M3-N Series Servo System

User Manual

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Shenzhen Megmeet Electrical Co., Ltd. provides professional technical support for our customers. You can contact the local branch office or customer service center, or directly contact the company headquarters.

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Foreword

Thank you for choosing the M3-N series servo system manufactured by Shenzhen Megmeet Electrical Co., Ltd.

The M3-N servo system adopts a brand-new hardware design platform and cutting-edge control algorithms, featuring excellent performance, comprehensive functionality, compact structure, easy installation, simple commissioning, and convenient maintenance. It is a cost-effective product designed for general-purpose servo drives and the OEM market. This series supports the EtherCAT protocol, enabling multiple servo systems to operate in a same network with a host controller. It also provides stiffness level setting, inertia auto-tuning, and vibration suppression for easy control. The servo system is applicable to quick and accurate position control, speed control, and torque control of automatic equipment in such industries as machine tools, robotics, semiconductor manufacturing, glass production, lithium battery equipment, woodworking machinery, textile machinery, packaging machinery, and painting machinery.

The M3-N servo system runs stably with medium inertia servo motors by virtue of a high mechanical time constant. The servo series supports absolute encoders.

Relevant instructions during installation, wiring, parameter setting, troubleshooting and daily maintenance will be detailed in this manual. To ensure the correct installation and operation of the M3-N series servo system as well as give full play to its performance, read this user manual carefully before installation. This manual shall be kept properly and delivered to the actual users of the servo drive.

Unboxing inspection

When you unbox the product, remember to check the following:

- whether there is any damage on the servo drive and servo motor;
- whether the servo motor's shaft rotates smoothly (excluding motors with brakes);
- whether the rated values on the nameplates of the servo drive and servo motor are the same as what you ordered;
- whether there is any damage on the cables which may affect connection and use.

Our company has implemented strict inspection on the product's manufacturing and packaging. If there is still any error, please contact us or the local distributor.

We are engaged in the continuous improvement of drives. The relevant manuals provided by us are subject to change without notice.

Safety precautions

Indicates that failure to comply with the notice can result in death or severe personal injuries.

Indicates that failure to comply with the notice may result in moderate or minor personal injuries or equipment damage.

- Install the product on incombustible materials such as metal. Failure to comply will result in a fire.
- Do not install the product near combustible objects. Failure to comply will result in a fire.
- Do not install the product in places with explosive gases.
- The wiring work must be done by professional personnel. Otherwise, there will be an electric shock.
- Before wiring, check that the input power supply is cut off. Otherwise, there will be an electric shock.
- Properly connect the grounding terminal of the servo drive. Otherwise, there will be an electric shock.
- Properly close the cover before power-on. Otherwise, electric shock or explosion may occur.
- When powering on a servo drive that has been stored for 2 years, use a voltage regulator to increase voltage gradually. Otherwise, electric shock or explosion may occur.
- To avoid electric shock, do not touch terminals when the drive is powered on.
- To avoid electric shock, do not operate the drive with wet hands.
- Before conducting maintenance, ensure that the power is cut off for 10 minutes, and check that the charging indicator is completely off or the voltage of bus negative/positive is below 36 V. Failure to comply will result in an electric shock.
- Only professional personnel are qualified to replace the components. Do not leave any wire or metal parts inside the drive. Failure to comply will result in a fire.
- The bare parts of the terminal lugs in the main circuit must be wrapped with insulation tape. Otherwise, electric shock may occur.

- Install the servo drive on the place that can bear the weight. Failure to comply will result in personal injuries or equipment damage.
- Do not install the servo drive near water pipes or other places with water splash. Otherwise, there will be equipment damage.
- Take care not to drop screws, gaskets, metal bars and the like into the servo drive. Otherwise, fire and

equipment damage may occur.

- If the servo drive is damaged or lack of components, do not run the servo drive. Failure to comply will result in a fire or personal injuries.
- Do not install the servo drive in the place exposed to direct sunlight. Otherwise, there will be equipment damage.
- Cable lugs must be firmly connected to main circuit terminals. Otherwise, there will be equipment damage.
- When removing the servo motor, do not pull the motor only by the cables or hold only the rotating shaft, as this may lead to personal injuries or equipment damage if the motor falls.
- Avoid directly impacting the shaft core, such as by striking or hammering it. Such actions may damage the shaft core and the encoder attached to its opposite side, leading to equipment damage.
- Do not store the servo motor in environments with vibration levels exceeding the specified limits, as this may cause equipment damage.

Contents

Chapter 1 M3-N Servo System Selection

1.1 Servo motor model and servo drive model

1.1.1 Servo motor model

SPM - S C 8 06 04 M A K - ST4 - X
① ②③④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① Product series SPM series	⑤ Motor frame 06: 60 08: 80	⑧ With/Without brake A: Without brake B: With brake
② Voltage dass S: 220 V	⑥ Power Below 100 W: one number and one letter A: Power = Number*10 Example: 5A = 5 * 10 = 50 W 100 to 9.9 kW: two numbers Power = Number * 100 Example: 02 = 2 * 100 = 200 W	⑨ Definition M: With keyway without oil seal O: Round shaft with oil seal K: With keyway and oil seal D: D-type shaft with oil seal
③ Rated speed C: 3000 rpm		⑩ Motor type ST4: Straight plug economical type
④ Encoder type 8: 17-bit multi-turn absolute magnetic	⑦ Inertia M: Medium inertia	⑪ Motor design number

Fig. 1-1 Servo motor model

1.1.2 Servo motor nameplate

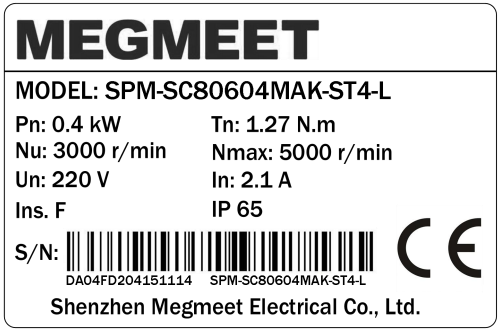


Fig. 1-2 Servo motor nameplate

1.1.3 Servo drive model

M3 - N S 5R5 A - XX
① ②③ ④ ⑤ ⑥

① Product series M3 series servo	③ Voltage class S: 220 V	⑤ Structural features A: Standard version
② Drive type P: Pulse type N: EtherCAT	④ Rated current 2R8: 2.8 A 5R5: 5.5 A 7R6: 7.6 A	⑥ Software features Null: Standard version

Fig. 1-3 Servo drive model

1.1.4 Servo drive nameplate

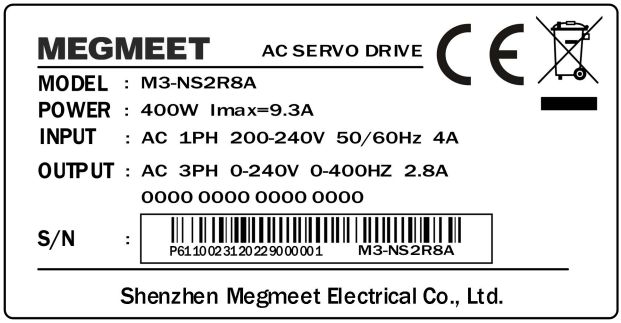


Fig. 1-4 Servo drive nameplate

1.1.5 Servo drive components

1.1.5.1 SIZE A drive (Rated power: 0.4 kW)

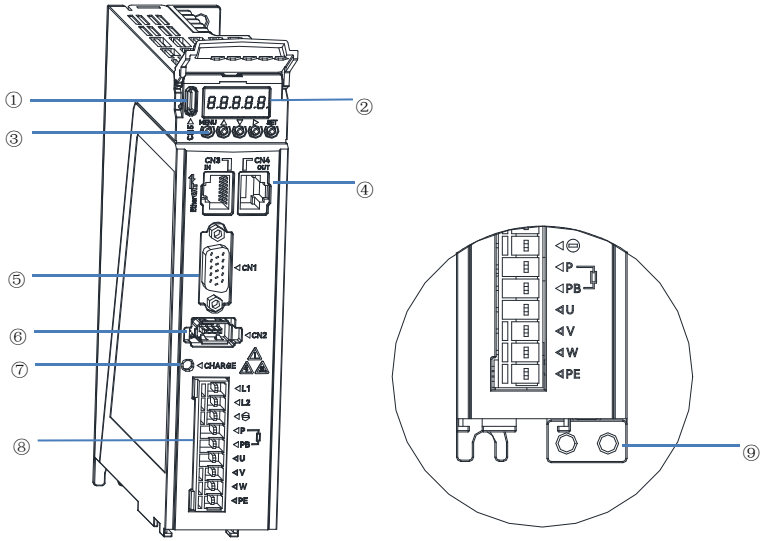


Fig. 1-5 Components of M3-N servo drive (M3-NS2R8A)

Table 1-1 Component description of M3-N servo drive (M3-NS2R8A)

No.	Name	Description
①	CN5 Type-C USB communication port	Connected to a computer's USB port for parameter setting and performance debugging.
②	LED digital tube	5-digit 8-segment digital tube used for status monitoring, parameter display and parameter setting.
③	Operation keys	5 keys for parameter adjustment and display status switching, etc.
④	CN3, CN4 Communication interface	Two RJ45 ports used for EtherCAT communication.
⑤	CN1 Control IO interface	DB15 female connector, control IO interface, connected to external IO and a host controller.
⑥	CN2 Encoder interface	1394 female connector connected to a motor encoder.
⑦	CHARGE Bus power indicator	Used to indicate the state of the bus power. The indicator being on indicates that the bus capacitor is charged. Even if the main power supply has been disconnected, do not touch the power terminals to avoid electric shock.

No.	Name		Description
⑧	Main circuit terminals	L1, L2 Main power supply input	Main power supply input, single-phase 220 V.
		⊖, P DC bus terminals	DC bus terminals for common bus connection
		P, PB Braking resistor wiring terminals	Braking resistor wiring terminals. Using an external braking resistor, connect it between P and PB.
		U, V, W Servo motor power terminals	Servo motor UVW power terminals
		PE	Motor grounding terminal
⑨	⏚ Grounding terminal		Power grounding terminal

1.1.5.2 SIZE B drive (Rated power: 0.75 kW to 1 kW)

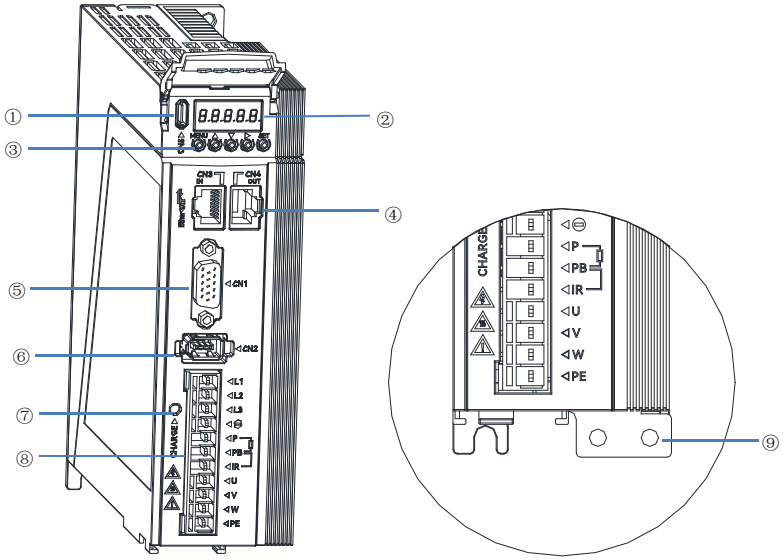


Fig. 1-6 Components of M3-N servo drive (M3-NS5R5A, M3-NS7R6A)

Table 1-2 Component description of M3-N servo drive (M3-NS5R5A, M3-NS7R6A)

No.	Name		Description
①	CN5 Type-C USB communication port		Connected to a computer's USB port for parameter setting and performance debugging.
②	LED digital tube		5-digit 8-segment digital tube used for status monitoring, parameter display and parameter setting.
③	Operation keys		5 keys for parameter adjustment and display status switching, etc.
④	CN3, CN4 Communication interface		Two RJ45 ports used for EtherCAT communication.
⑤	CN1 Control IO interface		DB15 female connector, control IO interface, connected to external IO and a host controller.
⑥	CN2 Encoder interface		1394 female connector connected to a motor encoder.
⑦	CHARGE Bus power indicator		Used to indicate the state of the bus power. The indicator being on indicates that the bus capacitor is charged. Even if the main power supply has been disconnected, do not touch the power terminals to avoid electric shock.
⑧	Main circuit terminals	L1, L2, L3 Main power supply input	Main power supply input, single/three-phase 220 V.
		⊖, P DC bus terminals	DC bus terminals for common bus connection
		P, PB, IR Braking resistor wiring terminals	Braking resistor wiring terminals. Using a built-in braking resistor, short PB and IR; Using an external braking resistor, connect it between P and PB.
		U, V, W Servo motor power terminals	Servo motor UVW power terminals
		PE	Motor grounding terminal
⑨	⏚ Grounding terminal		Power grounding terminal

1.2 Servo system configuration

Table 1-3 220 V servo system configuration

Rated speed (rpm)	Max. speed (rpm)	Power (W)	Motor model	Drive model
Straight plug economical motors 60/80 frames Medium inertia Vn = 3000 rpm Vmax = 6000/5000 rpm				
3000	6000	200	SPM-SC*0602M*K-ST4-L	M3-NS2R8A
3000	5000	400	SPM-SC*0604M*K-ST4-L	M3-NS2R8A
3000	5000	750	SPM-SC*0807M*K-ST4-L	M3-NS5R5A
3000	5000	1000	SPM-SC*0810M*K-ST4-L	M3-NS7R6A

1.3 Servo cable model

The naming rules of servo power cables and encoder cables are shown in the following figures.

SPL - MA05 - M5 - XX - X
① ② ③ ④ ⑤

① Product series
SPL: SPL series

② Cable type
MA05:
L series straight plug motor power cable, compatible with 60/80 frames, cross sectional area 0.75mm²

③ Applicable drive
M5: M5 series and M3 series

④ Cable length
03: 3 m
05: 5 m
.....

⑤ Flexible cable or not
Null: Normal cable
R2: 10 million times flexible cable

Fig. 1-7 Power cable model

SPL - E03 - M5 - XX - X
① ②③④ ⑤ ⑥ ⑦

① Product series
SPL: SPL series

② Cable type
E: Encoder cable

③ Encoder type
0: Absolute encoder

④ Plug type
3: Straight plug (with battery case)
4: Straight plug (without battery case)

⑤ Applicable drive
M5:
M5 series and M3 series

⑥ Cable length
03: 3 m
05: 5 m

⑦ Flexible cable or not
Null: Normal cable
R2:
10 million times flexible cable

Fig. 1-8 Encoder cable model

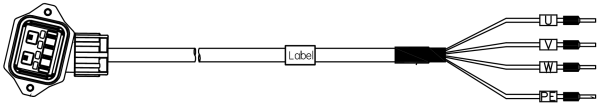
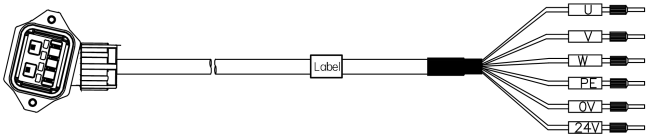
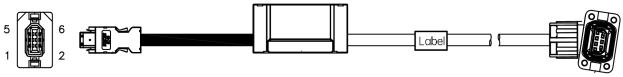
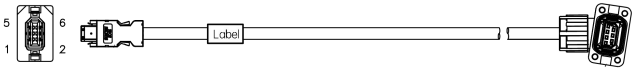
The cable configuration for servo motors is shown in the following table.

Table 1-4 Cable configuration for servo motors

Motor model	Power cable (without brake)	Power cable (with brake)	Encoder cable (with battery case)	Encoder cable (without battery case)
Straight plug economical motors 60&80 frames Medium inertia Vn = 3000 rpm Vmax = 6000/5000 rpm				
SPM-SC*0602M*K-ST4-L	SPL-MA05-M5-XX	SPL-BMA05-M5-XX	SPL-E03-M5-XX	SPL-E04-M5-XX
SPM-SC*0604M*K-ST4-L	SPL-MA05-M5-XX	SPL-BMA05-M5-XX	SPL-E03-M5-XX	SPL-E04-M5-XX
SPM-SC*0807M*K-ST4-L	SPL-MA05-M5-XX	SPL-BMA05-M5-XX	SPL-E03-M5-XX	SPL-E04-M5-XX
SPM-SC*0810M*K-ST4-L	SPL-MA05-M5-XX	SPL-BMA05-M5-XX	SPL-E03-M5-XX	SPL-E04-M5-XX

The cable drawings of servo motors are shown in the following table.

Table 1-5 Servo motor cables

Cable model	Drawing
SPL-MA05-M5-XX-X	
SPL-BMA05-M5-XX-X	
SPL-E03-M5-XX-X	
SPL-E04-M5-XX-X	

Chapter 2 Servo System Specifications

2.1 Servo drive standard specifications

2.1.1 Servo drive electrical specifications

Table 2-1 220 V drive list and electrical specifications

Voltage class	220 V		
Model	M3-NS2R8A	M3-NS5R5A	M3-NS7R6A
Power rating	400 W	750 W	1 kW
SIZE	SIZE A	SIZE B	
Phase	Single-phase	Single/Three-phase	
Rated input current (A)	4	7.6/3.7	9.6/5.1
Rated output current (A)	2.8	5.5	7.6
Max. output current (A)	9.3	16.9	20
Main circuit power	200 to 240V, -10% to +10%, 50/60 Hz		
Control circuit power	/		
Braking resistor	No built-in braking resistor		

2.1.2 Servo drive basic specifications

Table 2-2 Servo drive basic specifications

<table>
<tr><th colspan="4">Basic specifications</th></tr>
<tr><td rowspan="2">Basic specifications</td><td>Control mode</td><td colspan="2">IGBT, PWM control, sine wave current drive mode</td></tr>
<tr><td>Encoder</td><td colspan="2">Absolute encoder</td></tr>
<tr><td rowspan="3">Control IO</td><td rowspan="2">DI</td><td>Different functions configured through parameters</td><td>5 general inputs, optocoupler isolation, both NPN and PNP inputs available
Input voltage range 20 to 30 V, input impedance 3.9 kΩ</td></tr>
<tr><td rowspan="2">DO</td><td rowspan="2">Different functions configured through parameters</td><td>3 general outputs, optocoupler isolation, both NPN and PNP outputs available</td></tr>
<tr><td>Maximum operating voltage 30 V, maximum current 100 mA</td></tr>
<tr><td rowspan="2">Communication</td><td>EtherCAT</td><td colspan="2">CoE and SoE communication protocols supported, in compliance with CiA402 profile</td></tr>
<tr><td>USB</td><td colspan="2">Connect the computer and the servo drive for performance debugging</td></tr>
<tr><td rowspan="3">Other parts</td><td>Key</td><td colspan="2">5 operation keys</td></tr>
<tr><td>LED display</td><td colspan="2">5 8-segment LED display</td></tr>
<tr><td>Power indicator</td><td colspan="2">CHARGE indicator</td></tr>
<tr><td rowspan="8">General functions</td><td>Auto-adjustment</td><td colspan="2">The host controller issues an action command to run the motor, during which the load moment of inertia ratio is estimated in real time and the stiffness level is automatically set.</td></tr>
<tr><td>Switchover of multiple control modes</td><td colspan="2">Position mode, speed mode, torque mode, position/speed mode switchover, speed/torque mode switchover, position/torque mode switchover, and EtherCAT mode.</td></tr>
<tr><td>Protection functions</td><td colspan="2">Overvoltage, undervoltage, overcurrent, overspeed, stall, overheat, overload, encoder abnormality, input phase loss, and excessive position deviation.</td></tr>
<tr><td>High-frequency vibration suppression</td><td colspan="2">4 sets of notch filters, suppressing the vibration from 0 to 4000 Hz;
1 set of speed reference notch filter from 0 to 1000 Hz</td></tr>
<tr><td>End vibration suppression</td><td colspan="2">2 set of filters, suppressing the end low-frequency vibration from 1 to 100 Hz.</td></tr>
<tr><td>Homing mode</td><td colspan="2">Multiple homing modes</td></tr>
<tr><td>Reverse clearance compensation</td><td colspan="2">Used to improve the response delay that occurs when the traveling direction of the machine is reversed.</td></tr>
</table>

	Mechanical analyzer	Used to analyze frequency features of the mechanical system through the host controller software.		
	Inertia auto-tuning	Offline and online system inertia auto-tuning		
	Torque observer	Load torque observation and compensation		
	Friction compensation	System friction compensation		
Position control	Control input	Deviation counter clear, electronic gear switchover, and so on.		
	Control output	Positioning completed		
	Position reference	EtherCAT		
		Electronic gear ratio	4 sets of electronic gear ratios online	
Speed control	Performance	Speed variation rate	Load variation rate	0 to 100% load: below 0.5% (at rated speed)
			Voltage variation rate	Rated voltage ±10%: 0.5% (at rated speed)
			Temperature variation rate	25±25℃: below 0.5% (at rated speed)
		Speed control range	1 to 5000	
		Speed loop response	2.1 kHz	
		Soft start time	0 to 6000 ms	
	Control input	Internal speed reference selection 1/2/3, zero speed clamp, etc.		
	Control output	Speed reached, etc.		
Torque control	Performance	Torque control accuracy	±1%	
		Frequency feature	3 kHz	
	Control input	Torque reference input, etc.		
	Control output	Speed reached, etc.		
	Speed limit	Set speed limits through parameters		

2.2 Servo motor standard specifications

2.2.1 Servo motor basic specifications

Table 2-3 Servo motor basic specifications

Servo motor basic specifications	
Protection degree	IP67 (excluding the shaft end)
Excitation mode	Permanent magnet
Ambient temperature	0℃ to +40℃
Ambient humidity	Relative humidity 20% to 80% (non-condensing)
Storage temperature	-20℃ to +60℃
Storage humidity	20% to 80% RH (non-frosting)
Installation method	Flange mounted
Insulation resistance	50 MΩ (500 V)
Insulation voltage	1500 V (220 V motor) 1800 V (380 V motor)
Insulation class	F
Shock resistance	150 m/s²
Anti-vibration	50 m/s²
Vibration level	V15
Altitude	It is recommended to use the motors at a place below 1000 m. Derating is required above 1000 m.
Installation site	It is strictly forbidden to install motors in places with corrosive, flammable and explosive gases and liquids; In places with metal powder, grinding fluids, oil mist, cutting equipment and the like, choose motors with oil seals; Do not use motors in high-temperature enclosed environments which may largely shorten the motors' lifespan.

2.2.2 Servo motor electrical specifications

Table 2-4 Servo motor electrical specifications

Motor model	Rated voltage (V)	Rated power (W)	Rated speed (rpm)	Max. speed (rpm)	Rated torque (N·m)	Peak torque (N·m)	Rated current (A)	Peak current (A)	Rotor inertia (10^{-4}kg·m^2)
Straight plug economical motors 60/80 frames Medium inertia Vn = 3000 rpm Vmax = 6000/5000 rpm									
SPM-SC*0602M*K-ST4-L	220	200	3000	6000	0.64	2.23	1.5	5.4	0.28 (0.3)

Motor model	Rated voltage (V)	Rated power (W)	Rated speed (rpm)	Max. speed (rpm)	Rated torque (N·m)	Peak torque (N·m)	Rated current (A)	Peak current (A)	Rotor inertia (10^{-4}kg·m^2)
SPM-SC*0604 M*K-ST4-L		400	3000	5000	1.27	3.81	2.1	6.5	0.56 (0.58)
SPM-SC*0807 M*K-ST4-L		750	3000	5000	2.39	7.17	4.1	13.4	1.5 (1.65)
SPM-SC*0810 M*K-ST4-L		1000	3000	5000	3.19	9.56	5.7	17.7	2 (2.15)

Note: Parameters in "()" belong to motors with brakes.

2.3 Servo drive dimensions

1. SIZE A (corresponding drive: M3-NS2R8A)

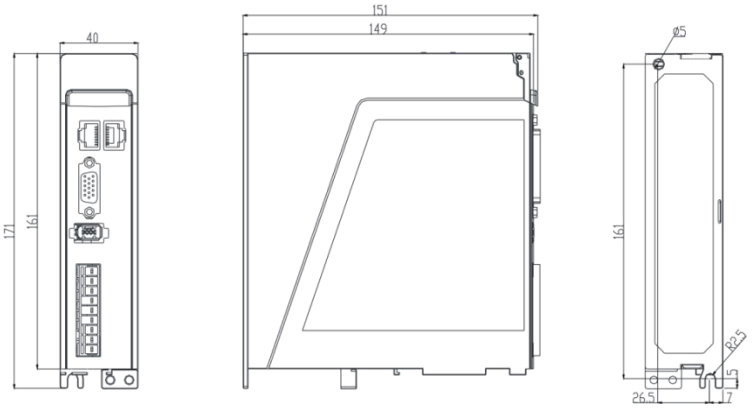


Fig. 2-1 SIZE A servo drive dimensions

2. SIZE B (correspond drives: M3-NS5R5A, M3-NS7R6A)

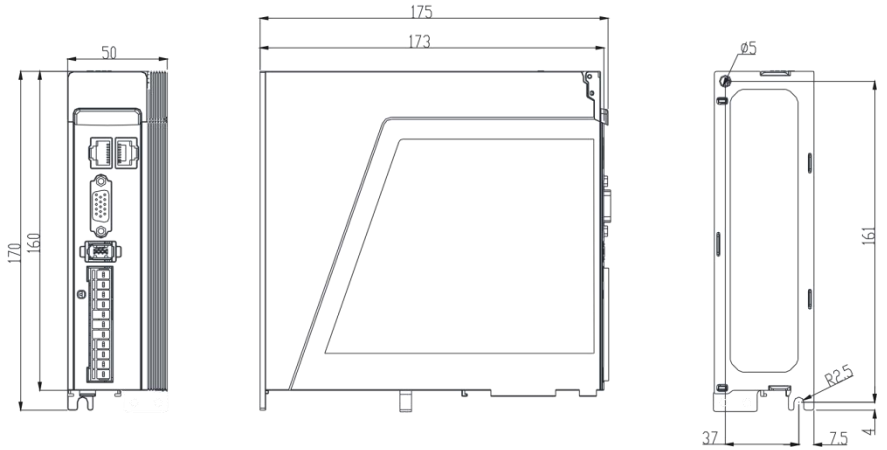


Fig. 2-2 SIZE B servo drive dimensions

2.4 Servo motor dimensions and interface definitions

2.4.1 Dimensions

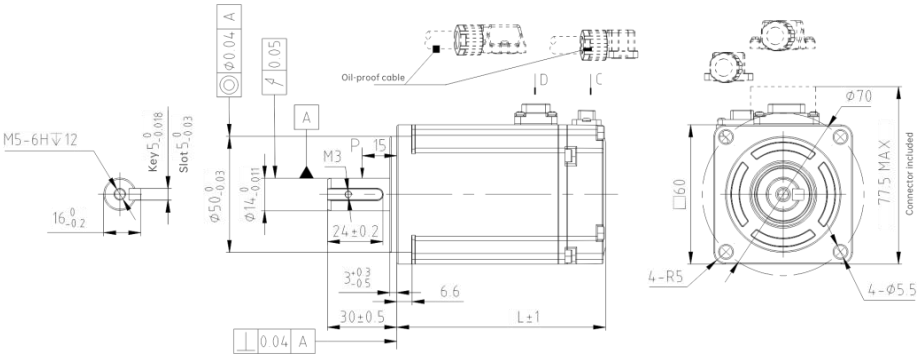


Fig. 2-3 Dimensions for 60 frame medium inertia straight plug economical servo motor (ST4-L series)

Table 2-5 Dimensions for 60 frame medium inertia straight plug economical servo motor (ST4-L series)

Model	L (mm)
SPM-SC*0602M*K-ST4-L	71.8 (101.2)
SPM-SC*0604M*K-ST4-L	90.1 (119.5)

Note: Dimensions in "()" belong to motors with brakes.

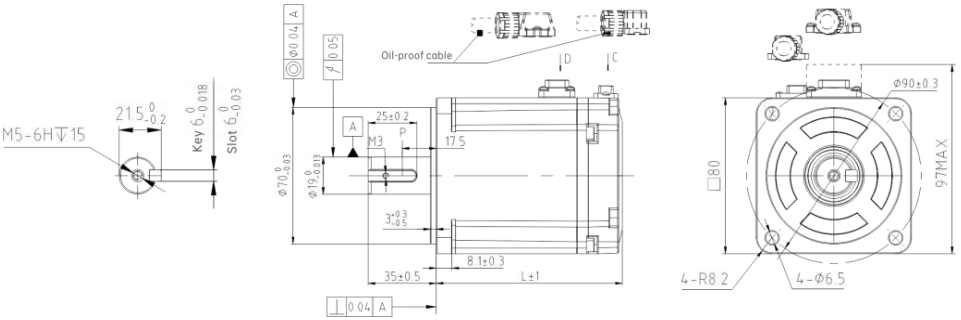


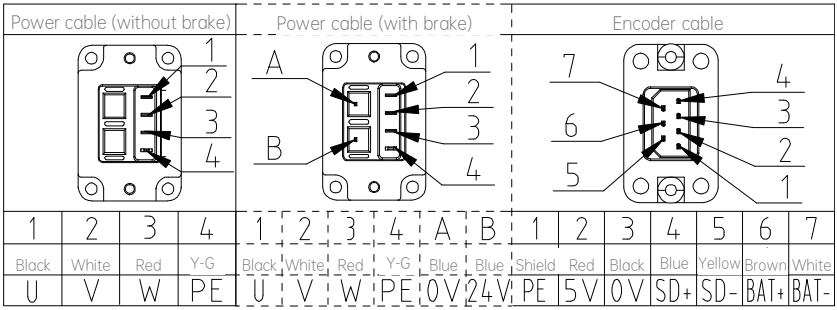
Fig. 2-4 Dimensions for 80 frame medium inertia straight plug economical servo motor (ST4-L series)

Table 2-6 Dimensions for 80 frame medium inertia straight plug economical servo motor (ST4-L series)

Model	L (mm)
SPM-SC*0807M*K-ST4-L	95.7 (126.7)
SPM-SC*0810M*K-ST4-L	103.9 (134.9)

Note: Dimensions in "()" belong to motors with brakes.

2.4.2 Interface definitions



Note: Y-G in the figure means the yellow-green color. The cable color is only for reference. Use the corresponding cable according to its actual definition.

Chapter 3 Installation

3.1 Servo drive installation

3.1.1 Installation site

- Install the servo drive in a cabinet free from direct sunlight, water droplets and rain.
- Avoid installing the servo drive in places with metal powder, oil mist, high temperature and high humidity.
- It is strictly forbidden to install the servo drive in places with corrosive, flammable and explosive gases.
- Install the servo drive in places with no vibration.

3.1.2 Installation environment requirements

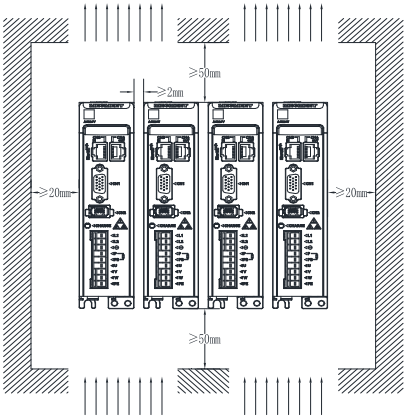
Table 3-1 Installation requirements for M3 servo drive

Item		Requirements
Operating conditions	Installation site	Install the drive vertically on a solid base indoors, with at least 5 cm of space for inlet and outlet, and at least 2 cm of space for left and right sides of the case. The cooling medium is air.
	Ambient temperature	0 to +45℃, air temperature change less than 0.5℃/min; Keep good ventilation. If it is above 45℃, derating is required. The maximum temperature is 55℃ (still working at 25% of normal load)
	Relative humidity	Relative humidity < 90% (no condensation)
	Other climatic conditions	No condensation, icing, rain, snow, hail, etc. solar radiation lower than 700W/m^2, and air pressure from 70 to 106 kPa.
	Salt spray and corrosive gas content	Pollution degree 2
	Dust and solid particle content	Pollution degree 2
	Protection degree	IP20
	Altitude	It is recommended to use the drive at a place below 1000 m. Derating is required above 1000 m. The drive shall be derated by 6% for every increase of 1000 m.
	Anti-vibration	Below 4.9 m/s^2
	Shock resistance	Below 19.6m/s^2

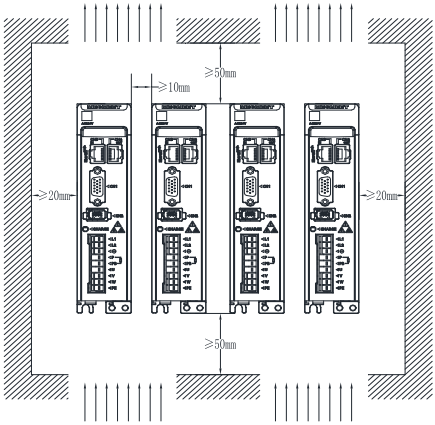
3.1.3 Installation clearance

Install the servo drive in a well-ventilated place indoors, typically inside a cabinet, with the drive mounted vertically and securely fixed to the mounting surface using its two mounting holes.

For compact installation of SIZE A and SIZE B, leave a clearance of at least 2 mm. In this case, the actual load rate needs to be derated (SIZE A actual load rate ⩽ 70%; SIZE B actual load rate ⩽ 80%). For side-by-side installation, leave a clearance of at least 20 mm between every two servo drives, and a clearance of at least 50 mm above and below each servo drive for heat dissipation.

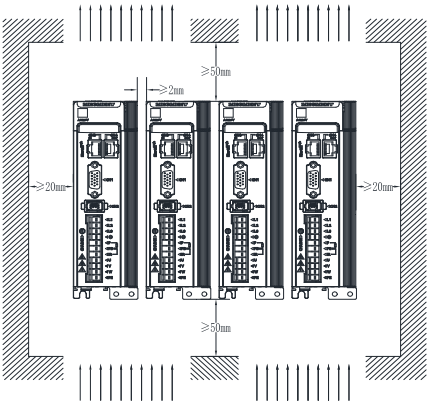


Clearance for compact installation

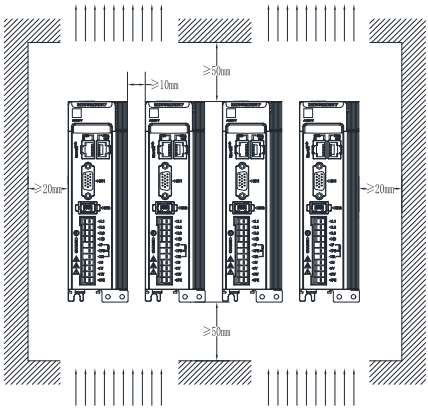


Clearance for side-by-side installation

Fig. 3-1 SIZE A servo drive installation



Clearance for compact installation



Clearance for side-by-side installation

Fig. 3-2 SIZE B servo drive installation

3.2 System wiring diagram

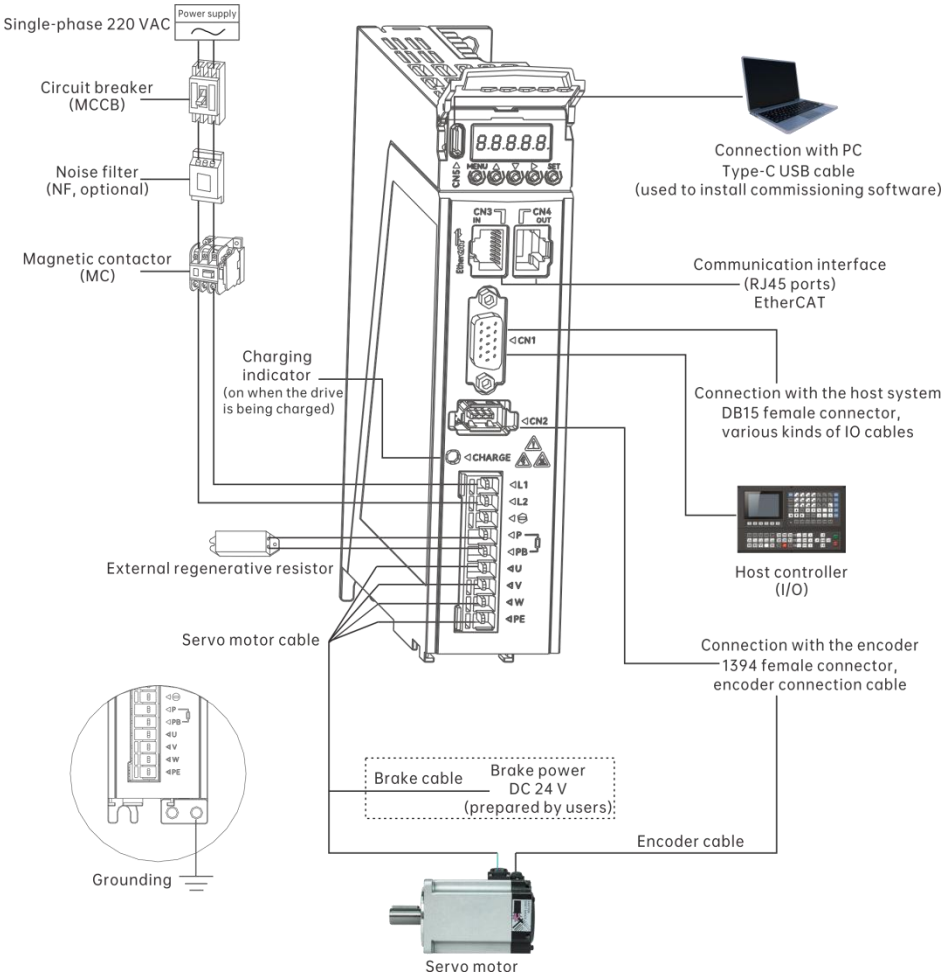


Fig. 3-3 SIZE A single-phase 220 V servo system wiring diagram

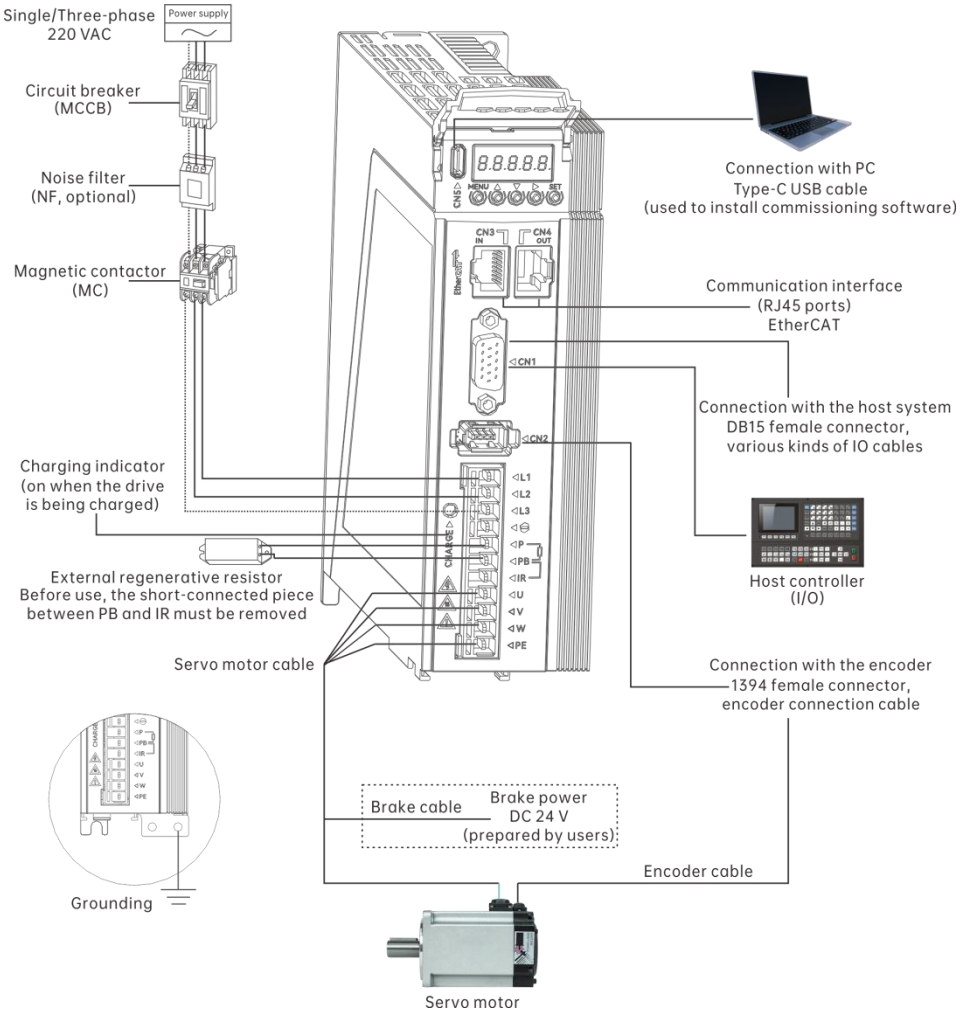


Fig. 3-4 SIZE B single/three-phase 220 V servo system wiring diagram

Follow the below instructions for system wiring:

- Ensure that the power specifications and wiring for L1, L2, and L3 are correct to avoid damage to the drive and potential hazards.
- Ensure that the motor output wiring sequence for U, V, and W is correct; otherwise, abnormal motor rotation may occur.
- When using an external braking resistor, remove the jumper bar between PB and IR, and connect the resistor between P and PB. When using the built-in braking resistor, simply short PB and IR.

