find a 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 5-10, refer to Table 5-22.

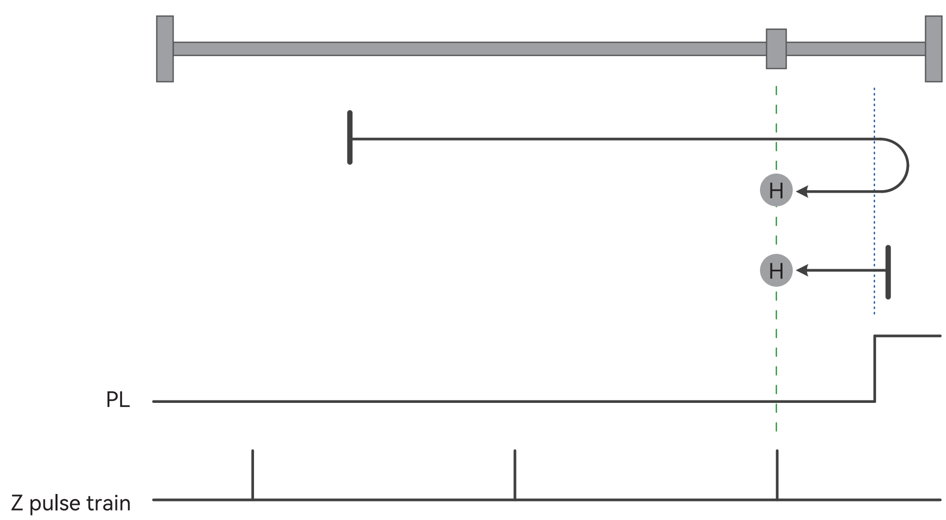


Figure 5-10 Homing mode 2 trajectory and signal state

E • Modes of operation

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, stop the homing process and alarm.

As shown in Figure 5-11, refer to Table 5-22.

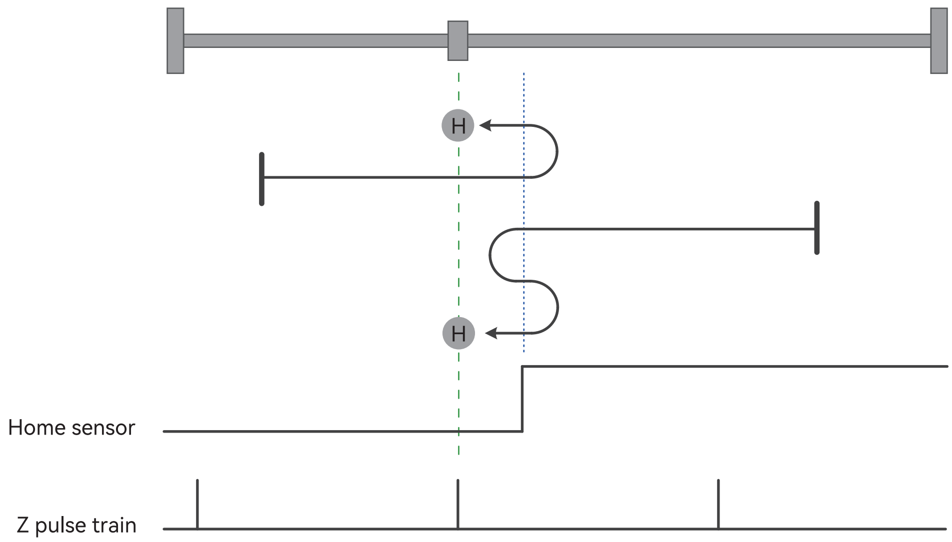


Figure 5-11 Homing mode 3 trajectory and signal state

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 a 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 a 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 the ON state, stop the homing process and alarm.

As shown in Figure 5-12, refer to Table 5-22.

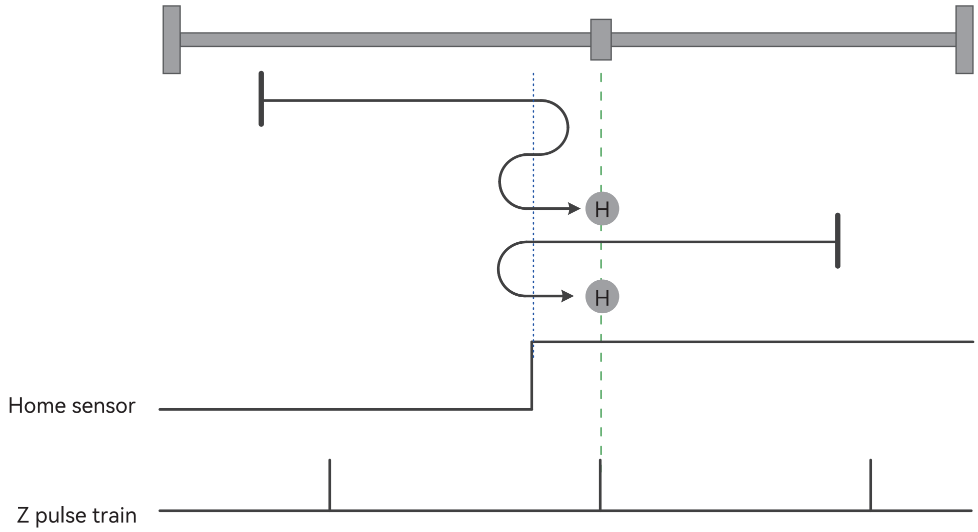


Figure 5-12 Homing mode 4 trajectory and signal state

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 5-13, refer to Table 5-22.

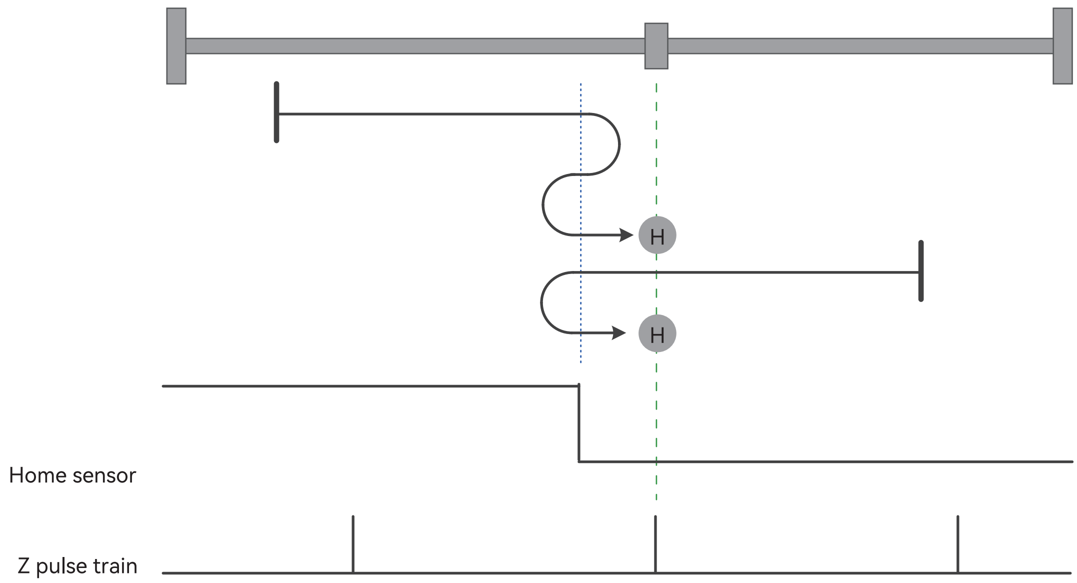


Figure 5-13 Homing mode 5 trajectory and signal state

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 5-14, refer to Table 5-22.

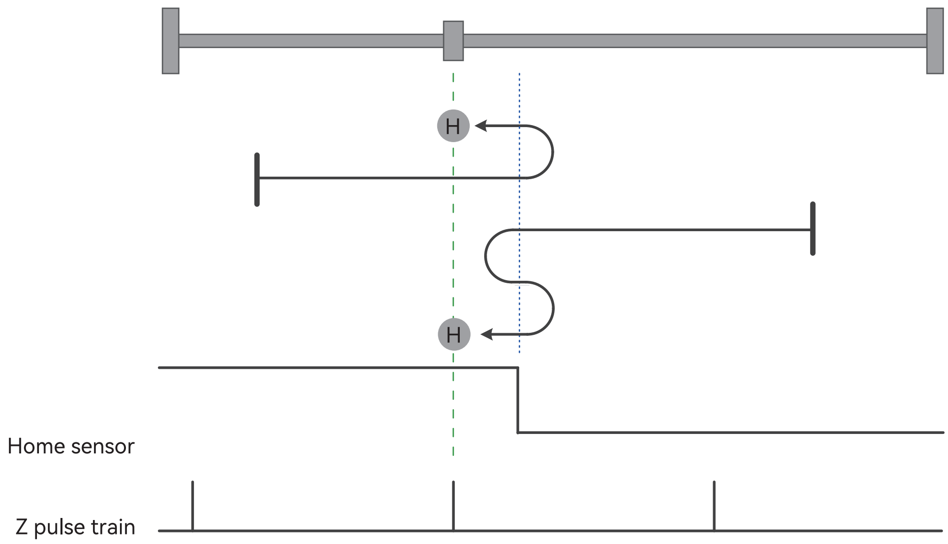


Figure 5-14 Homing mode 6 trajectory and signal state

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

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, stop the homing process and alarm.

As shown in Figure 5-15, refer to Table 5-22.

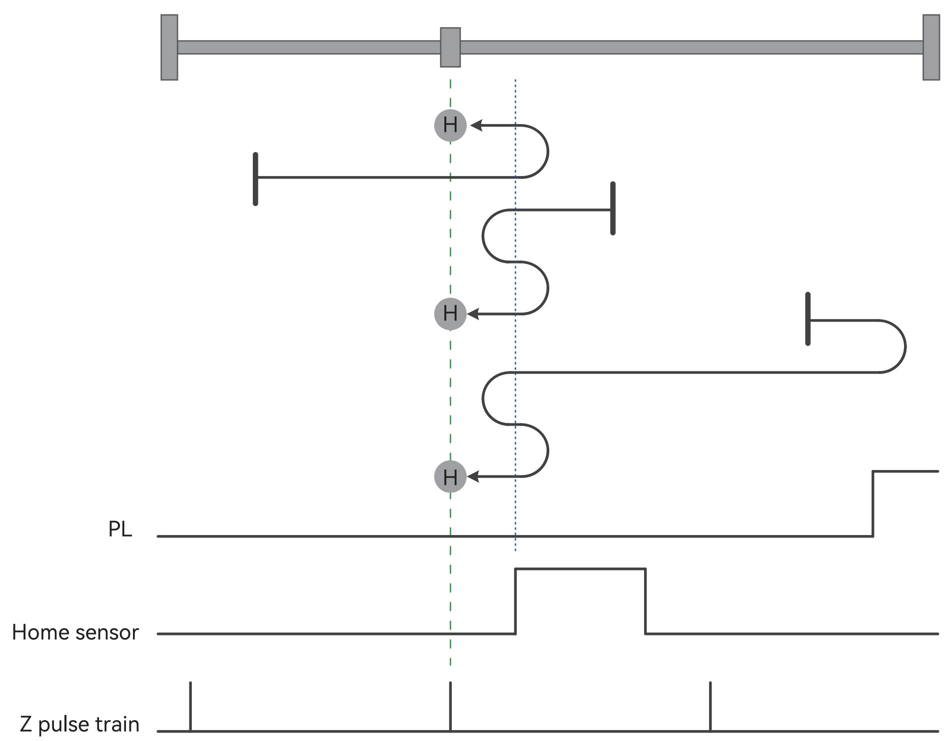


Figure 5-15 Homing mode 7 trajectory and signal state

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

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 5-16, refer to Table 5-22.

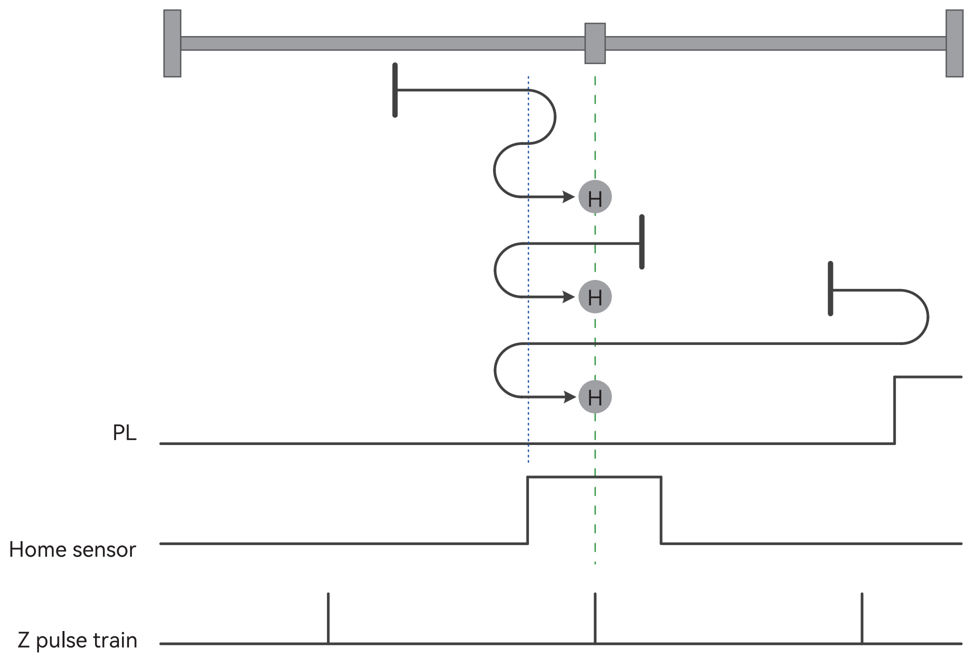


Figure 5-16 Homing mode 8 trajectory and signal state

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

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 5-17, refer to Table 5-22.

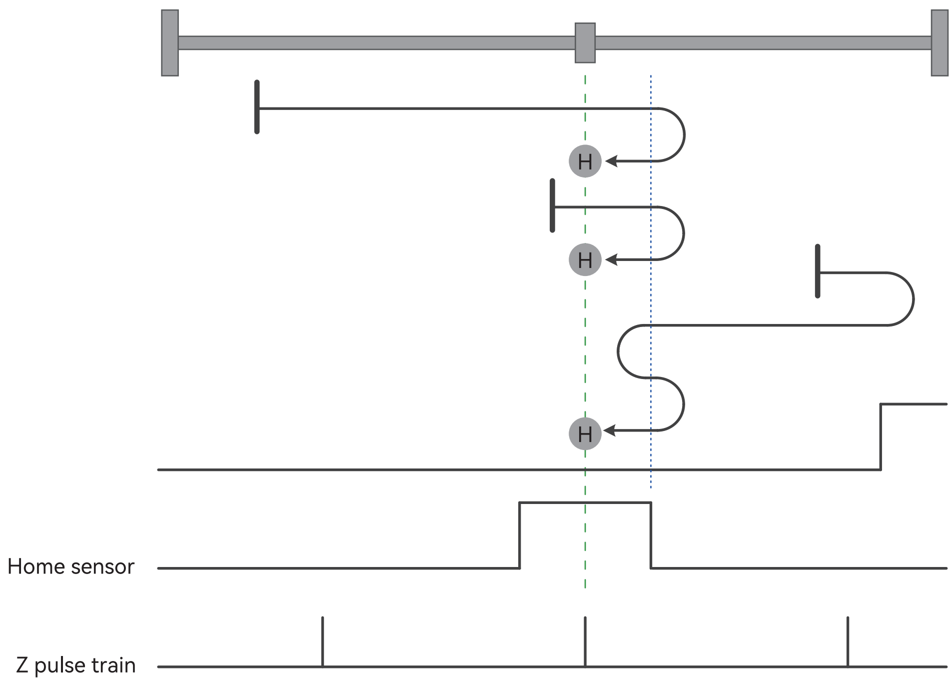


Figure 5-17 Homing mode 9 trajectory and signal state

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

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 5-18, refer to Table 5-22.

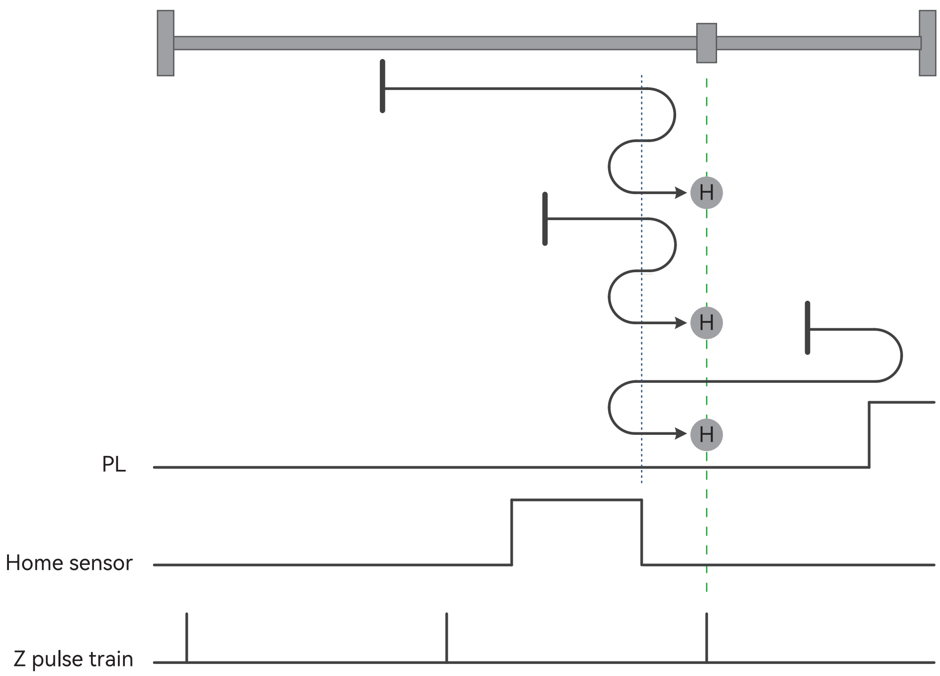


Figure 5-18 Homing mode 10 trajectory and signal state

11. Mode 11, find the HSW ON → OFF position and Z pulse when running in a positive direction and automatically reverse when 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 5-19, refer to Table 5-22.

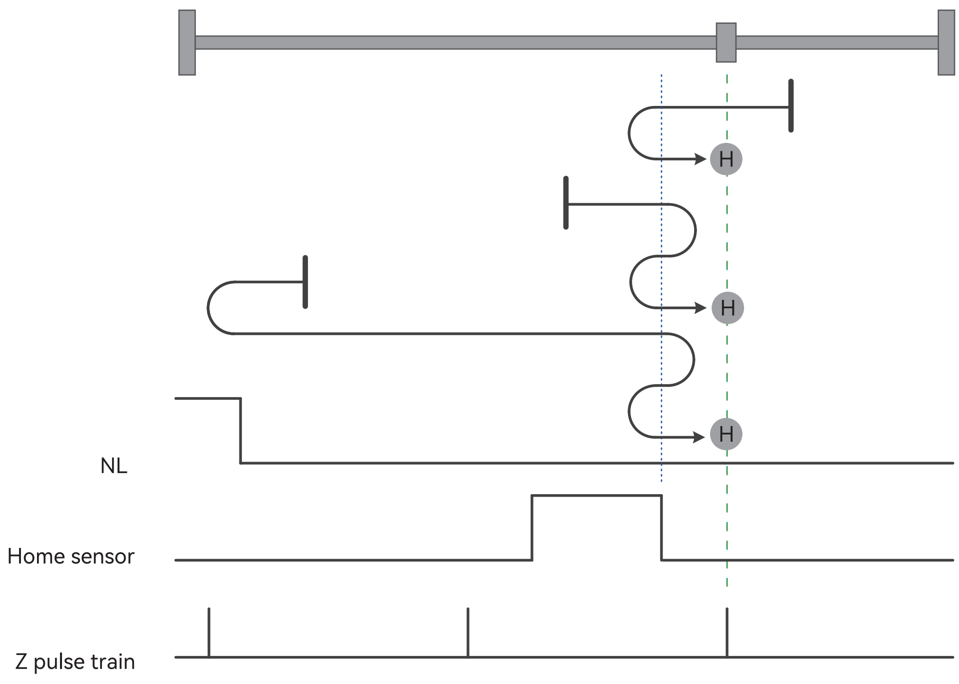


Figure 5-19 Homing mode 11 trajectory and signal state

12. Mode 12, find the HSW OFF → ON position and Z pulse when running in a negative direction and automatically reverse when 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 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 5-20, refer to Table 5-22.

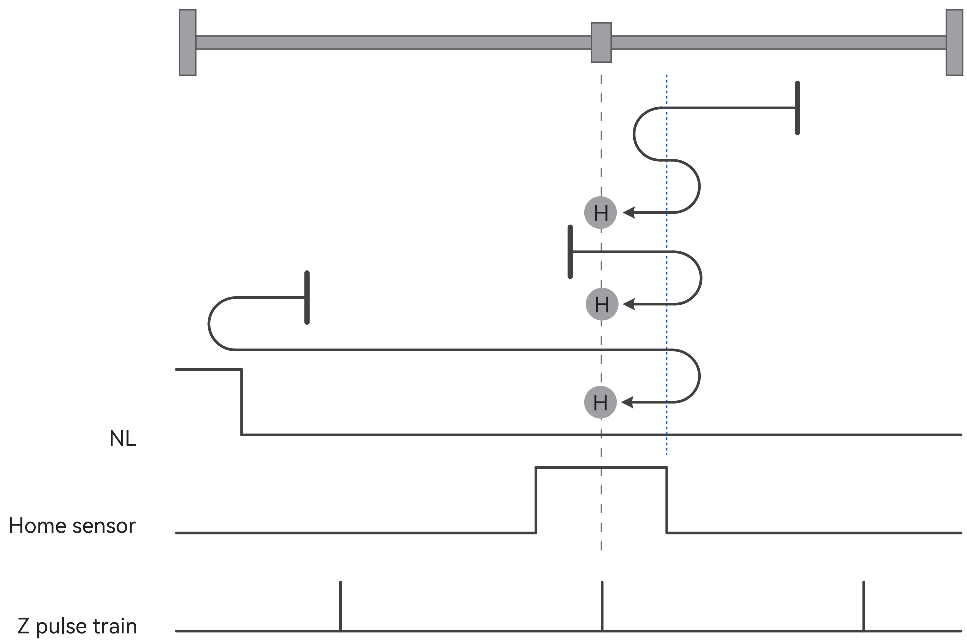


Figure 5-20 Homing mode 12 trajectory and signal state

13. Mode 13, find the HSW OFF → ON position and Z pulse when running in a positive direction and automatically reverse when 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 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 5-21, refer to Table 5-22.

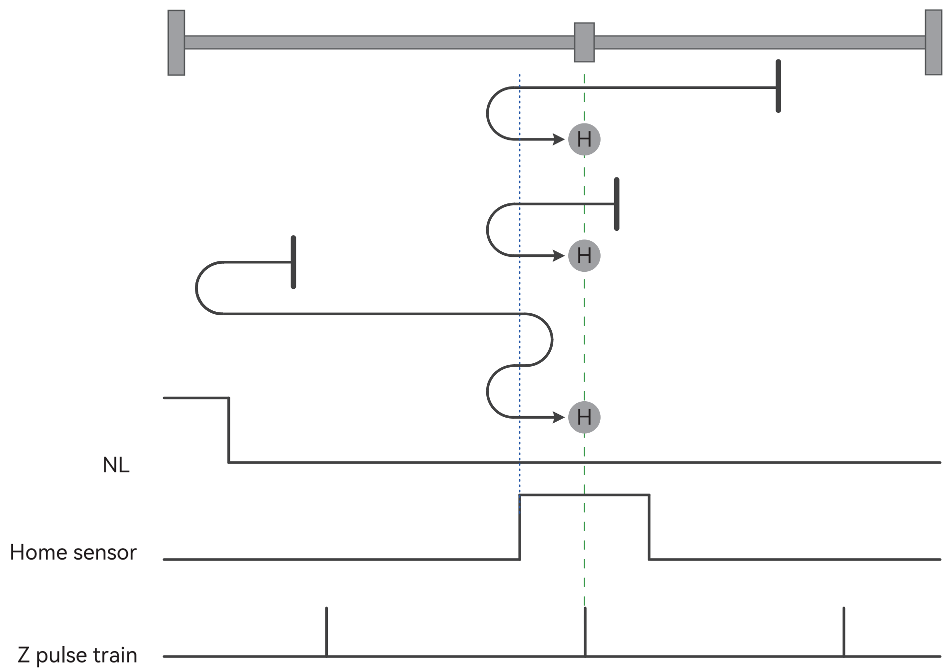


Figure 5-21 Homing mode 13 trajectory and signal state

14. Mode 14, find the HSW ON → OFF position and Z pulse when running in a negative direction and automatically reverse when 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 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 5-22, refer to Table 5-22.

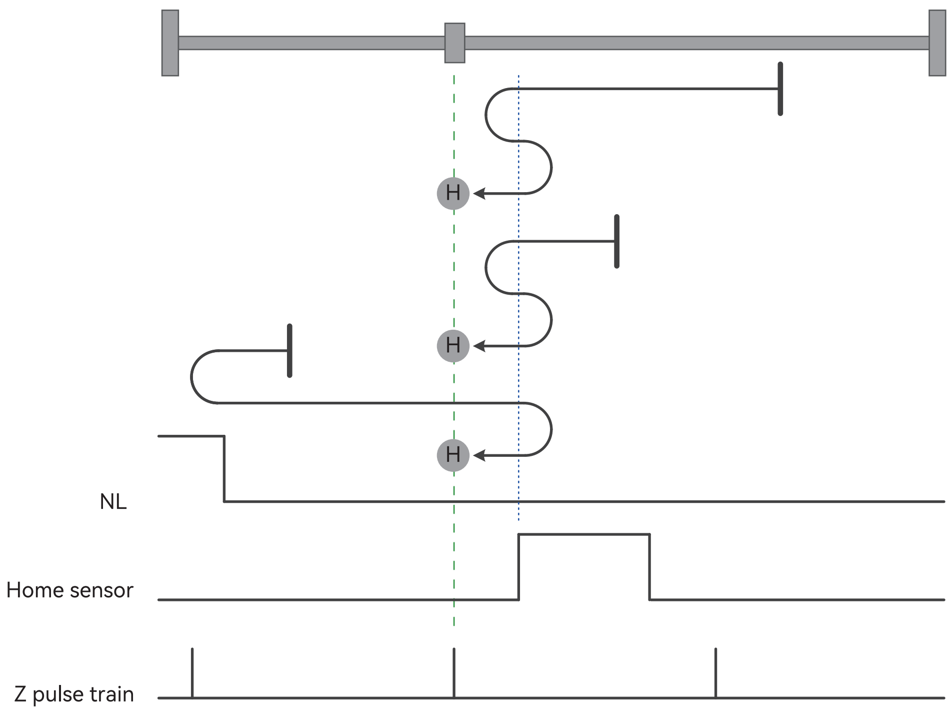


Figure 5-22 Homing mode 14 trajectory and signal state

15. Mode 15, reserved. Please do not set.

16. Mode 16, reserved. Please 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, and sets stop position as the origin.

As shown in Figure 5-23, refer to Table 5-22.

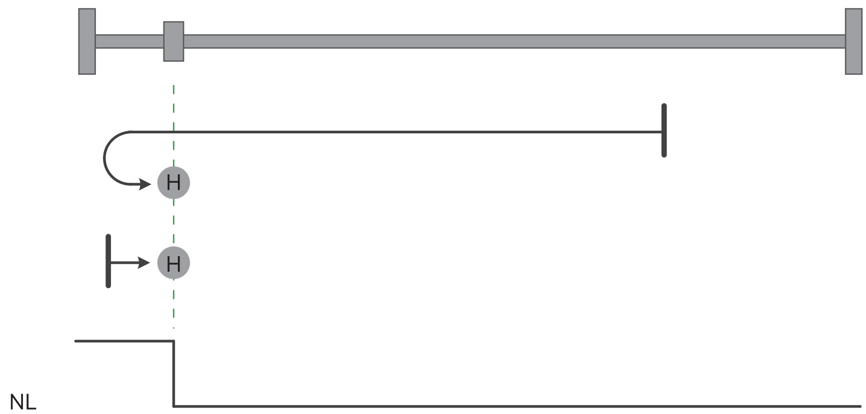


Figure 5-23 Homing mode 17 trajectory and signal state

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 and sets the stop position as the origin.

As shown in Figure 5-24, refer to Table 5-22.

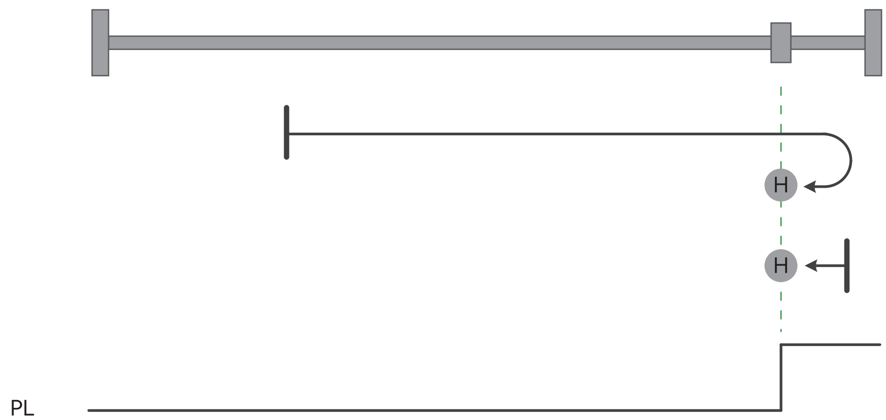


Figure 5-24 Homing mode 18 trajectory and signal state

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 5-25, refer to Table 5-22.

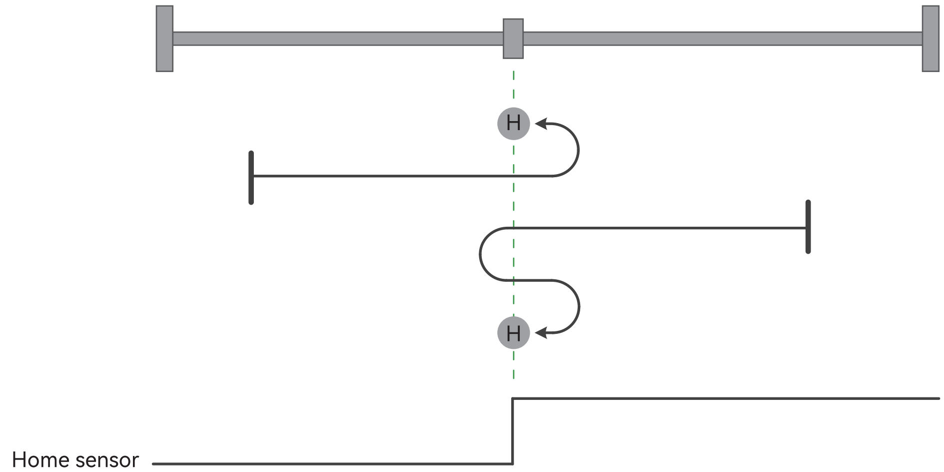


Figure 5-25 Homing mode 19 trajectory and signal state

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 5-26, refer to Table 5-22.

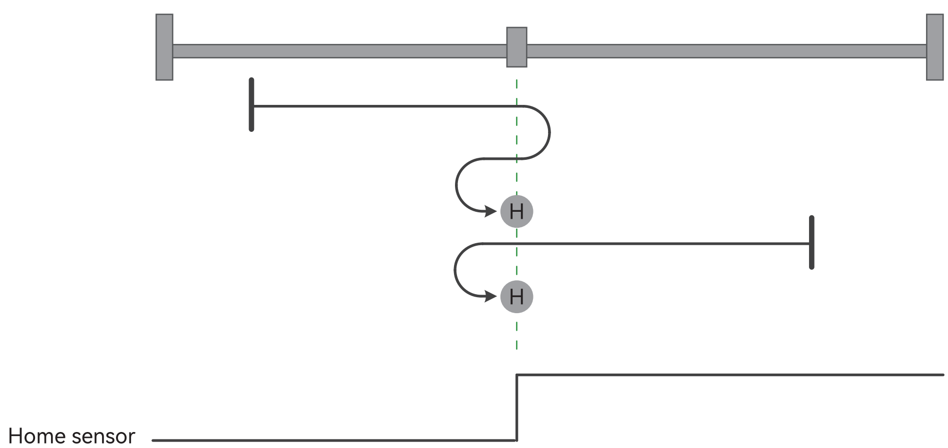


Figure 5-26 Homing mode 20 trajectory and signal state

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 5-27, refer to Table 5-22.

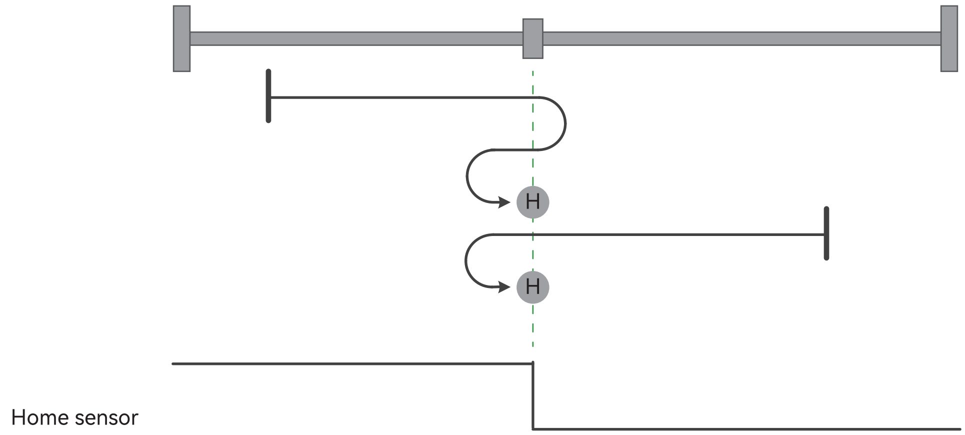


Figure 5-27 Homing mode 21 trajectory and signal state

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 5-28, refer to Table 5-22.

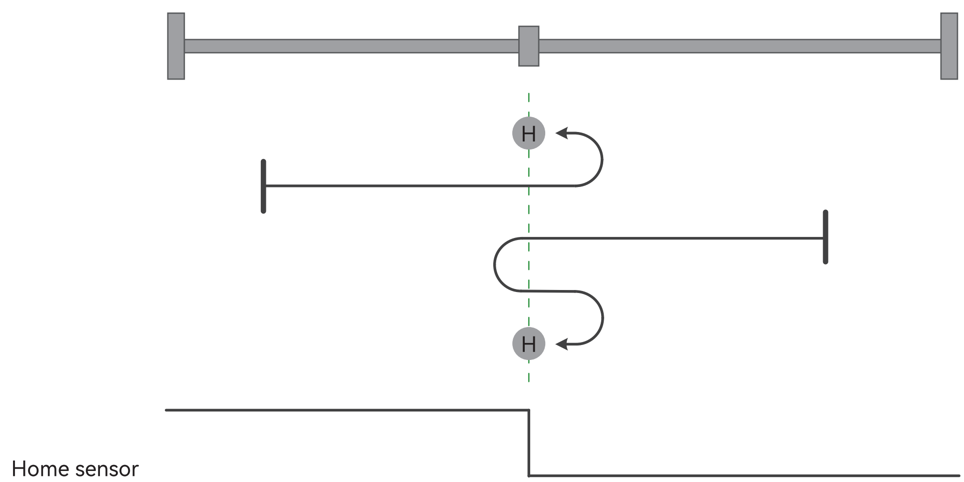


Figure 5-28 Homing mode 22 trajectory and signal state

23. Mode 23, find the HSW ON → OFF position when running in a negative direction and automatically reverse when encountering PL

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 5-29, refer to Table 5-22.

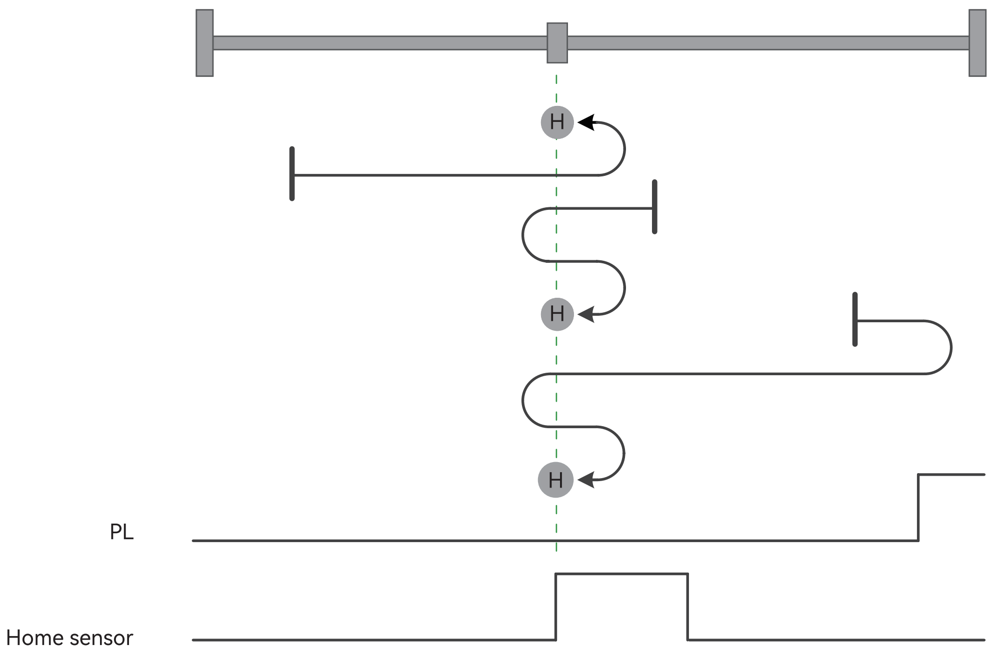


Figure 5-29 Homing mode 23 trajectory and signal state

24. Mode 24, find the HSW OFF → ON position when running in a positive direction, and automatically reverse when encountering PL

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 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 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 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, 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 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, 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 5-30, refer to Table 5-22.

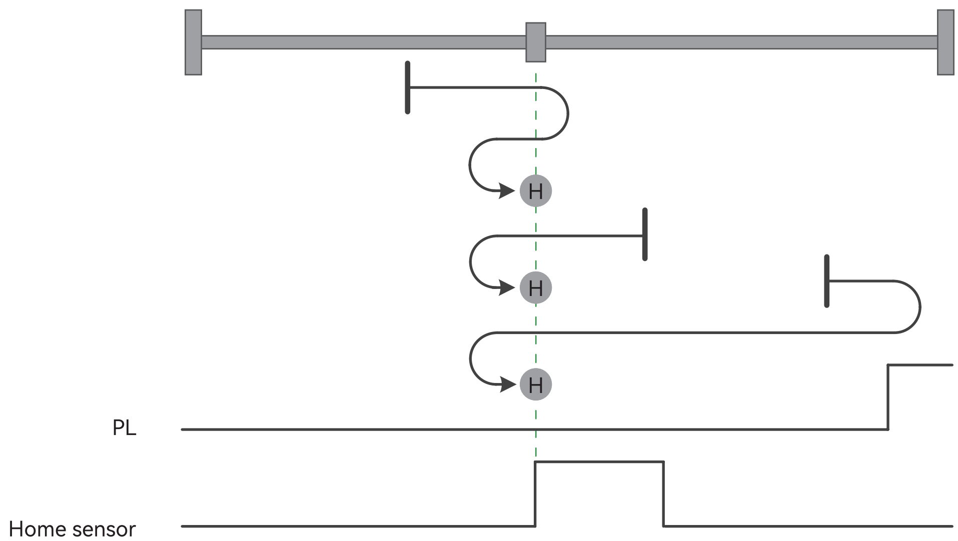


Figure 5-30 Homing mode 24 trajectory and signal state

25. Mode 25, find the HSW OFF → ON position when running in a negative direction and automatically reverse when encountering PL

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 5-31, refer to Table 5-22.

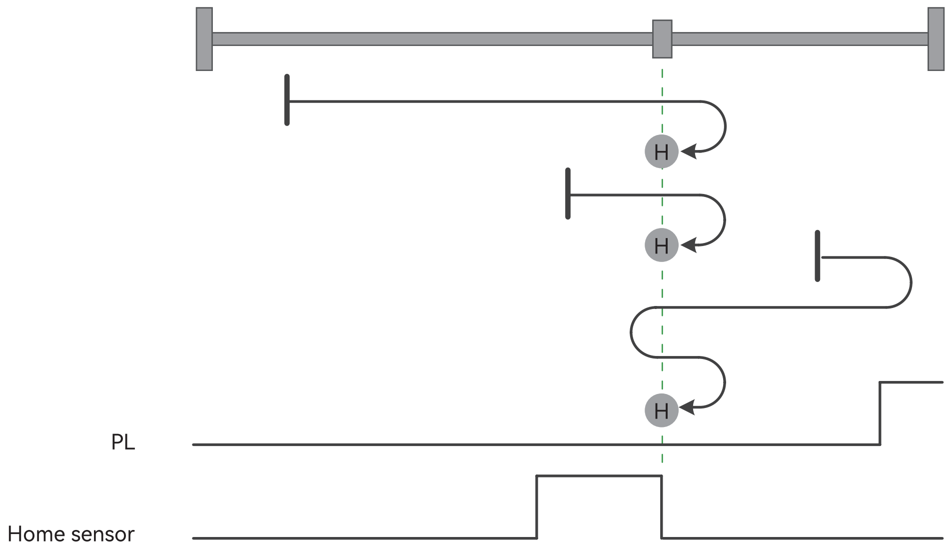


Figure 5-31 Homing mode 25 trajectory and signal state

26. Mode 26, find the HSW ON → OFF position when running in a positive direction and automatically reverse when encountering PL

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 5-32, refer to Table 5-22.

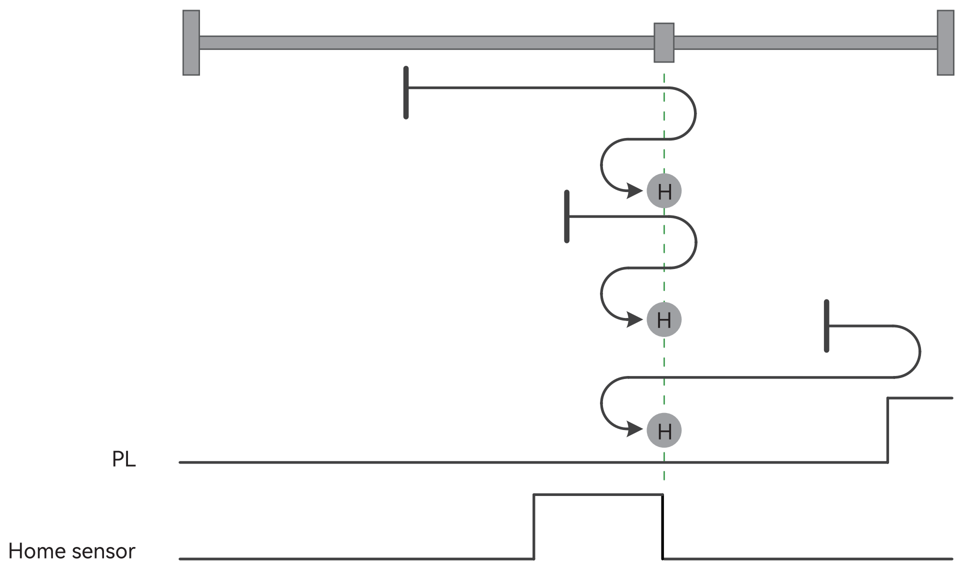


Figure 5-32 Homing mode 26 trajectory and signal state

27. Mode 27, find the HSW ON → OFF position when running in a positive direction and automatically reverse when 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. 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 5-33, refer to Table 5-22.

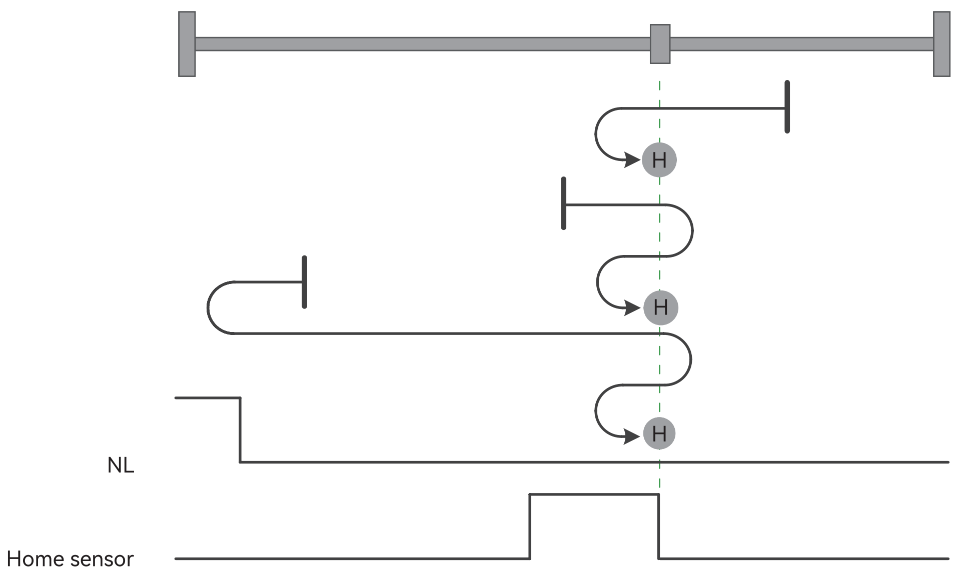


Figure 5-33 Homing mode 27 trajectory and signal state

28. Mode 28, find the HSW OFF → ON position when running in a negative direction and automatically reverse when 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 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 5-34, refer to Table 5-22.

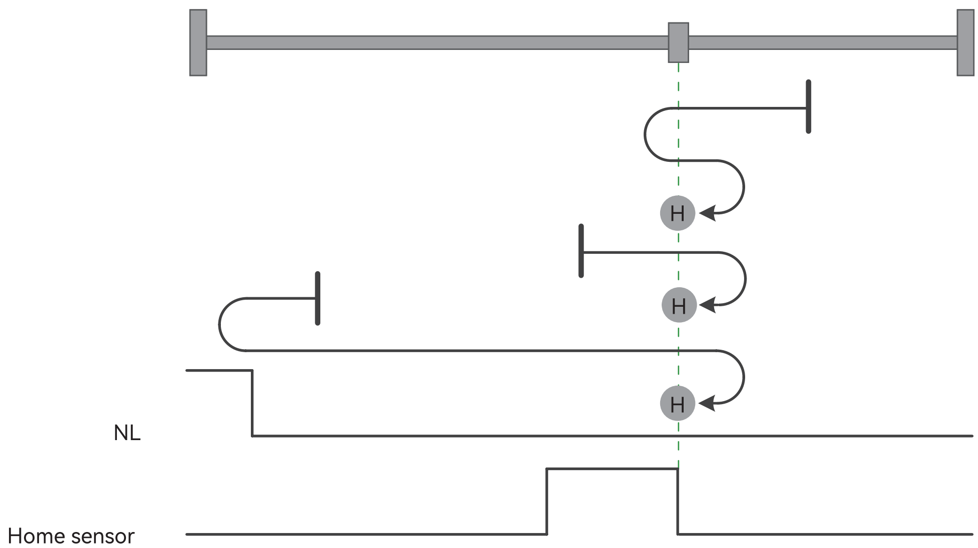


Figure 5-34 Homing mode 28 trajectory and signal state

29. Mode 29, find the HSW OFF → ON position when running in a positive direction and automatically reverse when 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 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 5-35, refer to Table 5-22.

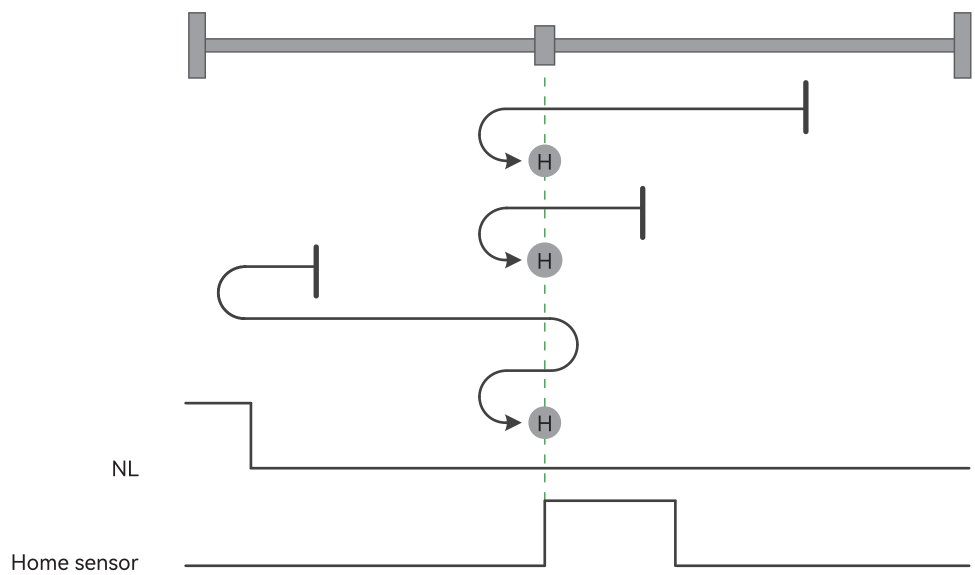


Figure 5-35 Homing mode 29 trajectory and signal state

E • Modes of operation

30. Mode 30, find the HSW ON → OFF position when running in a negative direction and automatically reverse when 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 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 5-36, refer to Table 5-22.

