M3-P 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-P series servo system manufactured by Shenzhen Megmeet Electrical Co., Ltd.

The M3-P 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 Modbus protocol and pulse reference, 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-P 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-P 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

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

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

DANGER

- 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 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.
- 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.
- 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.

WARNING

- 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-P 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

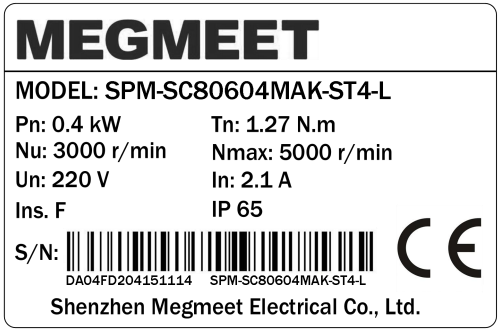


Fig. 1-2 Servo motor nameplate

1.1.3 Servo drive model

M3 - P 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

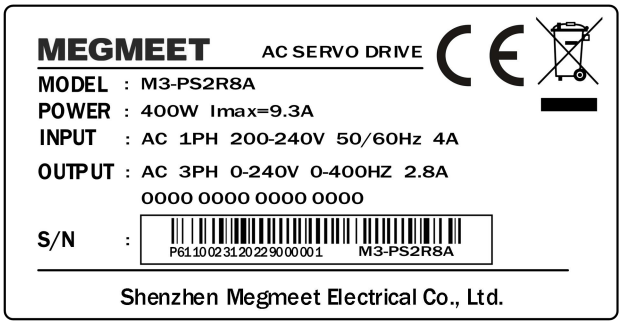


Fig. 1-4 Servo drive nameplate

1.1.5 Servo drive components

1.1.5.1 SIZE A drive (Rated power: 0.4 kW)

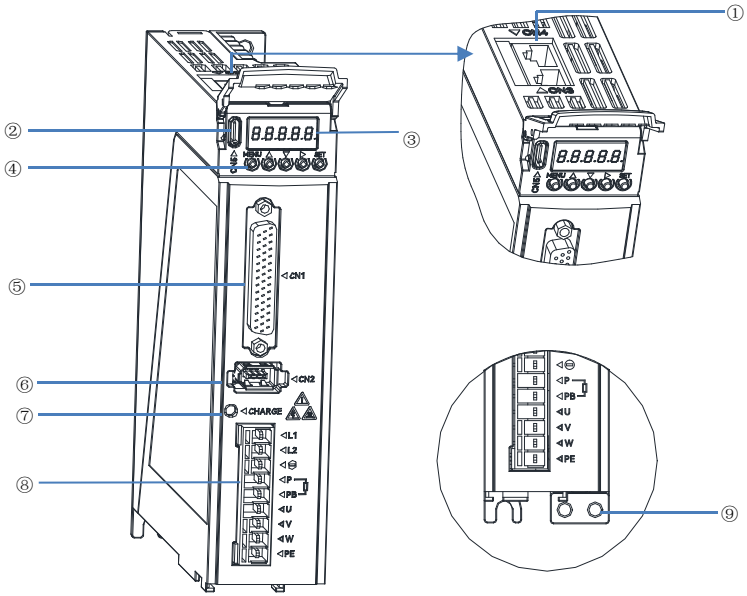


Fig. 1-5 Components of M3-P servo drive (M3-PS2R8A)

Table 1-1 Component description of M3-P servo drive (M3-PS2R8A)

No.	Name	Description
①	CN3, CN4 Communication interface	Two RJ45 ports used for RS485 communication.
②	CN5 Type-C USB communication port	Connected to a computer's USB port for parameter setting and performance debugging.
③	LED digital tube	5-digit 8-segment digital tube used for status monitoring, parameter display and parameter setting.
④	Operation keys	5 keys for parameter adjustment and display status switching, etc.
⑤	CN1 Control IO interface	DB44 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.

No.	Name		Description
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 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)

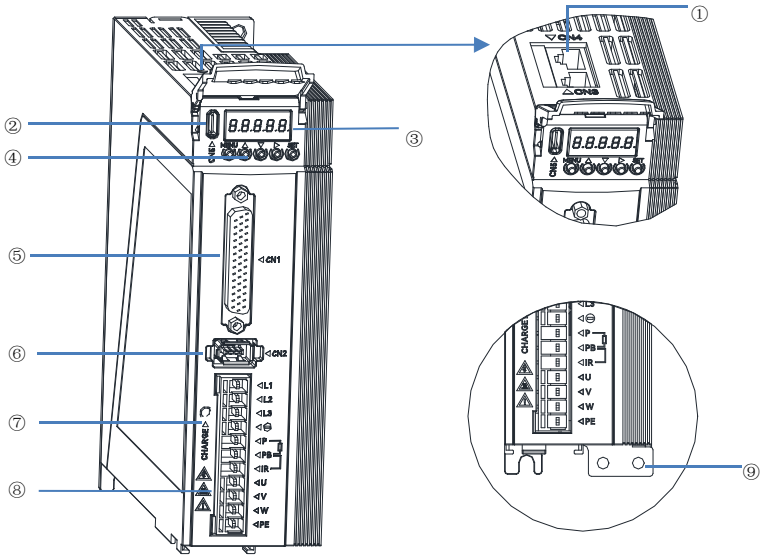


Fig. 1-6 Components of M3-P servo drive (M3-PS5R5A, M3-PS7R6A)

Table 1-2 Component description of M3-P servo drive (M3-PS5R5A, M3-PS7R6A)

No.	Name	Description
①	CN3, CN4 Communication interface	Two RJ45 ports used for RS485 communication.
②	CN5 Type-C USB communication port	Connected to a computer's USB port for parameter setting and performance debugging.
③	LED digital tube	5-digit 8-segment digital tube used for status monitoring, parameter display and parameter setting.
④	Operation keys	5 keys for parameter adjustment and display status switching, etc.
⑤	CN1 Control IO interface	DB44 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, 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-PS2R8A
3000	5000	400	SPM-SC*0604M*K-ST4-L	M3-PS2R8A
3000	5000	750	SPM-SC*0807M*K-ST4-L	M3-PS5R5A
3000	5000	1000	SPM-SC*0810M*K-ST4-L	M3-PS7R6A

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

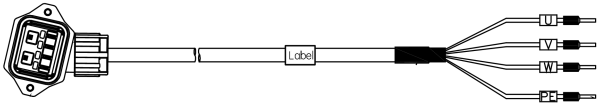
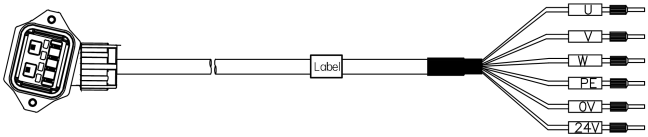
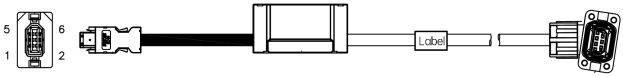
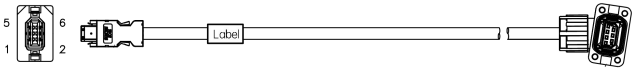
The cable configuration for servo motors is shown in the following table.

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-PS2R8A	M3-PS5R5A	M3-PS7R6A
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

Basic specifications			
Basic specifications	Control mode	IGBT, PWM control, sine wave current drive mode	
	Encoder	Absolute encoder	
Control IO	DI	Different functions configured according to parameters	8 general inputs, optocoupler isolation, both NPN and PNP inputs available Input voltage range 20 to 30 V, input impedance 3.9 kΩ
	DO	Different functions configured according to parameters	5 general outputs, optocoupler isolation, both NPN and PNP outputs available
			Maximum operating voltage 30 V, maximum current 100 mA
	Pulse reference	Direction + pulse, A/B quadrature, CW+CCW	Optocoupler isolation, collector input: 200 Kpps, differential input: 300 Kpps
	High-speed pulse reference		Differential input, 4 Mpps
	Pulse feedback	A/B quadrature differential output	
Communication	RS485	Modbus communication protocol supported	
	USB	Connect the computer and the servo drive for performance debugging	
Other ports	Key	5 operation keys	
	LED display	5 8-segment LED display	
	Power indicator	CHARGE indicator	
	Safety function	None	
General functions	Auto-adjustment	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.	
	Switchover of multiple control modes	Position mode, speed mode, torque mode, position/speed mode switchover, speed/torque mode switchover, and position/torque mode switchover.	
	Pulse frequency division	Arbitrary frequency division	
	Protection functions	Overvoltage, undervoltage, overcurrent, overspeed, stall, overheat, overload, encoder abnormality, input phase loss, excessive position deviation.	

	High-frequency vibration suppression	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		
	End vibration suppression	2 set of filters, suppressing the end low-frequency vibration from 1 to 100 Hz.		
	Homing mode	Multiple homing modes		
	Reverse clearance compensation	Used to improve the response delay that occurs when the traveling direction of the machine is reversed.		
	Mechanical analyzer function	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, command pulse input inhibition, electronic gear switchover, and so on.		
	Control output	Positioning completed		
	Pulse input	Pulse state	1. Pulse + direction; 2. Quadrature A/B pulse; 3. CW/CCW pulse	
		Input state	1. Differential input; 2. Open collector input	
		Pulse frequency	High-speed pulse port	Supports differential input, with a maximum rate of 4 Mpps. Pulse width cannot be less than 0.125 us.
			Low-speed pulse port	Supports differential input, with a maximum rate of 300 Kpps. Pulse width cannot be less than 1.7 us.
				Supports collector input, with a maximum rate of 200 Kpps. Pulse width cannot be less than 2.5 us.
		Pulse filtering	First-order reference smoothing filter or FIR filter	
		Electronic gear	4 sets of electronic gear ratios/online	
	Multi-position reference selection	Configure 4 DIs to select position segments 1 to 16.		
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.		
	Internal speed reference	Configure 4 DIs for switching of 16 internal speed segments.		
Torque control	Performance	Torque control accuracy	±1%	
		Frequency feature	3 kHz	
	Control input	Torque reference input, etc.		
	Control output	Speed reached, etc.		
	Speed limit function	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*0602 M*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-PS2R8A)

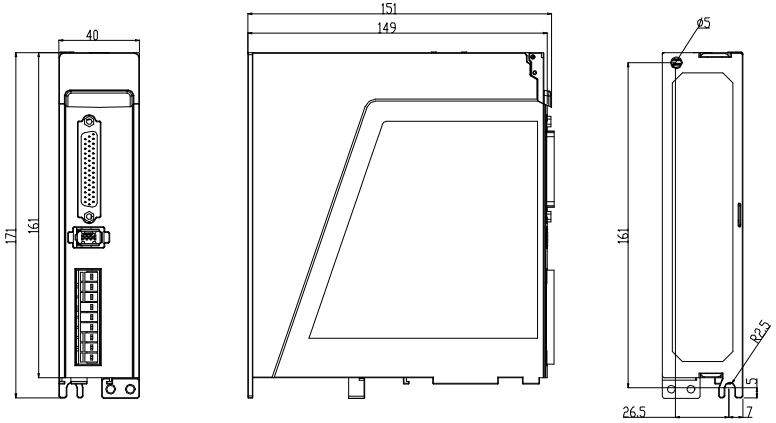


Fig. 2-1 SIZE A servo drive dimensions

2. SIZE B (correspond drives: M3-PS5R5A, M3-PS7R6A)

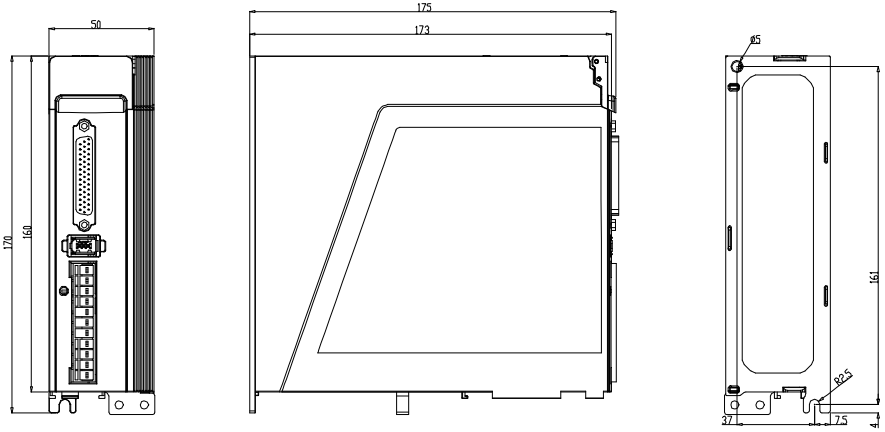


Fig. 2-2 SIZE B servo drive dimensions

2.4 Servo motor dimensions and interface definitions

2.4.1 Dimensions

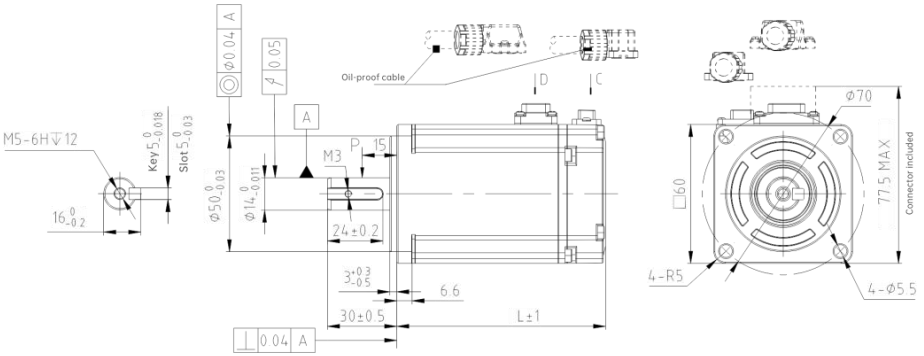


Fig. 2-3 Dimensions for 60 frame medium inertia straight plug economical servo motor (ST4-L series)

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.

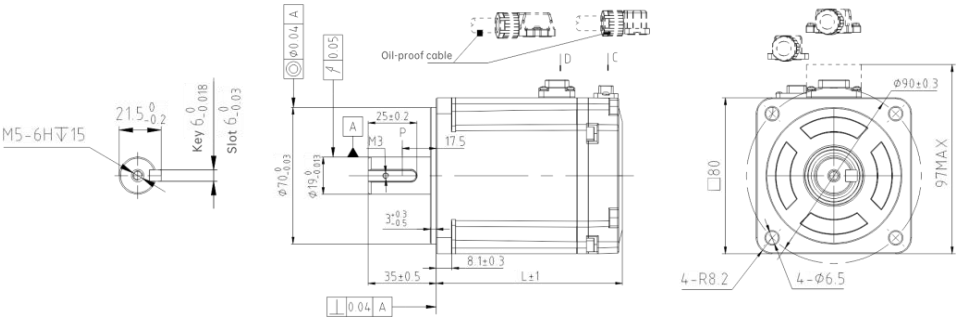


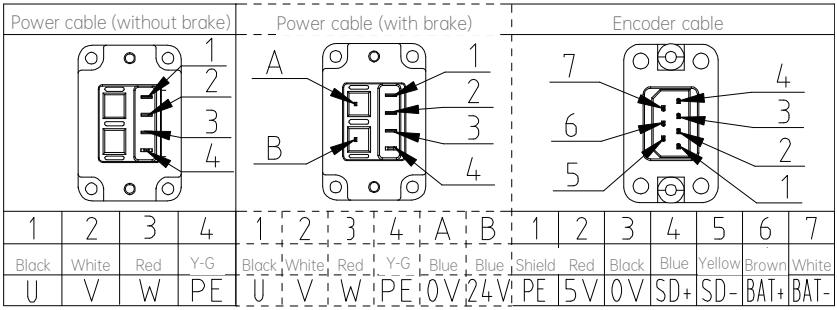
Fig. 2-4 Dimensions for 80 frame medium inertia straight plug economical servo motor (ST4-L series)

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



1	2	3	4	1	2	3	4	A	B	1	2	3	4	5	6	7
Black	White	Red	Y-G	Black	White	Red	Y-G	Blue	Blue	Shield	Red	Black	Blue	Yellow	Brown	White
U	V	W	PE	U	V	W	PE	0V	24V	PE	5V	0V	SD+	SD-	BAT+	BAT-

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

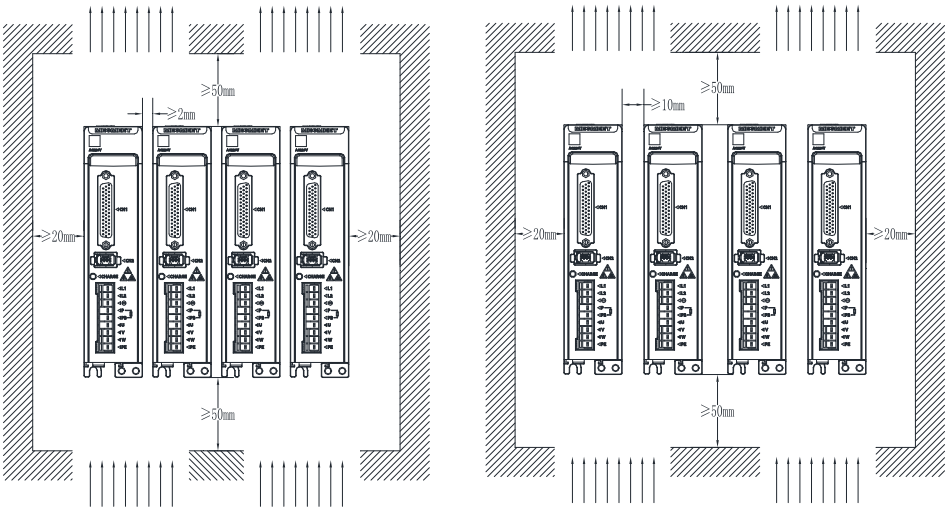
Table 3-1 Installation requirements for M3 servo drive

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.

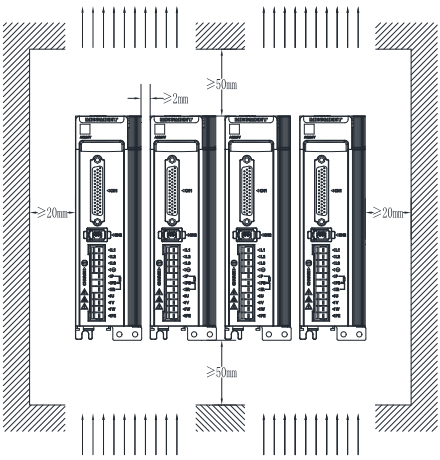
For compact installation of SIZE A and SIZE B, leave a clearance of at least 2 mm. In this case, the actual load rate needs to be derated (SIZE A actual load rate ⩽ 70%; SIZE B actual load rate ⩽ 80%). For side-by-side installation, leave a clearance of at least 20 mm between every two servo drives,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



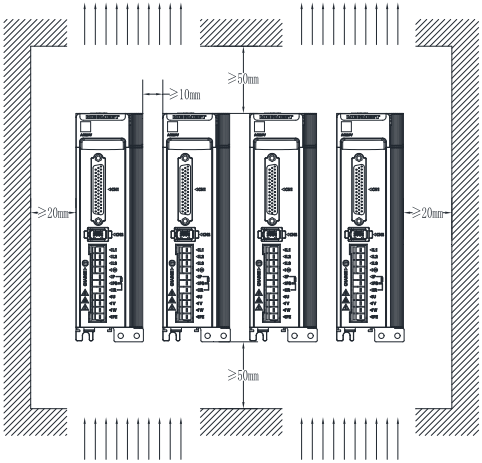
Clearance for compact installation

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

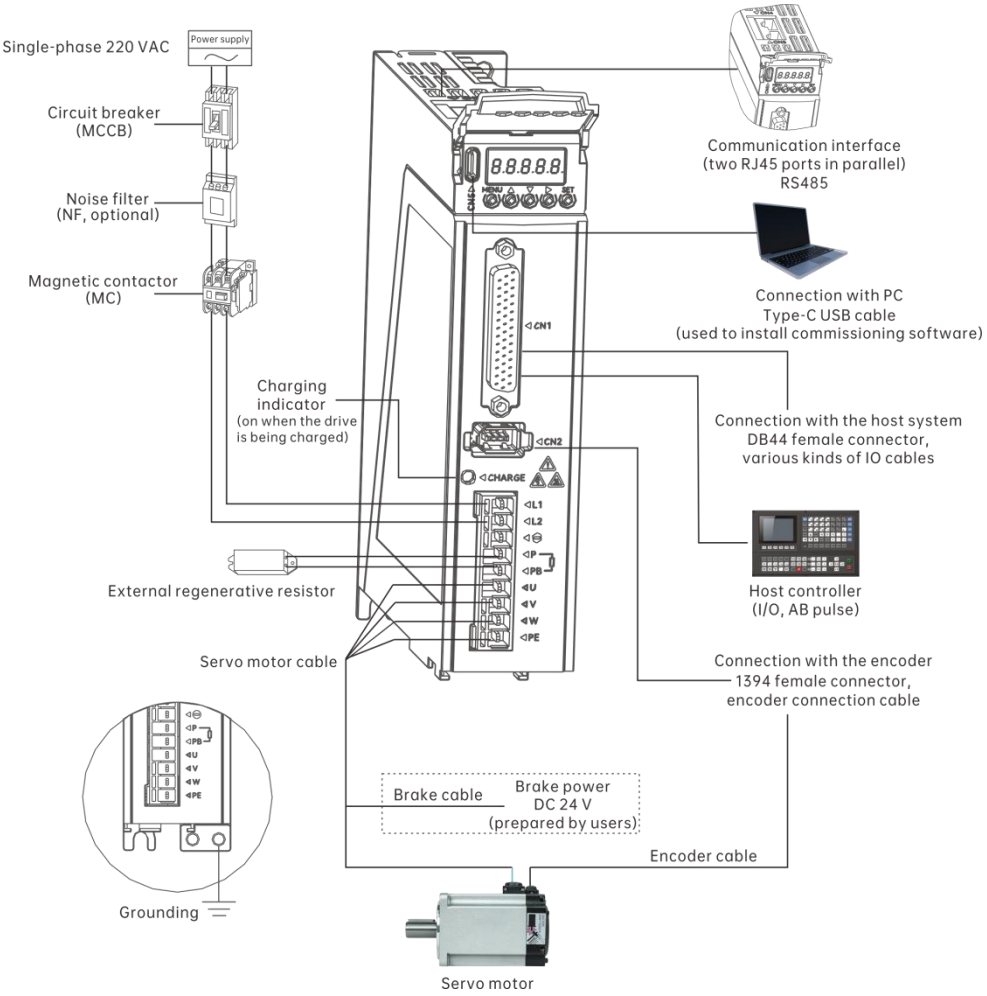


Fig. 3-3 SIZE A single-phase 220 V servo system wiring diagram

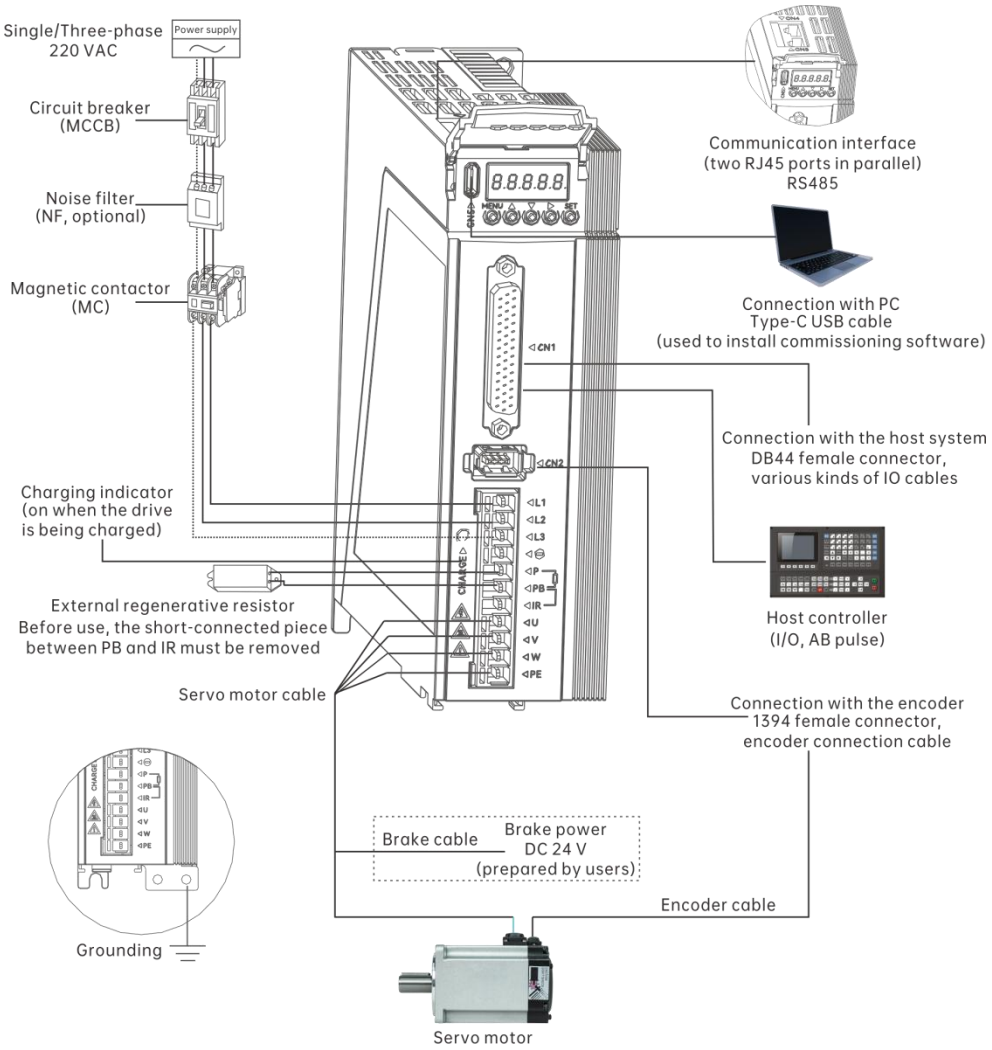


Fig. 3-4 SIZE B single/three-phase 220 V servo system wiring diagram

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-PS2R8A	10 A	15 A
M3-PS5R5A	16 A / 6 A	20 A / 10 A
M3-PS7R6A	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-PS2R8A	—	—	45	14
Single/three-phase 220 V	M3-PS5R5A	—	—	45	19
	M3-PS7R6A	—	—	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-P main circuit terminals

Terminal	Mark	Drive model	Terminal function
Main circuit power input terminals	L1, L2	M3-PS2R8A	Main circuit single-phase 220 V power input
	L1, L2, L3	M3-PS5R5A M3-PS7R6A	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-PS2R8A	If the braking capacity is insufficient, connect an external braking resistor between P and PB. Refer to the recommended specifications.
	P, PB, IR	M3-PS5R5A M3-PS7R6A	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-P main circuit cables

Drive model		Power input L1, L2, L3	Power output U, V, W	Grounding PE	Braking resistor PB, P
SIZE A	M3-PS2R8A	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-PS5R5A	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-PS7R6A	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)

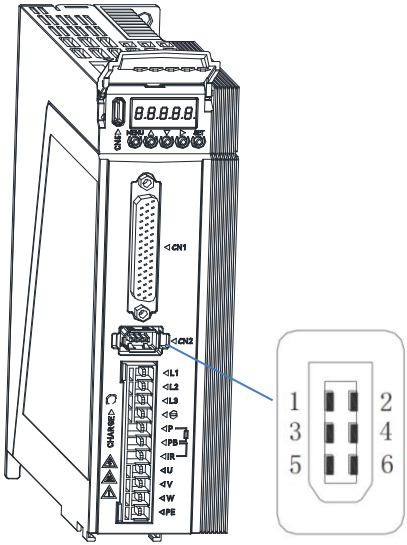


Fig. 4-1 Diagram of servo motor encoder signals

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

Table 4-3 Encoder signal definition

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 signal includes digital input, digital output, pulse reference, pulse feedback and other signals. The signal connection mode is DB44, and the drive end is a DB44 female seat.