- To protect the drive system and prevent electrical shock accidents, use a circuit breaker or fuse on the input power supply. Refer to the table below for specifications of the circuit breaker and fuse.
- The drive does not have a built-in grounding protection circuit. Use a leakage circuit breaker with overload and short-circuit protection, or a dedicated grounding leakage circuit breaker.
- It is strictly prohibited to use an electromagnetic contactor for motor start/stop operations. Motors are high-inductance devices, and the high transient voltage generated may damage the contactor and other components.
- To ensure reliable system operation and reduce interference to the power grid, it is recommended to install a filter on the input side.

3.3 Recommended specifications of circuit breakers and fuses

Table 3-2 Recommended specifications for circuit breakers and fuses

Drive model	Circuit breaker	Fuse
M3-NS2R8A	10 A	15 A
M3-NS5R5A	16 A / 6 A	20 A / 10 A
M3-NS7R6A	20 A / 10 A	35 A / 20 A

3.4 Related specifications of braking resistors

The related specifications of braking resistors are shown in the table below.

Table 3-3 Related specifications of braking resistors

Servo drive model		Built-in braking resistor specifications		Minimum allowable resistance of external braking resistor (Ω)	Max. braking energy absorbed by capacitor (J)
		Resistance (Ω)	Capacity (W)		
Single-phase 220 V	M3-NS2R8A	—	—	45	14
Single/three-phase 220 V	M3-NS5R5A	—	—	45	19
	M3-NS7R6A	—	—	20	23

Note:

1. By default, PB and IR are shorted upon delivery, and the built-in braking resistor is used.

2. If the braking capacity of the built-in braking resistor is insufficient, disconnect PB-IR and connect an external braking resistor between P and PB.

3. If an external braking resistor is required, consult us for technical support.

4. "—" in the table indicates that the model does not have a built-in braking resistor.

Chapter 4 Wiring of Servo System

This chapter explains the interfaces of servo drive and corresponding wiring.

DANGER

- Do not open the cover until the power supply of the servo drive is completely disconnected for at least 10 minutes.
- Even after the power is off, high voltage may remain inside the servo drive. To prevent electric shock, do not touch the power terminals. The charge indicator (CHARGE) light will turn off once discharge is complete. Ensure the CHARGE indicator is off before proceeding with connection and inspection tasks.
- Only well-trained and authorized professionals are allowed to perform the internal wiring of servo drive.
- Check the wiring carefully when connecting the emergency stop or safety circuit.
- Check the voltage class of the servo drive before powering it up to avoid personal injury or equipment damage.

WARNING

- Before use, check whether the rated input voltage of the servo drive matches the voltage of the AC power supply.
- The servo drive has passed the dielectric strength test before delivery. Do not conduct this test again.
- Do not connect the AC supply cables to the output terminals U, V and W.
- The grounding wire should be a copper wire with a diameter of 3.5 mm or more, and the grounding resistance should be less than 10 Ω.
- Depending on the operating conditions, leakage current more or less exists within the servo drive. To ensure safety, both the servo drive and the motor must be grounded, and a residual current device (RCD) is required. A type-B RCD is recommended, and the leakage current threshold shall be set to 300 mA.
- To provide overcurrent protection on the input side and facilitate power-off maintenance, the servo drive should be connected to the power supply via a circuit breaker or a fuse.

4.1 Main circuit connection

4.1.1 Main circuit terminals

Main circuit terminals are described in Table 4-1, and cable specifications are shown in Table 4-2.

Table 4-1 Description of M3-N main circuit terminals

Terminal	Mark	Drive model	Terminal function
Main circuit power input terminals	L1, L2	M3-NS2R8A	Main circuit single-phase 220 V power input
	L1, L2, L3	M3-NS5R5A M3-NS7R6A	Main circuit single/three-phase 220 V power input
DC bus terminals	P, ⊖	Servo DC bus terminals, used for multi-machine common bus connection.	
Braking resistor connection terminals	P, PB	M3-NS2R8A	If the braking capacity is insufficient, connect an external braking resistor between P and PB. Refer to the recommended specifications.
	P, PB, IR	M3-NS5R5A M3-NS7R6A	By default, PB and IR are shorted, and the built-in braking resistor is used. If the braking capacity is insufficient, disconnect PB and IR, and connect an external braking resistor between P and PB. Refer to the recommended specifications.
Servo motor connection terminals	U, V, W	Connected to a servo motor.	
Grounding terminal	PE	Connected to the power supply grounding terminal and the servo motor grounding terminal for grounding.	

Note: PB and IR are shorted upon delivery for the drive with a built-in resistor.

4.1.2 Main circuit cable dimensions

Recommended dimensions of main circuit cables are included in the table below.

Table 4-2 Recommended dimensions of M3-N main circuit cables

Drive model		Power input L1, L2, L3	Power output U, V, W	Grounding PE	Braking resistor PB, P
SIZE A	M3-NS2R8A	20 AWG (0.5 mm^2)	20 AWG (0.5 mm^2)	20 AWG (0.5 mm^2)	20 AWG (0.5 mm^2)
SIZE B	M3-NS5R5A	18 AWG (0.75 mm^2)	18 AWG (0.75 mm^2)	18 AWG (0.75 mm^2)	18 AWG (0.75 mm^2)

Drive model		Power input L1, L2, L3	Power output U, V, W	Grounding PE	Braking resistor PB, P
	M3-NS7R6A	18 AWG (0.75 mm^2)	18 AWG (0.75 mm^2)	18 AWG (0.75 mm^2)	18 AWG (0.75 mm^2)

4.2 Servo motor encoder signal connection (CN2)

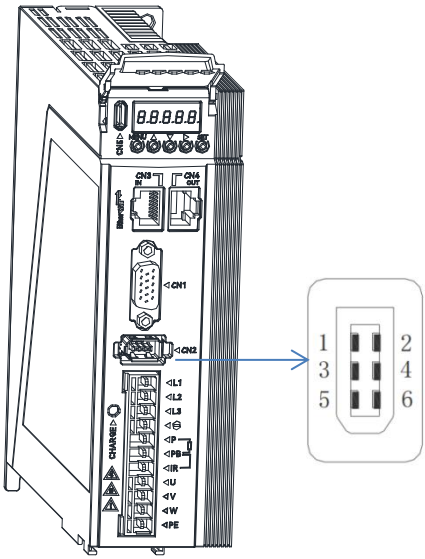


Fig. 4-1 Diagram of servo motor encoder signals

M3-N supports absolute encoders. The encoder signals are defined in the following table.

Table 4-3 Encoder signal definitions

Connection interface: CN2, 1394		
Pin	Signal	Description
1	+5V	Power +5V
2	GND	Power ground
3	Reserved	-
4	Reserved	
5	SD+	Serial data signal
6	SD-	
Housing	PE	Shield

4.3 Control signal connection

The control signals include digital input and digital output. The signal connection is established by DB15 (DB15 female connector on the servo drive).

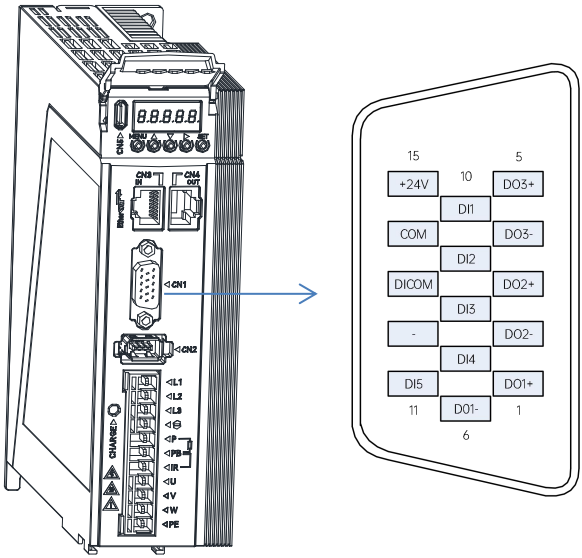


Fig. 4-2 Diagram of control signals

The control signals are defined in the following table.

Table 4-4 Control signal definitions

Pin	Signal	Pin	Signal
1	DO1+	9	DI2
2	DO2-	10	DI1
3	DO2+	11	DI5
4	DO3-	12	-
5	DO3+	13	DICOM
6	DO1-	14	COM
7	DI4	15	+24V
8	DI3		

4.3.1 Digital input and output signals

Digital input and output signals are defined in the following table.

Table 4-5 Digital input and output signals

Signal		Default function	Pin	Function
Common	DI1	/SON	10	Servo enable
	DI2	/ARST	9	Fault reset
	DI3	/GSEL	8	Gain switchover
	DI4	/P-OT	7	Positive limit switch
	DI5	/N-OT	11	Negative limit switch
	+24V		15	Internal 24 V power output, 20 to 28 V, Imax = 200 mA
	COM		14	
	DICOM	DI common terminal	13	DI common terminal (connected to the power supply or power ground)
	DO1+	/SRDY	1	Servo ready
	DO1-		6	
	DO2+	/ALM	3	Drive fault
	DO2-		2	
	DO3+	/BRK	5	Brake output
	DO3-		4	

4.3.1.1 Digital input circuit

M3-N series servo drive has 5 DI terminals in total. The DI common terminal can be connected to the power supply or ground. Supported input modes include dry contact input, NPN input and PNP input.

DI1 is taken as an example here. DI1 to DI5 circuits are the same.

(1) Dry contact mode

The dry contact mode is shown in Fig. 4-3 and Fig. 4-4.

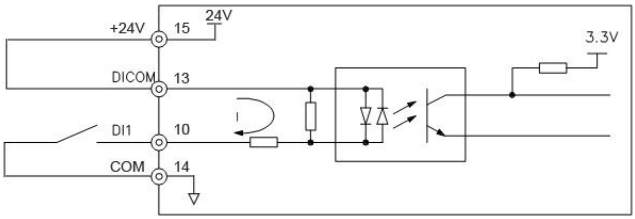


Fig. 4-3 DI terminal dry contact wiring mode (using the internal 24 V power of servo drive)

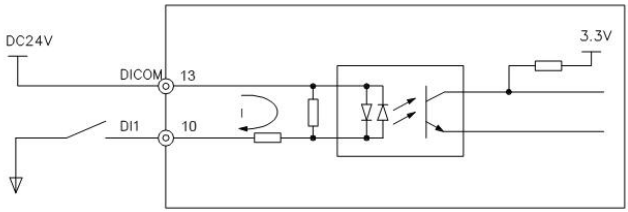


Fig. 4-4 DI terminal dry contact wiring mode (using the external power)

(2) NPN (sink) mode

The external controller is the NPN common emitter output. The wiring is shown in Fig. 4-5 and Fig. 4-6.

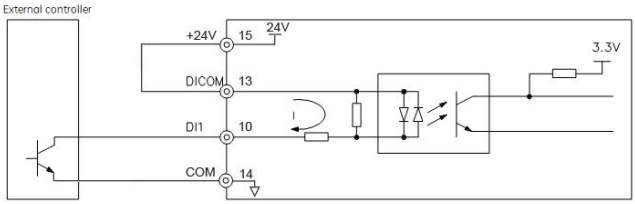


Fig. 4-5 DI terminal NPN wiring mode (using the internal 24 V power of servo drive)

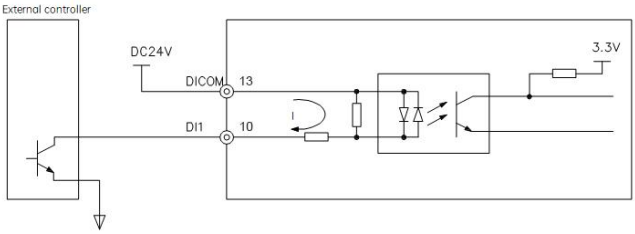


Fig. 4-6 DI terminal NPN wiring mode (using the external power)

(3) PNP (source) mode

The external controller is the PNP common emitter output. The wiring is shown in Fig. 4-7 and Fig. 4-8.

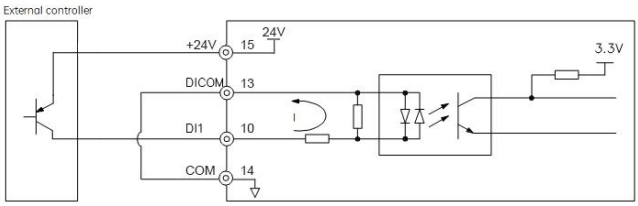


Fig. 4-7 DI terminal PNP wiring mode (using the internal 24 V power of servo drive)

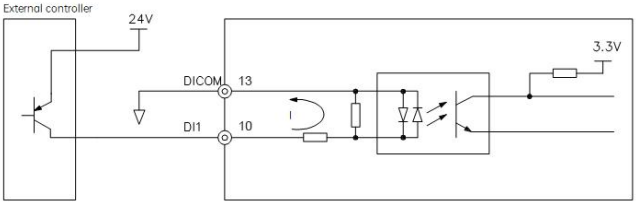


Fig. 4-8 DI terminal PNP wiring mode (using the external power)

Note: NPN and PNP modes cannot be mixed for multiple DI terminals on the same drive.

4.3.1.2 Digital output circuit

The DO terminals are double-ended outputs, with various output modes.

DO1 is taken as an example here. DO1 to DO3 circuits are the same.

(1) The host controller as the relay input

When an external device provides relay input, the wiring is shown in Fig. 4-9.

Warning: The inductive load (such as relay) shall be anti-parallel with the fly-wheel diode!

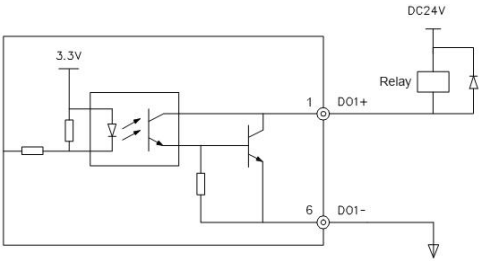


Fig. 4-9 DO terminal and relay wiring mode

(2) NPN (sink) output

When the controller input is sink input, the wiring is shown in Fig. 4-10.

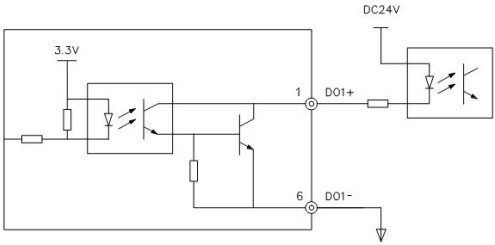


Fig. 4-10 DO terminal NPN (sink) output wiring mode

(3) PNP (source) output

When the controller input is source input, the wiring is shown in Fig. 4-11.

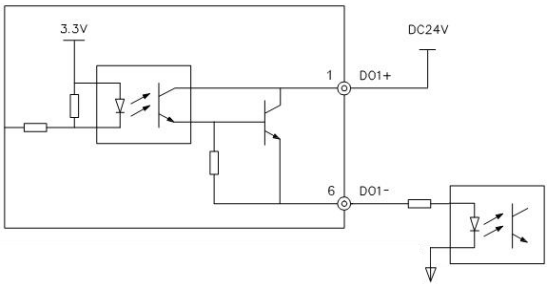


Fig. 4-11 DO terminal PNP (source) output wiring mode

4.4 Communication signal connection

M3-N series servo drive supports EtherCAT communication. The communication ports are CN3 and CN4, where CN3 (IN) is connected to the communication port of the master, and CN4 (OUT) is connected to the next slave.

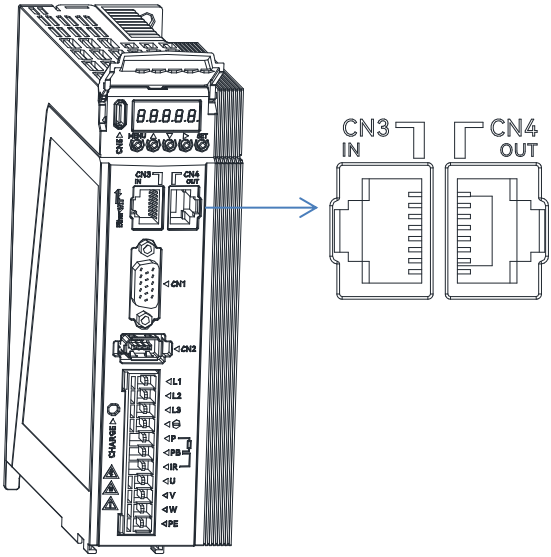


Fig. 4-12 Diagram of communication ports

Table 4-6 Communication signal definitions

Pin	Definition	Description
1	TX+	Data transmit+
2	TX-	Data transmit-
3	RX+	Data receive+
6	RX-	Data receive-
Housing	PE	Shield
4/5/7/8	Undefined	

Chapter 5 Operating Panel

5.1 Panel introduction

The operating panel of M3-N servo drive consists of 5 LED digital tubes and 5 keys, which are used for status display and parameter settings.

The panel is as shown in the figure below.

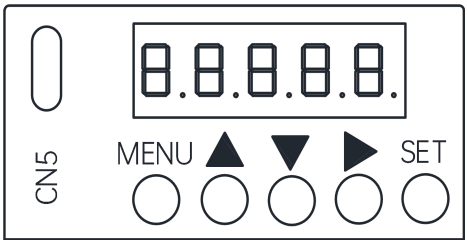


Fig. 5-1 Panel appearance

The key functions are shown in the table below:

Table 5-1 Key functions of operating panel

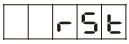
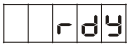
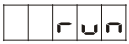
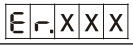
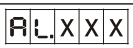
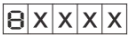
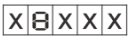
Key	Key name	Function
MENU	Menu/Exit key	In the working status display or parameter monitoring menu, press this key to switch between the working status display or parameter monitoring menu and the level 1 parameter setting menu. In the level 2 parameter setting menu, press this key to return to the previous menu.
▶	Switch/Shift/Page key	In the working status display menu, press this key to switch between the working status display menu and the parameter monitoring menu. In the parameter setting menu, press this key to left shift the selected blinking digit. When the parameter value exceeds 5 digits and is not editable, you can press this key to scroll through the parameter values.
▲	Increase key	In the parameter monitoring menu, press this key to select the monitored parameter. In the parameter setting menu, press this key to increase the current blinking digit's set value, or hold it down for a rapid increase.
▼	Decrease key	In the parameter monitoring menu, press this key to select the monitored parameter. In the parameter setting menu, press this key to decrease the current blinking digit's set value, or hold it down for a rapid decrease.

Key	Key name	Function
SET	Enter/Confirm/Reset key	In the parameter setting menu, press this key to enter the next menu level or confirm the current parameter value and return to the previous menu. During fault status display, press this key to reset the fault.

5.2 Working status display

M3-N servo drive can display the following working statuses.

Table 5-2 Servo drive working statuses and corresponding display

LED display	Symbol	Description
	"rst"	Power-on initialization state, indicating that the system is at start or reset state
	"nrd"	Start or reset is completed, but the servo is not yet ready.
	"rdy"	Servo system self-test normal, waiting for the host to give a command signal
	"run"	Servo running status
	"Er.xxx"	Servo fault status
	"AL..xxx"	Servo alarm status
	"8xxxx"	After the drive enters the OP state, the control mode P02.00 is displayed. 0: Speed mode 1: Position mode 2: Torque mode 3: Speed mode←→Position mode 4: Torque mode←→Position mode 5: Speed mode←→Torque mode 6: Speed mode←→Torque mode←→Position mode 8: EtherCAT mode
	"x8xxx"	After the drive enters the OP state, the bus operation mode 6061h is displayed. 1: Profile Position Mode 3: Profile Velocity Mode 4: Profile Torque Mode 6: Homing Mode 8: Cyclic Synchronous Position Mode 9: Cyclic Synchronous Velocity Mode A: Cyclic Synchronous Torque Mode

5.3 Working status display and parameter setting flowchart

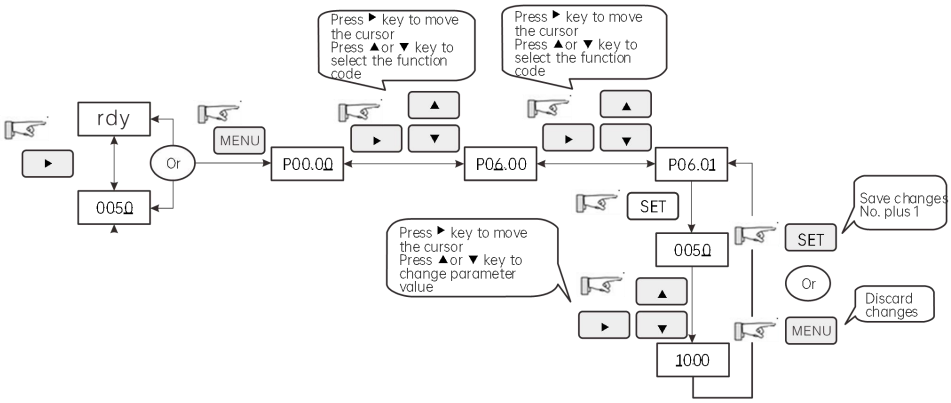


Fig. 5-2 Working status display and parameter setting flowchart

1. After power-on initialization is completed, the panel enters the working status display menu by default. If the servo system self-test is normal, the panel will display "rdy".

2. In the working status display menu, press the ▶ key to switch between the working status display menu and the parameter monitoring menu.

3. In the parameter monitoring menu, press the ▼/▲ key to select the monitored parameters.

4. In the working status display or parameter monitoring menu, press the MENU key to switch between the working status display or parameter monitoring menu and the level 1 parameter setting menu.

5. In the level 1 parameter setting menu, press the ▶ key to move the cursor to certain parameter group or parameter number.

6. In the level 1 parameter setting menu, press the ▼/▲ key to select the required parameter group and parameter number.

7. In the level 1 parameter setting menu, press the SET key to enter the level 2 parameter setting menu to display the current value of parameter. If such parameter value can be modified, its lowest digit will blink.

8. In the level 2 parameter setting menu, press the ▶ key to select the digit to be modified, and then press the ▼/▲ key to increase or decrease the value.

9. After the parameter is modified, you can either press the SET key to save the change and return to the previous menu, or press the MENU key to discard the change and return to the previous menu.

5.4 Parameter value display

1. Five-digit and below parameter values display

When the parameter value is within [-9999 to 99999], it can be displayed and edited in one page.

2. Above five-digit parameter values display

When the parameter value exceeds [-9999 to 99999], you need to turn the page to display and edit the value. The drive can display parameters up to three pages. The following illustrates the page display logic. For example, -21474836.48 can be divided into [-21], [4748], [36.48] in three pages, as shown in the figure below.

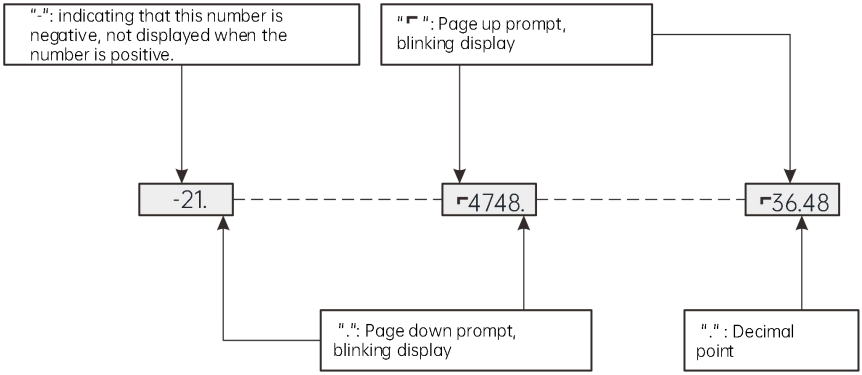


Fig. 5-3 Parameter division in different pages

If the parameter value can be modified currently, you can press the ▶ key to select the digit to be modified. If the parameter value can not be modified currently, then you can only press the ▶ key to display the next page.

Chapter 6 Commissioning Instructions

6.1 Check before running

Disconnect the servo motor from the load, the coupling connected to the motor shaft, and other related components. To prevent potential risks, check that the servo motor can work properly without load, and then connect the load.

Before running, check that the following requirements are met:

(1) There is no obvious damage on the appearance of the servo drive.

(2) The wiring terminals have been insulated.

(3) There are no conductive objects such as screws or metal sheets or combustible objects inside the servo drive, and there are no conductive objects around the wiring terminals.

(4) The servo drive or external braking resistor is not placed on combustible objects.

(5) The wiring is completed and correct regarding:

- Power cables, auxiliary power cables and grounding cable of the servo drive
- All control signal cables
- Limit switches and protection signals

(6) The servo drive enable switch is in the OFF state.

(7) The power circuit is cut off, and the emergency stop circuit remains active.

(8) The external voltage reference for the servo drive is correct.

When no running command is received from the host controller, power on the servo drive. Then, check that:

(1) The servo motor can rotate properly without vibration or loud noise.

(2) All parameters are set correctly. Avoid setting parameters too large or too small, as unexpected actions may occur due to different mechanical characteristics.

(3) The bus voltage indicator and the digital tubes display normally.

6.2 Trial running

After the wiring is completed, perform jog running to confirm whether the servo motor can rotate normally and check for any abnormal vibration or noise during operation. Jog running can be performed through the panel or by configuring two external DI terminals. The motor jog speed can be set through the function code P06.05.

a. Jog running through the panel

Use the panel to set the control mode P02.00 to 0, and set the jog speed P06.05, then go to P06.06 and press the SET key to display the current jog speed. Perform forward or reverse jog running through the ▼/▲ key. Finally, press the SET/MENU key to exit the jog mode.

b. Jog running through DI terminals

Configure two external DI terminals and assign the functions FunIN.17 and FunIN.18. After setting the jog speed P06.05, perform forward or reverse jog running through the DI state.

6.3 Electronic gear

The "electronic gear" function allows the movement of the workpiece corresponding to each unit of reference pulse to be set to any desired value. During system control, there is no need to account for the mechanical reduction ratio or the encoder pulse count.

(1) The electronic gear ratio is set as follows:

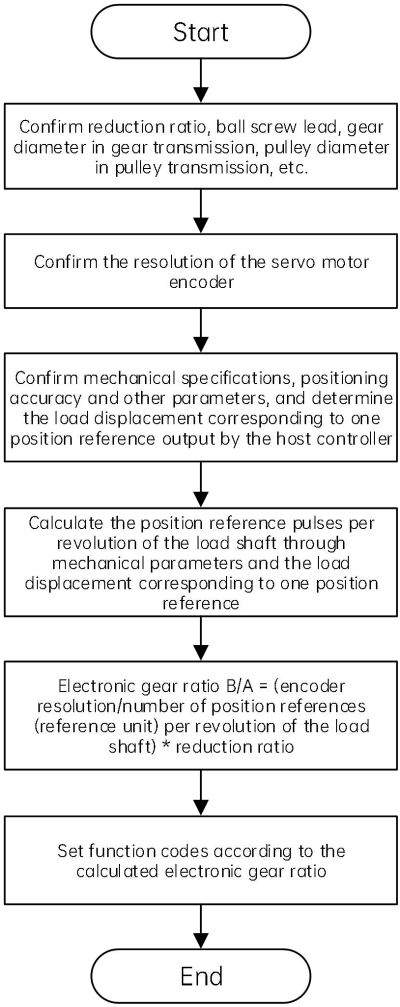


Fig. 6-1 Setting process of electronic gear ratio

The electronic gear ratio parameter function is shown as follows:

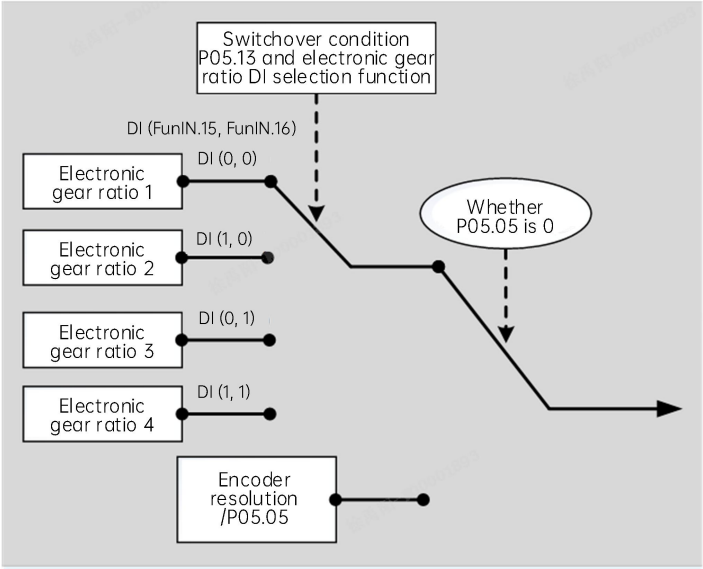


Fig. 6-2 Electronic gear ratio function diagram

When P05.05 is not 0, the electronic gear ratio $\frac{B}{A} = \frac{\text{Encoder resolution}}{\text{P05.05}}$. In this case, electronic gear ratio 1, electronic gear ratio 2, electronic gear ratio 3, and electronic gear ratio 4 are invalid.

(2) Related function codes

a. Electronic gear ratio parameter setting:

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P05.05	Number of pulses per motor revolution	0 to 8388608 P/r	1 P/r	10000	Immediately	At stop	Set the number of position reference pulses for one motor revolution
P05.08	Electronic gear numerator	1 to 1073741824	1	8388608	Immediately	At stop	Set the numerator of the electronic gear ratio
P05.09	Electronic gear denominator 1	1 to 1073741824	1	10000	Immediately	At stop	Set the denominator of the first electronic gear ratio group

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P05.10	Electronic gear denominator 2	1 to 1073741824	1	10000	Immediately	At stop	Set the denominator of the second electronic gear ratio group
P05.11	Electronic gear denominator 3	1 to 1073741824	1	10000	Immediately	At stop	Set the denominator of the third electronic gear ratio group
P05.12	Electronic gear denominator 4	1 to 1073741824	1	10000	Immediately	At stop	Set the denominator of the fourth electronic gear ratio group

Note:

1. The setting range of electronic gear ratio is: $0.001<\frac{B}{A}<30000$. Incorrect setting will cause fault Er.061 (electronic gear ratio error).

2. For the serial absolute encoder, the encoder resolution = 2^n among which "n" is the bits of the encoder. The standard absolute encoder of M3 is 17 bits, so the resolution of the encoder is 2^{17}=131072.

For an incremental encoder, encoder resolution = encoder lines * 4, for example, the resolution of a 2500-line incremental encoder is 2500 * 4=10000.

b. Electronic gear ratio switchover setting

When P05.05 is 0, the electronic gear ratio switchover function can be used. It should be determined whether it is necessary to switch among 4 sets of electronic gear ratios according to the mechanical conditions before setting the electronic gear ratio switchover condition. There is one and only one set of electronic gear ratio active at any time.

Associated function code

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P05.13	Electronic gear ratio switchover condition	0: Switched after position reference is kept 0 for 3 ms 1: Real-time switching	1	0	Immediately	At stop	Set the electronic gear ratio switchover condition

Meanwhile, configure 2 DI terminals of the servo drive as functions 15 and 16 (FunIN.15 and FunIN.16), and determine the valid logic of the DI terminals. Refer to the table below for electronic gear ratio selection. When no DI is configured as FunIN.15 or FunIN.16, FunIN.15 and FunIN.16 are invalid by default.

P05.05	P05.13	DI level of FunIN15	DI level of FunIN16	Electronic gear ratio B/A
0	0 or 1	Invalid	Invalid	P05.08/P05.09
		Valid	Invalid	P05.08/P05.10
		Invalid	Valid	P05.08/P05.11
		Valid	Valid	P05.08/P05.12
1 to 8388608	---			Encoder resolution/P05.05

(3) Calculation method of electronic gear ratio:

When the machine reduction ratio between the motor shaft and the load side is m/n (when the motor makes "m" revolutions, the load shaft makes "n" revolutions), the electronic gear ratio can be obtained by the following formula.

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Encoder resolution}}{\text{displacement per revolution of the load shaft (reference unit)}} \times \frac{m}{n}$$

a. Confirm the mechanical parameters and servo motor encoder resolution

Confirm mechanical parameters, such as reduction ratio, ball screw lead, belt transmission ratio, and confirm the servo motor encoder resolution.

b. Confirm the positioning accuracy (i.e. pulse equivalent)

Pulse equivalent refers to the minimum unit of load movement corresponding to each pulse signal. Pulse equivalent can be 0.001 mm, 0.1 °, 0.01 inches. So, when a pulse is input, a pulse equivalent of the distance or angle is moved .

For example, pulse equivalent is 0.001 mm, when the input reference pulse is 50000, the amount of the load movement is (50000 * 0.001 mm) = 50 mm.

c. Calculate the position reference pulses required by one revolution of the load shaft

Use mechanical parameters and pulse equivalent to calculate the number of position reference pulses required by one revolution of the load shaft.

For example, the ball screw pitch is 5 mm, pulse equivalent is 0.001 mm, then:

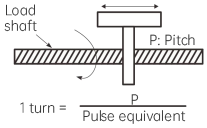
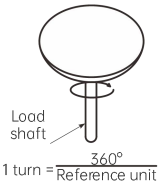
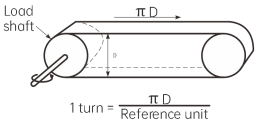
The displacement per revolution of the load shaft (reference unit) = 5 mm / 0.001 mm = 5000

d. Calculate the electronic gear ratio

If the reduction ratio of the motor shaft and load shaft is m/n (when the motor makes "m" revolutions, the load shaft makes "n" revolutions), then:

$$\text{Electronic gear ratio } = \frac{P05.08}{P05.09} = \frac{\text{Encoder resolution}}{\text{displacement per revolution of the load shaft (reference unit)}} \times \frac{m}{n}$$

(4) The examples are shown as follows.

Step	Content	Mechanical mechanism		
		Ball screw	Round table	Belt pulley
				
1	Mechanical mechanism	Screw lead: 5 mm Reduction ratio: 1/1	1 turn rotation angle: 360° Reduction ratio: 100/1	Pulley diameter 100 mm (pulley circumference 314 mm) Reduction ratio: 50/1
2	Encoder resolution	131072 (17 bits)	131072 (17 bits)	131072 (17 bits)
3	Load displacement corresponding to one reference unit	0.001 mm	0.01°	0.005 mm
4	Position reference pulses required by one revolution of the load shaft	5 mm / 0.001 mm = 5000	360° / 0.01° = 36000	314 mm / 0.005 mm = 62800
5	Electronic gear ratio	$\frac{B}{A}=\frac{131072}{5000}\times\frac{1}{1}$	$\frac{B}{A}=\frac{131072}{36000}\times\frac{100}{1}$	$\frac{B}{A}=\frac{131072}{62800}\times\frac{50}{1}$
6	Function code	P05.08 = 131072 P05.09 = 5000	P05.08 = 13107200 P05.09 = 36000	P05.08 = 6553600 P05.09 = 62800

6.4 Brake settings

6.4.1 Brake wiring diagram

The brake signal connection has no polarity. The customer needs to prepare a 24 V power supply. The standard connection of the brake signal BK and the brake power supply is as follows:

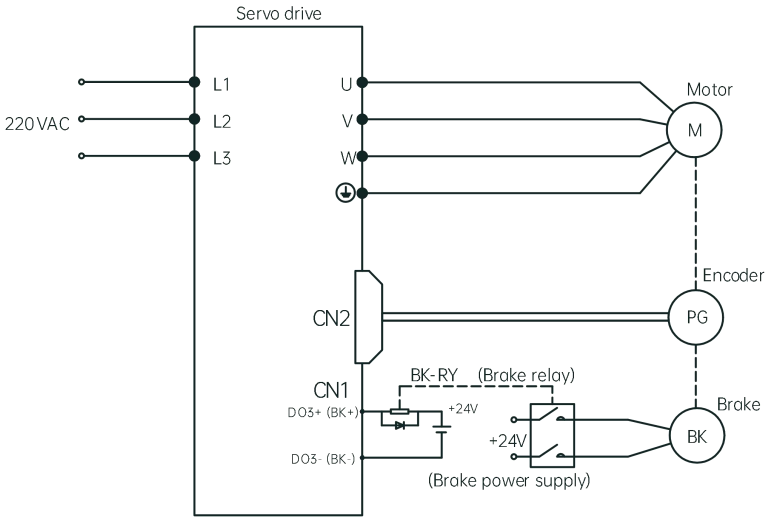


Fig. 6-3 Brake wiring diagram

Note: It is recommended not to share the brake power supply with other electrical devices. This prevents voltage or current drops caused by the operation of other devices, which could lead to brake malfunction.

6.4.2 Brake sequence

For a servo motor with brake, a DO terminal of servo drive shall be configured to the function 18 (brake output signal) and the valid logic of DO terminal shall be determined.

The operating sequence of the brake is divided into the "normal state" brake sequence and the "fault state" brake sequence.

The brake sequence of the normal state is further divided into "motor standstill" and "motor rotating":

a. Standstill: The actual motor speed is lower than P02.12;

b. Rotating: The actual motor speed is higher than or equal to P02.12.

6.4.3 Brake sequence for a motor at standstill

If the motor speed is lower than P02.12 upon switch-off of the S-ON signal, the drive operates according to the standstill sequence.

Note:

- After the brake output signal changes from "OFF" to "ON", do not put a position/speed/torque reference within the time defined by P02.10. Otherwise, reference loss or an operation error may occur.
- When the motor is used to drive a vertical axis, the motion part may move slightly under the influence of gravity or external force. When the motor is at standstill, if the S-ON signal is switched off, the brake output is set to "OFF" immediately. However, within the time defined by P02.11, the motor is still energized, preventing the load from moving under the influence of gravity or external force.