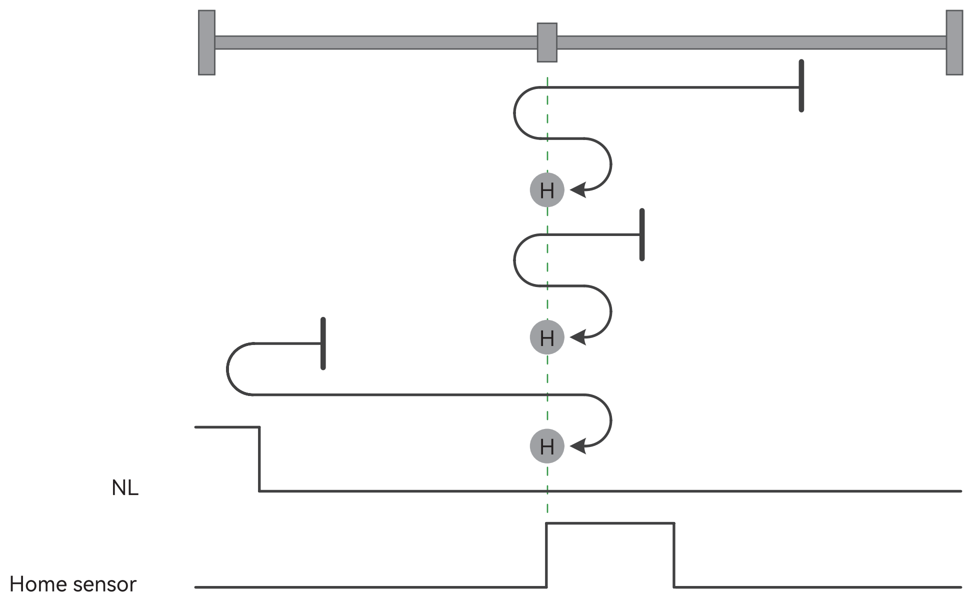


Figure 5-36 Homing mode 30 trajectory and signal state

31. Mode 31, reserved. Please do not set.

32. Mode 32, reserved. Please 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 5-37, refer to Table 5-22.

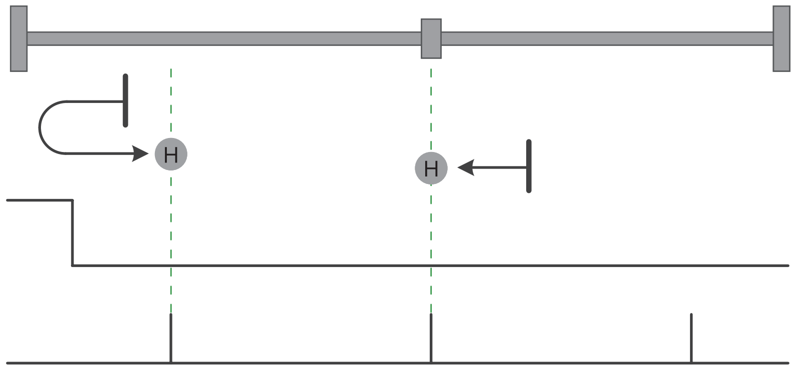


Figure 5-38 Homing mode 34 trajectory and signal state

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 5-38, refer to Table 5-22.

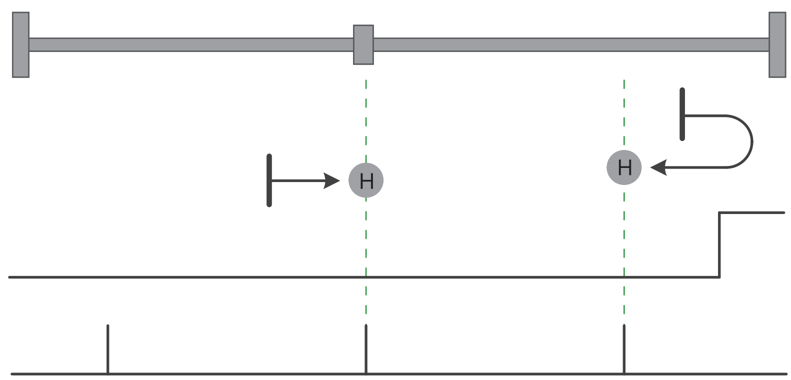


Figure 5-38 Homing mode 34 trajectory and signal state

5.5 Cyclic synchronous position mode (CSP)

In CSP mode, the host device is responsible for planning the start and stop speeds as well as the acceleration (deceleration) speeds to reach the target position. The absolute target position is set at each synchronous cycle and the servo drive follows the target position. When CSP mode is enabled, set the object 6060H to 8. This mode is applicable to EtherCAT, and the control block diagram and input and output are shown in Figure 5-41 and Figure 5-42.

Note: 1. Shift other modes to CSP mode, need to wait 20ms before position update.

2. Before enabling CSP mode, please follow 607Ah (target position) to 6064h (position actual value), otherwise please set the first digit of P09.17 from the right to 0 to ensure the safety of using the machine.

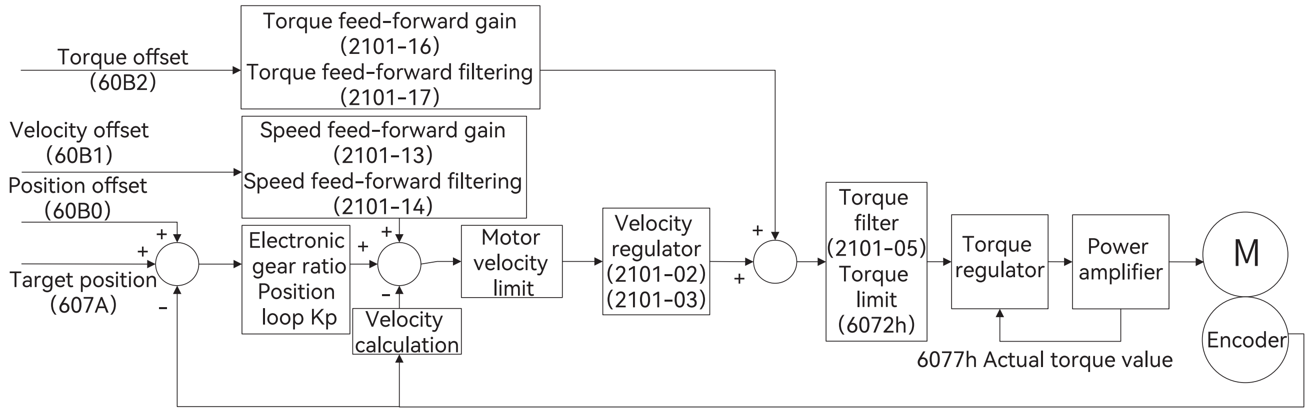


Figure 5-41 Control block diagram of the CSP mode

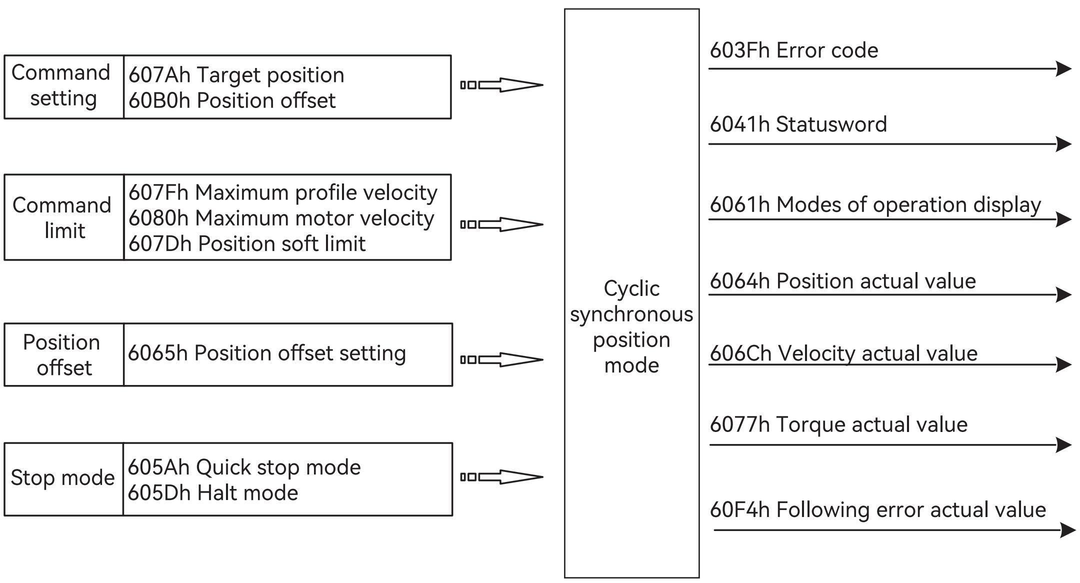


Figure 5-42 Input and output of the CSP mode

5.5.1 Controlword setting in the CSP mode

The meaning of each bit of Controlword (6040h) in the CSP mode is shown in Table 5-28.

Table 5-28 Controlword description in the CSP mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1
2	Quick stop	Servo enable must be set to 1 Set to 0 to enable quick stop

3	Operation enable	Servo enable must be set to 1
4 ~ 6	CSP mode reserved	Unavailable
7	Fault reset	In 0 → 1 change, one fault reset is executed; if multiple resets are required, multiple 0 → 1 changes are generated. When this position is equal to 1, other control instructions are invalid.
8	Pause	0: Invalid 1: Valid Stop executing the instruction when it is valid.
9	CSP mode reserved	Unavailable
10	Reserved	
11~15	Manufacturer customization	Unavailable

5.5.2 Statusword setting in the CSP mode

The meaning of each bit of Statusword (6041h) in the CSP mode is shown in Table 5-29 where the background is marked in dark color for the CSP-specific control commands.

Table 5-29 Statusword description in the CSP mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
2	Operation enabled	0: Invalid 1: Valid When valid, it means that the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable
9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect.
10	Position arrival	60400010h bit 8 (pause)=0, 0: position is not reached 1: position is reached 60400010h bit 8 (pause) = 1 0: Deceleration in progress 1: Speed=0

11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached
12	Whether or not to follow the target position	0: Not following the target position 1: Following the target position
13	Follow position deviation alarm	0: No position deviation alarm 1: Position deviation alarm occurs
14	Manufacturer customization	Unavailable
15	Homing finished	0: Invalid 1: Homing finished. For absolute system, when set the second digit from right of P09.14 to 2, it will store value of bit15 (power failure holding) after homing finished; set P20.06=7 can clear the stored value.

5.5.3 Object dictionary list in the CSP mode

Table 5-30 Object dictionary related to the CSP mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6062h		Position demand value	ro	integer32	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
6065h		Following error window	rw	unsigned32	1000000000
6067h		Position window	rw	unsigned32	1000000000
6068h		Position window time	rw	unsigned16	0
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
607A		Target position	rw	integer32	0
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min. software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
60B0h		Position offset	rw	integer32	0
60B1h		Velocity offset	rw	integer32	0
60B2h		Torque offset	rw	integer32	0
60F4h		Following error actual value	ro	integer32	0
60FCh		Position demand internal value	ro	integer32	0

5.5.4 Example of using the CSP mode

1. The host device is connected to the servo drive. Set communication parameters (communication synchronization cycle, motion control axis parameters, etc.)

2. When running the host device, the startup and operation procedure of the CSP mode is shown in the table below.

Table 5-32 The startup and operation procedure of the CSP mode

Address	Name	Value setting (decimal value)
60600008h	Modes of operation	8
60400010h Controlword	Enable	Any number → 6 → 7 → 15 or MC_Power
	Alarm clearing	Any number → 128 (valid at the rising edge, clear if possible)
	Axis error reset	The host device setting, PLC setting instruction MC_Reset
607A0020h	Position setting	The host device setting, including acceleration or deceleration
	Analog speed control	The host device setting, PLC setting instruction MC_MoveVelocity
	Relative position setting	The host device setting, PLC setting instruction MC_MoveRelative
	Incremental position setting	The host device setting, PLC setting instruction MC_MoveAdditive
	Incremental position setting	The host device setting, PLC setting instruction MC_MoveAbsolute
	Axis deceleration stop	The host device setting, PLC setting instruction MC_Stop
	Cyclic synchronous time	The host device setting (DC-SYnchro)

5.6 Cyclic synchronous velocity mode (CSV)

In CSV mode, the host device is responsible for planning the acceleration (deceleration) speeds to reach the target position. The absolute target velocity is set at each synchronous cycle and the servo drive follows the target velocity. When CSV mode is enabled, set the object 6060H to 9. The control block diagram and input and output are shown in Figure 5-43 and Figure 5-44.

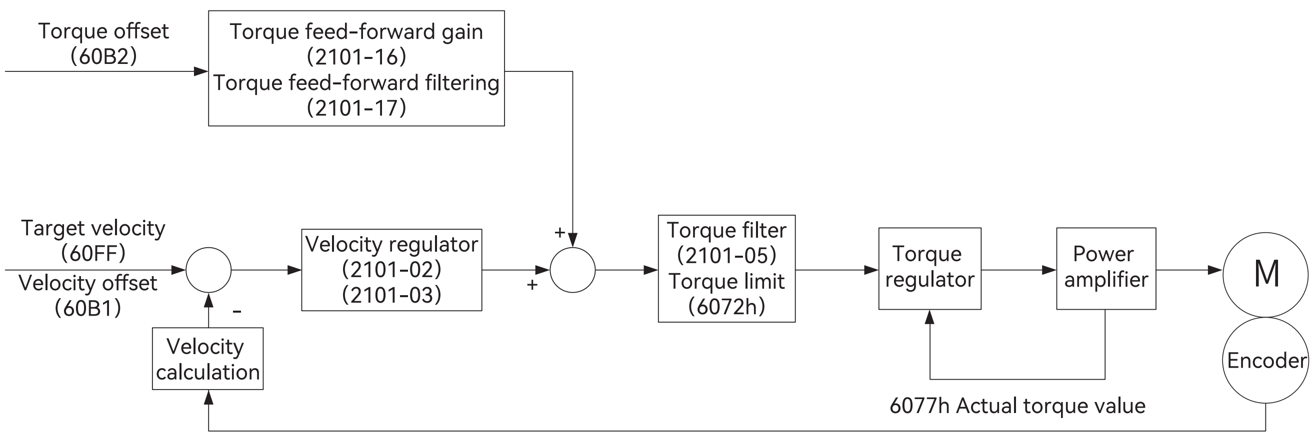


Figure 5-43 Control block diagram of the CSV mode

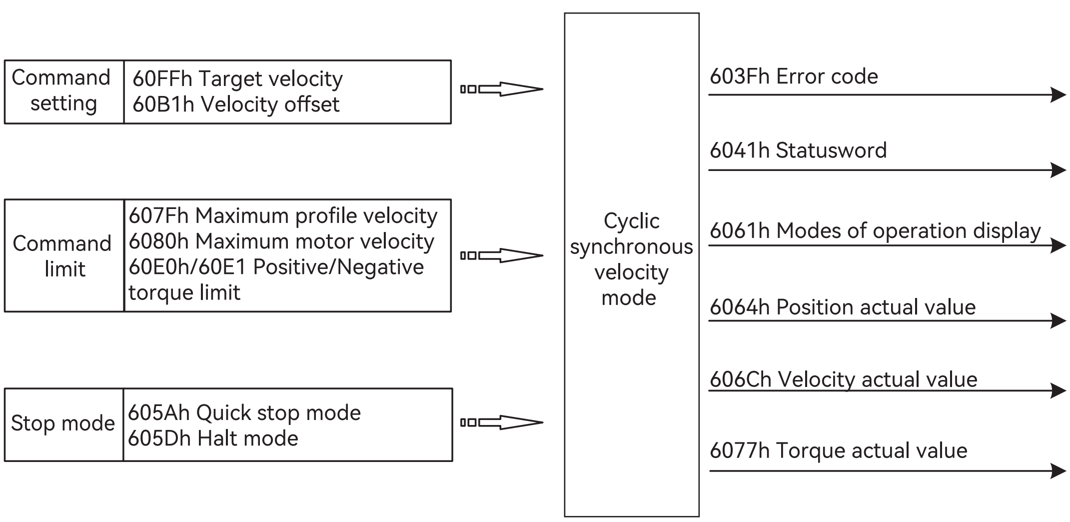


Figure 5-44 Input and output of the CSV mode

5.6.1 Controlword setting in the CSV mode

The meaning of each bit of Controlword (6040h) in the CSV mode is shown in Table 5-33.

Table 5-33 Controlword description in the CSV mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1
2	Quick stop	Servo enable must be set to 1 Set to 0 to enable quick stop
3	Operation enable	Servo enable must be set to 1
4 ~ 6	CSV mode reserved	Unavailable
7	Fault reset	In 0 → 1 change, one fault reset is executed; if multiple resets are required, multiple 0 → 1 changes are generated. When this position is equal to 1, other control instructions are invalid.
8	Pause	0: Invalid 1: Valid. Stop executing the instruction when it is valid
9	CSP mode reserved	Unavailable
10	Reserved	Unavailable
11~15	Manufacturer customization	Unavailable

5.6.2 Statusword setting in the CSV mode

The meaning of each bit of Statusword (6041h) in the CSV mode is shown in Table 5-72 where the background is marked in dark color for the CSV-specific control commands.

Table 5-72 Statusword description in the CSV mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
2	Operation enabled	0: Invalid 1: Valid When valid, it means the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable

9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect.
10	CSV mode reserved	Unavailable
11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached
12	Whether or not to follow the target velocity	0: Not following the target velocity 1: Following the target velocity
13	CSV mode reserved	Unavailable
14 ~ 15	Manufacturer customization	Unavailable

5.6.3 Object dictionary list in the CSV mode

Table 5-73 Object dictionary related to the CSV mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
606Dh		Velocity window	rw	unsigned16	65535
606Eh		Velocity window time	rw	unsigned16	0
606Fh		Velocity threshold	rw	unsigned16	65535
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
607Eh		Polarity	rw	unsigned8	0
6083h		Profile acceleration	rw	unsigned32	13107200
6084h		Profile deceleration	rw	unsigned32	13107200
60C5h		Max. acceleration	rw	unsigned32	1000000000
60C6h		Max. deceleration	rw	unsigned32	1000000000
60B1h		Velocity offset	rw	unsigned32	0
60B2h		Torque offset	Rw	unsigned32	0
60FFh		Target velocity	rw	integer32	0

5.6.4 Example of using the CSV mode

1. The host device is connected to the servo drive. Set communication parameters (communication synchronization cycle, motion control axis parameters, etc.)

2. When running the host device, the startup and operation procedure of the CSV mode is shown in the table below.

Table 5-74 The startup and operation procedure of the CSV mode

Address	Name	Value setting (decimal value)
60600008h	Modes of operation	9

60400010h Controlword	Enable	Any number → 6 → 7 → 15 or MC_Power
	Alarm clearing	Any number → 128 (valid at the rising edge, clear if possible)
	Axis error reset	The host device setting, PLC setting instruction MC_Reset
60FF0020h	Speed setting	Any number → 6 → 7 → 15 or MC_Power
	Axis deceleration stop	The host device setting, PLC setting instruction MC_Stop
	Synchronization cycle time (DC)	The host device setting

5.7 Cyclic synchronous torque mode (CST)

In CST mode, the host device is responsible for planning the rate of change of torque slope to reach the target torque. The target torque is set at each synchronous cycle and the servo drive follows the target torque. When CST mode is enabled, set the object 6060H to 10. This mode is applicable to EtherCAT, and the control block diagram and input and output are shown in Figure 5-45 and Figure 5-46.

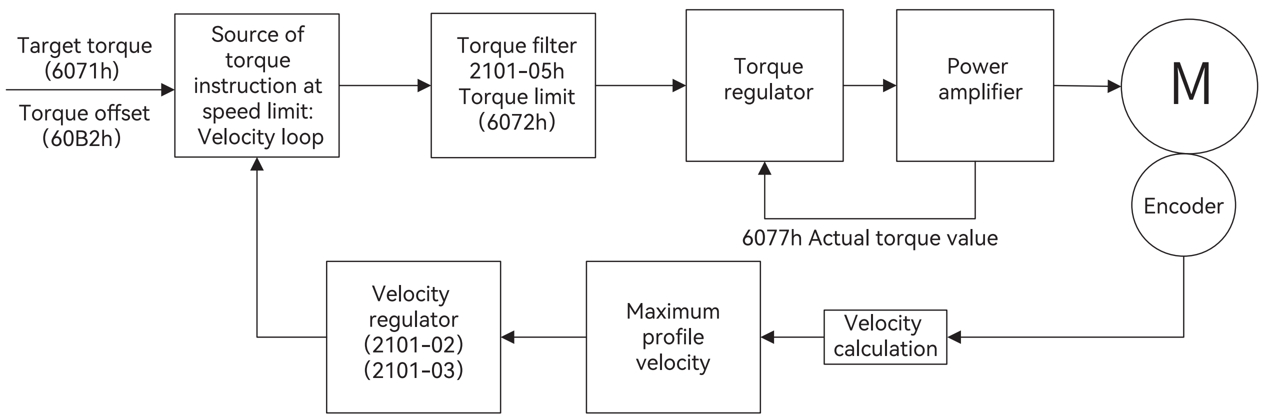


Figure 5-45 Control block diagram of the CST mode

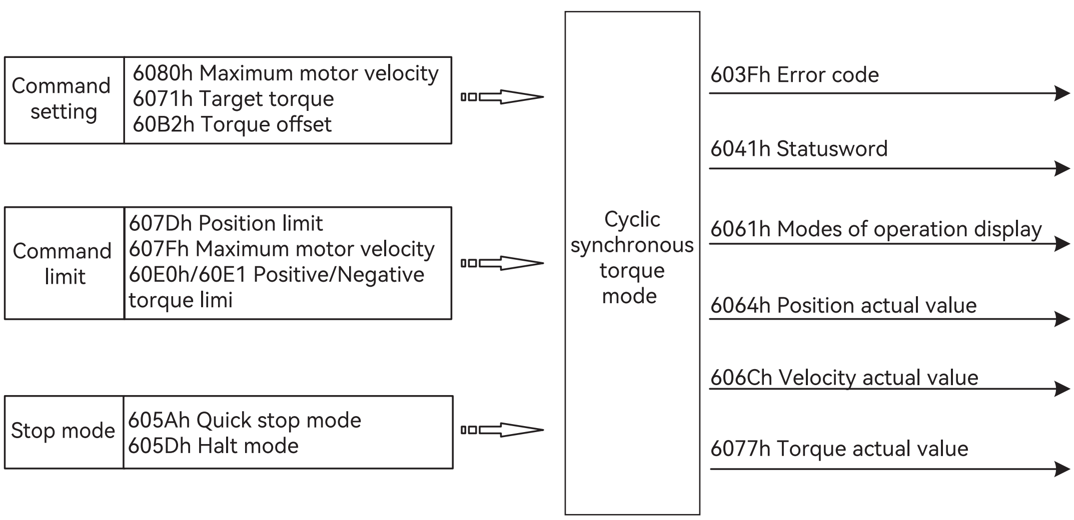


Figure 5-46 Input and output of the CST mode

5.7.1 Controlword setting in the CST mode

The meaning of each bit of Controlword (6040h) in the CST mode is shown in Table 5-38.

Table 5-38 Controlword description in the CST mode

Bit	Name	Description
0	Switch on	Servo enable must be set to 1
1	Enable voltage	Servo enable must be set to 1
2	Operation enable	Servo enable must be set to 1 Set to 0 to enable quick stop
3	Operation enable	Servo enable must be set to 1
4 ~ 6	CST mode reserved	Unavailable
7	Fault reset	In 0 → 1 change, one fault reset is executed; if multiple resets are required, multiple 0 → 1 changes are generated. When this position is equal to 1, other control instructions are invalid.
8	Pause	0: Invalid 1: Valid Stop executing the instruction when it is valid.
9~10	CST mode reserved	Unavailable
11~15	Manufacturer customization	Unavailable

5.7.2 Statusword setting in the CST mode

The meaning of each bit of Statusword (6041h) in the CST mode is shown in Table 5-39 where the background is marked in dark color for the CST-specific control commands.

Table 5-39 Statusword description in the CST mode

Bit	Name	Description
0	Ready to switch on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
1	Switched on	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
2	Operation enabled	0: Invalid 1: Valid When valid, it means that the servo is enabled.
3	Servo fault	0: Not faulty 1: Faulty
4	Voltage enabled	0: Invalid 1: Valid When valid, it means that the servo can be enabled.
5	Quick stop	0: Quick stop is valid 1: Quick stop is invalid
6	Switch on disabled	0: Invalid 1: Valid When valid, it means that the servo cannot be enabled.
7	Alarm	0: No alarm 1: Alarm
8	Manufacturer customization	Unavailable

9	Remote control	0: Invalid 1: Valid When valid, it means that the controlword is in effect
10	Reserved	Unavailable
11	Internal soft limit status	0: Soft limit is not reached 1: Soft limit is reached
12	Whether or not to follow the target torque	0: Not following the target torque 1: Following the target torque
13	CST mode reserved	Unavailable
14 ~ 15	Manufacturer customization	Unavailable

5.7.3 Object dictionary list in the CST mode

Table 5-40 Object dictionary related to the CST mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
606Ch		Velocity actual value	ro	integer32	0
6071h		Target torque	rw	integer16	0
6074h		Torque demand value	ro	integer16	0
6077h		Torque actual value	ro	integer16	0
607Dh	01h	Min. software position limit	rw	integer32	-2147483648
	02h	Max. software position limit	rw	integer32	2147483647
607Fh		Max. profile velocity	rw	unsigned32	5000
6087h		Torque slope	rw	unsigned32	0

5.7.4 Example of using the CST mode

1. The host device is connected to the servo drive. Set communication parameters (communication synchronization cycle, motion control axis parameters, etc.)

2. When running the host device, the startup and operation procedure of the CST mode is shown in the table below.

Table The startup and operation procedure of the CSV mode

Address	Name	Value setting (decimal value)
60600008h	Modes of operation	10 (A in hexadecimal)
60710010h 607F0020h	Torque/Speed setting	User setting, PLC setting instruction MC_TorqueControl
60400010h	Enable	Any number → 6 → 7 → 15/MC_Power
	Alarm clearing	Any number → 128 (valid at the rising edge, clear if possible)
	Axis error reset	The host device setting, PLC setting instruction MC_Reset
	Synchronization cycle time (DC)	The host device setting

5.8 Touch probe function

The probe function refers to the function that the servo drive records the position information (instruction unit) at that time and stores it in the specified register according to the externally specified DI signal or when the motor Z signal is changed, and the use of the following is noted:

1. Try to avoid using both the rising and falling edges of the same probe.

2. When using the Z signal, only use the rising edge, not the falling edge.

3. If the probe is triggered once, if the probe needs to be triggered once again, please clear 60B8h first and then set the value.

Table 5-43 Probe function description 1

Bit	Touch probe function (60B8h)	Probe statusword (60B9h)
0	Probe 1 enable 0: Probe 1 is not enabled 1: Probe 1 is enabled	Probe 1 enable 0: Probe 1 is not enabled 1: Probe 1 is enabled
1	Probe 1 trigger mode 0: Single trigger 1: Continuous trigger	Probe 1 rising edge latch 0: Probe 1 rising edge latch is not executed 1: Probe 1 rising edge latch is executed
2	Probe 1 trigger signal selection 0: DI4 trigger 1: Z signal trigger	Probe 1 falling edge latch 0: Probe 1 falling edge latch is not executed 1: Probe 1 falling edge latch is executed
3	Reserved	Reserved
4	Probe 1 rising edge latch 0: Probe 1 rising edge latch is not executed 1: Probe 1 rising edge latch is executed	Reserved
5	Probe 1 falling edge latch 0: Probe 1 falling edge latch is not executed 1: Probe 1 falling edge latch is executed	Reserved
6	Reserved	Probe 1 trigger signal selection 0: DI4 trigger 1: Z signal trigger
7	Reserved	Probe 1 trigger DI level selection 0: DI4 is low level 1: DI4 is high level
8	Probe 2 enable 0: Probe 2 is not enabled 1: Probe 2 is enabled	Probe 2 enable 0: Probe 2 is not enabled 1: Probe 2 is enabled
9	Probe 2 trigger mode 0: Single trigger 1: Continuous trigger	Probe 2 rising edge latch 0: Probe 2 rising edge latch is not executed 1: Probe 2 rising edge latch is executed
10	Probe 2 trigger signal selection 0: DI5 trigger 1: Z signal trigger	Probe 2 falling edge latch 0: Probe 2 falling edge latch is not executed 1: Probe 2 falling edge latch is executed
11	Reserved	Reserved

Bit	Touch probe function (60B8h)	Probe statusword (60B9h)
12	Probe 2 rising edge latch 0: Probe 2 rising edge latch is not executed 1: Probe 2 rising edge latch is executed	Reserved
13	Probe 2 falling edge latch 0: Probe 2 falling edge latch is not executed 1: Probe 2 falling edge latch is executed	Reserved
14	Reserved	Probe 2 trigger signal selection 0: DI5 trigger 1: Z signal trigger
15	Reserved	Probe 2 trigger DI level selection 0: DI5 is low level 1: DI5 is high level

◆ Example of using the Probe function in the following steps:

1. Set the probe trigger DI signal: the DI function codes corresponding to probe 1 and probe 2 are 39 and 40 respectively:

Servo function code	Meaning
P04.04	DI4 terminal function setting "39" for probe 1
P04.05	DI5 terminal function setting "40" for probe 2
P04.14	DI4 logic selection: 0: Low level is valid 1: High level is valid
P04.15	DI5 logic selection: 0: Low level is valid 1: High level is valid

2. Touch probe function setting (60B8h)

The meanings of each bit of touch probe function (60B8h) and Probe statusword (60B9h) are shown in Table 5-43:

For example, using Probe 1 and Probe 2 rising and falling edges, DI single trigger, then set 60B8h = 3131h (decimal representation is 12593), when DI4, DI5 signal rising edge, Probe 1 and Probe 2 will latch position at 60BAh and 60BCh respectively; when DI4, DI5 signal falling edge, Probe 1 and Probe 2 will latch position at 60BBh and 60BDh.

Note: If a single trigger is desired again, set 60B8h=0 and 60B8h=3131h.

3. Object dictionary list of the probe function

Table 5-46 Object dictionary related to the probe function

Object dictionary	Meaning
60B8h	Touch probe function
60B9h	Probe statusword
60BAh	Touch probe pos1 pos value
60BBh	Touch probe pos1 neg value
60BCh	Touch probe pos2 pos value
60BDh	Touch probe 2 falling edge position actual value

5.9 Electronic gear ratio

★ Two gear ratios can be selected by switching the second digit from the right of P09.13 (2109-0Eh):

★ When the second digit from the right of P09.13 is set to 0, the electronic gear ratio is set by P00.08 or P00.10/P00.12, at which time 6091h and 6092h no longer function. The electronic gear can be replaced by setting the number of instruction pulses required for each motor rotation by P00.08. If the value of P00.08 is 0, then the electronic gear ratio P00.10/P00.12 is used.

★ When the second digit from the right of P09.13 is set to 1, the electronic gear ratio is set by 6091h and 6092h, and at this time, P00.08 and P00.10/P00.12 no longer work, and the electronic gear ratio calculation formula is as follows:

$$\underset{\text{(Electronic gear ratio)}}{\text{608F*6091/6092}} = \frac{\dfrac{\text{608Fh\_01(Motor encoder resolution)}}{\text{608Fh\_02(Encoder resolution corresponds to the number of motor revolution)}} * \dfrac{\text{6091h\_01(Number of motor revolution)}}{\text{6091h\_02(Number of drive axis revolution)}}}{\dfrac{\text{6092h\_01(Host device setting value)}}{\text{6092h\_02(Number of drive axis revolution)}}}$$

Example: 17bit encoder motor 608F = 131072, if the host device needs to send 10000 instructions corresponding to the drive axis to rotate once, set the object 6091h for 1 : 1, 6092h for 10000 : 1.

5.10 Instruction unit

◆ Velocity instruction unit:

The third digit from the right of the hexadecimal value of P09.13 (2109-0Eh) determines the velocity instruction unit.

0: RPM

1: User instruction/s

◆ Acceleration/deceleration instruction unit:

The fourth digit from the right of the hexadecimal value of P09.13 (2109-0Eh) determines the acceleration time.

0: 0RPM-1000RPM acceleration time ms

1: Instruction/s^2

5.11 Stop protection function

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

5.11.1 Instantaneous power failure protection

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

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

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

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

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

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

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

5.11.2 Fault stop protection

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

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

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

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

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

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

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

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

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

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

5.11.3 Over-travel stop protection

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

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

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

1: Invalid

P06.29	Over-travel stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	1	--	Restart	P	S	T

0: Decelerate to stop by 6085h, enter position lock after stop, and stay in the state at the time the stop was triggered.

1: Decelerate to stop by 6085h, enter position lock after stop, and stay in the state at the time the stop was triggered.

2: Decelerate to stop by 6085h, enter position lock after stop, stay in the state when the stop was triggered, and limit the torque in the overtravel direction.

Note: The overtravel logic by default is valid at the high level.

5.11.4 Stop protection deceleration time

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

When the over-travel stop mode is zero speed or stop by emergency stop torque stop, the instruction deceleration time is the shortest deceleration stop time.

For the quick stop method, refer to the description of 605Ah in "9.3 6000H Object dictionary list".

5.12 Soft limit function

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

Related parameters: P06.28, P06.29, P07.08, 607Dh-01, 607Dh-02

◆ **Parameter setting method**

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

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

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

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

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

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

607Dh-01	Positive soft limit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	2147483647	--	Restart	P	S	T

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

607Dh-02	Negative soft limit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483648 ~ 2147483647	-2147483648	--	Restart	P	S	T

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

If the value of P21.07 (absolute position counter) exceeds the range set in 607Dh-02 to 607Dh-01 during motor operation, an over-travel warning is reported and the motor is stopped for protection.

5.13 Absolute system

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

◆ Relevant parameters

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

0 ~ 19

Unit's digit:

0: Incremental system;

1: Absolute system

2: Absolute system (Err.12 needs manual clearing, industrial robotics special)

3~9: Absolute system with overflow error.

Ten's digit:

0: Battery undervoltage warning and keep running;

1: Battery undervoltage warning and stop.

The incremental or absolute mode can be set in the unit's digit of this parameter, and whether AL.097 or Err.015 is reported in the event of the encoder battery undervoltage can be set in the ten's digit.

◆ Instruction for use

When using the absolute value system, P06.47 needs to be set to 1 or 2 to enable the absolute value system. When the absolute system is enabled for the first time and the power is restored, Err.012 (abnormal number of absolute encoder turns) is reported, which is a warning for the initialization of the encoder. If P06.47 is set to 1, the fault is reset with DI or is cleared by P20.01, and the "ok rdy" state can be entered by re-powering up after the fault is cleared.

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

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

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

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

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

5.14 Modulus function

Function description: Avoid the overflow of the position feedback value (P21.07/6064h) due to the motor rotating in one direction all the time.

Functional parameters: P00.28 (modulus mode low 32 bits), P00.30 (modulus mode high 32 bits)

Function application: Under absolute value system, if modulus mode is enabled, position feedback count value can only count from 0 to this value minus 1 (gear ratio is 1, the right from the first digit of P09.15 is 0). Set P07.11 to 1 to enable power down memory, write 8 to P20-06 to clear multi-turn and position feedback, and re-power up when setup is complete. If both modulus low and high bits are set to 0, it is linear mode.

Relevant parameters: The first digit from the right of P09.15

P09.15	Bus communication configuration 3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Hexadecimal number, right to left for each digit

Digit 1: Position feedback selection in modulus mode

0: 6064 count range from 0 to modal value minus 1 (when gear ratio is 1)

1: 6064 count range follows 607A, only modal value is saved during re-power up.

For example: For a 17-bit absolute value system, set 10000 instruction motor for one revolution, P00.28 modulus value is 131072

(1) P09.15 = xxx0, 6064 position feedback change range 0 ~ 9999

(2) P09.15 = xxx1, the 6064 position feedback follows the 607A changes, if 6064 = 55000 before power off, then 6064 = 5000 after restarting.

5.15 Limit alignment function

Cyclic synchronous position mode encounters limit during operation, if just in the limit switch, then report overtravel warning; if has exceeded the limit switch, and the position instruction and feedback are not aligned, then report limit alignment AL.099.

If the limit switch is exceeded, and the position instruction and feedback do not match, then the alarm will be reported as AL.099. When the alarm is raised, the motor will not run by continuing to send the instruction in the forward direction, and the motor will need to send the instruction in the reverse direction until the position instruction and the feedback are aligned (607A=6064) to automatically clear the warning (AL099).

Relevant parameters: The fourth digit from the right of P09.17

P09.17	Bus communication configuration 4	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	1011	--	Immediate	P	S	T

Hexadecimal number, right to left for each digit

0: Disable

1: Enable, reverse the instruction until the instruction and feedback are aligned to automatically clear alarm AL099

2: Enable, re-enable can clear alarm AL099

5.16 Virtual DI DO function

Function: Operate via the object address to realize the DI digital input and monitor the DO digital output status.

2120h	00h	Virtual DIDO	Type	Range	Effective	PDO	Pgroup parameter
2120h	01h	Virtual DI enable setting 1	U16	0-65535	Setting after restart	YES	P09.05
2120h	02h	Virtual DI enable setting 2	U16	0-65535	Setting after restart	YES	P09.06
2120h	03h	Virtual DI enable setting 3	U16	0-65535	Setting after restart	YES	P09.07
2120h	04h	Virtual DI enable setting 4	U16	0-65535	Setting after restart	YES	P09.08
2120h	05h	Virtual DO1	U16	0-65535	Parameter display	YES	P09.09
2120h	06h	Virtual DO2	U16	0-65535	Parameter display	YES	P09.10

(1) Virtual DI use, for example, when the input reports positive overtravel AL086: first cancel the P04 group DI overtravel (change P04.01 from the default 14 to 0), and then set the BIT14 corresponding to the value of the positive overtravel DI function code "14" to 1, i.e., P09.05 = 0x4000, then write 2020h01 to 0x4000, then the drive reports AL086;

(2) Virtual DO reading, e.g. when DO1 and DO2 have outputs: 2120h05 reads a value of 3.

Chapter 6 Parameters

6.1 List of parameters

Relevant mode:

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

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

Group No.		Name	Relevant mode		
			P	S	T
P00	00	Motor rotation positive direction definition	•	•	•
	01	Modes of operation	•	•	•
	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	•	_	_
	28	Modulus mode low bit (32-bit)	•	_	_
	30	Modulus mode high bit (32-bit)	•	•	•
P01	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	•	_	_

Group No.		Name	Relevant mode		
			P	S	T
P01	22	Position gain switching time	•	_	_
	23	Speed control switching mode	_	•	_
	24	Speed control switching delay	_	•	_
	25	Speed control switching class	_	•	_
	26	Speed control switching hysteresis	_	•	_
	27	Torque control switching mode	_	_	•
	28	Torque control switching delay	_	_	•
	29	Torque control switching class	_	_	•
	30	Torque control switching hysteresis	_	_	•
	31	Observer enabled	•	•	•
	32	Observer cut-off frequency	•	•	•
	33	Observer phase compensation time	•	•	•
	34	Observer inertia coefficient	•	•	•
P02	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 frequency	•	•	•
	14	The fourth notch filter width	•	•	•
	15	The fourth notch filter depth	•	•	•
	19	Position instruction FIR filter 2	•	_	_
	20	The first vibration damping frequency	•	•	_
	21	The first vibration damping filtering setting	•	•	_
	22	The second vibration damping frequency	•	•	_
	23	The second vibration damping filtering setting	•	•	_
	31	Resonance point 1 frequency	•	•	•
	32	Resonance point 1 bandwidth	•	•	•
	33	Resonance point 1 amplitude	•	•	•
	34	Resonance point 2 frequency	•	•	•
	35	Resonance point 2 bandwidth	•	•	•
	36	Resonance point 2 amplitude	•	•	•
P03	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	•	•	_

Group No.		Name	Relevant mode		
			P	S	T
P03	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	_	•	_
P04	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	•	•	•

Group No.		Name	Relevant mode		
			P	S	T
P04	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	•	•	•
	52	Speed setting for holding brake to take action in motion	•	•	•
	53	Waiting time for holding brake to take action in motion	•	•	•
	54	OCZ output selection	•	•	•
	55	Torque set value arrival	•	•	•
	56	Torque arrival detection width	•	•	•
	57	Z-phase pulse width adjustment	•	•	•
	58	Zero-speed signal output threshold	•	•	•
P05	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	•	•	•

Group No.		Name	Relevant mode		
			P	S	T
P05	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	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 friction 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 speed value	•	•	_
	20	Parameter identification acceleration time	•	•	_
	21	Parameter identification deceleration time	•	•	_
	22	Parameter identification mode	•	•	_
	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	•	•	•
	30	Input power phase loss protection	•	•	•
	31	Output power phase loss protection	•	•	•
	32	Stop by emergency stop torque	•	•	•

Group No.		Name	Relevant mode		
			P	S	T
P06	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	•	•	•
P07	00	Panel display option	•	•	•
	01	Panel monitoring parameter setting 1	•	•	•
	02	Panel monitoring parameter setting 2	•	•	•
	03	Panel monitoring parameter setting 3	•	•	•
	04	Panel monitoring parameter setting 4	•	•	•
	05	Panel monitoring parameter setting 5	•	•	•
	08	Function selection 1	•	•	•
	09	Function selection 2	•	•	•
	10	User password	•	•	•
	11	Instant memory storage during power outage	•	•	•
	12	User password screen-lock time	•	•	•
	14	Fast deceleration time	•	•	•
	16	Function selection 3	•	•	•
	17	Resolution	•	_	_
	19	Function selection 5	•	•	•
	20	Function selection 6	•	•	•
	21	Function selection 7	•	•	•
	22	Function selection 8	•	•	•
	23	Fault reset timing	•	•	•
	24	Positive soft limit (32-bit)	•	•	•
	26	Negative soft limit (32-bit)	•	•	•
P08	00	Multi-segment preset position execution method	•	_	_
	01	Starting segment number	•	_	_
	02	Ending segment number	•	_	_
	03	Dealing of residual segments after pausing and restarting	•	_	_
	04	Position instruction type	•	_	_
	05	Waiting time unit	•	_	_
	06	The first segment displacement (32-bit)	•	_	_
	08	The first segment maximum speed	•	_	_
	09	The first segment acceleration/deceleration time	•	_	_

Group No.		Name	Relevant mode		
			P	S	T
P08	10	Waiting time after the first segment completed	•	_	_
	11	The second segment displacement (32-bit)	•	_	_
	13	The second segment maximum speed	•	_	_
	14	The second segment acceleration/deceleration time	•	_	_
	15	Waiting time after the second segment completed	•	_	_
	16	The third segment displacement (32-bit)	•	_	_
	18	The third segment maximum speed	•	_	_
	19	The third segment acceleration/deceleration time	•	_	_
	20	Waiting time after the third segment completed	•	_	_
	21	The fourth segment displacement (32-bit)	•	_	_
	23	The fourth segment maximum speed	•	_	_
	24	The fourth segment acceleration/deceleration time	•	_	_
	25	Waiting time after the fourth segment completed	•	_	_
	26	The fifth segment displacement (32-bit)	•	_	_
	28	The fifth segment maximum speed	•	_	_
	29	The fifth segment acceleration/deceleration time	•	_	_
	30	Waiting time after the fifth segment completed	•	_	_
	31	The sixth segment displacement (32-bit)	•	_	_
	33	The sixth segment maximum speed	•	_	_
	34	The sixth segment acceleration/deceleration time	•	_	_
	35	Waiting time after the sixth segment completed	•	_	_
	36	The seventh segment displacement (32-bit)	•	_	_
	38	The seventh segment maximum speed	•	_	_
	39	The seventh segment acceleration/deceleration time	•	_	_
	40	Waiting time after the seventh segment completed	•	_	_
	41	The eighth segment displacement (32-bit)	•	_	_
	43	The eighth segment maximum speed	•	_	_
	44	The eighth segment acceleration/deceleration time	•	_	_
	45	Waiting time after the eighth segment completed	•	_	_
	46	The ninth segment displacement (32-bit)	•	_	_
	48	The ninth segment maximum speed	•	_	_
	49	The ninth segment acceleration/deceleration time	•	_	_
	50	Waiting time after the ninth segment completed	•	_	_
	51	The 10th segment displacement (32-bit)	•	_	_
	53	The 10th segment maximum speed	•	_	_
	54	The 10th segment acceleration/deceleration time	•	_	_
	55	Waiting time after the 10th segment completed	•	_	_
	56	The 11th segment displacement (32-bit)	•	_	_
	58	The 11th segment maximum speed	•	_	_
	59	The 11th segment acceleration/deceleration time	•	_	_
	60	Waiting time after the 11th segment completed	•	_	_
	61	The 12th segment displacement (32-bit)	•	_	_
	63	The 12th segment maximum speed	•	_	_
	64	The 12th segment acceleration/deceleration time	•	_	_
	65	Waiting time after the 12th segment completed	•	_	_
	66	The 13th segment displacement (32-bit)	•	_	_
	68	The 13th segment maximum speed	•	_	_

Group No.		Name	Relevant mode		
			P	S	T
P08	69	The 13th segment acceleration/deceleration time	•	_	_
	70	Waiting time after the 13th segment completed	•	_	_
	71	The 14th segment displacement (32-bit)	•	_	_
	73	The 14th segment maximum speed	•	_	_
	74	The 14th segment acceleration/deceleration time	•	_	_
	75	Waiting time after the 14th segment completed	•	_	_
	76	The 15th segment displacement (32-bit)	•	_	_
	78	The 15th segment maximum speed	•	_	_
	79	The 15th segment acceleration/deceleration time	•	_	_
	80	Waiting time after the 15th segment completed	•	_	_
	81	The 16th segment displacement (32-bit)	•	_	_
	83	The 16th segment maximum speed	•	_	_
	84	The 16th segment acceleration/deceleration time	•	_	_
	85	Waiting time after the 16th segment completed	•	_	_
	86	Position instruction interrupt execution setting	•	_	_
	88	Homing start method	•	_	_
	89	Homing mode	•	_	_
	90	Limit switch and z-phase signal setting when homing	•	_	_
	92	Origin searching high speed	•	_	_
	93	Origin searching low speed	•	_	_
	94	Acceleration/deceleration time during origin searching	•	_	_
	95	Homing time limit	•	_	_
	96	Origin offset (32-bit)	•	_	_
	98	Mechanical origin offset (32-bit)	•	_	_
P09	00	Servo axis address number	•	•	•
	01	Modbus baud rate	•	•	•
	02	Modbus data format	•	•	•
	03	Communication timeout	•	•	•
	04	Communication response delay	•	•	•
	05	Communication DI enable setting 1	•	•	•
	06	Communication DI enable setting 2	•	•	•
	07	Communication DI enable setting 3	•	•	•
	08	Communication DI enable setting 4	•	•	•
	09	Communication DO enable setting 1	•	•	•
	10	Communication DO enable setting 2	•	•	•
	11	Communication instruction holding time	•	•	•
	12	Enable AO function or CAN communication	•	•	•
	13	Bus communication configuration 1	•	•	•
	14	Bus communication configuration 2	•	•	•
	15	Bus communication configuration 3	•	•	•
	16	Bus disconnection detection	•	•	•
	17	Bus communication configuration 4	•	•	•
	18	Bus slave number configuration	•	•	•
P17	00	External encoder usage	•	_	_
	01	External encoder pitch (32-bit)	•	_	_
	03	Full-closed mixed deviation threshold(32-bit)	•	_	_
	05	Mixed deviation counting setting	•	_	_

Group No.		Name	Relevant mode		
			P	S	T
P17	06	Mixed vibration suppression gain	•	_	_
	07	Mixed vibration suppression time constant	•	_	_
	09	External units for full closed loop mixed deviation (32-bit)	•	_	_
	11	External units for internal encoder count value (32-bit)	•	_	_
	13	External encoder count value (32-bit)	•	_	_
	16	Position comparison output mode	•	_	_
	17	The first position (32-bit)	•	_	_
	19	The second position (32-bit)	•	_	_
	21	The third position (32-bit)	•	_	_
	23	The fourth position (32-bit)	•	_	_
	25	Signal validity time 1	•	_	_
	26	Signal effective time 2	•	_	_
	27	Signal effective time 3	•	_	_
	28	Signal effective time 4	•	_	_
	29	Display delay	•	_	_
P18	00	Motor model code	•	•	•
P19	00	Drive model code	•	•	•
P20	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	•	•	•
	10	Communication setting DI input	•	•	•
	11	Communication setting DI input	•	•	_
	12	Communication starting homing	•	_	_
P21	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 position instruction	•	•	•
	13	Position deviation counter (32-bit)	•	•	•
	15	Input instruction 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	•	•	•
	25	Total power-on time (32-bit)	•	•	•
	27	AI1 voltage after adjustment	•	•	•
	28	AI2 voltage after adjustment	•	•	•

Group No.		Name	Relevant mode		
			P	S	T
P21	29	AI1 voltage before adjustment	•	•	•
	30	AI2 voltage before adjustment	•	•	•
	31	Module temperature	•	•	•
	36	Version code 1	•	•	•
	37	Version code 2	•	•	•
	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	•	•	•
	46	V-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)	•	•	•

6.2 Parameter description

P00 Basic setting

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

Set the relation between instruction direction and motor rotational direction:

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

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

P00.01	Modes of operation	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 7	0	--	Restart	P	S	T

Set the desired control mode

0: Position mode;

1: Speed mode;

2: Torque mode;

3: Position mode / Speed mixed mode

4: Position mode/Torque mixed mode

5: Speed mode / Torque mixed mode

6: Full closed loop mode (Reserved)

7: EtherCAT mode

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

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

Set the mode for real-time auto-tuning.

