Manual Introduction

■ Basic Terms

The following terms in this manual are defined as follows unless stated in advance:

- Servo motor or motor: V7E series servo motor (permanent magnet synchronous motor).
- Servo drive: SD100 series servo motor controller.
- Servo system: Servo drive with servo motor.

■ Manual Content

Please refer to the relevant sections if needed.

No.	Title	Model & Accessory	Ratings & Characteristics	System design	Installation & Wiring	Trial run &Adjustment	Maintenance & Inspection
1	Pre-use Safety Precautions	●					
2	Product Information	●					
3	Installation and Wiring	●	●	●	●		
4	Commissioning and Trial Operation						
5	Adjustment			●		●	●
6	Debugging Software			●		●	●
7	Parameter					●	●
8	Fault Diagnosis					●	●
9	Communication				●	●	
10	Motion control					●	●
-	Appendix	●		●		●	●

■ DI/DO terminal logic

In this manual, the input terminals of the servo drive are all low when not externally closed, and high when externally closed.。

- Low level (OFF)——switch disconnected (OFF)
- High level (ON)——switch closed (ON)
- Rising edge (↑) ——switch disconnected to closed
- Falling edge (↓) ——switch closed to disconnected

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File No.: V1.3

Catalog

Chapter 1 Pre-use Safety Precautions

The following signs are used in this manual regarding safety, whose contents are very important. Please abide by them whenever and wherever.

⚠ Danger

Failure to operate as required can lead to serious injuries and even death.

⚠ Caution

Failure to operate as required can lead to minor or moderate injuries, and equipment damage.

1.1 Safety Precautions

This chapter explains the safety precautions to be observed during installation, wiring, operation, maintenance and inspection.

⚠ **Danger**

- Make sure that the power supply voltage is the same as the rated voltage of the servo drive, otherwise there is a risk of injury, fire, or damage to the drive.
- Do not connect the input power cable to the output terminals or the drive will be damaged.
- The drive cannot be tested for insulation withstand voltage, and a megohmmeter cannot be used to test the drive's control circuit.
- The drive must be connected to the motor in the correct phase sequence or it will cause the drive malfunction or damage.
- Disconnect the motor load and run the motor alone before test running the servo motor to avoid accidents.
- Make sure that the power supply can be disconnected from the drive via the emergency stop switch at any time before the machine starts running.
- Set the appropriate parameters before operation, otherwise the drive may operate incorrectly or act in an unanticipated manner due to the load.
- Please let an electrical engineer carry out the wiring work, otherwise there is a danger of electric shock or fire.
- Do not touch the conductive parts directly, and the output cables of the drive should never be connected or short-circuited to the casing, otherwise there is a risk of electric shock or short circuit.
- Disconnect the power and wait 20 seconds before rewiring the drive, otherwise there is a risk of electric shock.
- Contact current can be up to 0.5mA, be sure to take reliable grounding measures, otherwise there is a risk of electric shock.
- Do not touch the heat sink or external braking resistor during operation, otherwise burns may occur due to high temperature.
- Be sure to install an overcurrent protector, leakage current protector, and emergency stop device, and make sure they are effective after wiring is completed, otherwise there may be a risk of electric shock, injuries, and fire.
- Leakage current may exceed 0.5mA during operation of the drive, be sure to use a reliable grounding and ensure that the grounding resistance is lower than 10Ω, the conductivity of the PE grounding conductor and the phase conductor is the same (with the same cross-sectional area).
- The components inside the drive contain heavy metals so the drive must be disposed of as industrial waste after being scrapped.

1.2 Product Confirmation Precautions

Item	Description
Check the product against the order	The package contains the machine you ordered and the SD100 Servo Drive Manual (simplified version). Please check the nameplate model number of the servo motor and servo drive.
Check if the product is damaged in any way	Please check the whole appearance of the machine and whether there are any damages during the transportation. If you find any object omission or damage, please contact us or your supplier as soon as possible.
Check if the servo motor rotary axis is running smoothly	If you can turn it gently by hand, it is normal (except the servo motor with contacting brake).

1.3 Transportation and Storage Precautions

⚠ **Caution**

Do not store or place the product in the following environments, as this may result in fire, electric shock, or damage to the machine.

- Places exposed to direct sunlight, where the ambient temperature exceeds the storage temperature, where the relative humidity exceeds the storage humidity, where there is a large temperature difference or condensation, places close to corrosive gases or flammable gases, places with much dust, dirt, salt, and metal dust, places where there are drips of water, oil, and medicines, and places where vibrations or shocks can be transmitted to the main body. Do not hold the cables or motor shafts for handling, as this may result in injuries or malfunctions.
- Do not overstack this product during handling or storage as this may cause injuries or malfunctions.

1.4 Installation Precautions

⚠ **Caution**

- Do not install this product in a place with splashed water or in a place where corrosion is likely to occur.
- Do not use this product near flammable gases and combustibles as there is a risk of electric shock or fire.
- Do not sit on this product or place heavy objects on top of it, as this may result in injuries.
- Install this product in a cabinet that provides fire protection and electrical protection, otherwise it may cause a fire.
- Do not clog the suction and exhaust ports or allow foreign objects to enter the product, as this may cause malfunction and fire due to deterioration of the internal components.
- Be sure to comply with the requirements for the installation direction, otherwise it may result in malfunction.
- Make sure to maintain the specified spacing distance between the servo drive and the inner surface of the electrical cabinet and other machines during setting, otherwise it may result in fire or malfunction.
- Do not inflict excessive shock as it may result in malfunction.

1.5 Wiring Precautions

⚠ Caution

- Do not connect a DC power supply to the servo drive's output terminals U, V, and W, or it may result in injuries or fire.
- Please connect the output U, V, W of the servo drive and U, V, W of the servo motor directly. Do not use an electromagnetic contactor on the way, otherwise it may result in abnormal operation and malfunction.
- Please connect the power supply terminals and motor terminals firmly, otherwise it may result in fire.
- Do not route the power and signal cables through the same pipe or bundle them together. They should be separated by 30 cm or more during wiring.
- Please use twisted shielded cables for signal and encoder cables, and ground both ends of the shield.
- High voltage may remain inside the servo drive even if the power is turned off, so do not touch the power terminals for a while (within 20 seconds).
- Make sure that the indicator light is off before checking.
- Do not turn the power on/off frequently. If it is necessary to turn the power on/off repeatedly and continuously, keep it to no more than once a minute.
- Since the power supply of the servo drive has a capacitor inside, there is a large charging current (charging time of 1 second) flows when the power supply is ON/OFF. Therefore, if the power supply is turned ON/OFF frequently, the performance of the main circuit components inside the servo drive will be degraded.
- Please observe the following precautions when wiring the main circuit connectors.
  - Remove the connector from the servo drive during wiring.
  - Only one wire can be inserted into one of the connector's wire sockets. When inserting a wire, do not short-circuit the core wire to neighboring wires.
  - Please wire the machine correctly and reliably, otherwise it may result in control loss, injuries or malfunction of the motor.
  - Make sure to use the specified power supply voltage, otherwise the machine may be burned out.
  - When using the machine under poor power conditions, make sure that the input power is supplied within the specified voltage variation range, otherwise the machine may be damaged.
  - Install a safety device such as a circuit breaker to prevent short-circuiting of external wiring, which may result in a fire.
- When in the following places, take adequate and appropriate shielding measures, otherwise the machine may be damaged:
  - where interference is generated due to static electricity;
  - where strong electric or magnetic fields are generated;
  - where radiation may be present;
  - where power lines are present in the vicinity.

1.6 1.6 Operation Precautions

Caution

- Release all the load on the servo motor during test operation (disconnected to the drive shaft) to prevent accidents, otherwise it may result in injuries.
- Never touch the rotating part of the servo motor while it is running, or it may result in injury.
- Set the user's parameters that are consistent to the machine when installing the servo motor on the machine and starting operation. If the operation is started without such parameters, the machine may go out of control or malfunction.
- When home return is performed, the signals for positive limit (P-OT) and negative limit (N-OT) are invalid.
- When a servo motor is used on the vertical axis, a safety device should be installed to prevent the workpiece from falling under alarm or overtravel. Also, make sure there is a stop setting to lock servo during overtravel to prevent the workpiece from falling.
- Be sure to set the correct inertia ratio when online auto-tuning is not used, otherwise it may result in vibration.
- When the power is turned on or off for just a second, the heat sink, the external braking resistor, the motor, etc. of the servo drive are all at a high temperature, so do not touch them or users may be burned.
- Extreme parameter adjustments and setting changes can result in unstable servo system operation, so do not set unreasonable parameters as this may result in injuries.
- When an alarm occurs, reset and restart operation after troubleshooting the problems and, or it may result in injuries.
- Do not use the holding brake of the motor for usual braking, otherwise it may cause malfunction.

1.7 Maintenance and Inspection Precautions

Caution

- The operation of turning on and off the power supply should be carried out by a specialized operator.
- When performing the insulation resistance test of the drive, please disconnect all circuits beforehand, otherwise it will result in drive malfunction.
- Do not use gasoline, thinner, alcohol, acidic and alkaline detergents to avoid discoloration or damage to the casing.
- Please transfer the user parameters to the new servo drive when replacing the servo drive, and then restart the operation, otherwise the machine may be damaged.
- Do not change the wiring under power, otherwise it may result in electric shock.
- Do not disassemble the servo motor, otherwise it may result in electric shock or injuries.

1.8 Maintenance and Inspection of Servo Units

The servo system is composed of a number of parts and components, and only when all parts and components are functioning properly can the system fulfills properly its functions. For the mechanical parts and electronic parts, certain pieces need to be maintained, and must be regularly checked or replaced according to their service life in the light of actual use, to ensure normal operation of servo motors and servo drives for a long period of time.

1.8.1 Servo Motor Overhaul

Servo motors do not contain brushes, so only simple daily overhauls are required. Please note that the maintenance periods shown in the table are just for your information. Please plan out the most suitable maintenance period based on the actual usage conditions and environment of the servo motor.

Table 1-1 Servo motor overhaul details

Item	**Period**	**Tip**	**Comment**
Check vibration and sound	Daily	Based on tactile and auditory senses	No louder or stronger than usual.
Check appearance	Based on defacement	Wipe with a cloth or sweep with an air gun.	-
Measure insulation resistance	At least once a year	Disconnect from the servo unit and measure the insulation resistance with a 500V megohmmeter. Resistance value over 10MΩ is normal.	When it is 10MΩ or below, please contact our maintenance department.
Replace oil seals	At least once every 5000 hours	Please contact our agent or technical support department.	Servo motor with oil seal only
General overhaul	At least once every 20,000 hours or 5 years		-

1.8.2 Servo Drive Overhaul

The servo driver unit does not need a daily overhaul, but at least once a year. See Table 1-2 for specific maintenance details.

Table 1-2 Servo drive overhaul details

Item	Period	Tip	Method
Appearance overhaul	At least once a year	No garbage, dust, oil, etc.	Clean with cloth or an air gun
Loose screws		No loose terminal block and connector screws	Tighten them.