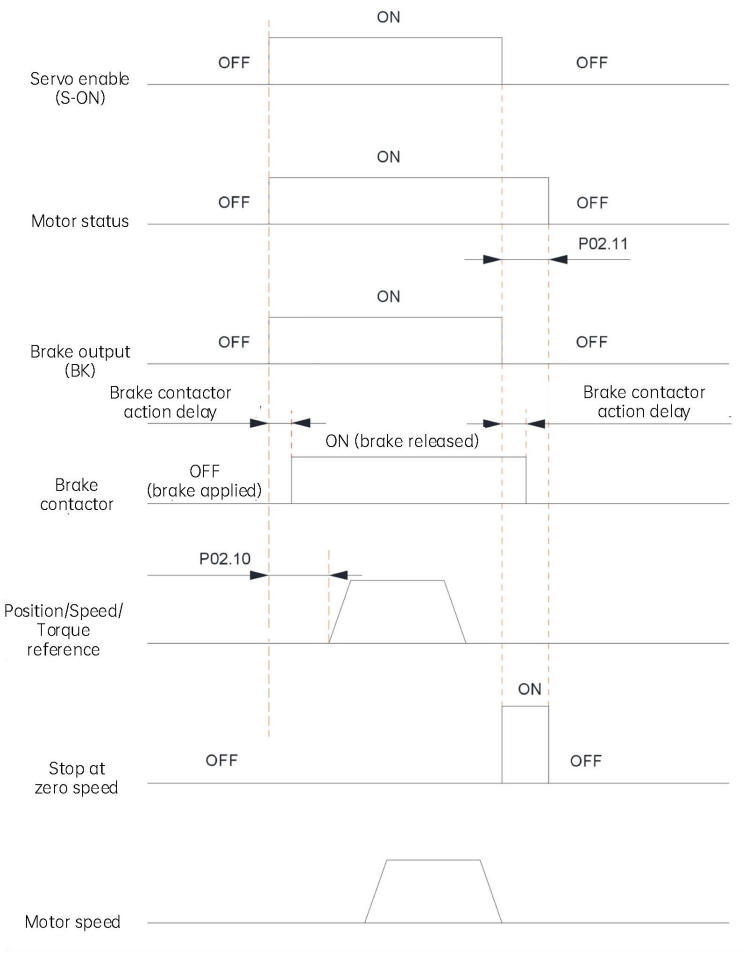


Fig. 6-4 Brake sequence for a motor at standstill

According to the above figure, the brake sequence for a motor at standstill is explained as below:

a. When the S-ON signal is switched on, the brake output is set to "ON", with the motor being energized at the same time.

b. For delay of brake contactor actions, refer to the related motor specifications.

c. The interval time, which starts from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of P02.10.

d. When the S-ON signal is switched off with the motor at standstill (motor speed lower than P02.12), the brake output is set to "OFF". You can set in P02.11 the delay of the motor in entering the de-energized state after the brake output is set to "OFF".

Function code	Name	Value range	Default value	Effective time	Property
P02.10	Delay from brake output ON to command received	20 to 500 ms	250	Immediately	During running
P02.11	Delay from brake output OFF to motor de-energized in static state	1 to 1000 ms	150	Immediately	During running

6.4.4 Brake sequence for a rotating motor

Regarding the brake sequence for a motor in the rotation state, pay attention to the following matters:

- When the brake output is switched on, do not input a speed/position/torque reference within the time defined by P02.10. Otherwise, reference loss or an operation error may occur.
- If the S-ON signal is switched off when the motor is still rotating, the motor enters the "Stop at zero speed" state, but the brake output can be set to "OFF" only when one of the following conditions is met:
  a. The motor has decelerated to the value defined by P02.12, but the time defined by P02.13 is not reached.
  b. The time defined by P02.13 has been reached, but the motor speed is till higher than the value defined by P02.12.
- The motor is still energized within 40 ms after the brake output changes from "ON" to "OFF". This is to prevent the motion parts from moving under the influence of gravity or external force.

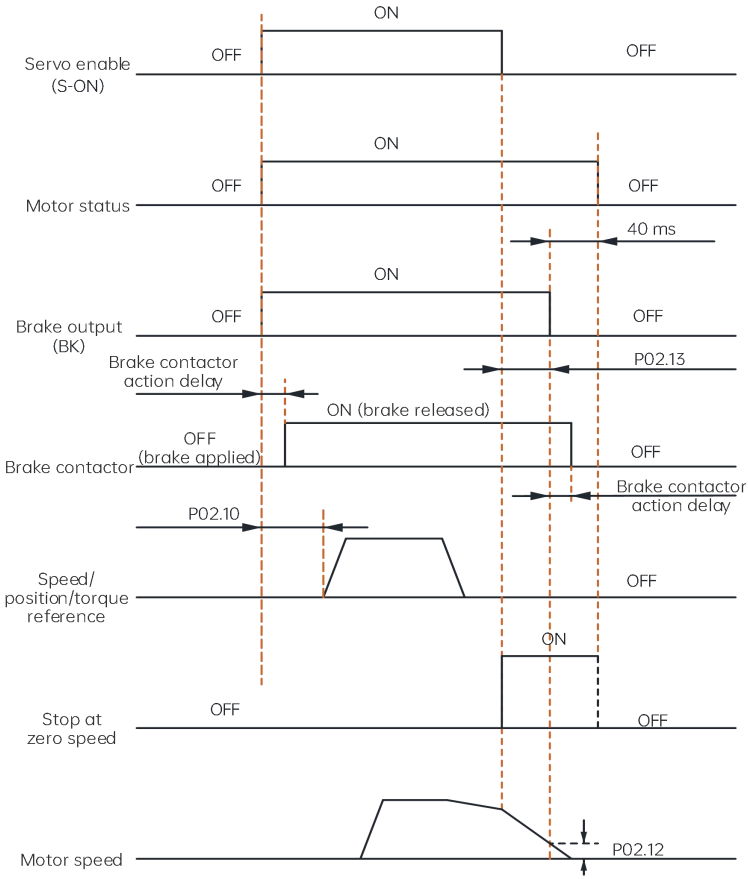


Fig. 6-5 Brake sequence for a rotating motor

According to the above figure, the brake sequence for a rotating motor is explained as below:

a. When the S-ON signal is switched on, the brake output is set to "ON", with the motor being energized at the same time.

b. For delay of brake contactor actions, refer to the related motor specifications.

c. The interval time, which starts from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of P02.10.

d. When the S-ON signal is switched off during rotation of the motor, the motor enters the de-energized state after a delay of 50 ms following the brake output OFF on the premise of P02.12 and P02.13 conditions being met.

Function code	Name	Value range	Default value	Effective time	Property
P02.12	Motor speed threshold at brake output OFF in rotating state	0 to 3000 rpm	10	Immediately	During running
P02.13	Delay from S-ON OFF to brake output OFF in rotating state	1 to 30000 ms	500	Immediately	During running

6.4.5 Brake sequence in the fault state

When a drive fault occurs, the motor immediately enters the de-energized state, the brake output is switched from "ON" to "OFF", and the brake becomes applied.

Chapter 7 EtherCAT Communication

7.1 Overview of EtherCAT bus

EtherCAT is a high-performance, low-cost, easy-to-use and topologically flexible industrial Ethernet technology that can be used for ultra-fast I/O networks in the industrial field.

Standard physical layer of Ethernet, with transmission media of twisted pairs or optical fibers (100 Base-TX or 100 Base-FX).

EtherCAT system consists of a master station and several slave stations. The master station only requires a common network card, while slave stations require special chips for slave control, such as ET1100、ET1200、FPGA.

EtherCAT is real time down to the I/O level:

- No underlying sub-systems any more
- No delays in gateways
- All devices are included in one system:
  - Inputs and outputs, sensors, actuators, drives, displays...
- Transmission speed:
  - 2 x 100 Mbit/s (high-speed Ethernet, full duplex)
- Synchronization: up to 300 nodes are between two devices with the cable length of 120 m, but the jitter is less than 1 us
- Update time (in typical application):
  - 256 digital I/O in 11 us
  - 1000 digital I/O distributed to 100 nodes in 30 us = 0.03 ms
  - 200 analog I/O (16 bit) in 50 us, 20 kHz sampling rate
  - 100 servo axis (each 8 Byte IN + Out) in 100 us = 0.1 ms
  - 12000 digital I/O in 350 us

To support a wider range of devices and application layers, EtherCAT establishes the following application protocols:

- CoE (CANopen application protocol based on EtherCAT)
- SoE (Servo drive conventions according to IEC 61800-7-204)
- EoE (Ethernet over EtherCAT)
- FoE (File access over EtherCAT)

For slave devices, not all communication protocols are required. Just choose the most suitable protocol.

7.2 M3-N bus function introduction

M3-N series servo drive implements EtherCAT communication (real-time Ethernet communication), and CANopen Drive Profile (CiA402) in its application layer.

7.2.1 M3-N communication specifications

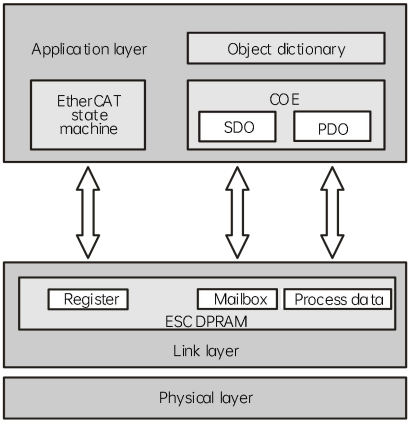
As shown in the following table:

Item		Specification
Communication standard		IEC 61158 Type12, IEC 61800-7 CiA402 Drive Profile
Physical layer	Transmission protocol	100 BASE-TX (IEEE 802.3)
	Maximum distance	100 m
	Interface	CN3 (RJ45): EtherCAT Signal IN CN4 (RJ45): EtherCAT Signal OUT
	Cable	Category 5 twisted pair
Application layer	SDO	SDO request, SDO response
	PDO	Mutable PDO mapping
	CiA402 Drive Profile	Profile Position Mode Profile Velocity Mode Profile Torque Mode Homing Mode Cyclic Synchronous Position Mode Cyclic Synchronous Velocity Mode Cyclic Synchronous Torque Mode
Distributed clock		DC mode, DC period≥ 250us

7.2.2 EtherCAT network reference model

Among all the application layer protocols of EtherCAT, M3-N uses IEC 61800-7 (CiA402) - CANOpen motion control sub-protocol.

The following figure shows the EtherCAT communication structure based on the CANOpen application layer.



EtherCAT (CoE) network reference model is mainly composed of two parts: data link layer and application layer.

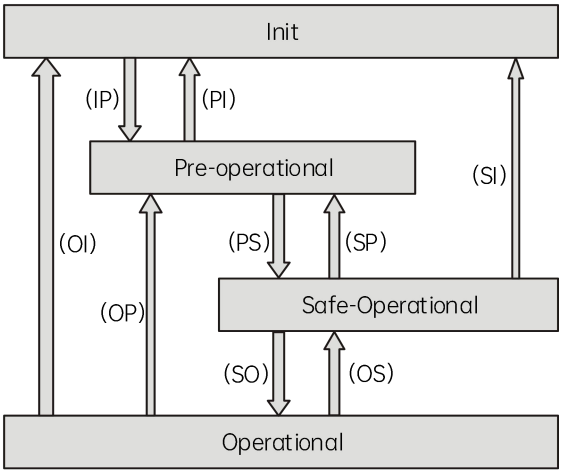
The data link layer is mainly in charge of the EtherCAT communication protocol, and the application layer is embedded with CANopen drive Profile (CiA402). The object dictionary in the application layer of CoE includes communication parameters, application data and PDO mapping information.

Process data objects (PDO) consist of objects in the object dictionary that can be PDO mapped, and the PDO data is defined by PDO mapping. The reading/writing of PDO data is cyclic without requirements to look up the object dictionary, while the reading/writing of service data objects (SDO) is non-cyclic with requirements to look up the object dictionary.

7.2.3 EtherCAT state machine

EtherCAT state machine is used to describe the states and state changes of the slave application.

State change requests are usually initiated by the master station and responded to by the slave station.



The EtherCAT device must support 4 states to manage the status relations between the master station and the slave station upon initialization and operation.

- Init: initialization, abbreviated as I;
- Pre-Operational: abbreviated as P;
- Safe-Operational: abbreviated as S;
- Operational: abbreviated as O.

From the initialization state to the operational state, the transition must be in the sequence of "Initialization> Pre-Operational>Safe-Operational>Operational". No state shall be skipped.

However, going back from the operational state, the transition allows state skipping.

The state initialization and transition is shown in the following table:

State and Transition	Operation description
Initialization (I)	No communication in the application layer, no mailbox data and

State and Transition	Operation description
	process data; The master station can only read and write the ESC register.
IP	The master station configures the address of slave station; Configure the mailbox channel; Configure the DC distributed clock; Check whether the mailbox is initialized successfully; Request "Pre-Operational".
Pre-Operational (P)	Mailbox data communication (SDO) of application layer is activated.
PS	The master station uses the process data mapping of mailbox initialization; The master station configures the SM channel used for process data communication; The master station configures FMMU; The master station requests "Safe-Operational".
Safe-Operational (S)	Process data communication is available. It is only allowed to read the input data. No output signals can be generated, and the output is set to the "safe" state. (SDO, TPDO)
SO	The master station sends valid input data; The master requests "Operational".
Operational (P)	Both input and output are valid; Mailbox communication can still be used. (SDO, TPDO, RPDO)

7.2.4 Process data object (PDO)

EtherCAT process data can be divided into RPDO (Reception PDO) and TPDO (Transmission PDO). The slave station receives commands from the master station by RPDO, and sends feedback of its own status by TPDO.

7.2.4.1 PDO assignment of Sync Manager

During the cyclic data communication of EtherCAT, the process data includes multiple PDO mapping data objects. The CoE protocol uses data objects 1C10h – 1C2Fh to define the PDO mapping list of the corresponding SM (Sync Manager Channel). Multiple PDOs can be mapped in different sub-indexes.

The M3-N series servo drive supports assignment of four RPDOs and four TPDOs, as shown in the following table.

Index	Sub-index	Description
1C12h	01	Assign 1600h as the RPDO mapping object
1C13h	01	Assign 1A00h as the TPDO mapping object

7.2.4.2 PDO mapping parameters

PDO mapping is used to establish the mapping relation between the object dictionary and the PDO.

1600h – 1603h are RPDOs, and 1A00h – 1A03h are TPDOs.

The M3-N series servo drive provides one mutable RPDO1, three fixed RPDOs (RPDO2 to RPDO4), one mutable TPDO1 and and three fixed TPDOs (TPDO2 to TPDO4), as listed in the following table.

PDO	Index	Max. number of mapping objects	Max. length of the byte	Default mapping object
RPDO1	1600h	10	40	6040h (Control word) ……
RPDO2	1601h	2	6	6040 (Control word) 60FF (Target velocity)
RPDO3	1602h	2	6	6040 (Control word) 607A (Target position)
RPDO4	1603h	2	4	6040 (Control word) 6071 (Target torque)
TPDO1	1A00h	10	40	6041h (Status word) ……
TPDO2	1A01h	3	10	6041 (Status word) 6064 (Position actual value) 606C (Velocity actual value)
TPDO3	1A02h	2	6	6041 (Status word) 6064 (Position actual value)
TPDO4	1A03h	3	8	6041 (Status word) 6064 (Position actual value) 6077 (Torque actual value)

7.2.4.3 PDO configuration

PDO mapping parameters contain indicators of the process data for PDOs, including the index, sub-index and mapping object length. The sub-index 0 indicates the number (n) of mapping objects in the PDO, and the maximum length of each PDO is 4*n bytes. One or multiple objects can be mapped simultaneously. Sub-indexes 1 to n indicate the mapping content, as defined below:

Bit	31	…	16	15	…	8	7	…	0
Meaning	Index			Sub-index			Object length		

The index and sub-index together define the position of an object in the object dictionary. The object length indicates the bit length of the object in hexadecimal, as shown below:

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

For example, the mapping parameter of the 8-bit operating mode 6060-00h is 60600008h, the mapping parameter of the 16-bit control word 6040-00h is 60400010h, the mapping parameter of the 32-bit interpolated position 60C1-01h is 60C10120h.

7.2.4.4 Steps for PDO mapping

- Disable the PDO assignment function (by setting the sub-index 00h of 1C12h and 1C13h to 0);
- Disable the PDO mapping function (by setting the sub-index 00h of 1600h and 1A00h to 0 to clear the original mapping contents);
- Set the contents of PDO mapping objects (by writing the indexes, sub-indexes and lengths of mapping objects to the sub-indexes 1 – 10 of 1600h and 1A00h, depending on the actual application);
- Set the number of PDO mapping objects (by setting the sub-indexes 00h of 1600h and 1A00h to 1 – 10, depending on the actual application);
- Set the PDO assignment objects (by setting the sub-indexes 1 of 1C12h and 1C13h);
- Enable the PDO assignment function (by setting the sub-indexes 00h of 1C12h and 1C13h to 1)

7.2.5 Service data object (SDO)

The EtherCAT SDO is used to transfer on-cyclic data, such as communication parameter configuration and servo drive parameter configuration. The CoE service types of EtherCAT include: emergency message, SDO request, SDO response, remote TxPDO transmission request, remote RxPDO transmission request, and SDO message.

The M3-N series servo drive supports SDO request, SDO response, and SDO message.

7.2.6 Distributed clock (DC)

In an EtherCAT system, the distributed clock is initialized, configured, started, and drift-compensated by the master station. On the slave side, the distributed clock is implemented by the ESC control chip which provides interrupt signals and clock information for the slave. The distributed clock can also be used to record the timestamp of latched input signals.

The distributed clock enables all EtherCAT devices to use the same system time and allows synchronous execution of slave tasks. A slave can generate synchronous signals according to the synchronized system time.

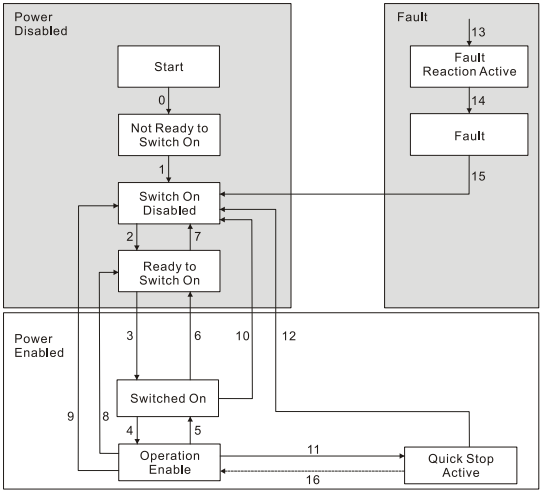
The M3-N series servo drive supports DC synchronization mode. The synchronization cycle, which is controlled by SYNC0, varies with different motion modes. Typical synchronization cycles include 250 μs, 500 μs, 1 ms, and 2 ms. The minimum synchronization cycle supported by the M3-N is 250 μs.

7.3 CiA402 device control (device profile)

Device control is used to implement all operational functions of the drive, including state machine control and operating modes. The master station controls the drive via the "controlword" and monitors the drive's current status through the "statusword."

7.3.1 CoE state machine

The following figure shows the CoE state machine.



As shown in the above figure, the state machine can be divided into "Power Disabled", "Power Enabled" and "Fault".

After power-on, the drive is initialized, and enters the "Switch On Disabled" state. The drive's operation mode can be configured, but the main power is still off.

After State Transmission 2, 3, 4, the drive enters the "Operation Enable" state. At the time, the main power is started, and the drive controls the motor according to the configured operation mode. Thus, before this state, the user must confirm that the drive parameters are correctly configured and corresponding input values are zero.

After State Transmission 9, the main power is disabled.

If an alarm occurs, the drive, no matter what the current state, enters the "Fault" state.

The following table describes the meanings of drive states.

State	Description
Not Ready to Switch On	The drive is in initialization.
Switch On Disabled	The initialization is done; Drive parameters can be configured.
Ready to Switch On	The main power can be switched on; Drive parameters can be configured.

State	Description
Switch On	The main power is already switched on; Drive parameters can be configured.
Operation Enable	No faults on the drive; The drive is enabled for operation; Configured drive parameters are valid.
Quick Stop Active	The drive quickly stops.
Fault Reaction Active	The drive performs fault stop when a fault is detected.
Fault	The drive fault is produced, and fault stop is done; Drive functions are inhibited.

The following table describes the switchover of drive states.

State switchover ID	Description
0	Auto state change after reset of the drive
1	Auto state change after reset of the drive
2	Receive the Shut Down command
3	Receive the Switch On command
4	Receive the Enable Operation command
5	Receive the Disable Operation command
6	Receive the Shut Down command
7	Receive the Quick Stop and Disable Voltage command
8	Receive the Shut Down command
9	Receive the Disable Voltage command
10	Receive the Quick Stop and Disable Voltage command
11	Receive the Quick Stop command
12	Receive the Quick Stop or Disable Voltage command
13	Auto state change after detecting a fault
14	Auto state change after the complete response to a fault
15	Receive the Fault Reset command
16	Receive the Enable Operation command

7.3.2 Object dictionary

The object dictionary is the most important part of the device profile. It is an ordered set of parameters and variables, containing all parameters related to device description and device network state.

The objects in a group can be accessed through network in an orderly and pre-defined way.

The CANopen protocol adopts the object dictionary with 16-bit index and 8-bit sub-index. The structure of the object dictionary is shown in the following table.

Index range	Meaning
0000h – 0FFFh	Section for objects of data type description
1000h – 1FFFh	Section for communication objects: stores frequently-used communication parameters
2000h – 5FFFh	Section for manufacturer-defined objects: stores device parameters defined by the manufacturer, such as drive parameters
6000h – 9FFFh	Section for sub-protocol objects: CiA402 protocol parameters
A000h – FFFFh	Reserved section

7.3.3 Control word and status word

Index	Object code	Name	Data type	Access
6040h	VAR	Control word	UINT16	RW
6041h	VAR	Status word	UINT16	RO

7.3.3.1 Control word

The bit definitions for the control word are shown in the following table.

Bit15 to Bit11	Bit10 to Bit9	Bit8	Bit7	Bit6 to Bit4	Bit3	Bit2	Bit1	Bit0
Manufacture specific	Reserved	Halt	Fault reset	Operation mode specific	Enable operation	Quick stop	Enable voltage	Switch on
O	O	O	M	O	M	M	M	M

(In the above table, O: Optional; M: Mandatory)

The control commands composed of Bit0 – Bit3 and Bit7 are used for the switchover of state machine, as shown below.

Command	Bit of controlword					Transitions
	Fault reset	Enable operation	Quick stop	Enable voltage	Switch on	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3*
Switch on	0	1	1	1	1	3**
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16

Command	Bit of controlword					Transitions
	Fault reset	Enable operation	Quick stop	Enable voltage	Switch on	
Fault reset		X	X	X	X	15

(In the above table, the bit with "X" can be ignored.)

The Bit4 - Bit6 and Bit8 of the control word are defined differently in different control modes, as shown below.

Bit	Operation mode					
	Profile position mode	Profile velocity mode	Homing mode	Interpolated position mode	Cyclic Synchronous position mode	Cyclic Synchronous velocity mode
4	New set-point	Reserved	Homing operation start	Enable ip Mode	Reserved	Reserved
5	Change set immediately	Reserved	Reserved	Reserved	Reserved	Reserved
6	Abs/Rel	Reserved	Reserved	Reserved	Reserved	Reserved
8	Halt	Halt	Halt	Halt	Halt	Halt

(For detailed description of bits above, refer to the description of operation modes.)

7.3.3.2 Status word

The bit definitions for the status word are shown in the following table.

Bit	Description
0	Ready to switch on
1	Switched on
2	Operation enabled
3	Fault
4	Voltage enabled
5	Quick stop
6	Switch on disabled
7	Warning
8	Manufacturer specific
9	Remote
10	Target reached
11	Internal limit active
12 - 13	Operation mode specific
14 - 15	Manufacturer specific

The Bit0 – Bit3, Bit5 and Bit6 of the status word indicate the drive states, as shown in the following table.

Bit value (binary)	State
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Switched on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

Notes for the status word:

- Bit0 – Bit9 have the same meaning in different control modes. When the master station sends the control word 6040h, the drive gives certain status feedback;
- Bit10, Bit11, Bit12 and Bit13 are specific to different control modes;
- Bit14 and Bit15 are defined by the manufacturer.

7.3.4 Common conversion factor

The user units are usually different from the motor units in drive control. The CiA402 device profile provides a group of conversion factors to make conversion between user units and motor units.

The default motor units of M3-N are as follows:

- Motor displacement unit: p (pulse)
- Motor speed unit: rpm (revolutions per minute)

The commonly used user units are as follows:

- Load displacement unit: mm
- Load speed unit: mm/s

7.3.4.1 Gear ratio factor (6091h)

The conversion factor refers to the motor displacement (unit: p) corresponding to the load shaft displacement of one user unit.

The gear ratio is composed of the numerator 6091-1h and the denominator 6091-2h. It determines the proportional relation between the load shaft displacement (user unit) and the motor displacement (motor unit), as formulated below:

$$\text{Gear ratio factor (6091h)} = \frac{\text{Motor encoder resolution (6091 - 1h)}}{\text{Load shaft resolution (6091 - 2h)}}$$

$$\text{Motor displacement} = \text{Load displacement (user)} \times \text{Gear ratio factor}$$

$$\text{Load feedback displacement (user)} = \frac{\text{Motor feedback displacement}}{\text{Gear ratio factor}}$$

[Example]

For the ball screw:

- Each feed of load: 40 mm
- Lead pB=10 mm/r
- 23-bit motor encoder, resolution: P = 8388608 (p/r)

Thus, the position factor is calculated as follows:

Each feed of load shaft:

$$\text{Position factor: Each feed of load shaft} = \frac{\text{Feed of load}}{\text{pB}} = \frac{40}{10\ \text{mm/r}} = 4\ \text{(r)}$$

$$\text{Position factor} = \frac{\text{Each feed of load shaft} \times \text{Motor resolution}}{\text{Each feed of load}} = \frac{4\ \text{r} \times 8388608\ \text{p/r}}{40} = \frac{8388608}{10}$$

It indicates that 10 mm of load displacement corresponds to 83888608 pulses of motor displacement.

Thus, the numerator 6091-1h can be set to 8388608, and the denominator 6091-2h can be set to 10.

7.4 Bus operation mode

M3-N supports the following bus operation modes in the CoE:

- Profile Position Mode;
- Profile Velocity Mode;
- Profile Torque Mode;
- Homing Mode;
- Cyclic Synchronous Position Mode;
- Cyclic Synchronous Velocity Mode;
- Cyclic Synchronous Torque Mode;

Operation mode related objects are shown in the following table below, where 6060h is used to set the operation mode of the drive and 6061h is used to display the current operation mode of the drive.

Index	Object code	Name	Data type	Attr.
6060h	VAR	Modes of operation	INT8	RW
6061h	VAR	Modes of operation display	INT8	RO

The following table lists the values and meanings of the two objects.

Value	Description
1	Profile Position Mode
3	Profile Velocity Mode
4	Profile Torque Mode
6	Homing Mode
8	Cyclic Synchronous Position Mode
9	Cyclic Synchronous Velocity Mode
10	Cyclic Synchronous Torque Mode

7.4.1 Profile position mode

This mode mainly applies to point-to-point positioning. In this mode, the master station sets the target position (absolute or relative), operating speed of position profile, acceleration and deceleration, and the drive generates position profiles based on preceding settings and executes the positioning control.

7.4.1.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
603Fh	VAR	Error code	UINT16	RW	TPDO	-
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6063h	VAR	Position actual value* (motor unit)	INT32	RO	TPDO	p
6064h	VAR	Position actual value (user unit)	INT32	RO	TPDO	Reference unit
6065h	VAR	Following error window	UINT32	RW	RPDO	Reference unit
6066h	VAR	Following error window time	UINT16	RW	RPDO	ms
6067h	VAR	Position window	UINT32	RW	RPDO	Reference unit
6068h	VAR	Position window time	UINT16	RW	RPDO	ms
607Ah	VAR	Target position	INT32	RW	RPDO	Reference unit
607Eh	VAR	Polarity	UINT8	RW	RPDO	-

Index	Object code	Name	Data type	Access	PDO mapping	Unit
607Fh	VAR	Max profile velocity	UINT32	RW	RPDO	Reference unit/s
6080h	VAR	Max motor speed	UINT32	RW	RPDO	rpm
6081h	VAR	Profile velocity	UINT32	RW	RPDO	Reference unit/s
6083h	VAR	Profile acceleration	UINT32	RW	RPDO	Reference unit/s^2
6084h	VAR	Profile deceleration	UINT32	RW	RPDO	Reference unit/s^2
6091h	ARRAY	Gear ratio	UINT32	RW	RPDO	-
60F4h	VAR	Following error actual value	INT32	RO	TPDO	Reference unit

Note: The drive has set the default profile velocity, acceleration and deceleration, max profile velocity, gear ratio factor and other parameters related to the position profile. So, if the master station does not set these parameters, the default values will take effect. To change the default values, the drive shall be powered off and restarted.

7.4.1.2 Control word and status word

The control word in the Profile Position Mode (PP) :

Bit15 to Bit7	Bit6	Bit5	Bit4	Bit3 - Bit0
*	Abs/Rel	Change set immediately	New set-point	*

Note: "*" means the bit definition is the same as the standard definition, the same below.

Description of control word bits in the Profile Position Mode (PP) :

Bit	Value	Description
New set-point	0	No set-point position
	1	New set-point position, start positioning
Change set immediately	0	Position not updated immediately
	1	Position updated immediately
Abs/Rel	0	Absolute position reference
	1	Relative position reference

The status word in the Profile Position Mode (PP) :

Bit15 to Bit14	Bit13	Bit12	Bit11	Bit10	Bit9 - Bit0
*	Following error	Set-point acknowledge	*	Target reached	*

Description of status word bits in Profile Position Mode (PP) :

Bit	Value	Description
Target reached	0	Target position not reached
	1	Target position reached
Set-point acknowledge	0	Set-point can be updated
	1	Set-point cannot be updated
Following error	0	Excessive position deviation not reported
	1	Excessive position deviation reported

7.4.1.3 Function description

- Operation mode: Set 6060h = 1;
- Target position: Use 607Ah to set the target position in user unit. If necessary, set the gear ratio factor 6091h;
- Positioning mode: Set the positioning mode through the control word 6040h (absolute position/relative position, change set immediately/not immediately, etc.);
- Positioning speed setting: Use 6081h to set the positioning speed in user unit. If necessary, set the gear ratio 6091h, profile acceleration time 6083h, and profile deceleration time 6084h;
- Positioning enable: Enable the drive to run through the object 6040h and enable positioning through its bit4;
- Speed limit setting: Select the speed limit channel according to 2007.0Ah (P07.09 FWD speed limit channel) and 2007.0Ch (P07.11 REV speed limit channel). By default, the bus speed limit channel is applied, with the value determined by 607Fh (Max profile velocity) and 6080h (Max motor speed). Alternatively, you can select the internal speed limit channel and set 2007.0Bh (P07.10 FWD speed limit value) and 2007.0Dh (P07.12 REV speed limit value). Besides, you can set P20.19(2014.14h) to specify the time during which the speed is decelerated to zero from the speed limit;

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P20.19	Deceleration time for bus speed limit	0 to 65535	1	0	Immediately	At stop	The deceleration time from the maximum speed of speed limit value to zero Unit: ms

- Torque limit setting: Select the torque limit channel according to 2006.0Dh (P06.12 Positive torque limit channel) and 2006.0Eh (P06.13 Negative torque limit channel). By default, the bus torque limit channel is applied, with the positive/negative torque value determined by the smaller one between the maximum torque 6072h and positive torque limit 60E0h/negative torque limit 60E1h. Alternatively, you can select the internal torque limit channel and set 2006.0Fh (P06.14 Internal positive torque limit value) and 2006.10h (P06.15 Internal negative torque limit value);
- Positioning reach threshold: If the position deviation in user unit is less than 6067h and the time reaches 6068h, it indicates that the target position has been reached, and the bit10 of status word 6041h is set to 1;

- Excessive position deviation threshold: If the position deviation 60F4h in user unit is more than 6065h, a fault is triggered, and the bit13 of status word 6041h is set to 1;
- Reference polarity 0x607E: Logic of torque, speed or position reference is set according to the bits of object 0x607E.

Bit	Name	Value	Function
Bit5	Torque reference polarity	0	Torque reference positive logic
		1	Torque reference negative logic
Bit6	Speed reference polarity	0	Speed reference positive logic
		1	Speed reference negative logic
Bit7	Position reference polarity	0	Position reference positive logic
		1	Position reference negative logic

7.4.1.4 Basic configuration

The following table describes the basic configuration of objects in the Profile Position Mode (PP).

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Target position 607Ah	Position actual value 6064h	Required
Profile velocity 6081h		Required
Other objects		Optional. You can configure them as SDO parameters, or use the default parameters of the drive.

7.4.2 Profile velocity mode

In this mode, the master station sets the target velocity, acceleration and deceleration, and the drive generates velocity profiles based on preceding settings and executes acceleration/deceleration control.

7.4.2.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
603Fh	VAR	Error code	UINT16	RW	TPDO	-
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6063h	VAR	Position actual value* (motor unit)	INT32	RO	TPDO	p
6064h	VAR	Position actual value (user unit)	INT32	RO	TPDO	Reference unit

Index	Object code	Name	Data type	Access	PDO mapping	Unit
6069h	VAR	Velocity sensor actual value	INT32	RO	TPDO	rpm
606Bh	VAR	Velocity demand value	INT32	RO	TPDO	rpm
606Ch	VAR	Velocity actual value	INT32	RO	TPDO	Reference unit/s
606Dh	VAR	Velocity window	UINT16	RW	RPDO	rpm
606Eh	VAR	Velocity window time	UINT16	RW	RPDO	ms
606Fh	VAR	Velocity threshold	UINT16	RW	RPDO	rpm
6070h	VAR	Velocity threshold time	UINT16	RW	RPDO	ms
607Eh	VAR	Polarity	UINT8	RW	RPDO	-
607Fh	VAR	Max profile velocity	UINT32	RW	RPDO	Reference unit/s
6080h	VAR	Max motor speed	UINT32	RW	RPDO	rpm
6083h	VAR	Profile acceleration	UINT32	RW	RPDO	Reference unit/s^2
6084h	VAR	Profile deceleration	UINT32	RW	RPDO	Reference unit/s^2
6091h	ARRAY	Gear ratio	UINT32	RW	RPDO	-
60FFh	VAR	Target velocity	INT32	RW	RPDO	Reference unit/s

Note: The drive has set the acceleration, deceleration, maximum speed, gear ratio factor, and other parameters related to the velocity profile. So, if the master station does not set these parameters, the default values will take effect. To change the default values, the drive shall be powered off and restarted.

7.4.2.2 Control word and status word

The control word in the Profile Velocity Mode (PV) is the same as the standard definition.

The status word in the Profile Velocity Mode (PV):

Bit15 to Bit13	Bit12	Bit11	Bit10	Bit9 to Bit0
*	Speed	*	Target reached	*

Description of status word bits in the Profile Velocity Mode (PV):

Bit	Value	Description
Target reached	0	Target velocity not reached
	1	Target velocity reached
Speed	0	Speed not being 0
	1	Speed being 0

7.4.2.3 Function description

- Control mode: Set P02.00 = 8;
- Operation mode: Set 6060h = 3;
- Target speed setting: Use 60FFh to set the target speed in user unit. If necessary, set the gear ratio 6091h;
- Acceleration curve setting: If necessary, set the profile acceleration time 6083h and profile deceleration time 6084h;
- Running enable: Enable the drive to run through the control word 6040h;
- Speed limit setting: Select the speed limit channel according to 2007.0Ah (P07.09 FWD speed limit channel) and 2007.0Ch (P07.11 REV speed limit channel). By default, the bus speed limit channel is applied, with the value determined by 607Fh (Max profile velocity) and 6080h (Max motor speed). Alternatively, you can select the internal speed limit channel and set 2007.0Bh (P07.10 FWD speed limit value) and 2007.0Dh (P07.12 REV speed limit value). Besides, you can set P20.19(2014.14h) to specify the time during which the speed is decelerated to zero from the speed limit;

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P20.19	Deceleration time for bus speed limit	0 to 65535	1	0	Immediately	At stop	The deceleration time from the maximum speed of speed limit value to zero Unit: ms

- Torque limit setting: Select the torque limit channel according to 2006.0Dh (P06.12 Positive torque limit channel) and 2006.0Eh (P06.13 Negative torque limit channel). By default, the bus torque limit channel is applied, with the positive/negative torque value determined by the smaller one between the maximum torque 6072h and positive torque limit 60E0h/negative torque limit 60E1h. Alternatively, you can select the internal torque limit channel and set 2006.0Fh (P06.14 Internal positive torque limit value) and 2006.10h (P06.15 Internal negative torque limit value);
- Speed reach threshold: If the deviation between the velocity actual value 606Ch and the target velocity 60FFh is less than 606Dh, and the time reaches 606Eh, it indicates that the target speed has been reached, and the bit10 of status word 6041h is set to 1;
- Zero-speed running threshold: If the velocity actual value 606Ch in user unit is less than 606Fh, and the time reaches 6070h, it indicates that the zero speed has been reached, and the bit12 of status word 6041h is set to 1.
- Reference polarity 0x607E: Logic of torque, speed or position reference is set according to the bits of object 0x607E.

Bit	Name	Value	Function
Bit5	Torque reference polarity	0	Torque reference positive logic
		1	Torque reference negative logic
Bit6	Speed reference polarity	0	Speed reference positive logic
		1	Speed reference negative logic
Bit7	Position	0	Position reference positive logic

Bit	Name	Value	Function
	reference polarity	1	Position reference negative logic

7.4.2.4 Basic configuration

The following table describes the basic object configurations in the Profile Velocity Mode (PV).

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Target velocity 60FFh		Required
	Velocity actual value 606Ch	Optional
Other objects		Optional. You can configure them as SDO parameters, or use the default parameters of the drive.

7.4.3 Profile torque mode

A servo drive (slave station) receives torque reference from a host controller (master station) for torque control.

7.4.3.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
603Fh	VAR	Error code	UINT16	RW	TPDO	-
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6063h	VAR	Position actual value* (motor unit)	INT32	RO	TPDO	Encoder unit
6064h	VAR	Position actual value (user unit)	INT32	RO	TPDO	Reference unit
6069h	VAR	Velocity sensor actual value	INT32	RO	TPDO	rpm
606Bh	VAR	Velocity demand value	INT32	RO	TPDO	rpm
606Ch	VAR	Velocity actual value	INT32	RO	TPDO	Reference unit/s
606Dh	VAR	Velocity window	UINT16	RW	RPDO	rpm
606Eh	VAR	Velocity window time	UINT16	RW	RPDO	ms
606Fh	VAR	Velocity threshold	UINT16	RW	RPDO	rpm

Index	Object code	Name	Data type	Access	PDO mapping	Unit
6070h	VAR	Velocity threshold time	UINT16	RW	RPDO	ms
6071h	VAR	Target torque	INT16	RW	RPDO	0.1%
6072h	VAR	Max torque	UINT16	RW	RPDO	0.1%
6074h	VAR	Torque demand	INT16	RO	TPDO	0.1%
6077h	VAR	Torque actual value	INT16	RO	TPDO	0.1%
607Eh	VAR	Polarity	UINT8	RW	RPDO	-
607Fh	VAR	Max profile velocity	UINT32	RW	RPDO	Reference unit/s
6080h	VAR	Max motor speed	UINT32	RW	RPDO	rpm
6087h	VAR	Torque slope	UINT16	RW	RPDO	0.1%/s
60E0h	VAR	FWD torque limit	UINT16	RW	RPDO	0.1%
60E1h	VAR	REV torque limit	UINT16	RW	RPDO	0.1%

7.4.3.2 Control word and status word

The control word in the Profile Torque Mode (PT) is the same as the standard definition.