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

1: Standard mode, no gain switching.

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

3: Dynamic testing of load, without parameter setting

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

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

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

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

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

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

Set the ratio of load to motor inertia.

0 ~ 60.00

P00.05	Position instruction source	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P		

Set the source of instruction for position control.

0: Pulse instruction

1: Step value instruction

2: Internal position control

Pulse input source selection via P00_06 when set to 0.

P00.06	Pulse source	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

0: Low-speed pulse

1: High-speed pulse

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

Set the input form of the pulse instruction. 0: Direction + pulse, positive logic (default)

1: Direction + pulse, negative logic

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

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

4: CW+CCW, positive logic

5: CW+CCW, negative logic

P00.08	Required pulse instruction number per turn of motor rotation (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483646	10000	1Unit	Restart	P		

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

0 Unit/Turn ~ 2147483646 Unit/Turn

It works when this function code value is 0.

P00.10	Electronic gear 1 numerator (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2147483646	1	--	Immediate	P		

Set the numerator of the first group electronic gear.

1 ~ 2147483646

It works when P00.08=0.

P00.12	Electronic gear denominator (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 2147483646	1	--	Immediate	P		

Set the denominator for the first group electronic gear.

1 ~ 2147483646

It works when P00.08=0.

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 ~ 2147483646PPR (calculate the number of lines according to the incremental optical 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: Low level at the arrival of Z-phase pulse

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

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

3: High-precision Z-phase pulse, high 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) 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 ~ 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: A-phase (pulse) + B-phase (sign) orthogonal pulse, 4 multiplication, positive logic

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

4: CW+CCW, positive logic

5: CW+CCW, negative logic

P00.28	Modulus mode low bit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4294967295	0	P	Restart	P		

Encoder unit: P

In the absolute value system, if this value is set will open modulus mode, the count value can only count from 0 to this value minus 1 (when gear ratio is 1). P07.11 need setting to 1 to open power-down memory function. P20-06 need writing to 8 to clear multi-turn and position feedback. Complete the setting to re-power on the device. If P00.28 and P00.30 are 0 by default, it is linear mode.

P00.30	Modulus mode low bit (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4294967295	0	P	Restart	P		

(Encoder unit: P)

In the absolute value system, if this value is set, the modulus mode will be enabled, and the count value can only count from 0 to this value minus 1 (when the gear ratio is 1), it is necessary to set P07.11 to 1 to enable the power-failure memory function, and write P20-06 to 8 to clear the multi-turn and position feedback, and setup is completed to re-power up the device.

P00.28 and P00.30 are set to 0 for linear mode.

P01 Gain tuning

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

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

1.0/s ~ 2000.0/s

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

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

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

1.0Hz ~ 2000.0Hz

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

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

Set the integration time of the speed loop controller.

0.15ms ~ 512.00ms

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

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

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

Set the filter level for speed detection.

0 ~ 15

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

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

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

0.00ms ~ 100.00ms

It suppresses the resonance caused by mechanical distortion.

P01.05	Position loop gain 2	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 20000	100	0.01ms	Immediate	P	S	T

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 ~ 100.0%

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

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

P01.11	Speed feed-forward control selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 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% ~ 100.0%

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

Set the speed feedforward filter time constant for position control.

0.00ms ~ 64.00ms

P01.14	Torque feed-forward control selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 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 feed-forward gain	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	0.1%	Immediate	P	S	

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

0.0% ~ 100.0%

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

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

0.00ms ~ 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_SWITCH) or P/PI switching by the speed regulator.

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

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

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

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

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

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

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

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

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

Set the delay time for gain switching for 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 ~ 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) and switches 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 exceeds the level (P01.25) + hysteresis (P01.26) and switches to 2nd gain, when speed instruction is lower than the level (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 exceeds the level (P01.29) + hysteresis (P01.30) and switches to the 2nd gain, and when the torque instruction is lower than the 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 ~ 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 compen-sation 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	Model vibration suppression	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P		

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, external feedforward is valid

3: Enabled, model 2, no external feedforward

4: Enable, model 2, external feedforward is valid

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	Model tracking compensation coefficient 2	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 ~ 20000	500	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

P02 Vibration suppression

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

In position control mode, set the position instruction first-order low-pass filter time constant.

0.0ms ~ 6553.5ms

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

In position control mode, set the position instruction first-order low-pass filter time constant.

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 are 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

P03 Speed & torque control parameters

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

Set the source of instruction during speed control.

0: Digital setting (P03:03)

1: SPR (default AI1)

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

3: Multi-segment instruction 1 ~ 16 switching

4: Communication setting

5: SPR + digital setting

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

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

Set the speed instruction digital setting value.

-9000rpm ~ 9000rpm

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

Set the speed setting value during JOG.

0rpm ~ 3000rpm

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

Torque limiting source selection.

0: Positive and negative internal torque limit (default)

1: Positive and negative external torque limit (select via P_CL, N_CL)

2: TLMTP is used as forward and reverse torque limit.

3: TLMTP, TLMTN forward and reverse limit.

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

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

When DI is configured with function 16 (P_CL) and the DI input is valid, the forward rotation external torque limit is in effect; this set value must not be greater than the P03.09 (forward rotation internal torque limit value) set 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 during reverse rotation in the range of 0.0% to 500.0% (based on the rated torque of the motor).

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

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

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

When DI is configured with function 16 (P_CL) and the DI input is valid, the forward rotation external torque limit is in effect.

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

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

When DI is configured with function 17 (N_CL) and the DI input is valid, the reverse rotation external torque limit is in effect.

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% ~ 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% ~ 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 ~ 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	

Internal multi-segment speed set values of 16 segments.

-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

P04 Digital input and output

P04.00	Normal DI filter selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	500	1us	Restart	P	S	T

0 ~ 10000

This filtering parameter is available only for DI terminal 1 to DI terminal 6, and the filtering setting 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

Output code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.26	DO6 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	Restart	P	S	T

Output code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.27	DO7 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	Restart	P	S	T

Output code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.28	DO8 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	Restart	P	S	T

Output code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.29	DO9 terminal function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 31	0	--	Restart	P	S	T

Output code: 1 ~ 31

0: No definition

1 ~ 31: Refer to the digital output (DO) function definition table, some DO functions are undefined and reserved.

P04.31	DO1 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	T

Output polarity setting: 0 ~ 1

0: Conduct when valid (normally-open contact)

1: Not to conduct when valid (normally-closed contact)

P04.32	DO2 terminal logic level selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	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	FunINH signal unassigned status (HEX)	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Range (hexadecimal number) 0H to FFFFH.

Bit0: Correspond to DI function 16

Bit1: Correspond to DI function 17

......

Bit15: Correspond to DI function 31

For DI functions numbered 32 and larger, user-set initial status is not supported.

P04.43	Motor rotational signal threshold	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1000	0	--	Restart	P	S	T

0rpm ~ 1000rpm

P04.44	Speed conformity signal width	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 1000	50	1rpm	Immediate		S	

10rpm ~ 9000rpm

P04.45	Speed specified value arrival	Range	Default	Unit	Effective	Relevant mode		
		10 ~ 9000	100	1rpm	Immediate	P	S	T

10rpm ~ 9000rpm

P04.47	Positioning completion range	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	100	1P	Immediate	P		

1P ~ 65535P

P04.48	Positioning completion output setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 7	0	--	Immediate	P		

0: When the absolute value of position deviation is less than the positioning completion range (P04_47), output COIN signal.

1: When the absolute value of the position deviation is less than the positioning completion range (P04_47) and the position instruction is 0, output COIN signal.

2: If the absolute value of position deviation is less than the range of positioning completion (P04_47) and the position instruction is 0, the COIN signal is output and the holding time is P04_49.

3: When the absolute value of position deviation is less than the positioning completion range (P04_47), and the filtered position instruction is 0, output COIN signal.

4: Condition 0, zero speed signal is valid, output COIN signal.

5: Condition 1, zero speed signal is valid, output COIN signal.

6: Condition 2, zero speed signal is valid, output COIN signal.

7: Condition 3, zero speed signal is valid, output COIN signal.

P04.49	Positioning completion holding time	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	1	1ms	Immediate	P		

1 ~ 65535ms

P04.50	Positioning near range	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	65535	1P	Immediate	P		

1P ~ 65535P

P04.51	Servo OFF delay time after holding brake taking action when speed is 0	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	10	1ms	Immediate	P	S	T

0ms ~ 9999ms

P04.52	Speed setting for holding brake to take action in motion	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 3000	100	1rpm	Immediate	P	S	T

0rpm ~ 3000rpm

P04.53	Waiting time for holding brake to take action in motion	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	10	1ms	Immediate	P	S	T

0ms ~ 9999ms

P04.54	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% ~ 300.0% (based on rated motor torque).

When the actual torque (absolute value) ≥ (P04.55 + P04.56) is detected, DO function 12 is valid.

When the actual torque (absolute value) < (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 ~ 1000rpm, DO function 5 is valid after the actual speed falls below this threshold.

P05 Analog input and output

P05.00	AI1 minimum input	Range	Default	Unit	Effective	Relevant mode		
		-1000 ~ 1000	-1000	0.01V	Immediate	P	S	T

The setting range is -10.00V ~ 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 ~ 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 ~ 5.00 times rated motor torque

P05.16	AI1 function selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Immediate	P	S	T

0 ~ 5

0: SPR, speed instruction

1: TQR, torque instruction

2: SPL, speed limit

3: TLMTP, positive torque limit

4: TLMTN, negative rotation 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 rotation 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 ~ +10V.

1: Absolute value data output, 0 ~ 10V.

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 friction torque compensation	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 3000	0	0.1%	Immediate	P	S	

0.1 % 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	

0.1% torque unit (-300.0 ~ 300.0)

P06.14	Viscous friction compensa-tion	Range	Default	Unit	Effective	Relevant mode		
		-3000 ~ 3000	0	0.1%	Immediate	P	S	

0.1% torque unit (-300.0 ~ 300.0)

P06.15	Friction compensation time constant	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	0	0.1ms	Immediate	P	S	

0.1ms unit (0 ~ 1000.0ms)

P06.16	Friction compensation low speed range	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 500	1	1rpm	Immediate	P	S	

0 ~ 500rpm

P06.18	The first type of fault stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	1	Immediate	P	S	T

0: Coast to stop, remain free

1: DB stop, hold DB

P06.19	Parameter identification rate	Range	Default	Unit	Effective	Relevant mode		
		100 ~ 1000	500	--	Restart	P	S	

100 ~ 1000rpm

P06.20	Parameter identification acceleration time	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 10000	100	--	Restart	P	S	

50 ~ 10000ms

P06.21	Parameter identification deceleration time	Range	Default	Unit	Effective	Relevant mode		
		50 ~ 10000	100	--	Restart	P	S	

50 ~ 10000ms

P06.22	Parameter identification mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P	S	

0: Inertia is not automatically updated during auto-tuning.

1: Inertia is automatically updated during auto-tuning;

P06.23	Initial angle identification current limit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	500	0.1%	Restart	P	S	T

0 ~ 200.0%

P06.24	Instantaneous power failure protection & The third type of fault stop	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		
		0 ~ 10000	20	1ms	Immediate	P	S	T

After enabling the momentary power failure protection, use this power failure deceleration time when stopping the machine. The range is 0ms to 10000ms/1000rpm.

P06.26	Servo OFF stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	4	--	Restart	P	S	T

0: Coast to stop, remain free

1: Zero speed stop, remain free

2: Stop by emergency stop torque, remain free

3: DB stop, hold DB

4: Zero speed stop, hold DB

5: Stop by emergency stop torque, hold DB

P06.27	Fault stop mode selection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	4	--	Restart	P	S	T

0: Coast to stop, remain free

1: Zero speed stop, remain free

2: Stop by emergency stop torque, hold DB

3: DB stop, hold DB

4: Zero speed stop, hold DB

5: Stop by emergency stop torque, hold DB

Note: Encoder alarm Err.13, Err.14 fault stop mode:

P06.27 set 0~2: Coast to stop and remain free

P06.27 set 3~5: 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: Deceleration stop at the deceleration rate defined in the user's actual position/speed instruction, enter position lock after stopping, and stay in the state at the time the stop was triggered.

1: Deceleration stop with the deceleration time set in 6085h, enter position lock after stopping, and stay in the state at the time the stop was triggered.

2: Deceleration stop with the deceleration time set at 6085h, enter position lock after stopping, and stay in the state at the time the stop was triggered and limit the torque in the overtravel direction.

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% ~ 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% ~ 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% ~ 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	High-speed DI filtering setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 10000	50	1us	Restart	P	S	T

1us/unit

(DI4 and DI5 probe filtering 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

Unit's digit:

0: Incremental system;

1: Absolute system;

2: Absolute system (Err.12 needs manual clearing, special for industrial robotics);

3~9: Absolute system with overflow error.

Ten's digit:

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.

P07 Auxiliary function

P07.00	Panel display option	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Hexadecimal, from right to left:

Digit 1: Display the setting at homepage of panel

0: Status display

When set to 1 to 5, display the parameters set in P07. 01 ~ P07. 05.

Other digits are reserved.

P07.01	Panel monitoring parameter setting 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	1	--	Immediate	P	S	T

0 ~ 79,

Parameters of group P21 except P21.00 can be displayed directly on the panel. Setting to 0 does not display

P07.02	Panel monitoring parameter setting 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	5	--	Immediate	P	S	T

0 ~ 79, same as P07_01.

P07.03	Panel monitoring parameter setting 3	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	6	--	Immediate	P	S	T

0 ~ 79, same as P07_01.

P07.04	Panel monitoring parameter setting 4	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	21	--	Immediate	P	S	T

0 ~ 79, same as P07_01.

P07.05	Panel monitoring parameter setting 5	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 79	23	--	Immediate	P	S	T

0 ~ 79, same as P07_01.

P07.08	Function selection 1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Hexadecimal number, from right to left:

Digit 1, the time multiplication of the origin searching;

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 searching:

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;

Set to 1, soft limit detection starts at power-on;

Set to 2, the soft limit is detected only after the homing 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 minutes

P07.14	Fast deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	5	1ms	Restart	P	S	T

0ms ~ 9999ms

P07.16	Function selection 3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal, from right to left:

Digit 1: Interrupt positioning instruction setting

0: No adjustment with electronic gear

1: Adjust with electronic gear

Digit 2: Interrupt positioning instruction direction setting

0: Follow the current operation direction

1: Decided by instruction sign

Other digits are reserved.

P07.17	Resolution	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 99	0	--	Immediate	P		

Divide a circle of corresponding pulses into 0 to 99 parts.

P07.19	Function selection 5	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal, from right to left,

Digit 1: Reserved

Digit 2: Reserved

Digit 3: Position feedback initialization selection

Non-absolute system (P06. 47 is equal to zero):

0: Initialize to 0

1: Initialize to the value before power-failure (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: 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: Automatic reset is allowed

1: Automatic reset is not allowed

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: 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.

Digit 3: Error storage 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: Reset is allowed when SON is valid

1: Reset is not allowed 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.

P07.28	Homing signal holding time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	2000	ms	Immediate	Hm	S	T

In the recovery mode, set the effective holding time of DO output when the recovery of HOME is completed, for example, the factory value is "2000" ms, the meaning is: when the recovery is completed, the DO logic output level corresponding to HOME will be set to 1 and held for two seconds, and then cleared.

6041h status word BIT12 changes as above.

P08 Internal position instruction

P08.00	Multi-segment preset position execution method	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	0	--	Restart	P		

0: Single operation

1: Cyclic operation

2: DI terminal switching operation

3: Communication switching operation

4: Single continuous operation

5: Cyclic continuous operation

There are a total of 16 segment instructions, and the starting segment serial number is set by P08.01, and the ending segment serial number is set by P08.02.

For single operation, start from the starting segment and execute each segment in turn until the ending segment;

For cyclic operation, start from the starting segment, execute each segment in turn until the ending segment, and then start from the starting segment again. This is repeated until the internal position enable signal is disabled or the servo is OFF;

Set to 2 and 3 to conduct random execution of selected segments, with segment serial numbers selected via the DI terminal or communication.

Set to 4 and 5, corresponding to 0 and 1, the difference is that the current segment does not need to decelerate to 0 before starting the next segment in the transition between the two segments, while each segment of execution mode 0 and 1 needs to decelerate to 0 before starting the next segment.

P08.01	Starting segment number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 32	1	--	Immediate	P		

Range: 1 ~ (P08.02)

The two parameters P08.01 and P08.02 constrain each other.

P08.02	Ending segment number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 32	2	--	Immediate	P		

Range: (P08: 01) ~ 16

The two parameters P08.01 and P08.02 constrain each other.

P08.03	Dealing of residual segments after pausing and restarting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	1	--	Immediate	P		

0: Run the remaining segments

1: Run from the beginning again

P08.04	Position instruction type	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Restart	P		

0: Relative position instruction

1: Absolute position instruction

P08.05	Waiting time unit	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1	0	--	Immediate	P		

0: The wait time between sequential execution (single or cyclic) timeslots and segments is measured in ms.

1: The wait time between sequential execution (single or cyclic) timeslots and segments is measured in s.

P08.06	The first segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 to 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.08	The first segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.09	The first segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.10	Waiting time after the first segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.11	The second segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.13	The second segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.14	The second segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.15	Waiting time after the second segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.16	The third segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.18	The third segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.19	The third segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	200	1rpm	Immediate	P		

0 ~ 65535ms

P08.20	Waiting time after the third segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.21	The fourth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.23	The fourth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.24	The fourth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.25	Waiting time after the fourth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.26	The fifth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.28	The fifth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.29	The fifth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.30	Waiting time after the fifth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.31	The sixth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.33	The sixth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.34	The sixth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.35	Waiting time after the sixth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.36	The seventh segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.38	The seventh segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000ms

P08.39	The seventh segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.40	Waiting time after the seventh segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.41	The eighth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.43	The eighth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.44	The eighth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.45	Waiting time after the eighth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.46	The ninth segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.48	The ninth segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.49	The ninth segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.50	Waiting time after the ninth segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.51	The 10th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.53	The 10th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.54	The 10th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.55	Waiting time after the 10th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.56	The 11th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction,while a negative setting indicates a negative position instruction.

P08.58	The 11th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.59	The 11th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.60	Waiting time after the 11th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.61	The 12th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.63	The 12th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.64	The 12th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.65	Waiting time after the 12th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.66	The 13th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.68	The 13th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.69	The 13th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.70	Waiting time after the 13th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.71	The 14th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.73	The 14th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.74	The 14th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.75	Waiting time after the 14th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.76	The 15th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.78	The 15th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.79	The 15th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.80	Waiting time after the 15th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.81	The 16th segment displacement (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	10000	--	Immediate	P		

A value between -2147483646 and 2147483646 can be set, and a positive setting indicates a positive position instruction, while a negative setting indicates a negative position instruction.

P08.83	The 16th segment maximum speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 9000	200	1rpm	Immediate	P		

1 ~ 9000rpm

P08.84	The 16th segment acceleration/deceleration time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	10	1ms	Immediate	P		

0 ~ 65535ms

P08.85	Waiting time after the 16th segment completed	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

0 ~ 65535ms/s. The specific unit is set by P08.05.

P08.86	Position instruction interrupt execution setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Restart	P		

0: Disable the function of interrupt execution;

1: Enable, interrupt at the rising edge of the DI signal, and automatically release the interrupt lock state after completion;

2: Enable, interrupt at the rising edge of the DI signal, and release the interrupt lock state by DI signal XINT_ULK after completion;

3: Enable, interrupt at the falling edge of the DI signal, and automatically release the interrupt lock state after completion;

4: Enable, interrupt at the falling edge of the DI signal, and release the interrupt lock state by DI signal INTP_ULK after completion.

P08.88	Homing start method	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 4	0	--	Restart	P		

0: Disable

1: Enable by DI function STHOME

2: Enable by key

3: Enable by communication

4: Enable immediately after powering on the servo ON for the first time

P08.89	Homing mode	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 8	2	--	Restart	P		

0: Forward rotation to search for the origin, with the positive limit as the origin

1: Reverse rotation to search for the origin, with the negative limit as the origin

2: Forward rotation to search for the origin, with the HOME_IN signal OFF → ON as the origin

3: Reverse rotation to search for the origin, with the HOME_IN signal OFF → ON as the origin

4: Forward rotation to search for the origin, with the HOME_IN signal ON → OFF as the origin

5: Reverse rotation to search for the origin, with the HOME_IN signal ON → OFF as the origin

6: Forward rotation to directly search for the nearest Z signal as the origin

7: Reverse rotation to directly search for the nearest Z signal as the origin

8: Directly use the current position as the origin

P08.90	Limit switch and Z-phase signal setting when homing	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 5	2	--	Restart	P		

The meaning of the set values is as follows:

0: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will automatically return to the reverse direction to find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will automatically return to the reverse direction and go forward to search for the Z signal.

1: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will automatically return to the reverse direction to find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will directly go forward to search for the Z signal.

2: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and not find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will automatically return to the reverse direction and not find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will automatically return to the reverse direction and go forward to search for the Z signal.

3: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will stop and alarm and return to find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will stop and alarm (AL.096) and go forward to search for the Z signal.

4: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096), and return to find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will stop and alarm (AL.096) and go forward to search for the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will stop and alarm (AL.096) and go forward to search for the Z signal.

5: Homing mode 0 ~ 1: When the other side of the limit is encountered, it will stop and alarm (AL.096) and not find the Z signal.

Homing mode 2 ~ 5: When the limit position is encountered, it will stop and alarm (AL.096) and not find the Z signal.

Homing mode 6 ~ 7: When the limit position is encountered, it will stop and alarm (AL.096) and go forward to search for the Z signal.

P08.92	Origin searching high speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 3000	500	1rpm	Immediate	P		

1 ~ 3000rpm

After the homing process is started, the search for the origin begins at this speed unless a deceleration signal or an origin position signal is already present at the start.

P08.93	Origin searching low speed	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 300	50	1rpm	Immediate	P		

1 ~ 300rpm

When searching for the origin, switch to a low-speed search after encountering a deceleration point, or after encountering the origin position.

P08.94	Acceleration/deceleration time during origin searching	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 10000	500	1ms	Immediate	P		

1 ~ 10000ms

P08.95	Homing time limit	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 65535	60000	1ms	Immediate	P		

1 ~ 65535ms

Set the limit time for the origin return process, if the origin is not searched after this time, the search for the origin is stopped and the alarm AL.96 will occur. If the limit time set here is still not enough, the multiplication of the limit time can be set by the 1st digit from the right of P07.08. When digit 1 from the right of P07.08 is not 0, the actual limit time is the product of this value and digit 1 from the right of P07.08.

P08.96	Origin offset (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	0	--	Immediate	P		

Range: -2147483646 ~ 2147483646

It is used to adjust the value of the origin coordinate.

Note: It is only used for adjusting coordinate and does not affect the actual origin position.

P08.98	Mechanical origin offset (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-2147483646 ~ 2147483646	0	--	Immediate	P		

Range: -2147483646 ~ 2147483646

It is used to move a distance after the origin position has been found.

P09 Communication setting

P09.00	Servo axis address number	Range	Default	Unit	Effective	Relevant mode		
		1 ~ 247	1	--	Immediate	P	S	T

1 ~ 247, 0 is the broadcast address.

It is used for communication and supports Modbus, CANOpen, and so on.

P09.01	Modbus baud rate	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 6	2	--	Immediate	P	S	T

The supported baud rates and for setting 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 bus for data for a set period of time

P09.04	Communication response delay	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9999	0	1ms	Immediate	P	S	T

Respond after delaying for a set period of time after receiving data

P09.05	Communication DI enable 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 is reserved, 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 DI enable setting 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 16 ~ 31 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DI function:

0: Not enabled;

1: Enabled

Refer to section 10.3 of this manual for detailed instructions.

P09.07	Communication DI enable setting 3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 32 ~ 47 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DI function:

0: Not enabled;

1: Enabled

Refer to section 10.3 of this manual for detailed instructions.

P09.08	Communication DI enable setting 4	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DI function, BIT0 ~ BIT15 corresponds to DI functions 48 ~ 63 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DI function:

0: Not enabled;

1: Enabled

Refer to section 10.3 of this manual for detailed instructions.

P09.09	Communication DO enable 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 is reserved, BIT0 ~ BIT15 corresponds to DO functions 1 ~ 15 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DO function:

0: Not enabled;

1: Enabled

Refer to section 10.4 of this manual for detailed instructions.

P09.10	Communication DO enable setting 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

This parameter is displayed in hexadecimal form on the panel, where each binary bit indicates a DO function, BIT0 ~ BIT15 corresponds to DO functions 16 ~ 31 respectively. The value of the binary bit indicates whether to enable the communication control of the corresponding DO function:

0: Not enabled;

1: Enabled

Refer to section10.4 of this manual for detailed instructions.

P09.11	Communication instruction holding time	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 60	5	--	Immediate	P	S	T

The time to maintain the original state when communication is disconnected after the command value is written to the communication can be set from 0 to 60 in seconds. Setting 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;

The remaining digits are reserved.

P09.13	Bus communication configuration 1	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	1115	--	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: Use servo internal electronic gear ratio

1: Enable 608Fh*6091h/6092h electronic gear ratio

Digit 3: Instruction unit selection

0: rpm

1: Instruction/sec.

Digit 4: Jerk unit selection

0: Acceleration time ms from 0RPM-1000RPM

1: Instruction/s^2

P09.14	Bus communication configuration 2	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Restart	P	S	T

Hexadecimal numbers, from right to left (EtherCAT):

Digit 1: CSP mode BIT10 selection

0: Invalid

1: Valid

Digit 2: Absolute system (P06.47=2) origin completion flag storage setting

0: Not to store

1: Store

Digit 3: 603Fh display selection

0: Protocol fault code

1: X5E internal fault code

P09.15	Bus communication configuration 3	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	0	--	Immediate	P	S	T

Hexadecimal numbers, from right to left:

Digit 1: Position feedback selection in modulus mode

0: 6064 count range from 0 to the modal value minus 1 (when gear ratio is 1)

1: 6064 count range follows 607A, only the modal value is saved when re-powering on the device

Digit 3: Homing deviation (607C) zero value writing selection

0: Not to store

1: Store

Digit 4: Switching to the CSP mode bit15 selection after homing process

0: Not to clear

1: Clear

P09.16	Bus disconnection detection	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 300	12	--	Immediate	P	S	T

1 ~ 300, the number of times EtherCAT disconnection is detected, and when the number of times synchronization data that is lost reaches this value, Er.77 is reported.

P09.17	Bus communication configuration 4	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ FFFFH	1011	--	Immediate	P	S	T

Hexadecimal numbers, from right to left:

Digit 1: CSP mode maximum speed selection

0: Maximum speed limit of the motor, exceeding the maximum speed will report Er.078.

1: Maximum speed according to 6080h value. No faults will be reported if the value is exceeded, but may lead to positioning errors.

Digit 2: Synchronization offset setting

Digit 3: Stop at the origin to make homing selection again:

0: No movement

1: Restart homing process

Digit 4: Limit alignment function selection

0: Disable

1: Enable, reverse the instruction until the alarm AL099 is cleared automatically after alignment

2: Enable, re-enable can clear the alarm AL099

P09.18	Servo slave number setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Immediate	P	S	T

1 ~ 65536, EtherCAT slave number setting

0: The slave ALIAS address is determined from the address written to the ESC EPROM by the host computer;

For other values, P09.18 sets the slave ALIAS address; ALIAS address is ignored when automatic incremental addressing is used.

P17 Expansion position control function

P17.00	External encoder usage	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2	0	--	Restart	P		

0: No external encoder is used for position feedback

1: When using external encoder as position feedback; the external encoder count is increased when the motor direction is CCW.

2: External encoder is used as position feedback; the external encoder count is increased when the motor direction is CW.

P17.01	External encoder pitch (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	10000	--	Restart	P		

Set the number of feedback pulses from the external encoder for one revolution of the motor:

0 ~ 1073741824

P17.03	Full-closed mixed deviation Threshold (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	--	Immediate	P		

0 ~ 1073741824

P17.05	Mixed deviation counting setting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 1073741824	0	0.01	Restart	P		

0 ~ 100%

P17.06	Mixed vibration suppression gain	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 30000	400	0.1/s	Immediate	P		

1.0 ~ 3000.0 /s

P17.07	Mixed vibration suppression time constant	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 30000	0	0.1ms	Immediate	P		

1.0 ~ 3000.0/s

P17.09	External units for full closed loop mixed deviation (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P		

-1073741824 ~ 1073741824

P17.11	External units for internal encoder count value (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P		

-1073741824 ~ 1073741824

P17.13	External encoder count value (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Display only	P		

-1073741824 ~ 1073741824

P17.16	Position comparison output mode	Range	Default	Unit	Effective	Relevant mode		
		0000H ~ 0003H	0	--	Restart	P		

Range: 0 ~ 3,

0: Disable

1: Forward trigger

2: Reverse trigger

3: Bi-directional trigger

"Position comparison" means that the value set by P17.17~ P17.23 is compared with the value of P21.07.

"Forward trigger" means "Absolute position feedback" (from small to large).

P17.17	The first position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

P17.19	The second position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

P17.21	The third position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

P17.23	The fourth position (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		-1073741824 ~ 1073741824	0	--	Immediate	P		

-1073741824 ~ 1073741824

P17.25	Signal effective time 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65535ms.

P17.26	Signal effective time 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65535ms.

P17.27	Signal effective time 3	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65535ms.

P17.28	Signal effective time 4	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	1ms	Immediate	P		

After the 1st position is reached, the effective signal is output from 0 to 65535ms.

P18 Motor model

P18.00	Motor model code (32-bit)	Range	Default	Unit	Effective	Relevant mode		
		00000000H ~ EFFFFFFFH	1964114433	--	Restart	P	S	T

The coding rules for motor models are as follows: XXXYZMNN

(1) XXX: motor rated output (3 digits) Example 751 --- 750W

(2) Y: Voltage specification

2: AC200V

6: AC380V

(3) Z: Rotor inertia ring specifications

0: Low inertia (MA 40 ~ 130 flange)

1: Medium inertia (MM 40 ~ 130 flange)

2: High inertia (MH 40 ~ 130 flange)

4: Medium inertia (MG 40 ~ 130 flange)

5: Low inertia (MA 180 ~ 220 flange)

6: Low inertia (MN 14/25 flange)

7: Medium inertia (MM 180 ~ 220 flange)

8: High inertia (MG 180 ~ 220 flange)

9: High inertia (MH 180 ~ 220 flange)

(4) M: Series number

0: X3 motor

1: X2 motor

2: X1 motor

3: X6 motor

(5) N: Number of encoder bits

0: 17-bit

1: 23-bit

(6) N: Design serial number

P20 Key and communication control interface

P20.00	Key JOG trial	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 2000	0	rpm	Restart	P	S	T

0 ~ Rated speed of motor

P20.01	Fault reset	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	0	rpm	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 defaults (manufacturer parameters excluded)

2: Clear fault records

7: Absolute encoder reset, reset clear P21.32

8: Absolute value encoder reset, reset clear P21.32 and P21.07

9: Save 6000 groups of objects write value, first write 6000 groups, then P20.06 set 9

10: Restore 6000 groups of objects, P20.06 set 10, re-power restored to the factory value

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 ~ 32

P20.12	Communication homing starting	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	0	--	Immediate	P		

0: No operation

1: Start homing

P21 Status parameters

P21.00	Servo status	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

Real-time display of the status of the drive.

The following signs are available: rdy, run, Err.00 to 99 (fault), AL.00 to 99 (warning).

P21.01	Motor speed feedback	Range	Default	Unit	Effective	Relevant mode		
		-9000 ~ 9000	0	1rpm	Display only	P	S	T

Real-time display of 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 effective 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 ~ 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

Real-time display of inertia value recognized online.

The range is 0.01 kg cm^2 ~ 655.35 kg cm^2.

P21.12	Speed value relative to input position 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 digit 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 digit 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 DI9, 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 digit 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 digit 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

Reserved

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: 214748364.7s

P21.27	AI1 voltage after adjustment	Range	Default	Unit	Effective	Relevant mode		
		-32768 ~ 32767	0	1mV	Display only	P	S	T

Real-time display of the voltage value of AI1, which has been adjusted.

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 adjusted.

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 adjusted.

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 adjusted.

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	1P	Display only	P	S	T

Record the number of encoder pulses for less than one revolution in absolute position.

P21.36	Version code 1	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Display software version number.

P21.37	Version code 2	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Display software version number.

P21.38	Version code 3	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	0.01	Display only	P	S	T

Display software version number.

P21.39	Product series code	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 65535	0	--	Display only	P	S	T

PP.XXX

P21.40	Fault record display	Range	Default	Unit	Effective	Relevant mode		
		0 ~ 9	0	--	Immediate	P	S	T

It can be set to 0 to 9 to view 10 times fault records. When there is a current fault, set it to 0 to display the current fault record; when there is no current fault, display the last 10 times fault record.

0: Current fault type

1: Previous 1 time fault

2: Previous 2 times fault

......

9: Previous 9 times fault

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 “Error & 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 busbar 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	1%	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 version series number

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 the fourth digit 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	1Unit	Display only	P	S	T

When the fourth digit of P07.19 is 1, the feedback pulse is a 64-bit count, and it is shown here as the high 32 bits. Unit is-the instruction unit.

Digital input (DI) function definition table

Setting value	Symbol	Name	Description
1	S_ON	Servo enable	Invalid- Disable servo motor enable Valid- Enable servo motor power-up
2	ERR_RST	Alarm reset signal	According to the type of alarm, the servo motor is able to continue to work after alarm reset. This function is along the effective level, when the set terminal is level effective, and also only effective when the edge changes are detected.
3	GAIN_SEL	Proportional action switching/gain switching	Invalid - Speed control loop is controlled by PI Valid - Speed control loop is controlled by P
4	CMD_SEL	Torque instruction source switching	Invalid-Currently running instruction is A Valid-Currently running instruction is B
5	PERR_CLR	Pulse deviation clear	Invalid-No action Valid-Clear pulse deviation
6	MI_SEL1	Switching 16 operation instructions	Execute 16 position instructions or speed instructions by selecting them via DI terminal
7	MI_SEL2	Switching 16 operation instructions	
8	MI_SEL3	Switching 16 operation instructions	
9	MI_SEL4	Switching 16 operation instructions	
10	MODE_SEL	Switching 16 operation instructions	Switch between speed, position, and torque according to the selected control mode (3, 4, 5).
12	ZERO_SPD	Zero speed clamp function	Valid-Enable the zero fixing function Invalid - Disable the zero position fixing function
13	INHIBIT	Pulse inhibit	Valid- Prohibit instruction pulse input Invalid-Allow instruction pulse input
14	P_OT	Positive overtravel	When the mechanical movement exceeds the movable range limit switch action, enter the overtravel protection function. Valid-Positive overtravel, prohibit forward drive Invalid-Normal range, allow positive drive
15	N_OT	Negative overtravel	When the mechanical movement exceeds the movable range limit switch action, enter the overtravel protection function. Valid-Negative overtravel, prohibit positive drive Invalid-Normal range, allow positive drive
16	P_CL	Positive external torque limit	Valid - External torque limit is valid Invalid - External torque limit is not valid
17	N_CL	Negative external torque limit	Valid - External torque limit is valid Invalid - External torque limit is not valid
18	P_JOG	Positive JOG	Valid - Input according to the set instruction Invalid - Stop input of the running instruction

Setting value	Symbol	Name	Description
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	Invalid-Ignore internal multi-segment instructions Valid-Enable internal multi-segment instructions
26	INTP_ULK	Release the interrupt positioning lock	Invalid-No effect Valid - When parameter P08.86 is set to 2 or 4, the position instruction interrupt execution lock status is released.
27	INTP_OFF	Disable the execution of interrupt positioning.	Invalid - No effect Valid-When parameter P08.86 is not set to 0, DI can be used to disable the execution of the interrupt positioning function at any time after the interrupt execution function is enabled.
28	HOME_IN	Origin position signal	Available as an origin or deceleration position signal
29	STHOME	Enable homing process	Start homing process
30	ESTOP	Emergency stop	Invalid - No effect Valid - Enter emergency stop
31	STEP	Position step enable	Valid-Execute the step amount instruction Invalid-Instruction is zero as the positioning status
32	FORCE_ERR	Forced fault protection input	Invalid - No effect Valid - Enter fault status
34	INTP_TRIG	Interrupt positioning execution trigger signal	Invalid - No effect Valid - When the value of parameter P08.86 is not 0, the position instruction is triggered to interrupt the execution process, which can only be configured to DI8 and DI9.
35	INPOSHALT	Halt generation of internal position instructions	Invalid - No effect Effective-Decelerate and halt execution of internal multi-stage positional and interrupt positioning
36	ANALOG	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-Touch probe function 1 execution signal
40	Touch2	Touch probe 2	Invalid - No effect Valid- Touch probe function 2 execution signal

Digital output (DO) function definition table

Setting value	Symbol	Name	Description
1	S_RDY	Servo ready	Valid-Servo ready Invalid - Servo not ready
2	S_ERR	Fault output signal	Valid when a fault is detected
3	S_WARN	Warning output signal	Warning output signal active (conducted)
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 for confirming torque limit Valid - Motor torque is limited Invalid - Motor torque is not limited
10	V_LT	Speed limit signal	Signal for confirming 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 unlocked Invalid - Resume the brake, the motor shaft is locked
12	T_ARR	Torque specified range arrival	The output signal is valid when the torque instruction value reaches the value set in P04.55, and the permissible variation range is determined by P04.56.
13	V_ARR	Speed feedback specified range arrival	The output signal is valid when the speed feedback value reaches the value set in P04.45, and a variation range of +/-10rpm is allowed.
15	INTP_DONE	Interrupt positioning completion	Output after position instruction interrupt is completed.
16	DB_OUT	Dynamic braking output	External relay or contactor and current limiting resistor are required.
17	HOME	Homing completion	
18	INTP_WORK	Interrupt positioning being executed	Interrupt positioning is being executed.
19	PCOM1	Position 1 comparison trigger signal	Trigger signal is output when the position 1 reaches the corresponding range.
20	PCOM2	Position 2 comparison trigger signal	Trigger signal is output when position 2 reaches the corresponding range.
21	PCOM3	Position 3 comparison trigger signal	Trigger signal is output when position 3 reaches the corresponding range.
22	PCOM4	Position 4 comparison trigger signal	Trigger signal is output when position 4 reaches the corresponding range.

6.3 Bus-related function code

For ease of use, the X5EB bus drive is configured with relevant function codes in the internal parameters as follows:

Parameter address	Name	Description	Default
1010_01h	Group 6000 written parameter storage	Group 6000 parameters write the parameters that need writing first, and then conduct parameter memory and power-failure storage after writing 0x65766173 (or P20.06 set 9) in 1010-01. Write 0x74736572 in 1010-01 (or set 10 in P20.06) to cancel the parameter storage, and reboot to restore the default.	0
2100_02h (P00.01)	Modes of operation	0: Position mode 1: Speed mode 2: Torque mode 7: EtherCAT mode	7
2100_09h~2100_0Dh (P0.08~P0.12)	Electronic gear ratio	Servo internal electronic gear ratio setting, see section 5.10 for details.	
2100_1Dh (P00.28)	Modulus mode Low 32-bit	(Encoder unit: P) In the absolute value system, if this value is set, the modulus mode will be enabled, and the count value can only count from 0 to this value minus 1 (when the gear ratio is 1), it is necessary to set P07.11 to 1 to enable the power-failure memory function, and write P20-06 to 8 to clear the multi-turn and position feedback, and setup is completed to re-power up the device. P00.28 and P00.30 are set to 0 for linear mode.	0
2100_1Fh (P00.30)	Modulus mode High 32-bit		0
2101_0Ch (P01.11)	Speed feedforward channel selection	0: No speed feedforward 1: Internal speed feedforward 2: 60B1h speed feedforward input	0
2101_0Fh (P01.14)	Torque feedforward channel selection	0: No torque feedforward 1: Internal torque feedforward 2: TFFD used as torque feedforward input 3: 60B2h torque feedforward input	0
2103_0Ah (P03.09)	Internal forward torque limit	It has the same function as the 60E0h positive maximum torque limit and is a parallel relationship. The minimum value of the two is taken when using.	5000
2103_0bh (P03.10)	Internal reverse torque limit	It has the same function as the 60E1h negative maximum torque limit and is a parallel relationship. The minimum value of the two is taken when using.	5000
2103_1Ch (P03.27)	Internal positive speed limit	It can be used as a maximum positive speed limit for the profile torque mode, or it can be replaced by the 6080h maximum motor speed.	3000
2103_1Dh (P03.28)	Internal negative speed limit	It can be used as a maximum negative speed limit for the profile torque mode, or it can be replaced by the 6080h maximum motor speed.	3000
2107_09h (P07.08)	Soft limit function selection	Hexadecimal numbers, from right to left: Digit 4: 607Dh soft limit function selection 0: Soft limit is not enabled 1: Enable the soft limit function during power-on. 2: The soft limit function is enabled only after the homing is completed.	0
2107_16h (P07.21)	Protection function reset selection	Hexadecimal numbers, from right to left: Digit 3: Tripping protection selection 0: Resettable 1: Not resettable Digit 4: Encoder undervoltage warning selection 0: Resettable 1: Not resettable	1000
2107_1Dh (P07.28)	Homing signal holding time	Set (non-DI homing starting method) homing signal holding time (unit ms)	2000

Parameter address	Name	Description	Default
2109_0Eh (P09.13)	Bus communication configuration 1	Digit 2: Electronic gear ratio selection 0: Use servo internal gear ratio such as P00.08 1: Use 608Fh*6091h/6092h electronic gear ratio Digit 3: Speed instruction unit selection 0: rpm 1: Instruction/sec. Digit 4: Acceleration unit selection 0: Acceleration time from 0 to 1000rpm (unit ms) 1: Acceleration (instruction/s^2)	1115
2109_0Fh (P09.14)	Bus communication configuration 2	Digit 1: CSP mode BIT10 selection 0: Invalid 1: Valid Digit 2: Absolute system (P06.47=2) Origin completion flag storage setting 0: Not to store 1: Store Digit 3: 603Fh display selection 0: Protocol fault code 1: 0XFF for high 8 bits, X5E internal fault code displayed in low 8 bits Digit 4: Touch probe function selection (refer to section 5.10)	0
2109_10h (P09.15)	Bus communication configuration 3	Digit 1: Position feedback selection in modulus mode 0: 6064 count range from 0 to the modal value minus 1 (when gear ratio is 1) 1: 6064 count range follows 607A, only the modal value is saved when re-powering on the device Digit 3: Homing deviation (607C) zero value writing selection 0: Not to store 1: Store Digit 4: Switching to the CSP mode bit15 selection after homing process 0: Not to clear 1: Clear	0
2109_11h (P09.16)	Bus disconnection detection	The number of times EtherCAT disconnection is detected, and when the number of times synchronization data that is lost reaches this value, Er.77 is reported.	12
2109_12h (P09.17)	Bus communication configuration 4	Digit 1: CSP mode maximum speed selection 0: Maximum speed limit of the motor, exceeding the maximum speed will report Er.078. 1: Maximum speed according to 6080h value. No faults will be reported if the value is exceeded, but may lead to positioning errors. Digit 2: Synchronization offset setting Digit 3: Stop at the origin to make the homing selection again: 0: No movement 1: Restart homing process Digit 4: Limit alignment function selection 0: Disable 1: Enable, reverse the instruction until the alarm AL099 is cleared automatically after alignment 2: Enable, re-enable can clear the alarm AL099	1101

Parameter address	Name	Description	Default
2109_12h (P09.18)	Servo slave number setting	0: The slave ALIAS address is determined from the address written to the ESC EPROM by the host computer; For other values, P09.18 sets the slave ALIAS address; ALIAS address is ignored when automatic incremental addressing is used.	0
2114_03h (P20.02)	Group 2100 written parameter storage	P20.02 set 42330 (or 2114-03h write 0xA55A), then written 2100 groups parameters of the host device can be stored to the servo EPROM.	0

Chapter 7 Error & Alarm and troubleshooting

7.1 Error & Alarm code list

Table 7-1 lists all of the manufacturer-defined faults, and the cells marked by the dark background in the table are bus-specific faults. The 603Fh column in the table indicates the CiA protocol fault code corresponding to the factory-defined fault code, which can be read from dictionary object 603Fh when the fault occurs. If a fault occurs that is not in Table 7-1, refer to the standard user's manual for the corresponding servo drive.

Table 7-1 List of factory-defined error & alarm codes

Error & Alarm code	Name	Stop mode	Reset (Y/N)	Record memory (Y/N)	603Fh
Err.001	Abnormal system parameter	Stop immediately	N	N	6320h
Err.002	Product model selection fault	Stop immediately	N	N	6320h
Err.003	Parameter storage fault	Stop immediately	N	N	7600h
Err.004	FPGA fault	Stop immediately	N	N	6320h
Err.005	Product matching fault	Stop immediately	N	N	6320h
Err.006	Program error	Stop immediately	N	N	6320h
Err.007	Encoder initialization failure	Stop immediately	N	Y	7305h
Err.008	Short circuit to ground detection fault	Stop immediately	N	Y	2330h
Err.009	Over-current fault A	Stop immediately	N	Y	2310h
Err.010	Over-current fault B	Stop immediately	N	Y	2310h
Err.012	Incremental optical encoder Z disconnection or abnormal number of absolute encoder turns	Configurable	N	Y	7305h
Err.013	Abnormal encoder communication	Configurable	N	Y	7305h
Err.014	Abnormal encoder data	Stop immediately	N	Y	7305h
Err.015	Abnormal under-voltage of encoder battery	Stop immediately	N	Y	7305h
Err.016	Overlarge speed deviation	Configurable	Y	Y	8400h
Err.017	Torque saturation timeout	Configurable	Y	Y	8300h
Err.018	Control power under-voltage	Configurable	Y	Y	3220h
Err.019	Tripping	Configurable	Y	Y	8400h
Err.020	Over-voltage	Stop immediately	Y	Y	3210h
Err.021	Under-voltage	Decelerate to stop	Y	Default N, optional	3220h
Err.022	Current sampling fault	Stop immediately	Y	Y	7200h
Err.023	Overlarge AI sampling voltage	Stop immediately	Y	Y	7200h
Err.024	Over-speed	Stop immediately	Y	Y	8400h
Err.025	Electric angle identification failure	Stop immediately	Y	N	FF00h
Err.026	Inertia identification failure	Stop immediately	Y	N	FF00h
Err.027	DI terminal parameter setting fault	Stop immediately	Y	N	6320h
Err.028	DO terminal parameter setting fault	Stop immediately	Y	N	6320h
Err.040	Invalid servo ON instruction fault	Configurable	Y	N	FF00h
Err.042	Over-speed pulse division output	Configurable	Y	Y	FF00h
Err.043	Overlarge position deviation	Configurable	Y	Y	8611h
Err.044	Main circuit input phase loss	Configurable	Y	Y	3130h
Err.045	Drive output phase loss	Configurable	Y	Y	3130h
Err.046	Overloaded drive	Configurable	Y	Y	3230h
Err.047	Overloaded motor	Configurable	Y	Y	3230h
Err.048	Electronic gear setting error	Configurable	Y	N	6320h
Err.049	Overheated heat spreader	Configurable	Y	Y	4210h

Error & Alarm code	Name	Stop mode	Reset (Y/N)	Record memory (Y/N)	603Fh
Err.050	Abnormal pulse input	Configurable	Y	Y	8500h
Err.051	Overlarge full-loop position deviation	Configurable	Y	Y	8611h
Err.054	User forced fault	Decelerate to stop	Y	Y	FF00h
Err.055	Absolute position resetting fault	Configurable	Y	Y	FF00h
Err.058	Safe Torque Off (STO)	Stop immediately	Y	Default N, optional	5100h
Err.060	The first start after writing customized software	Stop immediately	N	N	6320h
Er.075	Slave initialization failure	Stop	N	Y	7500h
Er.076	Synchronization failure	Stop	Y	Y	7500h
Er.077	EtherCAT communication interruption	Decelerate to stop	Y	Y	7500h
Er.078	Abnormal instruction setting	Stop	Y	Y	7500h
Er.079	No control mode when enabled	Stop	Y	Y	7500h
AL.080	Under-voltage alarm	No stop	Y	N	3220h
AL.081	Overloaded drive alarm	No stop	Y	Y	3230h
AL.082	Overloaded motor alarm	No stop	Y	Y	3230h
AL.083	Modification of parameters that need power restart	No stop	Y	N	6320h
AL.084	Servo not ready	No stop	Y	N	FF00h
AL.085	E2PROM writing frequency alarm	No stop	Y	N	7600h
AL.086	Positive over-travel alarm	No stop	Y	N	FF00h
AL.087	Negative over-travel alarm	No stop	Y	N	FF00h
AL.088	Position instruction over-speed	No stop	Y	N	8500h
AL.090	Absolute encoder angle initialization alarm	No stop	Y	Y	FF00h
AL.093	Overloaded energy consumption brake	No stop	Y	Y	3210h
AL.094	Over-small external regenerative resistor	No stop	Y	N	3210h
AL.095	Emergency stop	Decelerate to stop	Y	N	FF00h
AL.096	Homing error	Decelerate to stop	Y	N	FF00h
AL.097	Encoder battery under-voltage	No stop	Y	N	7305h
AL.099	Limit alignment warning	No stop	Y	N	FF00h

7.2 Error & Alarm causes and handling measures

Table 7-2 lists all of the manufacturer-defined errors & alarms, causes and handling measures. The cells marked by the dark background in the table are bus-specific faults.