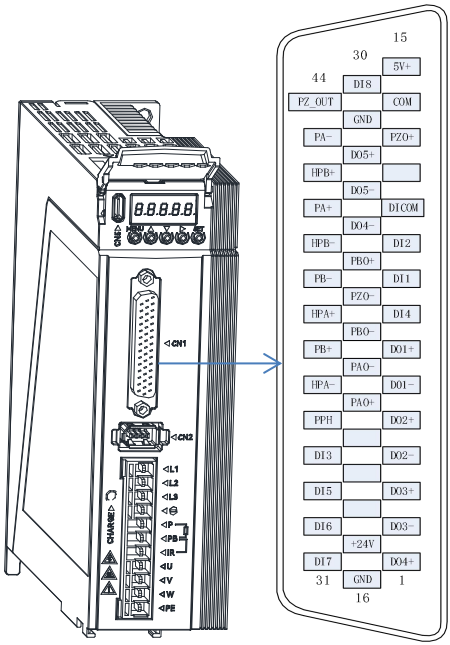


Fig. 4-2 Control signal terminal definition diagram（SIZE A&B）

The control signal definitions are shown in the following table.

Table 4-4 Control signal definition table

Pin	Signal name	Pin	Signal name	Pin	Signal name
1	DO4+	16	GND	31	DI7
2	DO3-	17	+24V	32	DI6
3	DO3+	18	/	33	DI5
4	DO2-	19	/	34	DI3
5	DO2+	20	/	35	PPH
6	DO1-	21	PAO+	36	HPULS-
7	DO1+	22	PAO-	37	SIGN+
8	DI4	23	PBO-	38	HPULS+
9	DI1	24	PZO-	39	SIGN-

Pin	Signal name	Pin	Signal name	Pin	Signal name
10	DI2	25	PBO+	40	HSIGN-
11	DICOM	26	DO4-	41	PULS+
12	NC	27	DO5-	42	HSIGN+
13	PZO+	28	DO5+	43	PULS-
14	COM	29	GND	44	PZ_OUT
15	5V+	30	DI8		

4.3.1 Digital input and output signals

Digital input and output signals are as shown in the following table.

Table 4-5 Digital input and output signals

Signal name		Default function	Pin No.	Function description
Common	DI1	/SON	9	Servo enable
	DI2	/ARST	10	Fault reset
	DI3	/GSEL	34	Gain switching
	DI4	/P-OT	8	Positive limit switch
	DI5	/N-OT	33	Negative limit switch
	DI6	/MSEL1	32	Operating mode switching 1
	DI7	/MSEL2	31	Operating mode switching 2
	DI8	/STOP	30	Emergency shutdown
	/+24V		17	Internal 24 V power output, 20 to 28 V, Imax = 200 mA
	/COM		14	
	DICOM	DI common terminal	11	DI common terminal (connect power or power ground)
	DO1+	/SRDY	7	Servo ready
	DO1-		6	
	DO2+	/ALM	5	Drive fault
	DO2-		4	
	DO3+	/BRK	3	Brake output
	DO3-		2	
	DO4+	/RUN	1	Servo drive running signal (RUN)
	DO4-		26	
	DO5+	/COIN	28	Positioning completed
	DO5-		27	

4.3.1.1 Digital input circuit

M3-P series servo has 8 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 DI8 circuits are the same.

(1) Dry contact mode

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

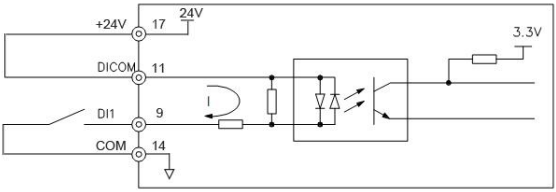


Fig. 4-3 DI terminal dry contact wiring mode (using the internal 24 V power of servo drive)

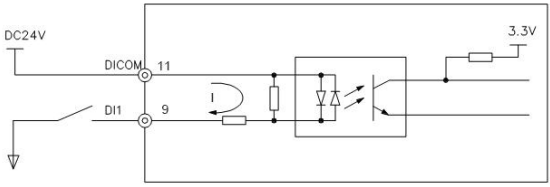


Fig. 4-4 DI terminal dry contact wiring mode (using the external power)

(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.

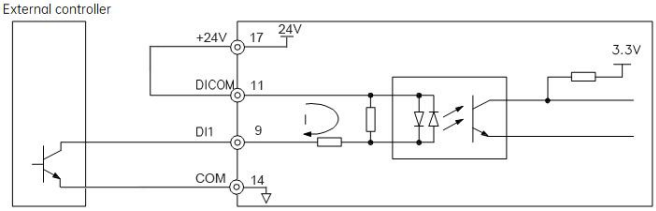


Fig. 4-5 DI terminal NPN wiring mode (using the internal 24 V power of servo drive)

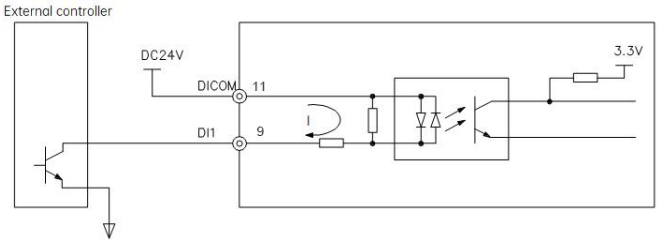


Fig. 4-6 DI terminal NPN wiring mode (using the external power)

(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.

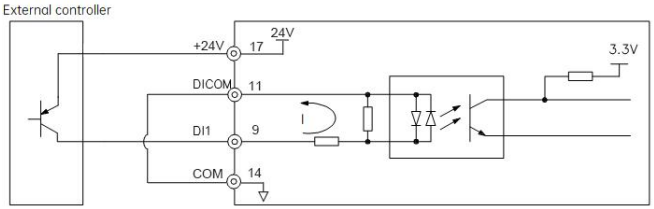


Fig. 4-7 DI terminal PNP wiring mode (using the internal 24 V power of servo drive)

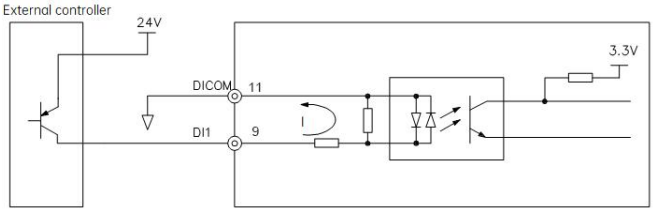


Fig. 4-8 DI terminal PNP wiring mode (using the external power)

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 output, with various output modes.

DO1 is taken as an example here. DO1 to DO5 circuits are the same.

(1) The host device is 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!

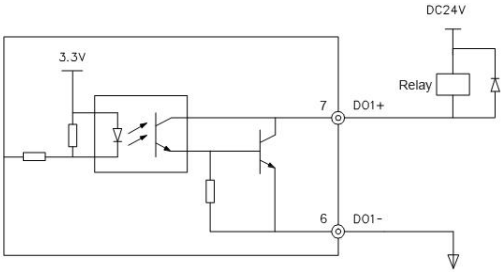


Fig. 4-9 DO terminal and relay wiring mode

(2) NPN (sink) output

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

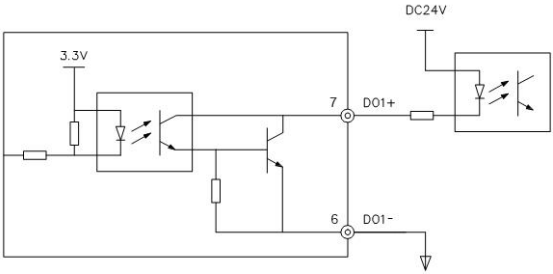


Fig. 4-10 DO terminal NPN (sink) output wiring mode

(3) PNP (source) output

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

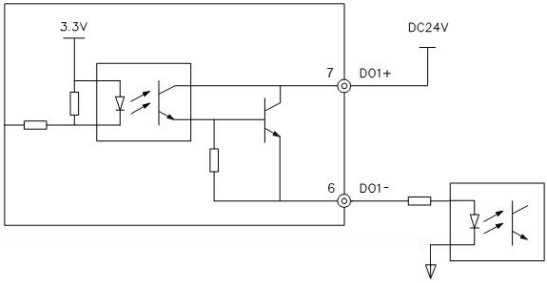


Fig. 4-11 DO terminal PNP (source) output wiring mode

4.3.2 Position reference input signal

Table 4-6 Position reference input signal

Signal name		Pin	Function	
Position reference	PULS+	41	Low-speed pulse reference Open-collector input Push-pull input Differential input	Pulse input mode: PULSE+SIGN CW/CCW A / B phase quadrature
	PULS-	43		
	SIGN+	37		
	SIGN-	39		
	HPULS+	38	High-speed pulse reference Differential input	Pulse input mode: PULSE+SIGN CW/CCW A / B phase quadrature
	HPULS-	36		
	HSIGN+	42		
	HSIGN-	40		
	PPH	35	External power input interface of pulse reference	
	GND	29	Differential input pulse signal ground	

There are two channels for pulse reference input: low-speed pulse reference input and high-speed pulse reference input. The former supports differential input and open-collector input, while the latter only supports differential input. Its maximum input frequency and minimum pulse width are shown in the table below.

Table 4-7 Pulse input specification requirements

Pulse channel	Supported input mode	Maximum input frequency	Minimum pulse width	Voltage specification	Current consumption
Low-speed pulse input	Open-collector input	200 Kpps	2.5 us	24 V	<10 mA
	Differential input	300 Kpps	1.7 us	5 V	<10 mA
High-speed pulse input	Differential input	4 Mpps	0.125 us	5 V	<10 mA

4.3.2.1 Low-speed pulse reference input

a) The host device is 5 V differential mode output

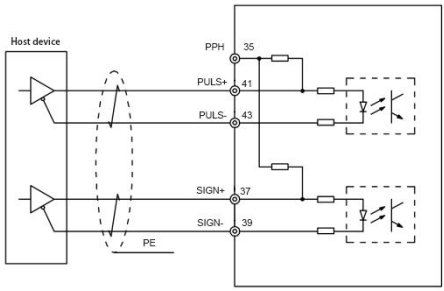


Fig. 4-12 Low-speed pulse reference differential input wiring diagram

b) The host device is open-collector NPN output

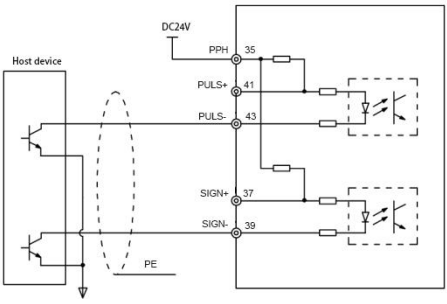


Fig. 4-13 Low-speed pulse reference NPN input wiring diagram

c) The host device is open-collector PNP output

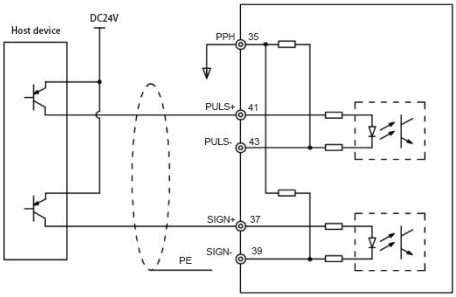


Fig. 4-14 Low-speed pulse reference PNP input wiring diagram

4.3.2.2 High-speed pulse input

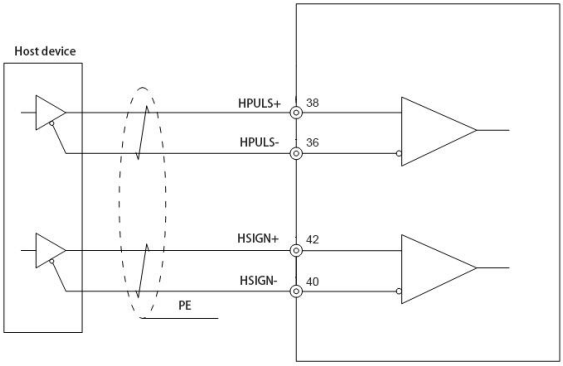


Fig. 4-15 High-speed pulse input wiring diagram

4.3.3 Encoder frequency dividing output circuit

Table 4-8 Encoder frequency-division output signal

Signal name		Pin	Function	
Common	PAO+ PAO-	21 22	Phase A output signal	A, B quadrature pulse output
	PBO+ PBO-	25 23	Phase B output signal	
	PZO+ PZO-	13 24	Phase Z output signal	Home signal
	PZ-OUT	44	Home pulse open-collector output	
	GND	29	Pulse signal ground	

Encoder frequency-division output wiring is as shown in Fig. 4-16 to Fig. 4-18.

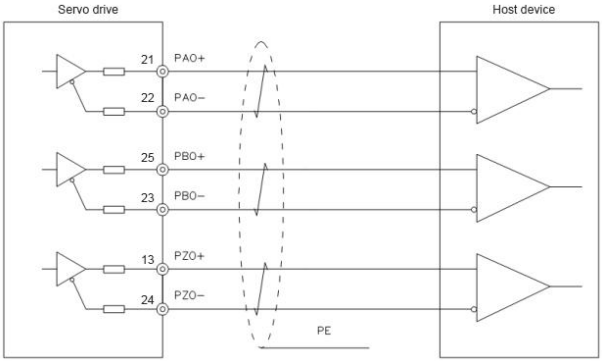


Fig. 4-16 Encoder frequency-division output wiring 1

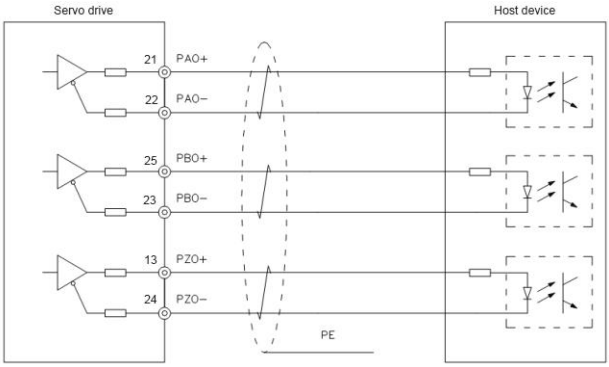


Fig. 4-17 Encoder frequency-division output wiring 2

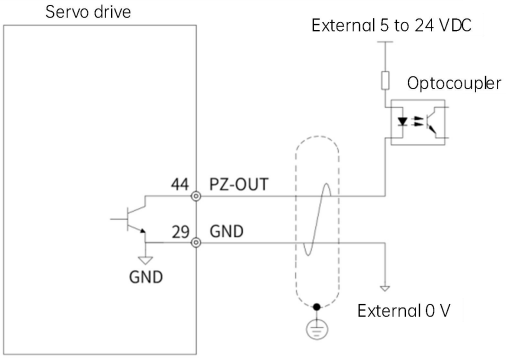


Fig. 4-18 Encoder frequency-division output wiring 3

4.4 Communication port wiring

The M3 series servo supports RS485 communication. The communication ports are CN3 and CN4 in parallel, facilitating multi-station cascading. Data flows in from the upper port and out from the lower port.

RS485 supports the standard Modbus-RTU protocol.

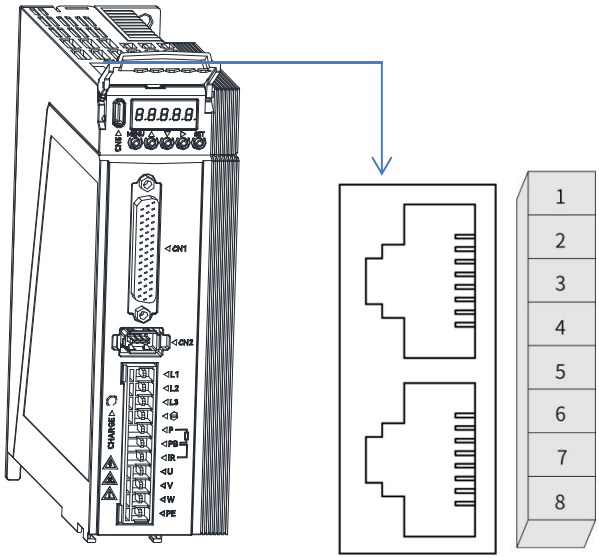


Fig. 4-19 Diagram of communication ports

Table 4-9 Communication signal definition

Pin	Definition	Description
1	Undefined	
2		
3	485+	RS485
6	485-	
7/8	GND	Communication ground
4/5	Undefined	

Chapter 5 Operating Panel

5.1 Panel introduction

The operating panel of M3 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.

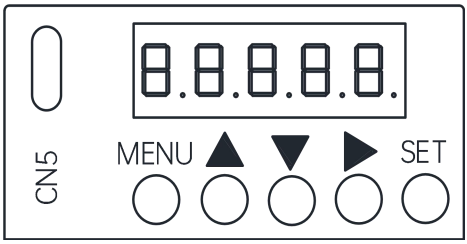


Fig. 5-1 Panel appearance

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.
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

Key	Key name	Function
		menu. During fault status display, press this key to reset the fault.

5.2 Working status display

M3 servo drive can display the following working statuses.

Table 5-2 Servo drive working statuses and corresponding display

LED display	Symbol	Description
rSt	"rst"	Power-on initialization state, indicating that the system is at start or reset state
nrd	"nrd"	Start or reset is completed, but the servo is not yet ready.
rdy	"rdy"	Servo system self-test normal, waiting for the host to give a command signal
run	"run"	Servo running status
Er.XXX	"Er.xxx"	Servo fault status
AL.XXX	"AL..xxx"	Servo alarm status

5.3 Working status display and parameter setting flowchart

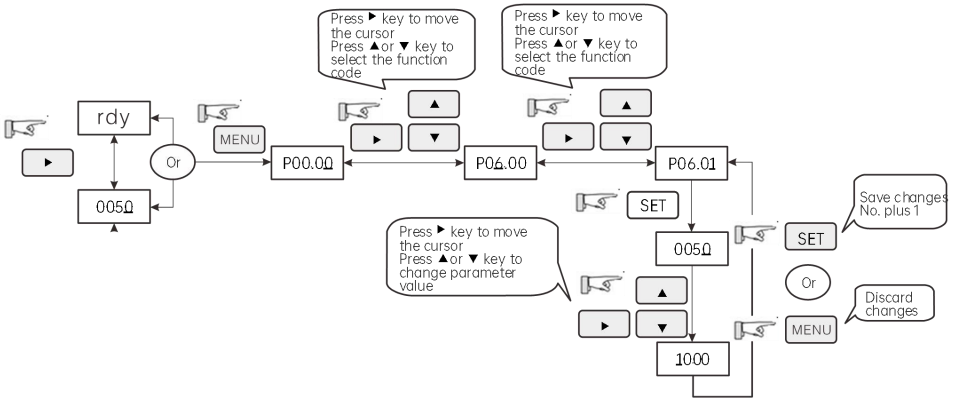


Fig. 5-2 Working status display and parameter setting flowchart

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.

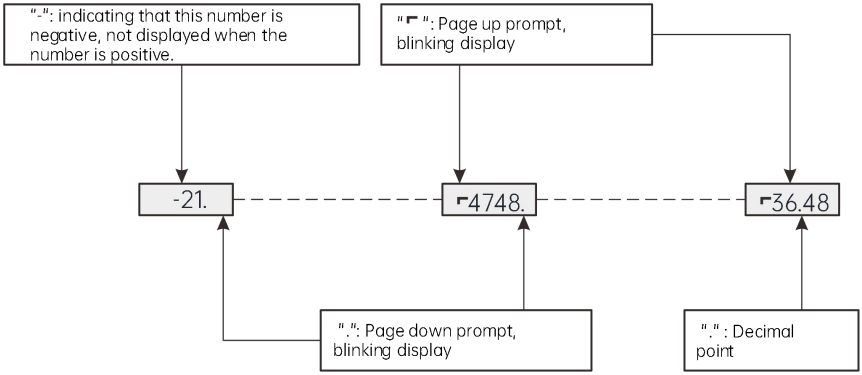


Fig. 5-3 Parameter division in different pages

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 Position control mode

6.3.1 Position control wiring

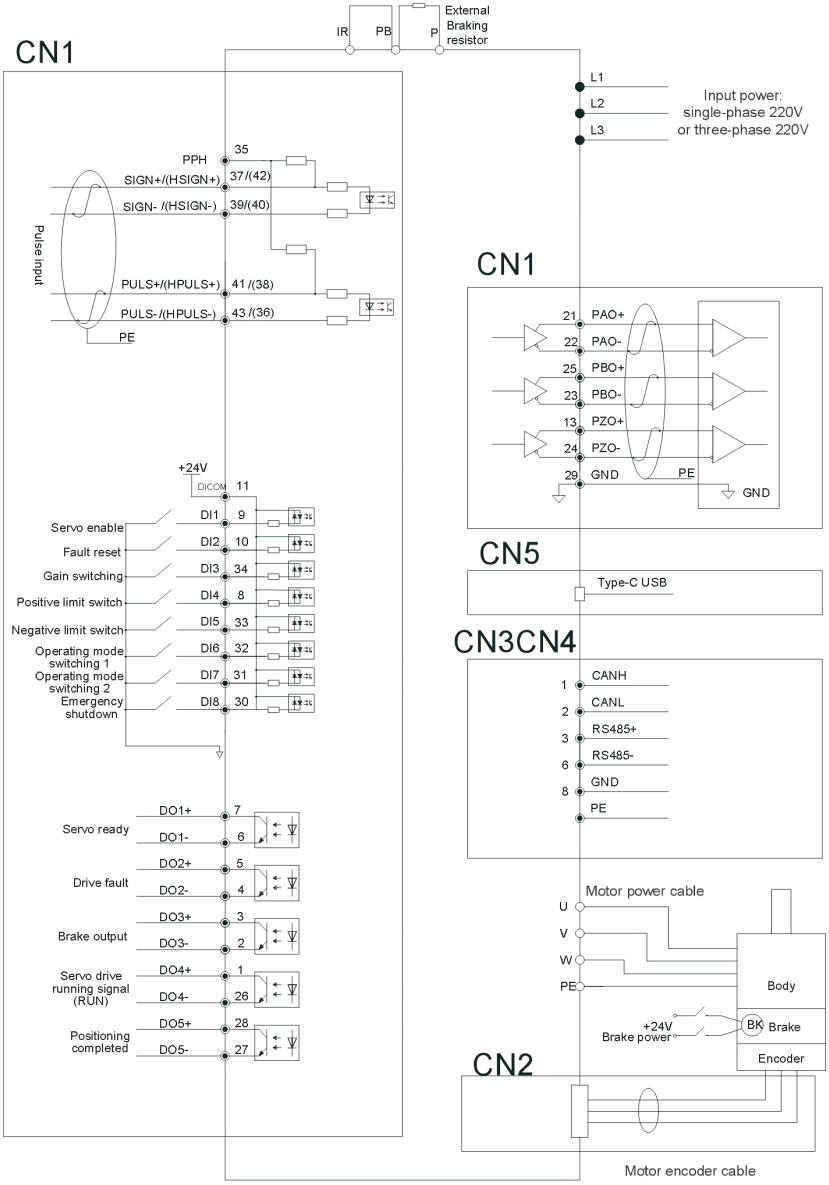


Fig. 6-1 Position control mode wiring

6.3.2 Position control function code setting

Position control is selected by P02.00:

Function code	Name	Value range	Effective time	Property	Default value
P02.00	Control mode selection	1: Position mode	Immediately	At stop	0

6.3.2.1 Position reference input setting

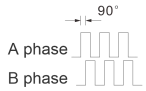
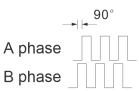
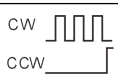
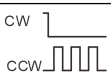
Pulse input source, pulse reference input mode and logical form are set by P05.01, P05.02 and P05.03 respectively.