The status word in the Profile Torque Mode (PT):

Bit15 - Bit13	Bit12	Bit11	Bit10	Bit9 - Bit0
*	*	*	Target reached	*

Description of status word bits in the Profile Torque Mode (PT):

Bit	Value	Description
Target reached	0	Target torque not reached
	1	Target torque reached

7.4.3.3 Function description

- Control mode: Set P02.00 = 8;
- Operation mode: Set 6060h = 4;
- Target torque setting: Use 6071h to set the target torque in user unit, unit 0.1%;
- Speed limit setting: Select the speed limit channel according to the function code object dictionary 2007.0Ah(P07.09 forward speed limit channel) and 2007.0Ch(P07.11 reverse speed limit channel). By default, the bus speed limit channel is applied, with the value determined by 607Fh (Max profile velocity) and 6080h (Max motor speed). Alternatively, you can select the internal speed limit channel and set 2007.0Bh (P07.10 FWD speed limit value) and 2007.0Dh (P07.12 REV speed limit value). Besides, you can set P20.19(2014.14h) to specify the time during which the speed is decelerated to zero from the speed limit;

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P20.19	Deceleration time for bus speed limit	0 to 65535	1	0	Immediately	At stop	The deceleration time from the maximum speed of speed limit value to zero Unit: ms

- Torque limit setting: Select the torque limit channel according to 2006.0Dh (P06.12 Positive torque limit channel) and 2006.0Eh (P06.13 Negative torque limit channel). By default, the bus torque limit channel is applied, with the positive/negative torque value determined by the smaller one between the maximum torque 6072h and positive torque limit 60E0h/negative torque limit 60E1h. Alternatively, you can select the internal torque limit channel and set 2006.0Fh (P06.14 Internal positive torque limit value) and 2006.10h (P06.15 Internal negative torque limit value);
- Running enable: Enable the drive to run through the control word 6040h;
- Reference polarity 0x607E: Logic of torque, speed or position reference is set according to the bits of object 0x607E.

Bit	Name	Value	Function
Bit5	Torque reference polarity	0	Torque reference positive logic
		1	Torque reference negative logic
Bit6	Speed reference polarity	0	Speed reference positive logic
		1	Speed reference negative logic
Bit7	Position reference polarity	0	Position reference positive logic
		1	Position reference negative logic

- Torque reach function

  This function defines whether the actual torque feedback has reached the torque window. If the difference between the Torque actual value (6077h) and the Base value for torque reached (2007.0Eh) is greater than the Valid value for torque reached (2007.0Fh), bit10 (target_reached) of the status word will be set to 1. When the difference between the Torque actual value (6077h) and the Base value for torque reached (2007.0Eh) falls below the Invalid value for torque reached (2007.10h), bit10 (target_reached) of the status word will be immediately cleared.

7.4.3.4 Basic configuration

The following table describes the basic object configurations in the Profile Torque Mode (PT).

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Target torque 6071h		Required
	Torque actual value 6077h	Optional
Other objects		Optional. You can configure them as SDO parameters, or use the default parameters of the drive.

7.4.4 Homing mode

The M3-N drive supports the homing mode. In this mode, the drive returns to the specified position according to the set homing mode, homing speed, and homing offset.

7.4.4.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6098h	VAR	Homing method	INT8	RW	RPDO	-
607Ch	VAR	Home offset	INT32	RW	RPDO	Reference unit
6099h	ARRAY	Homing speeds	UINT32	RW	RPDO	Reference unit/s
609Ah	VAR	Homing acceleration	UINT32	RW	RPDO	Reference unit/s^2

Object description:

- Homing method (6098h)

M3-N drive supports standard CiA 402 mode -4 to mode 35.

- Homing offset (607Ch)

Number of offset pulses after the M3-N drive finds the home.

- Homing speeds (6099h)

Sub-index	Description	Unit
0	Number of subindexes (2)	-
1	Homing high speed	rpm
2	Homing low speed	rpm

7.4.4.2 Control word and status word

The control word in the Homing Mode:

Bit15 to Bit5	Bit4	Bit3 to Bit0
*	Homing start	*

Description of control word bits in the Homing Mode:

Bit	Value	Description
Homing start	0->1	Start the Homing
	1	Homing in progress
	1->0	End the Homing

The status word in the Homing Mode:

Bit15 to Bit14	Bit13	Bit12	Bit11	Bit10	Bit9 to Bit0
*	Homing error	Homing attained	*	Target reached	*

Description of status word bits in the Homing Mode:

Bit	Value	Description
Target reached	0	Target position not reached
	1	Target position reached
Homing attained	0	Unsuccessful Homing
	1	Successful Homing
Homing error	0	Homing error free
	1	Homing error occurred

7.4.4.3 Function description

- Operation mode: Set 6060h = 6;
- Homing method setting: Select the homing method from object 6098h;
- Homing offset setting: Select the homing offset value from object 607Ch;

P12.11 = 0 After finding the home, position feedback 6064h = 607Ch

P12.11 = 1 After finding the home, position feedback 6064h = current position + home offset 607Ch

P12.11 = 2 After finding the home, continue to execute the home offset position segment. After the execution is completed, the position feedback 6064h = 0

P12.11 = 3 After finding the home, continue to execute the home offset position segment. After the execution is completed, the position feedback 6064h = 607Ch

Note: When P12.11 = 0/1, the drive does not actually perform position offset displacement.

- Homing speed setting: Set the speed of the drive during homing using the subindexes 01h and 02h of object 6099h;
- Homing enable: Enable the drive homing using the control word 6040h.

7.4.4.4 Basic configuration

The following table describes the basic configuration of objects in the Homing Mode.

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Homing method 6098h		Optional. You can configure it as an SDO parameter.
Homing offset 607Ch		Optional. You can configure it as an SDO parameter.
Homing speed 6099-01h		Optional. You can configure it as an SDO parameter.
Homing speed 6099-02h		Optional. You can configure it as an SDO parameter.
Other objects		Optional. You can configure them as SDO parameters.

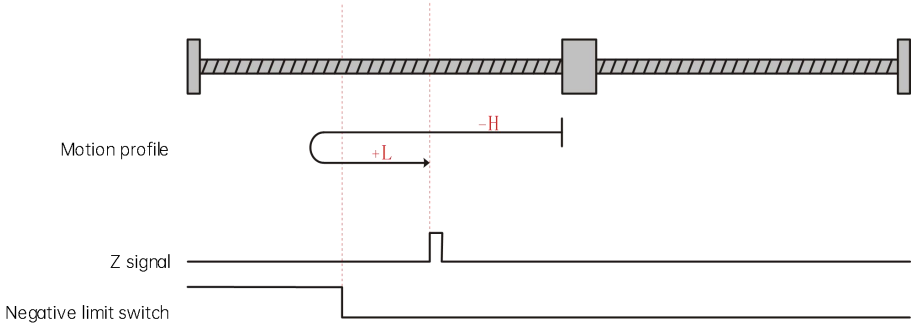
7.4.4.5 Homing mode

To support more applications, the M3-N series servo system supports CANopen CiA402 homing modes -4 to 35.

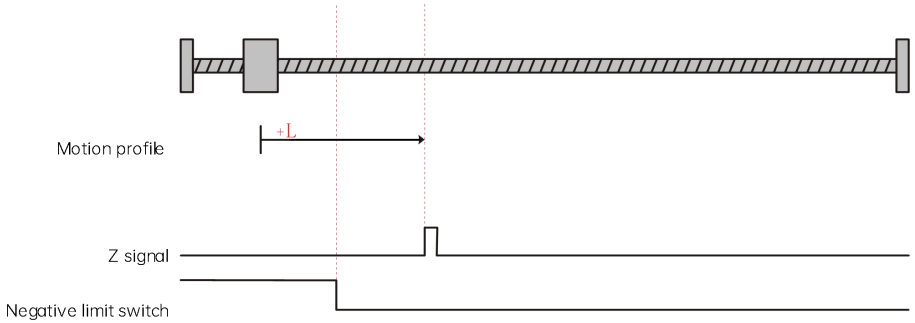
- 0x6098 = 1

Reverse, negative limit switch as deceleration point and Z signal as home

The current position of the motor is where the negative limit switch is inactive. When the homing is started, the negative limit switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at low speed. After reaching the falling edge of the negative limit switch, the motor continues to run in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



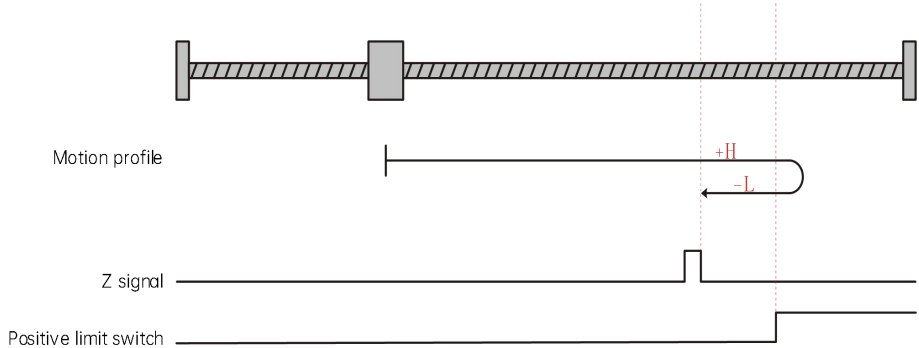
The current position of the motor is at the negative limit switch. When the homing is started, the negative limit switch is at high level, and the motor starts homing in the forward direction at low speed. After reaching the falling edge of the negative limit switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



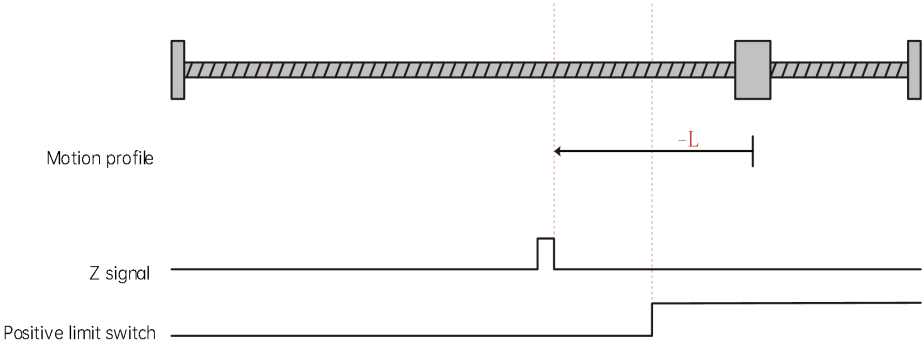
- 0x6098 = 2

Forward, positive limit switch as deceleration point and Z signal as home

The current position of the motor is where the positive limit switch is inactive. When the homing is started, the positive limit switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at low speed. After reaching the falling edge of the positive limit switch, the motor continues to run in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



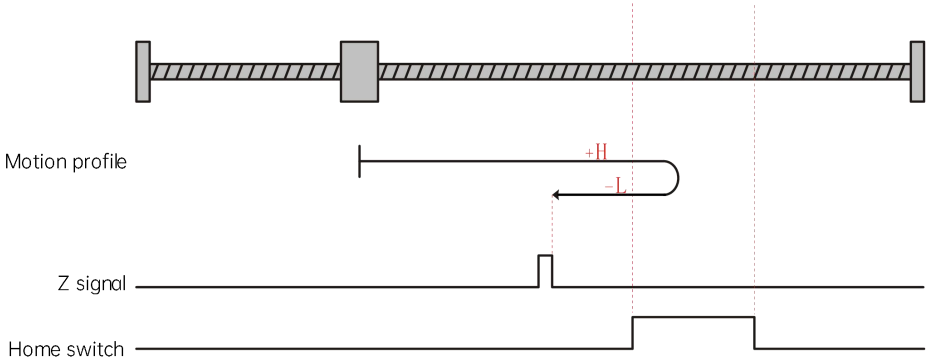
The current position of the motor is at the positive limit switch. When the homing is started, the positive limit switch is at high level, and the motor starts homing in the reverse direction at low speed. After reaching the falling edge of the positive limit switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



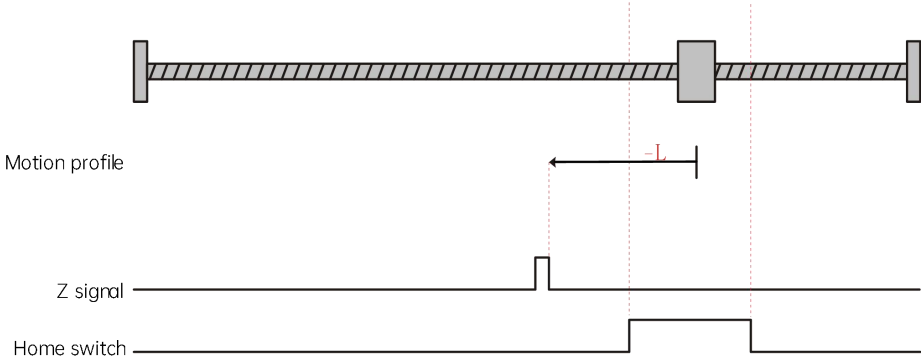
- 0x6098 = 3

Forward, home switch as deceleration point and Z signal as home

The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor continues to run in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



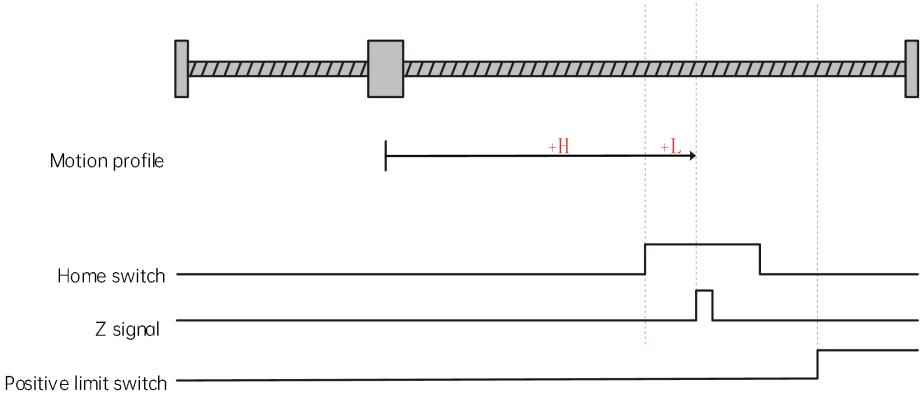
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



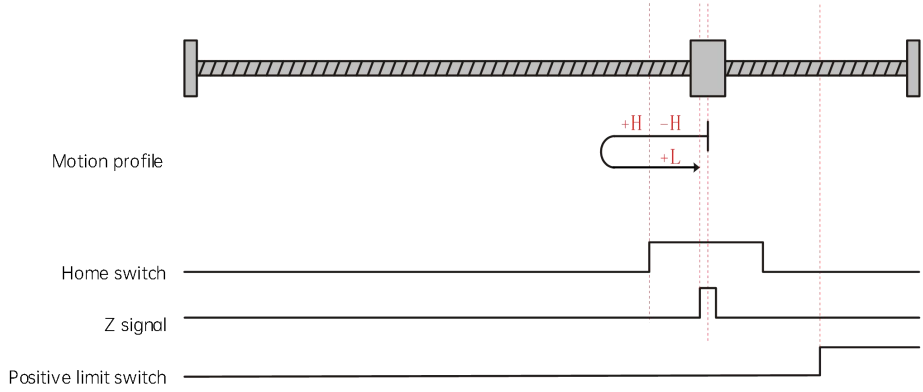
- 0x6098 = 4

Forward, home switch as deceleration point and Z signal as home

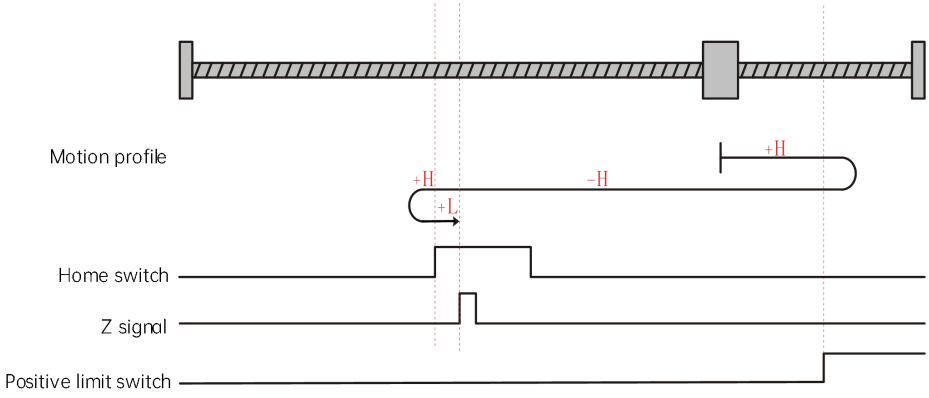
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



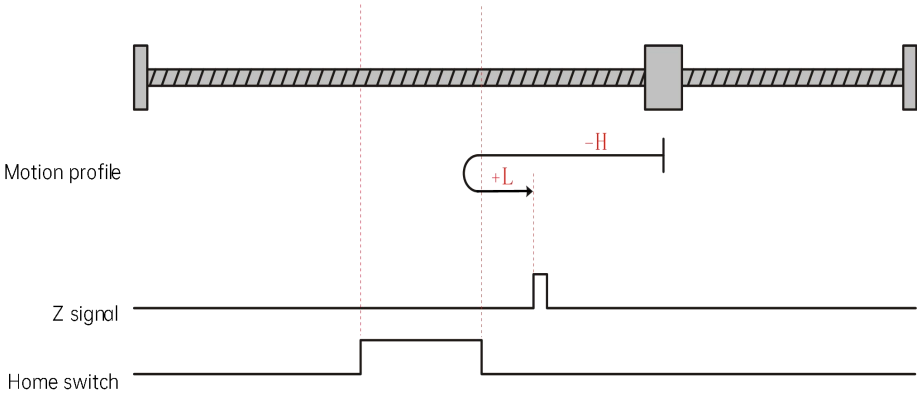
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



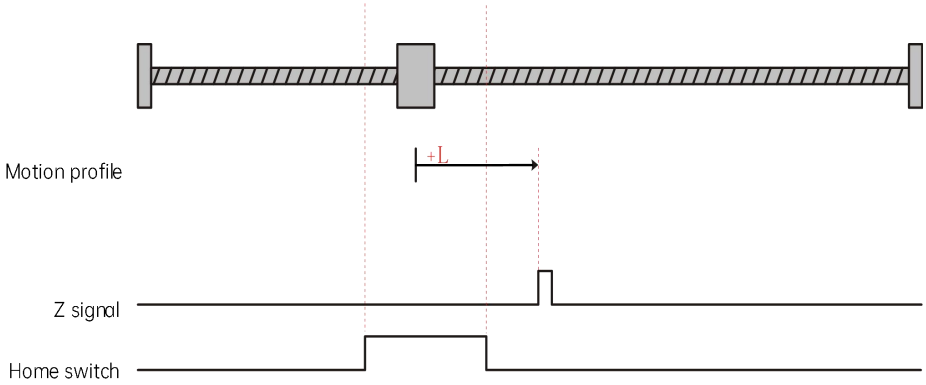
- 0x6098 = 5

Reverse, home switch as deceleration point and Z signal as home

The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed. After reaching the falling edge of the home switch, the motor continues to run in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



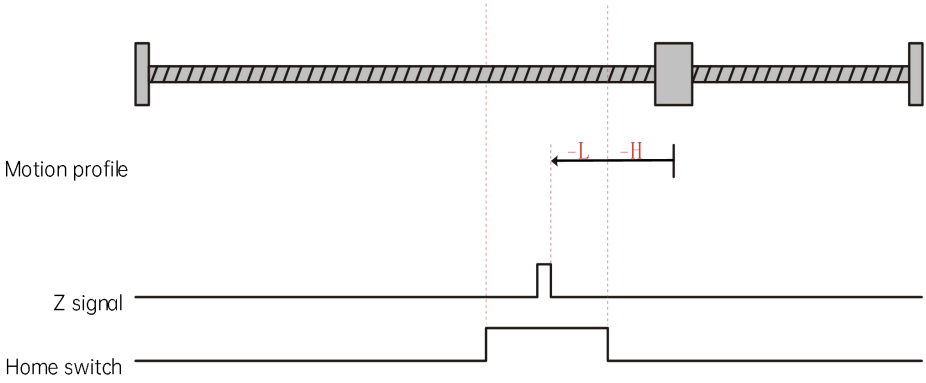
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at low speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low-speed, and stops when reaching the rising edge of the Z signal.



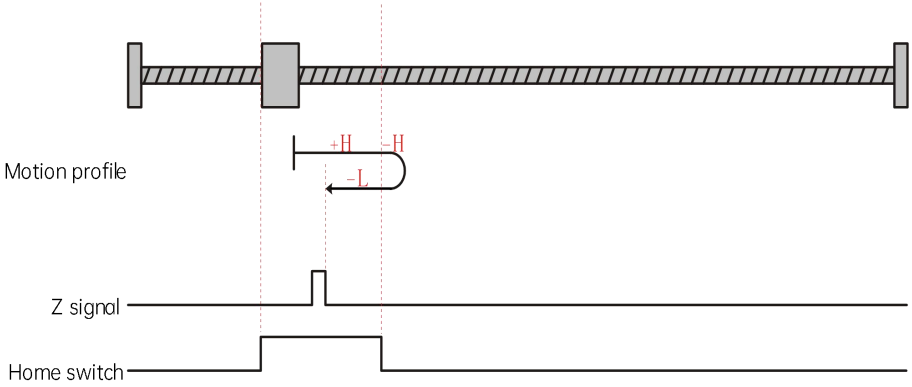
- 0x6098 = 6

Reverse, home switch as deceleration point and Z signal as home

The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



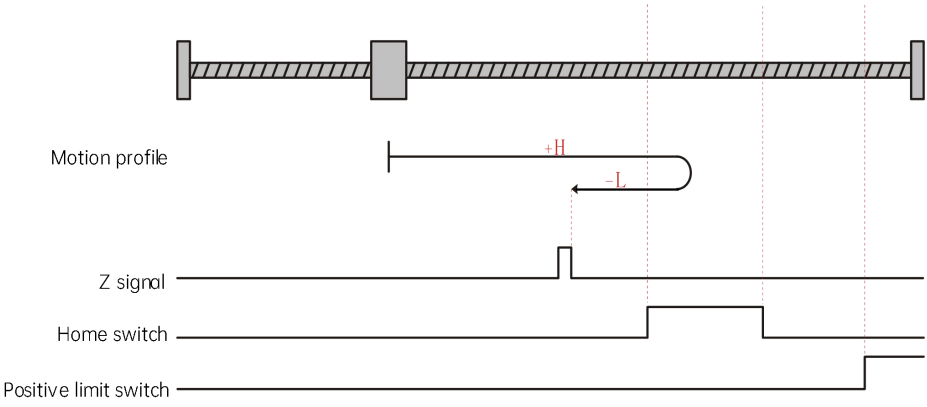
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



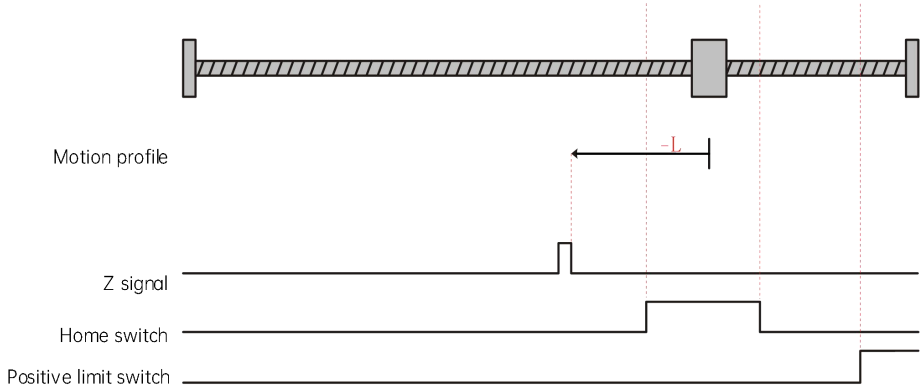
- 0x6098 = 7

Forward, home switch as deceleration point and Z signal as home

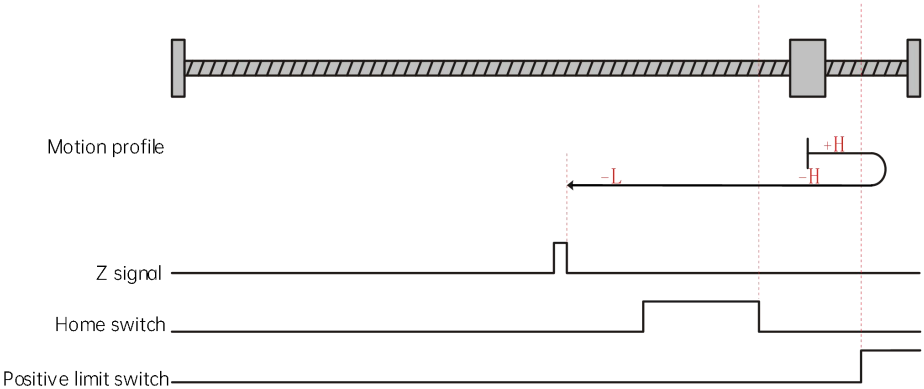
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor continues to run in the reverse direction at low speed, and stops when reaching at the rising edge of the Z signal.



The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



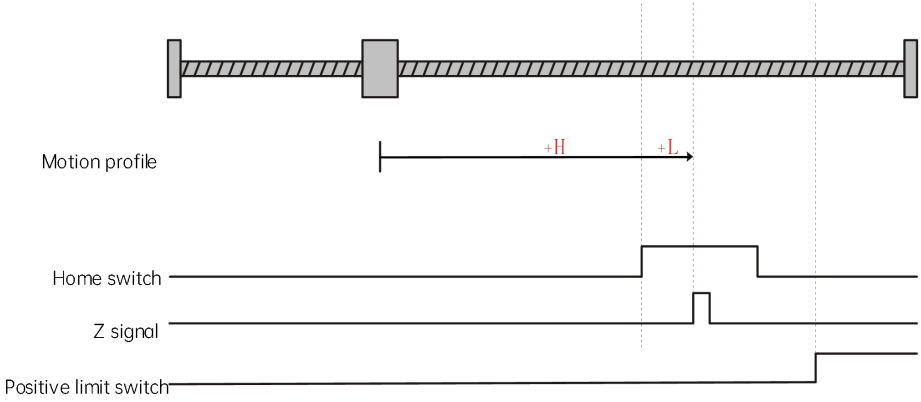
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



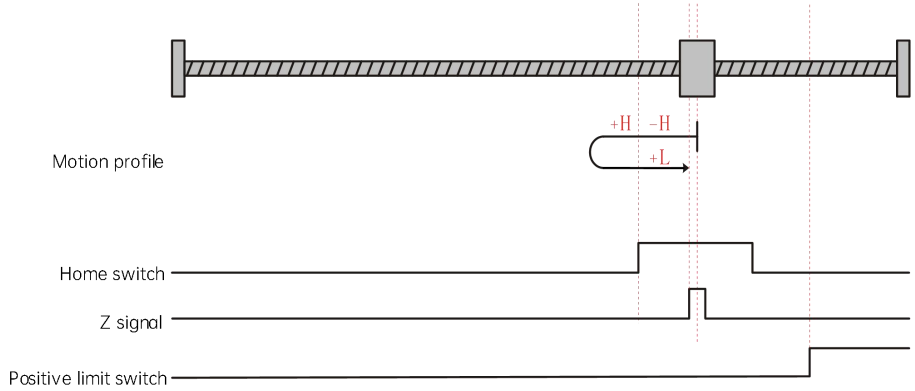
- 0x6098 = 8

Forward, home switch as deceleration point and Z signal as home

The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.

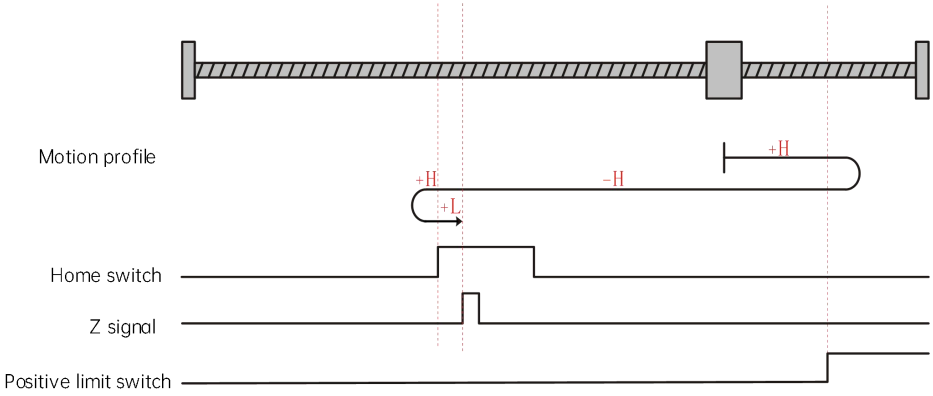


The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the

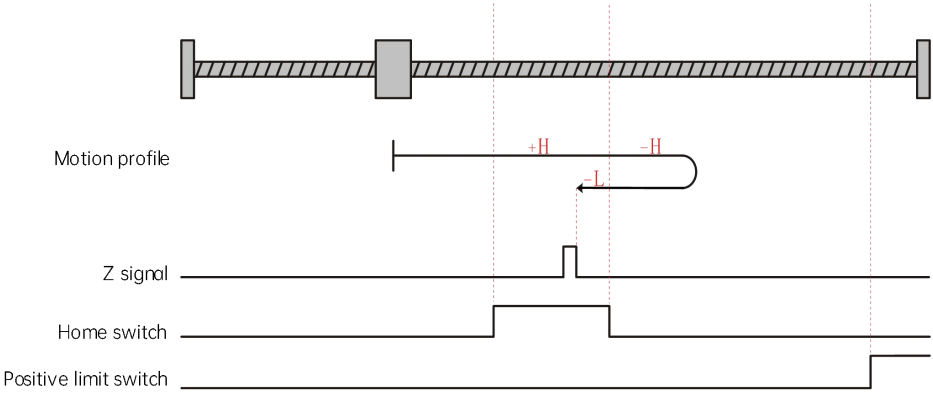
home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



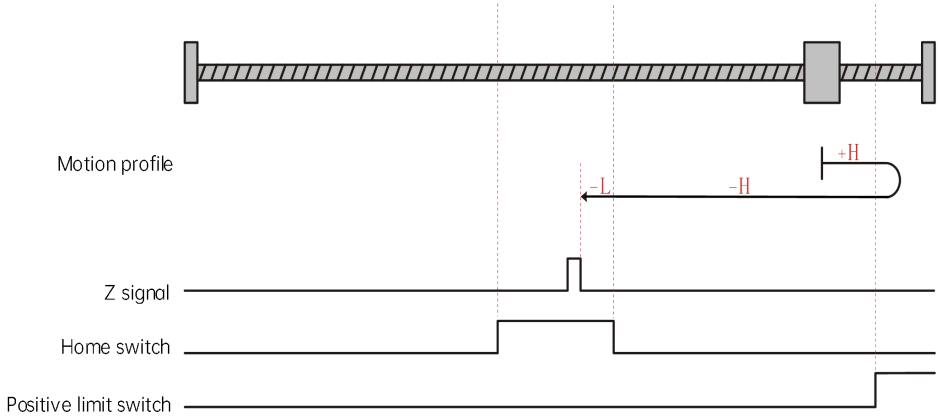
- 0x6098 = 9

Forward, home switch as deceleration point and Z signal as home

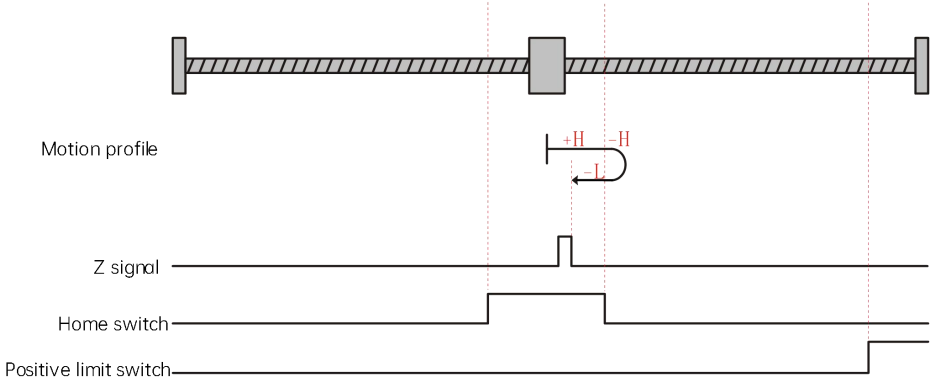
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



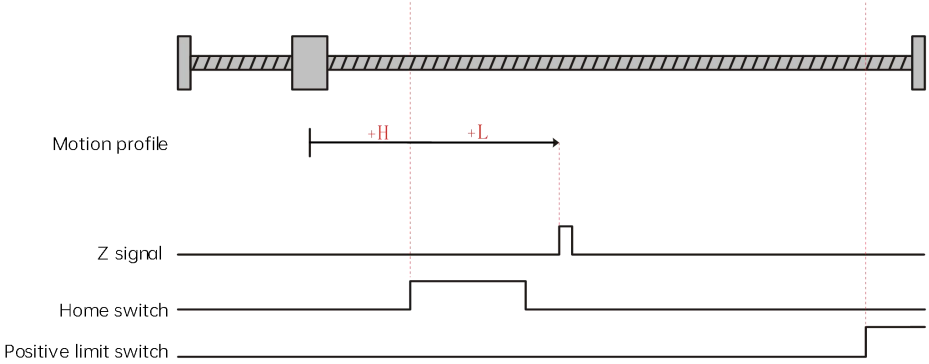
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



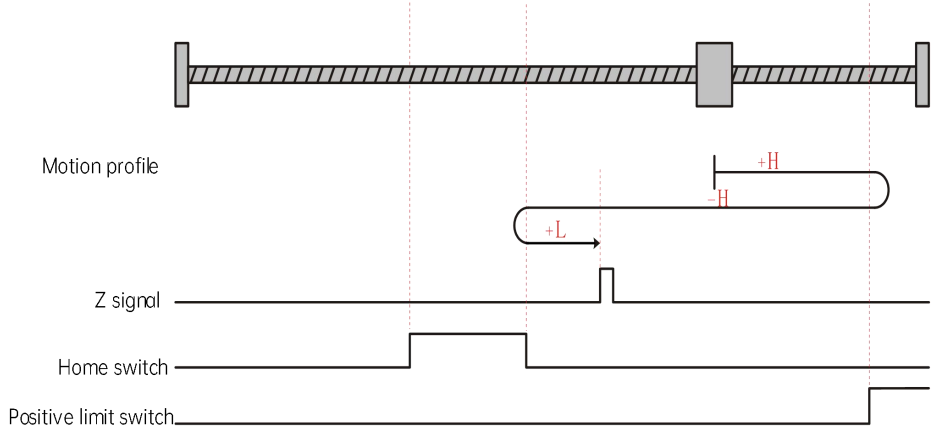
- 0x6098 = 10

Forward, home switch as deceleration point and Z signal as home

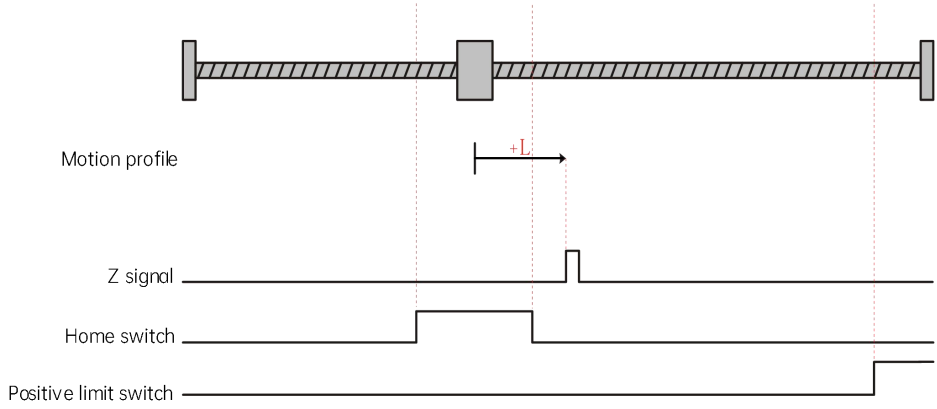
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



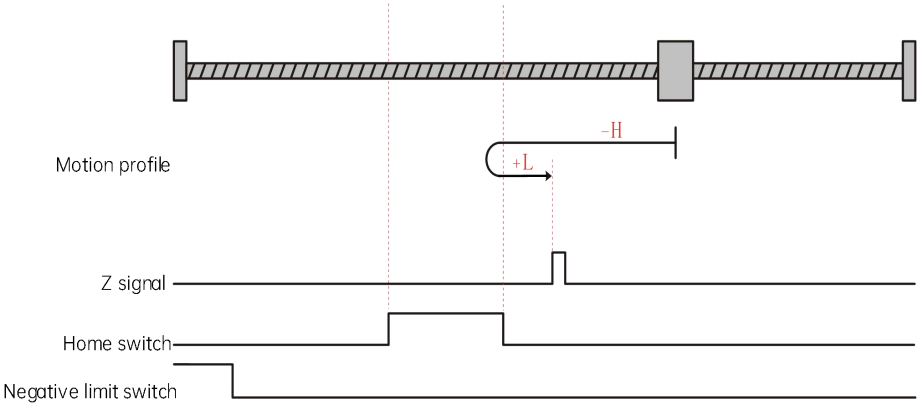
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



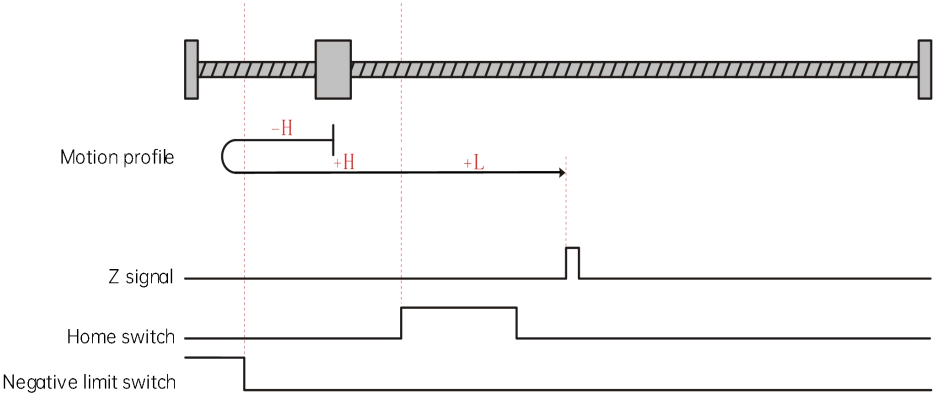
- 0x6098 = 11

Reverse, home switch as deceleration point and Z signal as home

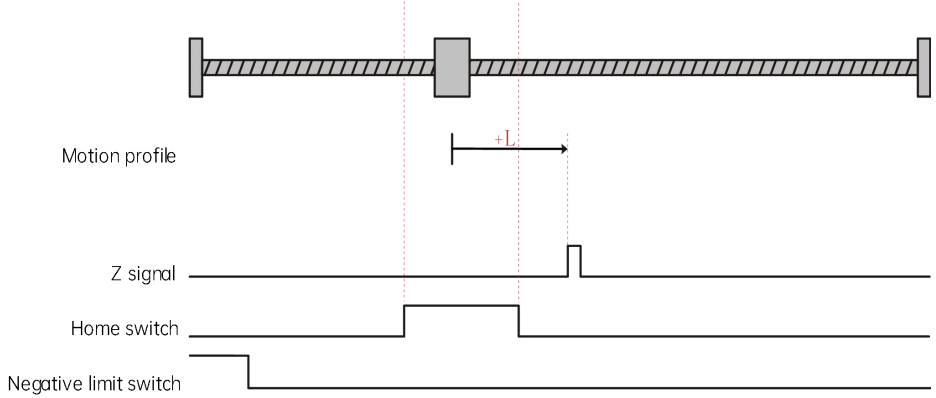
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