1.8.3 General Standard for Replacing Internal Parts of Servo Units

Electrical and electronic parts are subject to mechanical wear and aging. Please carry out regular maintenance to ensure safety.

In addition, please contact our agency or sales office based on the approximate replacement interval in Table 1-3, and we will judge whether replacement parts are necessary after investigation. The user parameters will be reset to the factory settings after the servo unit is repaired by our company, so be sure to restore the settings before running the unit.

Table 1-3 Servo drive inner part replacement

Name	Standard replacement interval	Condition
Smoothing capacitor	Every 7 to 8 years	Ambient temperature: annual average 30℃ Load ratio: below 80% Running rate: below 20 hours/day
Aluminum electrolytic capacitors on PCB	Every 5 years	

Chapter 2 Product Information

2.1 Servo Drive Introduction

2.1.1 Servo Drive Nameplate and Model Description

SD 100 — 210 G — C A

Mark	**Product series**
SD	Servo

Mark	**Product series**
100	100

Mark	**Rated current**
110	11A
210	21A
300	30A
400	40A
800	80A

Mark	**Encoder type**
A	Serial encoder

Mark	**Product type**
P	Pulse
C	CANopen
E	EtherCAT

Mark	**Voltage**
G	48V

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MODEL	SD100-110G-CA	IP20
INPUT	24V-72VDC	
OUTPUT	Continuous Current PEAK Current	11Arms 33Arms
SN		

400-600-0303

MADE IN CHINA

Figure 2.1 Nameplate and model description

2.1.2 Technical Specifications

Electrical Specifications

Table 2-1 Input voltage and output current of the drive

Model	Rated input voltage(V)	Rated output current (A)	Max. output current (A)
SD100-110G☐A	24-72	11	33
SD100-210G☐A	24-72	21	63
SD100-300G☐A	24-72	30	90
SD100-400G☐A	24-72	40	120
SD100-800G☐A	24-72	80	240
SD100-110G☐A-2	24-72	11(dual axis)	33
SD100-210G☐A-2	24-72	21(dual axis)	63

Basic Specifications

Table 2-2 Drive specifications

Item		Specification
Voltage range		24V～72V
Control mode		MOSFET PWM controlled, sine wave current drive mode
Encoder feedback		Serial encoder: absolute encoder Environmental condition
Environmental condition	Working temperature	0℃～55℃(dereate to use between 55°C～60°C)
	Storage temperature	-20℃～65℃
	Working humidity	Below 95%RH (No freezing, no condensation)
	Storage humidity	Below 95%RH (No freezing, no condensation)
	Vibration	4.9m/s^2
	Impact	19.6m/s^2
	Protection level	IP20
	Altitude	Below 1000m (derate between 1000m to 2000m)
	Others	No electrostatic interference, strong electric field, strong magnetic field, radiation, etc.
I/O control	Input signal	Working voltage range: DC24V±20%. Input mode: common collector input, common emitter input 4 channels of signals are available for function input and positive/negative logic are changeable.
	Output signal	Working voltage range: DC5V～DC30V Output mode: photocoupler output (isolated) 2 channels of signals are available for function output and positive/negative logic are changeable.
Speed	Speed control range	1:5000 (the lower limit of speed control range is the value under non-stop operation at rated torque load)

	Speed pulsation rate	Load fluctuation	Below ±0.01% of rated speed (load fluctuation: 0% to 100%)
		Voltage fluctuation	0% of rated speed (voltage fluctuation: ±10%)
		Temperature fluctuation	Below ±0.1% of rated speed (temperature fluctuation: 25 ℃ ± 25 ℃)
	Functions		Internal speed setting, acceleration/deceleration setting, zero speed clamping, speed control output and others.
Torque control	Torque control accuracy		±1% (reproducible)
	Functions		Internal torque setting, torque filtering, single trigger, torque control output and others.
Communication	485		Modbus protocol
	CAN		CiA-301 V4.02: CANopen application layer and communication protocols DSP-402 V2.0: drive and motion control sub-protocols
	USB		USB 2.0 Type-C port for PC (12Mbps)
Display			3 LED indicators (ERR, RUN, PWR)
Regenerative processing			External
Protections			Overcurrent, overvoltage, undervoltage, overload, regeneration fault, encoder disconnection, etc.
Auxiliary functions			Intelligent setting, alarm recording, JOG operation, inertia detection, FFT analysis, etc.
Position control	Feedforward compensation		0%～100%
	Command pulse	Command pulse pattern	Three types of commands: "Pulse + Direction", "CW + CCW Pulse Sequence", and "A and B Phase Quadrature Pulse".
		Input pattern	Linear drive, open collector
		Maximum input frequency	Differential input: high-speed 4Mpps max. Open collector: 200Kpps max.
	Functions		Basic configurations such as position command selection, electronic gear setting, gear backlash compensation, home return, positioning control output, etc., and position control functions such as low-frequency suppression and model tracking control.

2.1.3 Drive Installation Dimensions

SIZE A: SD100-110G, SD100-210G

SIZE B: SD100-300G, SD100-400G

SIZE C: SD100-110G-2, SD100-210G-2

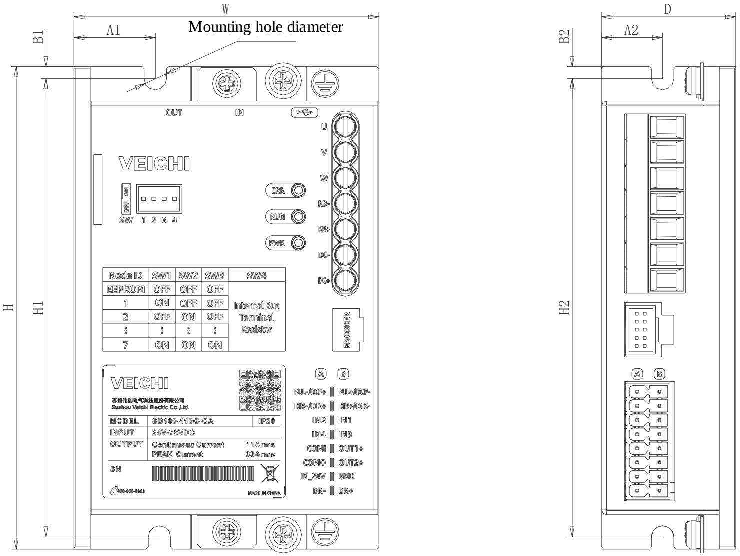


Figure 2.2 Drive profile diagram

Table 2-3 Correspondence between external dimensions and installation dimensions of the drive

Structure	**Outer dimension (mm)**			**Installation dimension (mm)**						**Hole diameter**
	W	**H**	**D**	**H1**	**A1**	**B1**	**H2**	**A2**	**B2**	**-**
SIZE A	75	119.5	33	113.5	20	3	113.5	15	3	4-M4
SIZE B	90	175	33.5	169	23	3	169	15.5	3	4-M4
SIZE C	90	202	33.5	196	22	3	194	15.5	3	4-M4

2.2 Servo Motor Introduction

2.2.1 Servo Motor Naming Rules

V7E－ L 06 G－ R40 30－ Q 1 Y

Mark	Product series
V7E	V7

Mark	Inertia level
L	Low

Mark	Flange
06	06×06
08	08×08

Mark	Voltage
G	48V

Mark	Rated power
R20	0.2kW
R40	0.4kW
R60	0.6kW
R75	0.75kW

Mark	Outlet
Y	Direct out for power cables, plug-in terminals for encoder cables
U	Power cable with 0.5m adapter, encoder cable with plug-in terminals

Mark	Brake type
1	w/o holding brake
2	With holding brake

Mark	Encoder type
Q	17-bit single-turn magnetic encoder
R	17-bit multi-turn magnetic encoder

Mark	Rated speed
30	3000rpm

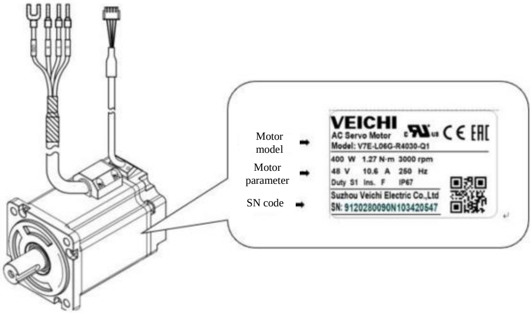


Figure 2.3 Motor model and nameplate information

2.2.2 Servo Motor Component Description

The left side shows the non-contracting motor structure and the right side the contracting motor.

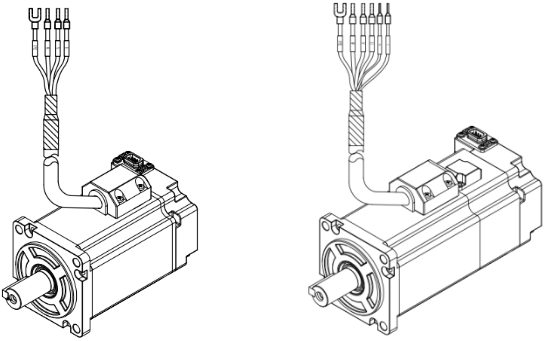


Figure 2.4 Motor diagram

2.2.3 Motor Specifications

Motor Mechanical Characteristics and Specifications

Table 2-4 Motor mechanical characteristics and specifications

Item	Description
Work mode	Continuous
Vibration	49m/s2(5G) or below during rotating, 24.5m/s2(2.5G) or below during stop
Insulation resistance	48V DC, >10MΩ
Ambient temperature	-20℃～40℃
Ambient humidity	20%～80% (no condensation)
Excitation mode	Permanent magnet
Installation	Flange
Heat resistance gr	Class F
Insulation voltage	AC1500V for 1 minute (200V)

Motor Rating Specifications

Table 2-5 Motor specifications

Model	V7E-L06G-R2030-#1△	V7E-L06G-R2030-#2△	V7E-L06G-R4030-#1△	V7E-L06G-R4030-#2△
Rated power (W)	200	200	400	400
Rated torque (N m)	0.64	0.64	1.27	1.27
Max. torque (N m)	1.92	1.92	3.81	3.81
Rated current (Arms)	5.3	5.3	10.6	10.6
Max. current (Arms)	15.9	15.9	31.8	31.8
Rated speed(rpm)	3000	3000	3000	3000
Maximum speed (rpm)	4000	4000	4000	4000

Torque coefficient (N • m/Arms)	0.12	0.12	0.12	0.12
Rotational inertia (10^{-4} kg m^2)	0.18	0.2	0.34	0.36
Allowable radial load (N)	76	76	76	76
Allowable axial load (N)	53	53	53	53

Model	**V7E-L06G-R6030-#1△**	**V7E-L06G-R6030-#2△**	**V7E-L08G-R7530-#1△**	**V7E-L08G-R7530-#2△**
Rated power (W)	600	600	750	750
Rated torque (N m)	1.91	1.91	2.4	2.4
Max. torque (N m)	5.73	5.73	7.2	7.2
Rated current (Arms)	15.8	15.8	19.9	19.9
Max. current (Arms)	47.7	47.7	60	60
Rated speed(rpm)	3000	3000	3000	3000
Maximum speed (rpm)	4000	4000	4000	4000
Torque coefficient (N m /Arms)	0.12	0.12	0.12	0.12
Rotational inertia (10^{-4} kg m^2)	0.51	0.53	1.02	1.13
Allowable radial load (N)	248	248	248	248
Allowable axial load (N)	76	76	76	76