(1) Pulse input source

Function code	Name	Value range	Effective time	Property	Default value
P05.01	Pulse reference input terminal selection	0: Low-speed terminal 1: High-speed terminal	Immediately	At stop	0

(2) Pulse reference input mode setting

Function code	Name	Value range	Effective time	Property	Default value
P05.02	Pulse reference mode	0: A/B phase pulse 1: PULSE+SIGN 2: CW/CCW pulse	Immediately	At stop	1

Pulse reference input mode	Forward	Reverse
A/B phase pulse		
PULSE+SIGN pulse		
CW/CCW pulse		

(3) Pulse reference logic

Function code	Name	Value range	Effective time	Property	Default value
P05.03	Pulse reference logic	0: Positive logic 1: Inverse logic	Immediately	At stop	0

(4) Reference pulse disable

Set FunIN.12 by DI to disable reference pulse input.

Type	Function No.	Function name	Description	Remarks
Input (DI)	FunIN.12	Reference pulse disable (INHIBIT)	ON: Closed OFF: Disconnected	ON: Stop reference pulse count OFF: Start reference pulse count

6.3.2.2 Position reference filter

The reference pulse input is filtered to make rotation of the servo motor smoother.

This function has obvious effects in the following occasions:

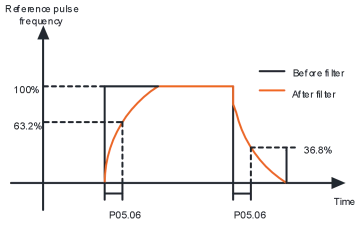
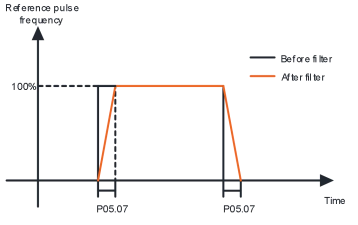
- Acceleration/deceleration is not performed on the reference pulses output by the host controller;
- The reference pulse frequency is low.

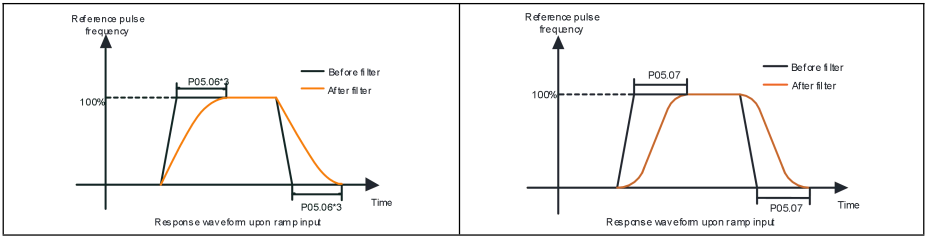
Position reference smoothing function parameters are set as follows. Do not input the reference pulse when changing the value. Modify the parameters when the motor stops.

Function code	Name	Value range	Effective time	Property	Default value
P05.06	Position reference first-order low-pass filter time	0.0 to 2000.0 ms	Immediately	At stop	0.0
P05.07	Position reference moving average filter time	0.0 to 12.8 ms	Immediately	At stop	0.0

Note: When set to 0, the function is disabled.

The difference between the position reference first-order low-pass filter time and the position reference average filter time is as follows:

Position reference first-order low-pass filter time	Position reference moving average filter time
	



6.3.2.3 Positioning near and positioning completed signals output

Type	Function No.	Signal name	Description	Remarks
Output (DO)	/NEAR	Positioning near	ON: Closed OFF: Disconnected	Output when arriving the point of positioning near
	/COIN	Positioning completed	ON: Closed OFF: Disconnected	Output when arriving the point of positioning completed

Positioning near and positioning completed are set by the following parameters. Positioning near is valid only for the internal position.

Function code	Name	Value range	Effective time	Property	Default value
P05.18	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	Immediately	At stop	0
P05.19	Positioning completed range	0 to 10000	Immediately	During running	10
P05.20	Positioning near signal width	1 to 32767	Immediately	During running	100

Note: These parameters have no effects on the final positioning accuracy.

Signal is output when the difference between the host device reference pulses and the the amount of movement of the servo motor encoder (position pulse deviation) is lower than the set value.

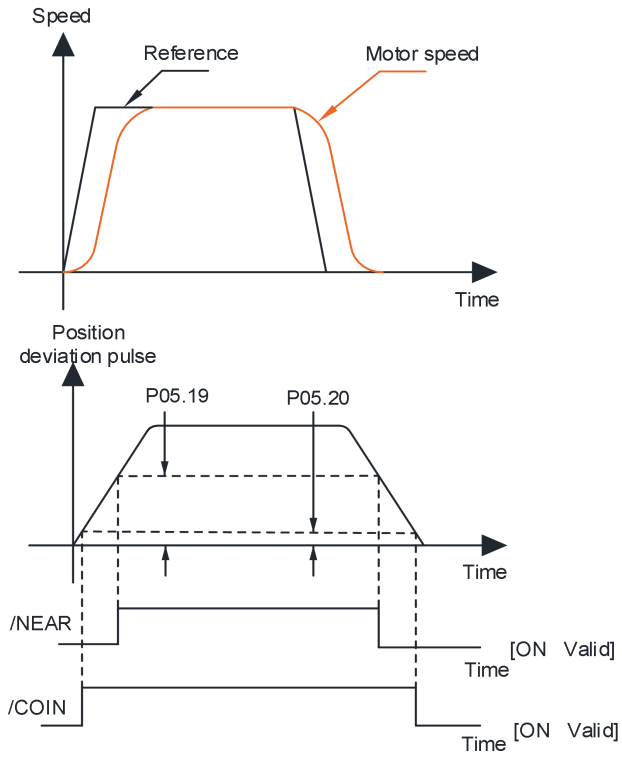


Fig. 6-2 Positioning near and positioning completed signal logic

6.3.2.4 Clearing position deviation

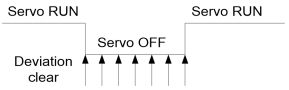
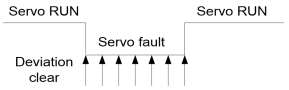
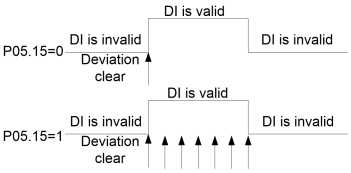
(1) Setting clear input signal

Type	Function No.	Function name	Description	Remarks
Input (DI)	FunIN.29	Position deviation clear	ON: Position deviation clear OFF: Position deviation not cleared	Edge valid

(2) Setting clear input signal form

Function code	Name	Value range	Effective time	Property	Default value
P05.14	Position deviation clearing method selection	0: Clear position deviation when servo enable is OFF or stopped 1: Clear position deviation	Immediately	At stop	0

Function code	Name	Value range	Effective time	Property	Default value
		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 deviation clear DI is valid			

Clearing form	Clearing time
Clear position deviation when servo enable is OFF or the servo is at stop	
Clear position deviation when servo enable is OFF or when the servo fails/triggers alarm	
Clear position deviation when servo enable is OFF or the external deviation clear DI is valid	

6.3.3 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:

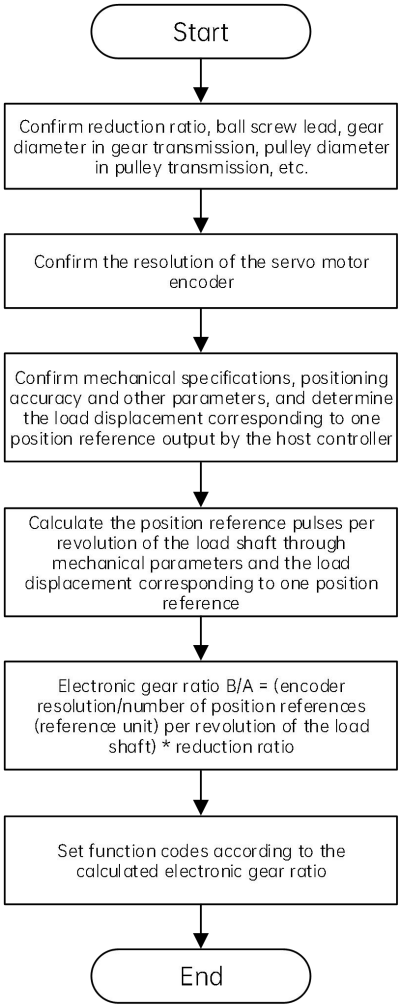


Fig. 6-3 Setting process of electronic gear ratio

The electronic gear ratio parameter function is shown as follows:

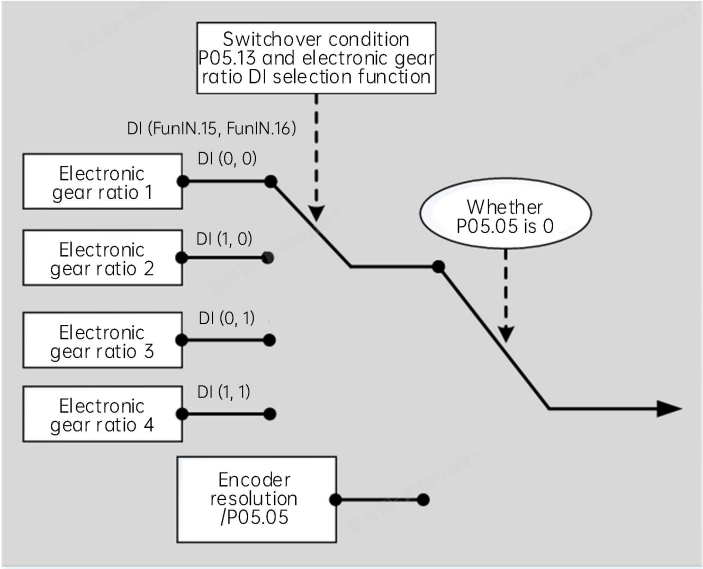


Fig. 6-4 Electronic gear ratio function diagram

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	Effective time	Property	Default value
P05.05	Number of pulses per motor revolution	0 to 8388608 P/r	Immediately	At stop	2097152
P05.08	Electronic gear numerator	1 to 1073741824	Immediately	At stop	8388608
P05.09	Electronic gear denominator 1	1 to 1073741824	Immediately	At stop	10000
P05.10	Electronic gear denominator 2	1 to 1073741824	Immediately	At stop	10000
P05.11	Electronic gear denominator 3	1 to 1073741824	Immediately	At stop	10000
P05.12	Electronic gear denominator 4	1 to 1073741824	Immediately	At stop	10000

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	Effective time	Property	Default value
P05.13	Electronic gear ratio switchover condition	0: Position reference is 0, switch after 3 ms duration 1: Real-time switching	Immediately	At stop	0

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:

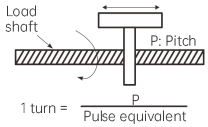
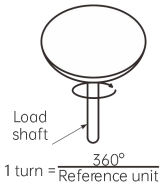
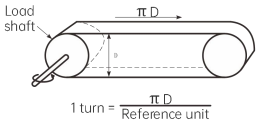
The displacement per revolution of the load shaft (reference unit) = 5 mm / 0.001 mm = 5000

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:

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

(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

6.3.4 Homing function

6.3.4.1 Function overview

The homing function means that in the position control mode, the servo motor will search for the home (zero point) according to the homing mode, homing speed and other commands to complete the positioning function, and use this position as the reference point for each subsequent operation.

Electrical homing refers to the process of running from the current position to the home after finding the position reference zero point.

Homing operation and pulse input operation, single-point operation and multi-segment operation are mutually exclusive, and other methods of position control can be performed only after one segment is executed.

6.3.4.2 Parameter settings

Function code	Name	Value range	Effective time	Property	Default value
P12.00	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	Immediately	During running	0
P12.01	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 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	Immediately	At stop	9
P12.02	Homing command terminal mode	0: Level mode 1: Pulse mode	Immediately	At stop	0

Function code	Name	Value range	Effective time	Property	Default value
P12.04	Positioning acceleration and deceleration curve selection	0: T-shaped curve 1: S-shaped curve	Immediately	At stop	0
P12.05	High-speed home searching speed	0.0 to 1000.0 rpm	Immediately	At stop	100.0
P12.06	Low-speed home searching speed	0.0 to 1000.0 rpm	Immediately	At stop	10.0
P12.07	Home position offset	-1073741824 to 1073741824	Immediately	At stop	0
P12.08	Home searching acceleration/deceleration time	0 to 65535 ms	Immediately	At stop	200
P12.09	Home search time limit	0 to 65535 ms	Immediately	At stop	10000

During various homing control processes, the effective travel of each switch should be fully considered to avoid logic errors Er.066 caused by excessive deceleration time or excessive home search speed. Carefully set the homing parameters.

If the time of homing exceeds the homing time limit, the drive will generate the time-out fault Er.037 for homing.

After the drive starts to find the home according to the homing mode, the homing DO (FunOUT.14) signal outputs a high level. Once the home is found with home position offset executed subsequently, the homing completed signal DO (FunOUT.15) will be output, and the homing DO (FunOUT.14) will be cleared.

After the drive starts to find the home according to the electrical homing mode, the electrical homing DO (FunOUT.16) signal outputs a high level, and the motor runs from the current position to the home position. After the position is reached, the electrical homing completed signal DO (FunOUT.17) will be output, and the homing DO (FunOUT.16) will be cleared.

There are six types of homing control modes:

1. Homing enabled by the HomingStart signal input from DI

Set DI to FunIN.33, which is the HomingStart signal. First enable the drive, and then enable the HomingStart signal to perform the homing. If the homing command terminal mode is set to the level mode, when the HomingStart is at low level, the homing process will be stopped, and re-enabling the signal will start the homing again. If the terminal mode of the homing command is set to the pulse mode, the low level of HomingStart will not affect the homing process, and the homing will be stopped only when the servo is disabled.

2. Electrical homing enabled by the HomingStart signal input from DI

Set DI to FunIN.33, which is the HomingStart signal. After the home is found during the homing, enable the drive first, and then enable the HomingStart signal for electrical homing. If the homing command terminal mode is set to the level mode, when the HomingStart is at low level, the electrical homing process will be stopped, and re-enabling the signal will

start the electrical homing again. If the terminal mode of the homing command is set to the pulse mode, the low level of HomingStart will not affect the electrical homing process, and the electrical homing will be stopped only when the servo is disabled.

3. Homing enabled immediately upon power-on

The first servo enable after power-on will trigger the homing process according to the homing mode, and subsequent servo enables will not trigger the homing again until the drive is powered on again.

4. Homing performed immediately

After the servo is enabled, the homing process will be triggered according to the homing mode. After the homing is completed, P12.00 will be cleared. To trigger again, you need to set P12.00=4 and then enable the drive.

5. Electrical homing started

After the home is found by homing, the servo enable will trigger the electrical homing process. After the electrical homing is completed, P12.00 will be cleared. To trigger again, you need to set P12.00=5 and then enable the drive.

6. Current position as the home

After the drive is enabled, the current position is taken as the home. When the home position offset P12.07 is 0, the position feedback=0. When the home position offset P12.07 is not 0, the position feedback is related to the home offset mode P12.11: when P12.11=0, the position feedback=P12.07; when P12.11=1, the position feedback=current position+P12.07. After the homing is completed, P12.00 will be cleared. To trigger again, you need to set P12.00=6 and then enable the drive.

6.3.4.3 Homing mode

1) P12.01 = 0, homing mode 0

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.

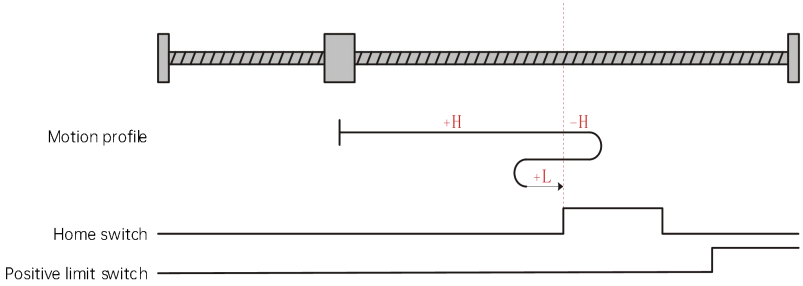


Fig. 6-5 Homing mode 0 motion profile Figure 1

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.

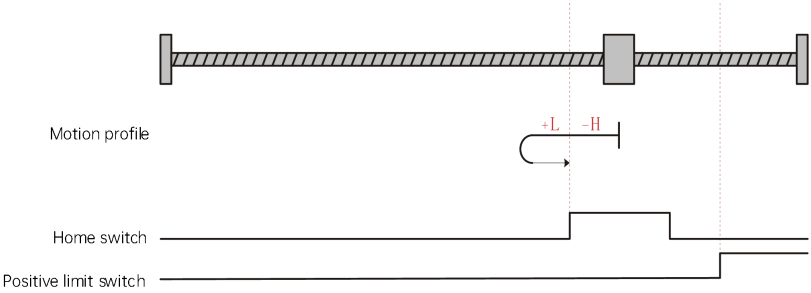


Fig. 6-6 Homing mode 0 motion profile Figure 2

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.

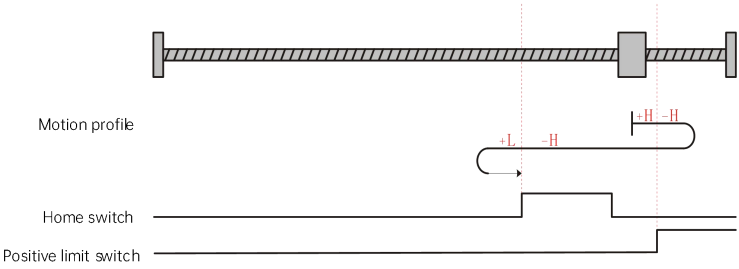


Fig. 6-7 Homing mode 0 motion profile Figure 3

2) P12.01 = 1, homing mode 1

Reverse, 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 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.

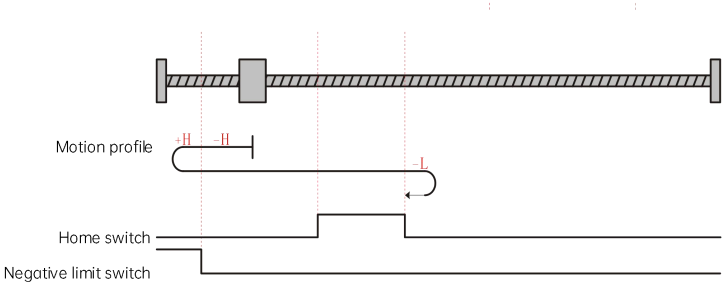


Fig. 6-8 Homing mode 1 motion profile Figure 1

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.

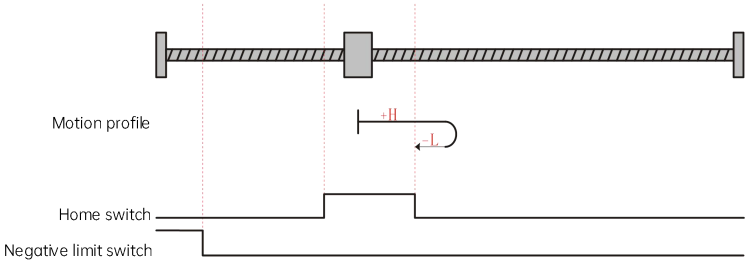


Fig. 6-9 Homing mode 1 motion profile Figure 2

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.

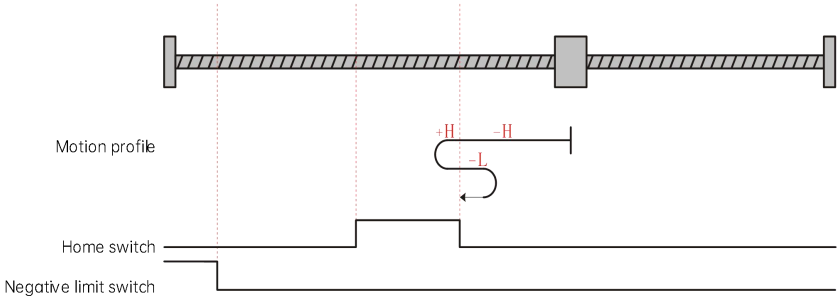


Fig. 6-10 Homing mode 1 motion profile Figure 3

3) P12.01 = 2, homing mode 2

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.

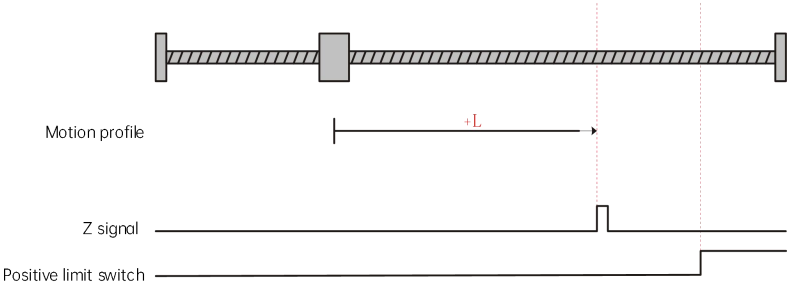


Fig. 6-11 Homing mode 2 motion profile Figure 1

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.

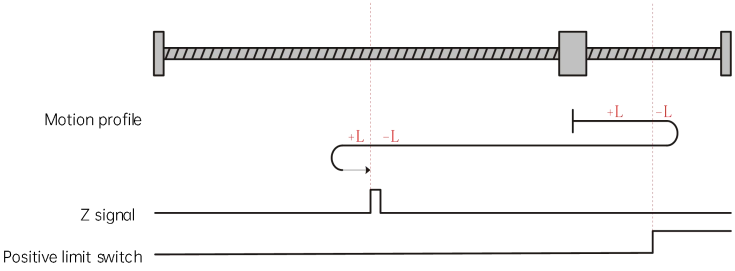


Fig. 6-12 Homing mode 2 motion profile Figure 2

4) P12.01 = 3, homing mode 3

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.

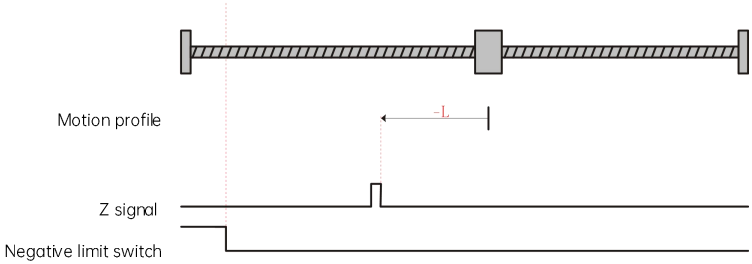


Fig. 6-13 Homing mode 3 motion profile Figure 1

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.

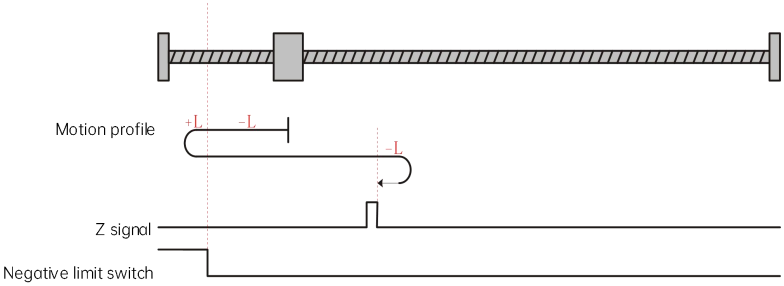


Fig. 6-14 Homing mode 3 motion profile Figure 2

5) P12.01 = 4, homing mode 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.

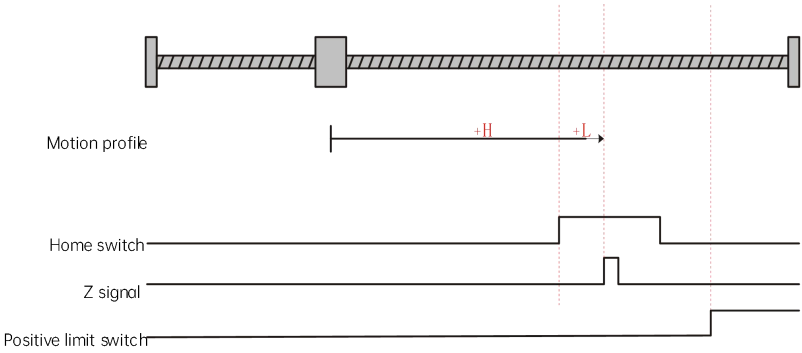


Fig. 6-15 Homing mode 4 motion profile Figure 1

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.