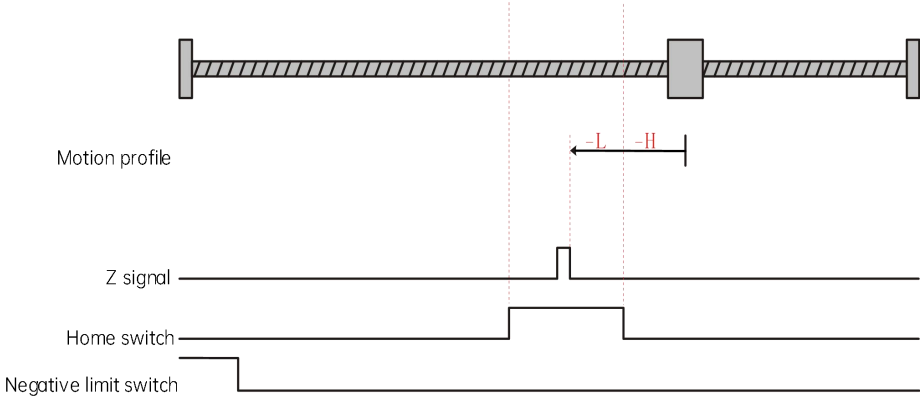
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



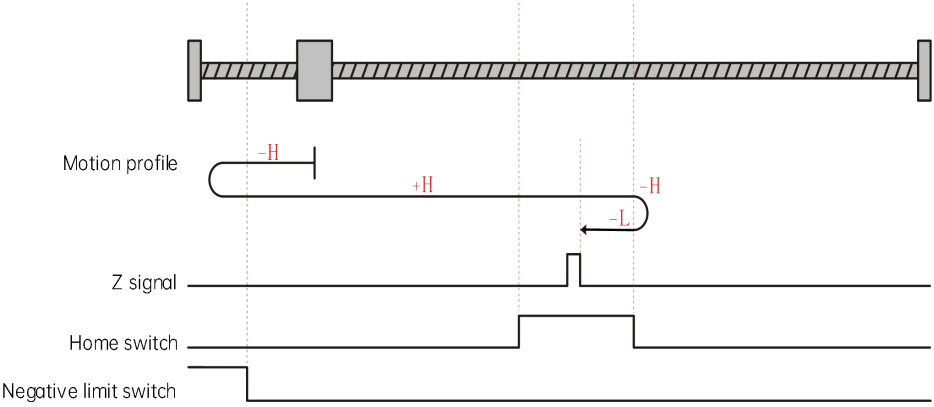
- 0x6098 = 12

Reverse, home switch as deceleration point and Z signal as home

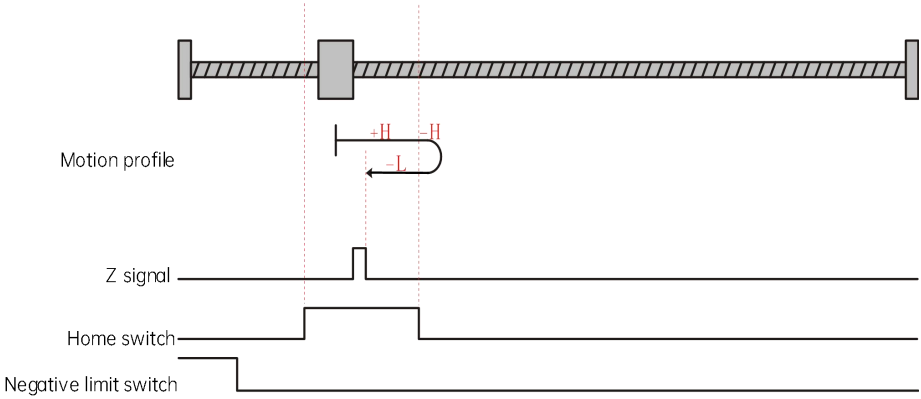
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



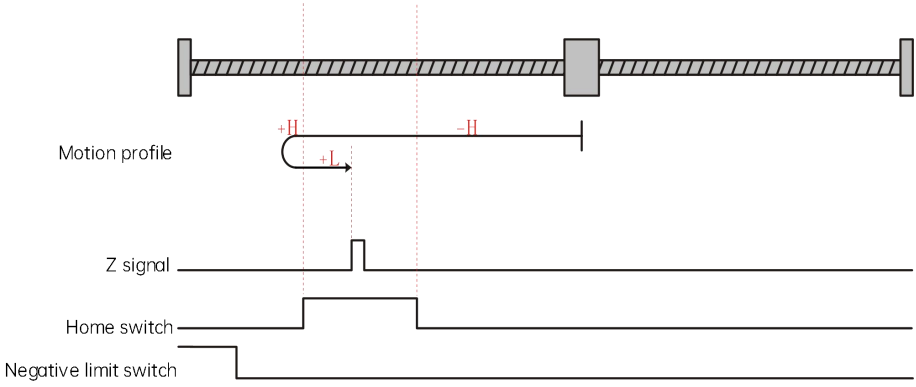
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



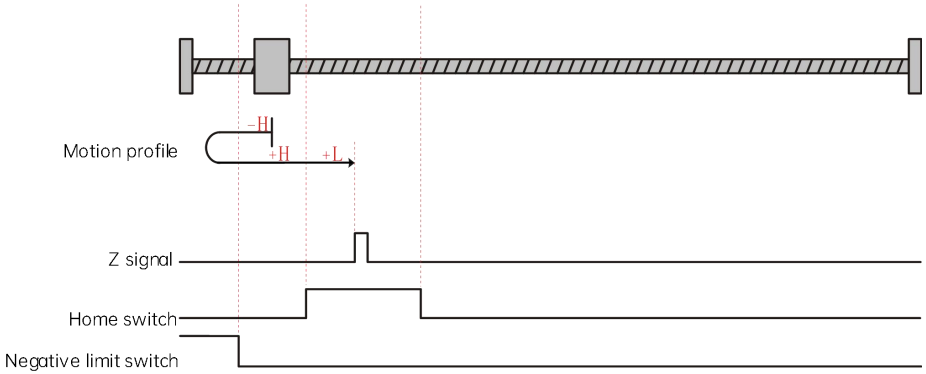
- 0x6098 = 13

Reverse, home switch as deceleration point and Z signal as home

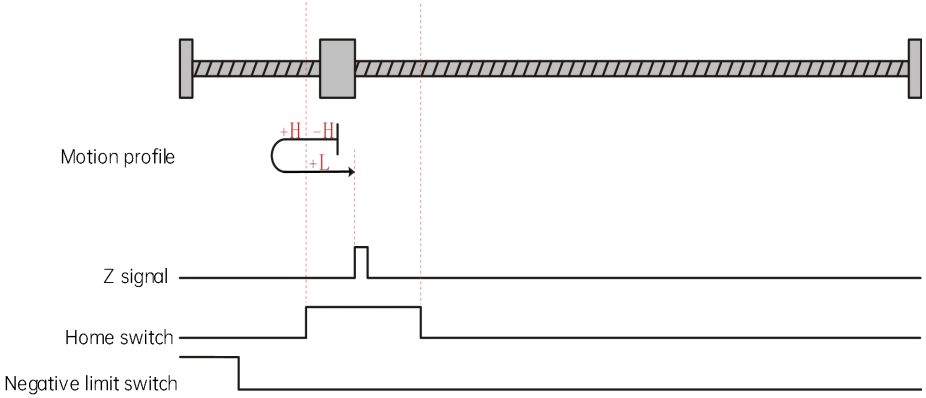
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



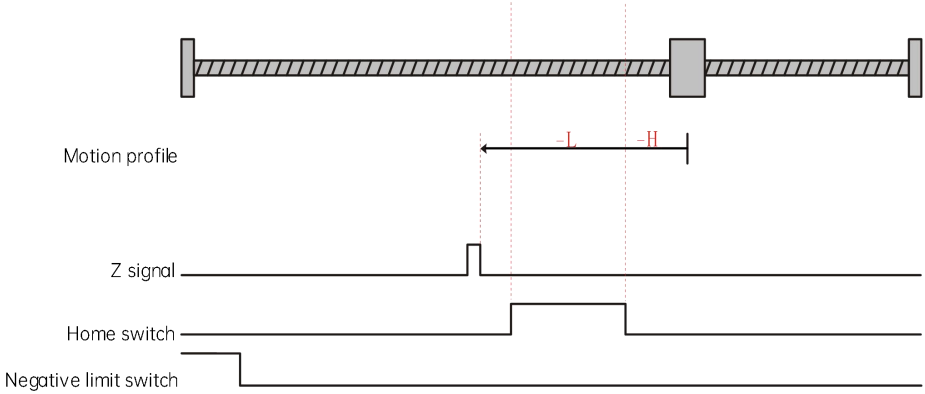
The current position of the motor is where the home switch is valid. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



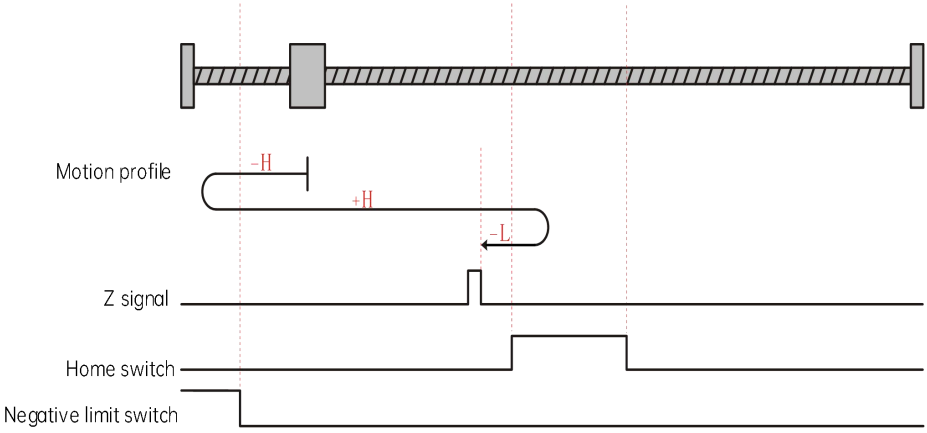
- 0x6098 = 14

Reverse, home switch as deceleration point and Z signal as home

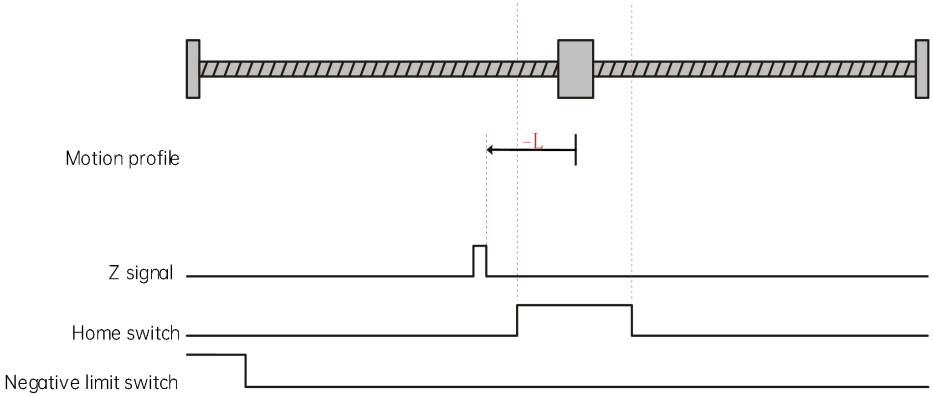
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



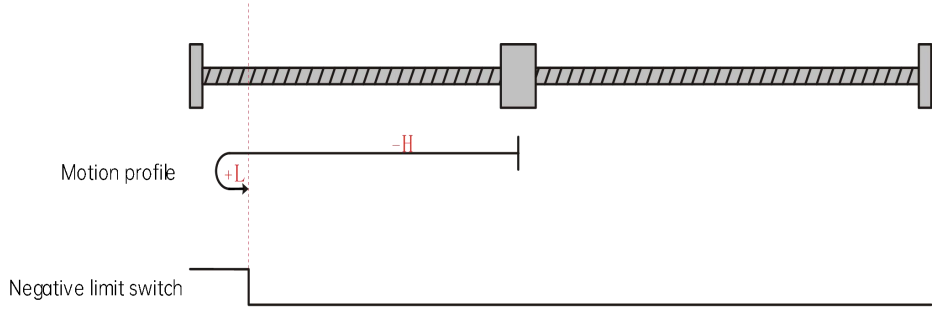
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



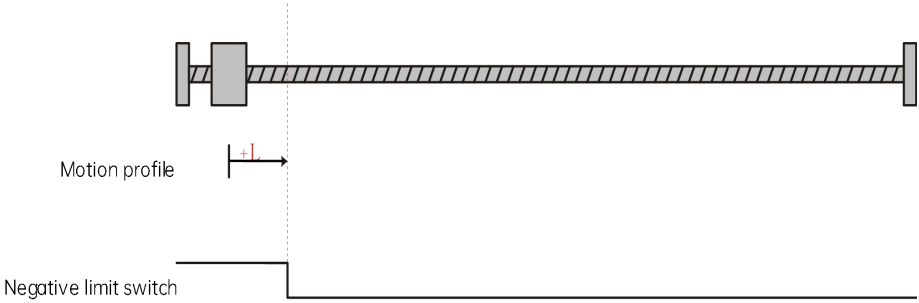
- 0x6098 = 17

Reverse, negative limit switch as deceleration point and home

The current position of the motor is where the negative limit switch is inactive. When the homing is started, the negative limit switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the negative limit switch.



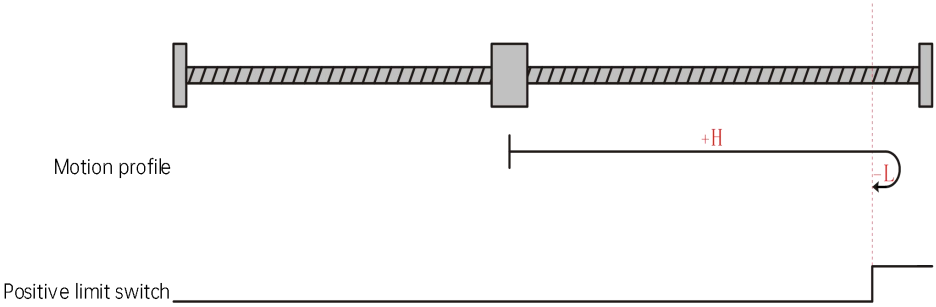
The current position of the motor is where the negative limit switch is valid. When the homing is started, the negative limit switch is at high level, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the negative limit switch.



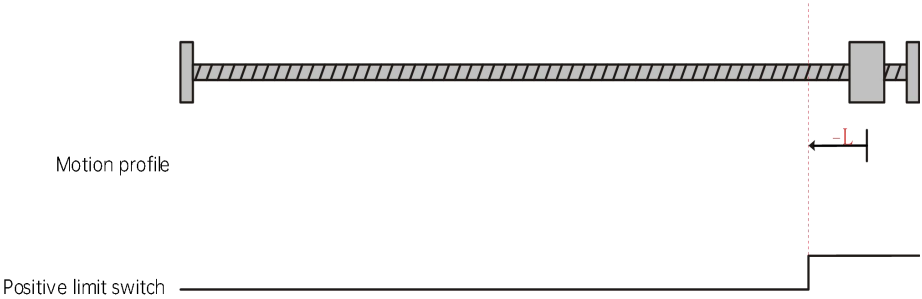
- 0x6098 = 18

Forward, positive limit switch as deceleration point and home

The current position of the motor is where the positive limit switch is inactive. When the homing is started, the positive limit switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the positive limit switch.



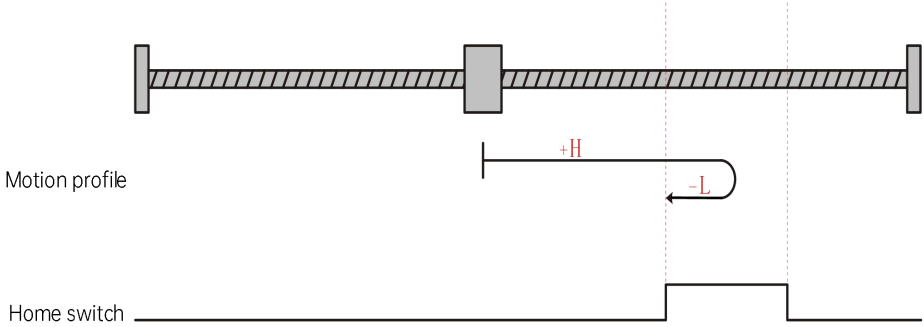
The current position of the motor is where the positive limit switch is active. When the homing is started, the positive limit switch is at high level, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the positive limit switch.



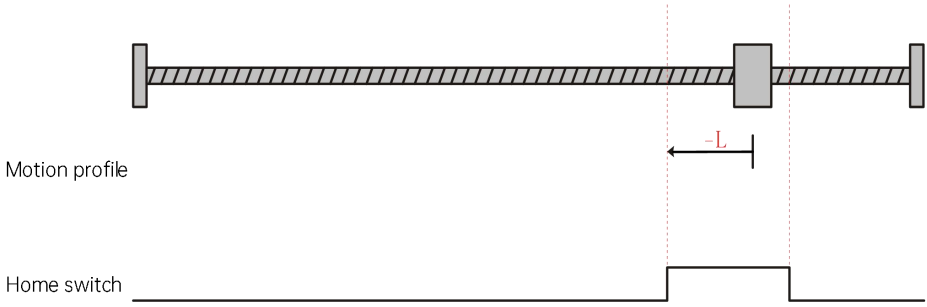
- 0x6098 = 19

Forward, home switch as deceleration point and home

The current position of the motor is where the home switch is inactive. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



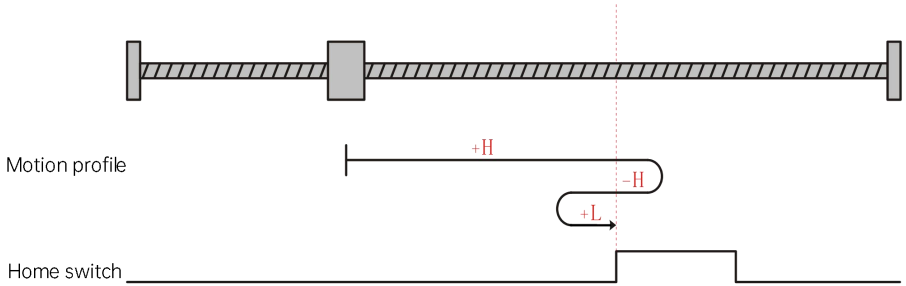
The current position of the motor is where the home switch is valid. When the homing is started, the home switch is at high level, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



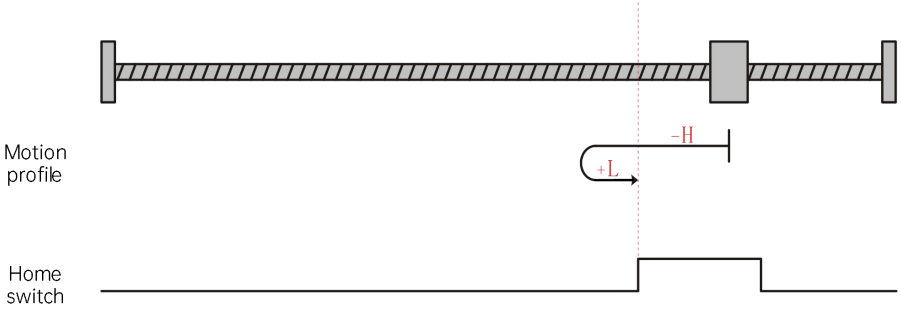
- 0x6098 = 20

Forward, home switch as deceleration point and home

The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



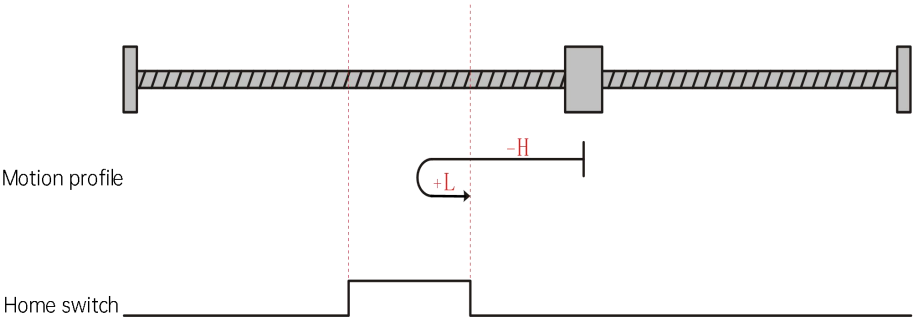
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



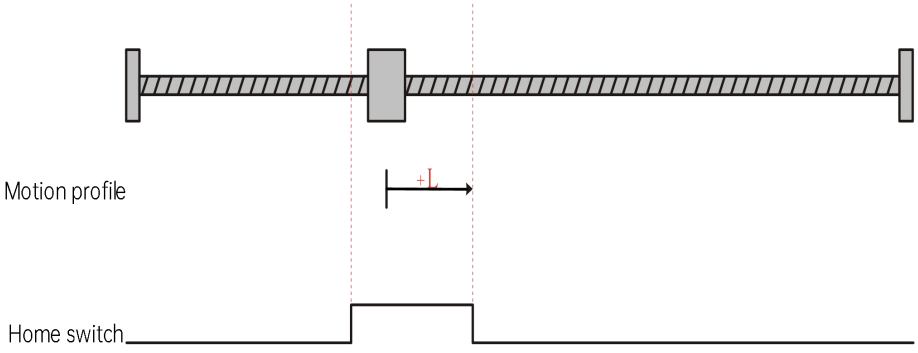
- 0x6098 = 21

Reverse, home switch as deceleration point and home

The current position of the motor is where the home switch is inactive. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



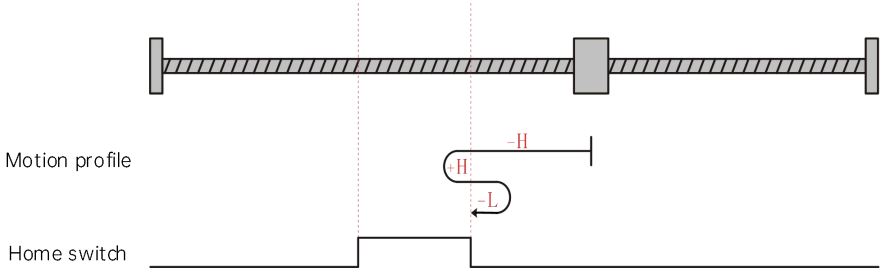
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



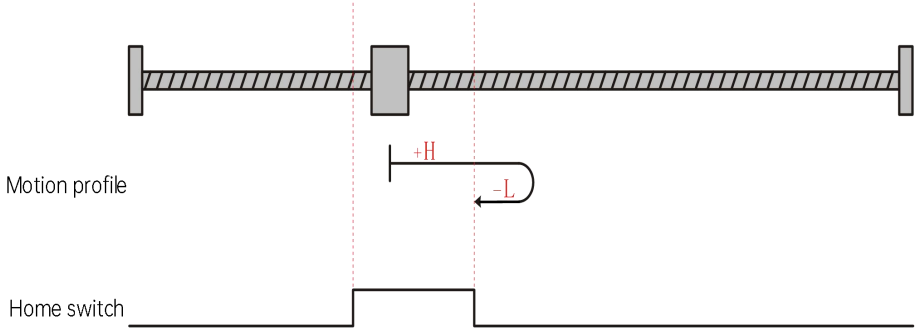
- 0x6098 = 22

Reverse, home switch as deceleration point and home

The current position of the motor is between the home switch and the positive limit switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



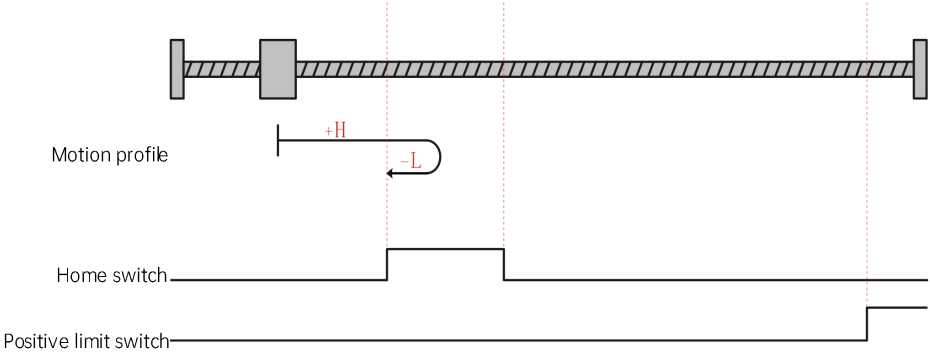
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



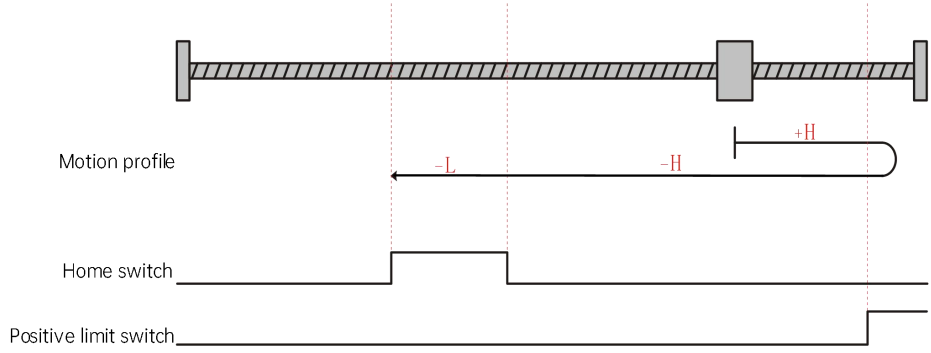
- 0x6098 = 23

Forward, home switch as deceleration point and home

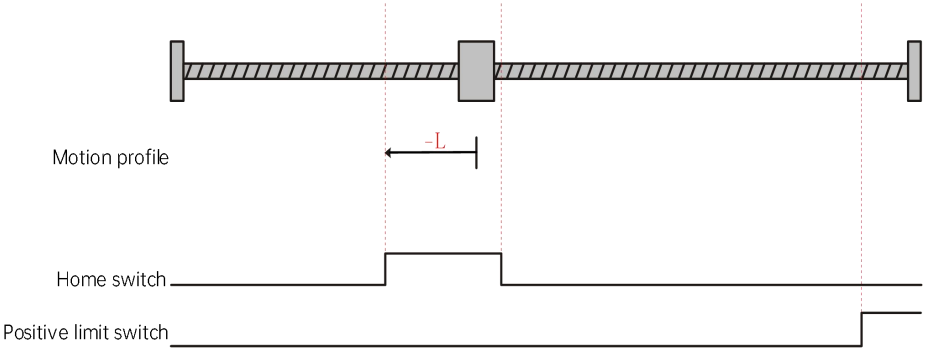
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



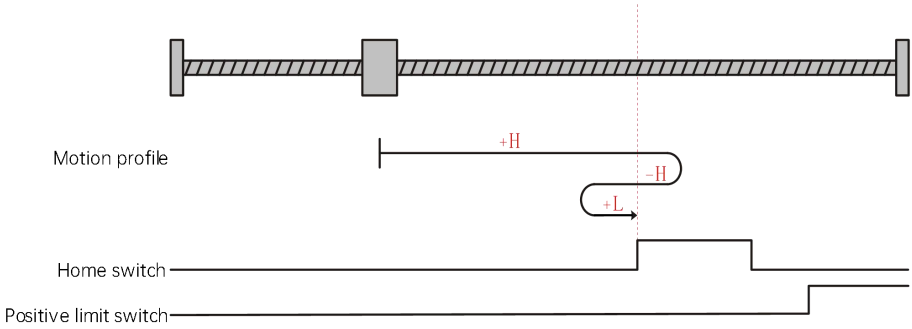
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



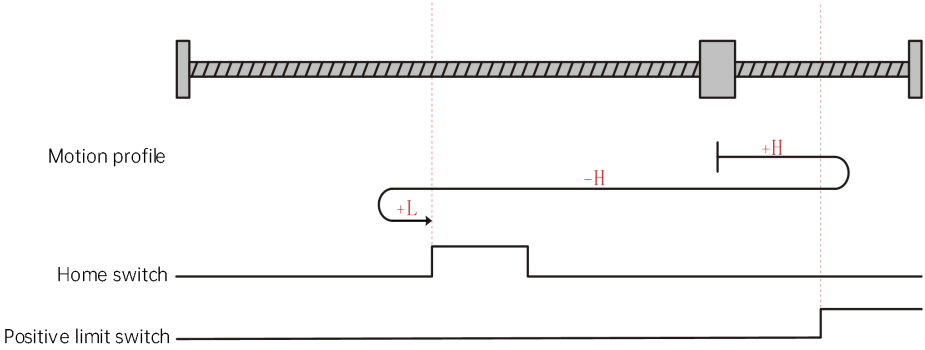
- 0x6098 = 24

Forward, home switch as deceleration point and home

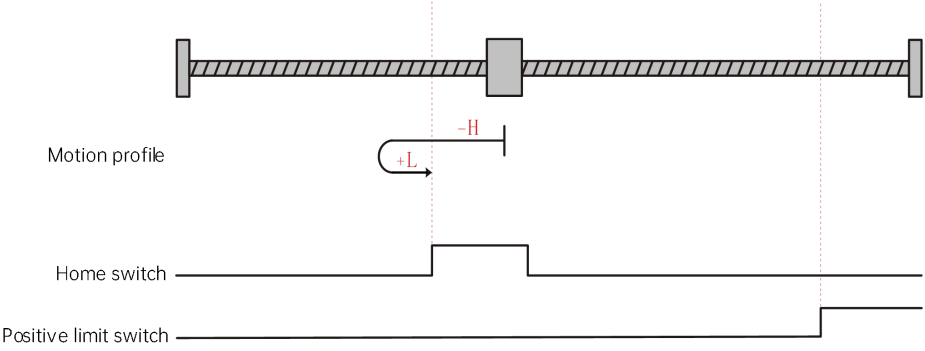
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



The current position of the motor is between the home switch and the positive limit switch. When the homing is started, the home switch is at low level, and the motor starts homing in the forward direction at high speed. After reaching the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



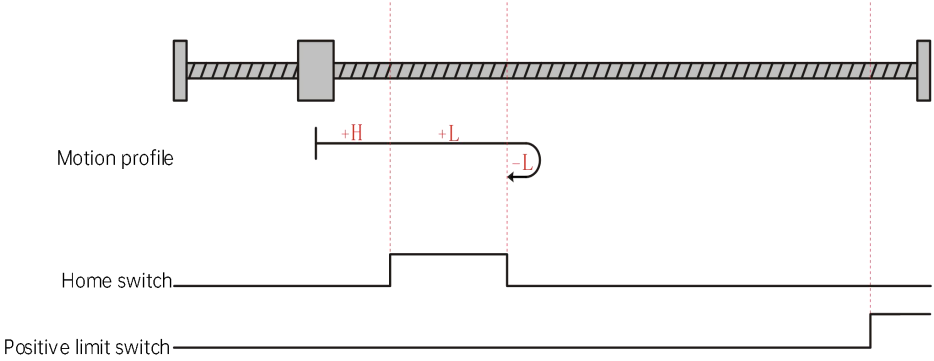
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the reverse direction at high speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



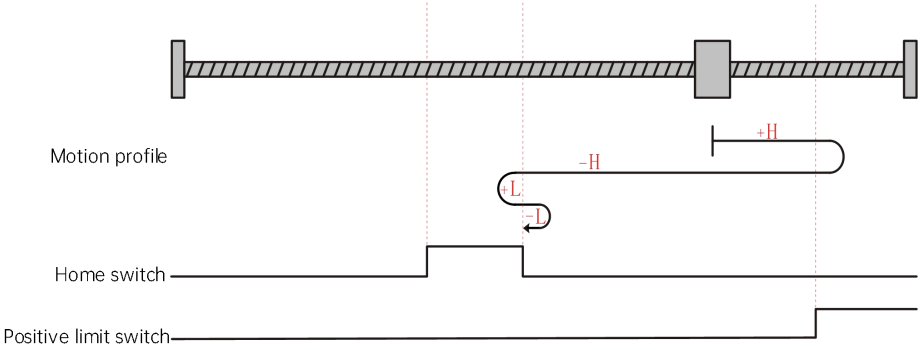
- 0x6098 = 25

Forward, home switch as deceleration point and home

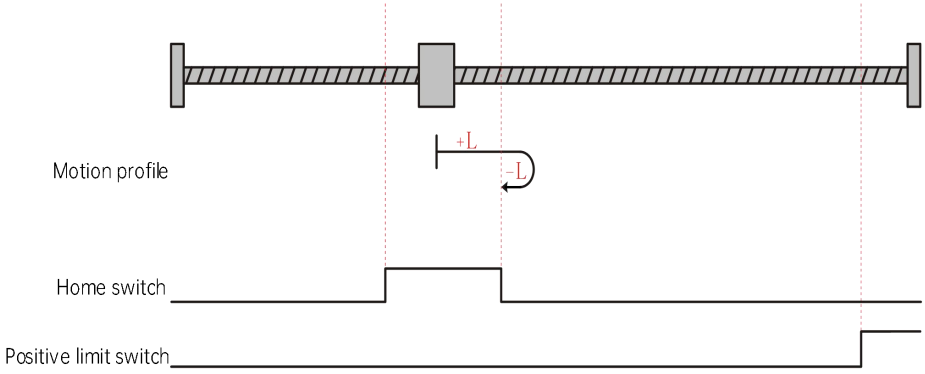
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



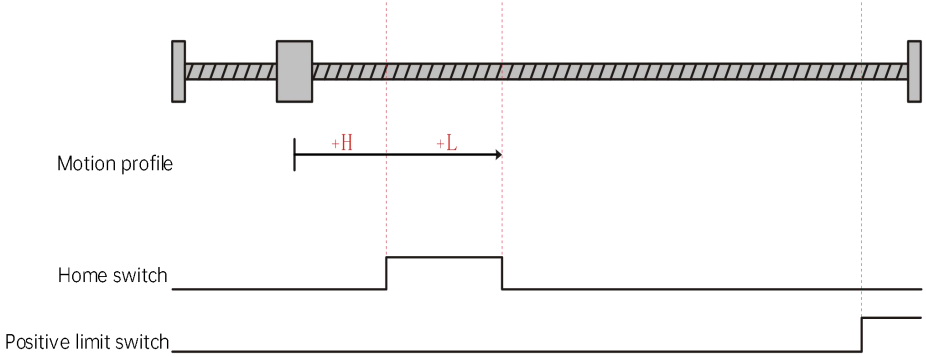
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the forward direction at low speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



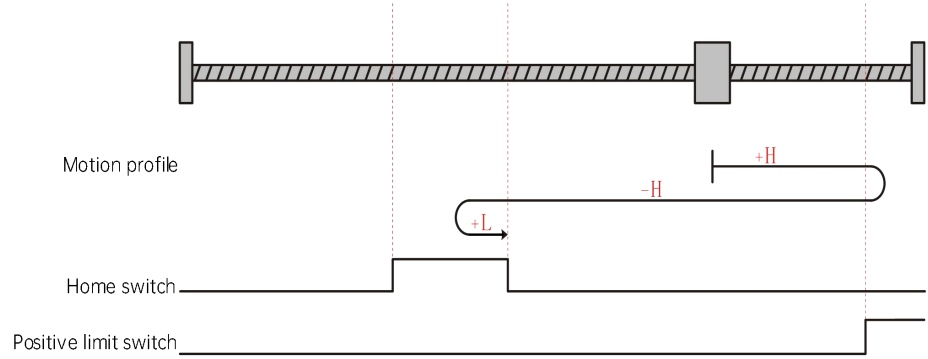
- 0x6098 = 26

Forward, home switch as deceleration point and home

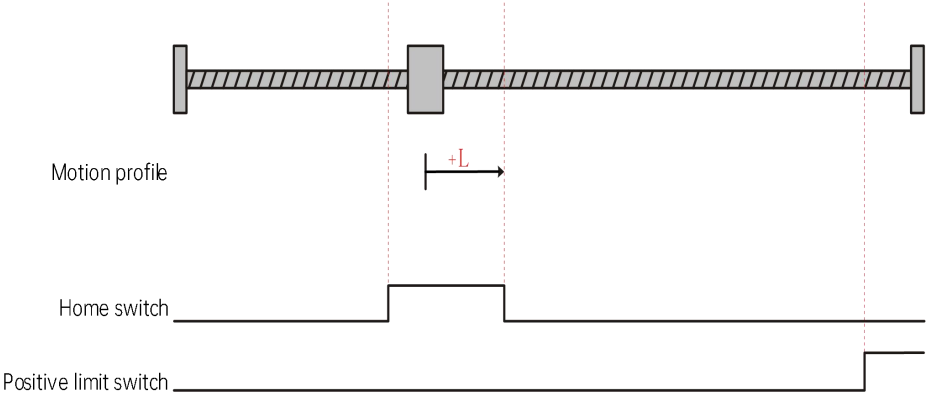
The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the forward direction at high speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



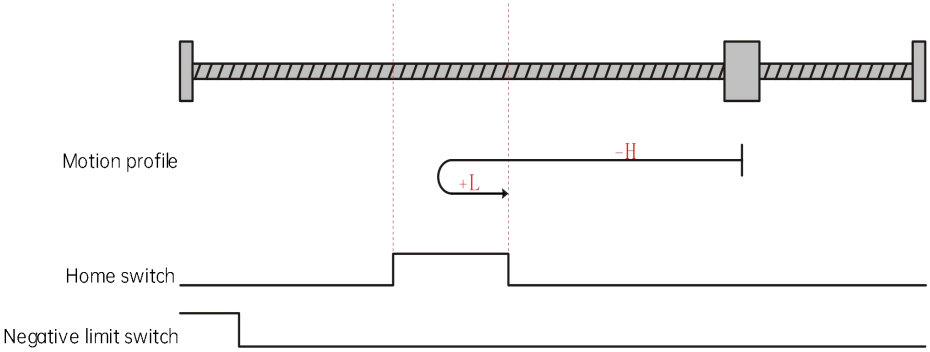
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



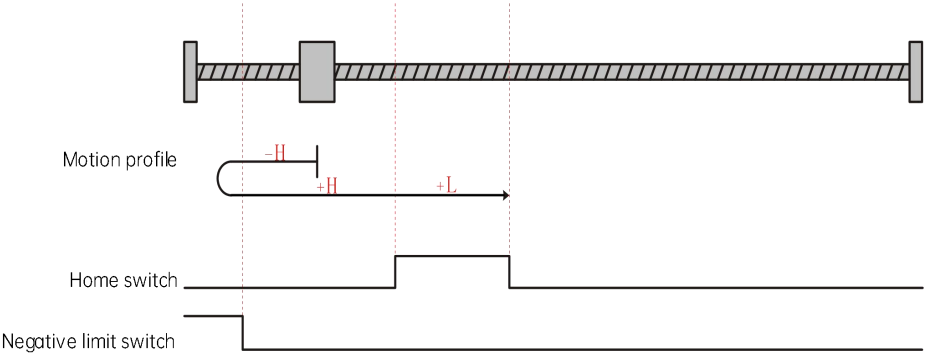
- 0x6098 = 27

Reverse, home switch as deceleration point and home

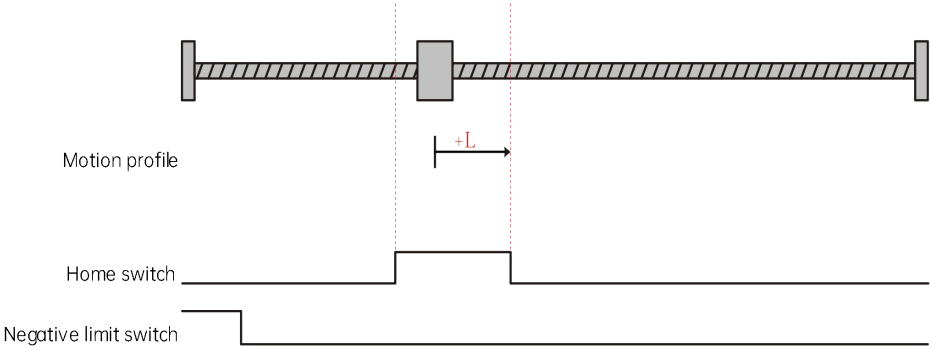
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



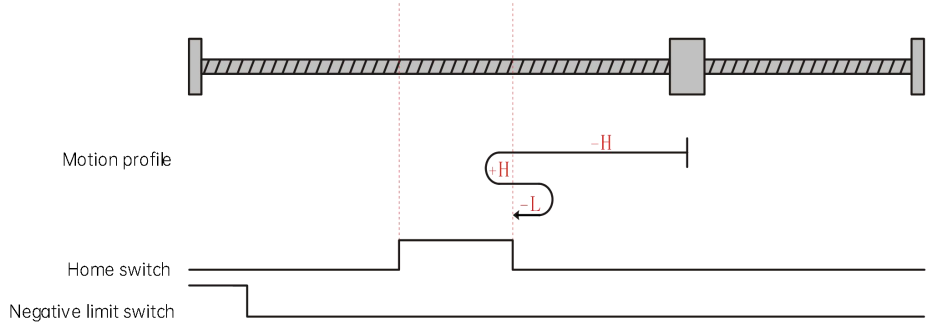
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the forward direction at low speed, and stops when reaching the falling edge of the home switch.