Model	**V7E-L08G-1R030-#1△**	**V7E-L08G-1R030-#2△**	**V7E-L08G-1R230-#1△**	**V7E-L08G-1R230-#2△**
Rated power (W)	1000	1000	1200	1200
Rated torque (N m)	3.18	3.18	3.82	3.82
Max. torque (N m)	9.54	9.54	11.46	11.46
Rated current (Arms)	21.2	21.2	28	28
Max. current (Arms)	63.3	63.3	84	84
Rated speed(rpm)	3000	3000	3000	3000
Maximum speed (rpm)	4000	4000	4000	4000
Torque coefficient (N m /Arms)	0.11	0.11	0.11	0.11
Rotational inertia (10^{-4} kg m^2)	1.34	1.45	1.63	1.74
Allowable radial load (N)	248	248	248	248
Allowable axial load (N)	76	76	76	76

Model	**V7E-L06E-R4030-#1△**	**V7E-L06E-R4030-#2△**	**V7E-L06E-R6030-#1△**	**V7E-L06E-R6030-#2△**
Rated power (W)	400	400	600	600
Rated torque (N m)	1.27	1.27	1.91	1.91
Max. torque (N m)	3.81	3.81	5.73	5.73
Rated current (Arms)	21.2	21.2	31.6	31.6
Max. current (Arms)	63.6	63.6	94.8	94.8
Rated speed(rpm)	3000	3000	3000	3000
Maximum speed (rpm)	4000	4000	4000	4000

Model	V7E-L08G-1R530-#1△	V7E-L08G-1R530-#2△	V7E-M13G-1R530-#1△	V7E-L08G-1R530-#2△
Rated power (W)				
Rated torque (N·m)	4.76	4.76	4.8	4.8
Max. torque (N·m)	14.28	14.28	14.4	14.4
Rated current (Arms)	35	35	38.7	38.7
Max. current (Arms)	105	105	116.1	116.1
Rated speed(rpm)	3000	3000	3000	3000
Maximum speed (rpm)	4000	4000	4000	4000
Torque coefficient (N·m /Arms)	0.11	0.11	-	-
Rotational inertia (10^{-4} kg·m^2)	1.94	2.05	10.51	12.65
Allowable radial load (N)	248	248	248	248
Allowable axial load (N)	76	76	76	76
Torque coefficient (N·m /Arms)	0.05	0.05	0.06	0.06
Rotational inertia (10^{-4} kg·m^2)	0.34	0.36	0.51	0.53
Allowable radial load (N)	76	76	248	248
Allowable axial load (N)	53	53	76	76

Note: # stands for 17-bit single-turn absolute encoder (Q) or 17-bit multi-turn absolute encoder (R)

△ stands for motor outlet mode U or Y.

2.2.4 Electrical Specifications for Contracting Motors

Table 2-5 Electrical specifications for holding brake motors

Model	Holding torque (N.m)	Supply voltage ±10% (V)	Release time (ms)	Armature pickup time (ms)	Backlash (°)
V7E-L06G-R2030-#2△	≥1.5	DC24	<20	<60	<0.5
V7E-L06G-R4030-#2△					
V7E-L06E-R4030-#2△					
V7E-L06G-R4030-#2△					
V7E-L06E-R6030-#2△					
V7E-L08G-R7530-#2△	≥3.8		<80	<100	
V7E-L08E-R7530-#2△					
V7E-L08G-1R030-#2△					
V7E-L08G-1R230-#2△					
V7E-L08G-1R530-#2△					

Note: # stands for 17-bit single-turn absolute encoder (Q) or 17-bit multi-turn absolute encoder (R)

△ stands for motor outlet mode U or Y.

2.2.5 Servo Motor Installation Dimensions

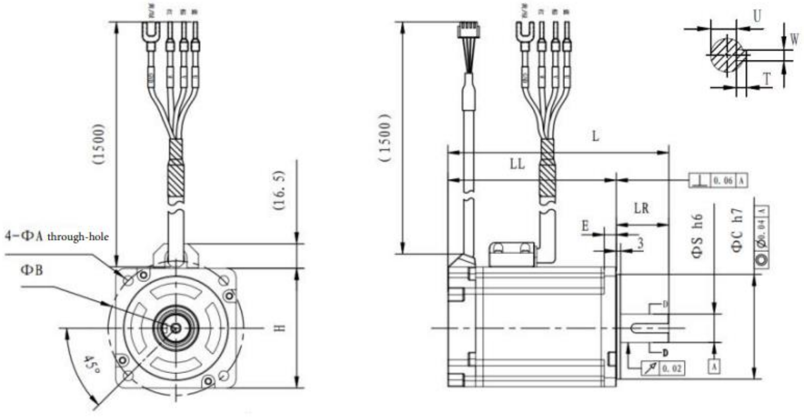


Figure 2.5 Servo motor installation dimensions

Table 2-6 Dimensions of different motor models

Model	Outer dimension(mm)					
	A	B	C	S	E	F
V7E-L06G-R2030-#1△	5.5	70	50	14	6.5	M5 Depth:10
V7E-L06G-R2030-#2△						
V7E-L06G-R4030-#1△						
V7E-L06G-R4030-#2△						
V7E-L06G-R6030-#1△						
V7E-L06G-R6030-#2△						
V7E-L08G-R7530-#1△	6.6	90	70	19	8	
V7E-L08G-R7530-#2△						
V7E-L08G-1R030-#2△						
V7E-L08G-1R230-#2△						
V7E-L08G-1R530-#2△						

Note: # stands for 17-bit single-turn absolute encoder (Q) or 17-bit multi-turn absolute encoder (R)

△ stands for motor outlet mode U or Y.

Model	Outer dimension(mm)						
	H	L	LL	LR	T	W	U
V7E-L06G-R2030-#1△	60	110.5	80.5	30	5	5	11
V7E-L06G-R2030-#2△		141.5	111.5				
V7E-L06G-R4030-#1△		129.5	99.5				
V7E-L06G-R4030-#2△		160.5	130.5				
V7E-L06G-R6030-#1△		148.5	118.5				
V7E-L06G-R6030-#2△		179.5	149.5				
V7E-L08G-R7530-#1△	80	147	112	35	6	6	15.

V7E-L08G-R7530-#2△		179	144				5
V7E-L08G-1R030-#1△		161	126				
V7E-L08G-1R030-#2△		193	158				
V7E-L08G-1R230-#1△		179	144				
V7E-L08G-1R230-#2△		211	176				
V7E-L08G-1R530-#1△		179	144				
V7E-L08G-1R530-#2△		211	176				

Note: # stands for 17-bit single-turn absolute encoder (Q) or 17-bit multi-turn absolute encoder (R)

△ stands for motor outlet mode U or Y.

2.3 Servo System Configuration

Table 2-7 Servo system configuration

Servo drive		Servo motor				
Model	**Rated current (Arms)**	**Power (W)**	**Model**	**Torque (N m)**	**Rated current (Arms)**	**Rated speed (rpm)**
SD100-110G-☐A	11	200	V7E-L06G-R2030-#1△	0.64	5.3	3000
			V7E-L06G-R2030-#2△			
		400	V7E-L06G-R4030-#1△	1.27	10.6	3000
			V7E-L06G-R4030-#2△			
SD100-210G-☐A	21	600	V7E-L06G-R6030-#1△	1.91	15.8	3000
			V7E-L06G-R6030-#2△			
		750	V7E-L08G-R7530-#1△	2.38	19.9	3000
			V7E-L08G-R7530-#2△			
SD100-300G-☐A	30	1000	V7E-L08G-1R030-#1△	3.18	21.2	3000
			V7E-L08G-1R030-#2△	3.18	21.2	
SD100-400G-☐A	40	1200	V7E-L08G-1R230-#1△	3.82	28	3000
			V7E-L08G-1R230-#2△	3.82	8	
		1500	V7E-L08G-1R530-#1△	4.76	35	3000
			V7E-L08G-1R530-#2△	4.76	35	

Note: # stands for 17-bit single-turn absolute encoder (Q) or 17-bit multi-turn absolute encoder (R)

△ stands for motor outlet mode U or Y.

Chapter 3 Wiring and Installation

3.1 Servo Drive Terminal Pin Layout

The terminal pins of the SD100 are shown in the following diagram:

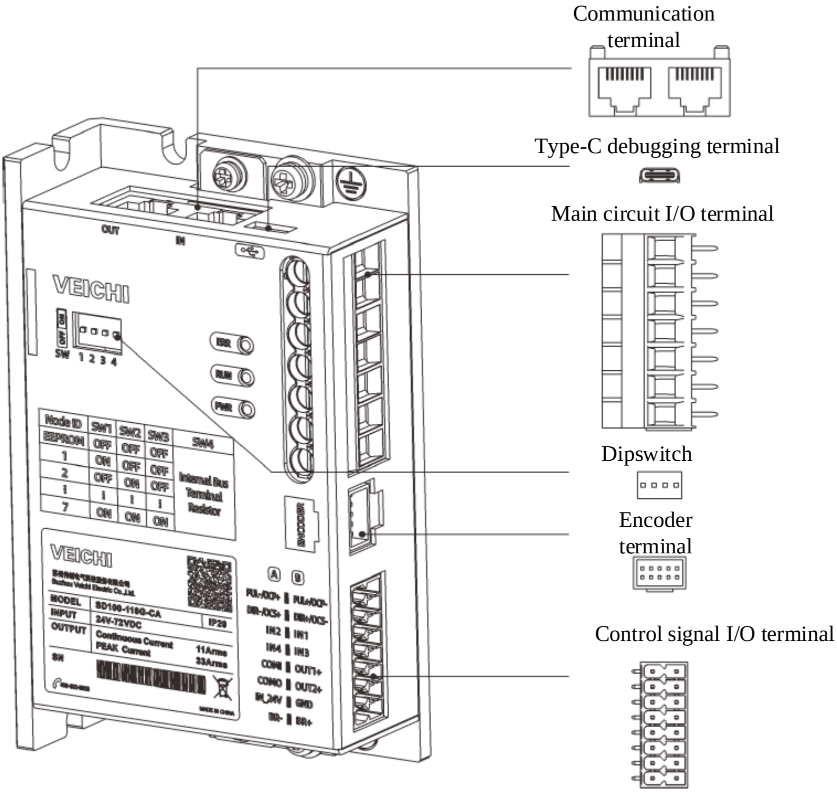
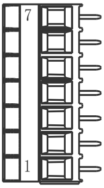