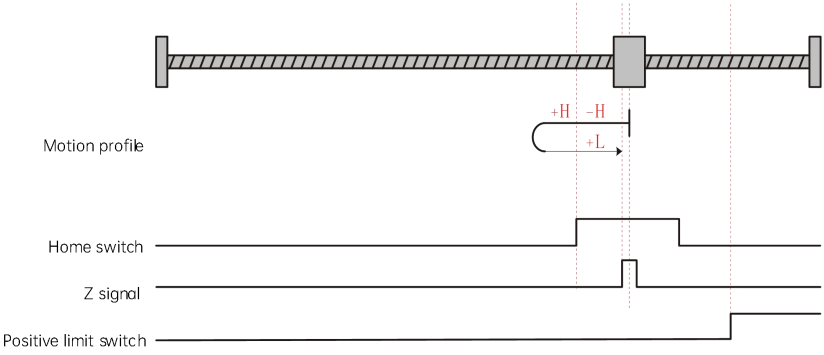


Fig. 6-16 Homing mode 4 motion profile Figure 2

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.

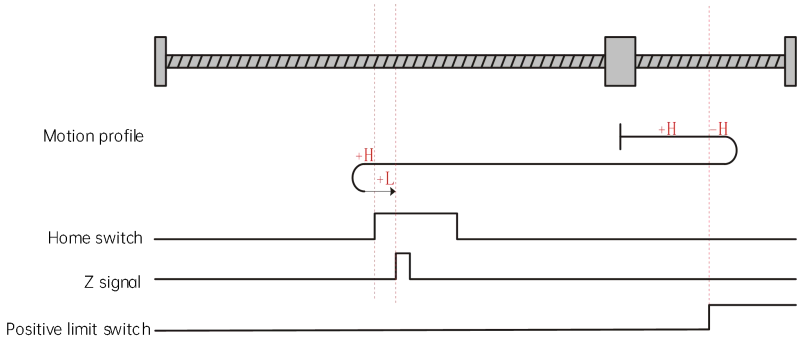


Fig. 6-17 Homing mode 4 motion profile Figure 3

6) P12.01 = 5, homing mode 5

Reverse, 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 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 at low speed and stops when reaching the rising edge of the Z signal.

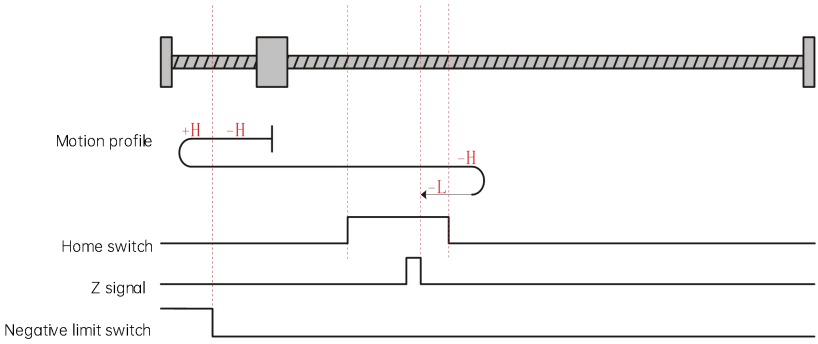


Fig. 6-18 Homing mode 5 motion profile Figure 1

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.

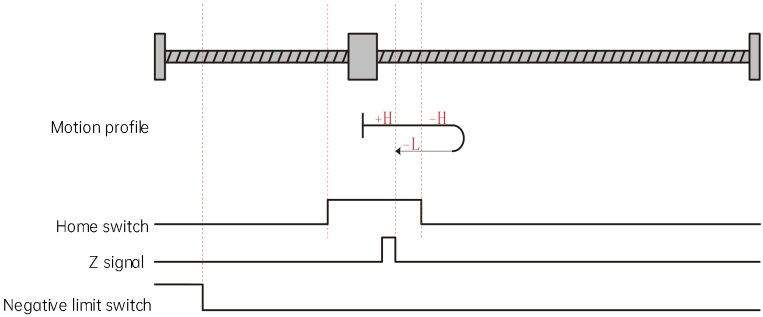


Fig. 6-19 Homing mode 5 motion profile Figure 2

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 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.

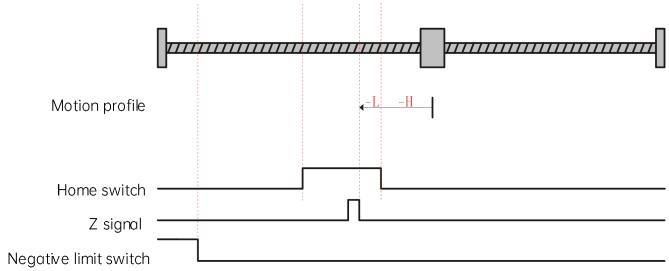


Fig. 6-20 Homing mode 5 motion profile Figure 3

7) P12.01 = 6, homing mode 6

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 high speed. After reaching the falling edge of the positive limit switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the positive limit switch.

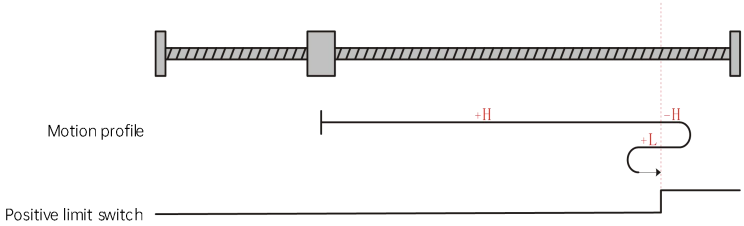


Fig. 6-21 Homing mode 6 motion profile Figure 1

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 high speed. After reaching the falling edge of the positive limit switch, the motor runs in the forward direction at low speed, and stops when reaching the rising edge of the positive limit switch.

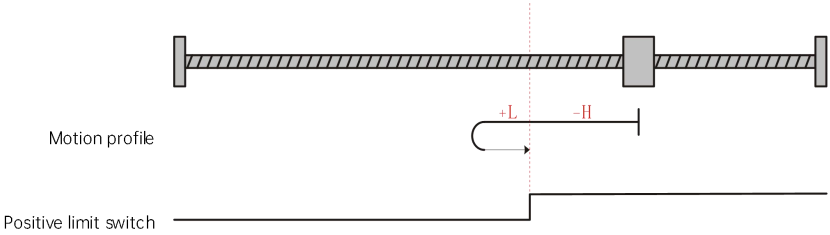


Fig. 6-22 Homing mode 6 motion profile Figure 2

8) P12.01 = 7, homing mode 7

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 high speed. After reaching the falling edge of the negative limit switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the negative limit switch.

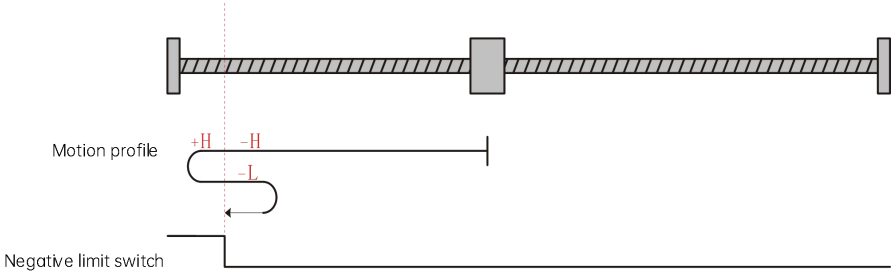


Fig. 6-23 Homing mode 7 motion profile Figure 1

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 high speed. After reaching the falling edge of the negative limit switch, the motor runs in the reverse direction at low speed, and stops when reaching the rising edge of the negative limit switch.

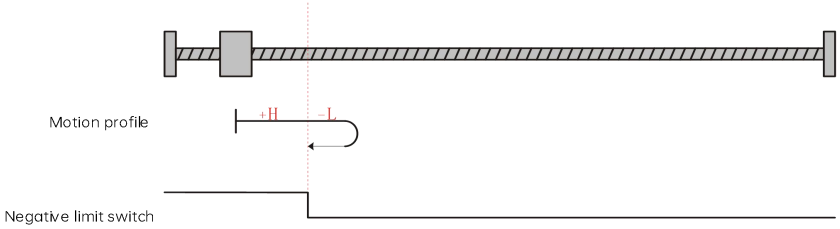


Fig. 6-24 Homing mode 7 motion profile Figure 2

9) P12.01 = 8, homing mode 8

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 high 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.

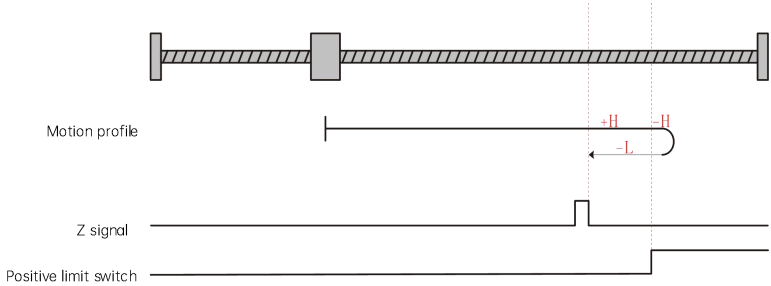


Fig. 6-25 Homing mode 8 motion profile Figure 1

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 high 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.

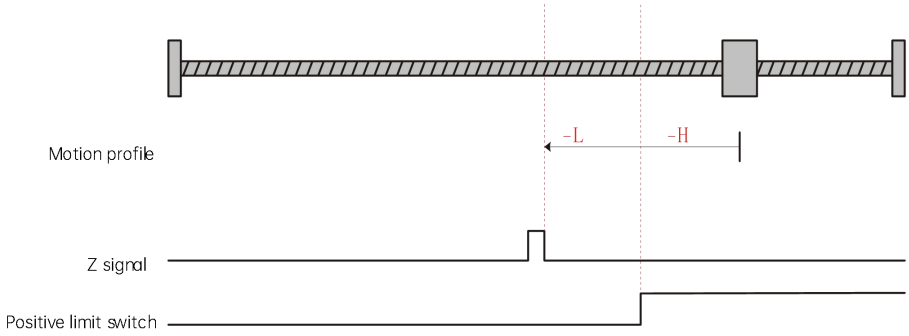


Fig. 6-26 Homing mode 8 motion profile Figure 2

10) P12.01 = 9, homing mode 9

Reverse, positive 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 high 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.

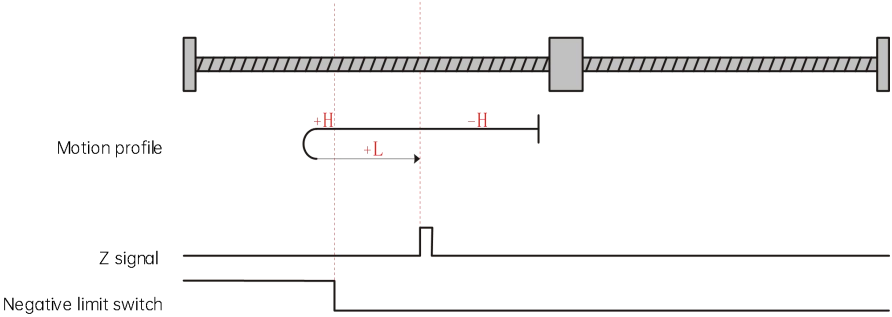


Fig. 6-27 Homing mode 9 motion profile Figure 1

The current position of the motor is at the positive 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 high 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.

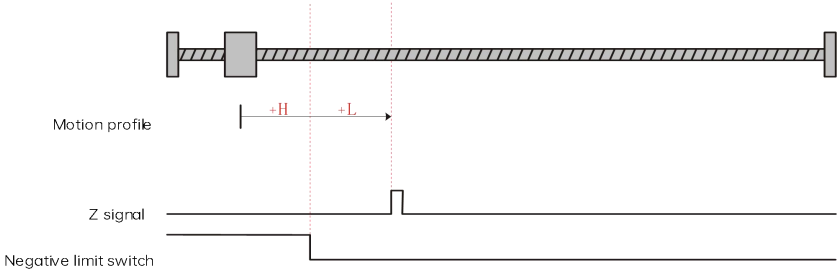


Fig. 6-28 Homing mode 9 motion profile Figure 2

6.3.5 Interrupt positioning

6.3.5.1 Function overview

In the position control mode, if interrupt positioning is triggered, the servo drive aborts current non-zero speed operation and turns to executing the preset position reference. When the servo receives the external trigger signal, it will shield the external position reference signal and run according to the internal preset length, speed and others. When the operation

is completed, the interrupt positioning completion signal is output, and then the next command action will be performed according to the external trigger signal.

When the interrupt positioning function is valid, DI10 is forced to be the interrupt positioning enable signal terminal. In the process of pulse reference, single point and multi-point operation, the interrupt positioning function is enabled at non-zero speed, and the enable is valid. If the speed is zero, alarm AL.062 is generated, and the alarm will be cleared when the DI10 interrupt positioning enable signal is disabled.

6.3.5.2 Parameter settings

When 31 Interrupt positioning prohibition is selected as DI terminal function, its priority is higher than the parameter setting of P12.86.

Function code	Name	Value range	Effective time	Property	Default value
P03.00-P03.07	DI terminal function selection	30: Interrupt positioning cancel 31: Interrupt positioning inhibit	Immediately	At stop	-
P03.15-P03.19	DO terminal function selection	27: Interrupt positioning completed	Immediately	At stop	-
P12.86	Interrupt positioning selection	0: Disable 1: Enable	Immediately	At stop	0
P12.87	Displacement of interrupt positioning	0 to 1073741824	Immediately	At stop	10000
P12.88	Constant operating speed in interrupt positioning	0.0 to 6000.0 rpm	Immediately	At stop	200.0
P12.89	Acceleration/ Deceleration time of interrupt positioning	0 to 1000 ms	Immediately	At stop	10
P12.90	Interrupt positioning cancel signal	0: Disable 1: Enable	Immediately	At stop	1

When P12.90 Interrupt positioning cancel signal is enabled, after interrupt positioning completion signal output, it is necessary to enable DI terminal function 30 to cancel the state before enabling the interrupt positioning function again. If P12.90 is in the non-enabled state, then the next interrupt positioning can be performed without the terminal to cancel the state.

6.3.5.3 Sequence diagram

When the interrupt positioning is triggered during position control, the device will run to the maximum constant speed P12.88 according to the current running direction, and then decelerate until the set interrupt positioning displacement is completed.

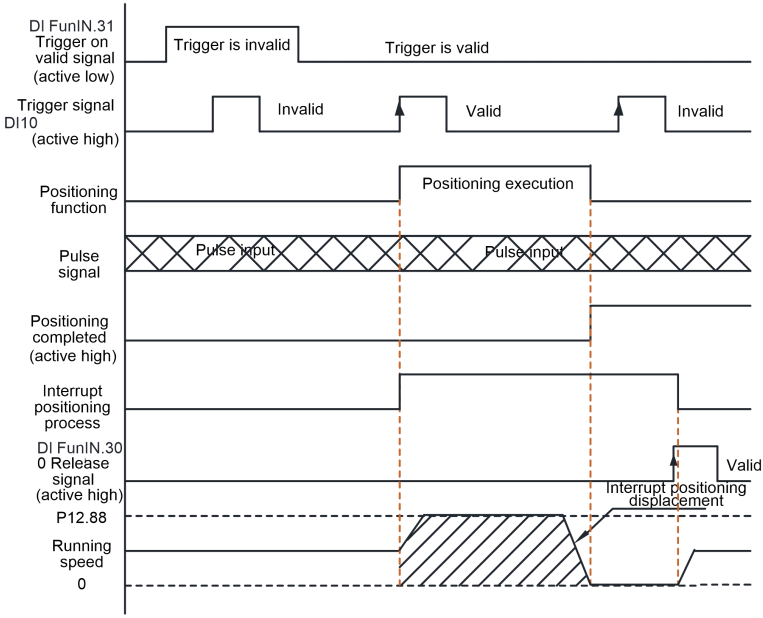


Fig. 6-29 Interrupt positioning sequence diagram

6.3.6 Function diagram of position control mode

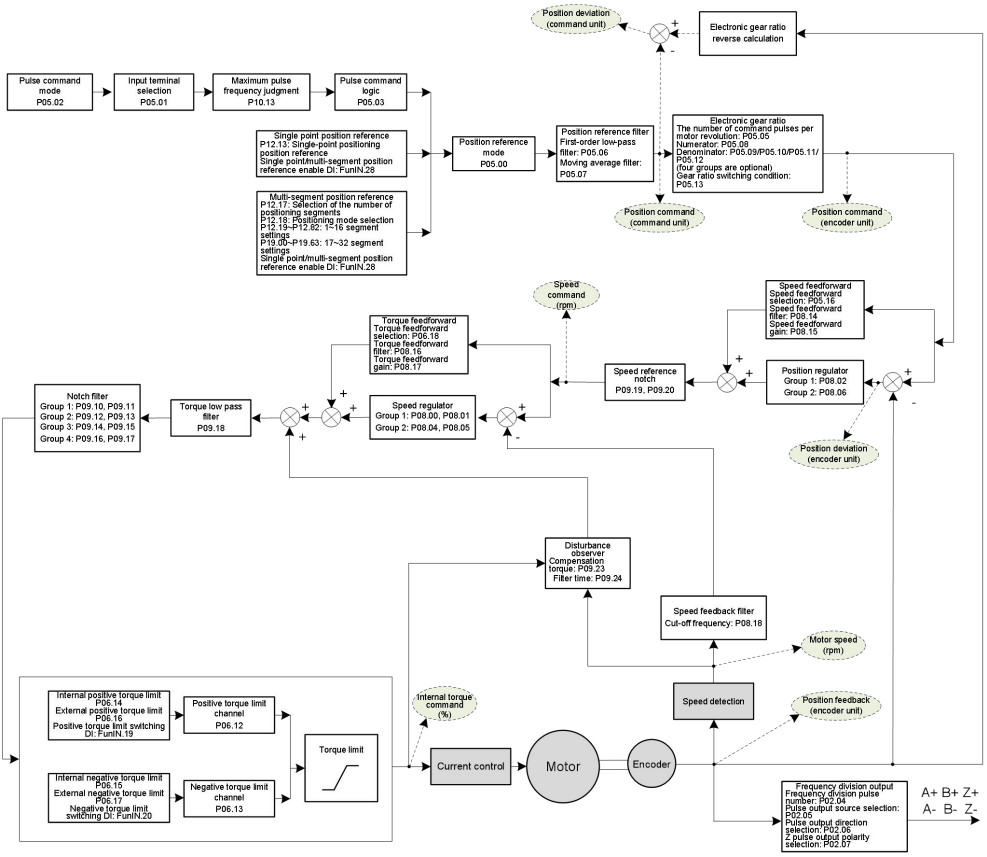


Fig. 6-30 Function block diagram of position control mode

6.4 Speed control mode

6.4.1 Speed control function code setting

6.4.1.1 Speed reference input setting

(1) Speed control selection

Function code	Name	Value range	Effective time	Property	Default value
P02.00	Control mode selection	0: Speed mode	Immediately	At stop	0

(2) Speed reference source

Function code	Name	Value range	Effective time	Property	Default value
P06.00	Main speed source selection	0: Digital reference (P06.01) 1 to 2: Reserved 3: Serial port communication reference 4: Multi-segment speed reference (auxiliary reference is not supported)	Immediately	At stop	0
P06.01	Main speed reference setting	-6000.0 to 6000.0 rpm	Immediately	During running	0.0
P06.02	Auxiliary speed source selection	0: No auxiliary reference 1: Digital reference 2 to 3: Reserved 4: Serial port communication reference	Immediately	At stop	0
P06.03	Auxiliary speed reference setting	-6000.0 to 6000.0 rpm	Immediately	During running	0.0
P06.05	Jog speed	0.0 to 6000.0 rpm	Immediately	During running	100.0

(3) Speed reference direction switching

Type	Function No.	Function name	Description	Remarks
Input (DI)	FunIN.26	Speed reference direction switching	ON: Switch OFF: Do not switch	Level valid

6.4.1.2 Ramp reference function settings

The ramp control function converts the stepped speed references to smooth speed references with constant acceleration/deceleration, which allows settings of acceleration and deceleration time. In speed control (including internal set speed control), you can use this function to achieve smooth speed control.

Function code	Name	Value range	Effective time	Property	Default value
P06.07	Speed reference acceleration time 1	0 to 65535 ms	Immediately	During running	1000
P06.08	Speed reference deceleration time 1	0 to 65535 ms	Immediately	During running	1000

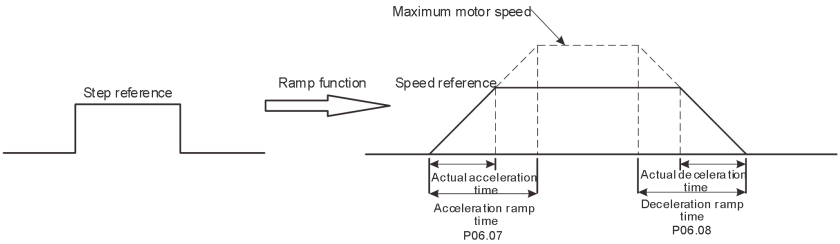


Fig. 6-31 reference ramp function operating logic

The actual acceleration and deceleration time is calculated as follows:

Actual acceleration time = (speed reference / P06.09) * P06.07

Actual deceleration time = (speed reference / P06.09) * P06.08

6.4.1.3 Zero clamp

Zero clamp refers to that at zero clamp signal (/P-CON) ON state, when the speed reference is below the speed set by zero clamp starting speed (P06.21), the servo motor enters servo lock. At this point in the inner of the servo drive position loop is constituted, speed reference will be ignored.

The servo motor is fixed within ± 1 pulse of zero clamp effective position, even if the rotation occurs due to an external force, it will return to the zero clamp position.

Zero clamp function is used for the system that host device does not constitute position closed loop in speed control.

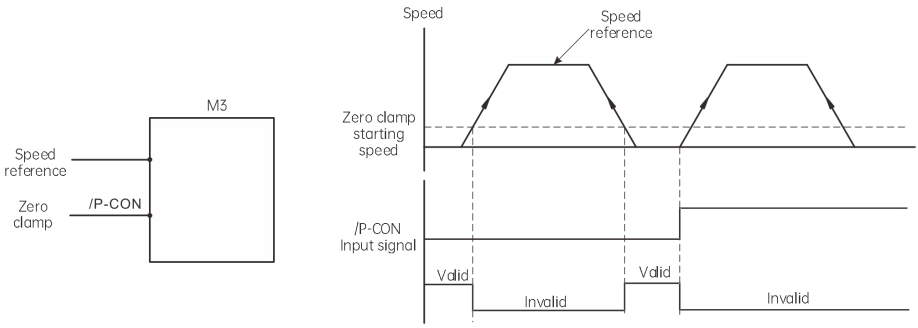


Fig. 6-32 Zero clamp logic

DI function selection:

Type	Function No.	Function name	Description	Remarks
Input (DI)	FunIN.11	Zero clamp (/P-CON)	ON: Perform zero clamp function OFF: Do not perform zero clamp function	Level valid

Related function codes:

Function code	Name	Value range	Effective time	Property	Default value
P06.19	Zero clamp function	0: Disabled 1: Always enabled 2: Enabled under conditions (terminal enabled)	Immediately	At stop	0
P06.20	Zero clamp gain	0 to 6.000	Immediately	During running	1.000
P06.21	Zero clamp starting speed	0.0 to 1000.0 rpm	Immediately	During running	2

If the servo motor oscillation occurs at zero clamp control status, you can adjust zero clamp gain.