Error & Alarm code and name	Cause	Handling measure
Err.001: Abnormal system parameter	1.Instantaneous decrease in power voltage; 2.The range of some parameters has been changed after software updates, which makes the stored parameters exceed set ranges.	1.Ensure the power voltage is within the specified range. Restore the parameters (P20.06 set to 1); 2.Please restore the parameters first if the software has been upgraded.
Err.002: Product model selection fault	1.The connecting cable of the encoder is damaged or loose; 2.Invalid drive or motor model.	1.Check if the encoder cable is normal and fasten the cable; 2.Replace the faulty motor or drive with a valid one.

Error & Alarm code and name	Cause	Handling measure
Err.003: Parameter storage fault	1.Over-frequent parameter reading/writing; 2.The equipment for parameter storage is faulty; 3.Power supply is unstable; 4.Faulty drive.	1.Check if the modification or writing EEPROM of the host device communication is too frequent. Check if there is an instruction for frequent parameter modification and EEPROM writing in the communication program. 2.Check the control circuit power cable and ensure the control circuit power voltage is within the specified range.
Err.004: FPGA fault	Abnormal software version	Check if software version is matching.
Err.005: Product matching fault	1.The connecting cable of the encoder is damaged or loose; 2.Use a three-party external port such as an encoder, which is not matched with the equipment; 3.The power of the motor and drive are mismatched with each other; 4.Product model number doesn't exist.	1.Check the connection of the encoder cable ; 2.Replace the mismatching product with a matching one; 3.Choose a matching encoder type or replace other types of drives. For example, the error alarm will be reported when choosing a motor, whose power is higher or two-level lower than that of a drive.
Err.006: Program error	1.Abnormal system parameter; 2.Internal fault of drive.	EEPROM fault, set P20.06 to1 to initialize system parameters and reconnect to the power supply.
Err.007: Encoder initialization failure	Abnormal encoder signal detected during power-on.na	Check the encoder wiring, or replace the encoder cable.
Err.008: Short circuit to ground detection fault	1.UVW wiring fault; 2.Motor damages; 3.Faulty drive.	1.Check if UVW is short-circuited to ground. If so, then replace the cable; 2.Check if the motor cable or grounding resistor is abnormal. If so, then replace the motor.
Err.009: Over-current fault A	1.The instruction input is synchronized with servo connection or is too fast. 2.The external braking resistor is too small or short-circuited; 3.Bad contact of motor cable; 4.Motor cable is grounded; 5.Motor UVW is short-circuited; 6.Motor is burnt; 7.Software detects the over-current in power transistors.	1.Check instruction input time sequence and input instruction after the servo connects with "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-circuit- ed, 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.

Error & Alarm code and name	Cause	Handling measure
Err.010: 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 "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-circuit- ed, 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.012: Incremental optical encoder Z disconnection or abnormal number of absolute encoder turns	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 ten's digit of P06.47 is 1.	Replace the encoder battery.
Err.016: Overlarge speed deviation	The absolute value between the speed instruction and measured speed surpasses the set threshold of P06.45.	1.Increase the setting value of P06.45; 2.Extend acceleration/deceleration time of internal position instruction or adjust the response of the gain system; 3.Set P06.45 to 0 to disable the overlarge speed deviation function.
Err.017: Torque saturation timeout	Torque maintains a long-term saturated state, which lasts longer than the threshold time specified by P06.46.	1.Increase the time span specified by P06.46 ; 2.Check if UVW is disconnected.

Error & Alarm code and name	Cause	Handling measure
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 for 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 de- fault, 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.
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.

Error & Alarm code and name	Cause	Handling measure
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.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 adjust the 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. 6.Check the running waveform in the background, if there is no feedback from the input, please replace the servo drive.
Err.044: Main circuit input phase loss	1.Bad contact of the three-phase input cable; 2.Phase loss fault, i.e., when the main power supply is ON, the voltage of one of the R\S\T phases is too low for more than 1 second.	1.Check whether the three-phase power supply cable is well connected (Note: Do not operate with the power supply on.); 2.Measure the voltage of each phase of the three-phase power supply to ensure that the input power supply is balanced or that the input power supply voltage conforms to the specifications;
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;

Error & Alarm code and name	Cause	Handling measure
Err.047: Overloaded motor	Overloaded motor The loaded operation exceeds the drive inverse time curve. The causes are as follows: 1.The motor UVW cable or encoder cable is loose or faulty; 2.The motor is blocked or acted upon by force, including mechanical jamming, collision, gravity force, and other acts of force. Or the mechanical brake is not released during operation. 3.Misconnect the UVW and encoder wires of the same motor to different drives when wiring multiple drives. 4.Overload or the drive or motor size is too small. 5.Possible lack of phase or wrong phase sequence. 6.Damaged drive or motor	1.Confirm that the motor UVW wire and encoder wiring are correct; 2.Confirm that the motor is not blocked or driven by force, and confirm that the mechanical brake (holding brake) is on; 3.Confirm that there is no cross-wiring of multiple drives and motors, i.e., the UVW cable and the encoder cable of a motor are connected to their corresponding drive; 4.Extend the acceleration and deceleration time, and re-select the appropriate drive or motor; 5.Check whether the motor output UVW is connected incorrectly and whether it is shorted to ground; 6.Replace the drive or motor
Err.048: Electronic gear setting error	The gear ratio exceeds the specified range [encoder resolution/10000000, encoder resolution/2.5].	Set the correct gear ratio.
Err.049: Overheated heat spreader	1.Faulty fan; 2.Ambient temperature is too high; 3.Repetitive reset overload fault through power-off 4.Install the drive in the wrong direction and leave inappropriate clearance between drives; 5.The servo drive is faulty; 6.The motor or drive is faulty.	1.Check if the fan operates normally, and replace the fan or drive if it is abnormal; 2.Measure the ambient temperature and improve the cooling conditions of the servo drive to reduce the ambient temperature; 3.Check if an overload fault has been reported before. The way to correct the fault is to wait for 30 seconds after overload and then reset the equipment. If the power of the drive or motor is too small, increase the capacity, extend the acceleration and deceleration time, and reduce the load. 4.Confirm the setting state of the drive and install it according to the installation standards; 5.If a fault is still reported after a 5-minute power off and then restart, replace the drive.
Err.050: Abnormal pulse input	1.Input pulse frequency is larger than the specified maximum pulse frequency 2.Input pulse is interfered.	1.Adjust the maximum pulse frequency parameter P06.38; 2.Use the background software to check whether the instruction is abnormal; ensure a reliable grounding; use a twisted pair of shielded wires, and separate the input cable from the power cable.
Err.051: Overlarge full-loop position deviation	1.Abnormal external encoder; 2.Relative setting is too conservative.	1.Confirm that the external encoder is correctly wired. If it is not, then replace it with a new one. 2.Full-loop deviation is too large; the protection function setting is incorrect. Confirm and correct the setting of relevant parameters.
Err.054: User forced fault	Enter faulty state forcibly through DI function 32 (FORCE_ERR).	Normal DI function inputs, which are configured with DI function 32 and valid inputs. Disconnecting the inputs can release the alarm.
Err.055: Absolute position resetting fault	Faulty position reset of absolute encoder	Contact the manufacturer for technical support.

Error & Alarm code and name	Cause	Handling measure
Err.056: Main circuit power outage	Power outage or abnormal main power circuit. (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.058: Safe torque off (STO)	1.The STO safety function is enabled; 2.Abnormal STO circuit power supply or wiring	1.STO terminal recovery, automatically clears the fault; check whether the STO power supply wiring is normal. 2.If the faults are still reported, replace the machine
Err.060: The first start after writing customized software	First startup after downloading a customized version of the program in a drive that already has a standard program.	Restore factory values for loading customized parameters.
Er.075: Slave initialization failure	EtherCAT slave initialization failure	Try re-flashing the XML configuration file, then reboot.
Er.076: Synchronization failure	EtherCAT synchronization failure	Check drive carriers and synchronization periods
Er.077: EtherCAT communication interruption	The maximum number of consecutive communication losses exceeds the set value	Please check if the cable is plugged in tightly, or replace it with a cable with a shield. Try the P09.16 value setting.
Er.078: Abnormal instruction setting	CSP mode operation speed instruction exceeds the motor maximum speed.	Check whether there is a hopping of the position instruction, if so, adjust the second digit starting from the right place of the synchronization offset P09.17 appropriately. If the instruction is normal, please reduce the acceleration and deceleration speed properly. This fault can be shielded by setting 0 to the first digit of P09.17, but it may trigger the alarm of excessive deviation.
Er.079: No control mode when enabled	Servo enabled, 6060h is an unsupported control mode.	Reset 6060h valid control mode.
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 & Alarm 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 (safety precaution, manual rotation of the motor is prohibited during overtravel).
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 (safety precaution, manual rotation of the motor is prohibited during overtravel).
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.

Error & Alarm code and name	Cause	Handling measure
AL.093: Overloaded energy consumption brake	Energy consumption braking power is overloaded: 1.Incorrect wiring or bad contact of the braking resistor; 2.Short connecting cable may be disconnected when using an internal resistor; 3.Insufficient braking resistor capacity; 4.Prolonged braking due to overlarge braking resistor value; 5.Input voltage exceeds the specifications; 6.Incorrect setting of constants including braking resistor value, capacity, or heat generation time constant; 7.Faulty drive.	1.Check if the resistor wiring is correct; 2.Check if the internal resistor wiring is correct; 3.Increase braking resistor capacity; 4.Reduce braking resistor value; 5.Reduce input voltage; 6.Set correct parameters according to specifications; 7.Replace drive.
AL.094: Over-small external regenerative resistor	1.External regenerative resistor value is smaller than the minimum value specified by the drive. 2.Incorrect parameter setting.	1.Configure the power of the external regenerative resistor according to the specifications; 2.Check that parameters P00.21 to P00.24 are correct.
AL.095: Emergency stop	The emergency stop is triggered.	Normal DI function inputs, configured with DI function 30 and valid inputs. Disconnecting the inputs can release the alarm.
AL.096: Homing error	1.Homing time exceeds the value specified by P08.95 2.P08.90 is set to 3, 4, or 5 and encounters the limit; 3.Encounter limit twice when not using limit as the origin.	1.Increase the specified value of P08.95; 2.Reduce homing searching speeds P08.92, and P08.93 to avoid the alarm caused by over-speed of homing.
AL.097: Encoder battery under-voltage	Encoder battery voltage is below the threshold value specified by P06.48.	Check or replace encoder battery.
AL.099: Limit alignment	When running in CSP mode, the situation is as follows: if it is just at the limit position, the alarm will be reported as over-travel; if it has exceeded the limit position, and there is an inconsistency between the position instruction and the feedback, then the alarm will be reported as AL.099. When the alarm is triggered, the motor will not be operated if the forward instruction continues to be sent. In this case, it is necessary to send a reverse instruction until the position instruction and feedback are consistent, then the motor will run and the alarm will be cleared automatically.	Send a reverse instruction until the position instruction and the feedback value are the same, then this warning will be cleared automatically (Safety warning, no manual rotation of the motor is allowed) This function can be deactivated by setting the fourth digit from the right to zero.

Chapter 8 Examples of application

8.1 Connection between X5EB and Beckoff PLC

This case is an example of connecting the X5_EtherCAT servo drive with Beckoff CX5020+EK1110 EtherCAT module (TwinCAT 2.11) in the cyclic synchronous position mode.

◆ Preparation

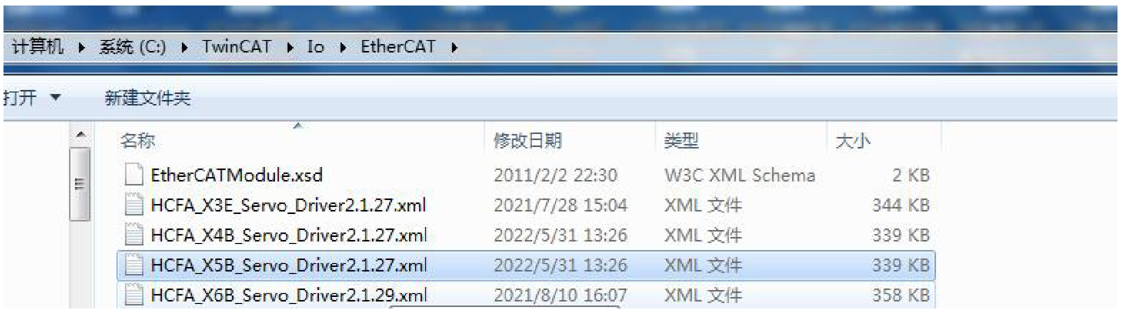
Servo drive:

1. Servo drive control mode P0.01 = 7 (EtherCAT mode). If more than one servo drive is running, the network cables should be plugged in strictly in the order of "top in, bottom out" (be careful not to add terminating resistors and not to set the P9.00 address).

Beckoff PLC:

1. Download and install the Beckoff PLC control software TwinCAT (version: V2.11).

2. Add XML file: Place the HCFA X5E servo EtherCAT XML device description file in the folder of the following path: TwinCAT\Io\EtherCAT (as shown in the figure below).

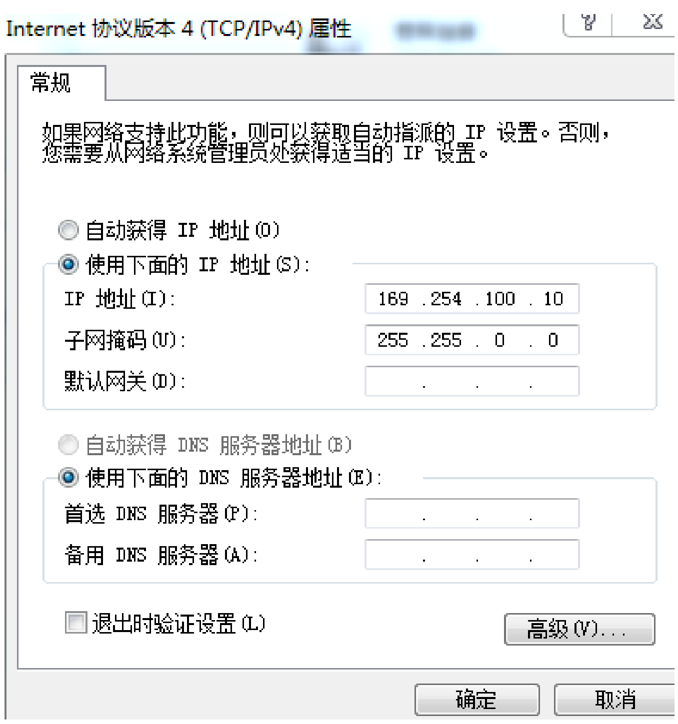


◆ Connection and operation process

Step 1: PLC connection and project building

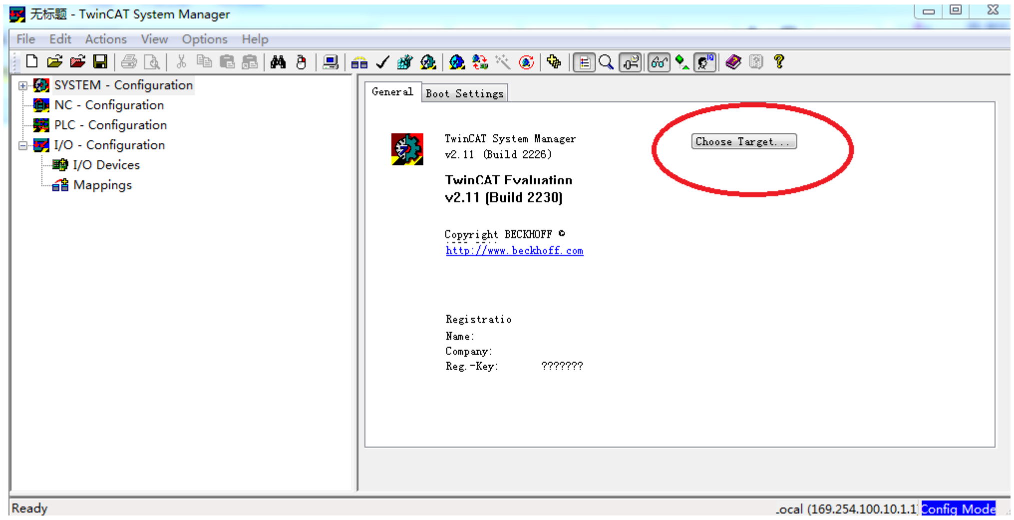
1. Set the computer IP address to the same network segment as the PLC:

Computer → Local connection → Property → Internet protocol version 4 (TCP/Ipv4) property → Use the following IP address as shown below (default is 169.254.X.X):

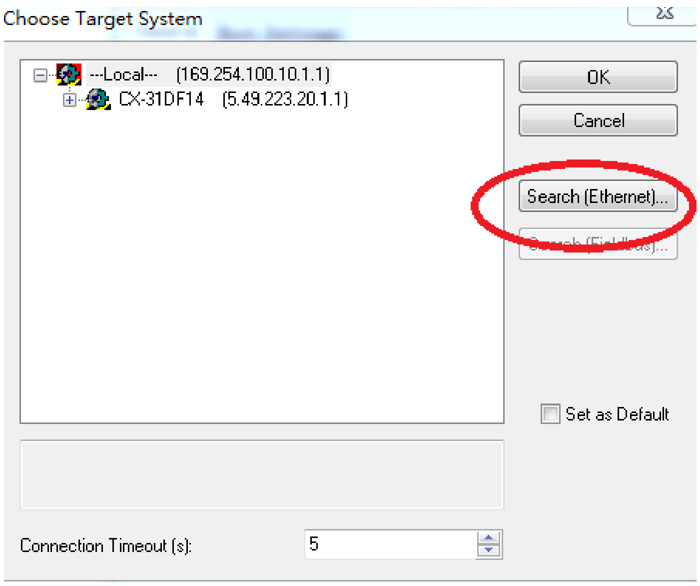


2. Open TwinCAT SystemManager (right-click on system tray icon), New (file->New), Choose target and search for CX. Search (Ethernet) ->Broadcast search, as shown:

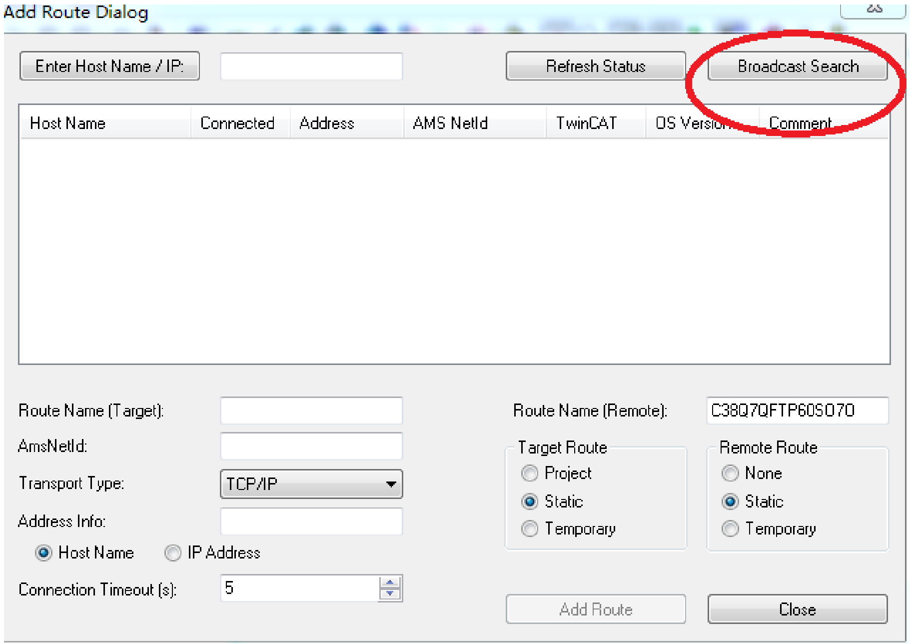
2.1 Build a new project and click on “Choose Target”



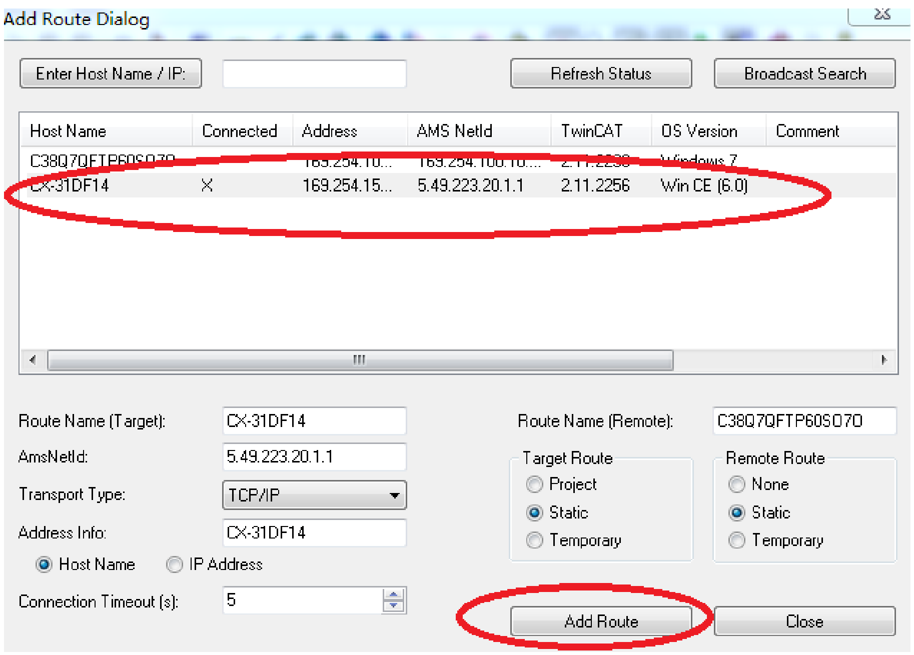
2.2 Click on “Search (Ethernet) ”



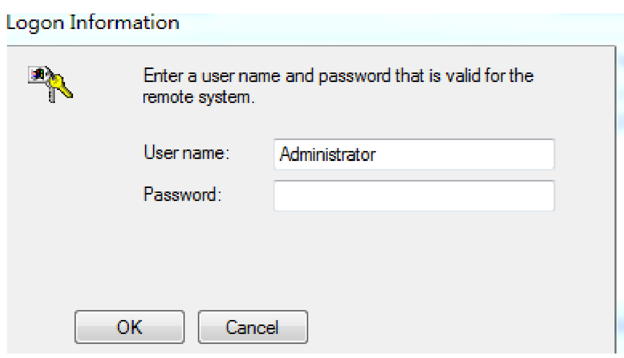
2.3 Click on “Broadcast Search”



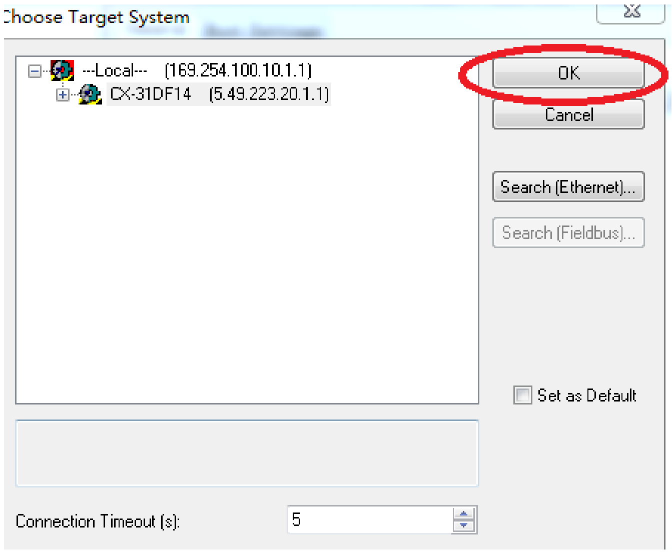
2.4 Find PLC master (if “X” has shown in the column named “Connected”, the master has been found, therefore step 2.5 does not need carrying out) , and click on “ADD Route”:



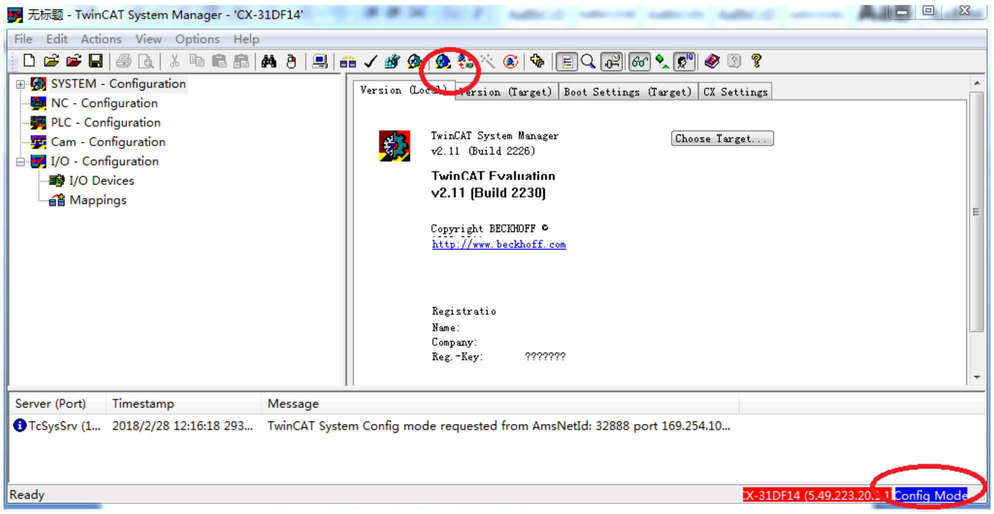
2.5 Add a password, and click on “OK” if not necessary.



2.6 Choose PLC master, and click on “OK”.

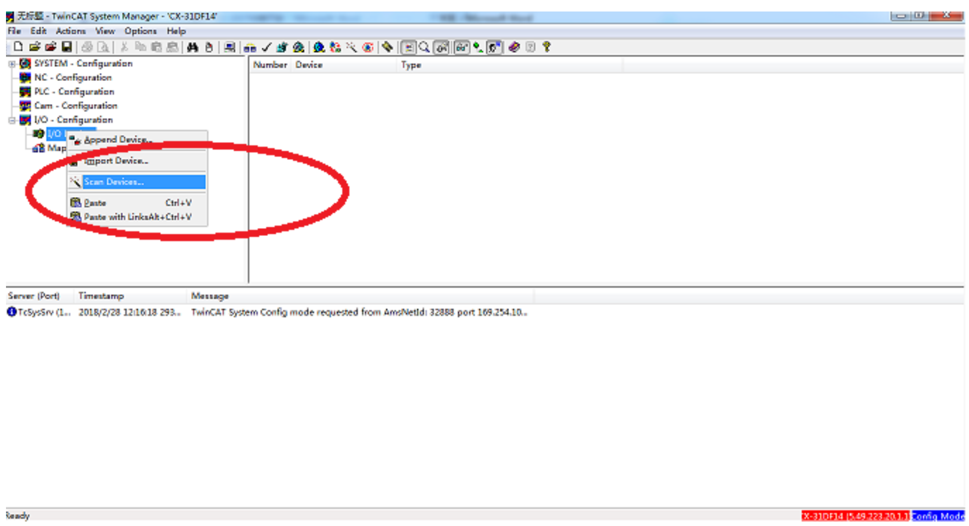


3. Switch to “Config Mode” after a successful connection

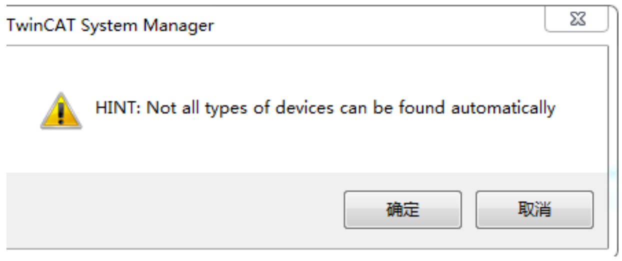


Step 2: PLC configuration X5E servo drive

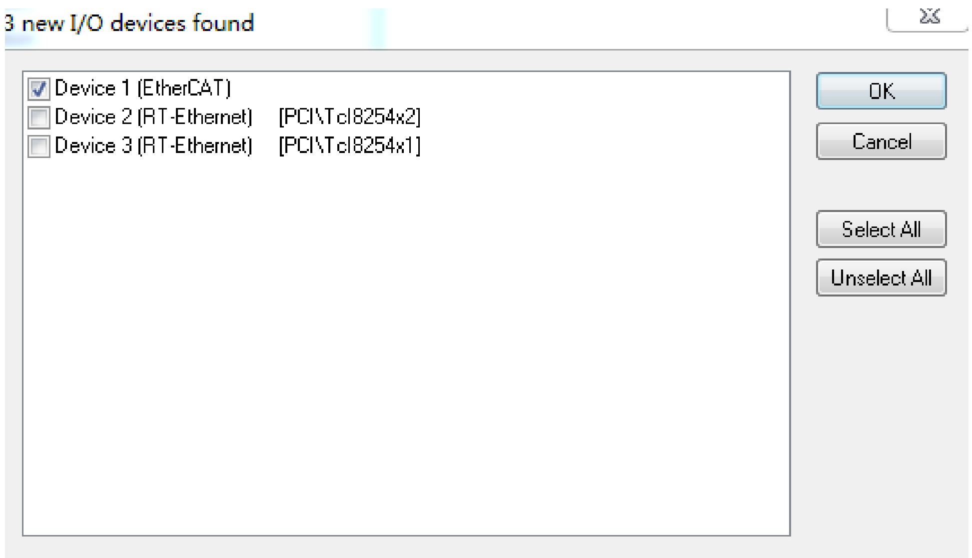
1. In Beckhoff PLC config mode, right-click on I/O devices->scan devices and the PLC automatically searches for connected modules:



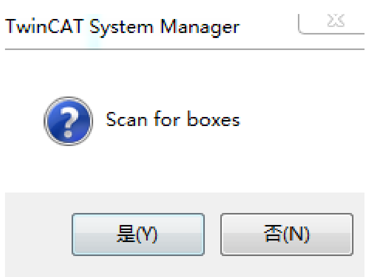
2. Click on “Confirm”.



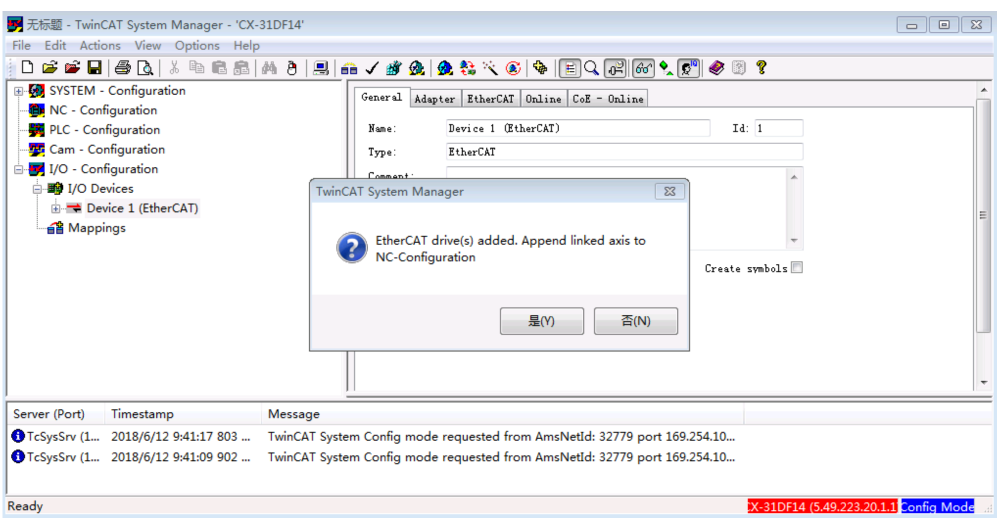
3. Click on “OK”.



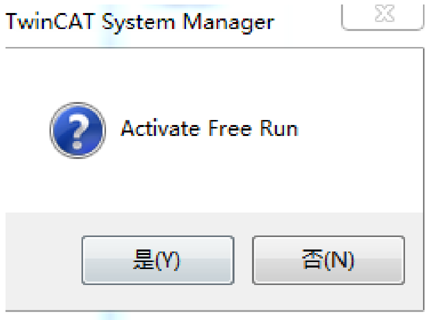
4. Search for modules, and click Yes (Y).



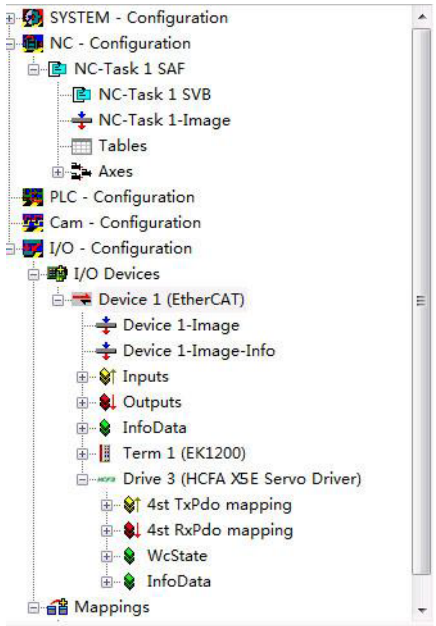
5. Add the motion control axis and click Yes (Y).



6. Complete search, and click No (N).



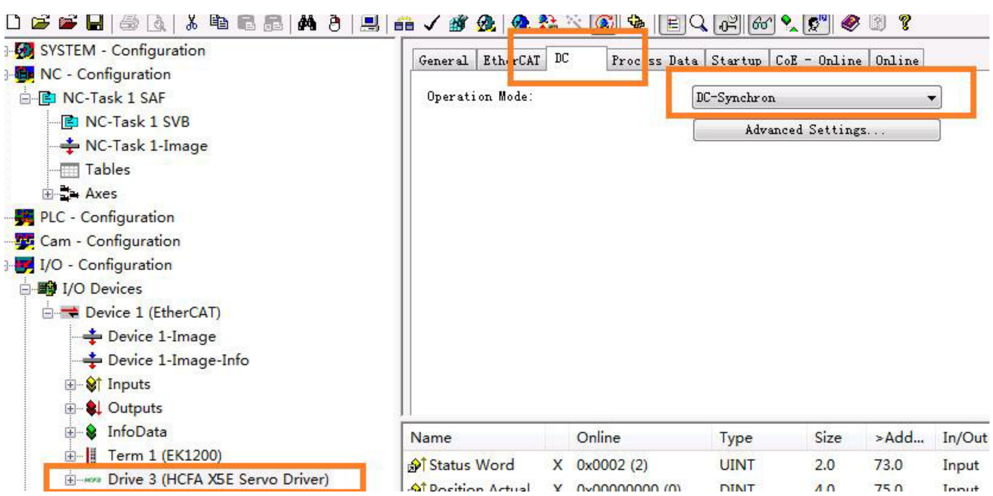
7. Find the X5E servo drive as shown in the following figure.



Step 3: Bus synchronization parameters setting

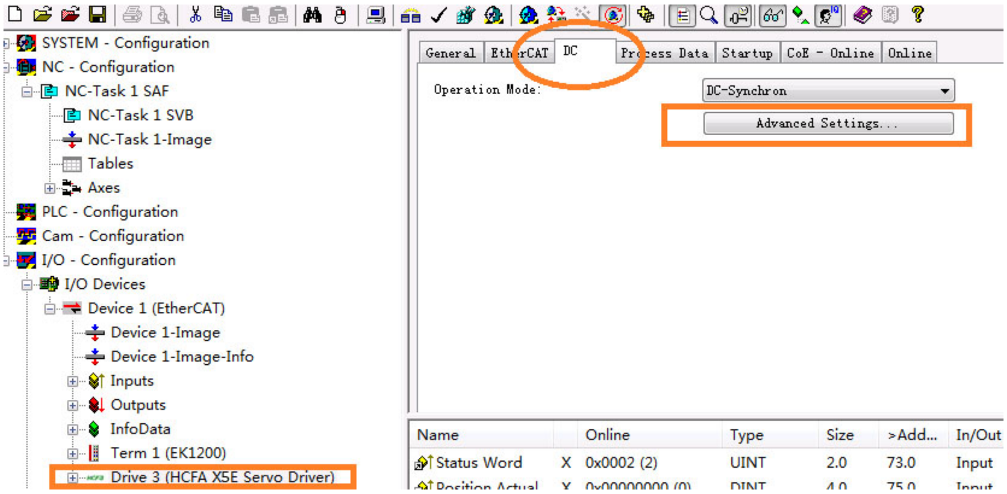
1. Set DC synchronization mode

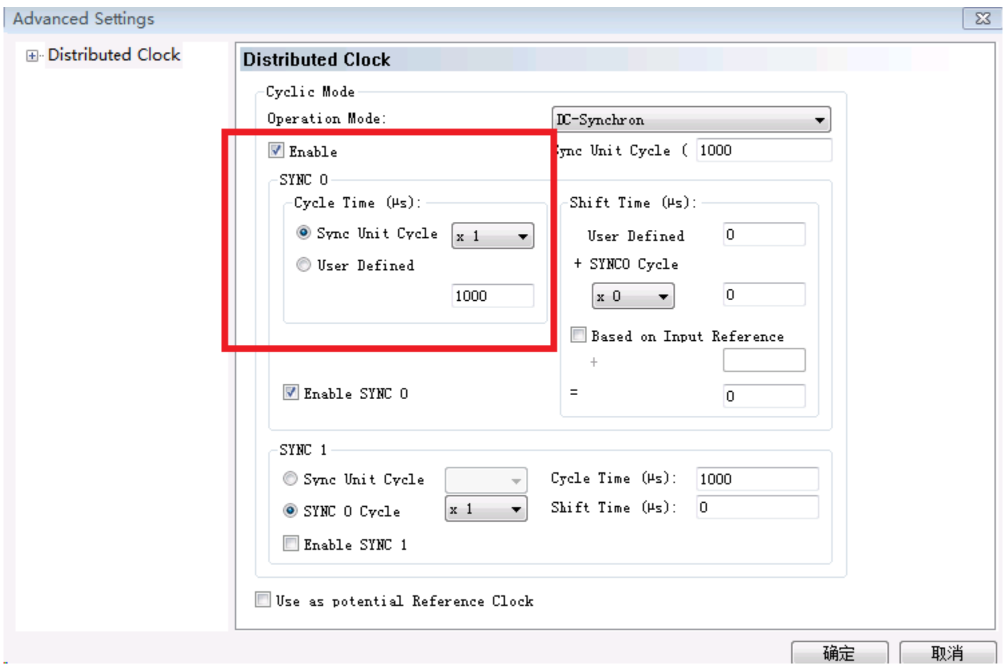
I/O-Configuration → I/O device → Device 1 (EtherCAT) → Drive 3 (HCFA X5E Servo Driver) →"DC" page → In the operation mode, select"DC-Synchro".



2. Set the synchronization cycle time

I/O-Configuration → I/O device → Device 1 (EtherCAT) → Drive 3 (HCFA X5E Servo Driver) →"DC" page → Advanced Settings → Cycle time (us). Choose an appropriate time, which should not be less than 1ms.

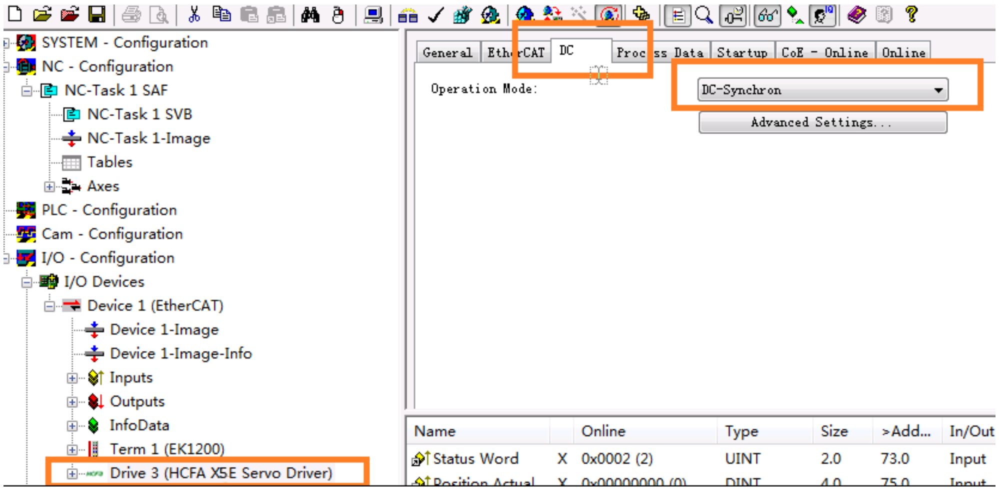




3. Configure PPDO object

The servo has default Tx/Rx PDO parameters, users can also add the required Tx/Rx PDO parameters according to the actual use situation. The steps are as follows:

I/O-Configuration → I/O device → Device 1 (EtherCAT) → Drive 3 (HCFA X5E Servo Driver) → “Process Data” page → In the“PDO list”, select the 1st TxPdo mapping or the 1st RxPdo mapping(The first group of Tx/Rx PDO parameters is used by default, other groups of parameters can also be selected) →“In the PDO Content”, right click to edit or inset PDO (1 Tx/Rx PDO group can currently configure at most 20 objects).

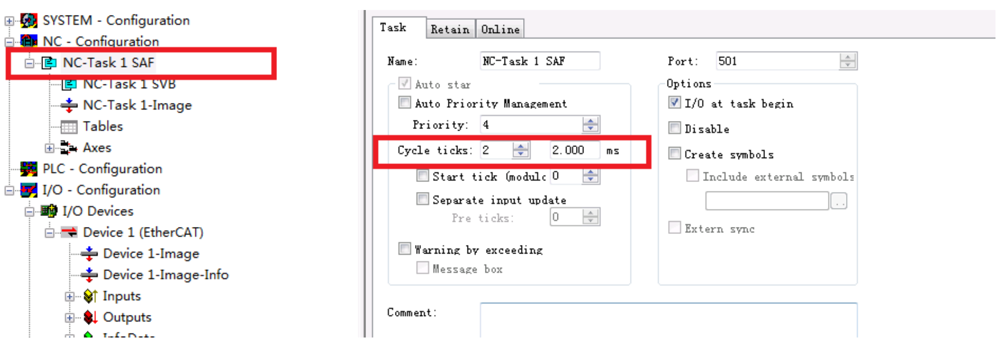


Step 4: Motion control axis parameters setting

1. Set the PLC task running cycle

(Task cycles for path planning, setting position and refreshing IO data, NC tasks are prioritized higher than TwinCAT PLCs)

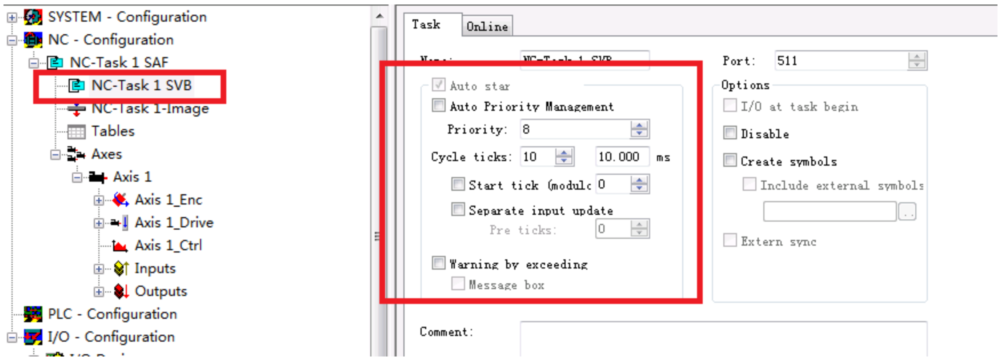
NC-Configuration → NC-Task1 SAF → Task page → In the cycle ticks, set the appropriate period (not less than the servo synchronization period).



2. Set the NC Task SVB cycle

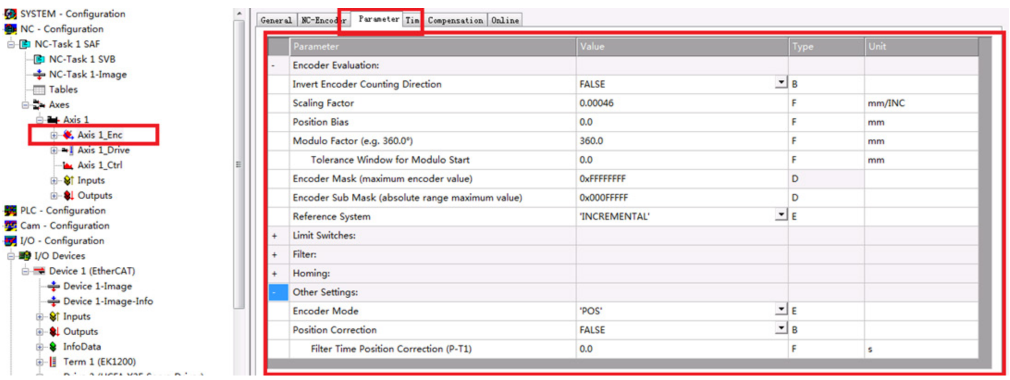
(Task cycle for the NC detection status, and fault handling, if not required, just use the default value)

NC-Configuration → NC-Task1 SVB → Task page → In the cycle ticks, set the appropriate period (10ms by default).



4. Set the NC axis Enc encoder

NC-Configuration → NC-Task1 SAF → Axes → Axis1 → Axis1_Enc → Parameter page



Invert Encoder Counting Direction: Reverse the encoder counting direction, the default is False, if the motor is expected to rotate positively while the position feedback value decreases, it needs to be set to True, and the motor polarity should also be reversed.

Encoder Evaluation: Scaling Factor quantization factor, each position feedback encoder pulse corresponding to the distance: write an appropriate value (for no-load debugging, it is customary to set a circle of 60mm, so that the speed of 1mm / s is equivalent to 1 turn/min). Because the motor's rated speed unit is rpm, debugging rpm for the speed unit is more intuitive, the value of the HCFA 17bit motor is generally set to 60/10000 = 0.006 (P0.08 = 10000, such as P0.08 = 131072, then the value should be 60/131072 = 0.000457763671875).

Position Bias: The deviation between the zero position of the servo axis and the zero position of the encoder. This value remains unchanged after the mechanical installation is fixed. This value is only required if an absolute encoder is used.

Modular Factor: Modular length. Usually refers to the distance of one process cycle of Axis movement. It is not necessary to set it for axes that are not positioned within a modular length. When debugging without load, it is common to use the modular length for the distance of one motor turn, e.g. 360mm.

Reference System: Reference point coordinate system, using default values.

Other Setting: Encoder Mod, select an appropriate encoder type.

Pos: The encoder is only used to calculate the position, and the host computer is only responsible for sending the position instruction, which is used when the servo is running in cycle synchronous position mode (CSP, 6060H=8).

PosVelo: The encoder is only used to calculate position and velocity, the host device establishes the position loop and outputs the velocity instruction, which is used when the servo is running in the cycle synchronous velocity mode (CSV, 6060H=9).

The encoder is used to calculate position, velocity and acceleration and is used when the velocity ring is in TwinCAT NC.

5. Set the NC axis Driver encoder

NC-Configuration → NC-Task1 SAF → Axes → Axis 1 → Axis 1_Driver → Parameter page:

Output Scaling: Invert Motor Polarity: Motor polarity is reversed. This value is true when the motor is given a positive speed value and the motor rotates clockwise. It should be noted that the encoder direction should also be reversed (Invert Encoder Counting Direction under NC Axis Encoder Settings).

6. Set the parameters related to Axis

NC-Configuration → NC-Task1 SAF → Axes → Axis 1 → Parameter page:

Velocities: Reference Velocity: When Scaling Factor=0.006 (i.e. P0.08=10000) or 0.000457763671875 (i.e. P0.08=131072), the default value of 2200 cannot be used for the given speed, otherwise it is easy to alarm out of the range of values, and it is recommended to change it to 3000.

Velocity: Maximum Velocity: When Scaling Factor=0.006 (i.e. P0.08=10000) or 0.000457763671875 (i.e. P0.08=131072), the default value of 2200 cannot be used for the maximum speed, otherwise it is easy to alarm out of the range of values, and it is recommended to change it to 3500.

General | Settings | Parameter | Dynamics | Online | Functions | Coupling | Compensation

Parameter	Value	Type	Unit
- Velocities:			
Reference Velocity	3000.0	F	mm/s
Maximum Velocity	3500.0	F	mm/s
Manual Velocity (Fast)	600.0	F	mm/s
Manual Velocity (Slow)	100.0	F	mm/s

Dynamics: Acceleration/Deceleration/Jerk, set the appropriate value according to the usage requirements, especially the jerk, a value that is too small may result in the acceleration value not being able to be increased.