Figure 3.1 Drive terminal pins

3.2 Main Circuit I/O Terminals

3.1.1 Main Circuit I/O Pin Definitions

Table 3-1 Servo drive main circuit terminal pin descriptions

Diagram	Pin No.	Signal	Function
	1	DC+	DC power supply positive end (DC: 24V~72V)
	2	DC-	DC power supply negative end
	3	RB+	Braking resistor positive
	4	RB-	Braking resistor negative
	5	W	Motor power cable phase W
	6	V	Motor power cable phase V
	7	U	Motor power cable phase U

3.1.2 Wiring Illustrations and Related Precautions

The wiring diagram is shown below:

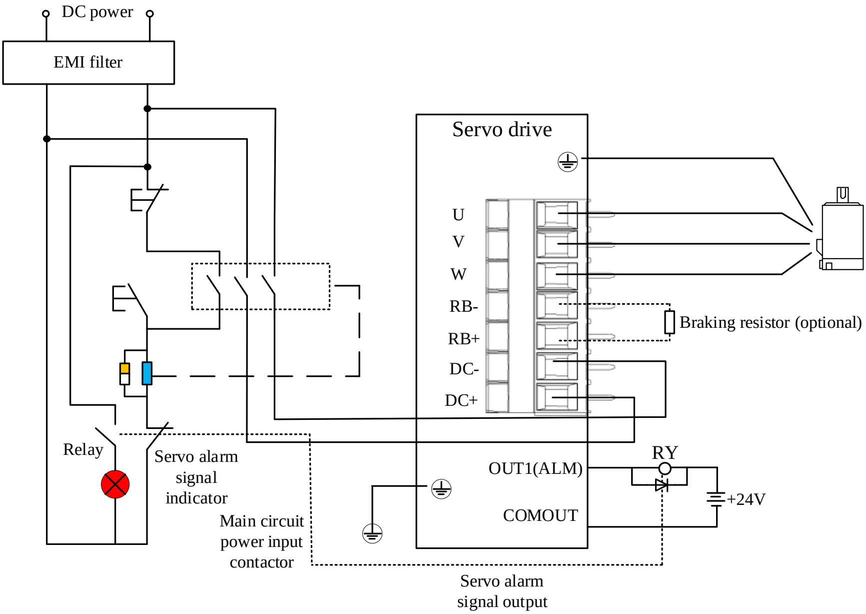


Figure 3.2 Main circuit I/O wiring diagram

Table 3-2 Drive main circuit cable specifications

Input voltage (V)	Drive model	Recommended input power cable (DC+,DC-)	Rated output current (A)	Recommended output power cable (U,V,W)	Recommended grounding cables (PE)
		mm^2	-	mm^2	mm^2
24-72	SD100-110G	1.5	11	1.5	1.5
	SD100-210G	2.5	21	2.5	2.5
24-72	SD100-300G	3.5	30	4.0	3.5
	SD100-400G	4.0	40	4.0	4.0

Precautions

All the above are copper core cables, if it is an aluminum cable, the wire diameter should be 1.5 times ~ 2 times of the copper wire.

- Do not connect the input power cable to the output terminals U, V, and W, otherwise the servo drive will be damaged.
- If the cable is bundled and placed in a duct or other place for use, the allowable current derating rate should be taken into account since the heat dissipation conditions deteriorate.
- When the temperature inside the cabinet is higher than the temperature limit value of the cables, use cables with a higher temperature limit value, and it is recommended to use Teflon cables; when surrounded by a low-temperature environment, pay attention to the warmth of the cables, as the surface of the cables tends to harden and rupture in a low-temperature environment.
- Ensure that the bending radius of the cables is more than 10 times the outer diameter of the cables themselves to prevent the core of the cables from breaking due to long-term bending.
- Do not route or bundle the power and signal cables together through the same pipe, and keep them at a distance of 30 cm or more to avoid interference.
- A high voltage may still remain inside the drive after the power is turned off. Do not touch the power terminals for 5 minutes.
- Do not turn on/off the power supply too often, and when it is necessary to turn on/off the power supply repeatedly and continuously, keep it to no more than 1 time/minute. The power supply section of the servo driver has a capacitor, and a large charging current flows when the power supply is turned ON, so it may cause the main circuit component deterioration within the drive.
- Use a ground cables with the same cross-sectional area as the main circuit cables. If the cross-sectional area of the main circuit wires is 1.6mm2, use a 2.0mm2 ground cable.
- Connect the servo drive reliably to earth.
- Do not turn on the power when the terminal block screws are loose or the cable is loose, as it may cause a fire.

3.1.3 Braking Resistor Selection

When the torque and speed of the motor are in opposite directions, the energy is fed back into the drive from the motor end, raising the drive bus voltage until it exceeds the preset braking point, then the energy can only be consumed by the braking resistor. The braking energy must be consumed at this point, otherwise, it will cause damage to the drive.

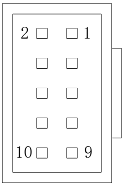
SD100 only supports external braking resistor, which needs to be connected to RB+ and RB- terminals for use. When selecting an external regenerative braking resistor, be sure to check that the capacity and resistance value are appropriate, otherwise it may cause injuries or fire.

Table 3-3 Servo drive braking resistor specifications

Model	Braking voltage(V)	Min. external resistor(Ω)	Resistor power(W)
SD100-110G☐A	75	10	100
SD710-210G☐A	75	5	100
SD710-300G☐A	75	5	200
SD710-400G☐A	75	5	200

3.3 Encoder Interface Terminal

Table 3-4 Encoder interface pin function configuration

Layout	Pin No.	Name	Function
	1	-	-
	2	PE	Shield grounding
	3	-	-
	4	-	-
	5	+5V	5V power output for encoders
	6	GND	
	7	BAT+	Battery for multi-turn encoders
	8	BAT-	
	9	SD+	Serial encoder input
	10	SD-	

Precautions

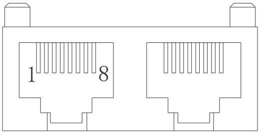
- When using a multi-turn absolute encoder, be sure to connect the battery and serial data.
- When soldering the encoder wiring by hand, refer to the pin definitions in the figure above.

3.4 Communication Interface Terminal

3.4.1 CAN/RS485 Communication Port

The definition of this port varies with the model, so check the model before using this it. If field identification bit is S (standard) or C (CANopen bus), the pin definition of the communication interface is shown in Table 3-5.

Table 3-5 CAN/RS485 communication interface definition

Layout	Pin No.	Name	Function	Comment
 1 8 IN OUT	1	CANH	CAN data+	Pulse type is not supported and can be built-in connected to the termination resistor via SW4
	2	CANL	CAN data-	
	3	CANG	CAN signal ground	
	4	485-(B-)	485 data-	Pulse and CANopen bus types are both supported.
	5	485+(A+)	485 data+	
	6	-	-	
	7	GND	signal ground	
	8	-	--	-
	Casing	Shield	Shield	-

When multiple drives are used at the same time, the cascade cables should be 50cm or shorter, left in and right out, and the right port of the last drive should be connected with a terminating resistor if necessary.

CAN Communication Precautions

When CAN communication is used, note that CGND in the upper unit is connected to the CGND terminal of the servo drive as shown below:

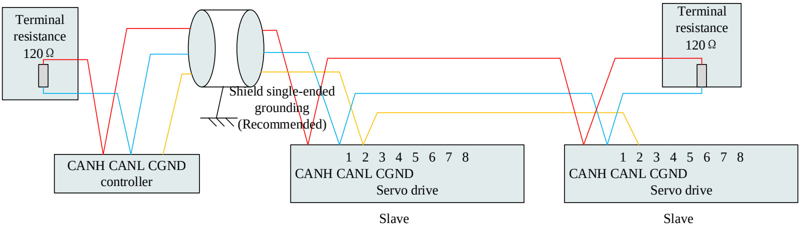


Figure 3.3 CAN and controller connection method

Precautions	
⚠	● Single-ended grounding of the shield is recommended. ● The controller-side termination resistor needs to be connected or turned on. ● Do not connect the CGND terminal in the upper unit to the GND terminal of the servo drive otherwise the machine will be damaged!

485 Communication Precautions

When using 485 communication, please note that the (GND) terminal of the upper unit is connected to the GND terminal of the servo drive, as shown in the following figure:

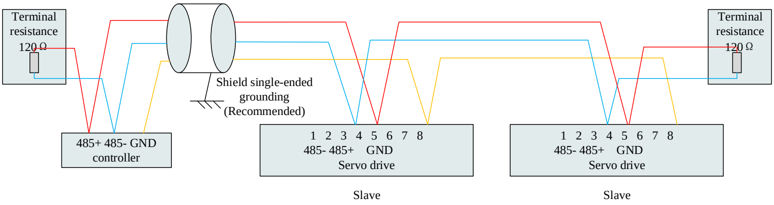


Figure 3.4 Method of connecting 485 and controller

Precautions

- Single-ended grounding of the shield is recommended.
- The controller-side termination resistor needs to be connected or turned on.
- Do not connect the CGND terminal in the upper unit to the GND terminal of the servo drive otherwise the machine will be damaged!

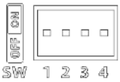
3.4.2 Address Selection by DIP Switches

RS485/CAN communication can be configured via the dip switch terminals.

When SW1 and SW3 are dialed OFF, the communication ID refers to the device address in the EEPROM (address selection refers to Pn080 setting via the upper computer); other states are set by manual communication address selection to SW1~3 bit.

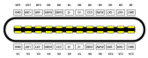
When used as CAN communication, the 120Ω built-in termination resistor is connected when SW4 dialed as ON.

Table 3-6 SW dip switch function selection

Layout	SW1	SW2	SW3	SW4	Communication ID Selection
	OFF	OFF	OFF	OFF: No termination resistor ON: Built-in termination resistor	EEPROM
	ON	OFF	OFF		1
	OFF	ON	OFF		2
	……	……	……		……
	ON	ON	ON		7

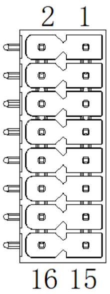
3.4.3 USB Communication Debugging Interface

Connect the VCDSoft debugging software on PC through the Type-C data cable interface for assisted debugging. Please refer to Chapter 6 "Debugging Software" for details.

Layout	Pin No.	Name	Function
	A6	D+	Data positive
	A7	D-	Data negative
	-	-	-
	A1, A12, B1, B12	GND	Grounding

3.5 Control Signal I/O Terminals

Table 3-8 Position command input signal description

Layout	Pin No.	Name	Function	
	1	PULSE+/OCP-	Pulse command input method: 1. differential drive 2. open collector	Input pulse pattern: 1. Direction + Pulse 2. Orthogonal A/B phase 3. CW/CCW pulse
	2	PULSE-/OCP+		
	3	DIR+/OCS-		
	4	DIR-/OCS+		
	5	IN1	DI channels 1~4	
	6	IN2		
	7	IN3		
	8	IN4		
	9	OUT1+	DO channel 1	
	10	COMI	DI common port	
	11	OUT2+	DO channel 2	
	12	COMO	DO common port	
	13	GND	Analog GND	
	14	IN_24V	External input backup power 24V	
	15	BR+	Holding brake output power supply 24V	
	16	BR-		

3.5.1 Position Command Signal Input

The upper unit measures the command pulse, i.e., the symbol output circuit, which can be selected from the differential drive output or the open collector output. Its maximum input frequency, i.e., minimum pulse width, is shown in Table 3-9.