6.4.2 Function diagram of speed control mode

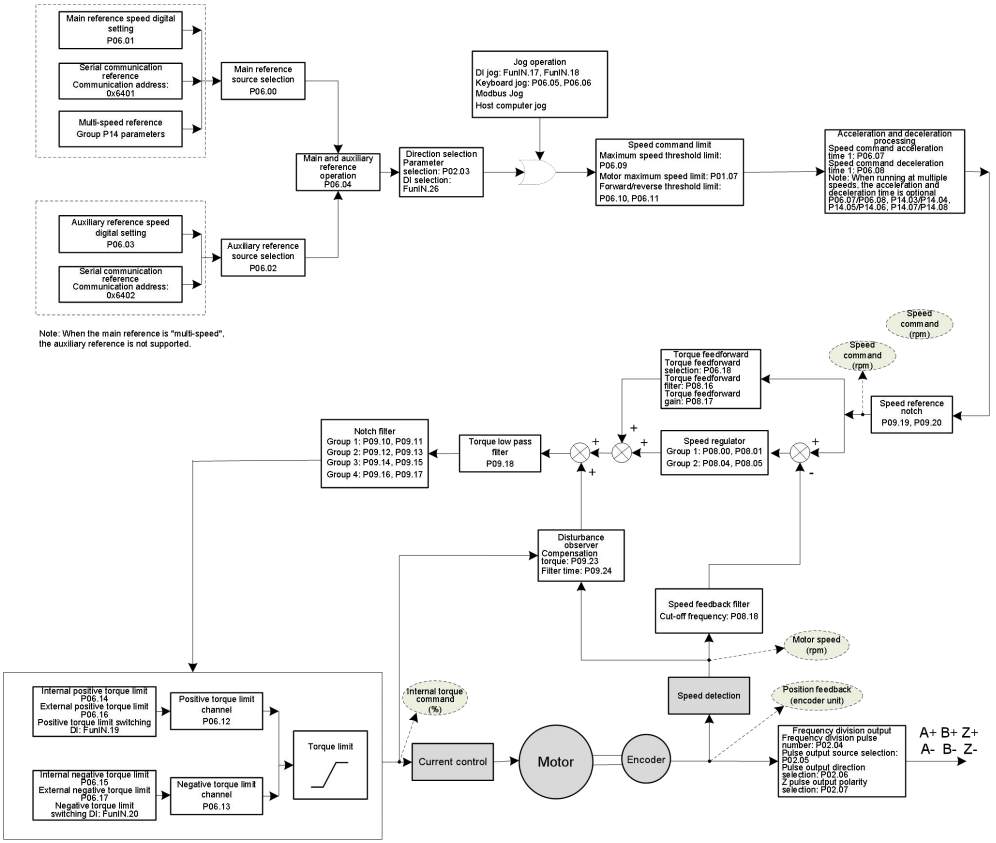


Fig. 6-33 Function block diagram of speed control mode

6.5 Torque control mode

6.5.1 Torque control function code setting

6.5.1.1 Torque reference input setting

(1) Torque control selection

Function code	Name	Value range	Effective time	Property	Default value
P02.00	Control mode selection	2: Torque mode	Immediately	At stop	0

(2) Torque reference source

Function code	Name	Value range	Effective time	Property	Default value
P07.00	Torque reference selection	0: Digital reference 1 to 2: Reserved 3: Serial port communication reference	Immediately	At stop	0
P07.03	Torque digital reference value	-400.0% to 400.0%	Immediately	At stop	0.0%

(3) Torque reference direction switching

Type	Function No.	Function name	Description	Remarks
Input (DI)	FunIN.27	Torque reference direction switching	ON: Switch OFF: Do not switch	Level valid

6.5.1.2 Speed limit in torque control

This function is to limit servo motor speed to protect mechanisms.

In the torque control mode, only the output torque reference of the servo motor is limited, and the speed is not controlled. Therefore, if the set torque reference is larger than the load torque on the mechanical side, the motor will keep acceleration. This may cause overload. In this case, the speed limit needs to be set.

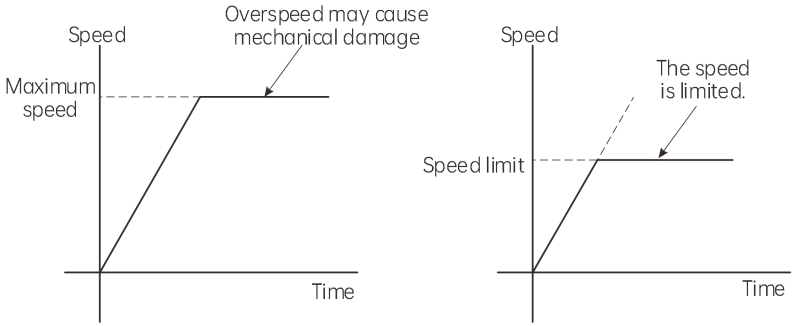


Fig. 6-34 Speed limit in torque control

(1) Output signal in motor speed limit

Type	Function No.	Function name	Output status	Description
Output (DO)	FunOUT.9	Speed limit (VLT)	ON (closed) OFF (disconnected)	Motor speed limited Motor speed not limited

(2) Speed limit value selection

Function code	Name	Value range	Effective time	Property	Default value
P07.09	FWD speed limit channel	0: FWD speed limit value 1: Bus speed limit value 2: MIN (FWD speed limit value, bus speed limit value)	Immediately	At stop	0
P07.10	FWD speed limit value	0.0% to +100.0%	Immediately	During running	100.0%
P07.11	REV speed limit channel	0: REV speed limit value 1: Bus speed limit value 2: MIN (REV speed limit value, bus speed limit value)	Immediately	At stop	0
P07.12	REV speed limit value	0.0% to +100.0%	Immediately	During running	100.0%

6.5.2 Function diagram of torque control mode

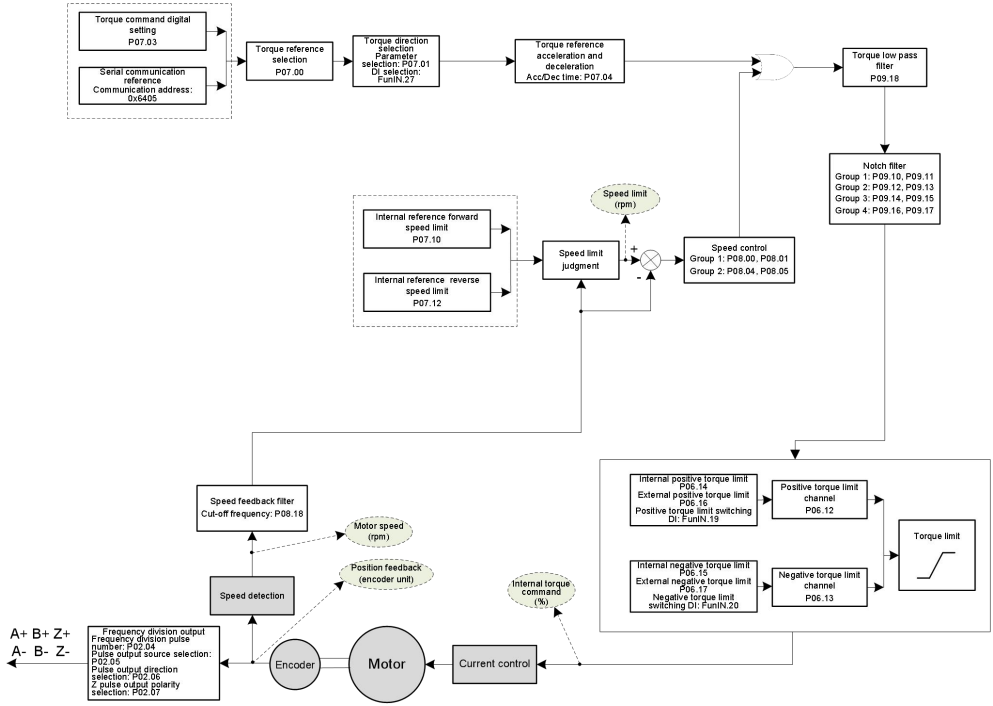


Fig. 6-35 Function block diagram of torque control mode

6.6 Brake settings

6.6.1 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:

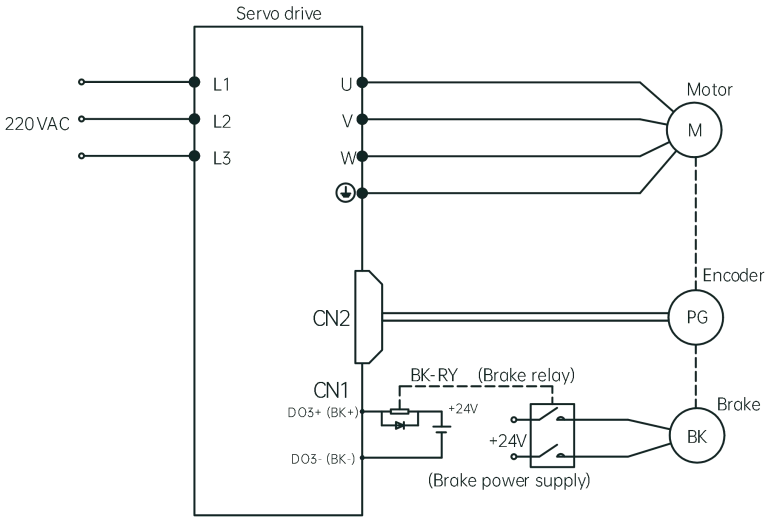


Fig. 6-36 Brake wiring diagram

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.

6.6.2 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.

6.6.3 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.

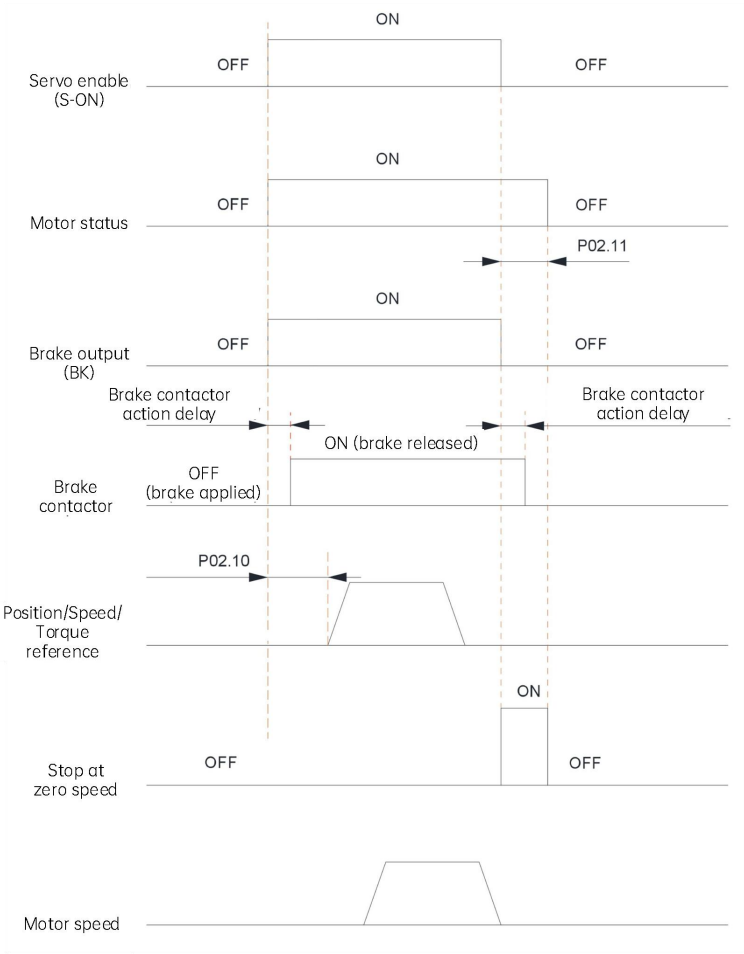


Fig. 6-37 Brake sequence for a motor at standstill

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

6.6.4 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.

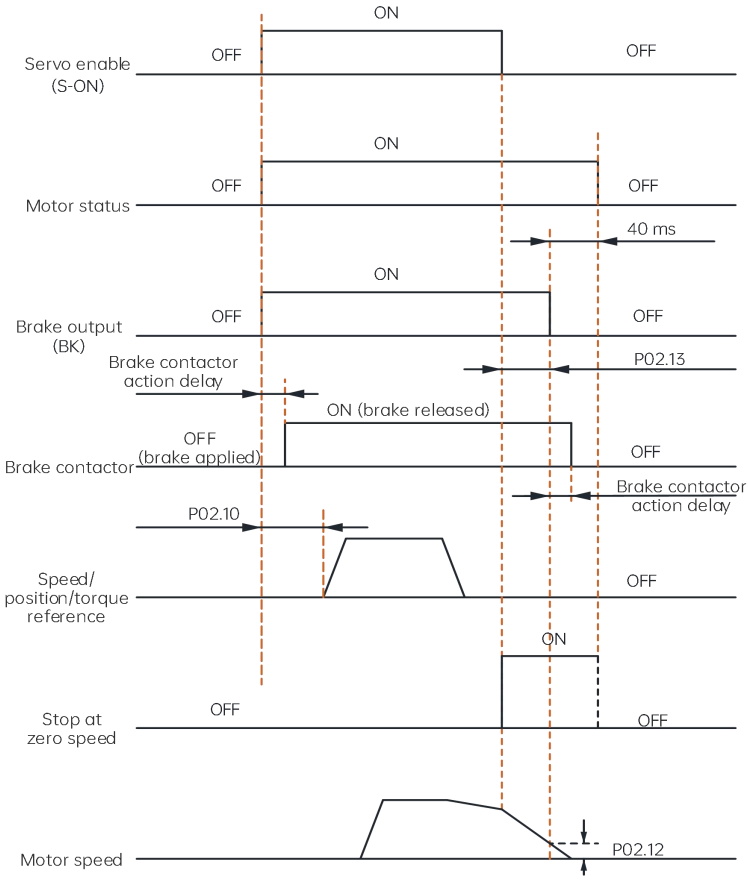


Fig. 6-38 Brake sequence for a rotating motor

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	Effective time	Property	Default value
P02.12	Motor speed threshold at brake output OFF in rotating state	0 to 3000.0 rpm	Immediately	During running	10.0
P02.13	Delay from S-ON OFF to brake output OFF in rotating state	1 to 30000 ms	Immediately	During running	500

6.6.5 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 Parameter List

Explanation to the terms in the function code parameter table

Table field	Explanation
Function code	Representing the number of the function code, e.g. P00.00
Name	Name of the function code, explaining the function
Value range	The minimum and maximum values of the function code allowed to set
Unit	V: Voltage; A: Current; ℃: temperature; Ω: resistance; mH: inductance; r: number of revolutions; rpm: rotating speed; %: percentage; bps: baud rate; Hz, kHz: frequency; ms, s, min, h, kh: time; kW: power; /: no unit Reference unit: The value of the input reference processed by the electronic gear ratio. Encoder unit: The minimum distinguishable value input to the servo drive from the host device.
Default value	The value of the function code after restoring the default settings
Effective time	Function code parameter settings valid condition
Property	Function code change condition
Mode	Function code effective control mode P: Position control; S: Speed control; T: Torque control.

Function code groups

Function code group	Parameter group description	Function code group	Parameter group description
P00	Drive parameters	P12	Servo positioning parameters
P01	Servo motor parameters	P14	Multi-stage speed parameters
P02	Basic control parameters	P15	Modbus communication parameters
P03	Digital input and output parameters	P18	Advanced parameters
P05	Position control parameters	P19	Internal positioning parameters 2
P06	Speed control parameters	P23	Special function parameters
P07	Torque control parameters		
P08	Gain parameters		
P09	Adjustment parameters		
P10	Fault and protection parameters		
P11	Display parameters		

Function code table

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P00: Drive parameters							
P00.00	Serial No.	0 to FFFF	1	Manufacturer setting	-	At display	PST
P00.01	DSP software version No.	0.00 to 99.99	0.01	Manufacturer setting	-	At display	PST
P00.02	User-customized version No.	0 to 9999	1	Manufacturer setting	-	At display	PST
P00.03	Reserved						
P00.04	Voltage class of servo drive	0: 220 V 1: 380 V	1	Manufacturer setting	-	At display	PST
P00.05	Rated current of servo drive	0 to 999.9 A	0.1 A	Manufacturer setting	-	At display	PST
P00.06	Maximum current of servo drive	0 to 999.9 A	0.1 A	Manufacturer setting	-	At display	PST
P01: Servo motor parameters							
P01.00	Motor SN	0: Motor parameters can be manually set 0x111: Motor parameters are automatically read Other: Reserved	1	0	Immediately	At stop	PST
P01.01	Rated power	0.04 to 99.99 kW	0.01 kW	Depending on model	Power-on again	At stop	PST
P01.02	Rated voltage	0 to rated voltage of servo drive	1 V	0	Power-on again	At stop	PST
P01.03	Rated current	0.1 to 999.9 A	0.1 A	Depending on model	Power-on again	At stop	PST
P01.04	Rated torque	0.1 to 655.35 N·m	0.01 N·m	Depending on model	Power-on again	At stop	PST
P01.05	Maximum torque	0.1 to 655.35 N·m	0.01 N·m	Depending on model	Power-on again	At stop	PST
P01.06	Rated speed	0.1 to 6000.0 rpm	0.1 rpm	Depending on model	Power-on again	At stop	PST
P01.07	Maximum speed	0.1 to 6000.0 rpm	0.1 rpm	Depending on model	Power-on again	At stop	PST
P01.08	Moment of inertia Jm	0.01 to 655.35 kg*cm^2	0.01 kg*cm^2	Depending on model	Power-on again	At stop	PST
P01.09	Number of pole	2 to 72 pairs of poles	1 pair of	Depending	Power-on	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	pairs		poles	on model	again		
P01.10	Stator resistance R1	0.000 to 65.000 Ω	0.001 Ω	Depending on model	Power-on again	At stop	PST
P01.11	D-axis inductance Ld	0.00 to 200.00 mH	0.01 mH	Depending on model	Power-on again	At stop	PST
P01.12	Q-axis inductance Lq	0.00 to 200.00 mH	0.01 mH	Depending on model	Power-on again	At stop	PST
P01.13	Back-EMF constant	1 to 600.0 V/krpm	0.1 V/krpm	Depending on model	Power-on again	At stop	PST
P01.14	Torque coefficient Kt	0.001 to 65.000 N·M/A	0.01 N·M/A	Depending on model	Power-on again	At stop	PST
P01.15	Electrical constant Te	0.01 to 650.00 ms	0.01 ms	Depending on model	Power-on again	At stop	PST
P01.16	Mechanical constant Tm	0.01 to 650.00 ms	0.01 ms	Depending on model	Power-on again	At stop	PST
P01.17	Brake function	0: Without brake 1: With brake	1	Depending on model	Immediately	At stop	PST
P01.18	Encoder selection	5: 17-bit absolute encoder	1	5	Immediately	At stop	PST
P01.19	Encoder PPR	1 to 4194304	1	2097152	Immediately	At stop	PST
P01.20	Encoder installation initial angle tuning	0: Disabled 1: Enabled	1	0	Immediately	At stop	PST
P01.21	Rotation direction	0: A before B 1: B before A	1	0	Immediately	At stop	PST
P01.22	Encoder installation initial angle	0.0 to 359.9°	0.1°	180.0	Immediately	At stop	PST
P01.23	Absolute encoder type	0: Multi-turn absolute encoder 1: Single-turn absolute encoder	1	0	Immediately	At stop	PST
P02: Basic control parameters							
P02.00	Control mode selection	0: Speed mode (actually effective, combined with P06.00) 1: Position mode 2: Torque mode	1	0	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	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)					
P02.01	Internal servo enable	0 to 1	1	0	Immediately	During running	PST
P02.02	Absolute value system mode selection	0: Absolute position linear mode 1: Absolute position rotation mode	1	0	Immediately	At stop	PST
P02.03	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	PST
P02.04	Encoder frequency-division output	1 to 32768 P/r	1	2500 P/r	Immediately	During running	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	pulses						
P02.05	Pulse output source selection	0: Motor encoder frequency dividing output 1: Pulse command synchronous output 2: Frequency dividing or synchronous output disabled	1	2	Immediately	During running	PST
P02.06	Output pulse direction selection	0: A before B 1: B before A	1	0	Immediately	During running	PST
P02.07	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	PST
P02.08	Stop mode	0: Decelerate to stop 1: Coast to stop	1	0	Immediately	During running	PST
P02.09	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	PST
P02.10	Delay from brake output ON to command received	20 to 500 ms	1 ms	250	Immediately	During running	PS
P02.11	Delay from brake output OFF to motor de-energized in static state	1 to 1000 ms	1 ms	150	Immediately	During running	PS
P02.12	Motor speed threshold at brake output OFF in rotating state	0 to 3000.0 rpm	1 rpm	10.0	Immediately	During running	PS
P02.13	Delay from S-ON OFF to brake	1 to 30000 ms	1 ms	500	Immediately	During running	PS

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	output OFF in rotating state						
P02.14	Regenerative resistor derating factor	0.5 to 1.0	0.1	0.8	Immediately	At stop	PST
P02.15	Power of built-in regenerative resistor	-	1	Model dependent	-	At display	PST
P02.16	Resistance of built-in regenerative resistor	-	1	Model dependent	-	At display	PST
P02.17	Resistor heat dissipation coefficient	0: 0% 1: 25% 2: 50% 3: 75% 4: 100%	1	2	Immediately	During running	PST
P02.18	Regenerative resistor type	0: Use the built-in regenerative resistor 1: Use the external regenerative resistor 2: Do not use the regenerative resistor	1	0	Immediately	At stop	PST
P02.19	Power of external regenerative resistor	1 to 65535 W	1 W	Model dependent	Immediately	At stop	PST
P02.20	Resistance of external regenerative resistor	1 to 65535 Ω	1 Ω	Model dependent	Immediately	At stop	PST
P02.21	Parameter protection setting	0: All the data can be changed; 1: Only P06.01 and this function code can be changed 2: Only this function code can be changed	1	0	Immediately	During running	PST
P02.22	Parameter initialization	0: Parameter changing status 1: Clear fault memory	1	0	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		information 2: Restore to leave-factory value 3: Clear motor model					
P02.23	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	PST
P02.24	Enable terminal valid type selection	0: Level valid 1: Transition edge valid	1	1	Immediately	During running	PST
P03: Digital input and output terminal parameters							
P03.00	DI1 terminal 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 6: Multi-segment operation reference switching 2 7: Multi-segment operation reference switching 3 8: Multi-segment operation reference	1	1	Immediately	At stop	PST
P03.01	DI2 terminal function selection		1	2	Immediately	At stop	PST
P03.02	DI3 terminal function selection		1	3	Immediately	At stop	PST
P03.03	DI4 terminal function selection		1	35	Immediately	At stop	PST
P03.04	DI5 terminal function selection		1	36	Immediately	At stop	PST
P03.05	DI6 terminal function selection		1	9	Immediately	At stop	PST
P03.06	DI7 terminal function selection		1	10	Immediately	At stop	PST
P03.07	DI8 terminal function selection		1	34	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		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 27: Torque command direction switching 28: Multi-segment/ single-point position command enable 29: Position deviation counter is cleared 30: Interrupt					