- Dynamics:			
Acceleration	15000000.0	F	mm/s2
Deceleration	1500000000.0	F	mm/s2
Jerk	22500000000000000.0	F	mm/s3

Limit switch: Soft limit setting, the default is no soft limit according to the requirement setting

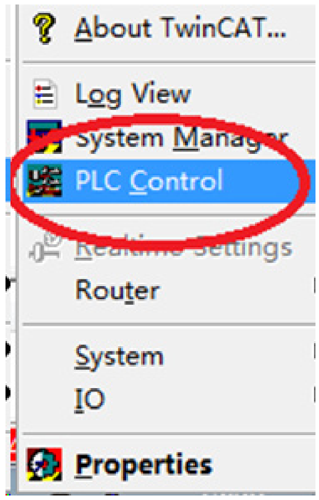
Monitoring: Position deviation, it is not recommended to use, the servo already has an excessive position deviation setting (P0.16), it is recommended to prohibit it, the function select FALSE.

General | Settings | Parameter | Dynamics | Online | Functions | Coupling | Compensation

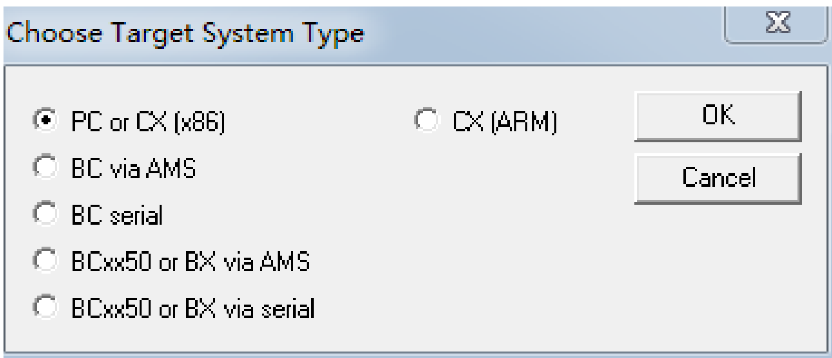
Parameter	Value	Type	Unit
+ Limit Switches:			
- Monitoring:			
Position Lag Monitoring	FALSE	B	
Maximum Position Lag Value	5.0	F	mm
Maximum Position Lag Filter Time	0.02	F	s
Position Range Monitoring	FALSE	B	
Position Range Window	5.0	F	mm
Target Position Monitoring	FALSE	B	
Target Position Window	2.0	F	mm
Target Position Monitoring Time	0.02	F	s

Step 5: PLC programming program building

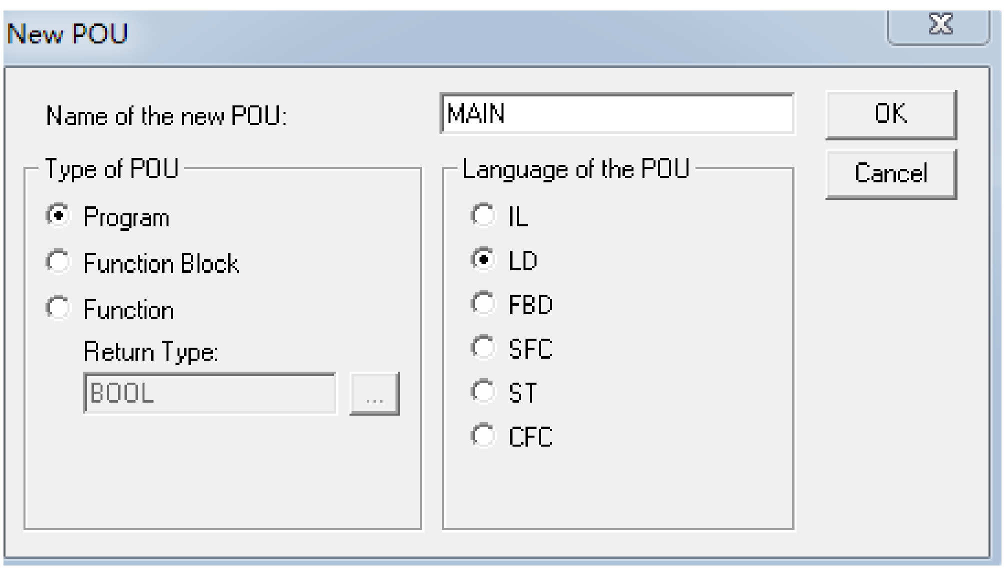
1. Open TwinCAT PLC and build a new project.



2. Choose a PLC type.



3. Select a programming type, and for this example, select the ladder diagram (LD).



4 . After building the project, the NC axis, PDO variables and PLC program need to be aligned before proceeding with PLC programming.

4.1 Align PDO variable

Although the NC axis has been added when the project was built, and the NC axis has been automatically aligned with some of the PDOs, there are still some PDO parameters that are not aligned, and if these parameters are to be used in the PLC program, the alignment setting must be made. The steps are as follows:

Enter the programming page and create the defined variables: as shown in the figure, the RPDO parameter suffix can only be AT%I*:+variable length unit, and the TPDO defined variable suffix can only be AT%Q*:+variable length unit, and the variable name can be named freely.

As shown in the figure, Er_Code1 AT%I*:WORD and mode_operation1 AT%Q*:BYTE represent Error Code 603Fh and Modes of operation 6060h respectively.

```
PROGRAM MAIN
VAR

        Err_Code1 AT%I*:WORD;
  mode_operation1 AT%Q*:BYTE;
   Axis_IN1 AT%I*:NCTOPLC_AXLESTRUCT;
        Axis_OUT1 AT%Q*:PLCTONC_AXLESTRUCT;
```

4.2 Establish the NC axis connection

In order to program the PLC, use the motion control library instruction. The NC axis connection must be made. the NC axis connection type is NCTOPLC_AXLESTRUCT and PLCTONC_AXLESTRUCT. The specific forms are as follows:

Axis_IN1 AT%I*:NCTOPLC_AXLESTRUCT;

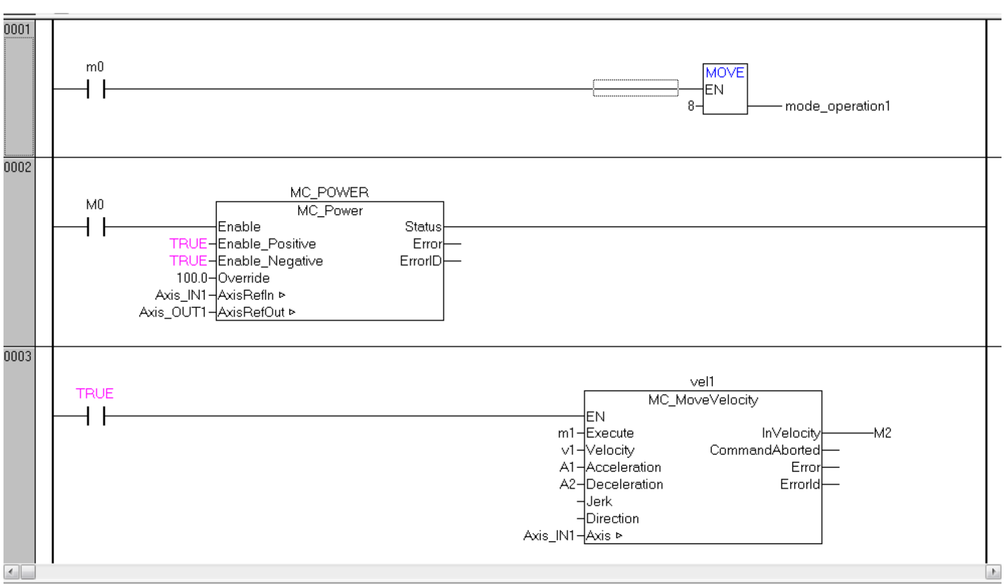
Axis_OUT1 AT%Q*:PLCTONC_AXLESTRUCT;

(Bolded red text is free to be named, as long as it meets the relevant naming character requirements)

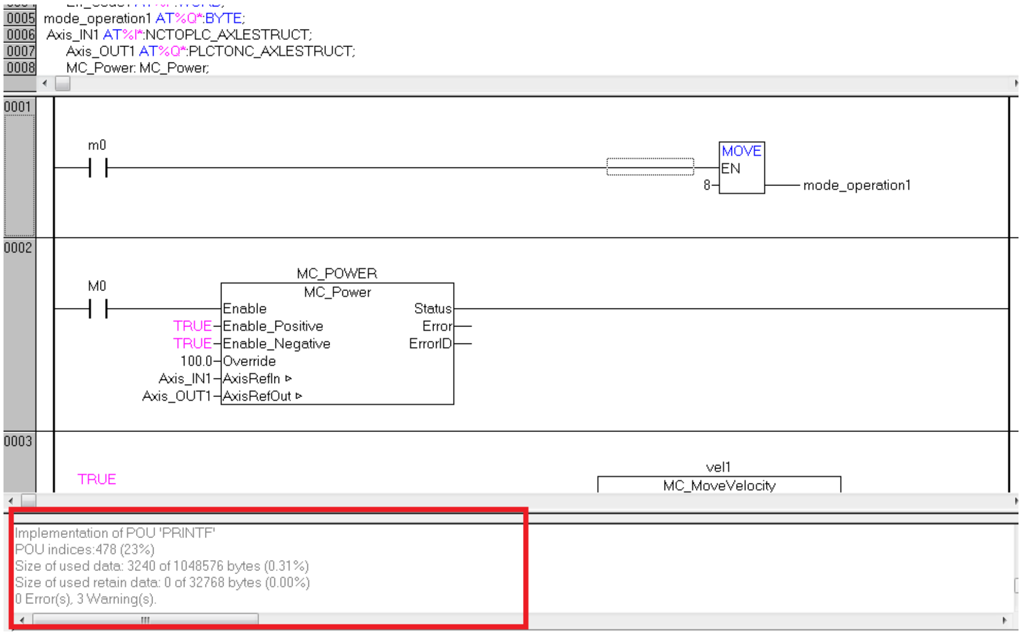
```
PROGRAM MAIN
VAR

        Err_Code1 AT%I*:WORD;
  mode_operation1 AT%Q*:BYTE;
   Axis_IN1 AT%I*:NCTOPLC_AXLESTRUCT;
        Axis_OUT1 AT%Q*:PLCTONC_AXLESTRUCT;
        MC_Power: MC_Power;
```

5. Write a PLC project: the following is a simple enable, constant speed operation program.

(Note: The units of target position and target speed in programming are mm and mm/S respectively, not the commonly used number of pulses and rpm)

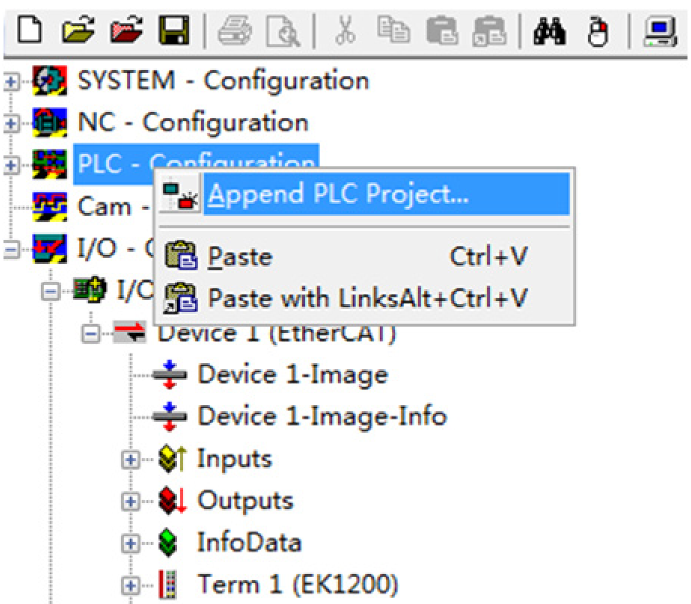


6. Once it's done, first save it, then compile it (Project->reBuild all), and generate the tpy file.

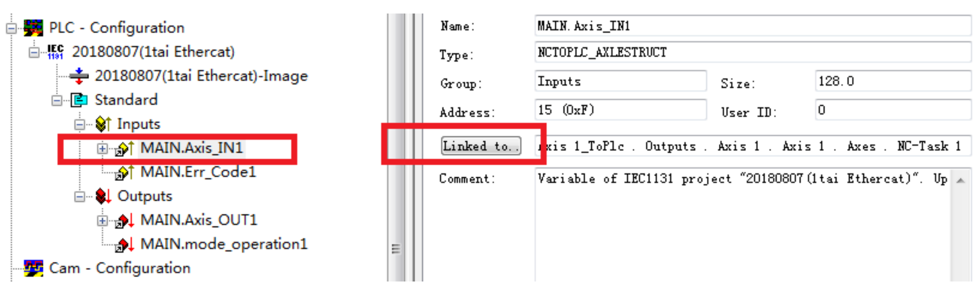


Step 6: Establishment of the link between the X5E parameters and the PLC defined variables

1. Add the tpy file of the PLC program in winCat SystemManager (right-click on PLC configuration->append PLC project...), and make the linking of variables (linked to);



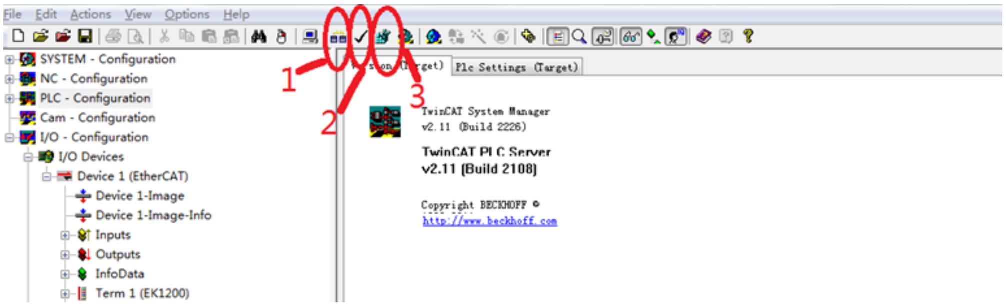
2. Click on MAIN.Axis_IN1. In the "Linked to" box, select Axis 1_ToPlc . Outputs . Axis 1 . Axis 1 . Axes . NC-Task 1 SAF.



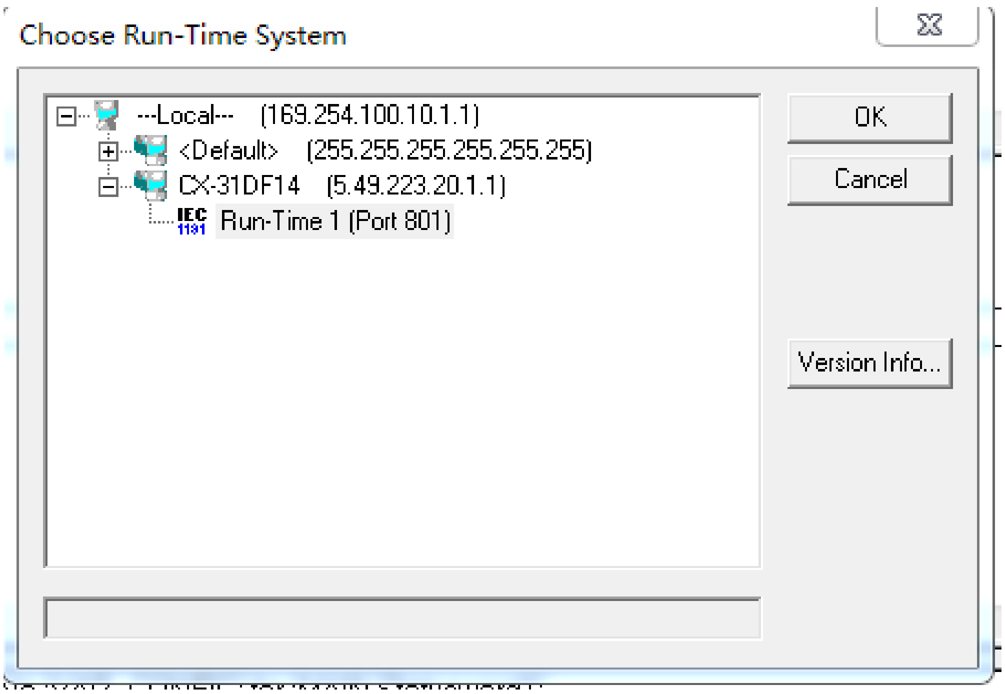
3. Similarly, the corresponding links are created for the other 3 parameters (Er_Code1, mode_operation1, Axis_OUT1).

Step 7: Program running

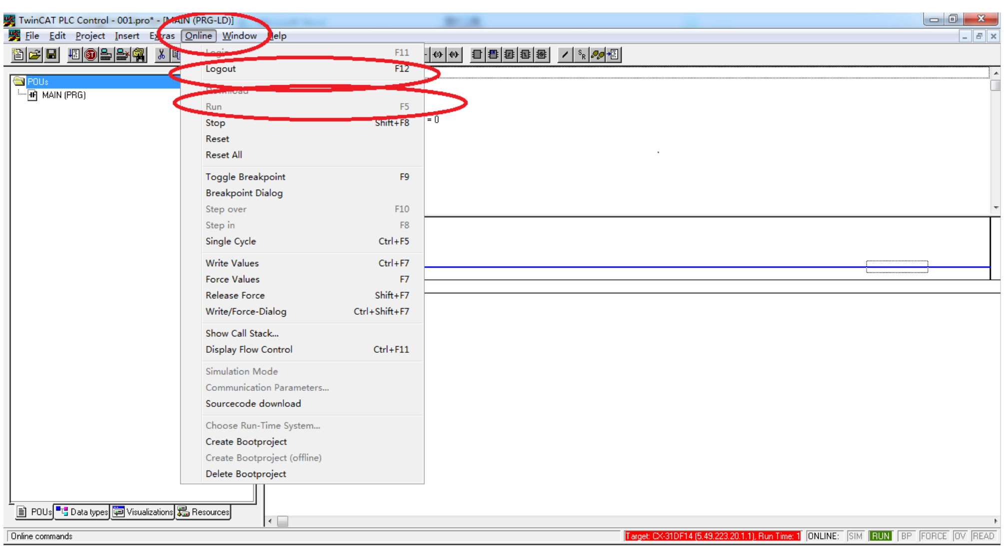
1. Enable the TwinCat SystemManager configuration in 3 steps, as shown in the figure, and finally enter Run mode.



2. Choose the download path in TwinCat PLC: online->select run time-system



3. In TwinCat PLC, click on on-line ->Login and Run.



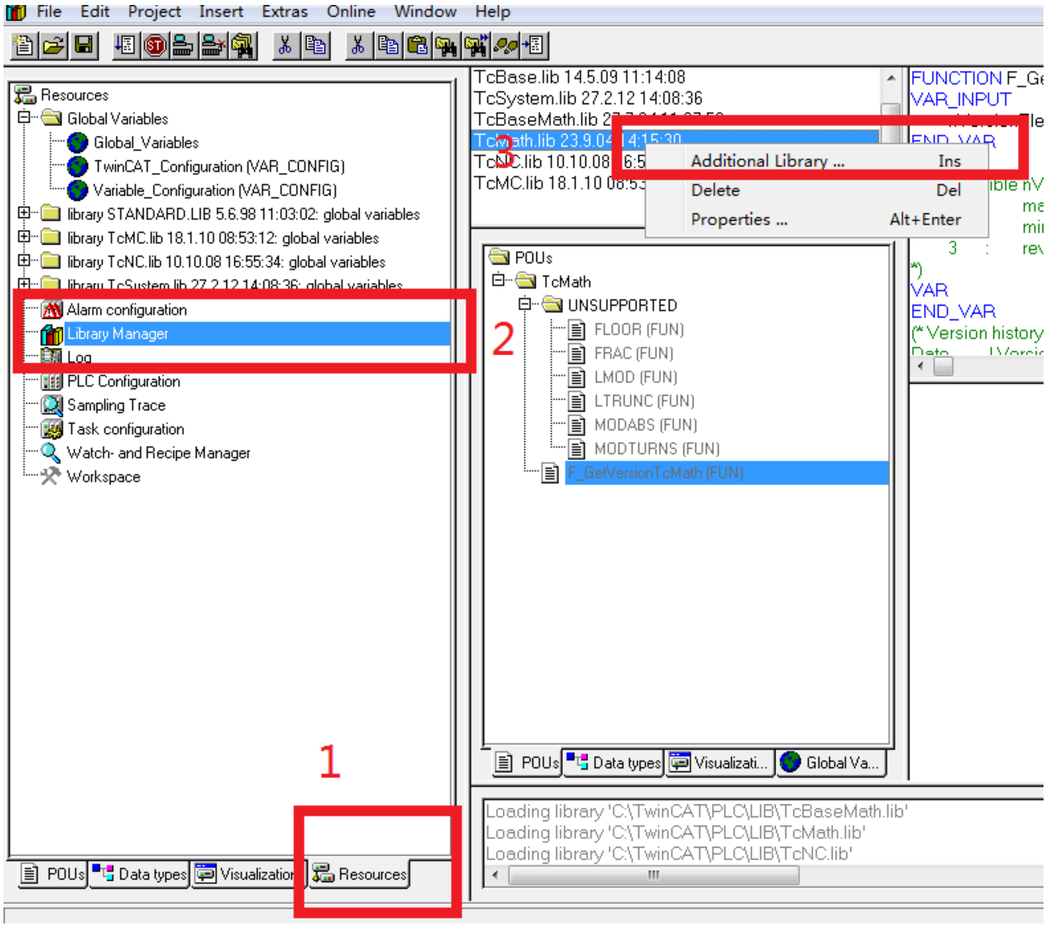
1. Click on Online->create bootproject if it is necessary to be able to run the written PLC program after the CX has been powered off.

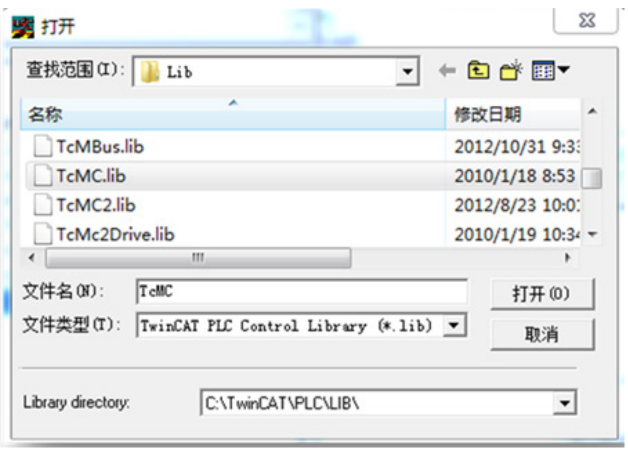
2. In order to be able to upload the program, click on Online->sourcecode download

---

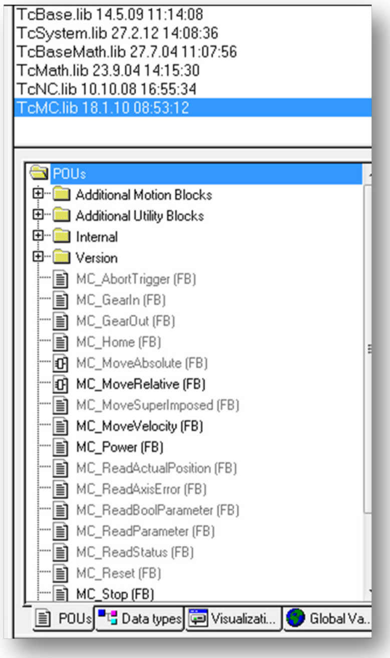
Note: If Beckoff PLC needs to use operation control library instruction, the motion control library should be added. If TwinCAT do not have motion control library TCMC.LIB, add it manually. LIB, then you need to add it manually. The steps are as follows:

Twincat PLC Control page → Resources page → Double click on "Library Manager" → Right-click in the page box that pops up to click "Additional Library".





The result of successful loading is shown below:



In the same way, if the electronic camming is required, install the Supplement: TwinCAT\ Supplement\ TwinCAT_NC_Camming, and also load the operation control library: TcNcCamming.lib.

8.2 Connection between X5EB and Omron PLC

This is an example of connecting and using the X5 series bus servo drive with the OMRON NJ501-1300 in the cyclic synchronous position mode.

◆ Preparation

Servo drive:

1. Servo drive control mode P0.01 = 7 (EtherCAT mode). If more than one servo drive is running, the network cables should be plugged in strictly in the order of "top in, bottom out", and set the node ID (set in P09.18).

OMRON PLC:

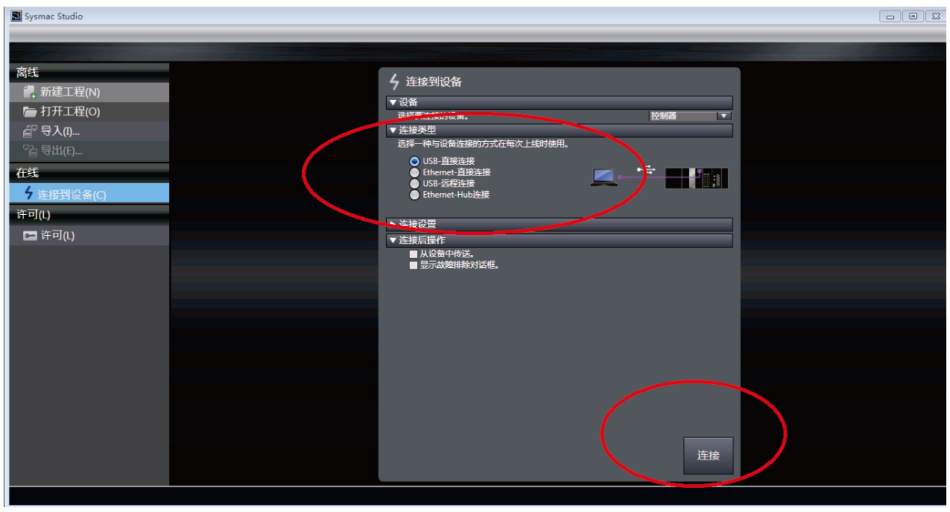
1. Download and install OMRON PLC computer control software Sysmac studio (version: V1.30)

Note: XML is updated irregularly, please download the latest version from the official website of HCFA if needed, and contact HCFA for technical consultation.

◆ Connection and operation process

Step 1: PLC connection (USB connection and network connection)

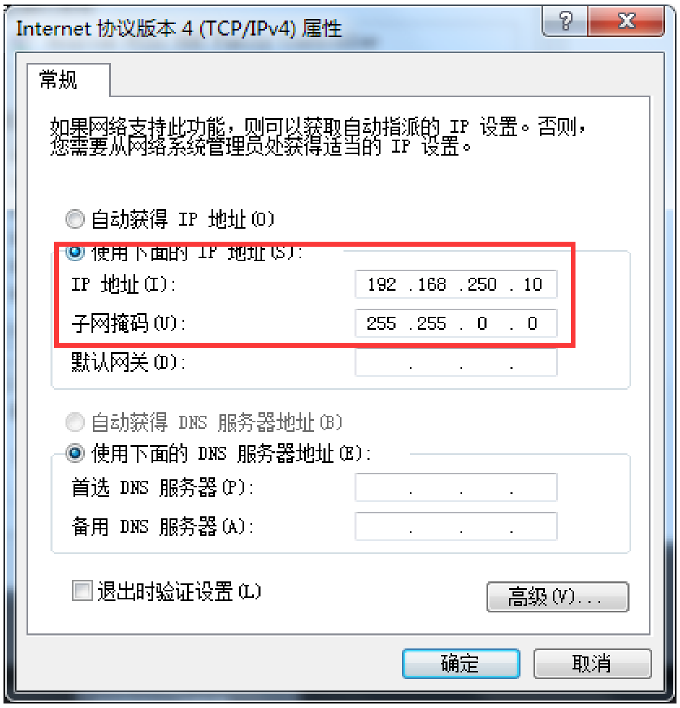
◆ USB connection



◆ Network connection (EtherNet interface)

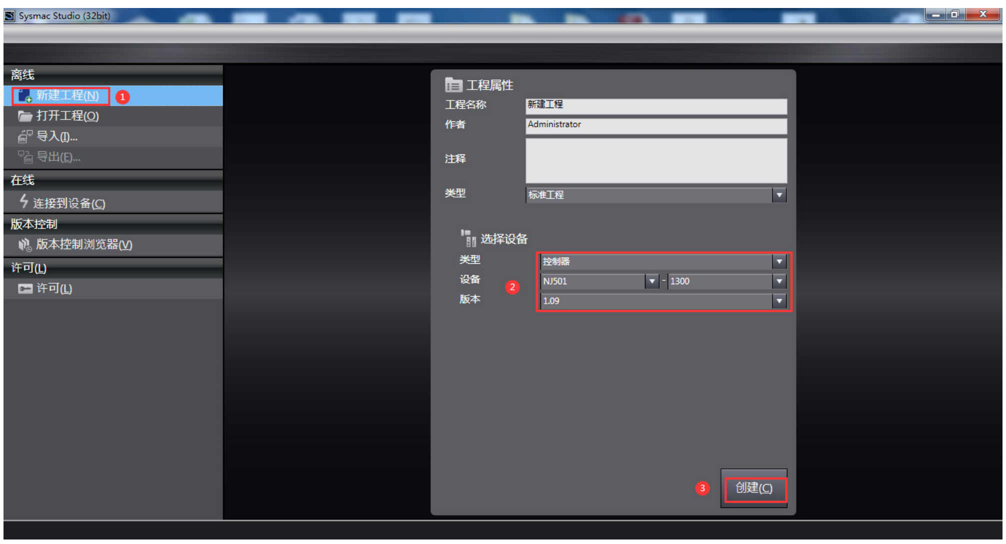
Set the computer IP address to the same network segment as the PLC:

Computer → Local connection → Property → Internet protocol version 4 (TCP/Ipv4) property → Use the following IP address as shown below:

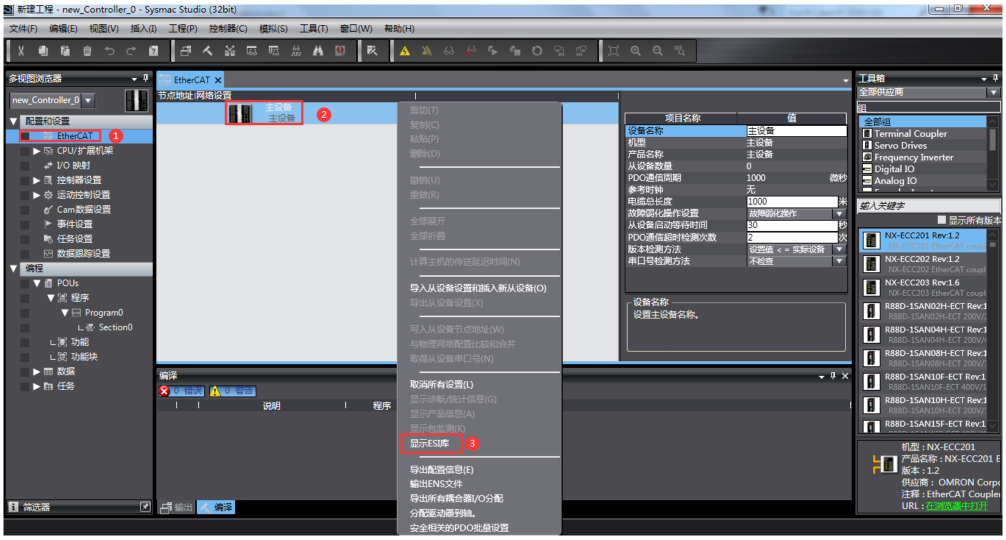


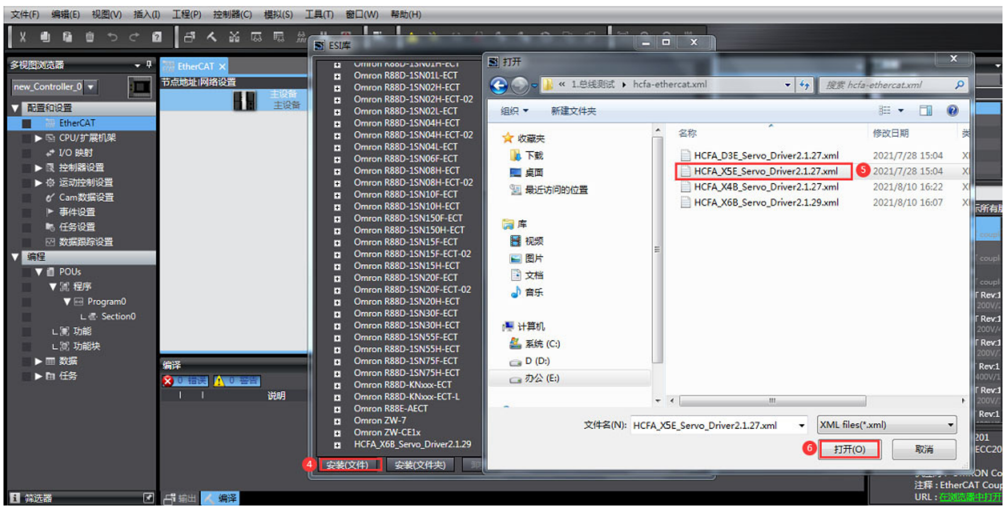
Step 2: XML configuration file adding

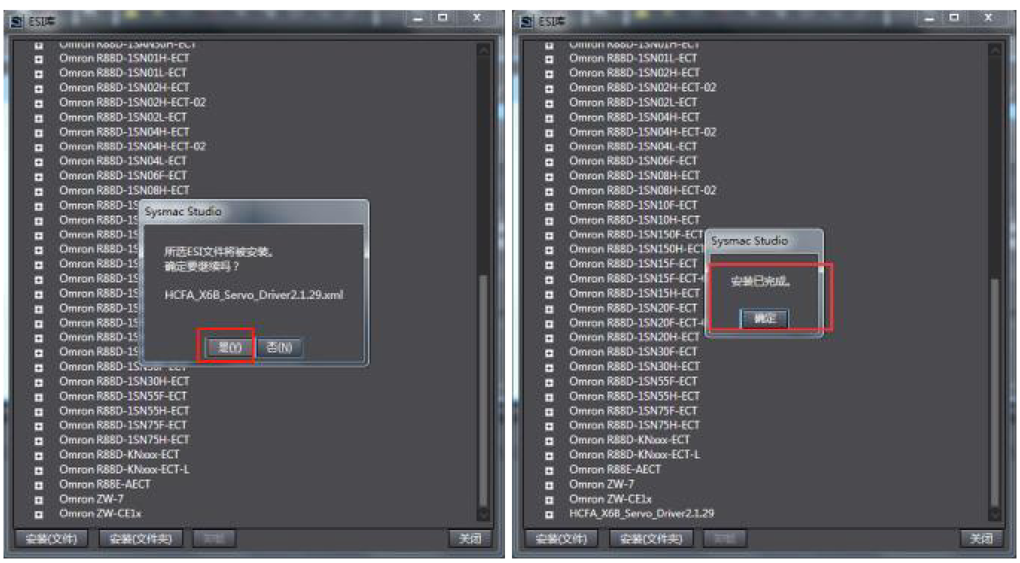
Click "New Project" → "Select Device" (type, device, version) → "Built".



Steps for adding an XML file: ① Click on "EtherCAT" → ② Select "Master Device" and right-click → ③ Click on "Show ESI" → ④ Install (file) → ⑤ Select the XML file → ⑥ Open it:

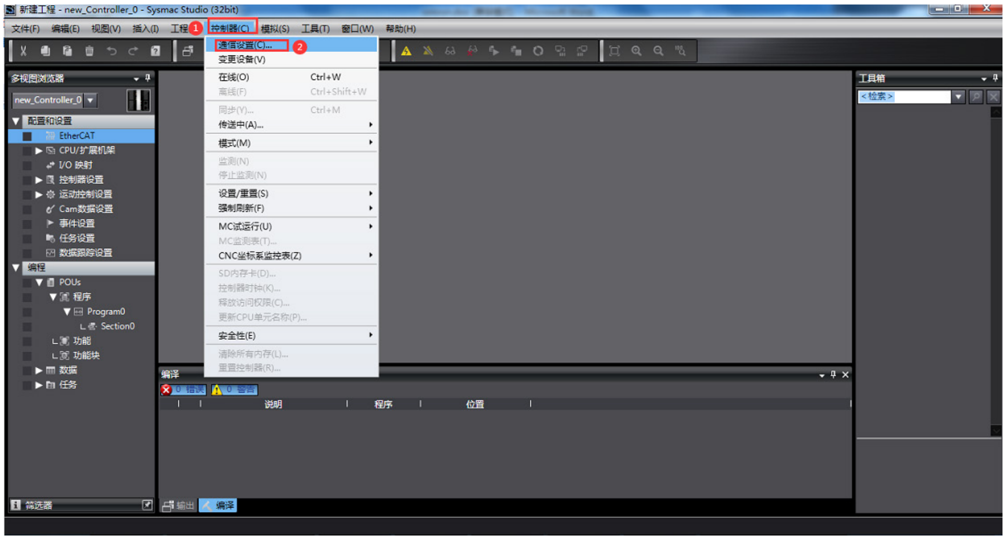


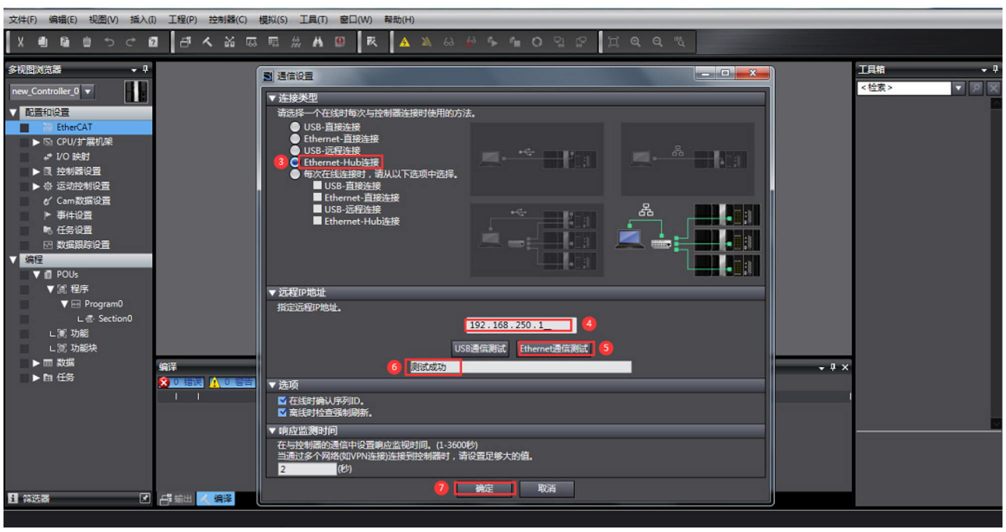




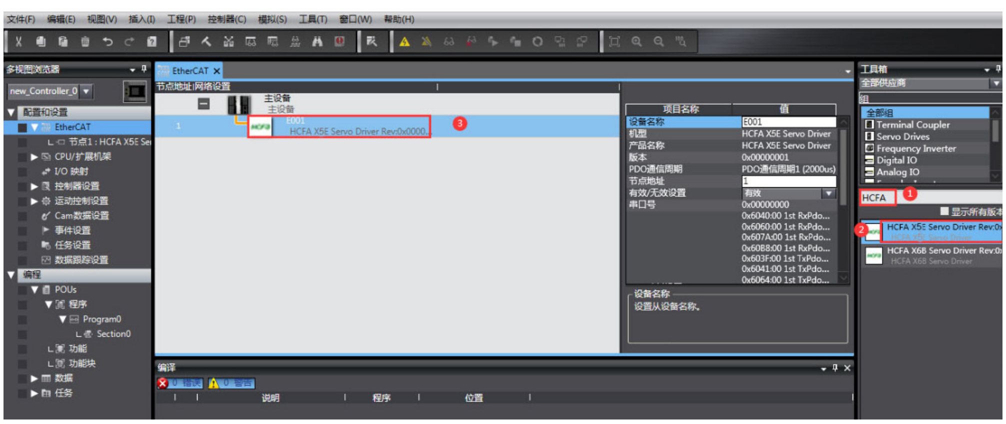
Step 3: Controller connection and EtherCAT-related parameters setting

• Connect to the controller: ①Click on "Controller" → ②Select "Communication Settings" → ③ Select "Ethernet-Hub Connection" → ④ Specify the remote IP address as "192.168.250.1" → ⑤Ethernet communication test → ⑥ Display "Test Successfully" → ⑦ Click on "OK".



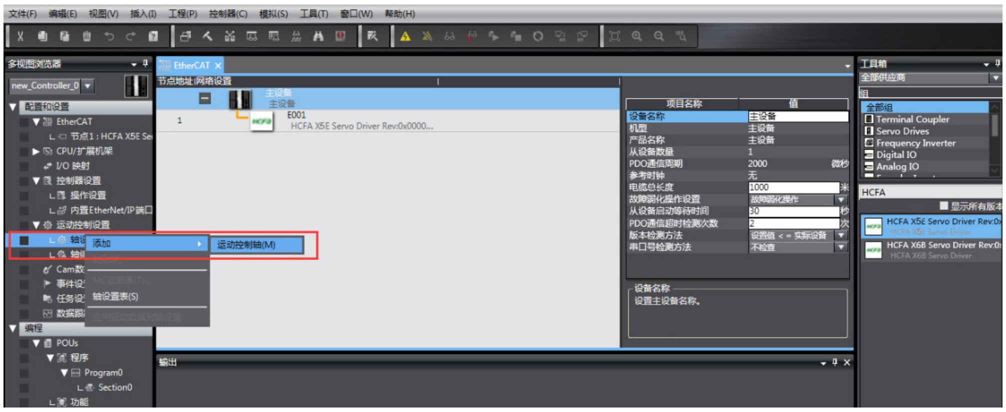


• Add Slave: ①Search for "hcfa" → ②Select "HCFA X5" and double-click → ③Display the added slave.



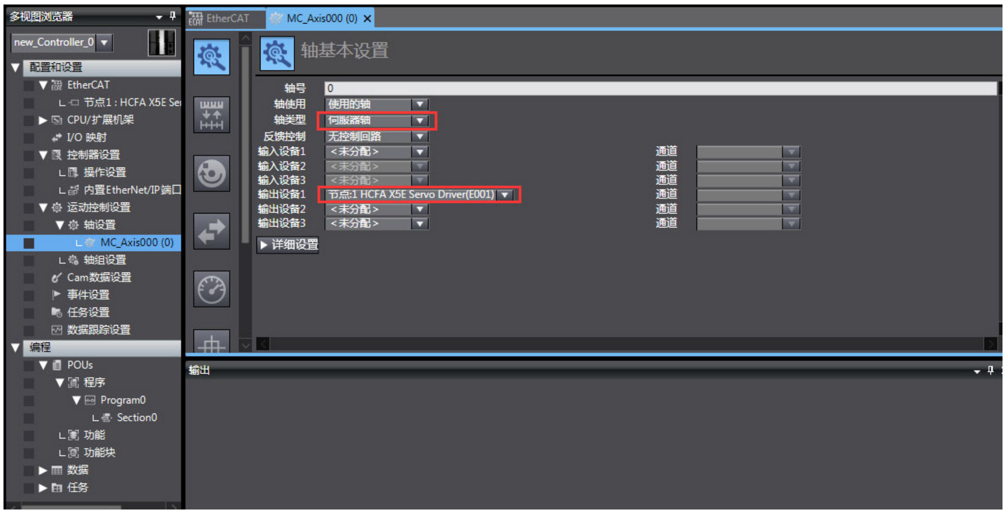
- Add motion control axis (PLC should be offline)

Main menu "Controller (C)" → Offline → Expand "Motion Control Settings" → Axis setting → Add "Motion Control Axis".



- Set the motion control axis parameters

① Add servo axis: In the axis basic setting page, the axis type is set as servo axis, and the "Output Device 1" is configured as X5 servo drive, as shown in the following figure.

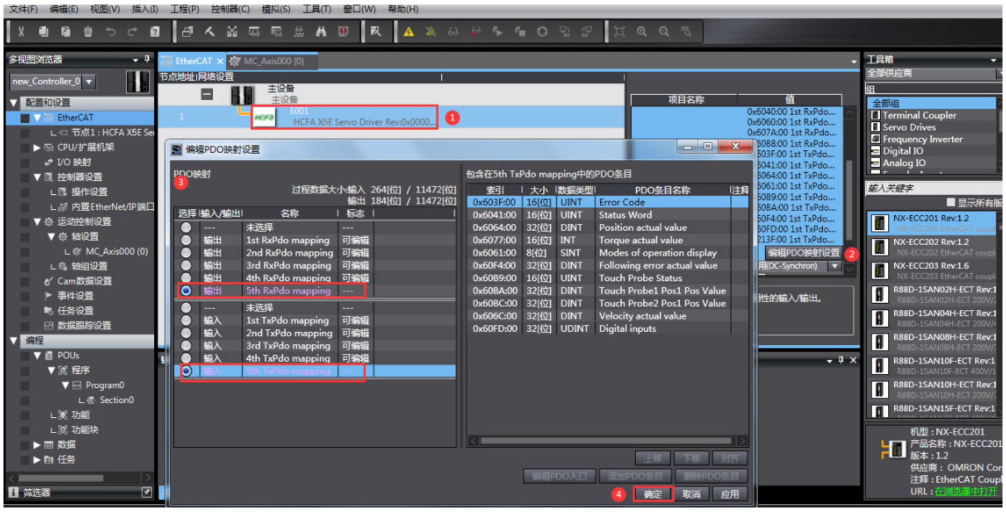


② Configure appropriate PDO parameters

A. Enable DC synchronization and select the appropriate PDO mapping parameter set:

EtherCAT → Node address/Network setting page → Slave E001 → Distributed Clock is effective, select "Enable (DC-Synchron)" → Edit the PDO mapping setting and select the appropriate Rx/Tx PDO parameters.

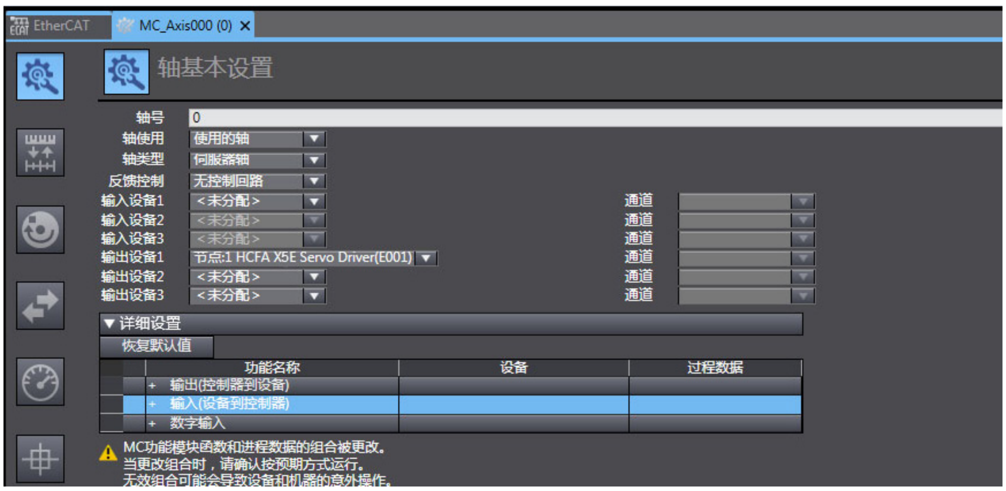
Note: Omron recommends using the fifth group of PDO fixed group mapping, other groups of PDO can be added and deleted.

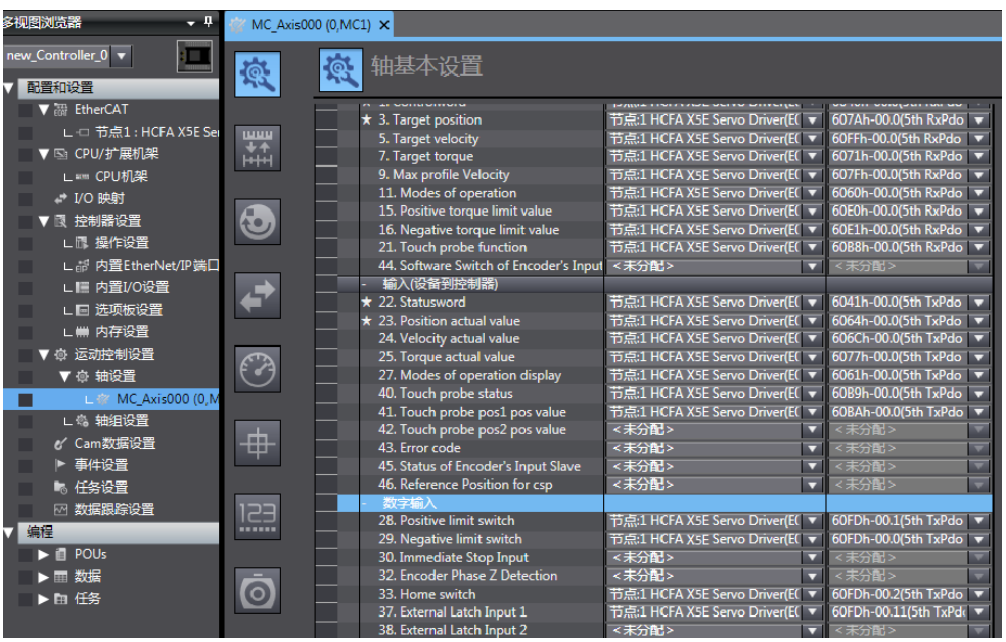


B. Map the motion control axis PDO parameters

The servo drive must be manually configured with the PDO parameters.