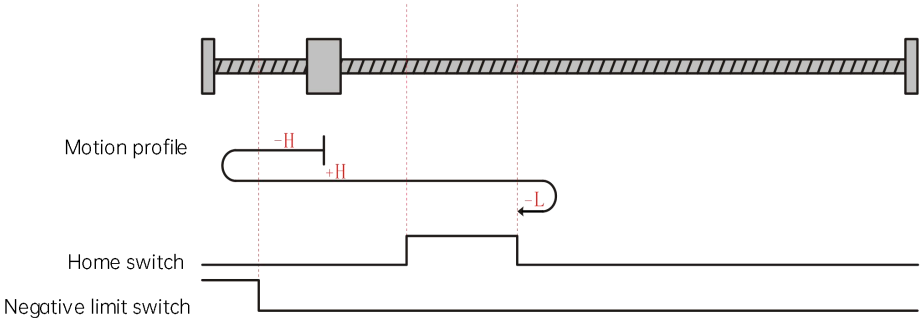
- 0x6098 = 28

Reverse, home switch as deceleration point and home

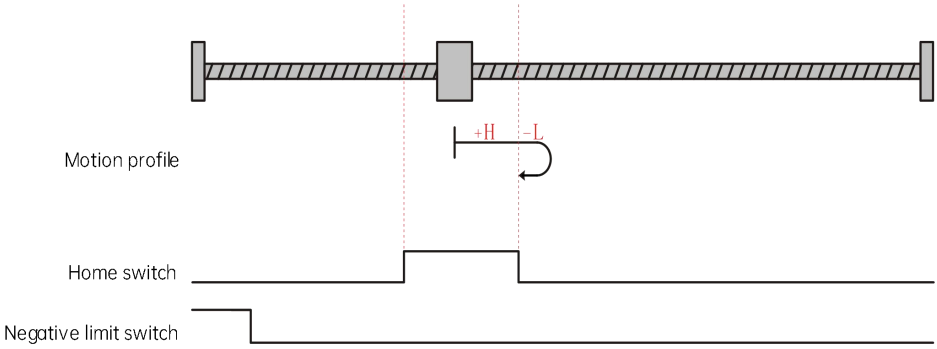
The current position of the motor is between the home switch and the positive limit switch. When the homing is started, the home switch is at low level, and the motor starts homing in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the negative limit switch, the motor runs in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



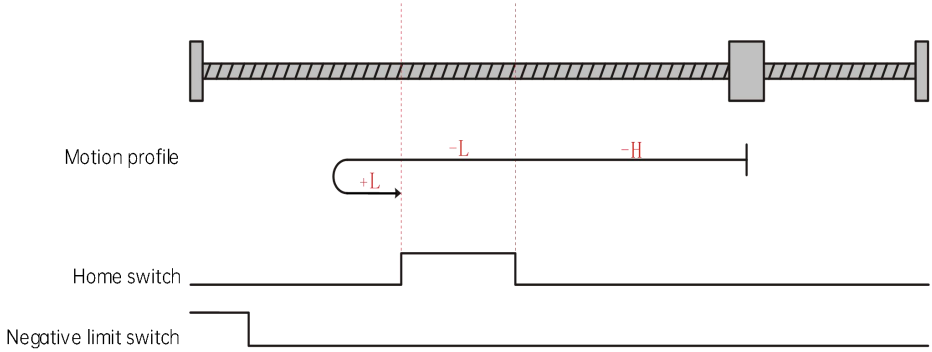
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor starts homing in the forward direction at high speed. After reaching the falling edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the home switch.



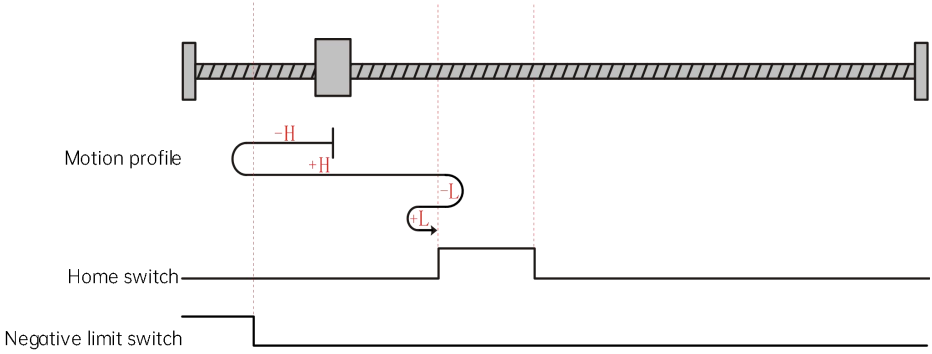
- 0x6098 = 29

Reverse, home switch as deceleration point and home

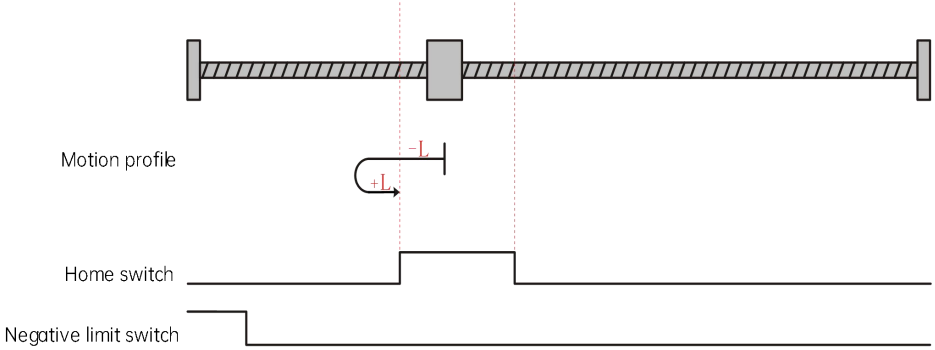
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



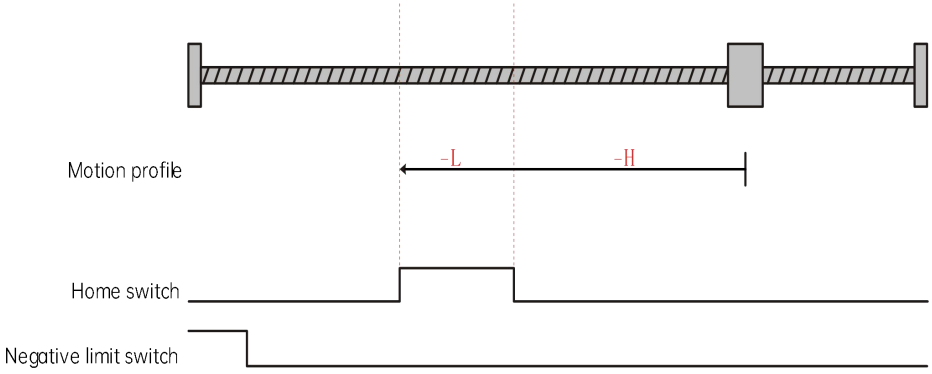
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, and the motor runs in the reverse direction at low speed. After reaching the falling edge of the home switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the home switch.



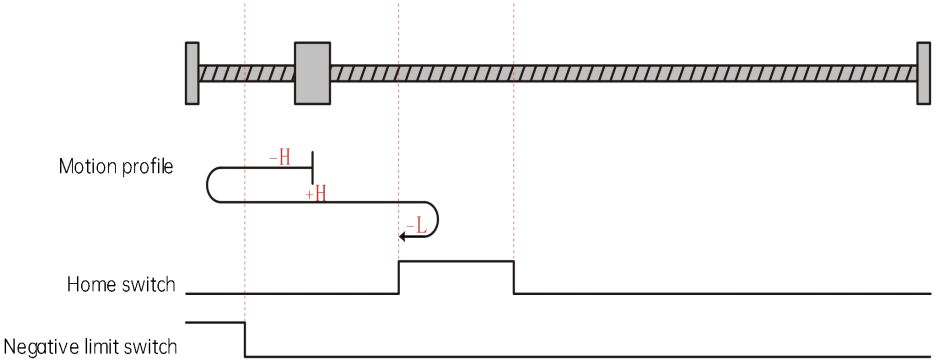
- 0x6098 = 30

Reverse, home switch as deceleration point and home

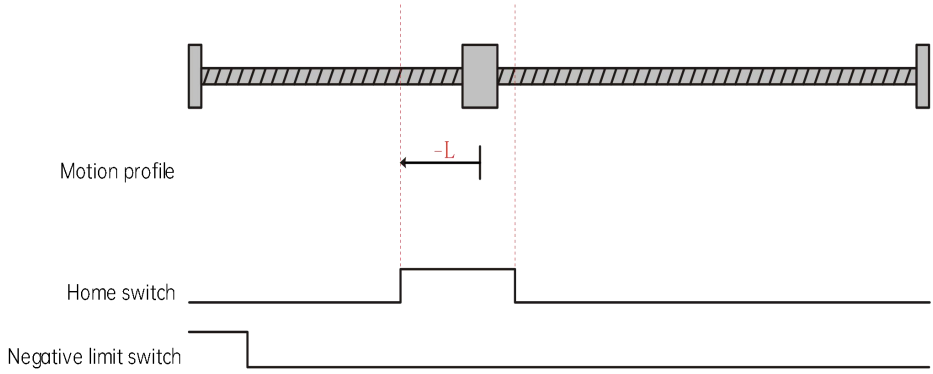
The current position of the motor is between the positive limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



The current position of the motor is between the negative limit switch and the home switch. When the homing is started, the home switch is at low level, and the motor runs in the reverse direction at high speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at high speed. After reaching the rising edge of the home switch, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



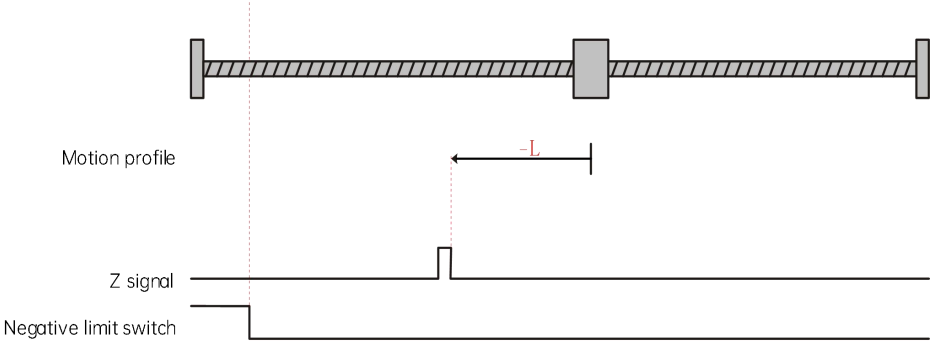
The current position of the motor is where the home switch is active. When the homing is started, the home switch is at high level, the motor runs in the reverse direction at low speed, and stops when reaching the falling edge of the home switch.



- 0x6098 = 33

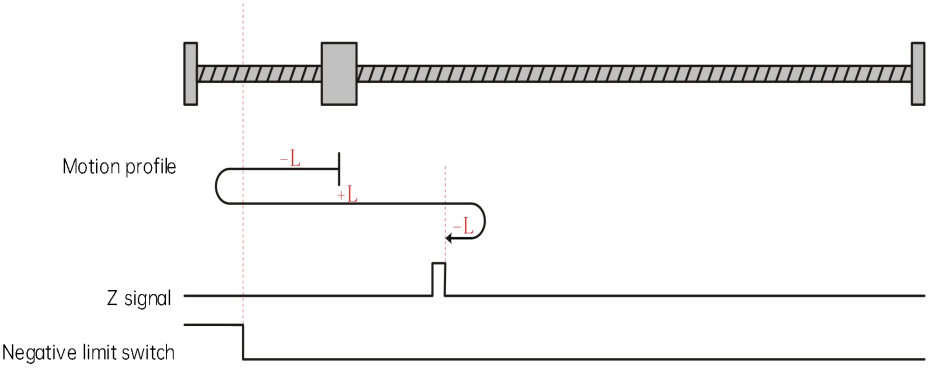
Reverse, motor Z signal as deceleration point and home

When there is at least one Z signal in the distance between the current position of the motor and the negative limit switch, the motor starts homing in the reverse direction at low speed, and stops when reaching the rising edge of the Z signal.



When the current position of the motor is at the Z signal, the homing enable is triggered, and the current position is immediately remembered as the home position to stop.

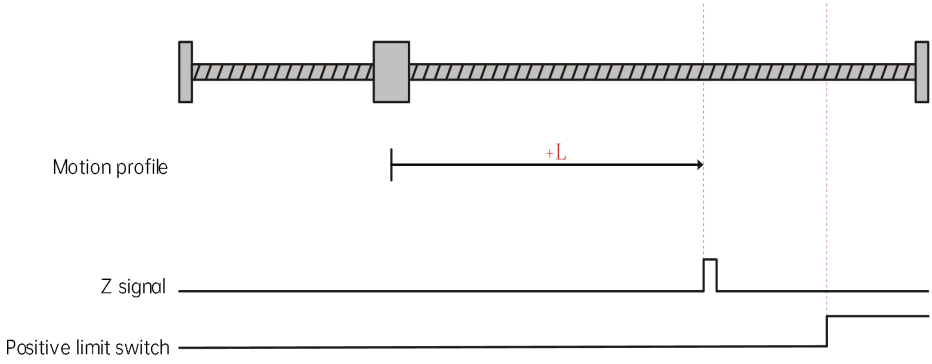
When there are no Z signals between the current position of the motor and the negative limit switch, the motor starts homing in the reverse direction at low speed. After reaching the rising edge of the negative limit switch, the motor runs in the forward direction at low speed. After reaching the falling edge of the Z signal, the motor runs in the reverse direction at low speed, and stops once the Z signal is found.



- 0x6098 = 34

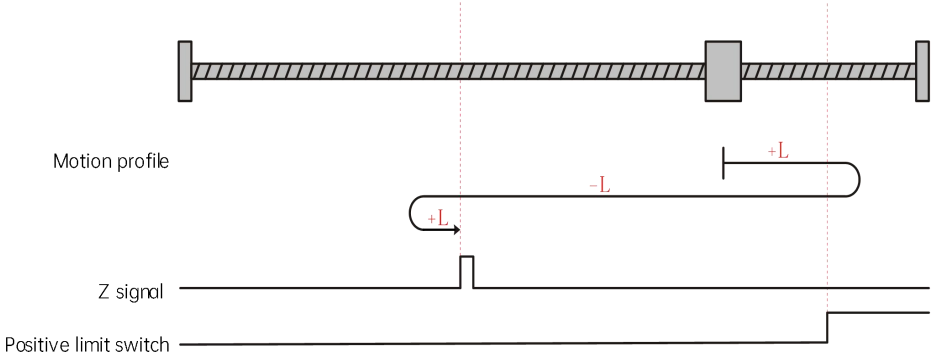
Forward, motor Z signal as deceleration point and home

When there is at least one Z signal in the distance between the current position of the motor and the positive limit switch, the motor starts homing in the forward direction at low speed, and stops when reaching the rising edge of the Z signal.



When the current position of the motor is at the Z signal, the homing enable is triggered, and the current position is immediately remembered as the home position to stop.

When there are no Z signals between the current position of the motor and the positive limit switch, the motor starts homing in the forward direction at low speed. After reaching the rising edge of the positive limit switch, the motor runs in the reverse direction at low speed. After reaching the falling edge of the Z signal, the motor runs in the forward direction at low speed, and stops once the Z signal is found.



- 0x6098 = 35

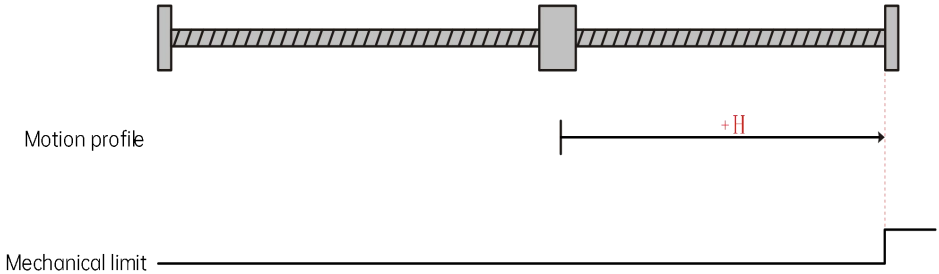
Take the current position as the home

- 0x6098 = -1

Forward, mechanical limit as deceleration point and home

The motor starts homing in the forward direction at high speed. After the motor reaches the mechanical limit position, with the output torque reaching 2017.15h (P23.20 Homing torque limit), and such state being kept for the time specified by 2017.16h (P23.21 Homing torque reached time), the motor stops.

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P23.20	Homing torque limit	0 to 400.0%	0.1%	30.0%	Immediately	At stop	The motor reaches the mechanical limit position if the output torque reaches the homing torque limit (P23.20) and such state is kept for the time specified by P23.21.
P23.21	Homing torque reached time	0 to 65535 ms	1 ms	1	Immediately	At stop	

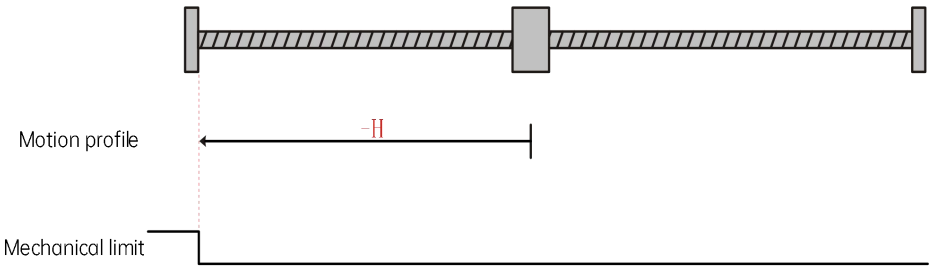


- 0x6098 = -2

Reverse, mechanical limit as deceleration point and home

The motor starts homing in the reverse direction at high speed. After the motor reaches the mechanical limit position, with the output torque reaching 2017.15h (P23.20 Homing torque limit), and such state being kept for the time specified by 2017.16h (P23.21 Homing torque reached time), the motor stops.

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P23.20	Homing torque limit	0 to 400.0%	0.1%	30.0%	Immediately	At stop	The motor reaches the mechanical limit position if the output torque reaches the homing torque limit (P23.20) and such state is kept for the time specified by P23.21.
P23.21	Homing torque reached time	0 to 65535 ms	1 ms	1	Immediately	At stop	

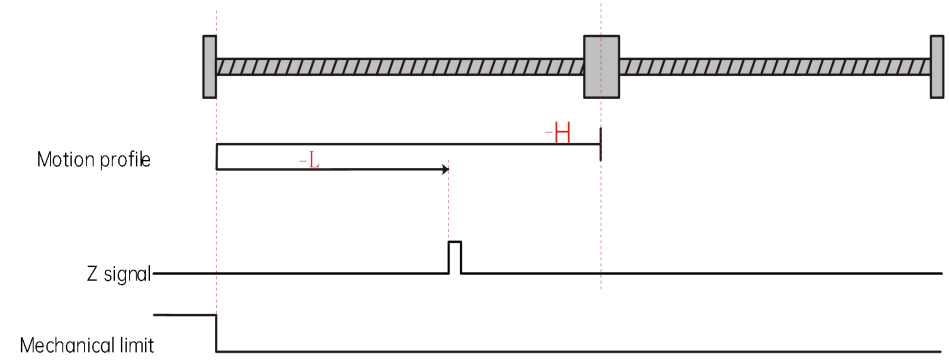


- 0x6098 = -3

Reverse, mechanical limit as deceleration point, and motor Z signal as home

The motor starts homing in the reverse direction at high speed. After the motor reaches the mechanical limit position, with the output torque reaching 2017.15h (P23.20 Homing torque limit), and such state being kept for the time specified by 2017.16h (P23.21 Homing torque reached time), the motor searches for the Z signal at low speed in the forward direction and then stops.

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P23.20	Homing torque limit	0 to 400.0%	0.1%	30.0%	Immedia tely	At stop	The motor reaches the mechanical limit position if the output torque reaches the homing torque limit (P23.20) and such state is kept for the time specified by P23.21.
P23.21	Homing torque reached time	0 to 65535 ms	1 ms	1	Immedia tely	At stop	



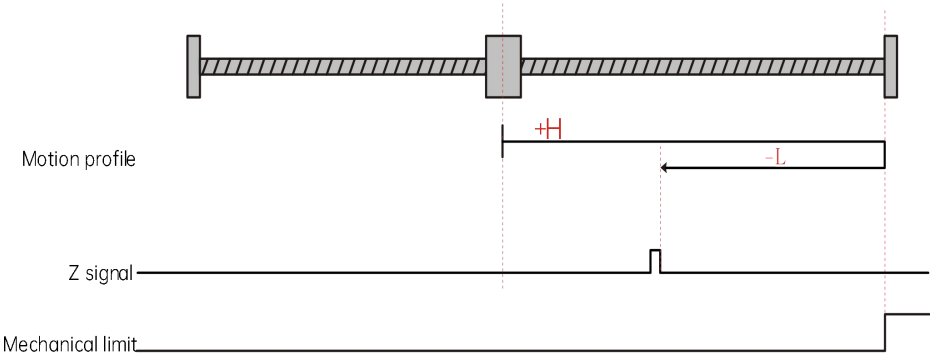
- 0x6098 = -4

Forward, mechanical limit as deceleration point, and motor Z signal as home

The motor starts homing in the forward direction at high speed. After the motor reaches the mechanical limit position, with the output torque reaching 2017.15h (P23.20 Homing torque limit), and such state being kept for the time specified

by 2017.16h (P23.21 Homing torque reached time), the motor searches for the Z signal at low speed in the reverse direction and then stops.

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P23.20	Homing torque limit	0 to 400.0%	0.1%	30.0%	Immediately	At stop	The motor reaches the mechanical limit position if the output torque reaches the homing torque limit (P23.20) and such state is kept for the time specified by P23.21.
P23.21	Homing torque reached time	0 to 65535 ms	1 ms	1	Immediately	At stop	



7.4.5 Cyclic synchronous position mode

The principle of the cyclic synchronous position mode is similar to that of the interpolated position mode. In this mode, the master station completes the position command planning and sends the planned target position to the slave drive in a cyclically synchronous manner. In this mode, the target position object is 607Ah.

The cyclic synchronous position mode only supports absolute position reference. M3-N only supports linear interpolation.

7.4.5.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6063h	VAR	Position actual value* (motor unit)	INT32	RO	TPDO	p

Index	Object code	Name	Data type	Access	PDO mapping	Unit
6064h	VAR	Position actual value (user unit)	INT32	RO	TPDO	Reference unit
6065h	VAR	Following error window	UINT32	RW	RPDO	Reference unit
6066h	VAR	Following error window time	UINT16	RW	RPDO	ms
6067h	VAR	Position window	UINT32	RW	RPDO	Reference unit
6068h	VAR	Position window time	UINT16	RW	RPDO	ms
607Ah	VAR	Target position	INT32	RW	RPDO	Reference unit
607Dh	ARRAY	Software position limit	INT32	RW	RPDO	Reference unit
607Eh	VAR	Polarity	UINT8	RW	RPDO	-
6091h	ARRAY	Gear ratio	UINT32	RW	RPDO	-
60F4h	VAR	Following error actual value	INT32	RO	TPDO	Reference unit
2014.0bh	VAR	Data interpolation cycle	UINT16	RW	RPDO	us

Note: P20.10 (2014.0bh) interpolation cycle is used only when the synchronous cycle is inconsistent with the data cycle, which is set as the data cycle in the unit of us.

7.4.5.2 Control word and status word

The control word in the Cyclic Synchronous Position Mode (CSP) is the same as the standard definition.

The status word in the Cyclic Synchronous Position Mode (CSP):

Bit15 - Bit14	Bit13	Bit12	Bit11	Bit10	Bit9 - Bit0
*	Following error	Target position ignored	*	Target reached	*

Description of status word bits in the Cyclic Synchronous Position Mode (CSP):

Bit	Value	Description
Target reached	0	Target position not reached
	1	Target position reached
Target position ignored	0	Position reference not followed
	1	Position reference followed
Following error	0	Excessive position deviation not reported
	1	Excessive position deviation reported

7.4.5.3 Function description

- Operation mode: Set 6060h = 8;
- Target position: Use 607Ah to set the target position in user unit. If necessary, set the gear ratio factor 6091h;
- Running enable: Enable the drive to run through the control word 6040h;
- Speed limit setting: Select the speed limit channel according to 2007.0Ah (P07.09 FWD speed limit channel) and 2007.0Ch (P07.11 REV speed limit channel). By default, the bus speed limit channel is applied, with the value determined by 607Fh (Max profile velocity) and 6080h (Max motor speed). Alternatively, you can select the internal speed limit channel and set 2007.0Bh (P07.10 FWD speed limit value) and 2007.0Dh (P07.12 REV speed limit value). Besides, you can set P20.19(2014.14h) to specify the time during which the speed is decelerated to zero from the speed limit;

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P20.19	Deceleration time for bus speed limit	0 to 65535	1	0	Immedia tely	At stop	The deceleration time from the maximum speed of speed limit value to zero Unit: ms

- Torque limit setting: Select the torque limit channel according to 2006.0Dh (P06.12 Positive torque limit channel) and 2006.0Eh (P06.13 Negative torque limit channel). By default, the bus torque limit channel is applied, with the positive/negative torque value determined by the smaller one between the maximum torque 6072h and positive torque limit 60E0h/negative torque limit 60E1h. Alternatively, you can select the internal torque limit channel and set 2006.0Fh (P06.14 Internal positive torque limit value) and 2006.10h (P06.15 Internal negative torque limit value);
- Excessive position deviation threshold: If the position deviation 60F4h in user unit is more than 6065h, a fault is triggered, and the bit13 of status word 6041h is set to 1;
- When the synchronous cycle is inconsistent with the data cycle, the data interpolation cycle 2014.0bh shall be set.
- Reference polarity 0x607E: Logic of torque, speed or position reference is set according to the bits of object 0x607E.

Bit	Name	Value	Function
Bit5	Torque reference polarity	0	Torque reference positive logic
		1	Torque reference negative logic
Bit6	Speed reference polarity	0	Speed reference positive logic
		1	Speed reference negative logic
Bit7	Position reference polarity	0	Position reference positive logic
		1	Position reference negative logic

7.4.5.4 Basic configuration

The following table describes the basic configuration of objects in the Cyclic Synchronous Position Mode (CSP).

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Target position 607Ah	Position actual value 6064h	Required
Other objects		Optional. You can configure them as SDO parameters.

7.4.6 Cyclic synchronous velocity mode

In this mode, the master station periodically synchronizes the calculated target speed to the slave drive, and the slave drive executes the target speed provided by the master station. The interpolation cycle is the same as the synchronization signal cycle.

7.4.6.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
603Fh	VAR	Error code	UINT16	RW	TPDO	-
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
606Ch	VAR	Velocity actual value	INT32	RO	TPDO	Reference unit/s
606Dh	VAR	Velocity window	UINT16	RW	RPDO	rpm
606Eh	VAR	Velocity window time	UINT16	RW	RPDO	ms
607Eh	VAR	Polarity	UINT8	RW	RPDO	-
6091h	ARRAY	Gear ratio	UINT32	RW	RPDO	-
60FFh	VAR	Target velocity	INT32	RW	RPDO	Reference unit/s

7.4.6.2 Control word and status word

The control word in the Cyclic Synchronous Velocity Mode (CSV) is the same as the standard definition.

The status word in the Cyclic Synchronous Velocity Mode (CSV):

Bit15 to Bit13	Bit12	Bit11	Bit10	Bit9 to Bit0
*	Target velocity ignored	*	Target reached	*

Description of status word bits in the Cyclic Synchronous Velocity Mode (CSV):

Bit	Value	Description
Target reached	0	Target speed not reached
	1	Target speed reached
Target velocity ignored	0	Speed reference not followed
	1	Speed reference followed

7.4.6.3 Function description

- Operation mode: Set 6060h = 9;
- Target speed setting: Use 60FFh to set the target speed in user unit. If necessary, set the gear ratio 6091h;
- Running enable: Enable the drive to run through the control word 6040h;
- Speed limit setting: Select the speed limit channel according to 2007.0Ah (P07.09 FWD speed limit channel) and 2007.0Ch (P07.11 REV speed limit channel). By default, the bus speed limit channel is applied, with the value determined by 607Fh (Max profile velocity) and 6080h (Max motor speed). Alternatively, you can select the internal speed limit channel and set 2007.0Bh (P07.10 FWD speed limit value) and 2007.0Dh (P07.12 REV speed limit value). Besides, you can set P20.19(2014.14h) to specify the time during which the speed is decelerated to zero from the speed limit;

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P20.19	Deceleration time for bus speed limit	0 to 65535	1	0	Immediately	At stop	The deceleration time from the maximum speed of speed limit value to zero Unit: ms

- Torque limit setting: Select the torque limit channel according to 2006.0Dh (P06.12 Positive torque limit channel) and 2006.0Eh (P06.13 Negative torque limit channel). By default, the bus torque limit channel is applied, with the positive/negative torque value determined by the smaller one between the maximum torque 6072h and positive torque limit 60E0h/negative torque limit 60E1h. Alternatively, you can select the internal torque limit channel and set 2006.0Fh (P06.14 Internal positive torque limit value) and 2006.10h (P06.15 Internal negative torque limit value);
- Reference polarity 0x607E: Logic of torque, speed or position reference is set according to the bits of object 0x607E.

Bit	Name	Value	Function
Bit5	Torque reference polarity	0	Torque reference positive logic
		1	Torque reference negative logic
Bit6	Speed reference polarity	0	Speed reference positive logic
		1	Speed reference negative logic
Bit7	Position reference polarity	0	Position reference positive logic
		1	Position reference negative logic

7.4.6.4 Basic configuration

The following table describes the basic object configurations in the Cyclic Synchronous Velocity Mode (CSV).

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Target velocity 60FFh		Required
	Velocity actual value 606Ch	Optional
Other objects		Optional. You can configure them as SDO parameters.

7.4.7 Cyclic synchronous torque mode

In this mode, the master station periodically synchronizes the calculated target torque to the slave drive, and the slave drive executes the target torque provided by the master station. The interpolation cycle is the same as the synchronization signal cycle.

7.4.7.1 Common objects

The following table lists the objects related to this mode.

Index	Object code	Name	Data type	Access	PDO mapping	Unit
603Fh	VAR	Error code	UINT16	RW	TPDO	-
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6063h	VAR	Position actual value* (motor unit)	INT32	RO	TPDO	Encoder unit
6064h	VAR	Position actual value (user unit)	INT32	RO	TPDO	Reference unit
606Ch	VAR	Velocity actual value	INT32	RO	TPDO	Reference unit/s
606Dh	VAR	Velocity window	UINT16	RW	RPDO	rpm
6071h	VAR	Target torque	INT16	RW	RPDO	0.1%
6072h	VAR	Max torque	UINT16	RW	RPDO	0.1%
6074h	VAR	Torque demand	INT16	RO	TPDO	0.1%
6077h	VAR	Torque actual value	INT16	RO	TPDO	0.1%
607Eh	VAR	Polarity	UINT8	RW	RPDO	-
607Fh	VAR	Max profile velocity	UINT32	RW	RPDO	Reference unit/s

Index	Object code	Name	Data type	Access	PDO mapping	Unit
6080h	VAR	Max motor speed	UINT32	RW	RPDO	rpm
60E0h	VAR	FWD torque limit	UINT16	RW	RPDO	0.1%
60E1h	VAR	REV torque limit	UINT16	RW	RPDO	0.1%

7.4.7.2 Control word and status word

The control word in the Cyclic Synchronous Torque Mode (CST) is the same as the standard definition.

The status word in the Cyclic Synchronous Torque Mode (CST):

Bit15 to Bit13	Bit12	Bit11	Bit10	Bit9 to Bit0
*	Target torque ignored	*	Target reached	*

Description of status word bits in the Cyclic Synchronous Torque Mode (CST):

Bit	Value	Description
Target reached	0	Target torque not reached
	1	Target torque reached
Target torque ignored	0	Torque reference not followed
	1	Torque reference followed

7.4.7.3 Function description

- Control mode: Set P02.00 = 8;
- Operation mode: Set 6060h = 10;
- Target torque setting: Use 6071h to set the target torque in user unit, unit 0.1%;
- Speed limit setting: Select the speed limit channel according to the function code object dictionary 2007.0Ah (P07.09 FWD speed limit channel) and 2007.0Ch (P07.11 REV speed limit channel). By default, the bus speed limit channel is applied, with the value determined by 607Fh (Max profile velocity) and 6080h (Max motor speed). Alternatively, you can select the internal speed limit channel and set 2007.0Bh (P07.10 FWD speed limit value) and 2007.0Dh (P07.12 REV speed limit value). Besides, you can set P20.19(2014.14h) to specify the time during which the speed is decelerated to zero from the speed limit;

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Function
P20.19	Deceleration time for bus speed limit	0 to 65535	1	0	Immediately	At stop	The deceleration time from the maximum speed of speed limit value to zero Unit: ms

- Torque limit setting: Select the torque limit channel according to 2006.0Dh (P06.12 Positive torque limit channel) and 2006.0Eh (P06.13 Negative torque limit channel). By default, the bus torque limit channel is applied, with the positive/negative torque value determined by the smaller one between the maximum torque 6072h and positive

torque limit 60E0h/negative torque limit 60E1h. Alternatively, you can select the internal torque limit channel and set 2006.0Fh (P06.14 Internal positive torque limit value) and 2006.10h (P06.15 Internal negative torque limit value);

- Running enable: Enable the drive to run through the control word 6040h;
- Reference polarity 0x607E: Logic of torque, speed or position reference is set according to the bits of object 0x607E.

Bit	Name	Value	Function
Bit5	Torque reference polarity	0	Torque reference positive logic
		1	Torque reference negative logic
Bit6	Speed reference polarity	0	Speed reference positive logic
		1	Speed reference negative logic
Bit7	Position reference polarity	0	Position reference positive logic
		1	Position reference negative logic

- Torque reach function:

  This function defines whether the actual torque feedback has reached the torque window. If the difference between the Torque actual value (6077h) and the Base value for torque reached (2007.0Eh) is greater than the Valid value for torque reached (2007.0Fh), bit10 (target_reached) of the status word will be set to 1. When the difference between the Torque actual value (6077h) and the Base value for torque reached (2007.0Eh) falls below the Invalid value for torque reached (2007.10h), bit10 (target_reached) of the status word will be immediately cleared.

- Torque reference slope function:

  This function defines the acceleration and deceleration time for target torque. If the controller can not plan the slope for the Target torque (6071h), you can set P20.20 (2014.15h) to plan the acceleration and deceleration of the servo's internal torque, in the unit of 0.01% / 1 ms. If it is only required to plan the slope when the target torque is down to zero, you can set P20.18 (2014.13h) to plan the deceleration of the servo's internal torque.

  If you set P20.18 and P20.20 at the same time, P20.18 is effective only when the target torque is down to zero while in other situations P20.20 is effective.

  If there is already a slope planned by the controller, P20.18 and P20.20 can not be set.

Function code	Name	Setting range	Min. unit	Default value	Effective time	Property	Function
P20.18	Rapid deceleration slope for bus torque reference	0 to 65535	1	0	Immediately	At stop	Slope for torque down to 0 Unit: 0.01% / 1 ms
P20.20	Acceleration and deceleration slope for bus torque reference	0 to 65535	1	0	Immediately	At stop	Torque acceleration /deceleration slope Unit: 0.01% / 1 ms Can be used together with P20.18

7.4.7.4 Basic configuration

The following table describes the basic object configurations in the Cyclic Synchronous Torque Mode (CST).

RPDO object	TPDO object	Note
Control word 6040h	Status word 6041h	Required
Target torque 6071h		Required
	Torque actual value 6077h	Optional
Other objects		Optional. You can configure them as SDO parameters, or use the default parameters of the drive.

7.5 Servo drive stop

The stop mode includes coasting to stop and ramping to stop.

In the running status, when the control word receives the "Shutdown" command, the drive will be stopped according to 605Bh.

In the running status, when the control word receives the "Disable operation" command, the drive will be stopped according to 605Ch.

In the running status, when the control word receives the "Quick stop" command, the drive will be stopped according to 605Ah.

When the DI (FunIN.34) emergency stop terminal is used, the drive will be stopped according to 605Ah.

Object dictionary	Name	Data type	Access	PDO mapping	Unit	Function
605Ah	Quick stop option code	INT16	RW	RPDO	-	0-Coast to stop 1-6084h/609Ah(HM)/6087h(PT/CST) 2-6085h/6087h(PT/CST) 5-6084h/609Ah(HM)/6087h(PT/CST), drive position lock 6-6085h/6087h(PT/CST), drive position lock Note: The torque mode does not support position lock currently
605Dh	Halt option code	INT16	RW	RPDO	-	1-6084h/609Ah(HM)/6087h(PT/CST) 2-6085h/6087h(PT/CST)
605Bh	Shutdown option code	INT16	RW	RPDO	-	0-Coast to stop 1-6084h/609Ah(HM)/6087h(PT/CST)
605Ch	Disable operation option code	INT16	RW	RPDO	-	0-Coast to stop 1-6084h/609Ah(HM)/6087h(PT/CST)
6084h	Profile deceleration	UINT32	RW	RPDO	Reference unit/s^2	
6085h	Quick stop deceleration	UINT32	RW	RPDO	Reference unit/s^2	
6087h	Torque slope	UINT16	RW	RPDO	0.1%/s	
609Ah	Homing acceleration	UINT32	RW	RPDO	Reference unit/s^2	

7.6 Application functions of servo drive

7.6.1 Touch probe function

The M3 servo provides 2 touch probes, and records the position information of the positive edges and negative edges of the two probes.

When the DI terminal is used as the probe triggering signal, DI4/DI5 can be chosen for high-speed input. Set P03.03 (DI4) and P03.04 (DI5) to the No.49 function (touch probe 1) or No.50 function (touch probe 2).

The Z signal can also be used as the probe triggering signal.