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		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					
P03.08 to P03.11	Reserved						
P03.12	DI terminal filter time	1 to 500 ms	1 ms	10	Immediately	During running	PST
P03.13	DI active state setting	Binary setting 0: Normal logical, enabled upon connection 1: Inverted logical, enabled upon disconnection Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0 to BIT3: DI5 to DI8 Hundreds place of LED: BIT0 to BIT3: DI9 to DI12	1	000	Immediately	During running	PST
P03.14	VDI active state setting	Binary setting 0: Disabled 1: Enabled	1	000	Immediately	During running	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0 to BIT3: DI5 to DI8 Hundreds place of LED: BIT0 to BIT3: DI9 to DI12					
P03.15	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 signal	1	0	Immediately	At stop	PST
P03.16	DO2 function selection		1	5	Immediately	At stop	PST
P03.17	DO3 function selection		1	18	Immediately	At stop	PST
P03.18	DO4 function selection		1	1	Immediately	At stop	PST
P03.19	DO5 function selection		1	11	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		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					
P03.20 to P03.22	Reserved						
P03.23	DO active state setting	Binary setting 0: Enabled upon connection 1: Enabled upon disconnection Unit place of LED: BIT0 to BIT3: DO1 to DO4 Tens place of LED: BIT0 to BIT3: DO5 to DO8	1	00	Immediately	During running	PST
P05: Position control parameters							
P05.00	Position reference mode	0: Pulse reference 1: Single point position reference 2: Multi-segment position reference	1	0	Immediately	At stop	P
P05.01	Pulse reference input terminal selection	0: Low-speed terminal 1: High-speed terminal	1	0	Immediately	At stop	P
P05.02	Pulse reference mode	0: A/B phase pulse 1: PULSE+SIGN	1	1	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		2: CW/CCW pulse					
P05.03	Pulse reference logic	0: Positive logic 1: Inverse logic	1	0	Immediately	At stop	P
P05.04	Reserved						
P05.05	Number of pulses per motor revolution	0 to 8388608 P/r	1 P/r	2097152	Immediately	At stop	P
P05.06	Position reference first-order low-pass filter time	0.0 to 2000.0 ms	0.1 ms	0.0	Immediately	At stop	P
P05.07	Position reference moving average filter time	0.0 to 12.8 ms	0.1 ms	0.0	Immediately	At stop	P
P05.08	Electronic gear ratio numerator	1 to 1073741824	1	8388608	Immediately	At stop	P
P05.09	Electronic gear ratio denominator 1	1 to 1073741824	1	10000	Immediately	At stop	P
P05.10	Electronic gear ratio denominator 2	1 to 1073741824	1	10000	Immediately	At stop	P
P05.11	Electronic gear ratio denominator 3	1 to 1073741824	1	10000	Immediately	At stop	P
P05.12	Electronic gear ratio denominator 4	1 to 1073741824	1	10000	Immediately	At stop	P
P05.13	Electronic gear ratio switchover condition	0: Position reference is 0, switch after 3 ms duration 1: Real-time switching	1	0	Immediately	At stop	P
P05.14	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	1	00	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		2: Clear position deviation when the servo enable is OFF or the external position deviation clear DI is valid					
P05.15	Position deviation clear DI signal type	0: Pulse mode 1: Level mode	0	0	Immediately	At stop	P
P05.16	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	P
P05.17	Position controller output limit	0 to maximum speed	0.1 rpm	3000.0	Immediately	During running	P
P05.18	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	P
P05.19	Positioning	0 to 10000	1	10	Immediat	During	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	completed range		reference unit		ely	running	
P05.20	Positioning near signal width	1 to 32767	1 reference unit	100	Immediately	During running	P
P05.21	Detection range for excessive position deviation	0 to 32767	1 encoder unit	20000	Immediately	During running	P
P05.22	Excessive position deviation alarm selection	0: Valid 1: Invalid	1	0	Immediately	During running	P
P05.23	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	P
P05.24	Servo stop time	0 to 3000 ms When the PL (CCWL), NL (CWL) occurs, according to the time to slow down	1	0	Immediately	During running	P
P05.25	Mechanical gear ratio in absolute position rotating mode (numerator)	1 to 65535	1	1	Immediately	At stop	P
P05.26	Mechanical gear ratio in absolute position rotating mode (denominator)	1 to 65535	1	1	Immediately	At stop	P
P05.27	Position offset in absolute position linear mode (low 32 bits)	0 to 4294967295	1 encoder unit	0	Immediately	At stop	P
P05.28	Position offset in absolute position linear mode (high 32 bits)	0 to 4294967295	1 encoder unit	0	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P05.29	Pulses per revolution of the load in absolute position rotating mode (low 32 bits)	0 to 4294967295	1 encoder unit	0	Immediately	At stop	P
P05.30	Pulses per revolution of the load in absolute position rotating mode (high 32 bits)	0 to 127	1 encoder unit	0	Immediately	At stop	P
P05.31	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	P
P05.32	Software limit maximum point	-2147483647 to 2147483647	1 reference unit	2147483647	Immediately	At stop	P
P05.33	Software limit minimum point	-2147483647 to 2147483647	1 reference unit	-2147483648	Immediately	At stop	P
P06: Speed control parameters							
P06.00	Main speed source selection	0: Digital reference (P06.01) 1 to 2: Reserved 3: Serial port communication reference 4: Multi-step speed reference (auxiliary reference is not supported)	1	0	Immediately	At stop	S
P06.01	Main speed reference setting	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	Immediately	During running	S
P06.02	Auxiliary speed source selection	0: No auxiliary reference 1: Digital reference 2 to 3: Reserved	1	0	Immediately	At stop	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		4: Serial port communication reference					
P06.03	Auxiliary speed reference setting	-6000.0 to 6000.0 rpm	0.1 rpm	0	Immediately	During running	S
P06.04	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	At stop	S
P06.05	Jog speed	0.0 to 6000.0 rpm	0.1 rpm	100.0	Immediately	During running	S
P06.06	Jog operation						
P06.07	Speed reference acceleration time 1	0 to 65535 ms	1 ms	1000	Immediately	During running	S
P06.08	Speed reference deceleration time 1	0 to 65535 ms	1 ms	1000	Immediately	During running	S
P06.09	Maximum speed threshold	0.0 to 6000.0 rpm	0.1 rpm	6000.0	Immediately	During running	S
P06.10	Forward speed threshold	0.0 to 6000.0 rpm	0.1 rpm	6000.0	Immediately	During running	S
P06.11	Reverse speed threshold	0.0 to 6000.0 rpm	0.1 rpm	6000.0	Immediately	During running	S
P06.12	Positive torque limit channel	0: Internal positive torque limit value 1 to 2: Reserved 3: External positive torque limit value	1	0	Immediately	At stop	PST
P06.13	Negative torque limit channel	0: Internal negative torque limit value 1 to 2: Reserved 3: External negative	1	0	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		torque limit value					
P06.14	Internal positive torque limit value	0.0% to +400.0%	0.1%	Depending on model	Immediately	During running	PST
P06.15	Internal negative torque limit value	0.0% to +400.0%	0.1%	Depending on model	Immediately	During running	PST
P06.16	External positive torque limit value	0.0% to +400.0%	0.1%	100.0	Immediately	During running	PST
P06.17	External negative torque limit value	0.0% to +400.0%	0.1%	100.0	Immediately	During running	PST
P06.18	Torque feedforward control selection	0: No torque feedforward 1: Internal torque feedforward (Use the speed command as the source of the torque feedforward signal.In position control mode, the speed command comes from the output of the position controller.)	1	1	Immediately	At stop	PST
P06.19	Zero clamp function	0: Disabled 1: Always enabled 2: Enabled under conditions (terminal enabled)	1	0	Immediately	At stop	S
P06.20	Zero clamp gain	0 to 6.000	0.001	1.000	Immediately	During running	S
P06.21	Zero clamp starting speed	0.0 to 1000.0 rpm	0.1 rpm	2.0	Immediately	During running	S
P06.22	Speed arrival detection width	0.0 to 6000.0 rpm	0.1 rpm	1000.0	Immediately	During running	PST
P06.23	Zero speed threshold	0.0 to 200.0 rpm	0.1 rpm	20.0	Immediately	During running	S
P06.24	Speed matching threshold	0.0 to 100.0 rpm	0.1 rpm	10.0	Immediately	During running	S
P07: Torque control parameters							
P07.00	Torque reference selection	0: Digital reference 1 to 2: Reserved	1	0	Immediately	At stop	T

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		3: Serial communication reference					
P07.01	Torque positive direction selection	0: Forward drive is positive 1: Reverse drive is positive	1	0	Immediately	At stop	T
P07.02	Speed/Torque switchover mode selection	0: Switching directly 1: Switching once over the torque switching point	1	0	Immediately	At stop	T
P07.03	Torque digital setting	-400.0% to +400.0%	0.1%	0.0	Immediately	During running	T
P07.04	Torque reference acceleration/ deceleration time	0 to 65535 ms	1 ms	0	Immediately	At stop	T
P07.05	Torque reference filter time constant	0 to 30.0 ms	0.1 ms	1.0	Immediately	At stop	T
P07.06	2nd torque reference filter time constant	0 to 30.0 ms	0.1 ms	1.0	Immediately	At stop	T
P07.07	Speed/Torque switchover point	0.0% to 400.0% initial torque	0.1%	100.0	Immediately	At stop	ST
P07.08	Speed/Torque switchover delay	0 to 1000 ms	1 ms	0	Immediately	At stop	ST
P07.09	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	0	Immediately	At stop	T
P07.10	FWD speed limit value	0.0% to 100.0%	0.1%	100.0	Immediately	During running	T
P07.11	REV speed limit channel	0: REV speed limit value 1: Bus speed limit value 2: MIN (REV speed	1	0	Immediately	At stop	T

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		limit value, bus speed limit value)					
P07.12	REV speed limit value	0.0% to 100.0%	0.1%	100.0	Immediately	During running	T
P07.13	Base value for torque reached	0.0 to 400.0%	0.1%	0.0	Immediately	During running	T
P07.14	Valid value for torque reached	0.0 to 400.0%	0.1%	20.0	Immediately	During running	T
P07.15	Invalid value for torque reached	0.0 to 400.0%	0.1%	10.0	Immediately	During running	T
P08: Gain parameters							
P08.00	Speed loop proportional gain 1	0.1 to 5000.0 Hz	0.1 Hz	20.0	Immediately	During running	PS
P08.01	Speed loop integral time 1	0.00 to 100.00 ms	0.01 ms	5.00	Immediately	During running	PS
P08.02	Position loop gain 1	1 to 8000 rad/s	1 rad/s	100	Immediately	During running	P
P08.03	Filter time 1 of speed regulator output	0 to 32.0 ms	0.1 ms	0.8	Immediately	During running	PS
P08.04	Speed loop proportional gain 2	0.1 to 5000.0 Hz	0.1 Hz	20.0	Immediately	During running	PS
P08.05	Speed loop integral time 2	0.00 to 10.000 ms	0.01 ms	1.00	Immediately	During running	PS
P08.06	Position loop gain 2	1 to 8000 rad/s	1 rad/s	100	Immediately	During running	P
P08.07	Filter time 2 of speed regulator output	0 to 32.0 ms	0.1 ms	0.8	Immediately	During running	PS
P08.08	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	PS
P08.09	Gain switchover condition selection	0: Gain 1 is not switched 1: Use external DI	1	0	Immediately	During running	PS

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		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 10: Position reference + actual speed					
P08.10	Gain switchover delay time	0 to 1000 ms	1 ms	5	Immediately	During running	PS
P08.11	Gain switchover level	0 to 20000	Switch according to conditions	50	Immediately	During running	PS
P08.12	Gain switchover dead time	0 to 20000	Switch according to conditions	30	Immediately	During running	PS
P08.13	Position gain switchover time	0 to 1000 ms	1 ms	5	Immediately	During running	P
P08.14	Speed feedforward filter time	0.00 to 64.00 ms	0.01 ms	0.05	Immediately	During running	P
P08.15	Speed feedforward gain	0.0 to 100.0%	0.01%	0.0	Immediately	During running	P
P08.16	Torque feedforward filter time	0.00 to 64.00 ms	0.01	0.05	Immediately	During running	PS
P08.17	Torque feedforward gain	0.0 to 200.0%	0.1%	0.0	Immediately	During running	PS
P08.18	Encoder filter time	0.0 to 40.0 ms	0.1 ms	1.0	Immediately	During running	PS

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P08.19	PDFF (pseudo-derivative feedforward) control coefficient (in non-torque control mode, reserved)	0.0 to 100.0%	0.1%	100.0	Immediately	During running	PS
P09: Adjustment parameters							
P09.00	Offline inertia auto-tuning function	-	0.01	0.00	Immediately	At stop	PST
P09.01	Maximum speed of inertia auto-tuning	200 to 2000 rpm	1 rpm	800	Immediately	At stop	PST
P09.02	Acceleration time for inertia auto-tuning	10 to 1000 ms	1 ms	100	Immediately	At stop	PST
P09.03	Motor revolutions for inertia auto-tuning	0.00 to 2.00 r	0.01 r	0.00	Immediately	At stop	PST
P09.04	Waiting time after a single inertia auto-tuning	50 to 10000	1 ms	800	Immediately	At stop	PST
P09.05	Online inertia auto-tuning mode	0: Disabled 1: Enabled, change slowly 2: Enabled, change generally 3: Enabled, change quickly	1	0	Immediately	At stop	PST
P09.06	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	1	0	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		parameters 2: Positioning mode, use the rigidity table to automatically adjust the gain parameters					
P09.07	Stiffness level	0 to 41	1	14	Immediately	At stop	PST
P09.08	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 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	1	0	Immediately	At stop	PST
P09.09	Automatic vibration suppression sensitivity	1 to 100	1	1	Immediately	At stop	PST
P09.10	Notch filter 1 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop	PS
P09.11	Notch filter 1 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop	PS
P09.12	Notch filter 2 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop	PS
P09.13	Notch filter 2 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop	PS

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P09.14	Notch filter 3 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop	PS
P09.15	Notch filter 3 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop	PS
P09.16	Notch filter 4 frequency	0 to 4000 Hz	1 Hz	0	Immediately	At stop	PS
P09.17	Notch filter 4 width	10 to 1000 Hz	1 Hz	100	Immediately	At stop	PS
P09.18	Torque low-pass filter time constant	0 to 65536 us	1 us	0	Immediately	At stop	PS
P09.19	Speed reference notch filter frequency	0 to 1000 Hz	1 Hz	0	Immediately	At stop	PS
P09.20	Speed reference notch filter width	10 to 500 Hz	1 Hz	100	Immediately	At stop	PS
P09.21	Reserved						
P09.22	Auto-tuned resonance frequency	0 to 4000 Hz	1 Hz	-	Immediately	At stop	PS
P09.23	Disturbance torque compensation gain	0.0% to 100.0%	0.1%	0	Immediately	At stop	PS
P09.24	Filter time of disturbance observer	0.00 to 25.00 ms	0.01 ms	0	Immediately	At stop	PS
P09.25	Suppression mode of low-frequency resonance	0: Manually set vibration suppression parameters 1: Automatically set vibration suppression parameters	1	0	Immediately	During running	P
P09.26	Low frequency resonance frequency	0.0 to 100.0 Hz	0.1 Hz	0.0	Immediately	During running	P
P09.27	Filter setting of low-frequency resonance frequency	0 to 20	1	0	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P09.28	Position deviation threshold in low-frequency resonance	0 to 100 P	1 P	10	Immediately	At stop	P
P09.29	Torque reference offset (vertical axis mode)	-300.00% to 300.00%	0.01%	0.00	Immediately	During running	P
P09.30	Gravity compensation value	-100.0% to 100.0%	0.1%	0.0	Immediately	At stop	PST
P09.31	Positive friction compensation	0.0% to 100.0%	0.1%	0.0	Immediately	At stop	P
P09.32	Negative friction compensation	0.0% to 100.0%	0.1%	0.0	Immediately	At stop	P
P09.33	Friction compensation speed threshold	0.1 to 30.0 rpm	0.1 rpm	0.0	Immediately	At stop	P
P09.34	Friction compensation speed selection	0: Speed reference 1: Speed feedback	1	0	Immediately	At stop	P
P09.35 to P09.37	Reserved						
P09.38	Load moment of inertia ratio	0.00 to 120.00	0.01	1.00	Immediately	At stop	PST
P10: Fault and protection parameters							
P10.00	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	PST
P10.01	Action upon Modbus communication timeout	0: Activate protection and coast to stop 1: Alarm and keep running	1	0	Immediately	During running	PST
P10.02	Action upon	0: Activate protection	1	0	Immediat	During	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	temperature sampling disconnection	and coast to stop 1: Alarm and keep running			ely	running	
P10.03	Reserved						
P10.04	Stop mode at overtravel	0: Activate protection and coast to stop 1: Alarm, decelerate to zero, keep position locked	1	0	Immediately	During running	P
P10.05	Action upon output disconnection	0: No action 1: Activate protection	1	0	Immediately	During running	PST
P10.06	Protection setting for motor overload	0: Activate protection and coast to stop 1: Alarm and keep running	1	1	Immediately	At stop	PST
P10.07	Motor overload protection gain	20.0% to 300.0%	0.1%	100.0	Immediately	During running	PST
P10.08	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	PST
P10.09	Stall overtemperature detection	0: Disable motor stall overtemperature protection detection 1: Enable motor stall overtemperature protection detection	1	0	Immediately	At stop	PST
P10.10	Stall	10 to 800 ms	1 ms	200	Immediat	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	overtemperature protection time window				ely		
P10.11	Encoder multi-turn overflow fault selection	0: Not hide 1: Hide	1	1	Immediately	At stop	PST
P10.12	Overspeed fault threshold	0.0 to 10000.0 rpm	0.1 rpm	6000.0	Immediately	At stop	PST
P10.13	Maximum position pulse frequency	100 to 8000 kHz	1 kHz	8000	Immediately	At stop	P
P10.14	Absolute encoder battery troubleshooting	0: Enable absolute encoder battery undervoltage, disconnection and other fault detection 1: Shield absolute encoder battery undervoltage, disconnection and other fault detection	1	0	Immediately	At stop	PST
P10.15 to P10.17	Reserved						
P10.18	Latest fault type	0: No abnormal record 1: Over-current 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	1	0	-	At display	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		overload 12: Motor overload 13: EEPROM read and write error 14: Serial port communication error 15: Reserved 16: Abnormal current detection circuit 17: Reserved 18: Poor auto-tuning 19: Encoder fault 20: Undervoltage during main circuit operation 21: Reserved 22: Parameter setting error 23 to 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: Reserved 37: Homing timeout					

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		38: Reserved 39: Forward overtravel 40: Reverse overtravel 41: Reserved 42: Reserved 43: External fault 44 to 45: Reserved 46: Short circuit to ground at power-on 47: Reserved 48: Internal logic error 2 (Periodic task timeout) 49: Reserved 50 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: Reserved 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 P01.00 78: Parameter not stored in EEPROM of absolute encoder 79: Absolute encoder EEPROM parameter write error					

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		80: Reserved 81: Encoder seeking origin error 84: Absolute encoder EEPROM parameter read error 85: Drive output disconnection					
P10.19	2nd fault type	The same as P10.18	1	0	-	At display	PST
P10.20	1st fault type	The same as P10.18	1	0	-	At display	PST
P10.21	Bus voltage upon the latest fault	0 to 999 V	1 V	0	-	At display	PST
P10.22	Phase V current upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.23	Phase W current upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.24	D-axis current reference value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.25	Q-axis current reference value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.26	D-axis current feedback value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.27	Q-axis current feedback value upon the latest fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.28	Speed upon the latest fault	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	-	At display	PST
P10.29	Encoder position feedback upon	-2147483648 to 2147483647	1	0	-	At display	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	the latest fault (PUU)						
P10.30	DI status upon the latest fault	Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0 to BIT3: DI5 to DI8 Hundreds place of LED: BIT0 to BIT3: DI9 to DI12	1	0	-	At display	PST
P10.31	DO status upon the latest fault	Unit place of LED: BIT0 to BIT3: DO1 to DO4 Tens place of LED: BIT0 to BIT3: DO5 to DO8	1	0	-	At display	PST
P10.32	Drive status upon the latest fault	0 to FFFFH (the same as P11.11)	1	0	-	At display	PST
P10.33	Temperature upon the latest fault	-40.0 to 150.0℃	0.1℃	0.0	-	At display	PST
P10.34	Bus voltage upon the 2nd fault	0 to 999 V	1 V	0	-	At display	PST
P10.35	Phase V current upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.36	Phase W current upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.37	D-axis current reference value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.38	Q-axis current reference value upon the 2nd fault	-1000.0 to 1000.0 A	0.1A	0.0	-	At display	PST
P10.39	D-axis current feedback value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.40	Q-axis current feedback value upon the 2nd fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.41	Speed upon the 2nd fault	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	-	At display	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P10.42	Encoder position feedback upon the 2nd fault (PUU)	-2147483648 to 2147483647	1	0	-	At display	PST
P10.43	DI status upon the 2nd fault	Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0 to BIT3: DI5 to DI8 Hundreds place of LED: BIT0 to BIT3: DI9 to DI12	1	0	-	At display	PST
P10.44	DO status upon the 2nd fault	Unit place of LED: BIT0 to BIT3: DO1 to DO4 Tens place of LED: BIT0 to BIT3: DO5 to DO8	1	0	-	At display	PST
P10.45	Drive status upon the 2nd fault	0 to FFFFH (the same as P11.11)	1	0	-	At display	PST
P10.46	Temperature upon the 2nd fault	-40.0 to 150.0℃	0.1℃	0.0	-	At display	PST
P10.47	Bus voltage upon the 1st fault	0 to 999 V	1 V	0	-	At display	PST
P10.48	Phase V current upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.49	Phase W current upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.50	D-axis current reference value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.51	Q-axis current reference value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.52	D-axis current feedback value upon the 1st fault	-1000.0 to 1000.0A	0.1A	0.0	-	At display	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P10.53	Q-axis current feedback value upon the 1st fault	-1000.0 to 1000.0 A	0.1 A	0.0	-	At display	PST
P10.54	Speed upon the 1st fault	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	-	At display	PST
P10.55	Encoder position feedback upon the 1st fault (PUU)	-2147483648 to 2147483647	1	0	-	At display	PST
P10.56	DI status upon the 1st fault	Unit place of LED: BIT0 to BIT3: DI1 to DI4 Tens place of LED: BIT0 to BIT3: DI5 to DI8 Hundreds place of LED: BIT0 to BIT3: DI9 to DI12	1	0	-	At display	PST
P10.57	DO status upon the 1st fault	Unit place of LED: BIT0 to BIT3: DO1 to DO4 Tens place of LED: BIT0 to BIT3: DO5 to DO8	1	0	-	At display	PST
P10.58	Drive status upon the 1st fault	0 to FFFFH (the same as P11.11)	1	0	-	At display	PST
P10.59	Temperature upon the 1st fault	-40.0 to 150.0℃	0.1℃	0.0	-	At display	PST
P11: Display parameters							
P11.00	Speed reference	-6000.0 to 6000.0 rpm	0.1 rpm		-	At display	S
P11.01	Actual motor speed	-6000.0 to 6000.0 rpm	0.1 rpm		-	At display	PST
P11.02	Output voltage	0 to 480 V	1 V		-	At display	PST
P11.03	Output current	0.0 to 4 Ie A	0.1 A		-	At display	PST
P11.04	Q-axis current	-400.0 to +400.0% Ie	0.1%		-	At display	PST
P11.05	D-axis current	-100.0 to +100.0% Ie	0.1%		-	At display	PST
P11.06	Output torque	-400.0 to +400.0%	0.1%		-	At	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
						display	
P11.07	Reserved						
P11.08	Average load rate	0.0 to 400.0% Te	0.1%		-	At display	PST
P11.09	Bus voltage	0 to 900 V	1 V		-	At display	PST
P11.10	Reserved						
P11.11	Operation state of servo drive	0 to FFFFH Bit0: RUN/STOP Bit1: REV/FWD Bit2: Running at zero speed 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	1		-	At display	PST
P11.12	DI terminal state	0 to FFFFH 0: open; 1: closed (The high-speed pulse reference will not be refreshed synchronously	1		-	At display	PST
P11.13	DO terminal state	0 to FFH 0: open; 1: closed (The high-speed pulse output will not be refreshed synchronously	1		-	At display	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P11.14 to P11.15	Reserved						
P11.16	Input pulse frequency	0 to 4000.0 kpps	0.1 kpps		-	At display	PS
P11.17	Speed corresponding to the input pulse reference	-6000.0 to 6000.0 rpm	0.1 rpm		-	At display	PS
P11.18	Motor encoder counter value	0 to 4 times motor encoder lines -1	1		-	At display	PST
P11.19	Reserved						
P11.20	Number of input pulses	-2147483648 to 2147483647			-	At display	PST
P11.21	Low 32 bits of reference point position (encoder unit)	-2147483648 to 2147483647	1		-	At display	P
P11.22	Position reference	-2147483648 to 2147483647	1		-	At display	P
P11.23	Position feedback	-2147483648 to 2147483647	1		-	At display	P
P11.24	Position error pulse	-2147483648 to 2147483647	1		-	At display	P
P11.25	Low 32 bits of reference point position (PUU)	-2147483648 to 2147483647	1		-	At display	P
P11.26	Position reference (PUU)	-2147483648 to 2147483647	1		-	At display	P
P11.27	Position feedback (PUU)	-2147483648 to 2147483647	1		-	At display	P
P11.28	Position error pulse (PUU)	-2147483648 to 2147483647	1		-	At display	P
P11.29	Accumulated power-on hours	0 to maximum 65535 hours	1 hour		-	At display	PST
P11.30	Accumulated work hours	0 to maximum 65535 hours	1 hour		-	At display	PST
P11.31	Module temperature	-40.0℃ to 150.0℃	0.1℃		-	At display	PST
P11.32	Encoder	0 to 8388608	1		-	At	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	single-turn position					display	
P11.33	Number of revolutions fed back by the absolute encoder	0 to 65535 r	1 r		-	At display	PST
P11.34	Load moment of inertia ratio	0.00 to 120.00	0.01		-	At display	PST
P11.35	Absolute position PUU value	Machine current absolute position (command unit) = mechanical absolute position / mechanical gear ratio -2147483648 to 2147483647	Reference unit		-	At display	PS
P11.36	Mechanical absolute position (low 32 bits)	In absolute position 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	Encoder unit		-	At display	PST
P11.37	Mechanical absolute position (high 32 bits)		Encoder unit		-	At display	PST
P11.38	Absolute position of absolute encoder (low 32 bits)	The absolute position of the absolute encoder feedback. Encoder unit	Encoder unit		-	At display	PST
P11.39	Absolute position of absolute encoder (high 32 bits)		Encoder unit		-	At display	PST
P11.40	Single-turn position of rotating load (low 32 bits)	In the absolute position rotation mode, the position within one revolution	Encoder unit		-	At display	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P11.41	Single-turn position of rotating load (high 32 bits)	of the rotating load is converted to the motor position of the motor side. Encoder unit	Encoder unit		-	At display	PST
P11.42	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	PST
P11.43	Mechanical angle (number of pulses starting from the home)		Encoder unit		-	At display	PST
P11.44	Electrical angle	0.00 to 360.00°	0.01°		-	At display	PST
P11.45	Encoder multi-turn overflow value	-2147483648 to 2147483647	1		-	At display	PST
P11.46	High 32 bits of reference point position (PUU)	-2147483648 to 2147483647	1		-	At display	PST
P11.47	Reserved						
P11.48	High 32 bits of reference point position (encoder unit)	-2147483648 to 2147483647	1		-	At display	PST
P11.49 to P11.54	Reserved						
P12: Servo positioning parameters							
P12.00	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	1	0	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		immediately 5: Electrical homing started 6: Current position as the home					
P12.01	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 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	1	9	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		Z signal as home					
P12.02	Homing command terminal mode	0: Level mode 1: Pulse mode	1	0	Immediately	At stop	P
P12.03	Reserved						
P12.04	Positioning acceleration and deceleration curve selection	0: T-shaped curve 1: S-shaped curve	1	0	Immediately	At stop	P
P12.05	High-speed home searching speed	0.0 to 1000.0 rpm	0.1 rpm	100.0	Immediately	At stop	P
P12.06	Low-speed home searching speed	0.0 to 1000.0 rpm	0.1 rpm	10.0	Immediately	At stop	P
P12.07	Home position offset	-1073741824 to 1073741824	1	0	Immediately	At stop	P
P12.08	Home searching acceleration/ deceleration time	0 to 65535 ms	1	200	Immediately	At stop	P
P12.09	Home search time limit	0 to 65535 ms	1	60000	Immediately	At stop	P
P12.10	Positioning mode selection	0: Relative position 1: Absolute position	1	0	Immediately	At stop	P
P12.11	Home offset mode	0: After the home is found, the position feedback=home position offset P12.07 1: After the home is found, the position feedback=current position+home position offset P12.07 2: After the home is found, continue to perform the home position offset segment, and after it is done, the position feedback=0 3: After the home is	1	0	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		found, continue to perform the home position offset segment, and after it is done, the position feedback=home position offset P12.07					
P12.12	Positioning time sequence selection	0: Receiving new positioning signal in the process of positioning, no response 1: Receiving new positioning signal in the process of positioning, positioning the new position directly	1	0	Immediately	At stop	P
P12.13	Position reference by single-point positioning	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.14	Positioning speed	0.1 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.15	Positioning acceleration time	1 to 65535 ms	1 ms	100	Immediately	During running	P
P12.16	Positioning deceleration time	1 to 65535 ms	1 ms	100	Immediately	During running	P
P12.17	Internal positioning end point setting	1 to 32	1	32	Immediately	At stop	P
P12.18	Multi-point positioning mode	0: Stop after a single operation (P12.17 selects the number of segments) 1: Cycle operation (P12.17 selects the number of segments) 2: DI switching operation (selected by DI)	1	0	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		3: Sequential operation					
P12.19	Internal position 1 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.20	Internal position 2 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.21	Internal position 3 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.22	Internal position 4 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.23	Internal position 5 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.24	Internal position 6 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.25	Internal position 7 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.26	Internal position 8 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.27	Internal position 9 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.28	Internal position 10 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.29	Internal position 11 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.30	Internal position 12 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.31	Internal position 13 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.32	Internal position 14 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.33	Internal position 15 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.34	Internal position 16 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P12.35	Acceleration/ Deceleration time of internal position 1	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.36	Acceleration/ Deceleration time	0 to 65535 ms	1 ms	100	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	of internal position 2						
P12.37	Acceleration/ Deceleration time of internal position 3	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.38	Acceleration/ Deceleration time of internal position 4	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.39	Acceleration/ Deceleration time of internal position 5	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.40	Acceleration/ Deceleration time of internal position 6	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.41	Acceleration/Deceleration time of internal position 7	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.42	Acceleration/ Deceleration time of internal position 8	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.43	Acceleration/ Deceleration time of internal position 9	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.44	Acceleration/ Deceleration time of internal position 10	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.45	Acceleration/ Deceleration time of internal position 11	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.46	Acceleration/ Deceleration time of internal	0 to 65535 ms	1 ms	100	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	position 12						
P12.47	Acceleration/ Deceleration time of internal position 13	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.48	Acceleration/ Deceleration time of internal position 14	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.49	Acceleration/ Deceleration time of internal position 15	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.50	Acceleration/ Deceleration time of internal position 16	0 to 65535 ms	1 ms	100	Immediately	During running	P
P12.51	Auto-running mode timer 1	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.52	Auto-running mode timer 2	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.53	Auto-running mode timer 3	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.54	Auto-running mode timer 4	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.55	Auto-running mode timer 5	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.56	Auto-running mode timer 6	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.57	Auto-running mode timer 7	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.58	Auto-running mode timer 8	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.59	Auto-running mode timer 9	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.60	Auto-running mode timer 10	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.61	Auto-running mode timer 11	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.62	Auto-running	0 to 600.00 s	0.01 s	1.00	Immediat	During	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	mode timer 12				ely	running	
P12.63	Auto-running mode timer 13	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.64	Auto-running mode timer 14	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.65	Auto-running mode timer 15	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.66	Auto-running mode timer 16	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P12.67	Positioning speed of internal position 1	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.68	Positioning speed of internal position 2	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.69	Positioning speed of internal position 3	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.70	Positioning speed of internal position 4	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.71	Positioning speed of internal position 5	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.72	Positioning speed of internal position 6	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.73	Positioning speed of internal position 7	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.74	Positioning speed of internal position 8	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.75	Positioning speed of internal position 9	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.76	Positioning speed of internal position 10	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.77	Positioning speed	0.0 rpm to P05.17	0.1 rpm	100.0	Immediat	During	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
	of internal position 11				ely	running	
P12.78	Positioning speed of internal position 12	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.79	Positioning speed of internal position 13	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.80	Positioning speed of internal position 14	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.81	Positioning speed of internal position 15	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.82	Positioning speed of internal position 16	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P12.83	Current positioning position reference display	1 to 32	1	0	Immediately	At stop	P
P12.84	Current positioning completed position display	1 to 32	1	0	Immediately	At stop	P
P12.85	Reserved						
P12.86	Interrupt positioning selection	0: Disable 1: Enable	1	0	Immediately	At stop	P
P12.87	Displacement of interrupt positioning	0 to 1073741824	Reference unit	10000	Immediately	At stop	P
P12.88	Constant operating speed in interrupt positioning	0.0 to 6000.0 rpm	0.1 rpm	200.0	Immediately	At stop	P
P12.89	Acceleration/ Deceleration time of interrupt positioning	0 to 1000 ms	1ms	10	Immediately	At stop	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P12.90	Interrupt positioning cancel signal	0: Disable 1: Enable	1	1	Immediately	At stop	P
P14: Multi-stage speed parameters							
P14.00	Multi-speed reference running mode	0: Stop at the end of a single operation 1: Cyclic operation 2: Switch via external DI	1	0	Immediately	During running	S
P14.01	Number of speed references	1 to 16	1	16	Immediately	During running	S
P14.02	Unit of running time	0: s 1: min	1	0	Immediately	During running	S
P14.03	Acceleration time 2	0 to 65535 ms	1 ms	10	Immediately	During running	S
P14.04	Deceleration time 2	0 to 65535 ms	1 ms	10	Immediately	During running	S
P14.05	Acceleration time 3	0 to 65535 ms	1 ms	10	Immediately	During running	S
P14.06	Deceleration time 3	0 to 65535 ms	1 ms	10	Immediately	During running	S
P14.07	Acceleration time 4	0 to 65535 ms	1 ms	10	Immediately	During running	S
P14.08	Deceleration time 4	0 to 65535 ms	1 ms	10	Immediately	During running	S
P14.09	1st speed reference	-9000 to 9000 rpm	1 rpm	0	Immediately	During running	S
P14.10	Running time of 1st speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.11	Acceleration/ Deceleration time of 1st speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P14.12	2nd speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	200.0	Immediately	During running	S
P14.13	Running time of 2nd speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.14	Acceleration/ Deceleration time of 2nd speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.15	3rd speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	400.0	Immediately	During running	S
P14.16	Running time of 3rd speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.17	Acceleration/ Deceleration time of 3rd speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.18	4th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	600.0	Immediately	During running	S
P14.19	Running time of 4th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.20	Acceleration/ Deceleration time of 4th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and	1	0	Immediately	During running	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4					
P14.21	5th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	800.0	Immediately	During running	S
P14.22	Running time of 5th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.23	Acceleration/ Deceleration time of 5th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.24	6th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	600.0	Immediately	During running	S
P14.25	Running time of 6th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.26	Acceleration/ Deceleration time of 6th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.27	7th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	400.0	Immediately	During running	S
P14.28	Running time of 7th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P14.29	Acceleration/ Deceleration time of 7th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.30	8th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	200.0	Immediately	During running	S
P14.31	Running time of 8th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.32	Acceleration/ Deceleration time of 8th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.33	9th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	0.0	Immediately	During running	S
P14.34	Running time of 9th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.35	Acceleration/ Deceleration time of 9th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P14.36	10th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-200.0	Immediately	During running	S
P14.37	Running time of 10th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.38	Acceleration/ Deceleration time of 10th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.39	11th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-400.0	Immediately	During running	S
P14.40	Running time of 11th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.41	Acceleration/ Deceleration time of 11th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.42	12th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-600.0	Immediately	During running	S
P14.43	Running time of 12th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.44	Acceleration/ Deceleration time of 12th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and	1	0	Immediately	During running	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4					
P14.45	13th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-800.0	Immediately	During running	S
P14.46	Running time of 13th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.47	Acceleration/ Deceleration time of 13th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.48	14th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-600.0	Immediately	During running	S
P14.49	Running time of 14th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.50	Acceleration/ Deceleration time of 14th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.51	15th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-400.0	Immediately	During running	S
P14.52	Running time of 15th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P14.53	Acceleration/ Deceleration time of 15th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P14.54	16th speed reference	-6000.0 to 6000.0 rpm	0.1 rpm	-200.0	Immediately	During running	S
P14.55	Running time of 16th speed reference	0 to 6553.5 s (min)	0.1 s (min)	0.5	Immediately	During running	S
P14.56	Acceleration/ Deceleration time of 16th speed reference	0- Zero acceleration and deceleration time 1- Acceleration and deceleration time 1 2- Acceleration and deceleration time 2 3- Acceleration and deceleration time 3 4- Acceleration and deceleration time 4	1	0	Immediately	During running	S
P15: Modbus communication parameters							
P15.00	Drive Modbus communication address	0 to 247 (0 is the broadcast address during Modbus communication)	1	5	Immediately	At stop	PST
P15.01	Modbus communication configuration	Unit place of LED: Baud rate selection 0: 2400BPS 1: 4800BPS 2: 9600BPS 3: 19200BPS 4: 38400BPS 5: 57600BPS 6: 115200BPS Tens place of LED:	1	02	Immediately	At stop	PST