Double click on MC_Axis000 (0) to enter the axis basic setting page → Click on detailed setting → Configure the output (controller to device), input (controller to device), and digital input related parameters respectively, as demonstrated below.





(Note: Unassigned parameters can be reconfigured according to the usage requirements. If access to the limit switch is not required, any 60FDh_0.3~60FDh_0.9 can be used instead of 60FDh_00.1 and 60FDh_00.0)

• Unit conversion setting

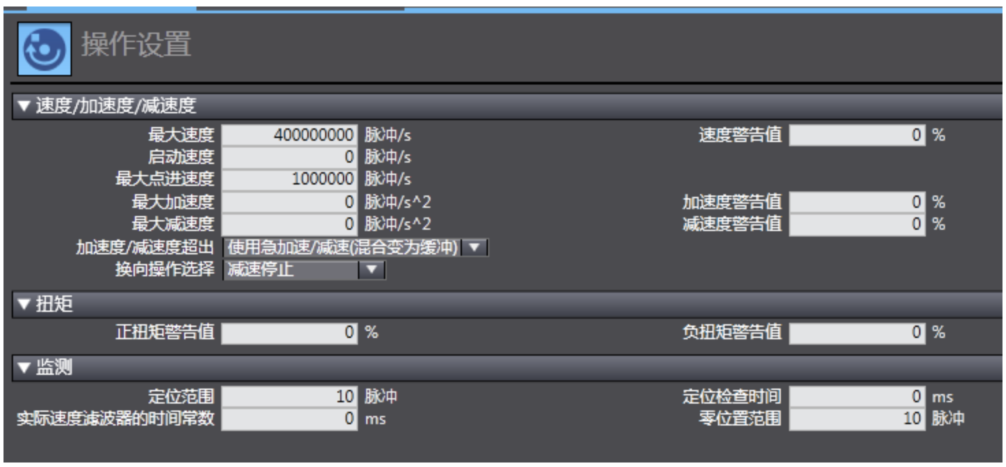
MC_Axis000 (0) page → Unit conversion setting page → Set the appropriate parameters as shown below:

Motor working stroke per cycle: HCFA generally uses a 17bit resolution encoder at present, which should be set to 131072.

Motor working instruction per cycle: Set according to requirements, if P09.13=1105, then use P00.08 (default 10000) for the gear ratio, which means 10000 PLC pulse instruction corresponds to one revolution of the motor in 131072 encoder unit, when the instruction is constant at 500000, it corresponds to a motor speed of 3000rpm.

• Operation setting

The maximum acceleration and deceleration are set according to actual applications, the maximum acceleration and deceleration are set to 0 for maximum acceleration and deceleration, and the torque is set to 0 for no alarm. If there is no special requirement, the default value can be used.



• Limit setting

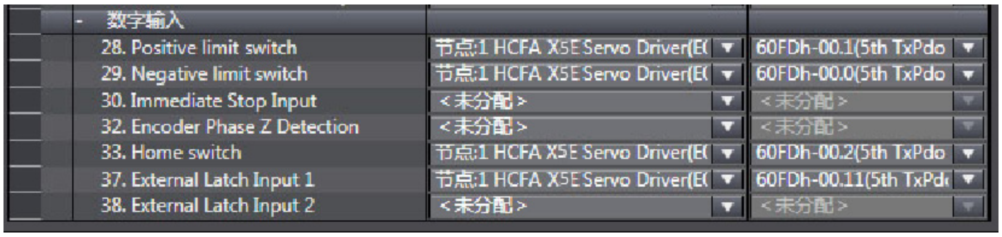
Parameters can be set according to actual applications.

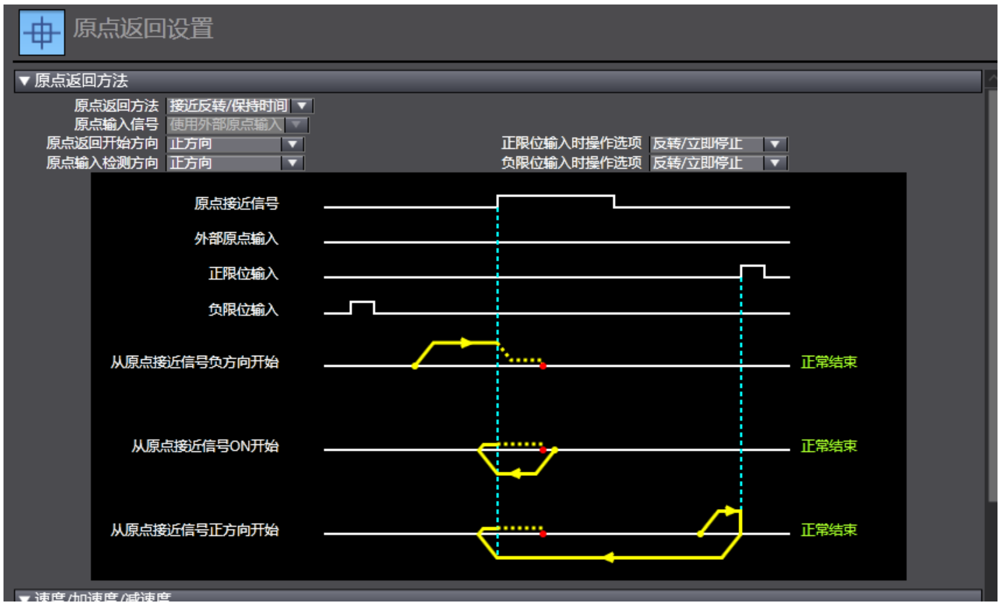
Note: The limit will not take effect until the homing is completed.

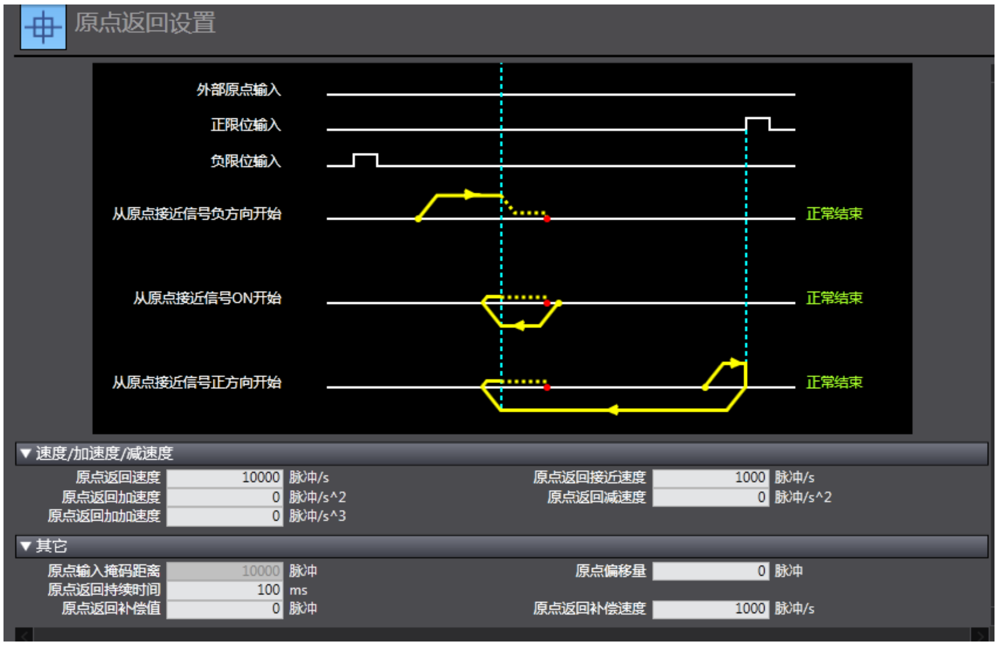
- Homing setting

Although this homing is an OMRON customized homing and has nothing to do with the homing method of the servo drive, the parameters (positive and negative limits and origin switches) should be set by the servo when using it. External signals can be directly connected to the servo drive and it is unnecessary to access the PLC. However, Omron PLC homing parameters must be set as shown in the following figure. After setting the parameters such as homing speed and origin deviation, use MC_home in PLC programming to start homing.

Note: The origin near signal of OMRON is the origin switch signal of the servo drive.



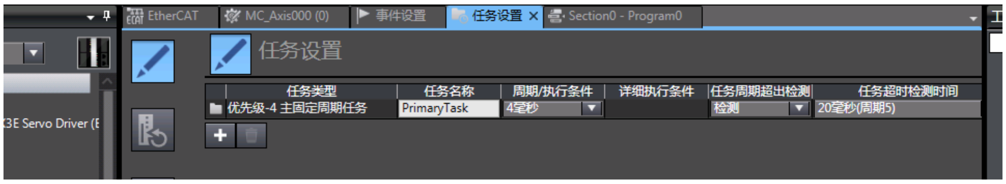




Step 4: Synchronization cycle time setting

(It is recommended not to be lower than 1ms, the cycle time > servo from the number of stations X 0.1ms)

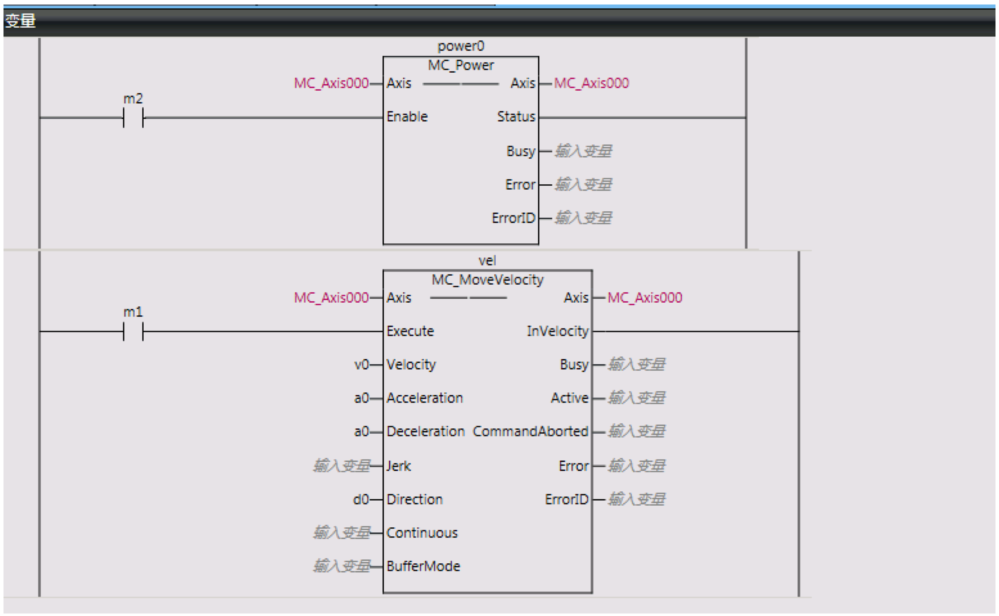
Double-click "Task Setting" to enter the Task Setting page → Select an appropriate cycle time, there are four options: 500 microseconds, 1 millisecond (default), 2 milliseconds, and 4 milliseconds.



Step 5: PLC program writing (take LD as an example)

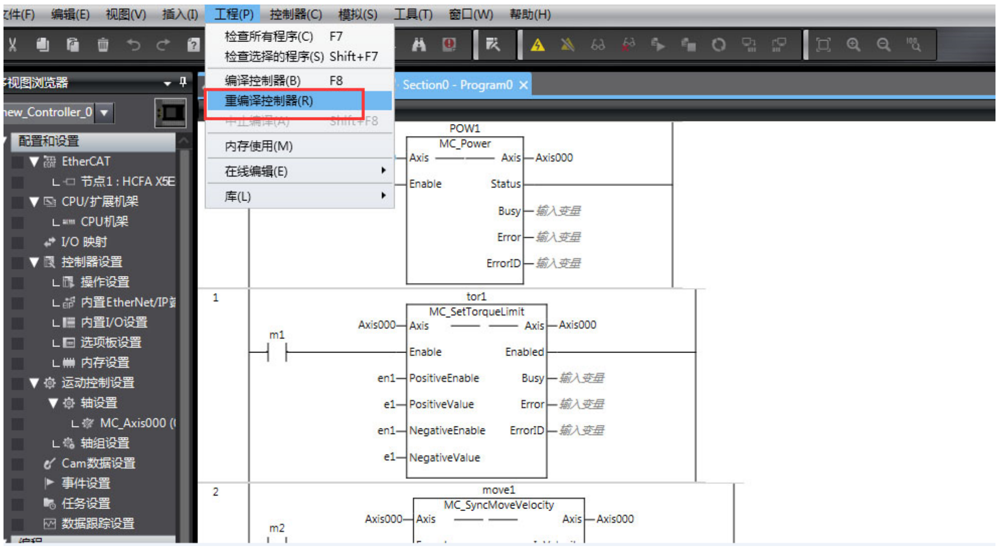
Programming → POUs → Program → Program0 → Double-click Section0 (if this part is not displayed, insert LD in Program0) to enter the programming page.

Note: To ensure the effective operation of the motor, the program should contain at least the enable instruction (MC_Power), the motion instruction (e.g., constant velocity rotation instruction MC_MoveVelcity, absolute position instruction MC_MoveAbsolute, relative position instruction MC_MoveRelation. The specific application of each instruction can be used by pressing F1 for help.



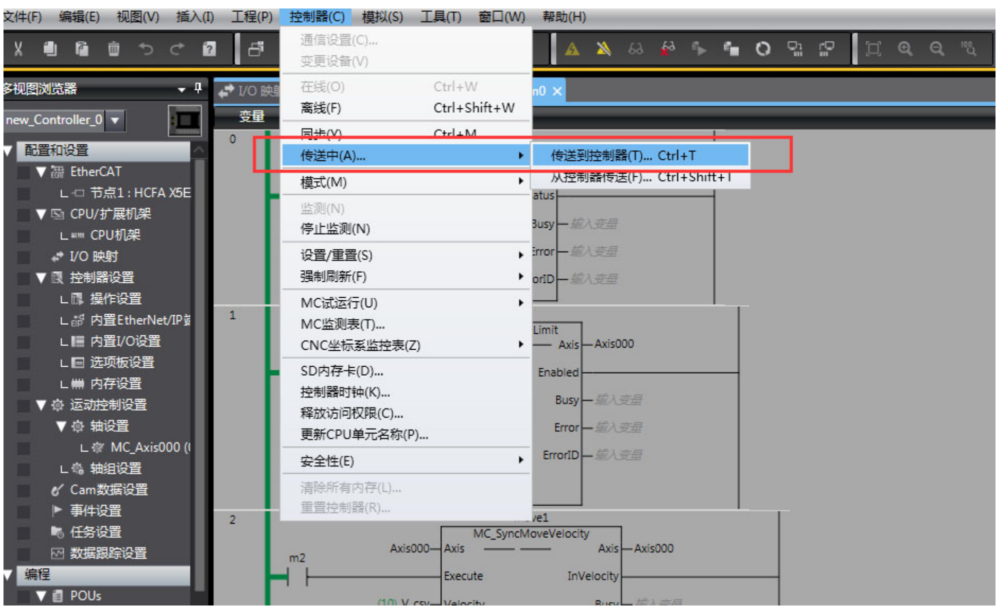
Step 6: Project compilation (offline)

Main menu, Project (P) → Recompile controller (R)



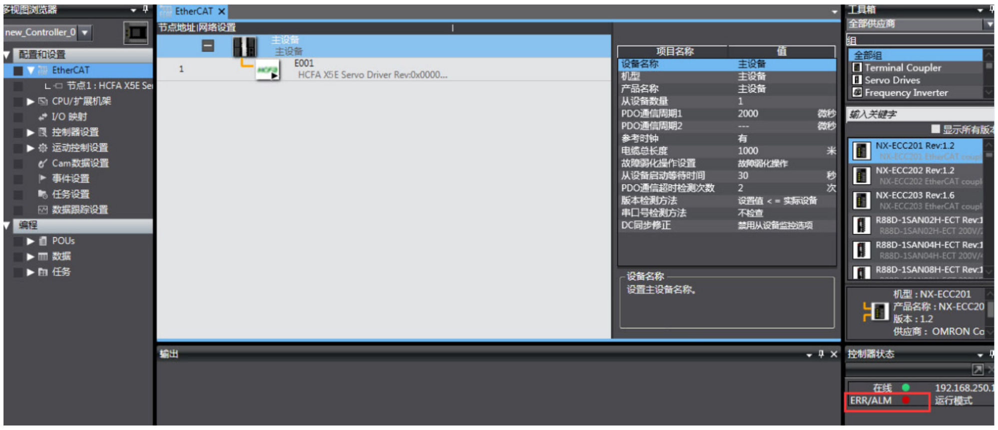
Step 7: Download project to PLC

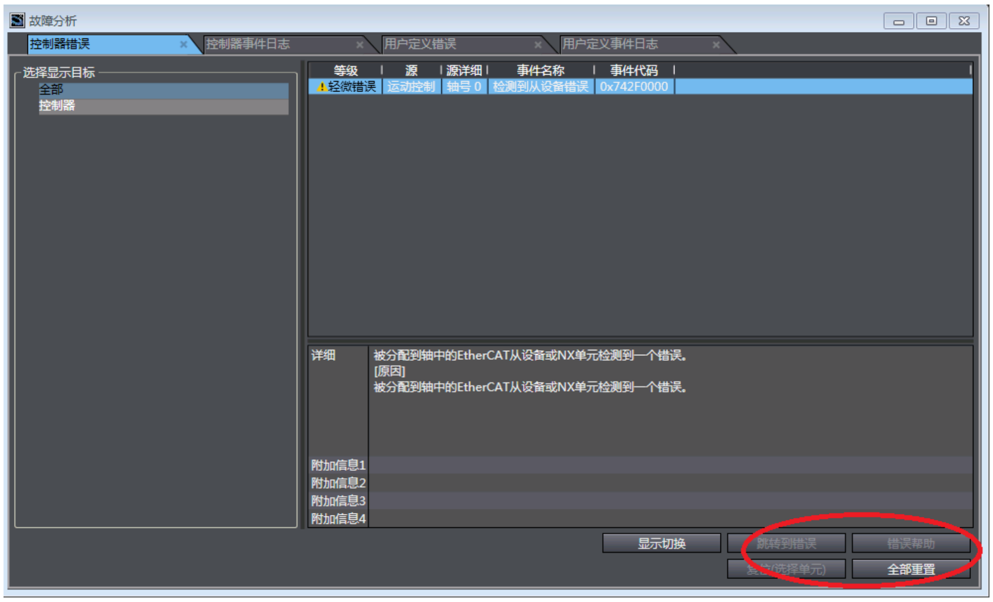
Main menu, Controller (C) → Online → Transferring (A) → Transfer to the controller (T)



Step 8: If there is an error report, sysmac Studio will show a red alarm dot in the lower right corner.

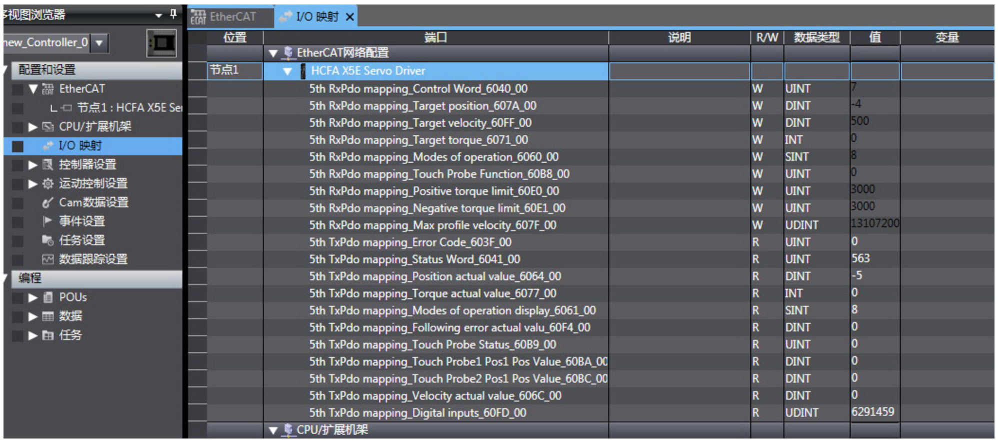
Some of the alarms can be cleared by the built-in function of the software: Main menu, Tool (T) → Troubleshooting (T) → Click "Reset all" in the pop-up window.



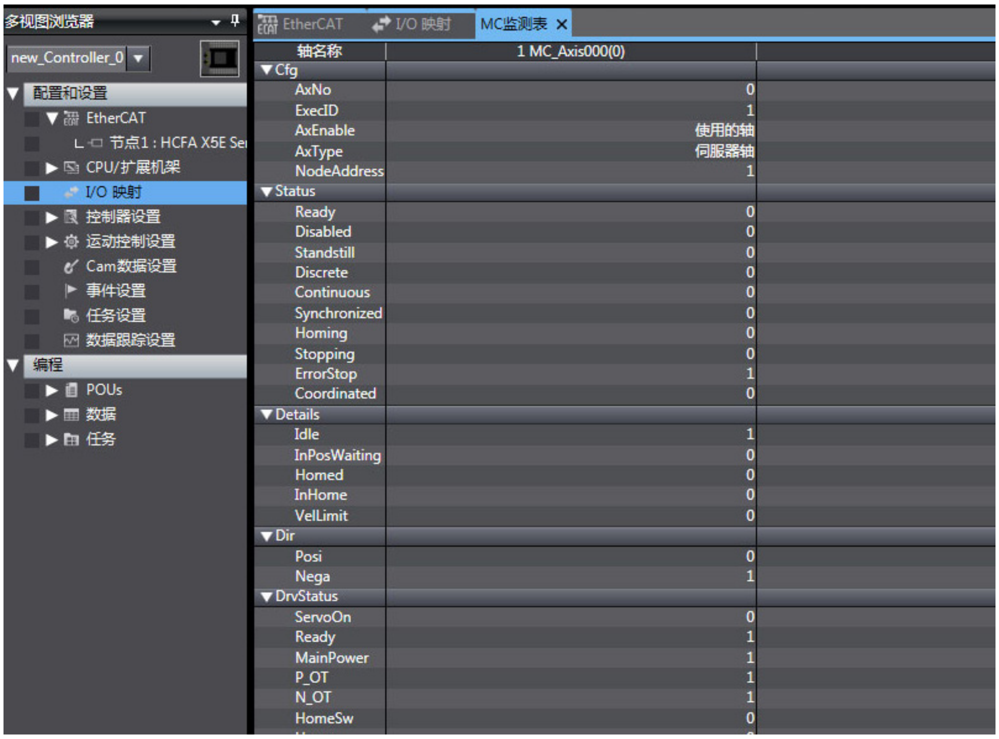


Step 9: Data monitoring

The PDO parameters related to the servo slave can be monitored in "Configuration and setting" - "I/O mapping".



The DI, DO, and various statuses of the servo slave can be monitored in the Main menu → Controller → "MC monitoring table".



Step 10: Project export

When using the edited OMRON PLC project on other computers, it is necessary to export the project (note that "Save as" can't realize the export).

Method: Programming page → File (F) → Export (E), and select the file name, save type, and save location, then select "Save".

8.3 Connection between X5EB and Inovance PLC

This is an example of connecting and using three X5EB servo drives with the Inovance PLC AM400 in the cyclic synchronous mode.

◆ Preparation

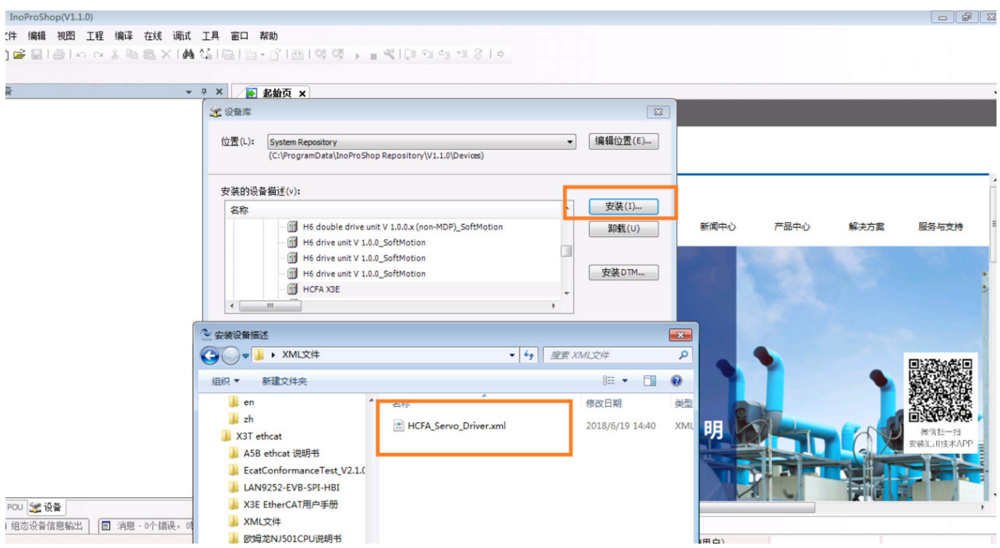
Servo drive:

1. Servo drive control mode P0.01 = 7 (EtherCAT mode). If more than one servo drive is running, the network cables should be plugged in strictly in the order of "top in, bottom out".

Inovance PLC :

1. Download and install the Inovance software AM400 (version: InoProShopV1.1.0).

2. Add X5_EtherCAT XML file: InoProShop software initial page → Tool → Device library → Installation

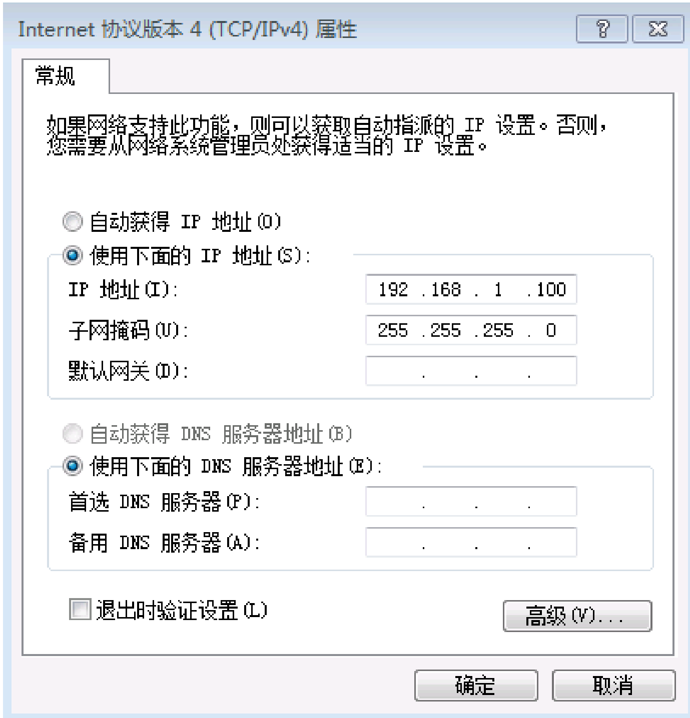


◆ Connection and operation process

Step 1: PLC connection (Inovance AM400 PLC)

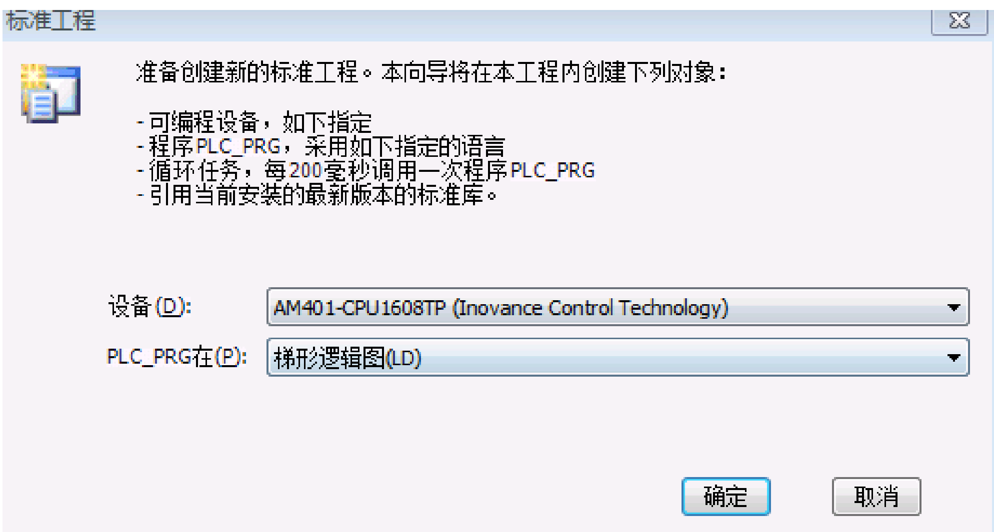
1. Set the computer IP address to the same network segment as the PLC:

Computer → Local connection → Property → Internet protocol version 4 (TCP/Ipv4) property → Use the following IP address, as shown below (for 192.168.1.X (X is 1~255 non-88 values), and Inovance CPU factory default address is 192.168.1.88):



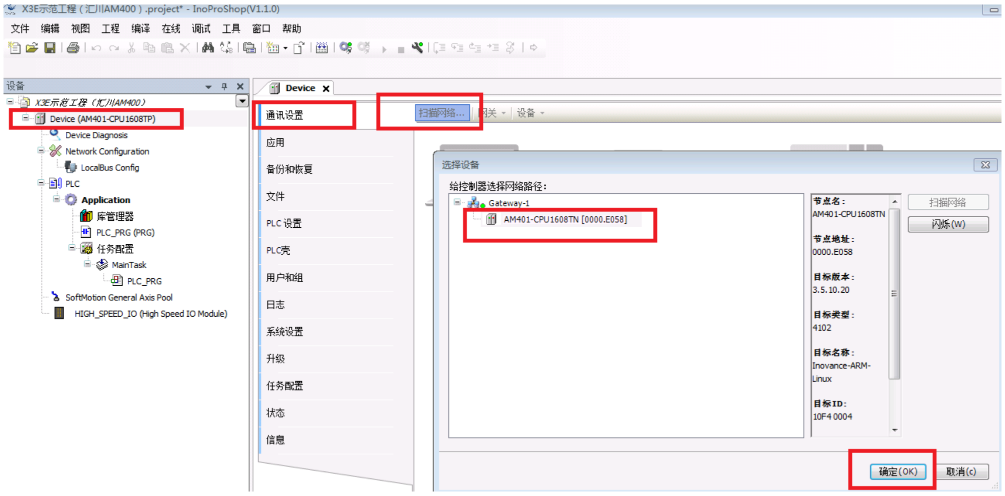
2. Build a new project

1. Build a new standard project and select the ladder logic diagram (other PLC programming languages can also be selected).



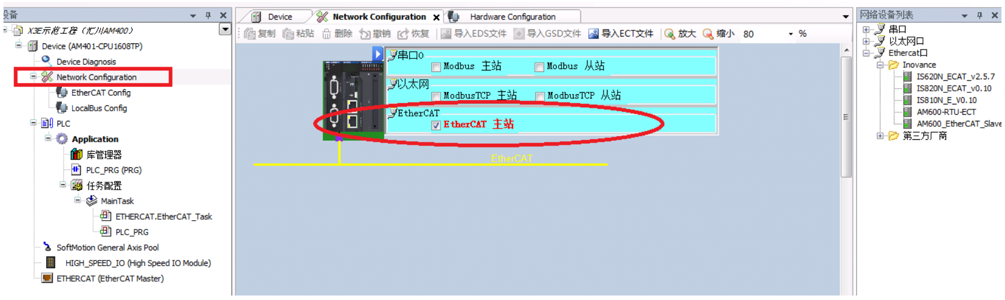
3.Connect PLC

Double click on Device (AM401-CPU1608TP) → Communication setting → Scan for the Internet → Select “AM401-CPU1608TN[000.E058]”→ Select “Confirm”.



Step 2: EtherCAT master adding

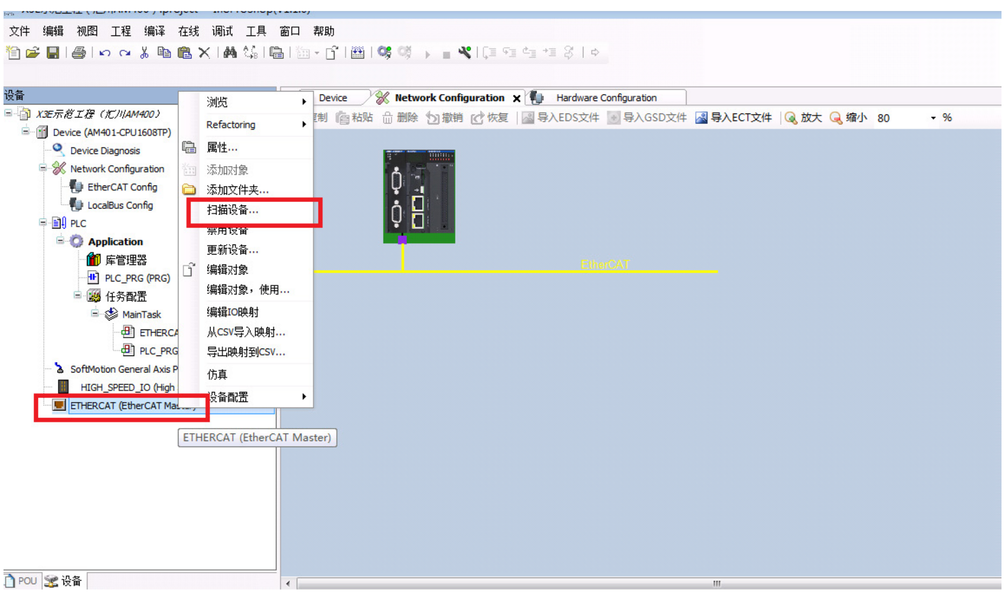
Double-click on Network Configuration → check the option "EtherCAT master".

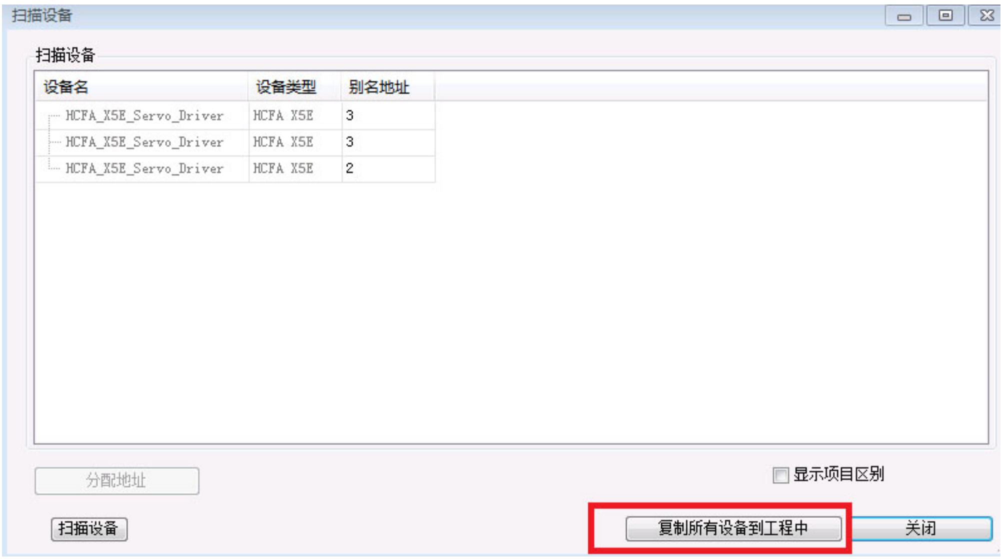


Step 3: Servo slave adding

Method 1: Add automatically

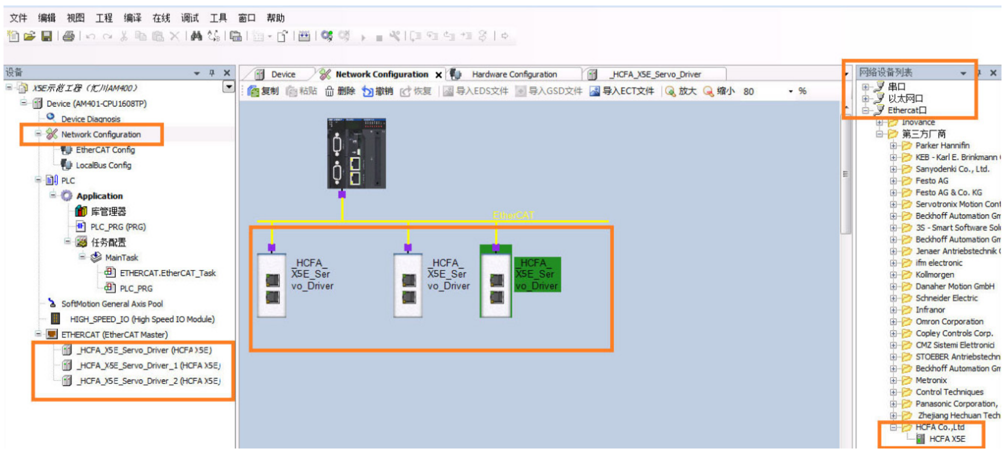
Right-click on "ETHERCAT(EtherCAT Master)" → Scan for devices → Scan for servos and click on "Copy all devices to project





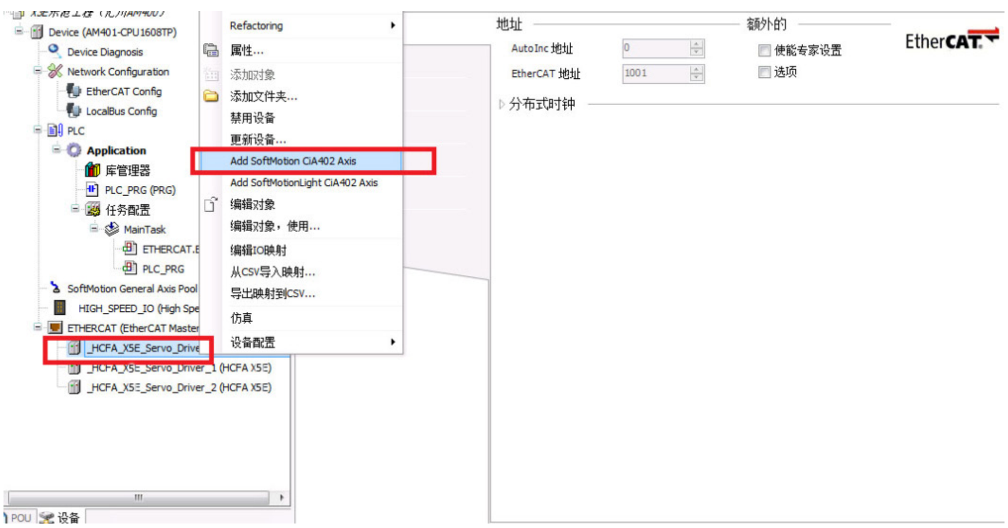
Method 2: Add manually

Double-click Network Configuration → Network device List → EtherCAT interface → Third-party vendor → HCFA Co.,Ltd → Drag the HCFA X5 icon under the bus.

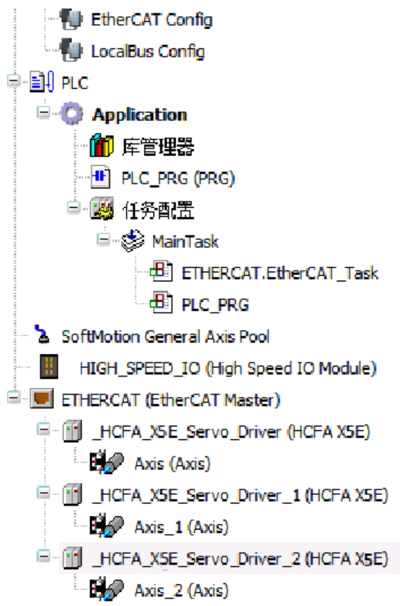


Step 3: Motion control axis adding

Select a servo drive → Right-click and select "Add SoftMotion CiA402 Axis".



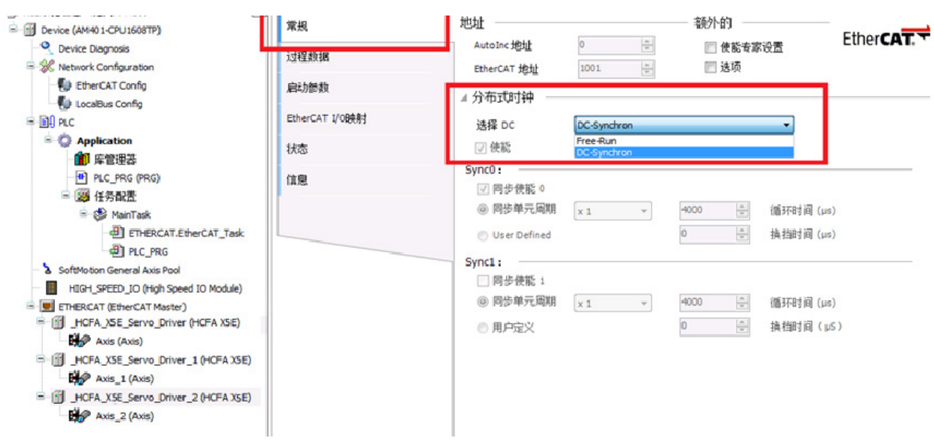
Similarly, add the motion control axes for the other two servo slaves, and the effect after adding them is as follows:



Step 4: Relevant parameters setting

1. Set the synchronization unit cycle: ETHERCAT (EtherCAT Master) → General → Distributed clock, set the appropriate cycle time (the default is 4ms, the lowest value is 1ms, it is recommended to check: Options → Automatic restart servo).

2. Set the distributed clock of servo slave: Select servo → General → Distributed clock → select "DC-Snchron".



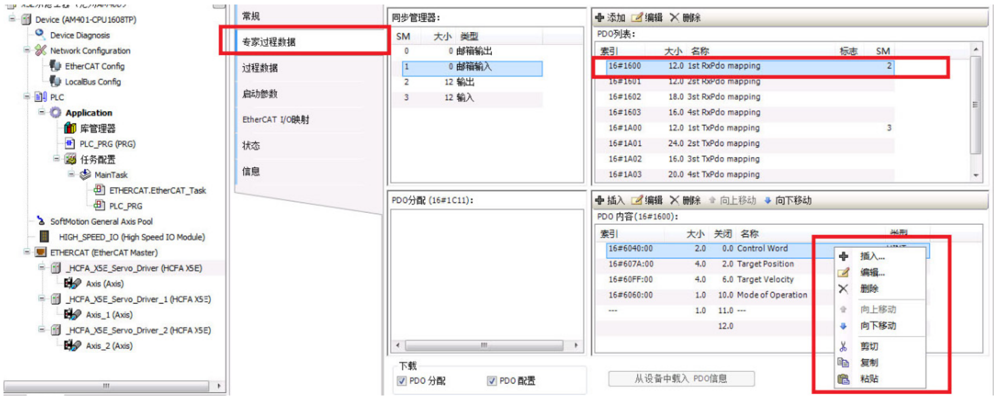
Similarly, set "DC-Snchron" for the other two servo slaves.

3. Add and delete RPDO/TPDO for servo slave (the first group of RPDO/TPDO parameters is used by default, use the de-

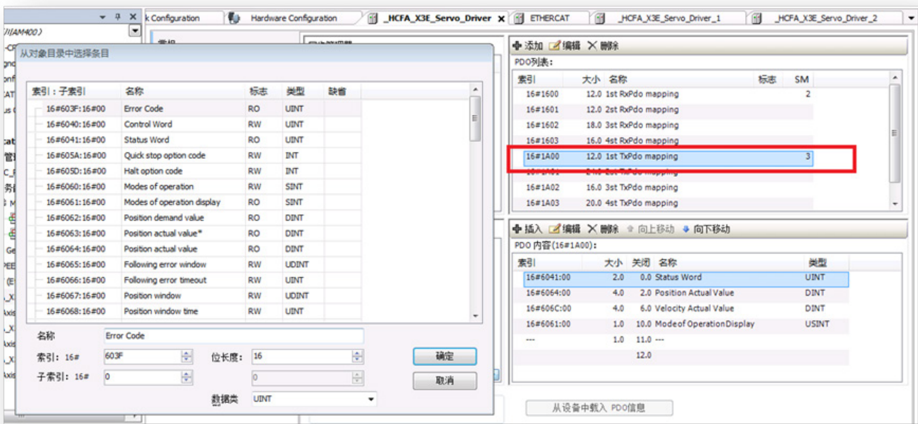
fault parameters if not necessary, the following is a brief introduction to the method of modifying the first group of RPDO/TPDO as an example):

Double-click the selected servo to modify RPDO/TPDO → General → Check "Enable expert setting" → Go to the "Process data" page → Check 16#1600 1st Rxpdo mapping and 16#1A00 1st Txpdo mapping. Txpdo mapping → Go to the "Expert process data" page → Select "16#1600 1st Rxpdo mapping" in the upper right corner.

Right click on the bottom right corner to add, delete, and edit the required RPDOs.

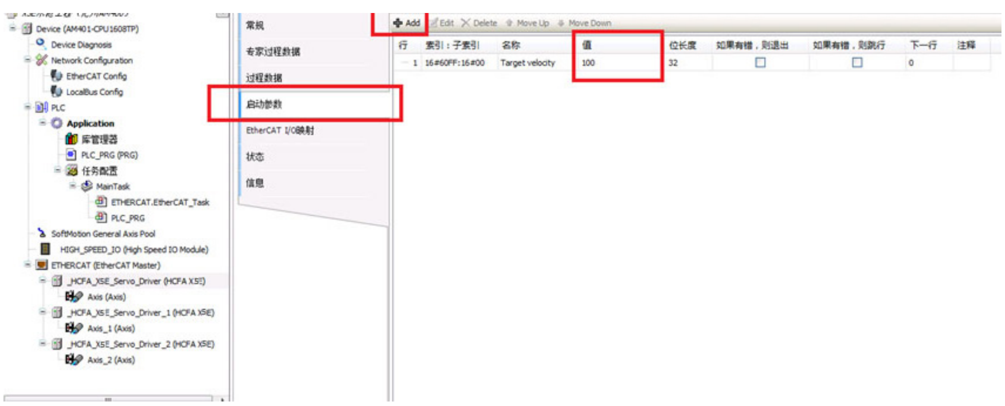


Select "16#1A00 1st Txpdo mapping" in the upper right corner → Right click on the lower right corner to add, delete or edit the desired TPDO.



4. Add startup parameters (if necessary, perform only one operation during power-up.)

Select the servo that requires startup parameters → "Startup parameter page" → Add → Add startup parameters and set appropriate values.



5. Set the motion control axis type:

Select any one of the servo slave motion control axes → "SoftMotion Drives: Basic" page → Axis type and limitation: Axis type and applications:

1. Virtual axis mode: no access for actual servo motors.

2. Cyclic mode: For the rotary axes running in a single direction, the use of linear mode is prone to cause overflow of position counting, leading to position calculation errors.

3. Linear mode: For the mechanism running reciprocally, its stroke is limited (used by default).

Note: Set corresponding axis type for all the motion control axes.

---

6. Set the servo soft limit (if necessary, the limit here refers to the PLC given instruction limit, not the servo encoder feedback limit).

Select the servo slave control axis to have the soft limit → "SoftMotion Driver: Basic" page → Check "Software Limit" and set the appropriate positive and negative limit values.

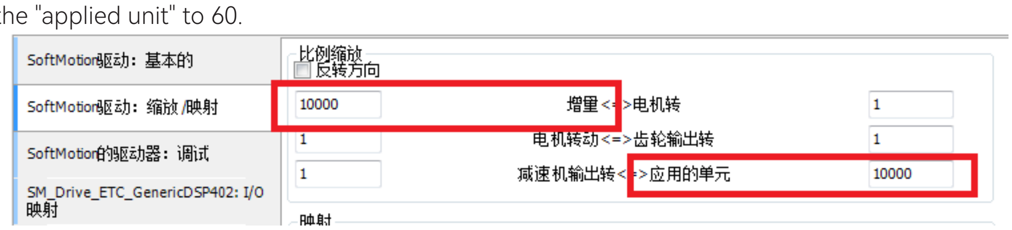
7. Set the resolution of the motion control axis encoder

Select one of the servo slave control axes → Set the appropriate encoder resolution on the "SoftMotion Drive: Scaling/Mapping" page.

This parameter is related to the electronic gear ratio, and the default parameter is used if only the pulse number of one motor revolution is considered, and not the speed reducer and lead of the load, etc. That is, in the case of using the internal electronic gear ratio of the servo, it can be set as follows:

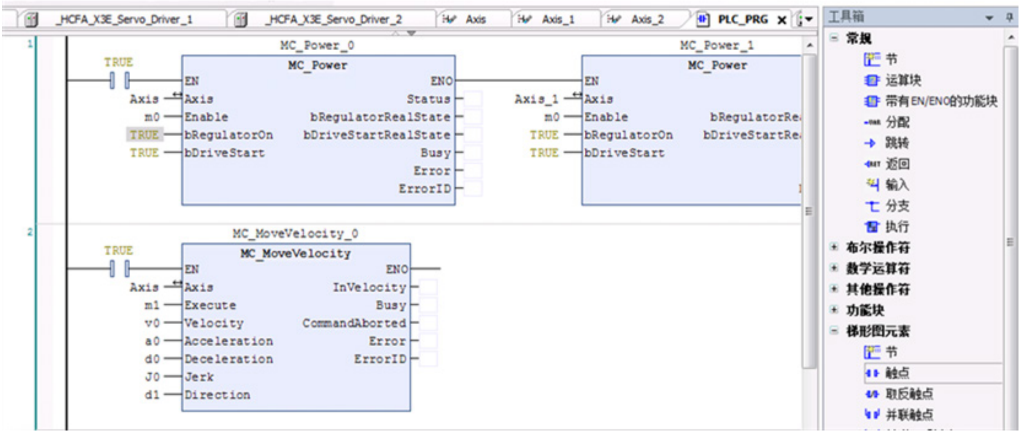
Set the "increment" to the value of P0.08. For example, when P0.08=10000, set this value to 10000, and when P0.08=131072, set this value to 131073.