Table 3-9 Correspondence between pulse input frequency and width

Pulse mode	Max. frequency (PPS)	Min. pulse width (us)
Differential	4M	0.125
Open collector	200k	2.5

Precautions	
⚠	●If the output pulse width of the upper unit is lower than the minimum pulse width, it will cause an error in pulse reception to the drive.

(1) Pulse input command

① Differential input

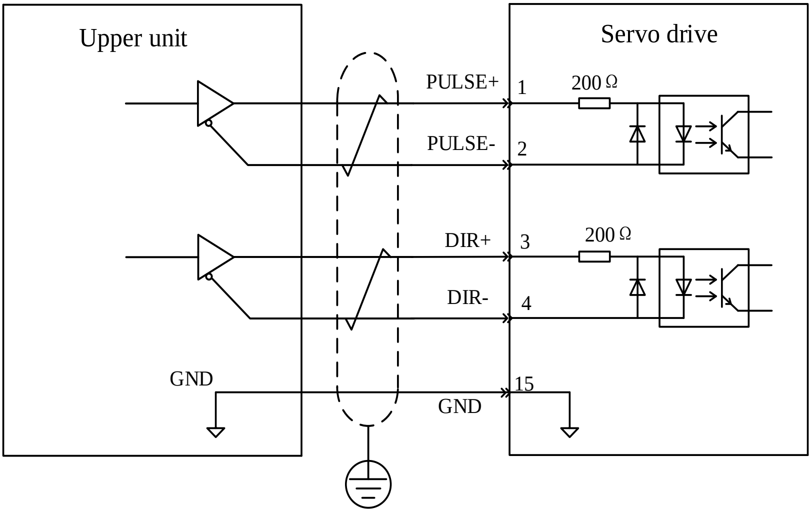
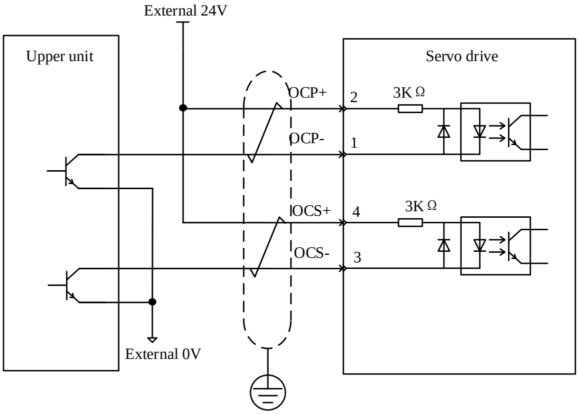
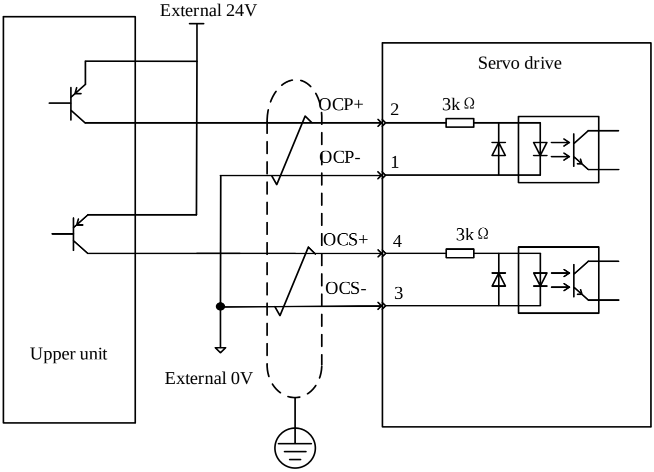


Figure 3.5 Connection example of linear drive input

Precautions	
⚠	● Be sure that the differential input is a 5V system, otherwise the input pulse of the drive will be unstable and further result in: pulse loss when the command pulse is input, and command reversal when the command direction is input. ● Be sure to connect the GND of the upper unit to the GND of the drive to minimize noise interference.

② Open collector input

Table 3-10 Open collector input wiring for external 24V supply

Module	Wiring
NPN (common cathode)	
PNP (common anode)	

Precautions	
⚠	● Incorrect wiring of NPN ports can cause port burnout.

3.5.2 DI/DO Signal

3.5.2.1 DI Circuit

X1 is used as an example here, and X1 to X4 interface circuits are the same.

(1) Relay output from the upper device

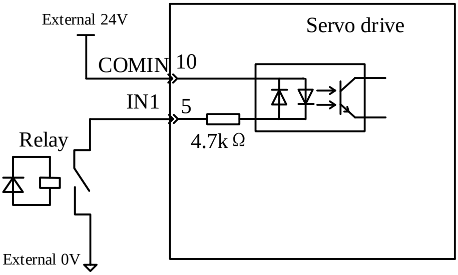


Figure 3.6 Example of relay output connection

(2) Open collector output from the upper device

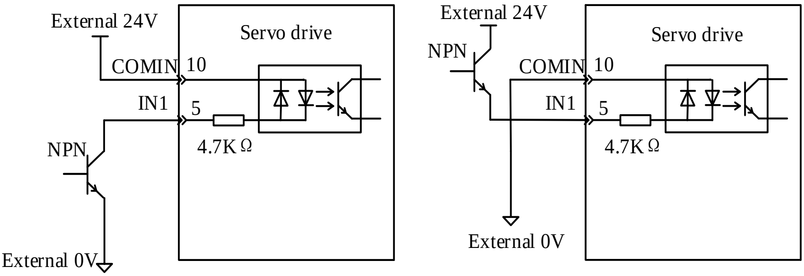


Figure 3.7 Connection example of NPN/PNP open collector

Precautions	
⚠	● Mixed use of NPN and PNP inputs is not supported.

3.5.2.2 DO Circuit

The circuit diagram for digital output is illustrated with Y1 as an example. The Y0 and Y1 interface circuits are the same.

(1) Drive output-controlled relays

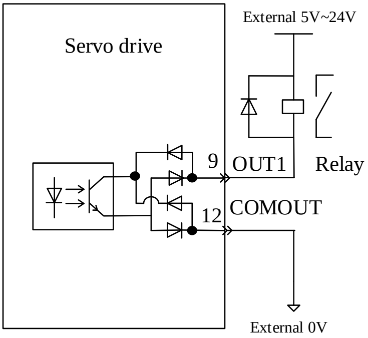


Figure 3.8 Example of relay output connection

Precautions	
⚠	● When output controls a relay, be sure to connect a current-continuing diode, otherwise the Y terminal connector may be damaged.

(2) Drive output-controlled optocouplers

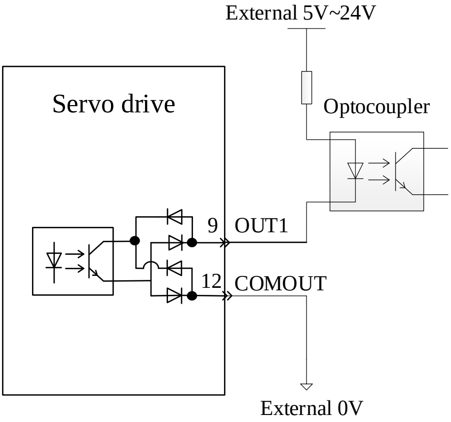


Figure 3.9 Example of optocoupler connection

The maximum allowable voltage and current capacity of the servo drive's internal optocoupler output circuit are as follows:

Voltage: DC30V (maximum)

Current: DC50mA (maximum)

3.5.3 Brake Wiring

When the servo motor is used for vertical axis, the holding brake can be used to stop or maintain the falling speed of the load when the servo drive is powered off. The electromagnetic brake is connected as shown below:

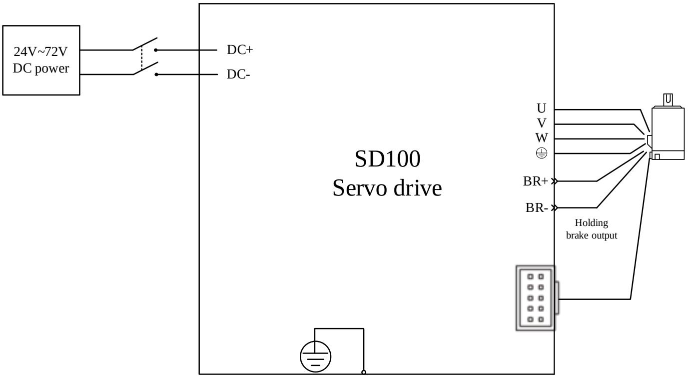


Figure 3.10 Example of brake connection

Brake wiring precautions:

Please fully consider the voltage drop caused by the resistance of the cable during length selection, and make sure the input voltage is at least 21.6 V. The brake parameters of the motor are shown in the following table.

Table 3-11 Brake parameters

Model	**Holding torque (N.m)**	**Supply voltage ±10% (V)**	**Release time (ms)**	**Armature pickup time (ms)**	**Backlash (°)**
V7E-L06G-R2030-#2△	1.5	24	20	50	0.5
V7E-L06G-R4030-#2△					
V7E-L06G-R6030-#2△					
V7E-L08G-R7530-#2△	3.8	24	80	100	
V7E-L08G-1R030-#2△					
V7E-L08G-1R230-#2△					
V7E-L08G-1R530-#2△					
V7E-L08G-R7530-#2L△					

V7E-L08G-1R030-#2L△					
V7E-L08G-1R230-#2L△					
V7E-L08G-1R530-#2L△					

3.6 Anti-interference Measures for Electrical Wiring

To suppress interference, take the following measures:

(1) The length of the command input cable should be 3m or shorter, and the encoder cable should be 20m or shorter.

(2) Use thick cables (2mm^{2}or more) for grounding wiring as much as possible.

① It is recommended to use D type or higher of grounding (grounding resistance of 100Ω or lower).

② It is necessary to ground for 1 point.

(3) Use a noise filter to prevent RF interference. If the product is used for residential purposes or in an environment with strong voltage interference noise, install a noise filter on the input side of the power cord.

(4) To prevent malfunction caused by electromagnetic interference, the following treatment can be used.

① Install the upper units and noise filters as close to the servo drives as possible.

② Install surge suppressors on the coils of relays, solenoids, and electromagnetic contactors.

③ Separate strong power lines from weak power lines when wiring, and keep the interval of 30cm or above. Do not put them into the same pipe or bundle them together.

④ Do not use a common power supply with welding machines, electrical discharge processing equipment, etc. When there is a high-frequency generator nearby, install a noise filter on the input side of the power supply line.

3.6.1 Anti-interference Wiring Examples and Grounding

The main circuit of the drive uses "high-speed switching elements", so the switching noise may affect normal system operation depending on the peripheral wiring and grounding of the servo drive. Therefore, it is necessary to correctly ground and wiring. Add a noise filter if necessary.