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
		Data format 0: 1-8-2-N format, RTU 1: 1-8-1-E format, RTU 2: 1-8-1-O format, RTU 3: 1-8-1-N format, RTU					
P15.02	Modbus communication timeout detection time	0.0 to 1000.0 s (When the parameter is set to 0, no disconnection detection is performed)	0.1 s	0.0	Immediately	At stop	PST
P15.03	Modbus response delay	0 to 1000 ms	1 ms	5	Immediately	At stop	PST
P15.04	Whether to store parameters written through Modbus	0x06, 0x10 Whether to store parameters during write operation 0: Do not store 1: Store	1	0	Immediately	At stop	PST
P18: Advanced parameters							
P18.00	User password						
P18.01	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	PST
P18.02	Current loop gain	1 to 500.00	0.01	10.00	Immediately	At stop	PST
P18.03	Current loop integral	0.5 to 100.0 ms	0.1 ms	10.0	Immediately	At stop	PST
P18.04 to P18.15	Advanced parameters						PST
P18.16 to P18.28	Reserved						
P19: Internal positioning parameter 2							
P19.00	Internal position 17 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.01	Internal position 18 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P19.02	Internal position 19 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.03	Internal position 20 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.04	Internal position 21 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.05	Internal position 22 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.06	Internal position 23 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.07	Internal position 24 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.08	Internal position 25 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.09	Internal position 26 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.10	Internal position 27 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.11	Internal position 28 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.12	Internal position 29 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.13	Internal position 30 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.14	Internal position 31 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.15	Internal position 32 reference	-1073741824 to 1073741824	1	0	Immediately	During running	P
P19.16	Acceleration/ Deceleration time of internal position 17	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.17	Acceleration/ Deceleration time of internal position 18	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.18	Acceleration/ Deceleration time of internal position 19	0 to 65535 ms	1 ms	100	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P19.19	Acceleration/ Deceleration time of internal position 20	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.20	Acceleration/ Deceleration time of internal position 21	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.21	Acceleration/ Deceleration time of internal position 22	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.22	Acceleration/ Deceleration time of internal position 23	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.23	Acceleration/ Deceleration time of internal position 24	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.24	Acceleration/ Deceleration time of internal position 25	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.25	Acceleration/ Deceleration time of internal position 26	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.26	Acceleration/ Deceleration time of internal position 27	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.27	Acceleration/ Deceleration time of internal position 28	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.28	Acceleration/ Deceleration time of internal position 29	0 to 65535 ms	1 ms	100	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P19.29	Acceleration/ Deceleration time of internal position 30	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.30	Acceleration/ Deceleration time of internal position 31	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.31	Acceleration/ Deceleration time of internal position 32	0 to 65535 ms	1 ms	100	Immediately	During running	P
P19.32	Auto-running mode timer 17	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.33	Auto-running mode timer 18	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.34	Auto-running mode timer 19	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.35	Auto-running mode timer 20	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.36	Auto-running mode timer 21	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.37	Auto-running mode timer 22	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.38	Auto-running mode timer 23	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.39	Auto-running mode timer 24	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.40	Auto-running mode timer 25	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.41	Auto-running mode timer 26	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.42	Auto-running mode timer 27	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.43	Auto-running mode timer 28	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.44	Auto-running mode timer 29	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.45	Auto-running mode timer 30	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P19.46	Auto-running mode timer 31	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.47	Auto-running mode timer 32	0 to 600.00 s	0.01 s	1.00	Immediately	During running	P
P19.48	Positioning speed of internal position 17	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.49	Positioning speed of internal position 18	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.50	Positioning speed of internal position 19	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.51	Positioning speed of internal position 20	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.52	Positioning speed of internal position 21	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.53	Positioning speed of internal position 22	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.54	Positioning speed of internal position 23	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.55	Positioning speed of internal position 24	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.56	Positioning speed of internal position 25	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.57	Positioning speed of internal position 26	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.58	Positioning speed of internal position 27	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.59	Positioning speed of internal position 28	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P

Function code	Name	Value range	Min. unit	Default value	Effective time	Property	Mode
P19.60	Positioning speed of internal position 29	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.61	Positioning speed of internal position 30	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.62	Positioning speed of internal position 31	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P19.63	Positioning speed of internal position 32	0.0 rpm to P05.17	0.1 rpm	100.0	Immediately	During running	P
P23: Special function parameters							
P23.00 to P23.05	Reserved						
P23.06	Output torque filter time constant	0 to 100.0 ms	0.1 ms	0.0	Immediately	At stop	PST
P23.07	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	PST
P23.08 to P23.10	Reserved						
P23.11	Accumulated position errors of absolute encoder	0 to 65535	1	0	-	At display	PST
P23.12	Pulse range for homing completed	0: 100 pulses Other: Self-defined pulses	1	0	Immediately	At stop	P
P23.13 to P23.39	Reserved						

Chapter 8 Troubleshooting

All possible fault types, fault cause and solutions for M3 are summarized as shown in Table 8-1.

Table 8-1 Fault record table

Fault code	Fault type	Fault cause	Confirming method	Solutions
Er.001	Drive overcurrent	The motor cables are in poor contact.	Check whether the cable connector is loose	Fasten the connector that become 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.
		External braking resistor value does not match (The resistance of the the external resistor is too large, and the energy	Confirm the braking resistor value.	Select the appropriate braking resistor value according to operating conditions and load.

Fault code	Fault type	Fault cause	Confirming method	Solutions
		absorption during braking is insufficient.)		
		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 220V, then P10.00=1; if the input power is three-phase 220V, 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.
		Multiple overload operation	Check fault records, whether overload fault has been reported.	Waiting for 60s 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	Check the braking resistor wiring	Rewire according to the correct wiring diagrams.

Fault code	Fault type	Fault cause	Confirming method	Solutions
		connection, becomes loose or breaks.	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
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	View inertia ratio, confirm start-stop	Increase the acceleration and deceleration time.

Fault code	Fault type	Fault cause	Confirming method	Solutions
		frequent or the load inertia is too large.	cycle	
		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), 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.
		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 circuit is abnormal.	-	Seek for technical support

Fault code	Fault type	Fault cause	Confirming method	Solutions
		The wiring 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
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.
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

Fault code	Fault type	Fault cause	Confirming method	Solutions
		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.
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	Increase the position loop gain P08.02.

Fault code	Fault type	Fault cause	Confirming method	Solutions
			gain P08.02 is too small.	
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.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.
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.049	Internal logic	----------	----------	Seek for service support

Fault code	Fault type	Fault cause	Confirming method	Solutions
	error 2			
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.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 220V drive is enabled, the motor speed is too large (over 100rpm).	Before enabling, check if the motor rotates.	Enable it after the motor is stationary or lower than 100rpm.
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
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.

Fault code	Fault type	Fault cause	Confirming method	Solutions
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 are summarized as shown in Table 8-2.

Table 8-2 Alarm code table

Alarm code	Alarm type	Alarm cause	Confirming method	Solutions
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	Confirming method	Solutions
		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
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.

Alarm code	Alarm type	Alarm cause	Confirming method	Solutions
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 3.1V 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 3.1V.	Replace the encoder cable or encoder battery.

Appendix 1 Modbus Communication Protocol

1. Networking mode

The drive has two networking modes: single host/multiple slaves mode and single host/single slave mode.

2. Interface mode

RS485 interface: asynchronous and half-duplex. Default: 1-8-N-2, 9600 bps, RTU. Refer to Group P15 function code for the parameter setting.

3. Communication mode

(1) The communication protocol of the drive is Modbus protocol, which does not only support common register reading and writing, but also expands some commands to manage the drive function codes.

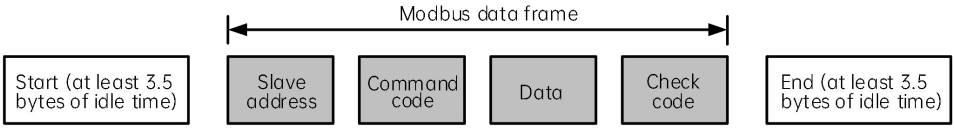
(2) The drive is slave, adopting host/salve mode P2P communication. The drive will not response to the command sent by the host via broadcast address.

(3) In multiple units communication or long-distance communication, parallel connecting the resistance of 100 to 120 ohms with the positive end and negative end of the communication signal line of the host station can enhance its immunity to interference.

(4) M3 provides RS485 interface only. If the communication interface of the external equipment is RS232, the RS232/RS485 conversion equipment is needed.

4. Protocol format

Modbus protocol supports the RTU mode, and the corresponding frame format is as shown in Attached Fig.1-1.



Attached Fig.1-1 Modbus protocol format

Modbus adopts the "Big Endian" encoding mode, which sends the high bytes first and then sends the low bytes.

Modbus data frame is RTU mode. The minimum idle time value between frames under the internal convention is as follows: the idle time that the frame head and frame trail pass the bus shall not be less than that of 3.5 bytes to define the frame. The data verification adopts CRC-16 and the verify checksum includes the whole information. The high and low bytes of the checksum can only be sent after their exchanging. Please refer to the example after the protocol for the detailed CRC verification. Please note: At least 3.5 characters of the BUS idle time shall be kept between the frames and it doesn't need to accumulate the start and end idle time.

In the sample below, it is used to read the parameters of the internal register 0101 (P01.01) of No.5 slave in the RTU mode.

Request frame:

Slave address	Command code	Data				Check code	
		Register address		Number of bytes read			
0x05	0x03	0x01	0x01	0x00	0x01	0xD5	0xB2

Response frame:

Slave address	Command code	Data			Check code	
		Number of bytes responded	Register content			
0x05	0x03	0x02	0x13	0x88	0x44	0xD2

In the above table, the check code is the CRC verification value. Please refer to the following text for the computing method of the CRC verification.

5. Protocol functions

The main function of Modbus is reading/writing parameters. Different command codes determine different operation requests. The Modbus protocol of M3 drive supports the operations as shown in the following table:

Command code	Meaning
0x03	Reading the drive parameters, including function code parameters, control parameters and status parameters.
0x06	Change the single 16-byte function code parameter or control parameter of the drive, and whether the parameter value is saved is determined by P15.04 after power off.
0x10	Change multiple function code or control parameters of the drive, and whether the parameter value is saved is determined by P15.04 after power off.
0x41	Change the single 16-byte function code parameter or control parameter of the drive, and the parameter value will be saved after power off.
0x43	Change multiple function code or control parameters of the drive, and the parameter values will be saved after power off.

All the function code parameters, control parameters and status parameters of the drive are mapped as the read/write registers of Modbus. The read/write features and range of the function code parameter follow the drive user manual. The group number of the drive function code is mapped as the high byte of the register address and the group internal index (i.e. the serial number of the parameter in the group) is mapped as the low byte of the register address. The control parameter and status parameter of the drive are virtual function code groups of the drive. The correspondence between the group numbers of the function codes and the high bytes of the register address mapped are as shown in the following table.

Drive parameter group	High byte of the address mapped	Drive parameter group	High byte of the address mapped
Group P00	0x00	Group P12	0x0C
Group P01	0x01	Group P13	0x0D
Group P02	0x02	Group P14	0x0E
Group P03	0x03	Group P15	0x0F
Group P04	0x04	Group P18	0x12
Group P05	0x05	Group P19	0x13

Drive parameter group	High byte of the address mapped	Drive parameter group	High byte of the address mapped
Group P06	0x06	Group P23	0x17
Group P07	0x07	Control parameter group	0x64
Group P08	0x08	Status parameter group	0x65
Group P09	0x09	……	……
Group P10	0x0A		
Group P11	0x0B		

For example, the register address of the function code parameter P03.02 of the drive is 0x0302, and the register address of the first control parameter (control word 1) is 0x6400.

As the format of the whole data frame has been detailed in the above text, the following text will focus on the format and meanings of the "command code" and "data" of Modbus protocol. These two parts constitute the Modbus application layer protocol data unit. Any reference to application layer protocol data unit to below refers to such two parts.

(1) Read the drive parameters

The application-layer protocol data units are as follows.

Request format:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Command code	1	0x03
Start register address	2	0x0000~0xFFFF
Number of registers	2	0x0001~0x000A

If the operation is successful, the response frame is as follows:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Command code	1	0x03
Number of bytes read	1	2 * Number of registers
Content read	2 * Number of registers	Parameter value

If the operation fails, it will return to the abnormal response frame. The abnormal response frame includes the error code and exception code. In which, the error code = (command code + 0x80), and the exception code indicates the error cause.

Abnormal response frame format:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Error code	1	(Command code + 0x80)
Exception code	1	

The exception codes and their meanings are as follows:

Exception code	Meaning
0x01	Invalid command code

Exception code	Meaning
0x02	Invalid register address.
0x03	Data error (the data is not within the upper/lower range).
0x04	Slave operation failure (including the error caused by that the data is within the upper/lower range, but it is invalid).
0x05	The command is valid and in process (It is mainly used to save the data into the nonvolatile memory cell).
0x06	The salve is busy, please try again later. It is mainly used to save the data into the nonvolatile memory cell.
0x16	Operation not supported (mainly refer to the control parameter and status parameter, for example, do not support reading the property, leave-factory value and upper/lower limit)
0x17	The number of registers in the request frame is wrong (for example, when the operation is 32-byte, the number of bytes is odd).
0x18	Information frame error (including information length error and verification error).
0x20	Parameters cannot be changed.
0x21	Parameters cannot be changed during the drive running.
0x22	Password required for parameters.

(2) Change the single 16-byte function code parameter and status parameter of the drive, and whether the parameter value is saved is determined by P15.04 after power off.

When this command is used, whether the rewritten parameter value is saved or not is set by P15.04 upon power on after power off.

The application-layer protocol data units are as follows.

Request format:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Command code	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

If the operation is successful, the response frame is as follows:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Command code	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

If the operation is failed, it will return to the abnormal response frame and its format is as shown above.

(3) Change multiple function code parameters and control parameters of the drive, and whether the parameter value is saved is determined by P15.04 after power off. When this command is used, whether the rewritten parameter value is saved or not is set by P15.04 upon power on after power off.

The application-layer protocol data units are as follows.

Request format:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Command code	1	0x10
Start register address	2	0x0000~0xFFFF
Number of registers in operation	2	0x0001~0x000A
Number of bytes of register content	1	2 * Number of registers in operation
Register content	2 * Number of registers in operation	

If the operation is successful, the response frame is as follows:

Application-layer protocol data unit	Data length (number of bytes)	Value or range
Command code	1	0x10
Start register address	2	0x0000~0xFFFF
Number of registers in operation	2	0x0001~0x000A

This command is used to change the content of the continuous data cells from the start register address. If the operation is failed, it will return to the abnormal response frame and its format is as shown above.

(4) Change single 16-byte function code parameters and status parameters of the drive, and the parameter values will be saved after power off. The command code 0x41 is used to change the single 16-byte function code parameters or control parameters of the drive, and store the value into the nonvolatile memory cell. Its command format is the same as that of 0x06. The only difference is as follows: when the 0x06 command operation is successful, whether the parameter value is saved after power-off is set by P15.04, and when the 0x41 operation is successful, the parameter value is saved after power-off.

(5) Rewrite multiple drive function code parameters and status parameters, and the parameter values will be saved after power off. The command code 0x43 is used to rewrite multiple drive function code parameters or control parameters, and store them in the non-volatile memory cell. Its command format is the same as that of 0x10. The only difference is as follows: when the 0x10 command operation is successful, whether the parameter value is saved after power off is set by P15.04, and when the 0x43 operation is successful, the parameter value is saved after power off.

6. Control parameters and status parameters of drive

The control parameters of the drive can realize the start, stop, running speed setting and other functions of the drive. Inquiring the status parameters of the drive can get the parameters like output current, output torque, motor speed, and encoder position, etc.

(1) Control parameters

The control parameters of the drive are as shown in the following table:

Register address	Parameter name	Save upon power off	Remarks
0x6400	Control word 1	No	Refer to its bit definition list
0x6401	Speed reference	No	

Register address	Parameter name	Save upon power off	Remarks
0x6402	Auxiliary speed reference	No	Enabled when the auxiliary reference channel is serial port communication and the auxiliary reference is in valid bit (BIT2 of control word 2).
0x6403	Reserved		
0x6404	Reserved		
0x6405	Torque reference	No	In the torque control mode, it is enabled when the torque reference channel is serial port and is in the torque control mode.
0x6406	Virtual DI terminal setting	No	BIT0~BIT9: DI1~DI10, the corresponding selected bit of P03.14 is enabled.
0x6407	Virtual DO terminal setting	No	BIT0~BIT5: DO1~DO6, when P03.15~P03.20=7, the corresponding terminal is enabled.

Note

1. When reading the control parameter, the value returned is the value written in the previous communication;

2. In the control parameters, the maximum length of "speed setting" and "auxiliary speed reference" is 32 bits, and for the others, the length is 16 bits;

3. In the control parameters, for the scaling of each reference, input/output setting range and decimal point, please refer to the corresponding function code parameter.