The "applied unit" is the number of pulses for one revolution, if the motor axis is expected to rotate once for every 10000 pulses, set it to 10000, if the rotation speed of the motion control instruction is expected to overlap with the actual motor rotation speed, set the "applied unit" to 60.



Step 5: PLC program writing

For example, the constant speed instruction is given as follow:



The more commonly used motion control instructions include the following:

Enabling instructions (MC_Power), such as constant velocity rotation instruction MC_MoveVelcity, absolute position instruction MC_MoveAbsolute, relative position instruction MC_MoveRelation, axis stop instruction MC_Stop) and so on.

Step 6: Project compilation and download

Step 7: PLC program running

Note: For detailed use of PLC, operation and control instructions, please refer to Inovance PLC instruction manual.

8.4 Connection between X5EB and HCQ1

This case is an example of connecting the X5_EtherCAT servo drive with HCFA HCQ1-1300-D. Please refer to the HCFA Q-series software manual for detailed procedure.

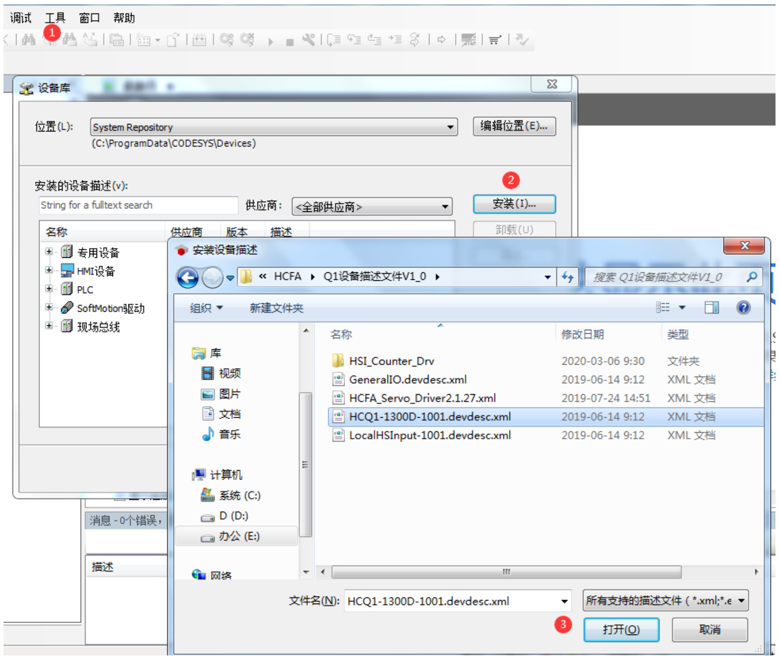
◆ Preparation

1. Servo drive control mode P0.01 = 7 (EtherCAT mode).

2. Download and install CODESYS software, refer to the official website (version: CODESYS V3.5 SP13)

3. Install the HCQ1-1300D and add X5_EtherCAT XML file.

CODESYS software initial page → Tool → Device library → Install XML files (HCQ1-1300D.devdesc.xml and HCFA_Servo_Driver.xml) as follows:

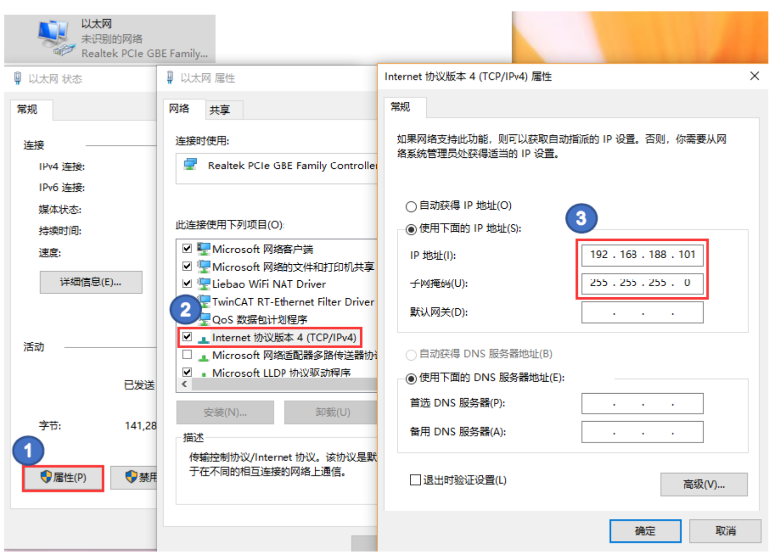


Communication establishment with HCQ1-1300D:

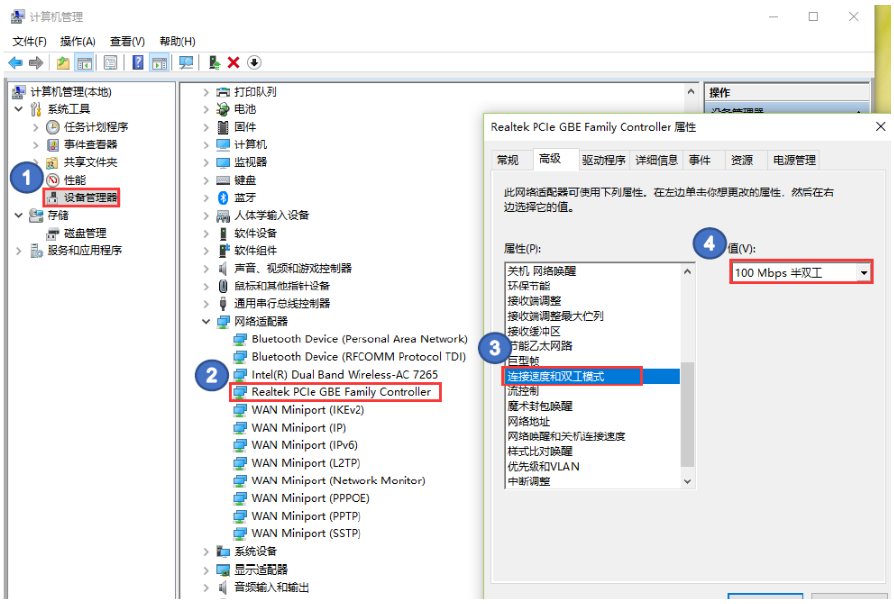
1. Install CODESYS software on the PC platform and double click on it to open the software. Then follow the above preparation to complete the installation of HCQ1-1300D and to add X5_EtherCAT XML file.

Default IP address of Q1 controller: 192.168.188.100 Subnet mask: 255.255.255.0.

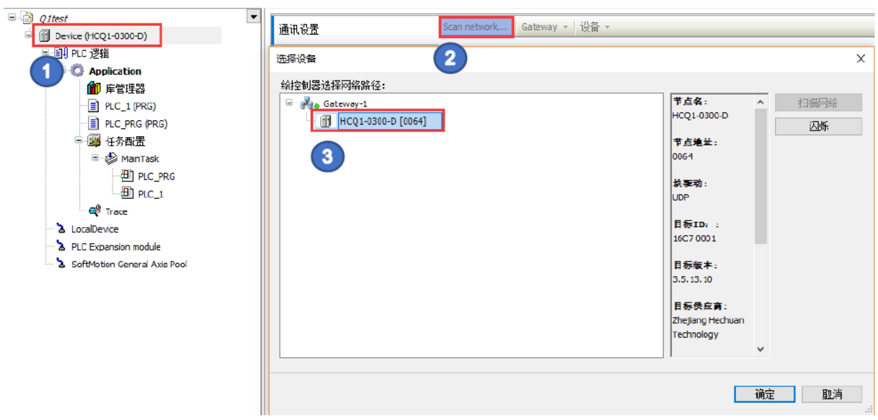
Set the IP address to the same network segment in the network adapter on the PC side, and the IP address should not be repeated.



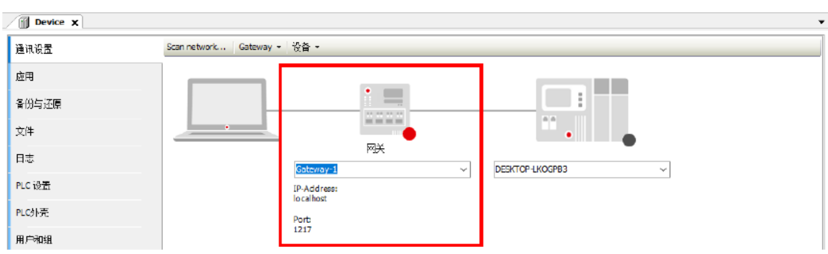
2. Modify the connection speed and duplex mode of the network card to "100Mbps half-duplex" in the device manager of PC.



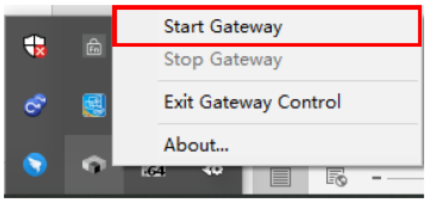
3. After completing the relevant settings of the network card on the PC side, double-click "Device" in the tree menu on the left side of the new project in CODESYS software to enter the communication settings. Make sure the gateway is correctly opened, then click on "Scan network", select the device after the Q1 is scanned, and click on OK to add it:



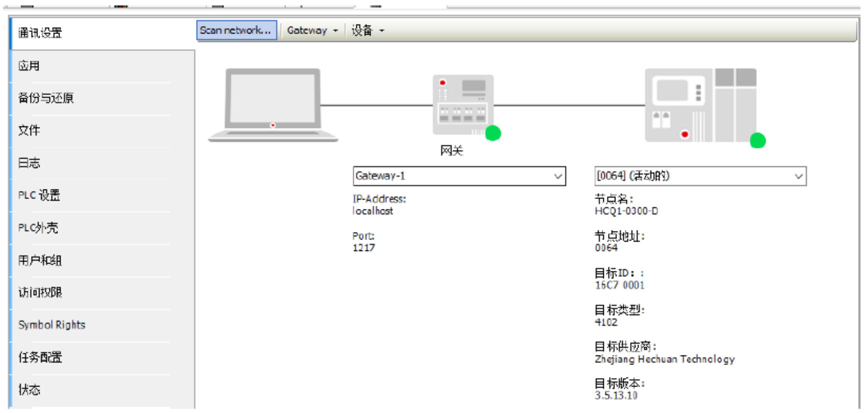
If CODESYS gateway is not opened, it will be displayed in red in the "Communication Settings" page, and users need to open it by themselves.



Locate the CODESYS icon in the lower right corner of the PC, right-click, and select StartGateway to perform gateway starting, scanning, and adding.



Communication is successfully completed when the correctly added device is displayed as follows:



Note: Please refer to the Q- series software instruction manual for detailed usage. Also refer to section 7.6 (same as CODESYS platform).

Chapter 9 Parameter list and object dictionary

9.1 1000H List of object group

Index	Sub-index	Name	Data type	Default
1000h	00h	Device type	Unsigned32	0x20192(131474)
1001h	00h	Error register	Unsigned8	0x0
1002h	00h	Manufacturer status register	Unsigned32	
1003h	00h	Predefined error domain: number of errors	Unsigned32	
	01h~FEh	Standard error domain		
1005h	00h	Synchronization COB-ID	Unsigned32	
1006h		Communication cycle	Unsigned32	
1007h		Synchronization window length	Unsigned32	
1008h		Manufacturer device name	VISIBLE_STRING	HCFA X5E Servo Driver
1009h		Manufacturer hardware version	VISIBLE_STRING	0.1
1010h	00	Maximum number of sub-indexes	Unsigned32	1
	01	Save all parameters	Unsigned32	0
100Ah		Manufacturer software version	VISIBLE_STRING	5.1
100Ch		Monitoring cycle	Unsigned16	
100Dh		Survival cycle factor	Unsigned8	
1010h		Save parameters	Unsigned32	
1011h		Restore default parameters	Unsigned32	
1012h		Timestamp object COB-ID	Unsigned32	
1013h		High resolution timestamp	Unsigned32	
1014h		EMCY COB-ID	Unsigned32	
1015h		EMCY inhibit time	Unsigned16	
1016h		Consumer heartbeat timeout	Unsigned32	
1017h		Producer heartbeat timeout	Unsigned16	
1018h	0	Object identity		4
	1	Supplier ID		0x 000116C7
	2	Product code		0x 003E0402
	3	Revision number		0x002
	4	Sequence number		0x001
1019h		Synchronization counter overflow value	Unsigned8	
1020h		Configuration verification	Unsigned32	
1021h		Storage EDS		
1022h		Storage format	Unsigned16	
1023h		OS command		
1024h		OS command mode	Unsigned8	
1025h		OS debugging interface		
1026h		OS prompt command interface	Unsigned8	
1027h		Module list	Unsigned16	
1028h		Emergency consumer object	Unsigned32	
1029h		Error behavior object	Unsigned8	
10F1h	0	Number of error setting indexes		2
	1	Local error response		0x001
	2	Synchronization error count limit		0x00C (12)
1C00	0	Synchronization management type subindex count		4
	1	Subindex 1		0x01

Index	Sub-index	Name	Data type	Default
	2	Subindex 2		0x02
	3	Subindex 3		0x03
	4	Subindex 4		0x04
1600		RxPDO mapping parameters (group 1)		
1601		RxPDO mapping parameters (group 2)		
1602		RxPDO mapping parameters (group 3)		
1603		RxPDO mapping parameters (group 4)		
1604		RxPDO mapping parameters (group 5)		Compatible with Omron
1A00		TxPDO mapping parameters (group 1)		
1A01		TxPDO mapping parameters (group 2)		
1A02		TxPDO mapping parameters (group 3)		
1A03		TxPDO mapping parameters (group 4)		
1A04		TxPDO mapping parameters (group 5)		Compatible with Omron
1C12	0	Number of RxPDO allocation indexes		1
	1	Subindex 1		0x1600 (5632)
1C13	0	TxPDO allocation index number		1
	1	Subindex 1		0x1A00 (6656)
1C32	0	Synchronization output parameter index number		32
	1	Synchronization type		0x0002(0: free run 2: DC SYNC0)
	2	Cycle time		(Unit, ns)
	4	Supported synchronization type		0x0005(5)
	5	Minimum cycle time		0x0003D090(250000)
	6	Calculation and copy time		0x00001388(5000)
	8	Synchronization time acquisition		0x0000(0)
	9	Delay time		0x000000000(0)
	A	Synchronization 0 cycle time		0x00989680(10000000)
	B	Synchronization event loss		0x0000(0)
1C33	0	Synchronization input parameter index number		32
	1	Synchronization type		Ox0002 (0: free run 2: DC SYNC0)
	2	Cycle time		(Unit, ns)
	4	Supported synchronization type		0x0005(5)
	5	Minimum cycle time		0x0003D090(250000)
	6	Calculation and copy time		0x00000000(0)
	8	Synchronization time acquisition		0x0000(0)
	9	Delay time		0x000000000(0)
	A	Synchronization 0 cycle time		0x00989680(10000000)
	B	Synchronization event loss		0x0000(0)
	C	Minimum cycle time		0x0000(0)
	20	Synchronization error		FALSE

9.2 2100H List of object group

Group 2100h: Basic setting

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2100h	00h	Basic setting	-	-	-	-		-
2100h	01h	Motor rotation positive direction definition	1	U16	0-1	Immediate	ALL	NO
2100h	02h	Modes of operation	1	U16	0-7	Restart	ALL	NO
2100h	03h	Real-time auto-tuning mode	1	U16	0-3	Immediate	ALL	NO
2100h	04h	Rigidity grade setting	1	U16	0-31	Immediate	ALL	NO
2100h	05h	Inertia ratio	0.01	U16	0-6000	Immediate	ALL	NO
2100h	06h	Position instruction source	1	U16	0-3	Restart	ALL	NO
2100h	08h	Pulse train form	1	U16	0-5	Restart	csp pp hm	NO
2100h	09h	Required pulse instruction number per turn of motor rotation (32-bit)	1Unit	U32	0-1073741824	Immediate	csp pp hm	NO
2100h	0Bh	Electronic gear 1 numerator (32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2100h	0Dh	Electronic gear denominator (32-bit)	1	U32	1-1073741824	Immediate	csp pp hm	NO
2100h	0Fh	Pulse number per turn of motor rotation (32-bit)	1PPR	U32	16-1073741824	Restart	csp pp hm	NO
2100h	11h	Pulse output positive direction definition	1	U16	0-1	Restart	ALL	NO
2100h	12h	Pulse output OZ polarity	1	U16	0-3	Restart	csp pp hm	NO
2100h	13h	Pulse output function selection	1	U16	0-3	Restart	csp pp hm	NO
2100h	14h	Overlarge position deviation threshold (32-bit)	1P	U32	1-1073741824	Immediate	ALL	NO
2100h	16h	Braking resistor setting	1	U16	0-1	Immediate	ALL	NO
2100h	17h	External resistor power capacity	1W	U16	1-65535	Immediate	ALL	NO
2100h	18h	External resistor value	1Ω	U16	1-1000	Immediate	ALL	NO
2100h	19h	External resistor heating time constant	0.1s	U16	1-30000	Immediate	ALL	NO
2100h	1Ah	Regenerative voltage point	1	U16	0-65535	Immediate	ALL	NO
2100h	1Bh	Step value setting	1	I16	-9999-9999	Immediate	csp pp hm	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2100h	1Ch	High pulse train form	1	U16	0-5	Restart	csp pp hm	NO
2100h	1Ch	High pulse train form	1	U16	0-5	Restart	csp pp hm	NO
2100h	1Dh	Modulus mode low bit (32-bit)	1P	U32	0-4294967295	Restart	csp pp hm	NO
2100h	1Fh	Modulus mode high bit (32-bit)	1P	U32	0-4294967295	Restart	csp pp hm	NO

Group 2101h: Gain tuning

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2101h	00h	Gain tuning	-	-	-	-	-	-
2101h	01h	Position loop gain 1	0.1/s	U16	10-20000	Immediate	csp pp hm	NO
2101h	02h	Speed loop gain 1	0.1HZ	U16	10-20000	Immediate	csp pp hm csv pv	NO
2101h	03h	Speed loop integral time 1	0.01ms	U16	15-51200	Immediate	csp pp hm csv pv	NO
2101h	04h	Speed detection filtering 1	1	U16	0-15	Immediate	ALL	NO
2101h	05h	Torque instruction filtering 1	0.01ms	U16	0-10000	Immediate	ALL	NO
2101h	06h	Position loop gain 2	0.1/s	U16	10-20000	Immediate	csp pp hm	NO
2101h	07h	Speed loop gain 2	0.1HZ	U16	10-20000	Immediate	csp pp hm csv pv	NO
2101h	08h	Speed loop integral time 2	0.01ms	U16	15-51200	Immediate	csp pp hm csv pv	NO
2101h	09h	Speed detection filtering 2	1	U16	0-15	Immediate	ALL	NO
2101h	0Ah	Torque instruction filtering 2	0.01ms	U16	0-10000	Immediate	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2101h	0Bh	Speed regulator PDFF coefficient	0.1%	U16	0-1000	Immediate	csp pp hm csv pv	NO
2101h	0Ch	Speed feed-forward control selection	1	U16	0-1	Restart	csp pp hm	NO
2101h	0Dh	Speed feed-forward gain	0.1%	U16	0-1500	Immediate	csp pp hm	NO
2101h	0Eh	Speed feed-forward filtering time	0.01ms	U16	0-6400	Immediate	csp pp hm	NO
2101h	0Fh	Torque feed-forward control selection	1	U16	0-2	Restart	csp pp hm csv pv	NO
2101h	10h	Torque feed-forward gain	0.1%	U16	0-1000	Immediate	csp pp hm csv pv	NO
2101h	11h	Torque feed-forward filtering time	0.01ms	U16	0-6400	Immediate	csp pp hm csv pv	NO
2101h	12h	DI function GAIN—SWITCH action switching selection	1	U16	0-1	Immediate	csp pp hm csv pv	NO
2101h	13h	Position control switching mode	1	U16	0-10	Immediate	csp pp hm csv pv	NO
2101h	14h	Position control switching delay	0.1ms	U16	0-1000	Immediate	csp pp hm csv pv	NO
2101h	15h	Position control switching class	1	U16	0-20000	Immediate	csp pp hm csv pv	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2101h	16h	Position control gain switching hysteresis	1	U16	0-20000	Immediate	csp pp hm csv pv	NO
2101h	17h	Position gain switching time	0.1ms	U16	0-10000	Immediate	csp pp hm csv pv	NO
2101h	18h	Speed control switching mode	1	U16	0-5	Immediate	csv pv	NO
2101h	19h	Speed control switching delay	0.1ms	U16	0-1000	Immediate	csv pv	NO
2101h	1Ah	Speed control switching class	1	U16	0-20000	Immediate	csv pv	NO
2101h	1Bh	Speed control switching hysteresis	1	U16	0-20000	Immediate	csv pv	NO
2101h	1Ch	Torque control switching mode	1	U16	0-3	Immediate	cst pt	NO
2101h	1Dh	Torque control switching delay	0.1ms	U16	0-1000	Immediate	cst pt	NO
2101h	1Eh	Torque control switching class	1	U16	0-20000	Immediate	cst pt	NO
2101h	1Fh	Torque control switching hysteresis	1	U16	0-20000	Immediate	cst pt	NO
2101h	20h	Observer enabled	1	U16	0-2	Restart	ALL	NO
2101h	21h	Observer cut-off frequency	1Hz	U16	0-500	Restart	ALL	NO
2101h	22h	Observer phase compensation time	0.01ms	U16	0-10000	Immediate	ALL	NO
2101h	23h	Observer inertia coefficient	1	U16	0-10000	Restart	ALL	NO

Group 2102h: Vibration suppression

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2102h	00h	Vibration suppression	-	-	-	-	-	-
2102h	01h	Position instruction smoothing filter	0.1ms	U16	0-65535	Immediate	csp pp hm	NO
2102h	02h	Position instruction FIR filter	0.1ms	U16	0-1280	Immediate	csp pp hm	NO
2102h	03h	Adaptive filter mode	1	U16	0-4	Immediate	ALL	NO
2102h	04h	Adaptive filter load mode	1	U16	0-1	Immediate	ALL	NO
2102h	05h	The first notch filter frequency (manual)	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	06h	The first notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	07h	The first notch filter depth	1	U16	0-99	Immediate	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2102h	08h	The second notch filter frequency (manual)	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	09h	The second notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	0Ah	The second notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	0Bh	The third notch filter frequency	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	0Ch	The third notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	0Dh	The third notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	0Eh	The fourth notch filter frequency	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	0Fh	The fourth notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	10h	The fourth notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	14h	Position instruction FIR filter 2	0.1ms	U16	0-1280	Immediate	csp pp hm	NO
2102h	15h	The first vibration damping frequency	0.1Hz	U16	0-1000	Immediate	csp pp hm csv pv	NO
2102h	16h	The first vibration damping filtering setting	0.1	U16	0-10	Immediate	csp pp hm csv pv	NO
2102h	17h	The second vibration damping frequency	0.1Hz	U16	0-1000	Immediate	csp pp hm csv pv	NO
2102h	18h	The second vibration damping filtering setting	0.1	U16	0-10	Immediate	csp pp hm csv pv	NO
2102h	20h	Resonance point 1 frequency	1Hz	U16	0-5000	Display parameter	ALL	NO
2102h	21h	Resonance point 1 bandwidth	1	U16	0-20	Display parameter	ALL	NO
2102h	22h	Resonance point 1 amplitude	1	U16	0-1000	Display parameter	ALL	NO
2102h	23h	Resonance point 2 frequency	1Hz	U16	0-5000	Display parameter	ALL	NO
2102h	24h	Resonance point 2 bandwidth	1	U16	0-20	Display parameter	ALL	NO
2102h	25h	Resonance point 2 amplitude	1	U16	0-1000	Display parameter	ALL	NO

Group 2103h: Speed & torque control

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2103h	00h	Speed & torque control	–	–	–	–	–	–
2103h	01h	Speed instruction source	1	U16	0-6	Restart	csv pv	NO
2103h	04h	Speed instruction setting value	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	05h	JOG speed setting	1rpm	U16	0-3000	Immediate	csv pv	NO
2103h	09h	Torque limit source	1	U16	0-3	Immediate	csp pp hm csv pv	NO
2103h	0Ah	Internal forward torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Bh	Internal reverse torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Ch	External forward torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Dh	External reverse torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Fh	Acceleration time 1	1ms	U16	0-65535	Immediate	csv pv cst pt	NO
2103h	10h	Deceleration time 1	1ms	U16	0-65535	Immediate	csv pv cst pt	NO
2103h	11h	Acceleration time 2	1ms	U16	0-65535	Immediate	csv pv	NO
2103h	12h	Deceleration time 2	1ms	U16	0-65535	Immediate	csv pv	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2103h	14h	Zero-speed clamp function	1	U16	0-2	Immediate	csv pv cst pt	NO
2103h	15h	Zero-speed clamp threshold value	1rpm	U16	0-1000	Immediate	csv pv cst pt	NO
2103h	17h	Torque instruction source	1	U16	0-4	Restart	cst pt	NO
2103h	1Ah	Torque instruction key set value	0.1%	I16	-3000-3000	Immediate	cst pt	NO
2103h	1Bh	Speed limit source under torque control	1	U16	0-1	Immediate	cst pt	NO
2103h	1Ch	Internal positive speed limit	1	U16	0-9000	Immediate	cst pt	NO
2103h	1Dh	Internal negative speed limit	1	U16	0-9000	Immediate	cst pt	NO
2103h	1Eh	Hard limit torque limit	0.1%	U16	0-4000	Immediate	ALL	NO
2103h	1Fh	Hard limit torque limit detection time	1	U16	0-2000	Immediate	ALL	NO
2103h	20h	Speed instruction number selection mode	1	U16	0-1	Restart	csv pv	NO
2103h	21h	Acceleration time number for speed instruction from segment 1 to 8	1	U16	0-1	Immediate	csv pv	NO
2103h	22h	Deceleration time number for speed instruction from segment 1 to 8	1	U16	0-1	Immediate	csv pv	NO
2103h	23h	Acceleration time number for speed instruction from segment 9 to 16	1	U16	0-1	Immediate	csv pv	NO
2103h	24h	Deceleration time number for speed instruction from segment 9 to 16	1	U16	0-1	Immediate	csv pv	NO
2103h	25h	Segment 1 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	26h	Segment 2 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	27h	Segment 3 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	28h	Segment 4 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	29h	Segment 5 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Ah	Segment 6 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Bh	Segment 7 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2103h	2Ch	Segment 8 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Dh	Segment 9 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Eh	Segment 10 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Fh	Segment 11 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	30h	Segment 12 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	31h	Segment 13 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	32h	Segment 14 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	33h	Segment 15 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	34h	Segment 16 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO

Group 2104h: Digital input and output

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2104h	00h	Digital input and output	-	-	-	-	-	-
2104h	01h	Normal DI filter selection	1us	U16	0-10000	Immediate	ALL	NO
2104h	02h	DI1 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	03h	DI2 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	04h	DI3 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	05h	DI4 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	06h	DI5 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	07h	DI6 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	08h	DI7 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	09h	DI8 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	0Ah	DI9 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	0Ch	DI1 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	0Dh	DI2 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	0Eh	DI3 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	0Fh	DI4 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	10h	DI5 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	11h	DI6 terminal logic selection	1	U16	0-1	Restart	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2104h	12h	DI7 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	13h	DI8 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	14h	DI9 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	16h	DO1 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	17h	DO2 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	18h	DO3 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	19h	DO4 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Ah	DO5 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Bh	DO6 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Ch	DO7 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Dh	DO8 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Eh	DO9 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	20h	DO1 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	21h	DO2 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	22h	DO3 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	23h	DO4 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	24h	DO5 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	25h	DO6 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	26h	DO7 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	27h	DO8 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	28h	DO9 terminal logic level selection	1	U16	0-1	Restart	ALL	NO
2104h	2Ah	FunINL signal unassigned status (HEX)	1	U16	0-65535	Immediate	ALL	NO
2104h	2Bh	FunINH signal unassigned status (HEX)	1	U16	0-65535	Immediate	ALL	NO
2104h	2Ch	Motor rotational signal (TGON) threshold	1rpm	U16	0-1000	Immediate	ALL	NO
2104h	2Dh	Speed conformity signal width	1rpm	U16	10-1000	Immediate	csv pv	NO
2104h	2Eh	Speed specified value arrival	1rpm	U16	10-9000	Immediate	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2104h	30h	Positioning completion range	1P	U16	1-65535	Immediate	csp pp hm	NO
2104h	31h	Positioning completion output setting	1	U16	0-7	Immediate	csp pp hm	NO
2104h	32h	Positioning completion holding time	1ms	U16	1-65535	Immediate	csp pp hm	NO
2104h	33h	Positioning near range	1P	U16	1-65535	Immediate	csp pp hm	NO
2104h	34h	Servo OFF delay time after holding brake taking action when speed is 0	1ms	U16	0-9999	Immediate	ALL	NO
2104h	35h	Speed setting for holding brake to take action in motion	1rpm	U16	0-3000	Immediate	ALL	NO
2104h	36h	Waiting time for holding brake to take action in motion	1ms	U16	0-9999	Immediate	ALL	NO
2104h	37h	Z pulse OC output enable	1	U16	0-3	Immediate	ALL	NO
2104h	38h	Torque set value arrival	0.1%	U16	0-3000	Immediate	ALL	NO
2104h	39h	Torque arrival detection width	0.1%	U16	0-3000	Immediate	ALL	NO
2104h	3Ah	Z-phase pulse width adjustment	1	U16	0-100	Immediate	ALL	NO
2104h	3Bh	Zero-speed signal output threshold	1rpm	U16	0-1000	Immediate	ALL	NO

Group 2105h: Analog input and output

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2105h	00h	Analog input and output	-	-	-	-	-	-
2105h	01h	AI1 minimum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	02h	Setting value corresponding to the AI1 minimum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	03h	AI1 maximum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	04h	Setting value corresponding to the AI1 maximum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	05h	AI1 zero-point fine tuning	1mV	I16	-500-500	Immediate	ALL	NO
2105h	06h	AI1 dead band setting	0.1%	U16	0-200	Immediate	ALL	NO
2105h	07h	AI1 input filtering time	0.1ms	U16	0-65535	Immediate	ALL	NO
2105h	08h	AI2 minimum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	09h	Setting value corresponding to the AI2 minimum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	0Ah	AI2 maximum input	0.01V	I16	-1000-1000	Immediate	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2105h	0Bh	Setting value corresponding to the AI2 maximum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	0Ch	AI2 zero-point fine tuning	1mV	I16	-500-500	Immediate	ALL	NO
2105h	0Dh	AI2 dead band setting	0.1%	U16	0-200	Immediate	ALL	NO
2105h	0Eh	AI2 input filtering time	0.1ms	U16	0-65535	Immediate	ALL	NO
2105h	0Fh	AI setting 100% speed	1rpm	U16	0-9000	Immediate	ALL	NO
2105h	10h	AI setting 100% torque	0.01	U16	0-500	Immediate	ALL	NO
2105h	11h	AI1 function selection	1	U16	0-5	Immediate	ALL	NO
2105h	12h	AI2 function selection	1	U16	0-5	Immediate	ALL	NO
2105h	1Dh	AO1 signal selection	1	U16	0-6	Immediate	ALL	NO
2105h	1Eh	AO1 voltage offset	1	U16	0-7	Immediate	ALL	NO
2105h	1Fh	AO1 multiplication	1	U16	0-8	Immediate	ALL	NO
2105h	20h	AO2 signal selection	1mV	U16	0-9	Immediate	ALL	NO
2105h	21h	AO2 voltage offset	0.01	U16	0-10	Immediate	ALL	NO
2105h	22h	AO2 multiplication	1	U16	0-11	Immediate	ALL	NO
2105h	23h	AO monitoring value type	1mV	U16	0-12	Immediate	ALL	NO

Group 2106h: Expansion parameters

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2106h	00h	Extended parameters (protection, auxiliary functions)	-	-	-	-	-	-
2106h	01h	Electronic gear numerator 2 (32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2106h	03h	Electronic gear numerator 3 (32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2106h	05h	Electronic gear numerator 4 (32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2106h	07h	Position deviation clearing function	1	U16	0-3	Immediate	csp pp hm	NO
2106h	0Ah	Electronic gear ratio switching delay	1	U16	0-1	Restart	csp pp hm	NO
2106h	0Bh	Potential energy load torque compensation	1%	I16	-100-100	Immediate	csp pp hm csv pv	NO
2106h	0Ch	P06.10 and friction compensation storage options	1	U16	0-2	Immediate	csp pp hm csv pv	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2106h	0Dh	Forward rotation friction torque compensation	0.1%	I16	-3000-3000	Immediate	csp pp hm csv pv	NO
2106h	0Eh	Reverse rotation friction torque compensation	0.1%	I16	-3000-3000	Immediate	csp pp hm csv pv	NO
2106h	0Fh	Viscous friction compensation	0.1%	I16	-3000-3000	Immediate	csp pp hm csv pv	NO
2106h	10h	Friction compensation time constant	0.1ms	U16	0-10000	Immediate	csp pp hm csv pv	NO
2106h	11h	Friction compensation low speed range	1rpm	U16	0-500	Immediate	csp pp hm csv pv	NO
2106h	13h	The first type fault stop selection	1	U16	0-1	Immediate	csp pp hm csv pv	NO
2106h	14h	Parameter identification speed value	1	U16	100-1000	Restart	csp pp hm csv pv	NO
2106h	15h	Parameter identification acceleration time	1	U16	50-10000	Restart	csp pp hm csv pv	NO
2106h	16h	Parameter identification deceleration time	1	U16	50-10000	Restart	csp pp hm csv pv	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2106h	17h	Parameter identification mode	1	U16	0-1	Restart	csp pp hm csv pv	NO
2106h	18h	Initial angle identification current limit	0.1%	U16	0-2000	Restart	ALL	NO
2106h	19h	Instantaneous power failure protection	1	U16	0-2	Immediate	ALL	NO
2106h	1Ah	Instantaneous power failure deceleration time	1ms	U16	0-10000	Immediate	ALL	NO
2106h	1Bh	Servo OFF stop mode selection	1	U16	0-2	Restart	ALL	NO
2106h	1Ch	The second type fault stop mode selection	1	U16	0-2	Restart	ALL	NO
2106h	1Dh	Over-travel input setting	1	U16	0-1	Restart	ALL	NO
2106h	1Eh	Over-travel stop mode	1	U16	0-2	Restart	ALL	NO
2106h	1Fh	Input power phase loss protection	1	U16	0-1	Immediate	ALL	NO
2106h	20h	Output power phase loss protection	1	U16	0-1	Immediate	ALL	NO
2106h	21h	Stop by emergency stop torque	0.1%	U16	0-5000	Immediate	ALL	NO
2106h	22h	Tripping protection function	1	U16	0-1	Immediate	ALL	NO
2106h	23h	Overload warning value	1%	U16	1-100	Immediate	ALL	NO
2106h	24h	Motor overload protection coefficient	1%	U16	10-300	Immediate	ALL	NO
2106h	25h	Undervoltage protection point	1%	U16	50-130	Immediate	ALL	NO
2106h	26h	Over-speed fault point	1%	U16	50-120	Immediate	ALL	NO
2106h	27h	Maximum input pulse frequency	1KHZ	U16	10-9000	Restart	csp pp hm	NO
2106h	28h	Short circuit to ground detection protection selection	1	U16	0-1	Immediate	ALL	NO
2106h	29h	Encoder interference detection delay	1	U16	0-99	Immediate	ALL	NO
2106h	2Ah	Input pulse filtering setting	1	U16	0-500	Restart	csp pp hm	NO
2106h	2Bh	Input pulse inhibition setting	1	U16	0-3	Restart	csp pp hm	NO
2106h	2Ch	Deviation clearing input setting	1	U16	0-1	Restart	csp pp hm	NO
2106h	2Dh	High-speed DI filtering setting	1us	U16	0-10000	Restart	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2106h	2Eh	Overlarge speed deviation threshold	1rpm	U16	0-10000	Immediate	csp pp hm csv pv	NO
2106h	2Fh	Torque saturation timeout duration	1ms	U16	0-30000	Immediate	ALL	NO
2106h	30h	Absolute system setting	1	U16	0-19	Immediate	ALL	NO
2106h	31h	Encoder battery undervoltage threshold	0.1V	U16	0-33	Immediate	ALL	NO

Group 2107h: Auxiliary function

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2107h	00h	Auxiliary function	-	-	-	-	-	-
2107h	01h	Panel display option	1	U16	0-65535	Immediate	ALL	NO
2107h	02h	Panel monitoring parameter setting 1	1	U16	0-69	Immediate	ALL	NO
2107h	03h	Panel monitoring parameter setting 2	1	U16	0-69	Immediate	ALL	NO
2107h	04h	Panel monitoring parameter setting 3	1	U16	0-69	Immediate	ALL	NO
2107h	05h	Panel monitoring parameter setting 4	1	U16	0-69	Immediate	ALL	NO
2107h	06h	Panel monitoring parameter setting 5	1	U16	0-69	Immediate	ALL	NO
2107h	09h	Function selection 1	1	U16	0-65535	Immediate	ALL	NO
2107h	0Ah	Function selection 2	1	U16	0-65535	Immediate	ALL	NO
2107h	0Bh	User password	1	U16	0-65535	Immediate	ALL	NO
2107h	0Ch	Instant memory storage during power outage	1	U16	0-1	Immediate	ALL	NO
2107h	0Dh	User password screen-lock time	1 min	U16	1-30	Immediate	ALL	NO
2107h	0Fh	Fast deceleration time	1ms	U16	0-9999	Restart	ALL	NO
2107h	11h	Function selection 3	1	U16	0-65535	Restart	ALL	NO
2107h	12h	Resolution	1	U16	0-99	Immediate	csp pp hm	NO
2107h	14h	Function selection 5	1	U16	0-65535	Restart	ALL	NO
2107h	15h	Function selection 6	1	U16	0-65535	Restart	ALL	NO
2107h	16h	Function selection 7	1	U16	0-65535	Immediate	ALL	NO
2107h	17h	Function selection 8	1	U16	0-65535	Immediate	ALL	NO
2107h	18h	Fault reset timing	1	U16	0-1	Immediate	ALL	NO
2107h	19h	Positive soft limit (32-bit)	1	I32	-2147483648-2147483647	Restart	ALL	NO
2107h	1Bh	Negative soft limit (32-bit)	1	I32	-2147483648-2147483647	Restart	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2107h	1Dh	Homing signal holding time	1ms	U16	0-65535	Immediate	hm	NO

Group 2108h: Internal position instruction

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	00h	Internal position instruction	-	-	-	-	-	-
2108h	01h	Multi-segment preset position execution method	1	U16	0-5	Restart	csp pp hm	NO
2108h	02h	Starting segment number	1	U16	1-16	Immediate	csp pp hm	NO
2108h	03h	Ending segment number	1	U16	1-16	Immediate	csp pp hm	NO
2108h	04h	Dealing of residual segments after pausing	1	U16	0-1	Immediate	csp pp hm	NO
2108h	05h	Position instruction type	1	U16	0-1	Restart	csp pp hm	NO
2108h	06h	Waiting time unit	1	U16	0-1	Immediate	csp pp hm	NO
2108h	07h	The first segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	09h	The first segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	0Ah	The first segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	0Bh	Waiting time after the first segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	0Ch	The second segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	0Eh	The second segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	0Fh	The second segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	10h	Waiting time after the second segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	11h	The third segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	13h	The third segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	14h	The third segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	15h	Waiting time after the third segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	16h	The fourth segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	18h	The fourth segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	19h	The fourth segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	1Ah	Waiting time after the fourth segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	1Bh	The fifth segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	1Dh	The fifth segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	1Eh	The fifth segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	1Fh	Waiting time after the fifth segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	20h	The sixth segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	22h	The sixth segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	23h	The sixth segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	24h	Waiting time after the sixth segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	25h	The seventh segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	27h	The seventh segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	28h	The seventh segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	29h	Waiting time after the seventh segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	2Ah	The eighth segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	2Ch	The eighth segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	2Dh	The eighth segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	2Eh	Waiting time after the eighth segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	2Fh	The ninth segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	31h	The ninth segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	32h	The ninth segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	33h	Waiting time after the ninth segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	34h	The 10th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	36h	The 10th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	37h	The 10th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	38h	Waiting time after the 10th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	39h	The 11th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	3Bh	The 11th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	3Ch	The 11th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	3Dh	Waiting time after the 11th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	3Eh	The 12th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	40h	The 12th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	41h	The 12th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	42h	Waiting time after the 12th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	43h	The 13th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	45h	The 13th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	46h	The 13th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	47h	Waiting time after the 13th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	48h	The 14th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	4Ah	The 14th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	4Bh	The 14th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	4Ch	Waiting time after the 14th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	4Dh	The 15th segment The 15th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	4Fh	The 15th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	50h	The 15th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	51h	Waiting time after the 15th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	52h	The 16th segment displacement (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	54h	The 16th segment maximum speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	55h	The 16th segment acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	56h	Waiting time after the 16th segment completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	57h	Position instruction interrupt execution setting	1	U16	0-4	Restart	csp pp hm	NO
2108h	59h	Homing start method	1	U16	0-4	Restart	csp pp hm	NO
2108h	5Ah	Homing mode	1	U16	0-8	Restart	csp pp hm	NO
2108h	5Bh	Limit switch and z-phase signal setting when homing	1	U16	0-5	Restart	csp pp hm	NO
2108h	5Dh	Origin searching high speed	1rpm	U16	1-3000	Immediate	csp pp hm	NO
2108h	5Eh	Origin searching low speed	1rpm	U16	1-300	Immediate	csp pp hm	NO
2108h	5Fh	Acceleration/deceleration time during origin searching	1ms	U16	1-10000	Immediate	csp pp hm	NO
2108h	60h	Homing time limit	1ms	U16	1-65535	Immediate	csp pp hm	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	61h	Origin offset (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2108h	63h	Mechanical origin offset (32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO

Group 2109h: Communication setting

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2109h	00h	Communication setting	-	-	-	-	-	-
2109h	01h	Servo axis address number	1	U16	1-247	Immediate	ALL	NO
2109h	02h	Modbus baud rate	1	U16	0-6	Immediate	ALL	NO
2109h	03h	Modbus data format	1	U16	0-3	Immediate	ALL	NO
2109h	04h	Communication timeout	1ms	U16	0-9999	Immediate	ALL	NO
2109h	05h	Communication response delay	1ms	U16	0-9999	Immediate	ALL	NO
2109h	06h	Communication DI enable setting 1	1	U16	0-65535	Restart	ALL	NO
2109h	07h	Communication DI enable setting 2	1	U16	0-65535	Restart	ALL	NO
2109h	08h	Communication DI enable setting 3	1	U16	0-65535	Restart	ALL	NO
2109h	09h	Communication DI enable setting 4	1	U16	0-65535	Restart	ALL	NO
2109h	0Ah	Communication DO enable setting 1	1	U16	0-65535	Restart	ALL	NO
2109h	0Bh	Communication DO enable setting 2	1	U16	0-65535	Restart	ALL	NO
2109h	0Ch	Communication instruction holding time	1	U16	0-60	Immediate	ALL	NO
2109h	0Dh	Enable AO function or CAN communication	1	U16	0-65535	Restart	ALL	NO
2109h	0Eh	Bus communication configuration 1	1	U16	0-65535	Restart	ALL	NO
2109h	0Fh	Bus communication configuration 2	1	U16	0-65535	Restart	ALL	NO
2109h	10h	Bus communication configuration 3	1	U16	0-65535	Restart	ALL	NO
2109h	11h	Bus disconnection detection	1	I16	0-300	Immediate	ALL	NO
2109h	12h	Bus communication configuration 4	1	U16	0-65535	Immediate	ALL	NO
2109h	13h	Bus slave number configuration	1	U16	0-65535	Immediate	ALL	NO

Group 2114h: Key and communication control interface

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2114h	00h	Key and communication control interface	-	-	-	-	-	-
2114h	01h	Key JOG trial	1	U16	0-2000	Restart	ALL	NO
2114h	02h	Fault reset	1	U16	0-9	Restart	ALL	NO
2114h	03h	Communication parameter writing and saving	1	U16	0-65535	Immediate	ALL	NO
2114h	04h	Parameter identification function	1	U16	0-5	Restart	ALL	NO
2114h	06h	Automatic calibration of analog input	1	U16	0-2	Restart	ALL	NO
2114h	07h	System initialization function	1	U16	0-99	Restart	ALL	NO
2114h	09h	Communication operation instruction input	1	U16	0-65535	Immediate	ALL	NO
2114h	0Ah	Communication operation status output	1	U16	0-65535	Display parameter	ALL	NO
2114h	0Ch	Communication selection of multi-segment instruction sequence numbers	1	U16	0-16	Immediate	csp pp hm csv pv	NO
2114h	0Dh	Communication starting homing	1	U16	0-9	Immediate	csp pp hm	NO

Group 2115h: Status parameters

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2115h	00h	Status parameters	-	-	-	-	-	-
2115h	01h	Servo status	1	U16	0-65535	Display parameter	ALL	NO
2115h	02h	Motor speed feedback	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	04h	Speed instruction	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	05h	Internal torque instruction (relative to rated torque)	0.1%	I16	-5000-5000	Display parameter	ALL	NO
2115h	06h	Phase current effective value	0.01A	U16	0-65535	Display parameter	ALL	NO
2115h	07h	DC busbar voltage	0.1V	U16	0-65535	Display parameter	ALL	NO
2115h	08h	Absolute position counter (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	0Ah	Electrical angle	0.1 degree	U16	0-65535	Display parameter	ALL	NO
2115h	0Bh	Mechanical angle (relative to encoder zero point)	0.1 degree	U16	0-65535	Display parameter	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2115h	0Ch	Load inertia identification value	0.01 kg c m²	U16	0-65535	Display parameter	ALL	NO
2115h	0Dh	Speed value relative to input position instruction	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	0Eh	Position deviation counter (32-bit)	1P	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	10h	Input instruction pulse counter (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	12h	Feedback pulse counter (32-bit)	1P	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	14h	Position deviation counter instruction unit (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	16h	Digital input signal monitoring	1	U16	0-511	Display parameter	ALL	NO
2115h	18h	Digital output signal monitoring	1	U16	0-511	Display parameter	ALL	NO
2115h	19h	Encoder status	1	U16	0-65535	Display parameter	ALL	NO
2115h	1Ah	Total power-on time (32-bit)	0.1s	U32	0-2147483647	Display parameter	ALL	NO
2115h	1Ch	AI1 voltage after adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	1Dh	AI2 voltage after adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	1Eh	AI1 voltage before adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	1Fh	AI2 voltage before adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	20h	Module temperature	1°C	U16	0-65535	Display parameter	ALL	NO
2115h	21h	Absolute position encoder turns (32 bit)	1	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	22h	Absolute position encoder turns (H)	1	I16	-1073741824-1073741824	Display parameter	ALL	NO
2115h	23h	Absolute position encoder single-turn position (32 bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	24h	Absolute position encoder single-turn position (H)	1Unit	I16	-1073741824-1073741824	Display parameter	ALL	NO
2115h	25h	Version code 1	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	26h	Version code 2	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	27h	Version code 3	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	28h	Product series code	1	U16	0-65535	Display parameter	ALL	NO
2115h	29h	Fault record display	1	U16	0-9	Immediate	ALL	NO
2115h	2Ah	Fault code	1	U16	0-65535	Display parameter	ALL	NO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2115h	2Bh	Time stamp upon selected fault (32-bit)	0.1s	U32	0-2147483647	Display parameter	ALL	NO
2115h	2Dh	Current rotation speed of the selected fault	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	2Eh	U-phase current of the selected fault	0.01A	U16	0-65535	Display parameter	ALL	NO
2115h	30h	Busbar voltage of the selected fault	0.1V	U16	0-65535	Display parameter	ALL	NO
2115h	31h	Input terminal state of the selected fault	1	U16	0-511	Display parameter	ALL	NO
2115h	32h	Output terminal state of the selected fault	1	U16	0-511	Display parameter	ALL	NO
2115h	33h	Customized software version number	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	34h	Load ratio	1%	U16	0-500	Display parameter	ALL	NO
2115h	35h	Regenerative load ratio	1%	U16	0-500	Display parameter	ALL	NO
2115h	36h	Internal warning code	1	U16	0-65535	Display parameter	ALL	NO
2115h	37h	Current segment number of internal instruction	1	U16	0-99	Display parameter	ALL	NO
2115h	38h	Customized serial code	1	U16	0-65535	Display parameter	ALL	NO
2115h	39h	Absolute position counter high 32 bits (32-bit)	1	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	3Bh	Feedback pulse counter high 32 bits (32-bit)	1	I32	-1073741824-1073741824	Display parameter	ALL	NO