(1) Example of anti-interference wiring

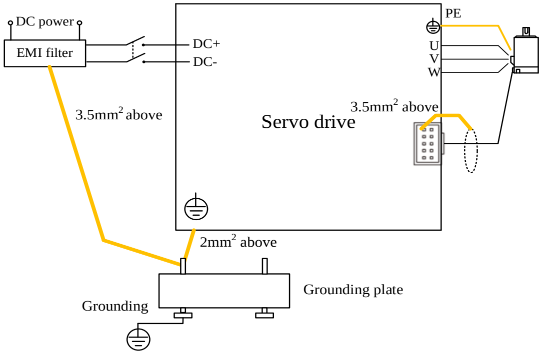


Figure 3.11 Example of anti-interference wiring

Whenever possible, use a thick cable of 3.5 mm ²or above (braided copper cable is recommended) for the connection to the outer case that is grounded;

When using the noise filter, observe the precautions described in " Noise Filter Instructions" below.

(2) Grounding

To avoid possible interference problems, ground the product as follows.

① Ground the servo motor casing

Connect the ground terminal of the servo motor to the ground terminal PE of the servo drive, and ground the PE terminal reliably to minimize potential electromagnetic interference problems.

② Ground the encoder cable shield.

Ground both ends of the shield of the motor encoder cables.

3.6.2 Noise Filter Instructions

To prevent interference from the power supply cable and weaken the performance of the servo drive on any sensitive equipment, select the appropriate noise filter at the power supply input end according to the input current. Also, install noise filters at the power supply lines of peripheral devices as necessary. When installing and wiring the noise filter, observe the following precautions to avoid weakening the actual performance.

(1) Separate the noise filter input and output wiring, and do not put them in the same pipe or bundle them together.

(2) Separate the noise filter's connection cables from its output power cables.

(3) Ground the noise filter separately with as short a thick wire as possible, and do not share a ground wire with other grounding equipment.

(4) Handling of the ground cables of the noise filter installed in the control cabinet: When the noise filter

is installed in the same control cabinet as the servo drive, it is recommended to fix the filter and the servo drive on the same metal plate to ensure that the contacting parts are electrically conductive with a good overlap, and then ground the metal plate.

3.7 Cable Precautions

(1) Do not bend the cables or subject them to tension. The core wire of the signaling cable has a diameter of only 0.2 mm or 0.3 mm, so it is easy to be broken. Please be careful when using it.

(2) When the cable needs to be moved, use flexible cables instead. Ordinary cables are easily damaged by long-term bending. Cables with low-power motors cannot be moved.

(3) When using cable protection chain, please make sure that:

① The bending diameter of the cable is more than 10 times of the outer diameter;

② Do not fix or bundle the wiring inside the cable protection chain, only bundle and fix it at the two immovable ends of the cable protection chain;

③ Do not entangle or twist the cables;

④ Ensure that the duty cycle inside the cable protection chain is lower than 60%;

⑤ Do not mix and match cables with too great a difference in shape, or thick cables may break the thinner ones; set up a spacer in the middle if they have to be mixed and matched.

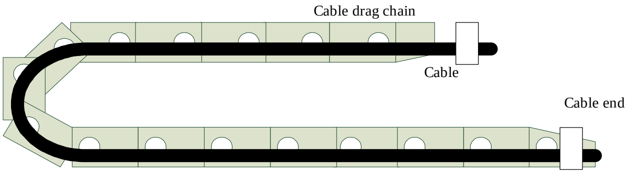


Figure 3.12 Cable protection chain

3.8 Typical Wiring

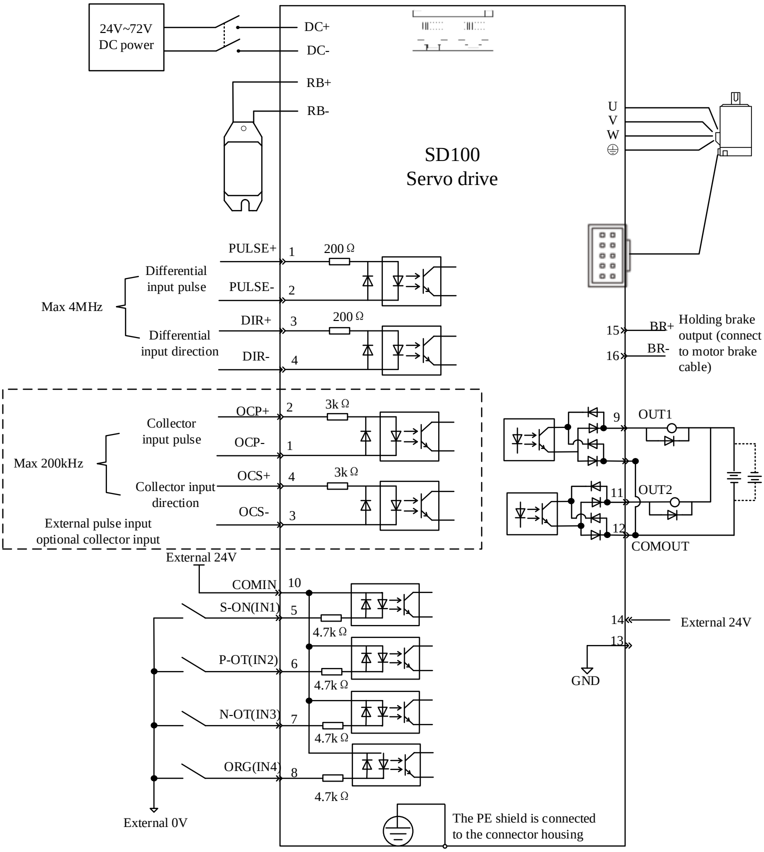


Figure 3.13 Typical wiring example under position control

[1] Example for external power supply wiring;

[2] IN1～IN4 are signal I/O input terminals for X1～X4, and OUT1～OUT2 are signal I/O output signals for Y1 and Y2, so please select and use them according to the functions;

[3] Please use twisted shielded cables for the pulse port, and the shield must be connected to PE at both ends. GND is reliably connected to the signal ground of the upper computer;

[4] Y output power supply is user-provided, power supply range is 5V~24V, allowable maximum voltage DC30V, allowable maximum current 50mA;

[5] Please use twisted shielded cables for the encoder crossover output, the shield must be connected to PE at both ends, and GND is reliably connected to the signal ground of the host computer.

Chapter 4 Debugging and Trial Operation

4.1 Basic Settings

4.1.1 Pre-operation Inspection

Please check and confirm the following items beforehand to ensure that the motor can be operated safely and normally. If problems are found, please handle them properly before operation.

Table 4-1 Check list before servo drive power-on operation

No.	Description
1	The power input terminals (DC+, DC-) of the servo drive must be connected correctly.
2	The servo drive output terminals (U, V, W) and servo motor power cable (U, V, W) phases must be matched correctly.
3	The power input terminals (DC+, DC-) and output terminals (U, V, W) of the servo drive must be connected correctly.
4	The external resistor connection port (RB+/RB-) must be wired correctly.
5	The control signal cable of the servo drive is wired correctly; external signal cables such as holding brake and overtravel protection are connected reliably. The power supply of the holding brake is correct.
6	Servo drive and servo motor must be reliably grounded.
7	Cable diameter, force, etc. are within the specified range.
8	There are no foreign objects such as metal shavings or cable ends inside or outside the servo drive that may cause short circuit of the signals and power cables.
9	The external braking resistor is not placed on a combustible object.
10	Servo motor installation, shaft and mechanical connections must be reliable.
11	The servo motor and the connected machinery must be ready for operation.

4.1.2 Turn on the Power

After the input power is turned on, the bus voltage indicators are on to show that there is no abnormality, and wait for the upper computer to give the servo enable signal.

4.1.3 Switch Input and Output

The input and output terminals of the servo drive can be configured by function codes.

The signal source of input and output terminals is given in two ways:

① via external terminals;

② via the virtual terminals.

The virtual terminal means that the signal state of the corresponding terminal is given through communication.

(1) Example of switch input operation:X1 terminal as an enable signal

Table 4-2 Switch input operation steps

Step	Item	Description
1	Power-up	After the drive is powered up, the PWR green indicator is on and the power is normal.
2	Terminal configuration	Set X1 signal as "servo enable control signal", Pn601=0x0001. That is, select the multifunction control terminal IN1 pin, and it is normally open (normal).
3	External terminal	Connect the terminal switch, the green indicator RUN is on, and then the servo is enabled; Disconnect the terminal switch, the red indicator PWR is off and then the servo is ready but not enabled.
4	External terminal signal monitoring	The current input terminal X1 signal status can be monitored by monitoring function code Un100.01.

(2) Example of operation of a switch output: Y1 as a ready signal

Table 4-3 Switching output operation procedure

Step	Item	Description
1	Power-up	After the drive is powered up, the PWR green indicator is on and the power is normal.
2	Output terminal assignment	Pn611=0x0001 (Y1 output signal is "servo ready"); at this time, Un101.01=1, Y1 terminal output low level.
3	Output terminal monitoring	The servo drive outputs the corresponding signal state without being ready. For example, the drive is currently faulty, bus voltage is not completed, etc.
4	Output terminal signal monitoring	The output terminal signal can be monitored by monitoring function code Un101.01.

(3) Example of virtual terminal input/output operation

Table 4-4 Example of virtual terminal input/output operation steps

Step	Item	Description
1	Power-up	After the drive is powered up, the PWR green indicator is on and the power is normal.
2	Terminal configuration	Set Pn601=0x1001, the X1 terminal is configured as a servo enable control terminal, and the signal of this terminal is given by Pn630.01, and at this time external terminal giving is invalid; Set Pn611=0x1001, that is, the output signal of Y1 terminal is controlled by function code Pn631.01.
3	Input given via virtual terminal	Set Pn630.01=1, the indicator RUN is green, i.e. the drive is enabled; Set Pn630.01=0, the indicator RUN is off, i.e. the drive is enabled and disconnected.
4	Output given	Set Pn631.01=1, and Un101.01=1, output terminal Y1 is low;

	via virtual terminal	Set Pn631.01=0, and Un101.01=0, output terminal Y1 is high.

4.1.4 Trial Jog

Trial jogging refers to the function of checking whether the servo motor can rotate normally through internal commands without connecting to the upper unit, and it can be used to judge whether there is any abnormal vibration or noise during motor rotation.

Jog operation includes:

① JOG mode (under speed control mode);

② Program JOG mode (under position control mode).

4.1.4.1 JOG Mode (Speed)

JOG mode (speed) is the internal operating speed mode of the drive, which performs the speed trajectory planning function in accordance with the parameter Pn500 and the acceleration and deceleration times on Pn310 and Pn311.

Related function codes:

Code	Name	Range	Default	Unit
Pn500	JOG speed	0～3000	200	rpm
Pn310	Speed command trapezoidal acceleration time	0～10000	200	ms
Pn311	Speed command trapezoidal deceleration time	0～10000	200	ms

Related input terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x17	JOGP	Positive jog	Forward jog at high level	By level	🄿 🅂 🅃
0x18	JOGN	Negative Jog	Reverse jog at high level	By level	🄿 🅂 🅃

(1) Operation of the upper computer

Open the debugging software on the upper computer, enter the speed jog interface, and set the related parameters. When the interface is closed and the jog operation is exited, the previously set speed value to Pn500 will be saved.