The bit definition of the control word 1 is as shown in the following table:

Bit	Value	Function	Remarks
BIT2~BIT0	111B	Stop for external fault	Coast to stop and the drive displays external fault
	110B	Stop in mode 1	Coast to stop
	101B	Stop in mode 0	Stop according to the deceleration time set (enabled when the jog is disabled)
	100B	Running command	Start the drive (enabled when the jog is disabled)
	Others	No command	
BIT3	1	Run reversely	Set the running direction when the running command is valid
	0	Run forward	
BIT4	1	Enable acceleration/deceleration	BIT0~BIT3, BIT7~BIT8 of control character 1 will be enabled only when this bit is enabled
	0	Disable acceleration/deceleration	
BIT5	1	The control character 1 of the host device is valid	The select bit for the validity of the control character 1 of the host

Bit	Value	Function	Remarks
	0	The control character 1 of the host device is disabled	device
BIT6	0	Reserved	
BIT7	1	Jog forward	When both jog forward and reversely are valid, it does not run; when both are disabled, the jog will stop.
	0	The "jog forward" is disabled	
BIT8	1	Jog reversely	
	0	The "jog reversely" is disabled	
BIT9	1	The fault reset is valid	The select bit for the validity of the fault reset of the host device
	0	The fault reset is disabled	
BIT15~BIT10	0	Reserved	

Note

1. The control command (control words 1 and 2) of the host device is valid only when the value of "running command channel selection" is "communication command"; the overall word 1 is valid only when its BIT5 is valid; BIT0~BIT3, BIT7~BIT8 are valid only when its BIT4 is valid.

2. The host device processes the faults and alarms as follows: when the drive meets faults, for control words 1 and 2, only the fault reset command is valid, any other commands from the host device are disabled. That is, the host device shall reset the fault first before sending any other commands. When the alarm occurs, the control character is valid.

(2) Status parameters

Register address	Parameter name	Remarks
0x6500	Status word 1	
0x6501	Speed reference	
0x6502	Actual motor speed	
0x6503	Output voltage	
0x6504	Output current	
0x6505	q-axis current	
0x6506	d-axis current	
0x6507	Output torque	
0x6508	Reserved	
0x6509	Bus voltage	
0x650A	Control voltage	
0x650B	Servo drive running status	
0x650C	DI terminal status	BIT0 to BIT11: DI1 to DI12
0x650D	DO terminal status	BIT0 to BIT7: DO1 to DO8

Register address	Parameter name	Remarks
0x650E	AI1 input voltage	
0x650F	AI2 input voltage	
0x6510	Input pulse frequency	
0x6511	Input pulse command corresponding speed	
0x6512	Motor encoder counter value	
0x6513	Motor encoder Z pulse position	
0x6514	Number of input pulses	
0x6515	Position reference point position	
0x6516	Position reference	
0x6517	Position feedback	
0x6518	Position error pulse	
0x6519	Position reference point position (PUU units)	
0x651A	Position reference (PUU units)	
0x651B	Position feedback (PUU units)	
0x651C	Position error pulse (PUU units)	
0x651D	Module temperature	
0x651E	Last fault type	
0x651F	Second fault type	
0x6520	First fault type	
0x6521	The bus voltage at the last fault time	
0x6522	V-phase current at the last fault time	
0x6523	W-phase current at the last fault time	
0x6524	The d-axis current reference value at the last fault time	
0x6525	The q-axis current reference value at the last fault time	
0x6526	D-axis current feedback value at the last fault time	
0x6527	Q-axis current feedback value at the last fault time	
0x6528	Speed at the last fault time	
0x6529	Encoder position feedback at the last fault time (PUU units)	
0x652A	DI status at the last fault time	
0x652B	DO status at the last fault time	
0x652C	Drive status at the last fault time	
0x652D	Temperature at the last fault time	

Register address	Parameter name	Remarks
0x652E	Drive operating status word 2	

Note

1. The status parameter does not support the writing operation.

2. In the status parameter, the maximum length of "speed command" and "actual motor speed" is 32 bits, and for the others, the length is 16 bits.

The bit definition of the status word 1 of the drive is as shown in the following table:

Bit	Value	Function	Remarks
BIT0	0	Reserved	
BIT1	1	Drive running	
	0	Drive stop	
BIT2	1	Drive runs reversely	
	0	Drive runs forward	
BIT3	1	Enable serial port reference	
	0	Disable serial port reference	
BIT4	1	Meet the main setting	
	0	Does not meet the main setting	
BIT5	1	Fault	If the value is 1, it means there is a fault. Please refer to BIT15~BIT8 of status word 1 to identify the current fault type.
	0	No fault	
BIT6	1	Alarm	If the value is 1, it means there is an alarm. Please refer to BIT15~BIT8 of status word 1 to identify the current alarm type.
	0	No alarm	
BIT7	0	Reserved	
BIT15~BIT8	0x00~0xFF	Fault or alarm code	0: No fault or alarm; Not 0: it means there is a fault or alarm, you need to consider both the status of BIT5 and BIT6 to identify if it is a fault or alarm code. Please refer to P97.15 for the fault and alarm types.

The bit definition of the status word 2 of the drive is as shown in the following table:

Bit	Value	Function	Remarks
BIT1~ BIT0		Drive operating mode:	

Bit	Value	Function	Remarks
		0: Speed mode 1: Position mode 2: Torque mode	
BIT2	1	Jog operation	
	0	Non-jog operation	
BIT3	1	Homing in progress	
	0	Non-homing operation	
BIT4	1	Inertia identification in progress	
	0	Non-inertia identification	
Other		Reserved	

7. Expand access mode

The standard protocol only supports the register of 16 bits, and the above description is also based on the register of 16 bits. The parameters of M3 series drive include both 16 bits (single character) and 32 bits (double characters). So, the data of both lengths shall be considered when reading/writing the parameters.

There are two modes in which the drive parameters are accessed to, including 16-bit mode and 32-bit mode, that is, the user can read/write the parameters with 16 bits or 32 bits as the unit separately. The 16-bit mode and 32-bit mode are identified through the "start register address" of the request frame. If the highest byte of the address is 0, the reading/writing shall be done in the 16-bit mode, otherwise, they shall be done in the 32-bit mode. As shown in the following table.

Start register address		Access mode	Remarks
BIT15	BIT14~BIT0		
0	Actual address of the start parameter	16-bit	
1	Actual address of the start parameter	32-bit	

When accessing to the parameters in the 32-bit mode, as the unit of the register of the request frame is 16 bits and each parameter of 32 bits needs two registers of 16 bits, the "number of registers" shall be set correctly. The "number of registers" in the request frame shall be twice of that of the parameters to be accessed to, otherwise, it will return to the abnormal response frame.

(1) Reading operation

The 16-bit access mode is as described above.

For the 32-bit access mode, the unit of the data returned is 32 bits.

As shown in the following table, reading 4 continuous function codes with P01.01 as the start address (the slave address is 5).

Request frame:

Bytes	Value		Description
	16-bit mode	32-bit mode	

Bytes	Value		Description
	16-bit mode	32-bit mode	
0	0x05	0x05	Slave address
1	0x03	0x03	Command code
2~3	0x0101	0x8101	Start address (in the 32-bit mode, the highest byte of the start address is 1)
4~5	0x0004	0x0008	Number of registers (in the 32-bit mode, the number of registers is twice of that of parameters)
6~7	Check code	Check code	CRC verification

If the operation is successful, the response frame is as follows:

Bytes	Value		Description
	16-bit mode	32-bit mode	
0	0x05	0x05	Slave address
1	0x03	0x03	Command code
2	0x08	0x16	Number of bytes read
3~4	Value P01.01	Value P01.01	Content read: 16-bit mode: 8 bytes in total 32-bit mode: 16 bytes in total
5~6	Value P01.02		
7~8	Value P01.03	Value P01.02	
9~10	Value P01.04		
11~12	Check code	Value P01.03	
13~14	—		
15~16	—	Value P01.04	
17~18	—		
19~20	—	Check code	

If the operation is failed, it will return to the abnormal response frame and its format is as shown above.

There are two types of drive parameters: one type of parameters adopts the decimal system and the other type is the variables adopting the hexadecimal system. The former is used to indicate the actual variables, such as the current, voltage, speed, power, torque, percentage, etc. which shall consider the positive and negative. Its data type is "int" or "long". The latter is used for the mode selection or the status indication, such as displaying the parameters selection, indicating the running status, etc. which needn't consider the positive and negative. Its data type is "unsigned int" or "unsigned long". The type and the value range of parameters are as shown in the following table:

Type	Number of bits	Value range	Remarks
int	16	-32768~32767	Parameter of type I
long	32	-2147483648~2147483647	
unsigned int	16	0~65535	Parameter of type II
unsigned long	32	0~4294967296	

If the 16-bit access mode is adopted to read the parameter with an actual length of 32 bits, the 16 low bits of this parameter of 32 bits will be captured and returned. This value may be not equal to the original value; it will be detailed in the following text.

If the 32-bit access mode is adopted to read the parameter with an actual length of 16 bits, the 32-bit data returned is the data expanded, that is, the length of the 16-bit parameter is expanded. The principles for the length expansion are as follow: if the highest bit of the 16-bit parameter value is 0, its 16 high bits will be filled with 0; if the highest bit is 1, it needs to judge the type of the parameter, for the parameter of type I, its 16 high bits will be filled with 1, but for the parameter of type II, its 16 high bits will be filled with 0.

If the data length is the same, that is, reading the 16-bit parameter in the 16-bit mode or reading the 32-bit parameter in the 32-bit mode, there is no need to expand or cut the length, the original value will be returned.

Assuming the parameter types of P01.01~P01.07 are as follows:

The value of P01.01 is 4500 (16-bit parameter of type I, 0x1194);

The value of P01.02 is 65036 (32-bit parameter of type I, 0x0000FE0C);

The value of P01.03 is -500 (16-bit parameter of type I, 0xFE0C);

The value of P01.04 is 5000 (32-bit parameter of type I, 0x00001388);

The value of P01.05 is 100000 (32-bit parameter of type I, 0x000186A0);

The value of P01.06 is -100000 (32-bit parameter of type I, 0x FFFE7960);

The value of P01.07 is 0x FFFF (16-bit parameter of type II).

The values returned in the reading operation are as shown in the following table:

Register address	Access mode	Value returned	Description
P01.01	16-bit	0x1194	The actual value is returned.
	32-bit	0x00001194	The 16 high bits are filled with 0 and the actual value is returned.
P01.02	16-bit	0xFE0C	The 16 low bits are captured and the value returned is -500, which is different from the actual value.
	32-bit	0x0000FE0C	The actual value is returned.
P01.03	16-bit	0xFE0C	The actual value is returned.
	32-bit	0xFFFFFE0C	The 16 high bits are filled with 1 and the actual value is returned.
P01.04	16-bit	0x1388	The 16 low bits are captured and the actual value is returned .
	32-bit	0x00001388	The actual value is returned.
P01.05	16-bit	0x86A0	The 16 low bits are captured and the value returned is -31072, which is different from the actual value.
	32-bit	0x000186A0	The actual value is returned.
P01.06	16-bit	0x7960	The 16 low bits are captured and the value returned is 31072, which is different from the actual value.
	32-bit	0xFFFE7960	The actual value is returned.
P01.07	16-bit	0xFFFF	

Register address	Access mode	Value returned	Description
	32-bit	0x0000FFFF	Parameter of type II, the 16 high bits are filled with 0.

As shown in the above table, when reading the parameter with an actual length of 32 bits in the 16-bit mode, the value returned may not be equal to the actual value. Therefore, please note: the reading operation of the 16-bit mode is only applicable to parameters with the current value range from -32768 to 32767, and the reading operation of other parameters shall adopt the 32-bit mode.

(2) Writing operation

1) Command codes 0x06 and 0x41

Both of these command codes supports changing the single parameter of 16 bits and do not support the 32-bit access mode. If the highest bit of the start register address in the request frame is 1, it will return to the abnormal information frame, indicating that the address is wrong.

Note:

1. The writing operation of the 16-bit mode is only applicable to the parameter of type I with the current value range from -32768 to 32767 and the parameter of type II with the current value range from 0 to 0xFFFF.

2. For the parameter of type I, when these two types of commands are used to write the value of 16 bits into the parameter with an actual length of 32 bits, the actual written value is the expanded value. The principles for the length expansion are as follows: expanding according to the highest bit of the 16-bit parameter value to be written, if the highest bit is 1, the 16 high bits will be filled with 0xFFFF, otherwise, they will be filled with 0x0000. If the expanded value is within the value range of the parameter, the value is valid and it is allowed to change the parameter, then the value can be written successfully. There is no need to expand the parameter of type II.

For example: assuming that the values of function codes P01.01 and P01.02 are 32-bit date and 16-bit data respectively and they are both parameters of type I, when the writing operation on them is successful, the data written are as shown in the following table.

Register address	Value to be written	Actual written value	Description
P01.01	0x1194	0x00001194	The 16 high bits is filled with 0x0000.
	0xFE0C	0xFFFFFE0C	The 16 high bits is filled with 0xFFFF.
P01.02	0x1194	0x1194	
	0xFE0C	0xFE0C	

2) Command codes 0x10 and 0x43

These two types of command codes can be used to change multiple function code parameters or control parameters and they support both 16-bit and 32-bit access modes.

The 16-bit access mode is as described above.

For the 32-bit access mode, the unit of the data to be written is 32 bits.

As shown in the following table, changing 4 continuous function codes with P02.00 as the start address (the slave address is 5).

Request frame:

Bytes	Value		Description
	16-bit mode	32-bit mode	
0	0x05	0x05	Slave address
1	0x10/0x43	0x10/0x43	Command code
2~3	0x0200	0x8200	Start address (in the 32-bit mode, the highest byte of the start address is 1)
4~5	0x0004	0x0008	Number of registers (in the 32-bit mode, the number of registers is twice of that of parameters)
6	0x08	0x16	Number of bytes of register content
7~8	Value P02.00	Value P02.00	Content to be written: 16-bit operation: 8 bytes in total 32-bit operation: 16 bytes in total
9~10	Value P02.01		
11~12	Value P02.02	Value P02.01	
13~14	Value P02.03		
15~16	Check code	Value P02.02	
17~18	—		
19~20	—	Value P02.03	
21~22	—		
23~24	—	Check code	

If the operation is successful, the response frame is as follows:

Bytes	Value		Description
	16-bit mode	32-bit mode	
0	0x05	0x05	Slave address
1	0x10/0x43	0x10/0x43	Command code
2~3	0x0200	0x8200	Start address (in the 32-bit mode, the highest byte of the start address is 1)
4~5	0x0004	0x0008	Number of registers (in the 32-bit mode, the number of registers is twice of that of parameters)
6~7	Check code	Check code	CRC verification

If the operation is failed, it will return to the abnormal response frame and its format is as shown above.

🕮 Note

1. The writing operation of the 16-bit mode is only applicable to the parameter of type I with the writing range from -32768 to 32767 and the parameter of type II with the writing range from 0 to 0xFFFF. The writing operation of other parameters shall adopt the 32-bit mode.

2. For the parameter of type I, when the value of 16 bits is written into the parameter with an actual length of 32 bits in the 16-bit mode, the actual written value is the expanded value. The principles for the length expansion are as follow: expanding according to the highest bit of the 16-bit parameter value to be written, if the highest bit is 1, the 16 high bits will be filled with 0xFFFF, otherwise, they will be filled with 0x0000. If the expanded value is within the value range of the parameter, the value is valid and it is allowed to change the parameter, then the value can be written successfully. There is no need to expand the parameter of type II and they are independent of the values of the 16 high bits.

3. In the 32-bit access mode, no matter the actual length is 16 bits or 32 bits, as long as the value to be written is within the value range of the parameter, the value is valid and it is allowed to change the parameter, then the value can be written successfully.

4. To change the parameter with an actual length of 16 bits in the 16-bit mode, please refer to the description above.

8. Cautions

(1) For the command codes 0x10 and 0x43, when writing several function code parameters of the drive continually, if the writing operation of any function code is invalid (for example, the parameter value is invalid, the parameter cannot be changed, etc.), the error message will be returned and none of the parameters can be changed; when writing several control parameters, if the writing operation of any parameter is invalid (for example, the parameter value is invalid, the parameter cannot be changed, etc.), the operation will return from the storage address of the first fault, this parameter and its following parameters cannot be changed normally, but the parameters before it can be written normally and the error message will be returned.

(2) When the command codes 0x06 and 0x10 are written, the function code P15.04 can be used to set whether the parameters are saved after power off.

9. CRC verification

For the purpose of improving speed, CRC-16 is often realized through the table. The following is the C language source code for realizing CRC-16. Please note: the final results have exchanged high and low bytes, that is, the result is the CRC checksum to be sent.

```
unsigned short CRC16 （unsigned char *msg, unsigned char length）        /* The function returns the CRC as a unsigned short type */
{
    unsigned char uchCRCHi = 0xFF ;                                     /* high byte of CRC initialized */
    unsigned char uchCRCLo = 0xFF ;                                     /* low byte of CRC initialized */
    unsigned uIndex ;                                                   /* index into CRC lookup table */
    while （length--）                                                  /* pass through message buffer */
    {
        uIndex = uchCRCLo ^ *msg++ ;                                    /* calculate the CRC */
        uchCRCLo = uchCRCHi ^ （crcvalue[uIndex] >>8）;
```

```
        uchCRCHi =crcvalue[ulndex]&0xff;
    }
    return （uchCRCHi | uchCRCLo<<8） ;
}
/* Table of CRC values */
const unsigned int   crcvalue[ ] = {
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,0x01C6,0xC006,0x8007,0x41C7,
0x0005,0xC1C5,0x81C4,0x4004,0x01CC,0xC00C,0x800D,0x41CD,0x000F,0xC1CF,0x81CE,0x400E,
0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009,0x8008,0x41C8,0x01D8,0xC018,0x8019,0x41D9,
0x001B,0xC1DB,0x81DA,0x401A,0x001E,0xC1DE,0x81DF,0x401F,0x01DD,0xC01D,0x801C,0x41DC,
0x0014,0xC1D4,0x81D5,0x4015,0x01D7,0xC017,0x8016,0x41D6,0x01D2,0xC012,0x8013,0x41D3,
0x0011,0xC1D1,0x81D0,0x4010,0x01F0,0xC030,0x8031,0x41F1,0x0033,0xC1F3,0x81F2,0x4032,
0x0036,0xC1F6,0x81F7,0x4037,0x01F5,0xC035,0x8034,0x41F4,0x003C,0xC1FC,0x81FD,0x403D,
0x01FF,0xC03F,0x803E,0x41FE,0x01FA,0xC03A,0x803B,0x41FB,0x0039,0xC1F9,0x81F8,0x4038,
0x0028,0xC1E8,0x81E9,0x4029,0x01EB,0xC02B,0x802A,0x41EA,0x01EE,0xC02E,0x802F,0x41EF,
0x002D,0xC1ED,0x81EC,0x402C,0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026,
0x0022,0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,0x01A0,0xC060,0x8061,0x41A1,
0x0063,0xC1A3,0x81A2,0x4062,0x0066,0xC1A6,0x81A7,0x4067,0x01A5,0xC065,0x8064,0x41A4,
0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F,0x806E,0x41AE,0x01AA,0xC06A,0x806B,0x41AB,
0x0069,0xC1A9,0x81A8,0x4068,0x0078,0xC1B8,0x81B9,0x4079,0x01BB,0xC07B,0x807A,0x41BA,
0x01BE,0xC07E,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,0x01B4,0xC074,0x8075,0x41B5,
0x0077,0xC1B7,0x81B6,0x4076,0x0072,0xC1B2,0x81B3,0x4073,0x01B1,0xC071,0x8070,0x41B0,
0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,0x8052,0x4192,0x0196,0xC056,0x8057,0x4197,
0x0055,0xC195,0x8194,0x4054,0x019C,0xC05C,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,
0x005A,0xC19A,0x819B,0x405B,0x0199,0xC059,0x8058,0x4198,0x0188,0xC048,0x8049,0x4189,
0x004B,0xC18B,0x818A,0x404A,0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C,
0x0044,0xC184,0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,0x0182,0xC042,0x8043,0x4183,
0x0041,0xC181,0x8180,0x4040}
```

If the CRC checksum of each byte to be sent is computed on line, it will take a longer time, but it can save the program space occupied by the table. The code for computing CRC online is as follows:

```
unsigned int crc_check（unsigned char *data,unsigned char length）
{
    int i;
    unsigned crc_result=0xffff;
    while (length--)
    {
        crc_result^=*data++;
        for (i=0;i<8;i++)
        {
            if (crc_result&0x01)
            {
            crc_result= (crc_result>>1) ^0xa001;
            }
            else
            {
        crc_result=crc_result>>1;
            }
        }
    }
    return  (crc_result= ( (crc_result&0xff) <<8) | (crc_result>>8) ) ;
}
```

10. Application example

To start No.5 drive and make it rotate forward with a speed of 500.0 rpm (expressed as 5000 internally), the command is as follows:

Data frame	Address	Command code	Register address	Number of registers	Register content Number of bytes	Register content	Check code
Request	0x05	0x10	0x6400	0x0002	0x04	0x0034, 0x1388	0x30C5
Response	0x05	0x10	0x6400	0x0002	None	None	0x5F7C

No.5 drive coast to stop:

Data frame	Address	Command code	Register address	Register content	Check code
Request	0x05	0x06	0x6400	0x0036	0x1768

Data frame	Address	Command code	Register address	Register content	Check code
Response	0x05	0x06	0x6400	0x0036	0x1768

No.5 drive jog-forward:

Data frame	Address	Command code	Register address	Register content	Check code
Request	0x05	0x06	0x6400	0x00B0	0x96CA
Response	0x05	0x06	0x6400	0x00B0	0x96CA

No.5 drive jog-stop:

Data frame	Address	Command code	Register address	Register content	Check code
Request	0x05	0x06	0x6400	0x0130	0x96FA
Response	0x05	0x06	0x6400	0x0130	0x96FA

No.5 drive fault reset:

Data frame	Address	Command code	Register address	Register content	Check code
Request	0x05	0x06	0x6400	0x0220	0x97C6
Response	0x05	0x06	0x6400	0x0220	0x97C6

Read the running speed of No.5 drive and the response running speed is 500.0 rpm (16 bits mode):

Data frame	Address	Command code	Register address	Number of registers or number of bytes read	Register content	Check code
Request	0x05	0x03	0x6502	0x0001	None	0x3A82
Response	0x05	0x03	None	0x02	0x1388	0x44D2

Read the running speed of No.5 drive and the response running speed is 500.0 rpm (32 bits mode):

Data frame	Address	Command code	Register address	Number of registers or number of bytes read	Register content	Checksum
Request	0x05	0x03	0xE502	0x0002	None	0x5343
Response	0x05	0x03	None	0x04	0x00001388	0xB2A5

Change the acceleration time 1 (i.e. function code P06.07) of No.5 drive to be 100 ms, which cannot be saved upon power off (16 bits mode).

Data frame	Address	Command code	Register address	Register content	Check code
Request	0x05	0x06	0x0607	0x0064	0x38EC
Response	0x05	0x06	0x0607	0x0064	0x38EC

Change the acceleration time 1 (i.e. function code P06.07) of No.5 drive to be 100 ms, which cannot be saved upon power off (32 bits mode).

Data frame	Address	Command code	Register address	Number of registers	Number of bytes of register content	Register content	Check code

Data frame	Address	Command code	Register address	Number of registers	Number of bytes of register content	Register content	Check code
Request	0x05	0x10	0x8607	0x0002	0x04	0x00000064	0xECF4
Response	0x05	0x10	0x8607	0x0002	None	None	0xD8C5

Read the output current of No.5 drive and the response output current is 30.0 A (16 bits mode):

Data frame	Address	Command code	Register address	Number of registers or number of bytes read	Register content	Check code
Request	0x05	0x03	0x6504	0x0001	None	0xDA83
Response	0x05	0x03	None	0x02	0x012C	0x49C9

Read the output current of No.5 drive and the response output current is 30.0 A (32 bits mode):

Data frame	Address	Command code	Register address	Number of registers or number of bytes read	Register content	Check code
Request	0x05	0x03	0xE504	0x0002	None	0xB342
Response	0x05	0x03	None	0x04	0x0000012C	0xBFBE

Read the deceleration time 1 (i.e. P06.08) of No.5 drive and the response deceleration time is 60ms (16 bits mode):

Data frame	Address	Command code	Register address	Number of registers or number of bytes read	Register content	Check code
Request	0x05	0x03	0x0608	0x0001	None	0x04C4
Response	0x05	0x03	None	0x02	0x003C	0x4995

Read the deceleration time 1 (i.e. P06.08) of No.5 drive and the response deceleration time is 60ms (32 bits mode):

Data frame	Address	Command code	Register address	Number of registers or number of bytes read	Register content	Check code
Request	0x05	0x03	0x8608	0x0002	None	0x6D05
Response	0x05	0x03	None	0x04	0x0000003C	0xBFE2

11. Scaling of drive parameters

(1) Scaling of the speed: 1:10

To make the drive run at 500.0rpm, the main setting shall be 0x1388 (5000).

(2) Scaling of time: 1:1

To make the acceleration time of the drive to be 100 ms, the function code shall be set as 0x0064 (100).

(3) Scaling of current: 1:10

If the feedback current of the drive is 0x001E (30), the present current shall be 3.0 A.

(4) The output power is its absolute value.

(5) For other parameters, please refer to the function parameter descriptions.

Appendix 2 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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