Object dictionary	Name	Data type	Access	PDO mapping	Unit
60B8h	Touch probe function	INT16	RW	RPDO	-
60B9h	Touch probe status	UINT16	RO	TPDO	-
60BAh	Touch probe Pos1 pos value	INT32	RO	TPDO	Reference unit
60BBh	Touch probe Pos1 neg value	INT32	RO	TPDO	Reference unit
60BCh	Touch probe Pos2 pos value	INT32	RO	TPDO	Reference unit
60BDh	Touch probe Pos2 neg value	INT32	RO	TPDO	Reference unit

	Bit	Function
60B8h Touch Probe function	0	0 - Disable touch probe 1 1 - Enable touch probe 1
	1	0 - Touch probe 1 single latching 1 - Touch probe 1 continuous latching
	2	0 - DI terminal to trigger touch probe 1 1 - Z signal to trigger touch probe 1
	3	Reserved
	4	0 - Disable latching of touch probe 1 position at the positive edge 1 - Enable latching of touch probe 1 position at the positive edge
	5	0 - Disable latching of touch probe 1 position at the negative edge 1 - Enable latching of touch probe 1 position at the negative edge
	6 to 7	Reserved
	8	0 - Disable touch probe 2 1 - Enable touch probe 2
	9	0 - Touch probe 2 single latching 1 - Touch probe 2 continuous latching

	10	0 - DI terminal to trigger touch probe 2 1 - Z signal to trigger touch probe 2
	11	Reserved
	12	0 - Disable latching of touch probe 2 position at the positive edge 1 - Enable latching of touch probe 2 position at the positive edge
	13	0 - Disable latching of touch probe 2 position at the negative edge 1 - Enable latching of touch probe 2 position at the negative edge
	14 to 15	Reserved

	Bit	Definition
60B9h Touch probe status	0	0 - Touch probe 1 disabled 1 - Touch probe 1 enabled
	1	0 - No positive edge value latched for touch probe 1 1 - Positive edge value latched for touch probe 1
	2	0 - No negative edge value latched for touch probe 1 1 - Negative edge value latched for touch probe 1
	3 to 7	Reserved
	8	0 - Touch probe 2 disabled 1 - Touch probe 2 enabled
	9	0 - No positive edge value latched for touch probe 2 1 - Positive edge value latched for touch probe 2
	10	0 - No negative edge value latched for touch probe 2 1 - Negative edge value latched for touch probe 2
	11 to 15	Reserved

7.6.2 Input and output terminal 60FDh/60FEh

The M3 servo drive supports 60FDh, which is used to indicate the input status of each terminal.

	Bit	Function
60FDh DI status (Digital inputs)	0	1 - Negative limit switch valid 0 - Negative limit switch invalid
	1	1 - Positive limit switch valid 0 - Positive limit switch invalid
	2	1 - Home signal valid 0 - Home signal invalid
	3 to 15	Reserved

	16	1 - DI1 input valid 0 - DI1 input invalid
	17	1 - DI2 input valid 0 - DI2 input invalid
	18	1 - DI3 input valid 0 - DI3 input invalid
	19	1 - DI4 input valid 0 - DI4 input invalid
	20	1 - DI5 input valid 0 - DI5 input invalid
	21 to 24	Reserved
	25	1 - Z signal valid 0 - Z signal invalid
	26	1 - Touch probe 1 valid 0 - Touch probe 1 invalid
	27	1 - Touch probe 2 valid 0 - Touch probe 2 invalid
	28 to 31	Reserved

The M3 servo drive supports 60FEh, using EtherCAT bus to control the forced output of DO signals.

Before the drive enters OP, the DO terminal does not output.

After the drive entered OP, the DO output is controlled by the corresponding bit of 60FESUB1 after the 60FESUB2 terminal is enabled.

After the drive exits OP, namely disconnection, the DO output status is controlled by P03.22.

	Bit	Function
60FEh sub1 DO forced output control	0 to 15	Reserved
	16	1 - DO1 Switch on 0 - DO1 Switch off
	17	1 - DO2 Switch on 0 - DO2 Switch off
	18	1 - DO3 Switch on 0 - DO3 Switch off
	19 to 31	Reserved
60FEh sub2 DO forced output enable	0 to 15	Reserved
	16	1 - DO1 output enabled 0 - DO1 output disabled
	17	1 - DO2 output enabled 0 - DO2 output disabled
	18	1 - DO3 output enabled 0 - DO3 output disabled

	19 to 31	Reserved
P03.22	0	0 - DO1 status unchanged after disconnection 1 - DO1 no output
	1	0- DO2 status unchanged after disconnection 1 - DO2 no output
	2	0 - DO3 status unchanged after disconnection 1 - DO3 no output
	3 to 15	Reserved

7.6.3 Slave address allocation

When the master station allocates the slave address automatically, P20.09 (2014.0Ah) will display the allocated address. When it is required to set the slave address, you can set P20.08 (2014.09h).

7.6.4 User unit selection

7.6.4.1 Position user unit

Users can set the pulses per motor revolution (8388608 P/r by default) through P05.05 (2005.06h) to match the controller position reference. Also, you can set the gear ratio factor (6091h).

7.6.4.2 Speed user unit

Users can set the speed user unit through P20.15 (2014.10h). The default user unit for bus speed is reference unit/s.

7.6.4.3 Torque user unit

Users can set the torque user unit through P20.14 (2014.0Fh). The default user unit for bus torque is 0.1% (rated torque P01.04 (2001.05h)).

Chapter 8 Drive Parameter Object

8.1 M3-N drive parameters

The M3-N drive parameter object index is shown in the following table:

Parameter group	Index	Sub-index	Note
P00	2000h	01h to Number of parameters in this group	Index of drive parameter = (2000h+ group number); Sub-index of the drive parameter = (the offset of the parameter within this group + 1). [Example]: The first parameter of P00 group P00.00: Index = 2000h, sub-index = 01h. The 11th parameter of P12 group P12.10: Index = 200Ch, sub-index = 0Bh
P01	2001h	01h to Number of parameters in this group	
……			

Drive parameters are listed as follows:

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
Index 2000h (P00): Drive parameters							
P00.00	01h	Serial No.	0 to FFFF	1	Manufacturer setting	-	At display
P00.01	02h	DSP software version No.	0.00 to 99.99	0.01	Manufacturer setting	-	At display
P00.02	03h	User-customized version No.	0 to 9999	1	Manufacturer setting	-	At display
P00.03	04h						
P00.04	05h	Voltage class of servo drive	0: 220 V 1: 380 V	1	Manufacturer setting	-	At display
P00.05	06h	Rated current of servo drive	0 to 999.9 A	0.1 A	Manufacturer setting	-	At display
P00.06	07h	Maximum current of servo drive	0 to 999.9 A	0.1 A	Manufacturer setting	-	At display
Index 2001h (P01): Servo motor parameters							
P01.00	01h	Motor SN	0: Motor parameters can be set 0x0001 to 0xFFFF: Motor parameters are automatically set according to the	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			number				
P01.01	02h	Rated power	0.04 to 99.99 kW	0.01 kW	Model dependent	Power-on again	At stop
P01.02	03h	Rated voltage	0 to rated voltage of servo drive	1 V	0	Power-on again	At stop
P01.03	04h	Rated current	0.1 to 999.9 A	0.1 A	Model dependent	Power-on again	At stop
P01.04	05h	Rated torque	0.1 to 655.35 N·m	0.01 N·m	Model dependent	Power-on again	At stop
P01.05	06h	Maximum torque	0.1 to 655.35 N·m	0.01 N·m	Model dependent	Power-on again	At stop
P01.06	07h	Rated speed	0.1 to 6000.0 rpm	0.1 rpm	Model dependent	Power-on again	At stop
P01.07	08h	Maximum speed	0.1 to 6000.0 rpm	0.1 rpm	Model dependent	Power-on again	At stop
P01.08	09h	Moment of inertia Jm	0.01 to 655.35 kg*cm^2	0.01 kg*cm^2	Model dependent	Power-on again	At stop
P01.09	0Ah	Number of pole pairs	2 to 72 pairs of poles	1 pair of poles	Model dependent	Power-on again	At stop
P01.10	0Bh	Stator resistance R1	0.000 to 65.000 Ω	0.001 Ω	Model dependent	Power-on again	At stop
P01.11	0Ch	D-axis inductance Ld	0.00 to 200.00 mH	0.01 mH	Model dependent	Power-on again	At stop
P01.12	0Dh	Q-axis inductance Lq	0.00 to 200.00 mH	0.01 mH	Model dependent	Power-on again	At stop
P01.13	0Eh	Back-EMF constant	1 to 600.0 V/krpm	0.1 V/krpm	Model dependent	Power-on again	At stop
P01.14	0Fh	Torque coefficient Kt	0.001 to 65.000 N·m/A	0.01 N·m/A	Model dependent	Power-on again	At stop
P01.15	10h	Electrical constant Te	0.01 to 650.00 ms	0.01 ms	Model dependent	Power-on again	At stop
P01.16	11h	Mechanical constant Tm	0.01 to 650.00 ms	0.01 ms	Model dependent	Power-on again	At stop
P01.17	12h	Brake function	0: Without brake 1: With brake	1	Model dependent	Immediately	At stop
P01.18	13h	Encoder selection	5: 17-bit absolute encoder	1	5	Immediately	At stop
P01.19	14h	Encoder PPR	1 to 4194304	1	2097152	Immediately	At stop
P01.20	15h	Encoder	0: Disabled	1	0	Immediat	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		installation initial angle tuning	1: Enabled (motor in static status)			ely	
P01.21	16h	Rotation direction	0: A before B 1: B before A	1	0	Immediately	At stop
P01.22	17h	Encoder installation initial angle	0.0 to 359.9°	0.1°	180.0	Immediately	At stop
P01.23	18h	Absolute encoder mode	0: Absolute position multi-turn mode 1: Absolute position single-turn mode 2: Incremental position mode Other: Reserved	1	0	Immediately	At stop
Index 2002h (P02): Basic control parameters							
P02.00	01h	Control mode selection	0: Speed mode 1: Position mode 2: Torque mode 3: Speed mode ← → position mode (9th function switching) 4: Torque mode ← → position mode (9th function switching) 5: Speed mode ← → torque mode (9th function switching) 6: Speed mode ← →torque mode ← → position mode (9th function for switching torque, 10th function for switching position. The mode is not switched when both functions are valid at the same time or invalid at the same time, and the speed mode will remain)	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			8: EtherCAT mode				
P02.01	02h	Internal servo enable	0 to 1	1	0	Immediately	During running
P02.02	03h	Absolute value system mode selection	0: Absolute position linear mode 1: Absolute position rotation mode	1	0	Immediately	At stop
P02.03	04h	Rotation direction selection	0: Take the CCW direction as the forward direction (A before B) 1: Take the CW direction as the forward direction (reverse mode, B before A)	1	0	Immediately	During running
P02.04	05h	Reserved					
P02.05	06h	Reserved					
P02.06	07h	Reserved					
P02.07	08h	Z pulse output polarity selection	0: Positive output (Z pulse is high level) 1: Negative output (Z pulse is low level)	1	0	Immediately	During running
P02.08	09h	Stop mode	0: Decelerate to stop 1: Coast to stop	1	0	Immediately	During running
P02.09	0Ah	Emergency stop enable	0: No operation, keep the current running state 1: Enable emergency stop, stop according to the set stop mode (P02.08), and alarm AL.038	1	0	Immediately	During running
P02.10	0Bh	Delay from brake output ON to command received	20 to 500 ms	1 ms	250	Immediately	During running
P02.11	0Ch	Delay from brake output OFF to motor	1 to 1000 ms	1 ms	150	Immediately	During running

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		de-energized in static state					
P02.12	0Dh	Motor speed threshold at brake output OFF in rotating state	0 to 3000.0 rpm	1 rpm	10.0	Immediately	During running
P02.13	0Eh	Delay from S-ON OFF to brake output OFF in rotating state	1 to 30000 ms	1 ms	500	Immediately	During running
P02.14	0Fh	Regenerative resistor derating factor	0.5 to 1.0	0.1	0.8	Immediately	At stop
P02.15	10h	Power of built-in regenerative resistor	-	1	Model dependent	-	At display
P02.16	11h	Resistance of built-in regenerative resistor	-	1	Model dependent	-	At display
P02.17	12h	Resistor heat dissipation coefficient	0: 0% 1: 25% 2: 50% 3: 75% 4: 100%	1	2	Immediately	During running
P02.18	13h	Regenerative resistor type	0: Built-in regenerative resistor 1: External regenerative resistor 2: No regenerative resistor	1	0	Immediately	At stop
P02.19	14h	Power of external regenerative resistor	1 to 65535 W	1 W	Model dependent	Immediately	At stop
P02.20	15h	Resistance of external regenerative resistor	1 to 65535 Ω	1 Ω	Model dependent	Immediately	At stop
P02.21	16h	Parameter protection setting	0: All the data can be changed;	1	0	Immediately	During running

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			1: Only P06.01 and this function code can be changed 2: Only this function code can be changed				
P02.22	17h	Parameter initialization	0: Parameter changing status 1: Clear fault memory information 2: Restore to leave-factory value 3: Clear motor model	1	0	Immediately	At stop
P02.23	18h	LED display parameter selection	0: Switching display P11.00 1: Switching display P11.01 2: Switching display P11.02 3: Switching display P11.03 4: Switching display P11.04 5: Switching display P11.05	1	0	Immediately	During running
P02.24	19h	DI enable terminal valid type selection	0: Level valid 1: Transition edge valid	1	1	Immediately	During running
Index 2003h (P03): Digital input and output terminal parameters							
P03.00	01h	DI1 function selection	0: No function 1: Servo enable 2: External reset (RESET) input 3: Gain switching 4: Multi-speed DI switching running direction 5: Multi-segment operation reference switching 1	1	1	Immediately	At stop
P03.01	02h	DI2 function selection		1	2	Immediately	At stop
P03.02	03h	DI3 function selection		1	3	Immediately	At stop
P03.03	04h	DI4 function selection		1	35	Immediately	At stop
P03.04	05h	DI5 function selection		1	36	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			6: Multi-segment operation reference switching 2 7: Multi-segment operation reference switching 3 8: Multi-segment operation reference switching 4 9: Control mode switching 1 10: Control mode switching 2 11: Zero servo enable terminal 12: Pulse input disable 13: FWD disabled 14: REV disabled 15: Electronic gear ratio switching 1 16: Electronic gear ratio switching 2 17: Forward jog 18: Reverse jog 19: Forward external torque limit 20: Reverse external torque limit 21: Multi-segment position reference 1 22: Multi-segment position reference 2 23: Multi-segment position reference 3 24: Multi-segment position reference 4 25: Multi-segment position reference 5 26: Speed command direction switching				

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			27: Torque command direction switching 28: Multi-segment/ single-point position command enable 29: Position deviation counter is cleared 30: Interrupt positioning state release 31: Interrupt positioning prohibition 32: Home switch 33: Homing enable 34: Emergency stop 35: Positive limit switch 36: Negative limit switch 37: Speed main/auxiliary reference switching 38: External fault input 39 to 48: Reserved 49: Touch probe 1 50: Touch probe 2				
P03.05 to P03.11	06h to 0Ch	Reserved					
P03.12	0Dh	DI1 to DI5 filter time	1 to 500 ms	1 ms	10	Immediately	During running
P03.13	0Eh	DI active state setting	Binary setting: 0: Normal logical, enabled upon connection 1: Inverted logical, enabled upon disconnection Unit place of LED:	1	000	Immediately	During running

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0: DI5				
P03.14	0Fh	VDI active state setting	Binary setting: 0: Disabled 1: Enabled Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0: DI5	1	000	Immediately	During running
P03.15	10h	DO1 function selection	0: Servo drive ready (RDY) 1: Servo drive running signal (RUN) 2: The speed is consistent 3: Speed arrival signal 4: Zero speed operation 5: Drive fault 6: Drive alarm 7: Host device switch signal 8: Torque limit 9: Speed limit 10: Zero servo completed 11: Positioning completed 12: Positioning close to 13: Position tolerance alarm 14: Homing 15: Homing completed 16: Electrical homing 17: Electrical homing completed 18: Brake output (brake output signal) 19: Torque arrival	1	0	Immediately	At stop
P03.16	11h	DO2 function selection		1	5	Immediately	At stop
P03.17	12h	DO3 function selection		1	18	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			signal 20: FWD/REV indication terminal 21: Reserved 22: Positioning position arrival 1 23: Positioning position arrival 2 24: Positioning position arrival 3 25: Positioning position arrival 4 26: Positioning position arrival 5 27: Interrupt positioning completed 28: ECAT forced DO output 29: Reserved 30: Reserved				
P03.18 to P03.22	13h to 17h	Reserved					
P03.23	18h	DO active state setting	Binary setting 0: Enabled upon connection 1: Enabled upon disconnection Unit place of LED: BIT0 to BIT3: DO1 to DO4	1	00	Immediately	During running
Index 2005h (P05): Position control parameters							
P05.00	01h	Position reference mode	0: Pulse reference 1: Single point position reference 2: Multi-segment position reference	1	0	Immediately	At stop
P05.01 to P05.04	02h to 05h	Reserved					

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
P05.05	06h	Number of pulses per motor revolution	0 to 8388608 P/r	1 P/r	8388608	Immediately	At stop
P05.06	07h	Position reference first-order low-pass filter time	0.0 to 2000.0 ms	0.1 ms	0	Immediately	During running
P05.07	08h	Position reference moving average filter time	0.0 to 12.8 ms	0.1 ms	0	Immediately	During running
P05.08	09h	Electronic gear ratio numerator	1 to 1073741824	1	8388608	Immediately	At stop
P05.09	0Ah	Electronic gear ratio denominator 1	1 to 1073741824	1	10000	Immediately	At stop
P05.10	0Bh	Electronic gear ratio denominator 2	1 to 1073741824	1	10000	Immediately	At stop
P05.11	0Ch	Electronic gear ratio denominator 3	1 to 1073741824	1	10000	Immediately	At stop
P05.12	0Dh	Electronic gear ratio denominator 4	1 to 1073741824	1	10000	Immediately	At stop
P05.13	0Eh	Electronic gear ratio switchover condition	0: Position command is 0, switch after 3 ms duration 1: Real-time switching	1	0	Immediately	At stop
P05.14	0Fh	Position deviation clearing method selection	0: Clear position deviation when servo enable is OFF or stopped 1: Clear position deviation when the servo enable is OFF or a fault/alarm occurs 2: Clear position deviation when the servo enable is OFF or the external position	1	00	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			deviation clear DI is valid				
P05.15	10h	Position deviation clear DI signal type	0: Pulse mode 1: Level mode	0	0	Immediately	At stop
P05.16	11h	Speed feedforward control selection	0: No speed feedforward 1: Internal speed feedforward (Take the speed information corresponding to the position command of the encoder unit as the source of the speed feedforward signal) 2 to 3: Reserved	1	1	Immediately	At stop
P05.17	12h	Position controller output limit	0 to maximum speed	0.1 rpm	6000.0	Immediately	During running
P05.18	13h	Condition for positioning completed signal output	0: Position deviation absolute value smaller than amplitude of positioning completed 1: Position deviation absolute value smaller than amplitude of positioning completed and position reference after filter being 0 2: Position deviation absolute value smaller than amplitude of positioning completed and position reference being 0	1	0	Immediately	At stop
P05.19	14h	Positioning completed range	0 to 10000	1 reference unit	100	Immediately	During running
P05.20	15h	Positioning near	1 to 32767	1 reference	100	Immediat	During

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		signal width		unit		ely	running
P05.21	16h	Detection range for excessive position deviation	0 to 32767	1 encoder unit	20000	Immediately	During running
P05.22	17h	Excessive position deviation alarm selection	0: Valid 1: Invalid	1	0	Immediately	During running
P05.23	18h	Servo stop mode	0: Switch to servo speed control according to the downtime 1: Switch to the speed control deceleration stop	1	1	Immediately	During running
P05.24	19h	Servo stop time	0 to 3000 ms When the PL (CCWL), NL (.CWL) occurs, according to the time to slow down	1	100	Immediately	During running
P05.25	1Ah	Mechanical gear ratio in absolute position rotating mode (numerator)	1 to 65535	1	1	Immediately	At stop
P05.26	1Bh	Mechanical gear ratio in absolute position rotating mode (denominator)	1 to 65535	1	1	Immediately	At stop
P05.27	1Ch	Position offset in absolute position linear mode (low 32 bits)	0 to 4294967295	1 encoder unit	0	Immediately	At stop
P05.28	1Dh	Position offset in absolute position linear mode (high 32 bits)	0 to 4294967295	1 encoder unit	0	Immediately	At stop
P05.29	1Eh	Pulses per revolution of the load in absolute position rotating	0 to 4294967295	1 encoder unit	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		mode (low 32 bits)					
P05.30	1Fh	Pulses per revolution of the load in absolute position rotating mode (high 32 bits)	0 to 127	1 encoder unit	0	Immediately	At stop
P05.31	20h	Soft limit function setting	0: Disable soft limit 1: Enable software limit immediately after power-on 2: Enable soft limit after homing	1	0	Immediately	At stop
P05.32	21h	Software limit maximum point	-2147483647 to 2147483647	1 reference unit	2147483647	Immediately	At stop
P05.33	22h	Software limit minimum point	-2147483647 to 2147483647	1 reference unit	-2147483648	Immediately	At stop
Index 2006h (P06): Speed control parameters							
P06.00	01h	Main speed source selection	0: Digital reference (P06.01) 1 to 4: Reserved	1	0	Immediately	During running
P06.01	02h	Main speed reference setting	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	Immediately	During running
P06.02	03h	Auxiliary speed source selection	0: No auxiliary reference 1: Digital reference 2 to 4: Reserved	1	0	Immediately	During running
P06.03	04h	Auxiliary speed reference setting	-6000.0 to 6000.0 rpm	0.1 rpm	0	Immediately	During running
P06.04	05h	Main/auxiliary reference calculation	0: + 1: - 2: Terminal switching main and auxiliary reference 3: MAX (main reference, auxiliary reference) 4: MIN (main reference, auxiliary reference)	1	0	Immediately	During running

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
P06.05	06h	Jog speed	0.0 to 6000.0 rpm	0.1 rpm	100.0	Immediately	At stop
P06.06	07h	Jog operation					
P06.07	08h	Speed reference acceleration time 1	0 to 65535 ms	1 ms	1000	Immediately	During running
P06.08	09h	Speed reference deceleration time 1	0 to 65535 ms	1 ms	1000	Immediately	During running
P06.09	0Ah	Maximum speed threshold	0.0 to 6000.0 rpm	0.1 rpm	6000.0	Immediately	During running
P06.10	0Bh	Forward speed threshold	0.0 to 6000.0 rpm	0.1 rpm	6000.0	Immediately	During running
P06.11	0Ch	Reverse speed threshold	0.0 to 6000.0 rpm	0.1 rpm	6000.0	Immediately	During running
P06.12	0Dh	Positive torque limit channel	0: Internal positive torque limit value 1: Bus positive torque limit value 2: MIN(internal positive torque limit value, bus positive torque limit value) 3: External positive torque limit value	1	1	Immediately	At stop
P06.13	0Eh	Negative torque limit channel	0: Internal negative torque limit value 1: Bus negative torque limit value 2: MIN(internal negative torque limit value, bus negative torque limit value) 3: External negative torque limit value	1	1	Immediately	At stop
P06.14	0Fh	Internal positive torque limit value	0.0% to +400.0%	0.1%	Model dependent	Immediately	During running
P06.15	10h	Internal negative torque limit value	0.0% to +400.0%	0.1%	Model dependent	Immediately	During running
P06.16	11h	External positive	0.0% to +400.0%	0.1%	100.0	Immediat	During

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		torque limit value				ely	running
P06.17	12h	External negative torque limit value	0.0% to +400.0%	0.1%	100.0	Immediately	During running
P06.18	13h	Torque feedforward control selection	0: No torque feedforward 1: Internal torque feedforward (Use the speed instruction as a source of torque feedforward signals. In position control mode, the speed instruction comes from the output of the position controller.)	1	1	Immediately	During running
P06.19	14h	Zero clamp function	0: Disabled 1: Always enabled 2: Enabled under conditions (terminal enabled)	1	0	Immediately	At stop
P06.20	15h	Zero clamp gain	0 to 6.000	0.001	1.000	Immediately	During running
P06.21	16h	Zero clamp starting speed	0.0 to 1000.0rpm	0.1 rpm	2.0	Immediately	During running
P06.22	17h	Speed reached detection width	0.0 to 6000.0rpm	0.1 rpm	1000.0	Immediately	During running
P06.23	18h	Zero speed threshold	0.0 to 200.0rpm	0.1%	20.0	Immediately	During running
P06.24	19h	Speed matching threshold	0.0 to 100.0rpm	0.1 rpm	10.0	Immediately	During running
Index 2007h (P07): Torque control parameters							
P07.00	01h	Torque reference selection	0: Digital reference 1 to 3: Reserved	1	0	Immediately	At stop
P07.01	02h	Torque positive direction selection	0: Forward drive is positive 1: Reverse drive is positive	1	0	Immediately	At stop
P07.02	03h	Speed/Torque switchover mode selection	0: Switching directly 1: Switching once over the torque switching	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			point				
P07.03	04h	Torque digital setting	-400.0% to +400.0%	0.1%	0.0	Immediately	During running
P07.04	05h	Torque reference acceleration/ deceleration time	0 to 65535 ms	1 ms	0	Immediately	At stop
P07.05	06h	Torque reference filter time constant	0 to 30.0 ms	0.1 ms	1.0	Immediately	At stop
P07.06	07h	2nd torque reference filter time constant	0 to 30.0 ms	0.1 ms	1.0	Immediately	At stop
P07.07	08h	Speed/Torque switchover point	0.0% to 400.0% initial torque	0.1%	100.0	Immediately	At stop
P07.08	09h	Speed/Torque switchover delay	0 to 1000 ms	1 ms	0	Immediately	At stop
P07.09	0Ah	FWD speed limit channel	0: FWD speed limit value 1: Bus speed limit value 2: MIN (FWD speed limit value, bus speed limit value)	1	1	Immediately	At stop
P07.10	0Bh	FWD speed limit value	0.0% to 100.0%	0.1%	100.0	Immediately	During running
P07.11	0Ch	REV speed limit channel	0: REV speed limit value 1: Bus speed limit value 2: MIN (REV speed limit value, bus speed limit value)	1	1	Immediately	At stop
P07.12	0Dh	REV speed limit value	0.0% to 100.0%	0.1%	100.0	Immediately	During running
P07.13	0Eh	Base value for torque reached	0.0 to 400.0%	0.1%	0.0	Immediately	During running
P07.14	0Fh	Valid value for torque reached	0.0 to 400.0%	0.1%	20.0	Immediately	During running
P07.15	10h	Invalid value for torque reached	0.0 to 400.0%	0.1%	10.0	Immediately	During running
Index 2008h (P08): Gain parameters							
P08.00	01h	Speed loop	0.1 to 5000.0 Hz	0.1 Hz	20.0	Immediat	During

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		proportional gain 1				ely	running
P08.01	02h	Speed loop integral time 1	0.00 to 100.00 ms	0.01 ms	5.00	Immediately	During running
P08.02	03h	Position loop gain 1	1 to 8000 rad/s	1 rad/s	100	Immediately	During running
P08.03	04h	Filter time 1 of speed regulator output	0 to 32.0 ms	0.1 ms	0.8	Immediately	During running
P08.04	05h	Speed loop proportional gain 2	0.1 to 5000.0 Hz	0.1 Hz	20.0	Immediately	During running
P08.05	06h	Speed loop integral time 2	0.00 to 100.00 ms	0.01 ms	1.00	Immediately	During running
P08.06	07h	Position loop gain 2	1 to 8000 rad/s	1 rad/s	100	Immediately	During running
P08.07	08h	Filter time 2 of speed regulator output	0 to 32.0 ms	0.1 ms	0.8	Immediately	During running
P08.08	09h	Gain mode selection	0: The first gain is fixed, use external DI for P/PI switching 1: Use gain switching according to the condition of P08.09	1	0	Immediately	During running
P08.09	0Ah	Gain switchover condition selection	0: Gain 1 is not switched 1: Use external DI terminal switching 2: Torque reference 3: Speed reference 4: Feedback speed 5: Speed reference change rate 6: Position deviation 7: Speed reference high and low speed threshold 8: Position reference 9: Positioning uncompleted	1	0	Immediately	During running

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			10: Position reference + actual speed				
P08.10	0Bh	Gain switchover delay time	0 to 1000 ms	1 ms	5	Immediately	During running
P08.11	0Ch	Gain switchover level	0 to 20000	Switch according to conditions	50	Immediately	During running
P08.12	0Dh	Gain switchover dead time	0 to 20000	Switch according to conditions	30	Immediately	During running
P08.13	0Eh	Position gain switchover time	0 to 1000 ms	1 ms	5	Immediately	During running
P08.14	0Fh	Speed feedforward filter time	0.00 to 64.00 ms	0.01 ms	0.5	Immediately	During running
P08.15	10h	Speed feedforward gain	0.0 to 100.0%	0.01%	0.0	Immediately	During running
P08.16	11h	Torque feedforward filter time	0.00 to 64.00 ms	0.01	0.5	Immediately	During running
P08.17	12h	Torque feedforward gain	0.0 to 200.0%	0.1%	0.0	Immediately	During running
P08.18	13h	Encoder filter time	0.0 to 40.0 ms	0.1 ms	1.0	Immediately	During running
P08.19	14h	PDFF (pseudo-derivative feedforward) control coefficient (in non-torque control mode, reserved)	0.0 to 100.0%	0.1%	100.0	Immediately	During running
Index 2009h (P09): Adjustment parameters							
P09.00	01h	Offline inertia auto-tuning function		0.01	0.00	Immediately	At stop
P09.01	02h	Maximum speed of inertia	200 to 2000 rpm	1 rpm	800	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		auto-tuning					
P09.02	03h	Acceleration time for inertia auto-tuning	10 to 1000 ms	1 ms	100	Immediately	At stop
P09.03	04h	Motor revolutions for inertia auto-tuning	0.00 to 2.00 r	0.01 r	0.00	Immediately	At stop
P09.04	05h	Waiting time after a single inertia auto-tuning	50 to 10000	1 ms	800	Immediately	At stop
P09.05	06h	Online inertia auto-tuning mode	0: Disabled 1: Enabled, change slowly 2: Enabled, change generally 3: Enabled, change quickly	1	0	Immediately	At stop
P09.06	07h	Gain adjustment mode	0: The parameter self-adjustment is invalid, and the parameter is adjusted manually 1: parameter self-adjustment mode, use the rigidity table to automatically adjust the gain parameters 2: Positioning mode, use the rigidity table to automatically adjust the gain parameters	1	0	Immediately	At stop
P09.07	08h	Stiffness level	0 to 31	1	14	Immediately	At stop
P09.08	09h	Adaptive notch filter mode	0: The 3rd and 4th notch filter parameters are not updated 1: 3rd notch filter parameter adaptive result update 2: 3rd and 4th notch	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			filter parameter adaptive results update 3: Automatically detect the mechanical resonance frequency, but do not set the relevant parameters of the notch filter 4: All 4 notch filter parameters return to default values				
P09.09	0Ah	Automatic vibration suppression sensitivity	1 to 100	1	1	Immediately	At stop
P09.10	0Bh	Notch filter 1 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop
P09.11	0Ch	Notch filter 1 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop
P09.12	0Dh	Notch filter 2 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop
P09.13	0Eh	Notch filter 2 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop
P09.14	0Fh	Notch filter 3 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop
P09.15	10h	Notch filter 3 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop
P09.16	11h	Notch filter 4 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop
P09.17	12h	Notch filter 4 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop
P09.18	13h	Speed loop low-pass filter time constant	0 to 65536 us	1 us	0	Immediately	At stop
P09.19	14h	Speed reference notch filter frequency	0 to 1000 Hz	1 Hz	0	Immediately	At stop
P09.20	15h	Speed reference notch filter width	10 to 500 Hz	1 Hz	100	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
P09.21	16h	Reserved					
P09.22	17h	Auto-tuned resonance frequency	0 to 4000 Hz	1 Hz	-	Immediately	At stop
P09.23	18h	Disturbance torque compensation gain	0.0% to 100.0%	0.1%	0	Immediately	At stop
P09.24	19h	Filter time of disturbance observer	0.00 to 25.00 ms	0.01 ms	0	Immediately	At stop
P09.25	1Ah	Suppression mode of low-frequency resonance	0: Manually set vibration suppression parameters 1: Automatically set vibration suppression parameters	1	0	Immediately	During running
P09.26	1Bh	Low-frequency resonance frequency	0.0 to 100.0 Hz	0.1 Hz	0.0	Immediately	During running
P09.27	1Ch	Filter setting of low-frequency resonance frequency	0 to 20	1	0	Immediately	During running
P09.28	1Dh	Position deviation threshold in low-frequency resonance	0 to 100 P	1 P	10	Immediately	At stop
P09.29	1Eh	Torque reference offset (vertical axis mode)	-300.00% to 300.00%	0.01%	0.00	Immediately	During running
P09.30	1Fh	Gravity compensation value	-100.0% to 100.0%	0.1%	0.0	Immediately	At stop
P09.31	20h	Positive friction compensation	0.0% to 100.0%	0.1%	0.0	Immediately	At stop
P09.32	21h	Negative friction compensation	0.0% to 100.0%	0.1%	0.0	Immediately	At stop
P09.33	22h	Friction compensation	0.1 to 30.0 rpm	0.1 rpm	0.0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		speed threshold					
P09.34	23h	Friction compensation speed selection	0: Speed reference 1: Speed feedback	1	0	Immediately	At stop
P09.35 to P09.37	Reserved						
P09.38	27h	Load moment of inertia ratio	0.00 to 120.00	0.01	1.00	Immediately	At stop
Index 200Ah (P10): Fault and protection parameters							
P10.00	01h	Action upon phase loss	0: Activate protection upon input and output phase loss 1: No protection upon input phase loss 2: No protection upon output phase loss 3: No protection upon input and output	1	0	Immediately	During running
P10.01	02h	Action upon communication fault	0: Activate protection and coast to stop 1: Alarm and keep running	1	0	Immediately	During running
P10.02	03h	Action upon temperature sampling disconnection	0: Activate protection and coast to stop 1: Alarm and keep running	1	0	Immediately	During running
P10.03	04h	Reserved					
P10.04	05h	Stop mode at overtravel	0: Activate protection and coast to stop 1: Alarm, decelerate to zero, keep position locked	1	0	Immediately	During running
P10.05	06h	Action upon output disconnection	0: No action 1: Activate protection	1	0	Immediately	During running
P10.06	07h	Protection setting for motor overload	0: Activate protection and coast to stop 1: Alarm and keep running	1	1	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
P10.07	08h	Motor overload protection gain	20.0% to 300.0%	0.1%	100.0	Immediately	During running
P10.08	09h	Drive fan control	0: Temperature control (if module temperature > 35℃, the fan runs; if < 30℃, the fan stops.) 1: Always runs 2: Control based on drive status (when the drive is enabled, the fan runs. when the drive is stopped: if the module temperature > 35℃, the fan runs; if < 30℃, the fan stops.) 3: Does not run	1	0	Immediately	At stop
P10.09	0Ah	Stall overtemperature detection	0: Disable motor stall overtemperature protection detection 1: Enable motor stall overtemperature protection detection	1	1	Immediately	At stop
P10.10	0Bh	Stall overtemperature protection time window	10 to 800 ms	1 ms	200	Immediately	At stop
P10.11	0Ch	Encoder multi-turn overflow fault selection	0: Not hide 1: Hide	1	1	Immediately	At stop
P10.12	0Dh	Overspeed fault threshold	0.0 to 10000.0 rpm	0.1 rpm	6000.0	Immediately	At stop
P10.13	0Eh	Maximum position pulse frequency	100 to 8000 kHz	1 kHz	8000	Immediately	At stop
P10.14	0Fh	Absolute encoder battery undervoltage troubleshooting	0: Set the battery low voltage to fault, monitor the battery voltage every time the driver is powered on or reset, undervoltage	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			will report the undervoltage alarm, and no detection over time; 1: Set the battery low voltage to warning: battery undervoltage (below 3V) will warn, always detect the battery voltage.				
P10.15	10h	Reserved					
P10.16	11h	Reserved					
P10.17	12h	Reserved					
P10.18	13h	Latest fault type	0: No abnormal record 1: Overcurrent 2: Main circuit overvoltage 3: Reserved 4: Motor blocked 5: Reserved 6: Phase loss on the input side 7: Phase loss on the output side 8: Heatsink over-temperature 9: Braking resistor overload 10: Power module protection 11: Servo drive overload 12: Motor overload 13: EEPROM read and write error 14: Reserved 15: Reserved 16: Abnormal current detection circuit 17: Reserved	1	0	-	At display

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			18: Poor auto-tuning 19: Encoder fault 20: Undervoltage during main circuit operation 21: Reserved 22: Parameter setting error 23: Reserved 24: Reserved 25: Inverter module sampling disconnection protection 26: Reserved 27: Overspeed (the actual speed of the servo motor exceeds the overspeed fault threshold) 28 to 30: Reserved 31: Encoder multi-turn count overflow 32: Position deviation is too large 33: Abnormal pulse input 34: Reserved 35: Reserved 36: Bus communication connection is interrupted 37: Homing timeout 38: Reserved 39: Forward overtravel 40: Reverse overtravel 41: Reserved 42: Reserved 43: External fault				

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			44 to 45: Reserved 46: Short circuit to ground at power-on 47: Reserved 48: Internal logic error 1 49: Internal logic error 2 50: EtherCAT initialization error 51: EtherCAT parameter mapping error 52: Incorrect EtherCAT distribution clock/interpolation cycle 53: Reserved 54: Synchronization signal lost 55 to 60: Reserved 61: Abnormal electronic gear ratio 62: Interrupt positioning alarm 63 to 65: Reserved 66: Homing logic error 70 to 71: Reserved 72: The software does not match the control board 73: Bootstrap timeout 74: Reserved 75: Absolute encoder battery undervoltage 76: Absolute encoder battery disconnection 77: The actual encoder type is inconsistent with that read by				

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			P01.00 78: Parameter not stored in EEPROM of absolute encoder 79: Absolute encoder EEPROM parameter write error 80: Reserved 81: Encoder seeking origin error 84: Absolute encoder EEPROM parameter read error 85: Drive output disconnection				
P10.19	14h	2nd fault type	The same as P10.18	1	0	-	At display
P10.20	15h	1st fault type	The same as P10.18	1	0	-	At display
P10.21	16h	Bus voltage upon the latest fault	0 to 999 V	1 V	0	-	At display
P10.22	17h	Phase V current upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.23	18h	Phase W current upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.24	19h	D-axis current reference value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.25	1Ah	Q-axis current reference value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.26	1Bh	D-axis current feedback value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.27	1Ch	Q-axis current	-1000.0 to 1000.0 A	0.1 A	0.0	-	At

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		feedback value upon the latest fault					display
P10.28	1Dh	Speed upon the latest fault	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	-	At display
P10.29	1Eh	Encoder position feedback upon the latest fault (PUU)	-2147483648 to 2147483647	1	0	-	At display
P10.30	1Fh	DI status upon the latest fault	Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0: DI5	1	0	-	At display
P10.31	20h	DO status upon the latest fault	Unit place of LED: BIT0 to BIT2: DO1 to DO3	1	0	-	At display
P10.32	21h	Drive status upon the latest fault	0 to FFFFH (the same as P11.11)	1	0	-	At display
P10.33	22h	Temperature upon the latest fault	-40.0 to 150.0℃	0.1℃	0.0	-	At display
P10.34	23h	Bus voltage upon the 2nd fault	0 to 999 V	1 V	0	-	At display
P10.35	24h	Phase V current upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.36	25h	Phase W current upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.37	26h	D-axis current reference value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.38	27h	Q-axis current reference value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.39	28h	D-axis current feedback value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.40	29h	Q-axis current feedback value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.41	2Ah	Speed upon the 2nd fault	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	-	At display
P10.42	2Bh	Encoder position	-2147483648 to	1	0	-	At