Group 2120h: Virtual DI & DO

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2120h	01h	Virtual DI enable setting 1	1	U16	0-65535	Restart	ALL	YES
2120h	02h	Virtual DI enable setting 2	1	U16	0-65535	Restart	ALL	YES
2120h	03h	Virtual DI enable setting 3	1	U16	0-65535	Restart	ALL	YES
2120h	04h	Virtual DI enable setting 4	1	U16	0-65535	Restart	ALL	YES
2120h	05h	Virtual DO enable setting 1	1	U16	0-65535	Display parameter	ALL	YES
2120h	06h	Virtual DO enable setting 2	1	U16	0-65535	Display parameter	ALL	YES

9.3 6000H Object dictionary list

Index	Sub-index	Type	Name	Data type	Access type	Mapping type	Unit
213Ah		VAR	Number of turns of absolute encoder (32-bit)	DINT	ro	T	Encoder unit
213Bh		VAR	Single turn position of absolute encoder (32-bit)	DINT	ro	T	*1 Turn
213Ch		VAR	Absolute encoder position (lower 32-bit)	DINT	ro	T	Encoder unit
213Dh		VAR	Absolute encoder position (higher 32-bit)	DINT	ro	T	Encoder unit
213Fh		VAR	Internal servo code	UINT	ro	T	
603Fh		VAR	Error code	UINT	ro	T	
6040h		VAR	Controlword	UINT	rw	R	
6041h		VAR	Statusword	UINT	ro	T	
605Ah		VAR	Quick stop mode selection	INT	rw	N	
605Dh		VAR	Pause mode selection	INT	rw	N	
6060h		VAR	Modes of operation	SINT	rw	R	
6061h		VAR	Modes of operation display	SINT	ro	T	
6062h		VAR	Position demand value	DINT	ro	T	User instruction unit
6063h		VAR	Position actual value	DINT	ro	T	Encoder unit
6064h		VAR	Position actual internal value	DINT	ro	T	User instruction unit
6065h		VAR	Following error window	UDINT	rw	R	User instruction unit
6066h		VAR	Position deviation time window	UINT	rw	R	ms
6067h		VAR	Position window	UDINT	rw	R	User instruction unit
6068h		VAR	Position window time	UINT	rw	R	ms
606Bh		VAR	Velocity demand value	DINT	ro	T	Determined by the hundred's digit of P09.13 0: RPM 1: User instruction
606Ch		VAR	Velocity actual value	DINT	ro	T	
606Dh		VAR	Velocity window	UINT	rw	R	
606Eh		VAR	Velocity window time	UINT	rw	R	ms
606Fh		VAR	Velocity threshold	UINT	rw	R	Determined by the hundred's digit of P09.13 0: RPM 1: User instruction
6071h		VAR	Target torque	INT	rw	R	0.1%
6072h		VAR	Max. torque	UINT	rw	R	0.1%
6074h		VAR	Torque demand	INT	ro	T	0.1%
6075h		VAR	Motor rated current	UINT	ro	T	0.001A
6076h		VAR	Motor rated torque	UINT	ro	T	0.001Nm
6077h		VAR	Torque actual value	INT	ro	T	0.1%
6078h		VAR	Actual current value	INT	ro	T	0.1%
6079h		VAR	DC bus voltage	UDINT	ro	T	0.001V
607Ah		VAR	Target position	DINT	rw	R	User instruction
607Ch		VAR	Home offset	DINT	rw	R	User instruction
607Dh	0	ARRAY	Soft-limit: Maximum number of Sub-indexes	UINT	ro	N	
607Dh	1	ARRAY	Soft-limit: Min. position limit	DINT	rw	R	User instruction

Index	Sub-index	Type	Name	Data type	Access type	Mapping type	Unit
607Dh	2	ARRAY	Soft-limit: Max. position limit	DINT	rw	R	User instruction
607Eh		VAR	Polarity	USINT	rw	R	
607Fh		VAR	Max. profile velocity	UDINT	rw	T	Determined by the thousand's digit of P09.13 0: Time unit ms 1: User instruction/s^2
6080h		VAR	Max. motor velocity	UDINT	rw	T	rpm
6081h		VAR	Profile velocity	UDINT	rw	R	Determined by the thousand's digit of P09.13 0: Time unit ms 1: User instruction/s^2
6083h		VAR	Profile acceleration	UDINT	rw	R	
6084h		VAR	Profile deceleration	UDINT	rw	R	
6085h		VAR	Deceleration for quick stop	UDINT	rw	R	
6087h		VAR	Torque slope	UDINT	rw	R	Unit: 1‰ /s
608Fh	0	ARRAY	Position encoder resolution	USINT	ro	N	
608Fh	1	ARRAY	Encoder resolution per motor revolution	UDINT	ro	T	Encoder unit
608Fh	2	ARRAY	Number of motor revolution	UDINT	ro	T	Revolution
6091h	0	ARRAY	Electronic gear ratio: Maximum number of sub-indexes	UINT	ro	R	
6091h	1	ARRAY	Electronic gear ratio: Numerator	UDINT	rw	R	
6091h	2	ARRAY	Electronic gear ratio: Denominator	UDINT	rw	R	
6092h	0	ARRAY	Feed constant: Maximum number of sub-indexes	UINT	ro	R	
6092h	1	ARRAY	Feed constant: Numerator	UDINT	rw	R	
6092h	2	ARRAY	Feed constant: Denominator	UDINT	rw	R	
6093h	0	ARRAY	Position factor: Maximum number of sub-indexes	UINT	ro	N	
6093h	1	ARRAY	Position factor: Numerator	UDINT	rw	R	
6093h	2	ARRAY	Position factor: Feed constant	UDINT	rw	R	
6094h	0	ARRAY	Speed encoder factor: Maximum number of sub-indexes	UINT	ro	N	
6094h	1	ARRAY	Speed encoder factor: Numerator	UDINT	rw	R	
6094h	2	ARRAY	Speed encoder factor: Denominator	UDINT	rw	R	
6095h	0	ARRAY	Speed factor: Maximum number of sub-indexes	UINT	ro	N	
6095h	1	ARRAY	Speed factor 1: Numerator	UDINT	rw	R	
6095h	2	ARRAY	Speed factor 1: Denominator	UDINT	rw	R	
6097h	0	ARRAY	Acceleration factor: Maximum number of Sub-indexes	UINT	ro	N	
6097h	1	ARRAY	Acceleration factor: Numerator	UDINT	rw	R	
6097h	2	ARRAY	Acceleration factor: Denominator	UDINT	rw	R	
6098h		VAR	Homing method	UINT	rw	R	
6099h	0	ARRAY	Homing speed: Maximum number of sub-indexes	UINT	ro	N	

Index	Sub-index	Type	Name	Data type	Access type	Mapping type	Unit
6099h	1	ARRAY	Velocity during search for switch	UDINT	rw	R	Determined by the hundred's digit of P09.13 0: RPM 1: User instruction/s
6099h	2	ARRAY	Velocity during search for zero	UDINT	rw	R	
609Ah		VAR	Homing acceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13 0: Time required for 0–1000RPM (ms) 1: User instruction/s^2
60B0h		VAR	Position offset	DINT	rw	R	User instruction
60B1h		VAR	Velocity offset	DINT	rw	R	Determined by the hundred's digit of P09.13 0:RPM 1: User instruction/s
60B2h		VAR	Torque offset	INT	rw	R	0.1%
60B8h		VAR	Touch probe function	UINT	rw	R	
60B9h		VAR	Probe statusword	UINT	ro	T	
60BAh		VAR	Touch probe pos1 pos value	DINT	ro	T	
60BBh		VAR	Touch probe pos1 neg value	DINT	ro	T	
60BCh		VAR	Probe 2 rising edge position actual value	DINT	ro	T	
60BDh		VAR	Probe 2 falling edge position actual value	DINT	ro	T	
60C0h		VAR	Interpolation sub mode selection	INT	rw	R	
60C1h	0	ARRAY	Interpolation data record: Maximum number of sub-indexes	UINT	ro	N	
60C1h	1	ARRAY	Interpolation offset	UDINT	rw	R	
60C2h	0	ARRAY	Interpolation time period: Maximum number of sub-indexes	UINT	ro	N	
60C2h	1	ARRAY	Interpolation time unit	USINT	rw	R	
60C2h	2	ARRAY	Interpolation time index	SINT	rw	R	
60C5h		VAR	Max. acceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13 0: Time required for 0–1000RPM (ms) 1: User instruction/s^2
60C6h		VAR	Max. deceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13 0: Time required for 0–1000RPM (ms) 1: User instruction/s^2
60E0h		VAR	Positive direction Max. torque limit	UINT	rw	R	0.1%
60E1h		VAR	Positive direction Max. torque limit	UINT	rw	R	0.1%
60F2h		VAR	Positioning option code	UINT	rw	R	
60F4h		VAR	Following error actual value	DINT	ro	T	User instruction

Index	Sub-index	Type	Name	Data type	Access type	Mapping type	Unit
60F8h		VAR	Max. slippage	DINT	rw	R	
60FCh		VAR	Position demand internal value	DINT	ro	T	User instruction
60FDh		VAR	Digital inputs	UDINT	ro	T	
60FEh	0	ARRAY	DO outputs: Maximum number of Sub-indexes	UINT	ro	N	
60FEh	1	ARRAY	DO status	UDINT	rw	R	
60FEh	2	ARRAY	Bit masking	UDINT	rw	R	
60FFh		VAR	Target velocity	UDINT	rw	R	Determined by the hundred's digit of P09.13 0: RPM 1: User instruction /s
6502h		VAR	Supported drive modes	UDINT	ro	T	

6000h Object dictionary description

Object 213A$_h$: Number of turns of absolute encoder (32-bit)			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	213A$_h$	Sub-index	00$_h$
Name	Single turn position for absolute encoder 32bit	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display the actual number of turns for absolute encoder, which is same as P21.32.			

Object 213B$_h$: Single turn position of absolute encoder (32-bit)			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	213B$_h$	Sub-index	00$_h$
Name	Single turn position for absolute encoder 32bit	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display the actual single-turn position for absolute encoder, which is same as P21.34.			

Object 213C$_h$: Absolute encoder position (lower 32bit)			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	213C$_h$	Sub-index	00$_h$
Name	Absolute encoder position (lower 32bit)	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display actual absolute encoder position (lower 32bit).			

Object $213D_h$: Absolute encoder position (higher 32-bit)			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$213D_h$	Sub-index	00_h
Name	Absolute encoder position (higher 32-bit)	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display actual absolute encoder position (higher 32bit).			

Object $213F_h$: Internal servo code			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$213F_h$	Sub-index	00_h
Name	Error code	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0
Display servo drive error code, which is consistent with the number of the panel display error code.			

Object $603F_h$: Error code			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$603F_h$	Sub-index	00_h
Name	Error code	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0
Display CiA protocol error code. Note: This not internal error code. For error code, refer to 213Fh.			

Object 6040h: Controlword			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6040h	Sub-index	00h
Name	Controlword	Access property	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0

Used for enabling and clearing alarms, starting the specified command in different modes.

Bit	Definition	
0	Servo ready	0: Invalid 1: Valid
1	Main circuit connected	0: Invalid 1: Valid
2	Quick stop	1: Invalid 0: Valid
3	Servo operation	0: Invalid 1: Valid
4~6	Relative to modes of operation	
7	Fault reset	Bit7 rising edge is valid When Bit7=1, other instructions become invalid.
8	Pause	0: Invalid 1: Valid
9~15	Reserved	

Note: 1. It is meaningless to assign the value to each bit of Statusword. It must be combined with other bits to form a certain control instruction.

2. Bit0 ~bit3 must be sent to switch the servo process according to CiA402 state machine and correctly import into the expected state.

Object 6041$_h$: Statusword			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6041$_h$	Sub-index	00$_h$
Name	Statusword	Access property	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0

Bit	Definition	
0	Servo ready	0: Invalid 1: Valid
1	Start servo running	0: Invalid 1: Valid
2	Servo operation	0: Invalid 1: Valid
3	Servo fault	0: Invalid 1: Valid
4	Main circuit voltage connected	0: Invalid 1: Valid
5	Quick stop	1: Invalid 0: Valid
6	Servo not running	0: Invalid 1: Valid
7	Alarm	0: Invalid 1: Valid
8	For manufacturer's use	Reserved
9	Remote control	0: Invalid 1: Valid
10	Target arrival (relative to modes operation)	0: Invalid 1: Valid
11	Internal software limit	0: Invalid 1: Valid
12~13	Relative to modes of operation	
14	For manufacturer's use	Reserved
15	Homing completion	0: Invalid 1: Valid In absolute system, when the second digit of P09.14 is set to 2, bit15 will be set to 1 (hold at power-failure) after homing completion. When P20.06=7, clear the bit15 status bit.

The following are the basic statuswords (X represents any value).

Statusword (binary)	Description
XXXX XXXX X0XX 0000	Servo is not ready (Not ready to switch)
XXXX XXXX X1XX 0000	Servo startup failure (Switch on disable)
XXXX XXXX X01X 0001	Servo is ready (Ready to switch on)
XXXX XXXX X01X 0011	Servo is started (Switch on)
XXXX XXXX X01X 0111	Servo operation enable (Operation enable)
XXXX XXXX X00X 0111	Quick stop is active (Quick stop active)
XXXX XXXX X0XX 1111	Fault reaction is active (Fault reaction active)
XXXX XXXX X0XX 1000	Servo fault (Fault)

Note: After Controlword6040h sends commands in sequence, the Statusword6041h displays the current status of the servo.

Object $605A_h$: Quick stop mode selection			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$605A_h$	Sub-index	00_h
Name	Quick stop mode selection	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	NO
Data type	Integer16	Data range	0~7
Modes of operation	ALL	Default	1

When Controlword 6040hbit8 pause function is valid, the pause effect is determined by 605Dh.

Setting value	Stop mode
0	Decelerate to stop as set in P06.26 and remain free.
1	Decelerate to stop according to 6084h deceleration time and remain free.
2	Decelerate to stop according to 6085h deceleration time and remain free.
3	Decelerate to stop according to 6085h deceleration time and remain free.
4	Not defined, cannot be set.
5	Decelerate to stop according to 6084h deceleration time, and keep position locked.
6	Decelerate to stop according to 6085h deceleration time, and keep position locked.
7	Decelerate to stop according to 6085h deceleration time, and keep position locked.

Note: If 605A h is set to 0, the stop mode is related to the setting of P06.26: if P06.26 is set to 0, the emergency stop mode is coast to stop; if P06.26 is set to 1 or 2, the emergency stop will be in accordance with the deceleration of the 6084h to stop, and the stop mode will be kept in the free mode after stopping.

If 605A h is set to any of 1, 2, 3, 5, 6, or 7, the emergency stop in ALL mode is performed as described in the table above.

Object $605D_h$: Pause mode selection			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$605D_h$	Sub-index	00_h
Name	Pause mode selection	Access property	rw
Data structure	Variable	PDO Mapping type	NO
Data type	Integer16	Data range	-32768~32767
Modes of operation	ALL	Default	1

When Controlword 6040hbit8 pause function is valid, the pause effect is determined by 605Dh.

Setting value	Stop mode
0	Not supported, cannot be set.
1	Decelerate to stop according to 6084h deceleration time, and keep position locked.
2	Decelerate to stop according to 6085h deceleration time, and keep position locked.

Note: If 605D h is set to 1 or 2, the pause in ALL mode is performed as described in the table above.

Object 6060_h: Modes of operation			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6060_h	Sub-index	00_h
Name	Modes of operation	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	integer8	Data range	0~10
Modes of operation	ALL	Default	0

Select the modes of operation

Setting value	Definition	
1	Profile position mode (PP)	Refer to section 5.2
2	Velocity mode	Not supported
3	Profile velocity mode (PV)	Refer to section 5.3
4	Profile torque mode (PT)	Refer to section 5.4
6	Homing method (HM)	Refer to section 5.5
8	Cycle sync position mode (CSP)	Refer to section 5.7
9	Cycle sync velocity mode (CSV)	Refer to section 5.8
10	Cycle sync torque mode (CST)	Refer to section 5.9

Object 6061_h: Modes of operation display			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6061_h	Sub-index	00_h
Name	Modes of operation display	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer8	Data range	0~10
Modes of operation	ALL	Default	0

Display the modes of operation display

Value	Definition	
1	Profile position mode (PP)	Refer to section 5.2
2	Velocity mode	Not supported
3	Profile velocity mode (PV)	Refer to section 5.3
4	Profile torque mode (PT)	Refer to section 5.4
6	Homing method (HM)	Refer to section 5.5
8	Cycle sync position mode (CSP)	Refer to section 5.7
9	Cycle sync velocity mode (CSV)	Refer to section 5.8
10	Cycle sync torque mode (CST)	Refer to section 5.9

Object 6062_h: Position demand value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6062_h	Sub-index	00_h
Name	Position demand value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PP/CSP/HM	Default	0

Display position instruction in real time (user unit)

Object 6063_h: Position actual internal value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6063_h	Sub-index	00_h
Name	Position actual internal value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display motor absolute position actual value in real time, same as P21.17 (encoder unit)			

Object 6064_h: Position actual value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6064_h	Sub-index	00_h
Name	Position actual value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display user absolute position actual value in real time, same as P21.07.(instruction unit)			

Object 6065_h: Following error window			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6065_h	Sub-index	00_h
Name	Following error window	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	unsigned32	Data range	0~ 4294967295
Modes of operation	PP/CSP/HM	Default	1000000000
When the difference between position demand value 6062h and position actual value 6064h exceeds ±6065h, the overlarge position deviation Err.043 occurs. Note: The following error window is the smaller of P00.19 and 6065h.			

Object 6066_h: Position deviation time window			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6066_h	Sub-index	00_h
Name	Position deviation time window	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PP/CSP/HM	Default	0
If the Value of 60F4h exceeds the overlarge position deviation threshold (the smaller value of P00.19 and 6065h) and the duration is greater than the 6066h set value, bit 13 of the 6041h status word will be set to 1.			

Object 6067h: Position window			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6067_h	Sub-index	00_h
Name	Position window	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	unsigned32	Data range	0~ 4294967295
Modes of operation	PP/CSP/HM	Default	1000000000

In position mode, when the difference between the position demand value 6062h and the user's position actual value 6064h is within ±6067h, and the time reaches 6068h, then the position reached and bit10 of Statusword 6041h becomes 1.

In position mode, when the servo is enabled, this flag is ON.

Note: The position arrival threshold value is based on the smaller value of P04.47 and 6067, and the position completion output is also related to P04.48.

Object 6068h: Position window time			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6068_h	Sub-index	00_h
Name	Position window time	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PP/CSP/HM	Default	0

In position mode, the holding time refers to the time when the difference between the position demand value 6062h and the user's position actual value 6064h is within ±6067h, the position reaches and the bit10 of Statusword 6041h becomes 1.

In position mode, when the servo is enabled, this flag is ON.

Note: Use this function to set P04.48 to 2. Take the larger value between 6068h and P04.49 positioning completion holding time as a reference.

Object 606Bh: Velocity demand value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$606B_h$	Sub-index	00_h
Name	Velocity demand value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer 32	Data range	-2147483648~2147483647
Modes of operation	PV/CSV	Default	0

Display actual velocity instruction. If converted into velocity unit, it is same as P21.03.

Object 606Ch: Velocity actual value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$606C_h$	Sub-index	00_h
Name	Velocity actual value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer 32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0

Display velocity actual value. If converted into velocity unit, it is same as P21.01.

Object $606D_h$: Velocity window			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$606D_h$	Sub-index	00_h
Name	Velocity window	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PV/CSV	Default	65535

When the difference between the target velocity 60FFh and the user actual speed 606Ch is within ±606Dh, and the time reaches 606Eh, the speed arrives. The bit10 of Statusword 6041h becomes 1 and DO is enabled.
In profile velocity mode and cycle sync velocity mode, this flag is ON when the servo is enabled.

Object $606E_h$: Velocity window time			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$606E_h$	Sub-index	00_h
Name	Velocity window time	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PV/CSV	Default	0

When the difference between the target velocity 60FFh and user actual speed 606Ch is within ±606Dh, and the time reaches 606Eh, then the speed arrives. The bit10 of Statusword 6041h becomes 1 and DO is enabled.
In Profile velocity mode and cycle sync velocity mode, this flag is ON when the servo is enabled.

Object $606F_h$: Velocity threshold			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$606F_h$	Sub-index	00h
Name	Velocity threshold	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PV	Default	65535

When the user velocity feedback 606Ch is within ±606Fh and the time reaches 606Eh setting value, it means that the user speed is 0 and bit12 of 6041h becomes 1.
In profile velocity mode, this flag turns ON. This flag has nothing to do with the enabling of the servo.

Object 6071_h: Target torque			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6071_h	Sub-index	00_h
Name	Target torque	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	integer16	Data range	-5000~5000
Modes of operation	PT/CST	Default	0

Torque setting in PT/CST mode, Unit0.1%.
100.0% corresponds to 1 time of rated motor torque.

Object 6072$_h$: Maximum torque			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6072$_h$	Sub-index	00$_h$
Name	Maximum torque	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	unsigned16	Data range	0~5000
Modes of operation	ALL	Default	5000
Set the maximum torque of the motor. Maximum torque instruction (Unit0.1%) Take the smaller value of 6072h maximum torque and internal torque limit parameter (P03.08, 03.09).			

Object 6074$_h$: Torque demand			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6074$_h$	Sub-index	00$_h$
Name	Torque demand	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer16	Data range	-5000~5000
Modes of operation	ALL	Default	0
Display the internal torque value in real time in the servo operation. Unit is 0.1%. 100.0% corresponds to 1 time of rated motor torque.			

Object 6075$_h$: Motor rated current			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6075$_h$	Sub-index	00$_h$
Name	Motor rated current	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer16	Data range	0~65535
Modes of operation	ALL	Default	-
Display motor rated current in real time. Unit is 000.1A.			

Object 6076$_h$: Motor rated torque			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6076$_h$	Sub-index	00$_h$
Name	Motor rated torque	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer16	Data range	0~65535
Modes of operation	ALL	Default	-
Display motor rated torque in real time. Unit is 000.1Nm.			

Object 6077h: Torque actual value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6077h	Sub-index	00h
Name	Torque actual value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer16	Data range	-5000~5000
Modes of operation	ALL	Default	0
Display the torque feedback inside the servo in real time. 100.0% corresponds to 1 time of rated motor torque. Same as P21.04. Unit is 0.1%.			

Object 6078h: Actual current value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6078h	Sub-index	00h
Name	Actual current value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	integer16	Data range	-32768~32767
Modes of operation	ALL	Default	0
Display the actual current value in real time (Unit: 0.1% of rated value)			

Object 6079h: DC bus voltage value			
Object description		Object entry description	
Property	Value	Property	Value
Index	6079h	Sub-index	00h
Name	DC bus voltage value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Unsigned32	Data range	0~ 4294967295
Modes of operation	ALL	Default	0
Display bus voltage (Unit: 1mv), same as the bus voltage in P21.06.			

Object 607Ah: Target position			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	607Ah	Sub-index	00h
Name	Target position	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PP/CSP	Default	0
Set the target position in profile position mode and cycle sync position mode. In profile position mode, if running the absolute instructions, the user absolute position 6064h = 607Ah after positioning is completed. If running relative instructions, the user's travel distance increment will be equal to 607Ah after positioning is completed.			

Object 607C$_h$: Home offset			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	607C$_h$	Sub-index	00$_h$
Name	Home offset	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	HM	Default	0

1. After the homing is completed, the motor stop position is the mechanical origin. By setting 607Ch, the relationship between mechanical origin and mechanical zero can be set: mechanical origin = mechanical zero + 607C (origin offset). When 607C=0, the mechanical origin coincides with the mechanical zero point.
2. The conditions for effective origin offset: Run at power-on, the homing is completed, bit15 of the statusword 6041h=1.
3. In homing modes, first select the homing method(6098h) from the host controller, then set the homing speed (6099-1h 6099-2h) and homing acceleration speed(609Ah). After the homing trigger signal is given, the servo will automatically find the mechanical origin according to the setting and complete the relative position relationship between the mechanical origin and the mechanical zero.

For example: By means of homing method 35, take the current position as mechanical origin. After the homing is completed, the user's current position 6064h= 607Ch, and the motor shaft will not rotate.

Mechanical origin: A fixed position on the machine, corresponding to the origin switch, limit switch, Z signal of the motor, etc.

Mechanical zero point : Absolute position 0 on the machine

Object 607D$_h$: Soft limit			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	607D$_h$	Sub-index	00$_h$
Name	Number of sub-indexes of soft limit	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2

When the position feedback reaches the internal soft limit, it will stop at the reach limit, the servo reports an overtravel alarm (AL.086 or AL.087), and bit11 of status word 6041h = 1, i.e., the soft limit is in effect. At this time, inputting a reverse motion instruction can exit the servo from the position overrun state and clear bit11 to zero.

In torque mode and speed mode, the soft limit function is constrained by P06.28, when P06.28=1, the soft limit is invalid. Enable the soft limit P06.28=0, P07.08=1 or 2 as follows:

Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	607D$_h$	Sub-index:	01$_h$
Name	Minimum software position limit	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	-2147483648

Software limit function: The fourth digit of P07.08 from the right

0: Disable software limit

1: Enable software limit after power-on

2: Enable software limit after homing is completed

Set the minimum value of the software absolute position limit. When the value is -2147483648, it means the negative direction is not limited.

Minimum software position limit = (607D-01h)

Property	**Value**	**Property**	**Value**
Index	607D$_h$	Sub-index:	02$_h$
Name	Maximum software position limit	Access property	Rw

Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	2147483647

Software limit function: The fourth digit of P07.08 from the right

0: Disable software limit

1: Enable software limit after power-on

2: Enable software limit after homing is completed

Set the maximum value of the software absolute position limit. When the value is 2147483647, it means the positive direction is not limited.

Maximum software position limit = (607D-02h)

Object $607E_h$: Polarity			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$607E_h$	Sub-index	00_h
Name	Polarity	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~1
Modes of operation		Default	0

1 Set the polarity for torque instruction, position instruction and speed instruction. When using, the speed, position and torque polarity should be 0 (Bit5~7 is 0) or set 224(Bit5~7 is 1). After setting 607Eh, this function will become effective after restarting the power supply.

Bit	Definition
0	Reserved
1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	Torque instruction 6071h/60B2h×(-1)
6	Speed instruction 60FFh/60B1h×(-1)
7	Position instruction 607Ah/60B0h×(-1)

Object $607F_h$: Max. profile velocity			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$607F_h$	Sub-index	00_h
Name	Max. profile velocity	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV/PT/CSV/CST	Default	13107200

Maximum speed limit in PP/PV/PT/CSV/CST/HM modes. Unit: instruction unit/S

PP/PV/CSV/HM mode, the maximum speed limit is based on the smaller value of 607Fh and 6080h.

PT/CST mode, the maximum speed limit is based on the smaller Value of 607Fh, 6080h, and internal speed limit (P03.27, P03.28).

Object 6080_h: Max. motor velocity			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6080_h	Sub-index	00_h
Name	Max. motor velocity	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Unsigned32	Data range	0~4294967295

Modes of operation	ALL	Default	6500

Maximum motor speed is set at 6080h to protect the motor and is valid in all modes. Unit: Rpm/min

1. In speed mode, the maximum speed limit is based on the smaller value of 607Fh and 6080h.
2. In torque mode, the maximum speed limit is based on the smaller Value of 607Fh, 6080h and internal speed limit (P03.27, P03.28).
3. In position mode, the maximum speed limit of PP mode is based on the smaller value of 607Fh and 6080h.

In CSP mode, the maximum speed limit is 6080h. The first digit from the right of the servo internal function code P09.17 can be selected to set the 6080h limit or not:

(1) In the CSP mode, if the first digit from the right of P09.17 is set to 0 and 6080h is not used as a speed limit, then Err.78 will be reported when the maximum speed is exceeded.

(2) In the CSP mode, if the first digit from the right of P09.17 is set to 1, the maximum speed of the motor will be set according to the value of 6080h.

Object 6081_h: Profile velocity			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6081_h	Sub-index	00_h
Name	Profile velocity	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP	Default	0

It represents the speed of offset instruction at constant speed in profile position mode. Unit: User instruction Unit/S

The actual operation speed of 6081h is limited by the smaller value between 607F and 6080.

Object 6083_h: Profile acceleration			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6083_h	Sub-index	00_h
Name	Profile acceleration	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV	Default	13107200

The fourth bit from the right of operation panel P09.13 can set the acceleration unit.

When it is 0: The meaning of the profile position mode is the acceleration of the motor from 0rpm to 1000rpm corresponding to the position of the given instruction, the unit is rpm/ms;

When it is 1: User instruction Unit/S^2

Object 6084_h: Profile deceleration			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6084_h	Sub-index	00_h
Name	Profile deceleration	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	131072000

1. The fourth digit from the right of P09.13 on the operation panel can set the acceleration unit: when it is 0, the unit is rpm/ms; when it is 1, the unit is the unit of the user instruction / S^2.
2. ALL mode operation, for quick stop: set 605A = 1 or 5; for emergency stop: decelerate to stop according to 6084h.
3. ALL mode operation, for pause: set 605D=1 and decelerate to stop according to 6084h.
4. ALL mode operation, for OFF stop: set P06.26=1 or 2, and decelerate to stop according to 6084h.
5. ALL mode operation, for NO2 fault: set P06.27=1, and decelerate to stop according to 6084h.

Object 6085h: Quick stop deceleration speed			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6085_h	Sub-index	00_h
Name	Quick stop deceleration speed	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	4294967295

1. The fourth position from the right of operation panel P09.13 can reduce the speed unit: when it is 0: the unit is rpm/ms; when it is 1: the unit is user's instruction/S^2.
2. ALL mode operation, for quick stop: set 605A=2,3,6,7 (any one of them); for emergency stop, decelerate to stop according to 6085h.
3. ALL mode operation, for pause: set 605D=2 and decelerate to stop according to 6085h.
4. ALL mode operation, for over-travel stop: decelerate and stop according to 6085h.

Object 6087h: Torque slope			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6087_h	Sub-index	00_h
Name	Torque slope	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PT/CST	Default	1000

The torque instruction acceleration in profile torque mode: Torque instruction increment per second (Unit: 1‰ /s)

Object 608Fh: Position encoder resolution			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$608F_h$	Sub-index	00_h
Name	Position encoder resolution	Access property	Ro
Data structure	/	PDO MAPPING TYPE	NO
Data type	Unsigned8	Data range	0~2
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	$608F_h$	Sub-index	01_h
Name	Motor encoder resolution	Access property	Rw
Data structure	/	PDO MAPPING TYPE	NO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	131072
Property	**Value**	**Property**	**Value**
Index	$608F_h$	Sub-index	02_h
Name	Motor resolution corresponding to the number of motor revolution	Access property	Rw
Data structure	/	PDO MAPPING TYPE	NO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1

The electronic gear ratio is formed by 6091h and 6092h. For specific relationship, refer to 6091h electronic gear ratio.

Object 6091h: Electronic gear ratio			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6091h	Sub-index	00h
Name	Number of electronic gear ratio index	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	6091h	Sub-index	01h
Name	Electronic gear ratio: Numerator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Property	**Value**	**Property**	**Value**
Index	6091h	Sub-index	02h
Name	Electronic gear ratio: Denominator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1

The X5E servo drive provides 2 sets of electronic gear ratio schemes, one is the default parameter inside the X5E servo, and the other is to enable the 608Fh/ 6091h/6092h schemes, which are switched via the second digit from the right of P09.13.

608Fh/6091h/6092h is not enabled when the 2nd digit from the right of P09.13 is set to 0 . In this case, P00.08 and P00.10/P00.12 are effective; 608Fh/ 6091h/6092h is enabled when the 2nd digit from the right of P09.13 is set to 1. In this case, P00.08 and P00.10/P00.12 are not effective.

$$\begin{array}{c}\text{608F*6091/6092}\\ \text{(Electronic gear ratio)}\end{array} = \frac{\dfrac{\text{608Fh\_01 (Motor encoder resolution)}}{\text{608Fh\_02(Encoder resolution corresponds to the number of motor revolution)}} * \dfrac{\text{6091h\_01(Number of motor revolution)}}{\text{6091h\_02(Number of drive axis revolution)}}}{\dfrac{\text{6092h\_01(Host device setting value)}}{\text{6092h\_02(Number of drive axis revolution)}}}$$

- For example: The upper instruction should be set to be one revolution per 10000 drive shafts: 6091h (1: 1) 6092h (10000: 1)
- Internal speed=60FFh*6091h Numerator*6092h Denominator *60 /6091h Denominator /6092h Numerator. Speed feedback coincides with instruction. The third digit of P09.13 from the right determines the speed unit. 0: RPM, 1: User instruction/s, the speed Unit is determined by 6091h and 6092h.
- Allowable range for gear ratio setting: Encoder resolution/10000000 ≤ Gear ratio ≤ Encoder resolution/2.5
- The final electronic gear ratio can be confirmed as follows: P21.70 is set to 3, P21.71 and P21.72 can respectively display the lower 16-bit and higher 16- bit of numerator of the final electronic gear ratio; P21.73 and P21.74 can respectively display the lower 16-bit and higher 16-bit of denominator of the final electronic gear ratio.

Object 6092$_h$: Feed constant			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6092$_h$	Sub-index	00$_h$
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	6092$_h$	Sub-index	01$_h$
Name	Feed constant: Numerator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	131072(17bit 编码器)
Property	**Value**	**Property**	**Value**
Index	6092$_h$	Sub-index	02$_h$
Name	Feed constant: Denominator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
The electronic gear ratio is formed by 608Fh and 6091h. For specific relationship, refer to 6091h electronic gear ratio.			

Object 6093$_h$: Position factor			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6093$_h$	Sub-index	00$_h$
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	6093$_h$	Sub-index	01$_h$
Name	Position factor: Numerator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Property	**Value**	**Property**	**Value**
Index	6092$_h$	Sub-index	02$_h$
Name	Position factor: Denominator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	默认值	1
Reserved			

Object 6094_h: Speed encoder factor			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6094_h	Sub-index	00_h
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	6094_h	Sub-index	01_h
Name	Speed encoder factor: Numerator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Property	**Value**	**Property**	**Value**
Index	6094_h	Sub-index	02_h
Name	Speed encoder factor: Denominator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6095_h: Speed factor			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6095_h	Sub-index	00_h
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	6095_h	Sub-index	01_h
Name	Speed factor: Numerator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Property	**Value**	**Property**	**Value**
Index	6095_h	Sub-index	02_h
Name	Speed factor: Denominator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6097_h: Acceleration speed factor			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6095_h	Sub-index	00_h
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	6095_h	Sub-index	01_h
Name	Acceleration speed factor: Numerator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Property	**Value**	**Property**	**Value**
Index	6092_h	Sub-index	02_h
Name	Acceleration speed factor: Denominator	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6098_h: Homing method			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6098_h	Sub-index	00_h
Name	Homing method	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer8	Data range	0~35
Modes of operation	HM	Default	0
All 31 kinds of homing methods are specified based on homing switch signal, limit switch signal, and encoder Z-phase signal. For details, refer to section 5.4 Homing method.			

Object 6099h: Homing speed			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6099_h	Sub-index	00_h
Name	Number of sub-indexes	Access property	RO
Data structure	/	PDO MAPPING TYPE	NO
Data type	Unsigned8	Data range	0~512
Modes of operation	HM	Default	2
Property	**Value**	**Property**	**Value**
Index	6099_h	Sub-index	01_h
Name	Velocity during search for switch	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	HM	Default	218453
Property	**Value**	**Property**	**Value**
Index	6099_h	Sub-index	02_h
Name	Velocity during search for zero	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	HM	Default	21845
Set the speed unit type at the third digit from the right of P09.13. When it is set to 1, the speed unit is user instruction /S; When it is set to 0, it is rpm. Two kinds of speed in homing method: Speed 60990120h can be set as the higher value, which is used to make quick prediction; Speed 60990220h can be set as the lower speed, which is used for accurate positioning.			

Object 609Ah: Homing acceleration			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$609A_h$	Sub-index	00_h
Name	Homing acceleration	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	unsigned32	Data range	0~4294967295
Modes of operation	HM	Default	1310720
The fourth digit from the right of P09.13 can set the type of acceleration unit, when it is set to 1, the speed unit is user instruction /S^2; When it is set to 0, it is rpm. For example: When P09.13=16#X0XX, it means the acceleration time that the motor accelerates from 0rpm to 1000rpm. Unit: ms			

Object 60B0h: Position offset			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$60B0_h$	Sub-index	00_h
Name	Position offset	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	CSP	Default	0
Set the position offset in cycle sync position mode, Target position=607Ah+60B0h			

Object 60B1h: Speed offset			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60B1h	Sub-index	00h
Name	Speed offset	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	CSV	Default	0
Set the speed offset in cycle sync velocity mode. Target velocity=60FFh+60B1h.			

Object 60B2h: Torque offset			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60B2h	Sub-index	00h
Name	Torque offset	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer16	Data range	-32768~32767
Modes of operation	CSP/CSV/CST	Default	0
Set the torque offset in cycle sync torque mode. Target torque=6071h+60B2h			

Object 60B8h: Touch probe function			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60B8h	Sub-index	00h
Name	Touch probe function	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	/	Default	0

Select the types of touch probe function at the highest bit of P09.14(the fourth digit from the right side), corresponding to 60B9h Touch probe function Statusword.

Some DI signals and Z-phase signals are too narrow, it cannot make sure that all the rising edge and falling edge signals can be captured. Therefore, please pay attention to the following when using:

1.Try to avoid using both rising and falling edges for the same probe

2.When using Z-signal, only the rising edge can be used, not the falling edge.

Bit	Description	
	P09.14==16#0000	**P09.14==16#1000**
0	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1
1	Probe 1 trigger mode 0: Single trigger 1: Continuous trigger	Probe 1 trigger mode 0: Single trigger 1: Continuous trigger
2	Probe 1 trigger signal selection 0: DI8 trigger 1: Z-signal trigger	Probe 1 trigger signal selection 0: DI8 trigger 1: Z-signal trigger
3	Reserved	Reserved
4	Probe 1 rising edge latch 0: Disable probe 1 rising edge latch 1: Enable probe 1 rising edge latch	Probe 1 rising edge latch 0: Disable probe 1 rising edge latch 1: Enable probe 1 rising edge latch

5	Probe 1 falling edge latch 0: Disable probe 1 falling edge latch 1: Enable probe 1 falling edge latch	Probe 1 falling edge latch 0: Disable probe 1 falling edge latch 1: Enable probe 1 falling edge latch
6~7	Reserved	Reserved
8	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2
9	Probe 2 trigger mode 0: Single trigger 1: Continuous trigger	Probe 2 trigger mode 0: Single trigger 1: Continuous trigger
10	Probe 2 trigger signal selection 0: DI9 trigger 1: Z-signal trigger	Probe 2 trigger signal selection 0: DI9 trigger 1: Z-signal trigger
11	Reserved	Reserved
12	Probe 2 rising edge latch 0: Disable probe 2 rising edge latch 1: Enable probe 2 rising edge latch	Probe 2 rising edge latch 0: Disable probe 2 rising edge latch 1: Enable probe 2 rising edge latch
13	Probe 2 falling edge latch 0: Disable probe 2 falling edge latch 1: Enable probe 2 falling edge latch	Probe 2 falling edge latch 0: Disable probe 2 falling edge latch 1: Enable probe 2 falling edge latch
14~15	Reserved	Reserved

Object 60B9$_h$: Probe Statusword			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60B9$_h$	Sub-index	00$_h$
Name	Probe Statusword	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	/	Default	0

Select the types of touch probe Statusword at the highest bit of P09.14(the fourth digit from the right side), corresponding to 60B8h touch probe function.

Bit	Description	
	P09.14==16#0000	P09.14==16#1000
0	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1
1	Probe 1 rising edge latch 0: Not execute probe 1 rising edge latch 1: Execute probe 1 rising edge latch	Probe 1 rising edge latch 0: Not execute probe 1 rising edge latch 1: Execute probe 1 rising edge latch
2	Probe 1 falling edge latch 0: Not execute probe 1 falling edge latch 1: Execute probe 1 falling edge latch	Probe 1 falling edge latch 0: Not execute probe 1 falling edge latch 1: Execute probe 1 falling edge latch
3~5	Reserved	Reserved
6	Probe 1 trigger signal selection 0: DI8 trigger 1: Z-signal trigger	Reserved

7	Probe 1 trigger DI level selection 0: DI8 low level trigger 1: DI8 high level trigger	Reserved
8	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2
9	Probe 2 rising edge latch 0: Not execute probe 2 rising edge latch 1: Execute probe 2 rising edge latch	Probe 2 rising edge latch 0: Not execute probe 2 rising edge latch 1: Execute probe 2 rising edge latch
10	Probe 2 falling edge latch 0: Not execute probe 2 falling edge latch 1: Execute probe 2 falling edge latch	Probe 2 falling edge latch 0: Not execute probe 2 falling edge latch 1: Execute probe 2 falling edge latch
11~13	Reserved	Reserved
14	Probe 2 trigger signal selection 0: DI9 trigger 1: Z-signal trigger	Reserved
15	Probe 2 trigger DI level selection 0: DI9 low level trigger 1: DI9 high level trigger	Reserved

Object 60BA$_h$: Touch probe pos1 pos value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60BA$_h$	Sub-index	00$_h$
Name	Touch probe pos1 pos value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position instruction when the probe 1 rising edge is valid (instruction unit, 6062h)			

Object 60BB$_h$: Touch probe pos1 neg value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60BB$_h$	Sub-index	00$_h$
Name	Touch probe pos1 neg value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position instruction when the probe 2 falling edge is valid (instruction unit, 6062h)			

Object 60BC$_h$: Touch probe pos2 pos value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60BC$_h$	Sub-index	00$_h$
Name	Touch probe pos2 pos value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position instruction when the probe 2 rising edge is valid (instruction unit, 6062h)			

Object 60BD$_h$: Touch probe 2 falling edge position actual value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60BD$_h$	Sub-index	00$_h$
Name	Touch probe 2 falling edge position actual value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position instruction when the probe 2 falling edge is valid (instruction unit, 6062h)			

Object 60C0$_h$: Interpolation sub-mode selection			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60C0$_h$	Sub-index	00$_h$
Name	Interpolation sub-mode selection	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer16	Data range	-32768~32767
Modes of operation	IP	Default	0
Interpolation curve selection in position interpolation mode			

Value	Interpolation mode
-32768~-1	For manufacturer use
0	Linear interpolation
1~32767	Reserved

Object 60C1$_h$: Interpolation data record			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Name	60C1h	Sub-index	00h
Data structure	Number of sub-indexes	Access property	Rw
Data type	/	PDO MAPPING TYPE	RPDO
Modes of operation	Unsigned8	Data range	0~512
	IP	Default	1
Property			
Property	**Value**	**Property**	**Value**
Index	60C1$_h$	Sub-index	01$_h$
Name	Interpolation offset	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	IP	Default	0
For the position instruction in interpolation position mode, the interpolation offset is absolute offset instruction. Each time the sync cycle comes, the host device sends offset instruction to the slave. Unit: p/s			

Object $60C2_h$: Interpolation cycle			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6099_h	Sub-index	00_h
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	IP	Default	2
Property	**Value**	**Property**	**Value**
Index	$60C2_h$	Sub-index	01_h
Name	Interpolation time unit	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	IP	Default	1
Set the interpolation cycle in interpolation position mode.(unit: ms) 60C20108h is the time constant of interpolation cycle. (ms)			
Property	**Value**	**Property**	**Value**
Index	$60C2_h$	Sub-index	02_h
Name	Interpolation time index	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Integer8	Data range	-255~255
Modes of operation	IP	Default	-3
60C20208h is the unit of interpolation cycle time. -3 represents ms of time unit.			

Object $60C5_h$: Max. Acceleration			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$60C5_h$	Sub-index	00_h
Name	Max. acceleration	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV/HM	Default	1000000000
The fourth bit from the right of P09.13 can set the unit of acceleration. When it is 0: It represents the acceleration speed of offset instruction acceleration in profile position/profile velocity mode. Set the max. acceleration speed in profile position mode, profile velocity mode and homing mode, which is limited by 6083h. It means the max. acceleration speed that the motor accelerates from 0rpm to 1000rpm. Unit: rpm/ms. When it is 1: User instruction unit/S^2 .			

Object 60C6h: Max. deceleration			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60C6h	Sub-index	00h
Name	Max. deceleration	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV/HM	Default	1000000000

The fourth bit from the right of P09.13 can set the unit of acceleration.

When it is 0: It represents the deceleration speed of offset instruction acceleration in the profile position/profile velocity mode. Set the max. deceleration speed in profile position mode, profile velocity mode, and homing mode, which is limited by 6084h.

It means the max. deceleration speed that the motor accelerates from 0rpm to 1000rpm. Unit: rpm/ms.

When it is 1: User instruction unit/S^2

Object 60E0h: Positive direction Max. torque limit			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60E0h	Sub-index	00h
Name	Positive direction Max. torque limit	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	ALL	Default	10000

Limit the max. torque in positive direction. Unit: 0.1%

Object 60E1h: Negative direction Max. torque limit			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60E1h	Sub-index	00h
Name	Negative direction Max. torque limit	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	ALL	Default	10000

Limit the max. torque in negative direction. Unit: 0.1%

Object 60F2h: Positioning option code			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60F2h	Sub-index	00h
Name	Positioning option code	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PP/IP	Default	0

Reserved

Object $60F4_h$: Following error actual value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$60F4_h$	Sub-index	00_h
Name	Following error actual value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PP/HM/CSP	Default	0
Display the actual position deviation (user position unit)			

Object $60F8_h$: Max. slippage			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$60F8_h$	Sub-index	00_h
Name	Max. slippage	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PV	Default	1000000000
Monitor whether the maximum slippage is reached, used for asynchronous motors.			

Object $60FC_h$: Position demand internal value			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$60FC_h$	Sub-index	00_h
Name	Position demand internal value	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Integer32	Data range	0~4294967295
Modes of operation	PP/HM/CSP	Default	0
Display the real-time position instruction of the motor. Position demand value (6062h)× Position factor (6093h) = Position instruction of motor 60FCh (encoder unit)			

Objet 60FD$_h$: Digital inputs			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60FD$_h$	Sub-index	00h
Name	Digital inputs	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	196608 (0 0000 0011 0000 0000 0000 0011)

Display DI input status, the default is 0 when no level is input.

Bit	Definition
0	Negative limit switch (DI function code 15)
1	Positive limit switch (DI function code 14)
2	Origin switch (DI function code 28)
3~9	Reserved
10	Z-pulse (No need to set)
11	External DI input 1: Touch probe function1 (DI function code 39)
12	External DI input 2: Touch probe function2 (DI function code 40)
13	Emergency stop (DI function code 30)
16	Corresponding to DI1 (P4.01) terminal logic and function selection.
17	Corresponding to DI2 (P4.02) terminal logic and function selection.
18	Corresponding to DI3 (P4.03) terminal logic and function selection.
19	Corresponding to DI4 (P4.04) terminal logic and function selection.
20	Corresponding to DI5 (P4.05) terminal logic and function selection.
21~31	Reserved

The logic level of DI terminal can be modified via P04.11~P04.19, DI1 and DI2 are positive and negative limit switches from the factory, and the default high level is valid.

Object 60FE$_h$: Forced DO output			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	60FE$_h$	Sub-index	00$_h$
Name	Number of sub-indexes	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Property	**Value**	**Property**	**Value**
Index	60FE$_h$	Sub-index	01$_h$
Name	Forced DO output status	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	0

Property	**Value**	**Property**	**Value**
Index	60FE$_h$	Sub-index	02$_h$
Name	Bit shielding	Access property	Rw
Data structure	/	PDO MAPPING TYPE	RPDO

Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	0

This function can force the output of DO, X5E EtherCAT servo supports DO1~DO3.

Bit	Definition
0	Reserved
1~15	Reserved
16~18	DO1~DO3 output

Usage: For example, forced DO1~DO3 output function

First, turn on the forced DO1~DO3 function: i.e. set 60FEh-02h=458752 (111 0000 0000 0000 0000)

Then, forced output DO1~DO3 is valid: i.e. set 60FEh-01h=458752 (111 0000 0000 0000 0000)

Object $60FF_h$: Target velocity			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	$60FF_h$	Sub-index	00_h
Name	Target velocity	Access property	rw
Data structure	Variable	PDO MAPPING TYPE	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PV/CSV	Default	0

Set instruction speed instruction in profile velocity/sync cycle speed mode.

Object 6502_h: Supported servo operation mode			
Object description		**Object entry description**	
Property	**Value**	**Property**	**Value**
Index	6502_h	Sub-index	00_h
Name	Supported servo operation mode	Access property	ro
Data structure	Variable	PDO MAPPING TYPE	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	1005

Display the supported servo operation mode

Bit	Definition	
0	Profile position mode (PP)	Supported, refer to section 5.2 (EtherCAT)
1	Velocity mode	Not supported
2	Profile velocity mode (PV)	Supported, refer to section 5.3 (EtherCAT)
3	Profile torque mode (PT)	Supported, refer to section 5.4 (EtherCAT)
4	Reserved	
5	Homing method (HM)	Supported, refer to section 5.5 (EtherCAT)
6	Reserved	
7	Cycle sync position mode (CSP)	Supported, refer to section 5.7 (EtherCAT)
8	Cycle sync velocity mode (CSV)	Supported, refer to section 5.8 (EtherCAT)
9	Cycle sync torque mode (CST)	Supported, refer to section 5.9 (EtherCAT)
10~31	Reserved	

Innovation Integrity Service

HCFA

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