(2) Terminal jog

Configure the corresponding input terminals to perform forward and reverse jog.

Table 4-5 Example of terminal jog

Step	Item	Description
1	Power-up	The drive is powered up and the PWR indicator is on.
2	Terminal configuration	Pn605=0x0017 (positive jog at high level); Pn606=0x0018 (negative jog at high level).

3	Trial operation	After enable the servo, X1 or X2 continuously gives a high level, it can let the servo to jog, the speed is determined by Pn500.

Precautions

⚠

- Terminal jog is not affected by the control mode, and the terminal jog function can be performed in any mode;
- Terminal forward and reverse jog cannot be valid at the same time.

4.1.4.2 Program JOG (Position)

Program jog is a function that runs continuously along the pre-set operation mode, travel distance, travel speed, acceleration and deceleration time, wait time, and number of travel.

Related function codes:

Code	Name	Range	Default	Unit
Pn502	Program JOG operation mode	0～5	0	-
Pn503	Program JOG travel distance	1～1073741824	60000	pulse
Pn505	Program JOG acceleration /deceleration time	2～10000	100	ms
Pn506	Program JOG wait time	0～10000	100	ms
Pn507	Program JOG travel No.	0～1000	1	time
Pn508	Program JOG travel speed	1～10000	500	rpm

Precautions

⚠

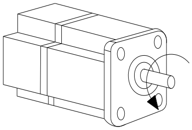
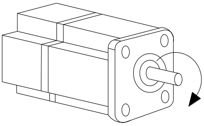
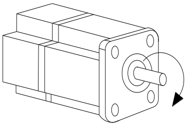
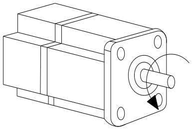
- Program JOG operation is position control; gear ratio and position command filtering are valid.
- To prevent accidents, it is recommended that the over-travel protection function be turned on during use.
- When Pn507 is set to 0, the program JOG runs cyclically all the time.

The specific steps of the JOG mode on the upper computer operation program is shown here:

4.1.5 Rotation Direction

Set the "Rotation direction selection (Pn002)" to change the rotation direction of the motor without changing the polarity of the input command.

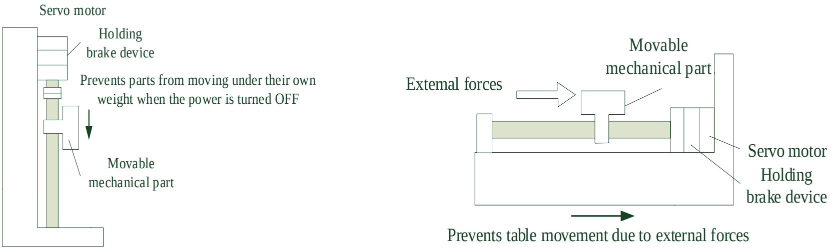
Table 4-6 Rotation direction of the motor

Code Pn002	Command direction	Motor direction
Pn002=0	Positive	 Motor rotates counterclockwise in face of the axis end (CCW)
	Negative	 Motor rotates clockwise in face of the axis end (CW)
Pn002=1	Positive	 Motor rotates clockwise in face of the axis end (CW)
	Negative	 Motor rotates counterclockwise in face of the axis end (CCW)

When the "Rotation direction selection" is changed, the servo driver output pulse pattern and the positive and negative monitoring parameters do not change.

4.1.6 Brake Setting

The holding brake is a mechanism that prevents the servo motor axis from moving when the servo drive is in a non-operating state, keeping the motor locked in position so that the moving part does not move due to self-weight or external force.



a. holding brake used for vertical axis b. holding brake used for horizontal axis

Figure 4.1 Holding brake example

Precautions

- ●The brake coil has no polarity;
- ● The servo enable (S-OFF) should be turned off when the servo motor is stopped;
- ● When the motor with built-in holding brake is running, there might be a clicking sound, but it won't cause any functional problems;
- ● When the holding brake coil is powered on (brake armature in open state), magnetic flux leakage may occur at the axis end and other parts of the motor. Be careful when using magnetic sensors or other devices near the motor;
- ● The holding brake mechanism is fixed and specialized while non-electrically triggered, so it should not be used for dynamic braking and should only be used when the servomotor is held stopped.

(1) Brake signal (/BK) ON when motor starts

When a servo motor starts, the delay time (Pn00B) for the motor to release the holding brake can be set to control the time from the ON signal reception of the servo to actual power-up to the motor.

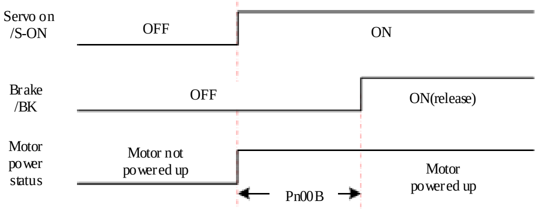


Figure 4.2 /BK signal ON when the motor starts

(2) Brake signal (/BK) OFF when the motor is stopped and locked.

When the servo motor is stopped, the holding brake signal (/BK) and the servo enable signal (/S-ON) are both OFF at the same time. The time from when the servo enable signal (/S-ON) is OFF to when the motor is unpowered state can be changed by setting Pn008.

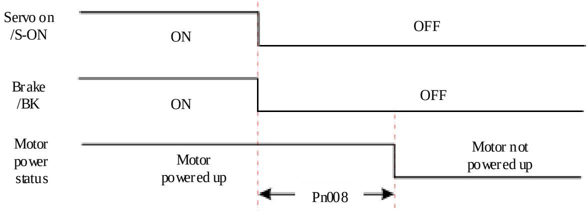


Figure 4.3 /BK signal OFF when the motor stops/locks

(3) Holding brake signal (/BK) OFF when the motor operates

When a warning occurs while the servo motor is running, the servo motor stops and the brake signal (/BK) is turned off. In this case, the brake signal (/BK) output time can be adjusted by setting the value of the brake command output speed (Pn010) and the " Brake command output delay time when servo is OFF during rotation " (Pn009).

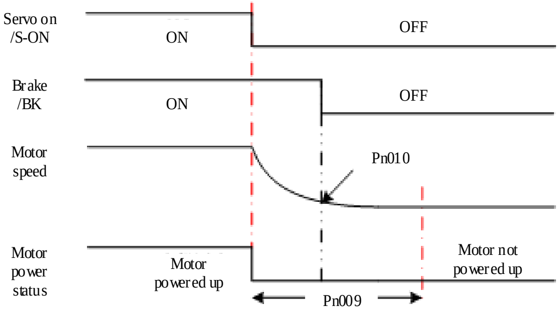


Figure 4.4 T /BK signal OFF during motor operation

Precautions

- ● Brake holding and release times may differ slightly depending on the brake model;
- ● Make sure that the input command comes after the brake opening time to ensure the accuracy of the command;
- ● When the motor is locked, to prevent large mechanical vibration caused by the holding brake during stop, the motor lock time (Pn008) can be set to ensure that the motor does not move then.

4.1.7 Overtravel Setting

The over-travel prevention function of the servo unit regarding safety enables the servo motor to be forced to stop by inputting a limit switch signal when the movable part of the machinery exceeds the allowed area.

The overtravel signals includes positive-overtravel (P-OT) signal and negative-overtravel (N-OT) which are installed at a specific position of the mechanical load, and when the mechanical load exceeds the range of that specific position, the mechanical load is stopped by the P-OT and N-OT signals.

（1） External overtravel signal

Use the switch signal of an external limit switch:

Setting	Mark	Name	Description	Trigger	Mode
0x02	P-OT	Forward running inhibit	When the mechanical movement exceeds the movable range, the overtravel prevention function is on: ON- forward drive is inhibited OFF - forward drive is allowed	By level	P S T
0x03	N-OT	Reverse running inhibit	When the mechanical movement exceeds the movable range, the overtravel prevention function is on: ON-reverse drive is inhibited OFF-reverse drive is allowed	By level	P S T

Connect the input signal of the overtravel limit switch to the pre-assigned input terminal correctly to use the overtravel function. In the case of linear drive (screw), etc., be sure to connect the limit switch as shown in the following diagram to prevent damage to the machine. For the wiring diagram of the input signal, refer to "Control Signal Terminal Wiring".

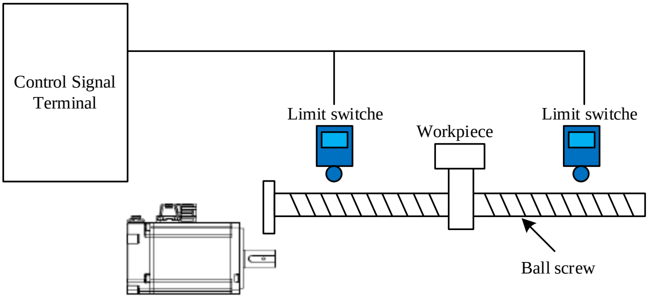


Figure 4.5 External over-travel limit switch connection

When the positive limit switch signal of the servo unit is valid, the servo system will not be allowed to run in the forward direction, but only in the reverse direction;

When the negative limit switch signal of the servo unit is valid, the servo system will not be allowed to run in the reverse direction but only in the forward direction.

If the servo motor reaches the positive limit switch during forward operation or the negative limit switch during reverse operation, the drive will stop immediately until the limit switch is released.

(2) Software limit

The switches for the internal software limit are Pn00D.W and they can be enabled by setting the corresponding function codes.

Related function codes:

Code	Name	Range	Default	Unit
Pn00D.W	Absolute position limit switch	0～2	0	-
Pn030	Software limit - max. absolute single-turn limit	$-2^{31}\sim 2^{31}-1$	0	-
Pn032	Software limit - max. absolute multi-turn limit	$-2^{15}\sim 2^{15}-1$	32767	-
Pn033	Software limit - min. absolute single-turn limit	$-2^{31}\sim 2^{31}-1$	0	-
Pn035	Software limit - min. absolute multi-turn limit	$-2^{15}\sim 2^{15}-1$	-32768	-

Precautions

- The motor encoder must be an absolute encoder (PnF00.W=1 and Pn00D.W=1) to use the soft limit function. W=1 and Pn00D.W=1.
- The soft limit function only distinguishes the number according to the absolute position of the motor encoder, and considers a larger position value to be a positive limit and a smaller position value to be a negative limit.

4.1.8 Overload Setting

Overloads include instantaneous overload and continuous overload.

(1) Setting of overload warning (AL.910) detection time

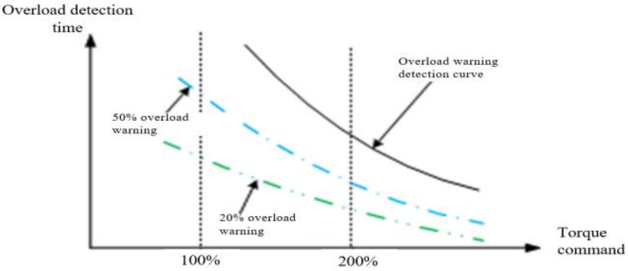


Figure 4.6 Overload warning detection time setting

The factory overload warning detection time is 20% of the overload alarm detection time. Change the overload warning value (Pn015) to change the overload warning detection time. In addition, use it as an overload protection function corresponding to the system to improve the safety of the system.