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		feedback upon the 2nd fault (PUU)	2147483647				display
P10.43	2Ch	DI status upon the 2nd fault	Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0: DI5	1	0	-	At display
P10.44	2Dh	DO status upon the 2nd fault	Unit place of LED: BIT0 to BIT2: DO1 to DO3	1	0	-	At display
P10.45	2Eh	Drive status upon the 2nd fault	0 to FFFFH (the same as P11.11)	1	0	-	At display
P10.46	2Fh	Temperature upon the 2nd fault	-40.0 to 150.0℃	0.1℃	0.0	-	At display
P10.47	30h	Bus voltage upon the 1st fault	0 to 999 V	1 V	0	-	At display
P10.48	31h	Phase V current upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.49	32h	Phase W current upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.50	33h	D-axis current reference value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.51	34h	Q-axis current reference value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.52	35h	D-axis current feedback value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.53	36h	Q-axis current feedback value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display
P10.54	37h	Speed upon the 1st fault	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	-	At display
P10.55	38h	Encoder position feedback upon	-2147483648 to 2147483647	1	0	-	At display

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		the 1st fault (PUU)					
P10.56	39h	DI status upon the 1st fault	Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0: DI5	1	0	-	At display
P10.57	3Ah	DO status upon the 1st fault	Unit place of LED: BIT0 to BIT2: DO1 to DO3	1	0	-	At display
P10.58	3Bh	Drive status upon the 1st fault	0 to FFFFH (the same as P11.11)	1	0	-	At display
P10.59	3Ch	Temperature upon the 1st fault	-40.0 to 150.0℃	0.1℃	0.0	-	At display
Index 200Bh (P11): Display parameters							
P11.00	01h	Speed reference	-6000.0 to 6000.0 rpm	0.1 rpm		-	At display
P11.01	02h	Actual motor speed	-6000.0 to 6000.0 rpm	0.1 rpm		-	At display
P11.02	03h	Output voltage	0 to 480 V	1 V		-	At display
P11.03	04h	Output current	0.0 to 4 Ie A	0.1 A		-	At display
P11.04	05h	Q-axis current	-400.0 to +400.0% Ie	0.1%		-	At display
P11.05	06h	D-axis current	-100.0 to +100.0% Ie	0.1%		-	At display
P11.06	07h	Output torque	-400.0 to +400.0%	0.1%		-	At display
P11.07	08h	Reserved					
P11.08	09h	Average load rate	0.0 to 400.0% Te	0.1%		-	At display
P11.09	0Ah	Main circuit bus voltage	0 to 800 V	1 V		-	At display
P11.10	0Bh	Control circuit bus voltage	0 to 800 V	1 V		-	At display
P11.11	0Ch	Operation state of servo drive	0 to FFFFH Bit0: RUN/STOP Bit1: REV/FWD Bit2: Running at zero speed	1		-	At display

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			Bit3: Accelerating Bit4: Decelerating Bit5: Running at constant speed Bit6: Reserved Bit7: Reserved Bit8: Over-current limiting Bit9: DC over-voltage limiting Bit10: Torque limiting Bit11: Speed limiting Bit12: Drive in fault Bit13: Speed control Bit14: Torque control Bit15: Position control				
P11.12	0Dh	DI terminal state	0 to 1FH, 0: open; 1: closed The high-speed pulse reference will not be refreshed synchronously	1		-	At display
P11.13	0Eh	DO terminal state	0 to 7H, 0: open; 1: closed The high-speed pulse output will not be refreshed synchronously	1		-	At display
P11.14 to P11.17	0Fh to 12h	Reserved					
P11.18	13h	Motor encoder counter value	0 to 4 times motor encoder lines -1	1		-	At display
P11.19	14h	Reserved					
P11.20	15h	Number of input pulses	-2147483648 to 2147483647			-	At display
P11.21	16h	Low 32 bits of reference point position (encoder unit)	-2147483648 to 2147483647	1		-	At display

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
P11.22	17h	Position reference	-2147483648 to 2147483647	1		-	At display
P11.23	18h	Position feedback	-2147483648 to 2147483647	1		-	At display
P11.24	19h	Position error pulse	-2147483648 to 2147483647	1		-	At display
P11.25	1Ah	Low 32 bits of reference point position (PUU)	-2147483648 to 2147483647	1		-	At display
P11.26	1Bh	Position reference (PUU)	-2147483648 to 2147483647	1		-	At display
P11.27	1Ch	Position feedback (PUU)	-2147483648 to 2147483647	1		-	At display
P11.28	1Dh	Position error pulse (PUU)	-2147483648 to 2147483647	1		-	At display
P11.29	1Eh	Accumulated power-on hours	0 to maximum 65535 hours	1 hour		-	At display
P11.30	1Fh	Accumulated work hours	0 to maximum 65535 hours	1 hour		-	At display
P11.31	20h	Module temperature	-40.0℃ to 150.0℃	0.1℃		-	At display
P11.32	21h	Encoder single-turn position	0 to 8388608	1		-	At display
P11.33	22h	Number of revolutions fed back by the absolute encoder	0 to 65535 r	1 r		-	At display
P11.34	23h	Load moment of inertia ratio	0.00 to 120.00	0.01		-	At display
P11.35	24h	Absolute position PUU value	Machine current absolute position (reference unit) = mechanical absolute position / mechanical gear ratio -2147483648 to 2147483647	Reference unit		-	At display
P11.36	25h	Mechanical	In absolute position	Encoder		_	At

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		absolute position (low 32 bits)	linear mode or absolute position rotary mode, the load position is converted to the position of the motor side (encoder unit) Mechanical absolute position = encoder absolute position - origin offset	unit			display
P11.37	26h	Mechanical absolute position (high 32 bits)		Encoder unit		-	At display
P11.38	27h	Absolute position of absolute encoder (low 32 bits)	The absolute position of the absolute encoder feedback. Encoder unit	Encoder unit		-	At display
P11.39	28h	Absolute position of absolute encoder (high 32 bits)		Encoder unit		-	At display
P11.40	29h	Single-turn position of rotating load (low 32 bits)	In the absolute position rotation mode, the position within one revolution of the rotating load is converted to the motor position of the motor side. Encoder unit	Encoder unit		-	At display
P11.41	2Ah	Single-turn position of rotating load (high 32 bits)		Encoder unit		-	At display
P11.42	2Bh	Single-turn position of rotating load	In absolute position rotation mode, the unit of position command within one revolution of the rotation load	Reference unit		-	At display
P11.43	2Ch	Mechanical angle (number of pulses starting from the home)		Encoder unit		-	At display
P11.44	2Dh	Electrical angle	0.00 to 360.00°	0.01°		-	At display
P11.45	2Eh	Encoder multi-turn overflow value	-2147483648 to 2147483647	1		-	At display
P11.46	2Fh	High 32 bits of	-2147483648 to	1		-	At

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		reference point position (PUU)	2147483647				display
P11.47	30h	Reserved					
P11.48	31h	High 32 bits of reference point position (encoder unit)	-2147483648 to 2147483647	1		-	At display
P11.49 to P11.54	32h to 37h	Reserved					
Index 200Ch (P12): Servo positioning parameters							
P12.00	01h	Homing selection	0: Disabled 1: Homing enabled by the HomingStart signal input from DI 2: Electrical homing enabled by the HomingStart signal input from DI 3: Homing enabled immediately upon power-on 4: Homing performed immediately 5: Electrical homing started 6: Current position as the home	1	0	Immediately	During running
P12.01	02h	Homing mode	0: Forward, home switch as deceleration point and home 1: Reverse, home switch as deceleration point and home 2: Forward, motor Z signal as deceleration point and home 3: Reverse, motor Z signal as deceleration	1	9	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			point and home 4: Forward, home switch as deceleration point and Z signal as home 5: Reverse, home switch as deceleration point and Z signal as home 6: Forward, positive limit switch as deceleration point and home 7: Reverse, negative limit switch as deceleration point and home 8: Forward, positive limit switch as deceleration point and Z signal as home 9: Reverse, negative limit switch as deceleration point and Z signal as home 100+X: CiA402 homing mode X				
P12.02	03h	Homing command terminal mode	0: Level mode 1: Pulse mode	1	0	Immediately	At stop
P12.03	04h	Reserved					
P12.04	05h	Positioning acceleration and deceleration curve selection	0: T-shaped curve 1: S-shaped curve	1	0	Immediately	At stop
P12.05	06h	High-speed home searching speed	0.0 to 1000.0 rpm	0.1 rpm	100.0	Immediately	At stop
P12.06	07h	Low-speed home searching speed	0.0 to 1000.0 rpm	0.1 rpm	10.0	Immediately	At stop
P12.07	08h	Home	-1073741824 to	1	0	Immediat	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		position offset	1073741824			ely	
P12.08	09h	Home searching acceleration/ deceleration time	0 to 65535 ms	1	200	Immediately	At stop
P12.09	0Ah	Home search time limit	0 to 65535 ms	1	60000	Immediately	At stop
P12.10	0Bh	Positioning mode selection	0: Relative position 1: Absolute position	1	0	Immediately	At stop
P12.11	0Ch	Home offset mode	0: After finding the home, position feedback 6064h = 607Ch 1: After finding the home, position feedback 6064h = current position + incremental displacement 607Ch 2: After finding the home, continue to execute the home offset position segment. After the execution is completed, the position feedback 6064h = 0 3: After finding the home, continue to execute the home offset position segment. After the execution is completed, the position feedback 6064h = 607Ch	1	0	Immediately	At stop
P12.12	0Dh	Positioning time sequence selection	0: Receiving new positioning signal in the process of	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
			positioning, no response 1: Receiving new positioning signal in the process of positioning, positioning the new position directly				
P12.85	56h	Mechanical position offset	-2147483648 to 2147483647			-	At display
Index 2011h (P17): EtherCAT communication parameters							
P17.00	01h	EtherCAT software version number	0.00 to 99.99	0.01		-	At display
P17.01	02h	EtherCAT bus subprotocol	101: COE 102: SOE (reserved) Other: Reserved	1	-	-	At display
P17.02	03h	EtherCAT bus status	1: INIT 2: PRE-OPERATIONAL 3: SAFE-OPERATIONAL 4: OPERATIONAL	1	-	-	At display
P17.03	04h	Bus operating mode	Drive operating mode when controlled by COE bus: 1: Profile Position Mode 3: Profile Velocity Mode 4: Profile Torque Mode 6: Homing Mode 8: Cyclic Synchronous Position Mode 9: Cyclic Synchronous Velocity Mode 10: Cyclic Synchronous Torque Mode	1	-	-	At display
P17.04	05h	0x6040 Control word	0 to 65535	1	-	-	At display
P17.05	06h	0x6060 Control mode	0 to 65535	1	-	-	At display
P17.06	07h	0x607A Position	-2147483648 to	1	-	-	At

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		reference	2147483647				display
P17.07	08h	0x60FF Speed reference	-2147483648 to 2147483647	1	-	-	At display
P17.08	09h	0x6071 Torque reference	-32768～32767	1	-	-	At display
P17.09	0Ah	0x60E0 Positive torque limit	0 to 65535	1	-	-	At display
P17.00	0Bh	0x60E1 Negative torque limit	0 to 65535	1	-	-	At display
P17.11	0Ch	0x6072 Maximum torque	0 to 65535	1	-	-	At display
P17.12	0Dh	0x607F Speed limit	0 to 4294967295	1	-	-	At display
P17.13	0Eh	0x6080 Speed limit	0 to 4294967295	1	-	-	At display
P17.14	0Fh	0x6098 Homing mode	0 to 65535	1	-	-	At display
P17.15	10h	0x607E Polarity	0 to 65535	1	-	-	At display
P17.16	11h	0x6081 Profile speed	0 to 4294967295	1	-	-	At display
P17.17	12h	0x6041 Status word	0 to 65535	1	-	-	At display
P17.18	13h	0x6061 Control mode	0 to 65535	1	-	-	At display
P17.19	14h	0x6064 Position feedback	-2147483648 to 2147483647	1	-	-	At display
P17.20	15h	0x606C Speed feedback	-2147483648 to 2147483647	1	-	-	At display
P17.21	16h	0x6077 Torque feedback	-32768 to 32767	1	-	-	At display
P17.22	17h	Reserved		1	-	-	At display
P17.23	18h	Reserved		1	-	-	At display
P17.24	19h	Whether to store function code parameters written through	0: Do not store 1: Data written through the EtherCAT bus is stored to the EEPROM	1	0	Immediately	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		EtherCAT in EEPROM	of the drive				
P17.25	1Ah	EtherCAT communication disconnection detection time	0.0 to 1000.0 s (When the parameter is set to 0, no disconnection detection is performed)	0.1 s	0.1	Power-on again	At stop
P17.26	1Bh	EtherCAT bus parameter initialization	0: No action 1: Restore to default value 2: Parameter saving	1	0	Immediately	At stop
Index 2012h (P18): Advanced parameters							
P18.00	01h	User password					
P18.01	02h	Drive operation mode	1: VC 2: IF (P02.00 is invalid at this time, and the speed reference is P06.01) 3: VF (same as above)	1	1	Immediately	At stop
P18.02	03h	Current loop gain	0.01 to 500.00	0.01	10.00	Immediately	At stop
P18.03	04h	Current loop integral	0.5 to 100.0 ms	0.1 ms	10.0	Immediately	At stop
P18.04 to P18.15	05h to 10h	Advanced parameters					
P18.16 to P18.28	P11h to 1Dh	Reserved					
Index 2014h (P20): Bus configuration group parameters							
P20.00	01h	Synchronization coefficient	0 to 65535	1	0	Power-on again	At stop
P20.01	02h	Upper limit of synchronization coefficient	0 to 65535	1	-	-	At display
P20.02 to P20.07	03h to 08h	Reserved					
P20.08	09h	Slave station axis	0 to 65535	1	0	Power-on	At stop

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
		address				again	
P20.09	0Ah	Master station configuration address	0 to 65535	1	-	-	At display
P20.10	0Bh	Data interpolation cycle	0 to 65535	1	0	Power-on again	At stop
P20.11	0Ch	Zero speed torque limit	0 to 65535	1	0	Immediately	At stop
P20.12	0Dh	Reserved					
P20.13	0Eh	Er.076 Fault reset selection	0: The bus cannot reset 76 fault 1: The bus can reset 76 fault	1	0	Immediately	At stop
P20.14	0Fh	Torque user unit	0: 0.1% 1: 0.01 N·M	1	0	Immediately	At stop
P20.15	10h	Speed user unit	0: Reference unit /s 1: rpm	1	0	Immediately	At stop
P20.16	11h	Interpolation setting for reference	0: Interpolation enabled 1: Interpolation disabled	1	0	Immediately	At stop
P20.17	12h	Bus torque reference filtering	0 to 65535	1	0	Immediately	At stop
P20.18	13h	Rapid deceleration slope for bus torque reference	0 to 65535	1	0	Immediately	At stop
P20.19	14h	Deceleration time for bus speed limit	0 to 65535	1	0	Immediately	At stop
P20.20	15h	Acceleration and deceleration slope for bus torque reference	0 to 65535	1	0	Immediately	At stop
P20.21 to P20.29	16h to 1Eh	Reserved					
Index 2017h (P23): Special function parameters							
P23.00 to	01h to	Reserved					

Parameter	Sub-index	Name	Value range	Min. unit	Default value	Effective time	Property
P23.05	06h						
P23.06	07h	Output torque filter time constant	0 to 100.0 ms	0.1 ms	0.0	Immediately	At stop
P23.07	08h	Whether to save encoder multi-turn overflow value on power failure	0: Saved on power failure 1: Not saved on power failure	1	0	Immediately	At stop
P23.08 to P23.10	09h to 0Bh	Reserved					
P23.11	0Ch	Accumulated position errors of absolute encoder	0 to 65535	1	0	-	At display
P23.12	0Dh	Pulse range for homing completed	0: 100 pulses Other: Self-defined pulses	1	0	Immediately	At stop
P23.13 to P23.39	0Eh to 28h	Reserved					

8.2 CiA402 object dictionary list

Index	Object code	Name	Data type	Access	PDO mapping	Unit
603Fh	VAR	Error code	UINT16	RW	TPDO	-
6040h	VAR	Control word	UINT16	RW	RPDO	-
6041h	VAR	Status word	UINT16	RO	TPDO	-
605Ah	VAR	Quick stop option code	INT16	RW	RPDO	-
605Bh	VAR	Shutdown option code	INT16	RW	RPDO	-
605Ch	VAR	Disable operation option code	INT16	RW	RPDO	-
605DH	VAR	Halt option code	INT16	RW	RPDO	-
6060h	VAR	Modes of operation	INT8	RW	RPDO	-
6061h	VAR	Modes of operation display	INT8	RO	TPDO	-
6063h	VAR	Position actual value* (motor unit)	INT32	RO	TPDO	p
6064h	VAR	Position actual value (user unit)	INT32	RO	TPDO	Reference unit
6065h	VAR	Following error window	UINT32	RW	RPDO	Reference unit
6066h	VAR	Following error window time	UINT16	RW	RPDO	ms
6067h	VAR	Position window	UINT32	RW	RPDO	Reference unit
6068h	VAR	Position window time	UINT16	RW	RPDO	ms
6069h	VAR	Velocity sensor actual value	INT32	RO	TPDO	rpm
606Bh	VAR	Velocity demand value	INT32	RO	TPDO	rpm
606Ch	VAR	Velocity actual value	INT32	RO	TPDO	Reference unit/s
606Dh	VAR	Velocity window	UINT16	RW	RPDO	rpm
606Eh	VAR	Velocity window time	UINT16	RW	RPDO	ms
606Fh	VAR	Velocity threshold	UINT16	RW	RPDO	rpm
6070h	VAR	Velocity threshold time	UINT16	RW	RPDO	ms
6071h	VAR	Target torque	INT16	RW	RPDO	0.1%
6072h	VAR	Max torque	UINT16	RW	RPDO	0.1%
6074h	VAR	Torque demand	INT16	RO	TPDO	0.1%
6077h	VAR	Torque actual value	INT16	RO	TPDO	0.1%
607Ah	VAR	Target position	INT32	RW	RPDO	Reference unit

Index	Object code	Name	Data type	Access	PDO mapping	Unit
607Ch	VAR	Home offset	INT32	RW	RPDO	Reference unit
607Dh	ARRAY	Software position limit	INT32	RW	RPDO	Reference unit
607Eh	VAR	Polarity	UINT8	RW	RPDO	-
607Fh	VAR	Max profile velocity	UINT32	RW	RPDO	Reference unit/s
6080h	VAR	Max motor speed	UINT32	RW	RPDO	rpm
6081h	VAR	Profile velocity	UINT32	RW	RPDO	Reference unit/s
6083h	VAR	Profile acceleration	UINT32	RW	RPDO	Reference unit/s^2
6084h	VAR	Profile deceleration	UINT32	RW	RPDO	Reference unit/s^2
6085h	VAR	Quick stop deceleration	UINT32	RW	RPDO	Reference unit/s^2
6087h	VAR	Torque slope	UINT16	RW	RPDO	0.1%/s
6091h	ARRAY	Gear ratio	UINT32	RW	RPDO	-
6098h	VAR	Homing method	INT8	RW	RPDO	-
6099h	ARRAY	Homing speeds	UINT32	RW	RPDO	
609Ah	VAR	Homing acceleration	UINT32	RW	RPDO	
60B8h	VAR	Touch probe function	INT16	RW	RPDO	-
60B9h	VAR	Touch probe status	UINT16	RO	TPDO	-
60BAh	VAR	Touch probe Pos1 pos value	INT32	RO	TPDO	Reference unit
60BBh	VAR	Touch probe Pos1 neg value	INT32	RO	TPDO	Reference unit
60BCh	VAR	Touch probe Pos2 pos value	INT32	RO	TPDO	Reference unit
60BDh	VAR	Touch probe Pos2 neg value	INT32	RO	TPDO	Reference unit
60E0h	VAR	FWD torque limit	UINT16	RW	RPDO	0.1%
60E1h	VAR	REV torque limit	UINT16	RW	RPDO	0.1%
60F4h	VAR	Following error actual value	INT32	RO	TPDO	Reference unit
60FDh	VAR	Digital inputs	UINT32	RO	TPDO	-
60FEh	ARRAY	Digital outputs	UINT32	RW	RPDO	-

Index	Object code	Name	Data type	Access	PDO mapping	Unit
60FFh	VAR	Target velocity	INT32	RW	RPDO	Reference unit/s

Chapter 9 Troubleshooting

The drive has two protection levels: Fault and Alarm. When the drive fault or alarm occurs, the high byte of 0x603f is 0xff, and the low byte is the drive fault code or alarm code. For details, see P10.18. please refer to the bit7 of 0x6041 to determine whether it is a fault or alarm, bit7=1 indicates an alarm, otherwise fault.

603Fh	VAR	Error Code	UINT16	RW	TPDO	-

All possible fault types, fault causes and solutions for M3-N are summarized in Table 9-1.

Table 9-1 Fault record table

Fault code	Fault type	Fault cause	Check method	Solution
Er.001	Drive overcurrent	The motor cables are in poor contact.	Check whether the cable connector is loose	Fasten the connector that becomes loose.
		The motor cables are grounded	Check the insulation resistance between the UVW and the grounding cable of the motor.	Replace the motor if the insulation is poor.
		The motor UVW cables are short circuited.	Check whether the motor UVW cables are short circuited.	Connect the motor cables correctly.
		The motor is damaged.	Check whether resistance between the motor cables UVW is balanced.	Replace the motor if the resistance is unbalanced.
		The gain setting is improper and the motor oscillates.	Check whether the motor oscillates or generates a shrill noise, or view the running graphics.	Re-adjust the gain.
		The encoder cable is incorrectly wired, corrosive, or connected loosely.	Check whether the encoder wiring is good and reliable.	Re-weld or fasten the encoder cable
Er.002	Drive main circuit overvoltage	The main circuit input voltage is too high.	Measure the input power line voltage range.	Adjust the power voltage according to the specification.
		The braking resistor fails.	Measure the resistance between P and PB.	If the resistor is open, replace the external braking resistor.

Fault code	Fault type	Fault cause	Check method	Solution
		External braking resistor value does not match (The resistance of the the external resistor is too large, and the energy absorption during braking is insufficient.)	Confirm the braking resistor value.	Select the appropriate braking resistor value according to operating conditions and load.
		The motor is in abrupt acceleration/deceleration state.	Confirm the deceleration ramp time during running and monitor the DC bus voltage P11.09.	Increase the acceleration/deceleration time in the allowed range.
Er.004	Motor is blocked	The power output phase (UVW) loss or incorrect phase sequence occurs on the servo drive.	Perform motor trial running when the motor has no load and check the motor wiring.	Connect the motor cables correctly again or replace them.
		The UVW cable breaks.	Check the wiring.	Connect the motor cables correctly again or replace them.
		The motor rotor is locked due to mechanical factors.	Confirm the running command and motor speed.	Eliminate mechanical factors.
Er.006	Input side phase loss	There is phase loss in input L1, L2, L3.	Check input wiring; check input power.	If the input power is single-phase 220 V, then P10.00=1; if the input power is three-phase 220 V, check whether the input power is missing phase, and replace the cable wiring.
Er.007	Output side phase loss	There is phase loss in output U, V, W.	Check the output wiring Check the motor and the cables	Replace the cable wiring.
Er.008	Drive overheat	Ambient temperature is too high	Check the cooling conditions around the drive.	Improve the servo drive cooling conditions, reduce the ambient temperature.

Fault code	Fault type	Fault cause	Check method	Solution
		Multiple overload operation	Check fault records, whether overload fault has been reported.	Waiting for 60 s to reset after overload, increase the drive, motor capacity, increase the acceleration and deceleration time, reduce the load.
		The fan is damaged.	Whether the fan is running when running	Replace the fan
Er.009	Braking resistor overload	The cable of the external braking resistor is in poor connection, becomes loose or breaks.	Check the braking resistor wiring according to the correct wiring diagrams.	Rewire according to the correct wiring diagrams.
		The jumper across terminals P and PB is disconnected when the internal braking resistor is used.	Confirm the power terminal jumper wiring	Properly connect the jumper.
		The capacity of the servo drive or the braking resistor is insufficient.	Calculate the maximum braking energy	Improve braking resistor capacity or servo unit capacity, increase acceleration and deceleration time.
		The load inertia is too large.	Confirm the load inertia	Improve the drive, motor, resistor capacity.
Er.010	Power module protection	There is interphase short circuit or grounding short circuit in output three phases.	Check cable and output motor insulation.	Replace the cable or motor.
		Instantaneous over-current of the drive	See the over-current solutions	See the over-current solutions
		The auxiliary power supply is damaged; the drive voltage is insufficient.	Seek for service support	Seek for service support
		Inverter module bridging conduction	Seek for service support	Seek for service support
		Abnormal control board	Seek for service support	Seek for service support
		Braking pipe damaged	Seek for service support	Seek for service support

Fault code	Fault type	Fault cause	Check method	Solution
Er.011 Er.012	Er.011: Servo drive overload Er.012: Motor overload	Wiring of the motor and encoder is incorrect.	Check the wiring according to the correct wiring diagram	Rewire according to the correct wiring diagram, replace the cable.
		The load is too heavy. The motor keeps output of effective torque higher than the rated torque for a long time.	Confirm the overload characteristic and operation instructions of the servo drive or servo motor.	Increase the drive, motor capacity, reduce the load, increase the acceleration and deceleration time.
		The acceleration/ deceleration is too frequent or the load inertia is too large.	View inertia ratio, confirm start-stop cycle	Increase the acceleration and deceleration time.
		The gain adjustment is inappropriate, the rigidity is too strong, the motor vibrates and the sound is abnormal	Observe whether the motor vibrates and generates noise during running.	Re-adjust the gain.
		The servo drive or motor model is set incorrectly.	View motor model settings	Set the correct model.
		The motor block occurs due to mechanical factors, resulting in very heavy load during running.	Check the running reference and the actual motor speed by using the drive debugging platform or the operation panel.	Eliminate mechanical factors.
		Note:You can clear the fault or re-power on the system 60 s after occurrence of the overload fault.		
Er.013	EEPROM read/write fault	The read/write error of the control parameters occurs.	Confirm whether the instantaneous power failure occurs in the process of writing parameter.	After restoring the default parameter (P02.22=2), re-enter the parameters.
		Writing parameter times exceeds the maximum within a certain time.	Confirm whether the change of parameters is frequent from the host device.	Change the parameter writing method and write again.
Er.014	Abnormal serial port communication	Improper setting of communication parameters.	Confirm the function code setting.	Set the correct baud rate, communication data format, etc.

Fault code	Fault type	Fault cause	Check method	Solution
		The communication cable is wired incorrectly or unreliably connected, disconnected, etc.	Check whether the communication cable is correct and reliable.	Reconnect the communication cable, or replace the communication cable.
		Improper setting of fault parameters.	Check whether the P15.02 setting is too short.	Set P15.02 correctly.
		The host device does not work.	Confirm the host system signal	Check whether the host device is working.
Er.016	Current detection circuit abnormal	The wirings or the plug-in units of the control board loosens.	Check whether the control board cables and plug-in units are loose	Check them and rewiring
		The AI analog input voltage is too high.	Check whether the AI analog voltage input is above 12 V	Adjust AI analog input.
Er.018	Poor auto-tuning	The parameters of the motor are incorrect.	Confirm the motor nameplate parameters	Re-enter the correct motor parameters.
		When reverse running is prohibited, reverse rotating auto-tuning is performed.	Confirm whether it is set to prohibit reverse function.	Cancel the reverse running prohibition
		Motor wiring is wrong.	Check motor wiring.	Confirm that the UVW power cable is connected properly and the phase sequence is correct.
Er.019	Encoder fault	Encoder type error	Check encoder type	Enter the correct encoder parameters.
		Encoder disconnection	Check encoder cable	Replace encoder cable.
Er.020	Undervoltage during main circuit operation	Grid voltage drop	Measure whether the grid voltage is abnormal	Improve the power grid.
		The load is too large or the motor does not match the drive	Confirm the load matching conditions	Select the appropriate drive and motor.
Er.022	The control mode parameter setting is incorrect	Parameter identification is performed in non-VC control mode.	Confirm the setting of the control mode in the parameter.	Confirm the control mode parameters.

Fault code	Fault type	Fault cause	Check method	Solution
Er.025	Inverter module temperature sampling disconnection protection	The temperature sampling circuit is abnormal.		Seek for service support
		The temperature sensor or signal cable is abnormal.		Seek for service support
Er.027	Servo motor overspeed	The initial angle of the encoder is wrong	See P01.22 to check and confirm the initial angle of the encoder	Retune the encoder angle
		The actual speed of the servo motor exceeds the overspeed threshold.	Confirm whether the overspeed threshold is appropriate (the overspeed threshold is set by P10.12, if P10.12 is equal to 0, the overspeed threshold is 1.2 times the maximum motor speed; if P10.12 is not equal to 0, the overspeed threshold is P10.12 and 1.2 times the maximum speed of the motor, whichever is smaller).	Set the correct overspeed threshold.
		The UVW phase sequence is incorrect.	Check whether the UVW phase sequence on the servo drive side is consistent with that on the motor side.	Connect the UVW cables according to the correct phase sequence.
		Input reference is higher than the overspeed level.	Confirm the input reference	Reduce the input reference, or adjust the gain.
		The motor speed overshoots.	Confirm the motor speed waveform	Reduce the controller gain, adjust the servo gain, or adjust the operating conditions.
		The servo drive is faulty.	Confirm whether the fault remains after the drive is powered off and powered on again	Replace the servo drive.

Fault code	Fault type	Fault cause	Check method	Solution
Er.031	Encoder multi-turn count overflow	The multi-turn count exceeds 65535.	Check whether P11.33 exceeds the maximum number of encoder turns.	Run the motor under the speed mode, and make the multi-turn count value deviate from the overflow threshold 65535; or hide the multi-turn overflow fault
Er.032	Position deviation is too large	The position deviation exceeds the set value of P05.21.	Check whether the position deviation detection range P05.21 is too small or whether the position gain P08.02 is too small.	Increase the position loop gain P08.02.
Er.033	Pulse input abnormal	The pulse frequency exceeds the value set by P10.13.	Confirm whether the maximum position pulse frequency P10.13 is too small	Set P10.13 again according to the maximum position pulse frequency required for the normal operation of the machine. If the output pulse frequency of the upper computer is greater than 4 MHz, the output pulse frequency of the upper computer must be reduced.
Er.036	EtherCAT bus communication connection interrupted	The communication between the controller and the servo is interrupted for more than the time of P17.25.	Confirm the wiring between the controller and the servo.	Rewire or set the appropriate disconnection detection time P17.25 according to the communication cycle.
Er.037	Homing timeout	After the homing is enabled, the home is not found within the time of P12.09.	Confirm the homing mode and the homing timeout detection time P12.09.	Set an appropriate homing timeout detection time according to the homing path.
Er.039	Positive overtravel	When P10.04=0, it exceeds the positive limit switch during running.	Check whether mechanical equipment encounters limit switch.	Run the motor in reverse to get the device off the limit switch.
Er.040	Negative overtravel	When P10.04=0, it exceeds the negative limit switch during running.	Check whether mechanical equipment encounters limit switch.	Run the motor in reverse to get the device off the limit switch.

Fault code	Fault type	Fault cause	Check method	Solution
Er.043	External fault	External fault terminal action.	Check whether the fault terminal is triggered by mistake.	Check external wiring.
Er.046	Output-to-ground short-circuit	The power output cables (UVW) of the servo drive are short circuited to ground.	Disconnect the UVW cables from the motor, and measure whether the motor UVW cables are short circuited to ground.	Connect the cables again or replace them.
		The motor is short circuited to ground.	Disconnect the UVW cables from the motor, and measure whether the motor UVW cables are short circuited to the motor grounding wire.	Replace the motor.
Er.047 Er.048 Er.049	Internal logic error	----------	----------	Seek for service support
Er.050	ASIC initialization error	Abnormal ASIC communication	Restart the drive	Restart the drive, the fault cannot be reset, replace the drive.
Er.052	Incorrect interpolation period	P20.10 sets an invalid interpolation period	Query master station synchronization period and interpolation period	When the synchronization period of the master station is consistent with the interpolation period, P20.10 is set to zero. When it is inconsistent, P20.10 is the same as the interpolation period of the master station.
Er.053	The given position instruction of the controller is too large.	The given position instruction of the controller is too large.	Confirm controller position instruction given	Reduce the given deviation of the controller position instruction.
Er.054	Synchronization signal lost	No synchronization signal was detected after entering the OP state	Check the DC configuration of the controller	Seek for service support

Fault code	Fault type	Fault cause	Check method	Solution
Er.061	Electronic gear ratio error	The electronic gear ratio is set incorrectly.	Confirm whether the electronic gear ratio parameter setting is reasonable.	Correctly set the electronic gear ratio parameters.
Er.062	Interrupt positioning alarm	----------	----------	Seek for service support
Er.065	The ASIC EEPROM was not programmed	The controller is not programmed ASIC EEPROM	The controller programs the EEPROM according to the description file	The fault cannot be reset, and the controller programs the EEPROM according to the description file.
Er.066	Homing logic is wrong	The setting of the homing parameters is unreasonable, or the homing command is executed during positioning.	Confirm the homing parameters such as acceleration and deceleration time of homing search and homing mode.	Set the appropriate homing parameters according to the actual homing mode, or wait for the positioning to complete before returning to the homing operation.
Er.073	Failed to bootstrap	When the 220 V drive is enabled, the motor speed is too large (over 200 rpm).	Before enabling, check if the motor rotates.	Enable it after the motor is stationary or lower than 200 rpm.
Er.075	Absolute encoder battery undervoltage	----------	----------	Seek for service support
Er.076	Absolute encoder battery disconnection	The absolute value encoder battery is disconnected or the battery voltage is lower than 2.75V during the drive is powered off.	Confirm whether the encoder battery wiring is disconnected during the drive is powered off; measure whether the battery voltage is too low.	If Er.076 is reported when the power is turned on for the first time, press the reset button to clear the fault; if the fault cannot be cleared after multiple resets, replace the encoder cable or the encoder battery.
Er.077	Encoder type setting error	The actual encoder type is inconsistent with that read by P01.00.	Check whether the encoder type to be read written in P01.00 is consistent with the actual encoder type	Determine the motor model and change the value of P01.00.
Er.078	No parameter is stored in absolute encoder EEPROM	When P01.00 reads the absolute value encoder EEPROM, the EEPROM has no parameters.	Check whether the parameters have been written in the encoder EEPROM.	Seek for service support

Fault code	Fault type	Fault cause	Check method	Solution
Er.079	Absolute encoder EEPROM parameter write error	An error occurred when writing parameters to the EEPROM in the absolute encoder.	Power off and restart to see if the parameters can be rewritten.	Confirm the encoder type, replace the encoder, or replace the motor.
Er.081	Encoder seeking origin error	----------	----------	Seek for service support
Er.084	Absolute encoder EEPROM parameter read error	----------	----------	Seek for service support
Er.085	Drive output disconnection	The U/V/W output cables and terminals of the drive are disconnected or not connected reliably.	Check the connection of output cables and terminals.	Ensure the output cables are connected reliably.

All the possible alarm types for M3-N are summarized in Table 9-2.

Table 9-2 Alarm code table

Alarm code	Alarm type	Alarm cause	Check method	Solution
AL.012	Motor overload	Wiring of the motor and encoder is incorrect or poor	Check the wiring according to correct wiring diagram.	Rewire according to correct wiring diagram, replace the cable.
		The load is too heavy. The motor keeps output of effective torque higher than the rated torque for a long time.	Confirm the overload characteristic and operating instructions of the servo drive or servo motor.	Increase the drive, motor capacity, reduce the load, increase the acceleration and deceleration time.
		The acceleration/ deceleration is too frequent or the load inertia is too large.	View inertia ratio, confirm start-stop cycle	Increase the acceleration and deceleration time.
		The gain adjustment is inappropriate, the rigidity is too strong, the motor vibrates and the sound is abnormal	Observe whether the motor vibrates and generates noise during running.	Re-adjust the gain.
		The servo drive or motor model is set incorrectly.	Check the motor model setting.	Set the correct motor model .

Alarm code	Alarm type	Alarm cause	Check method	Solution
		Motor blocking occurs due to mechanical factors, resulting in very heavy load during running.	Check the running reference and the actual motor speed by using the drive debugging platform or the operation panel.	Eliminate mechanical factors.
AL.014	Abnormal serial port communication	Improper setting of communication parameters.	Confirm the function code setting.	Set the correct baud rate, communication data format, etc.
		The communication cable is wired incorrectly or unreliably connected, disconnected, etc.	Check whether the communication cable is correct and reliable.	Reconnect the communication cable, or replace the communication cable.
		Improper setting of alarm parameters.	Check whether the P15.02 setting is too short.	Set P15.02 correctly.
		The host device does not work.	Confirm the host system signal	Check whether the host device is working.
AL.025	Temperature sampling disconnection	The temperature sampling circuit is abnormal.		Seek for service support
		The temperature sensor or signal cable is abnormal.		Seek for service support
AL.038	DI emergency brake warning	Emergency brake terminal action.	P02.09=1, enable emergency braking. When the drive is running, if the emergency brake terminal is activated, it will alarm.	Given by normal logic

Alarm code	Alarm type	Alarm cause	Check method	Solution
AL.039	Positive overtravel warning	When P10.04=1, the drive position exceeds the positive limit switch.	Check whether the DI terminal of group P03 is set with DI function 35 Check whether the DI terminal logic of the corresponding bit of input signal monitoring P11.12 is valid.	Check the running mode, and under the premise of safety, give a negative command or rotate the motor to make the logic of the "positive limit switch" terminal invalid.
AL.040	Negative overtravel warning	When P10.04=1, the drive position exceeds the negative limit switch.	Check whether the DI terminal of group P03 is set with DI function 36 Check whether the DI terminal logic of the corresponding bit of input signal monitoring P11.12 is valid.	Check the running mode, and under the premise of safety, give a negative command or rotate the motor to make the logic of the "negative limit switch" terminal invalid.
AL.062	Interrupt positioning warning	Enable interrupt positioning command at zero speed.	Check the servo operation status.	Interrupt positioning operation in non-zero speed state.
AL.075	Absolute encoder battery undervoltage	Absolute encoder battery voltage is lower than 3.1 V during drive power-up.	When the operation is enabled, it will report low, and if it is not enabled, it will report AL.075, and measure whether the battery voltage is lower than 3.1 V.	Replace the encoder cable or encoder battery.

Appendix 1 Warranty and Service

Shenzhen Megmeet Electrical Co., Ltd. manufactures motor drive products strictly according to the ISO9001:2015 standard. In case of any product abnormalities, please contact the distributor or the headquarters. Our company will provide full technical support for you.

1. Warranty period

The product is warranted for 18 months from the purchase date, however, the warranty date shall not exceed 24 months after the manufacturing date on the nameplate.

2. Warranty scope

During the warranty period, any product abnormalities incurred due to our company can be freely repaired or replaced by our company. In case of the following situations, maintenance fees will also be charged even if the product is still in the warranty period.

(1) The damages are caused by fire, flood, strong lightning strike, etc.

(2) The damages are caused by users' unauthorized modifications.

(3) The product is damaged due to drop or in transmission after the purchase.

(4) The product is damaged because the standard requirements are not obeyed in actual use.

(5) The product is damaged because the user does not follow the instructions of the user manual.

3. After-sales service

(1) If there are specific requirements for drive installation and trial operation, or the working status of the drive is not satisfactory (such as unsatisfactory performance and function), please contact the distributor or Shenzhen Megmeet Electrical Co., Ltd.

(2) In case of any abnormality, contact the distributor or Shenzhen Megmeet Electrical Co., Ltd. immediately for help.

(3) During the warranty period, our company will repair any drive abnormality incurred due to the product manufacturing and design free of charge.

(4) If the product is out of the warranty period, our company can provide paid repairing service according to the customers' needs.

(5) The service charge is calculated by actual costs. If there is an agreement, the agreement shall prevail.

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