Example: After changing the overload warning value (Pn015) from 20% to 50% as shown above, the overload warning detection time is half (50%) of the overload alarm detection time.

(2) Instantaneous overload and continuous overload

Report an overload warning via setting "Motor overload base current derating (Pn016)", so that motor overload warning time can be shortened, and the instantaneous overload warning detection can be changed accordingly.

Motor base current after derating = motor current threshold at which the overload warning is started to be calculated (default is 1.15 times the motor) × detectable motor overload base current derating (Pn016).

Example: As shown in Figure 4.7, if Pn016 is set to 50%, an overload warning is reported earlier because the motor overload is calculated from 50% of the base current.

When the value of Pn016 is changed, the overload warning detection time is changed accordingly because the amount of overload warning current is changed.

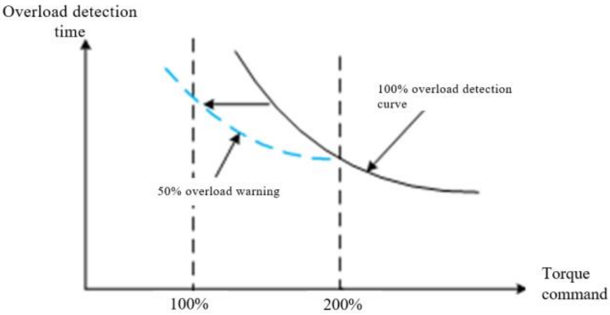


Figure 4.7 Motor overload warning detection time

As shown in Figure 4.8 Curve example of drive and motor overload, the overload curve of the motor in it shows (the two curves lower) that the overload starting point is 115%, continuous overload and instantaneous overload threshold is 180%; drive overload curve (two curves higher) starting point is 115% and the critical point is 170%.

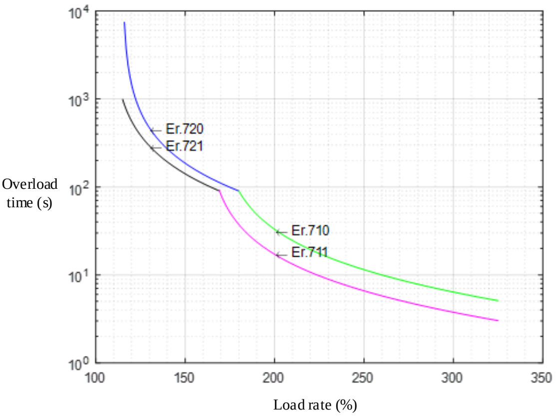


Figure 4.8 Servo drive and servo motor overload curves

Precautions

- The overload curves are different for different motors and drives.

4.1.9 Torque Limit

(1) Torque limit method

Output torque can be limited to protect the machine, etc., and divided into internal and external limiting. And the torque limit can be set via Pn050.

Related function codes:

Code	Name	Range	Default	Unit
Pn050	Torque limiting method selection	0～5	2	-
Pn051	Internal forward torque limit	0～500	300	%
Pn052	Internal reverse torque limit	0～500	300	%
Pn053	Emergency stop torque	0～800	800	%
Pn054	External torque limit1	0～500	300	%
Pn055	External torque limit2	0～500	300	%

Precautions

- If the set value exceeds the maximum torque of the servo motor, the actual torque will still be limited to the maximum torque of the servo motor.
- If the set value is too small, insufficient torque may occur when the servo motor is accelerated or decelerated, so set it according to the actual needs.

(2) Torque limit (TLT)

Torque limiting means that output torque is now under limit. This signal can be used to check the current torque limit status of the motor.

Setting	Mark	Name	Description	Trigger	Mode
0x05	TLT	Torque limiting	When the output torque of the motor is within the set range, this signal is ON. When the motor output torque is beyond the set range, this signal is OFF.	By level	P S T

(3) Torque limit during undervoltage

Undervoltage warning is detected when the main circuit DC voltage inside the servo unit is below the specified value due to an instantaneous power failure or insufficient power supply to the main circuit power supply voltage for a short period of time; in this case, the output current can be optionally limited via the relevant parameters as shown in the table below.

Code	Name	Range	Default	Unit
Pn045	Function selection during main circuit (DC) undervoltage	0: Undervoltage warning not reported 1: Undervoltage warning reported 2: Undervoltage warning is reported and torque limit is performed via Pn046 and Pn047	0	-
Pn046	Torque limiting during main circuit voltage drop	0～100	50	%
Pn047	Torque limiting release time during main circuit voltage drop	0～1000	100	ms

By combining this function with the instantaneous stop holding time function, when the power supply voltage is insufficient, shutdown caused by an alarm can be avoided and operation can be continued without power restoration.

The undervoltage warning applies torque limit within the servo unit. After receiving the undervoltage warning release signal, the torque limit value is controlled within the servo unit according to the set release time, and the logic timing is shown in Figure 4.9.

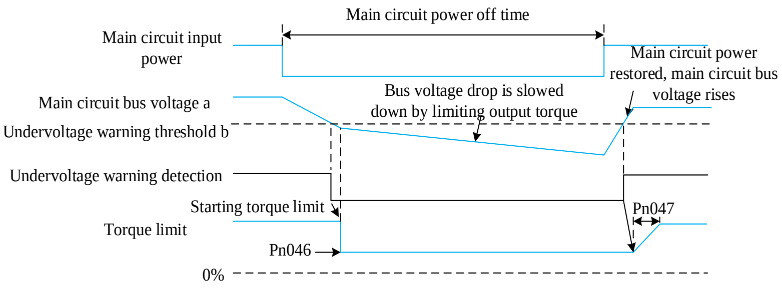


Figure 4.9 Undervoltage warning i.e. warning release sequence

4.1.10 Stop Mode

The servo will perform different stop modes according to malfunction, servo OFF, and over-travel (OT) settings. In the case of servo-OFF stop and fault stop Gr.1, when Pn039 is set to 0, the deceleration stop function is invalid and a free stop is performed.

Related function codes:

Code	Name	Range	Default	Unit
Pn004	Gr.1 alarm and servo-off stop mode	2: free stop	2	-
Pn005	Gr.2 alarm stop mode	0: zero-speed stop 1: same as Pn004	0	-
Pn007	Stop mode under over-travel (OT)	0: free stop 1: Stop the motor with the value of Pn053 as the maximum deceleration torque, and servo is locked. 2: Stop the motor with the value of Pn053 as the maximum deceleration torque, and then free running starts.	0	-
Pn039	Deceleration stop time at servo-off	0~10000	0	1ms

Precautions

● For the vertical axis, after entering overtravel, the workpiece may fall due to the brake signal (/BK) being turned ON (release brake). To prevent this, set to make the servomotor fixed at the zero position after stopping (Pn007=1)";

When an external force causes overtravel, the motor stops and enters base blocking state, and the load axis end may be pushed back by the external force. To prevent this, set to make the servo motor fixed at the zero position after stopping (Pn007=1)";

● When the servo motor is stopped or rotating at a very low speed, if dynamic braking is selected here, no braking force will be generated as free stop;

● Zero-speed stop is valid only for position control and speed control.

4.1.11 Regenerative Brake Setting

When the torque and speed of the motor are in opposite directions, the energy is fed back into the drive from the motor end, lifting the drive bus voltage value, and when the bus voltage rises to the preset braking point, the energy can only be consumed through the braking resistor. The braking energy must be consumed, otherwise it will cause damage to the drive.

Precautions

● When connecting an external regenerative braking resistor, be sure to set appropriate values for Pn012 and Pn013, otherwise the regenerative overload warning will not be reported properly and the external regenerative resistor may be damaged.

● When selecting an external regenerative braking resistor, be sure to check that the capacity is appropriate, otherwise injury or fire may result.

4.2 Position Mode

Position control refers to controlling the position of the motor by position commands. The total number of position commands determines the target position of the motor, and the frequency of position commands determines the speed of motor rotation. Position commands can be given by external pulse, internal position commands, and so on. Through the internal encoder (encoder included in the motor), the servo drive can realize fast and accurate control of the position and speed of the machinery.

Position control is mainly used where positioning control is required.

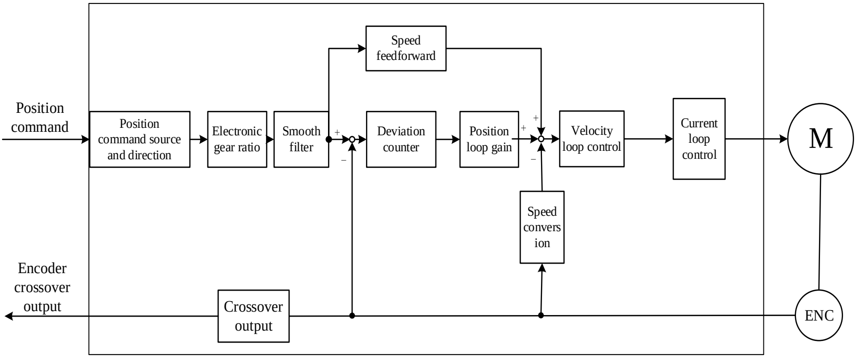


Figure 4.10 Position control block diagram

4.2.1 Pulse Command Source Selection

Set the position command source via function code Pn200 under position control. Please set the corresponding parameters according to actual needs.

Related function codes:

Code	Name	Range	Default	Unit
Pn200.X	Pulse command source selection	0: external high-speed pulse train 1: external low-speed pulse train 2: reserved 3: internal position command	0	-

4.2.2 Pulse Command Filter Selection

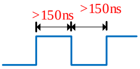
Select the appropriate command pulse filter via parameter Pn202.Y based on the frequency of the highest pulse during operation. Inappropriate selection may cause the servo unit to receive pulses abnormally.

If the instantaneous pulse frequency is too high, the pulse width will be lower than the filter width setting, in this case, and the pulse will be filtered out as noise. Therefore, the filter width setting must be lower than the actual pulse width, the former being 4 times or lower than the latter is highly recommended.

Example: A filter width duration shorter than 150ns is regarded as an interference signal.

When the pulse bandwidth of this segment is less than 150ns, it is considered to be low collimation, so the two input pulses are considered to be one pulse

When the pulse bandwidth of this segment is less than 150ns, it is considered to be low collimation, so the two output pulses are considered to be one pulse



When the width of the High and Low duty pulses is greater than 150ns, it is ensured that the pulse commands are not filtered out.

Figure 4.11 Pulse command filtering

Related function codes:

Code	Name	Range	Default	Unit
Pn200.Y	Pulse command filter time selection	0: pulse command input filter 1 1: pulse command input filter 2 2: pulse command input filter 3 3: pulse command input filter 4 4: pulse command input filter 5 5: pulse command input filter 6 6: pulse command input filter 7 7: pulse command input filter 8 8: filter time setting via Pn011	0	-
Pn011	External pulse signal filtering time customization	0～5000	400	12.5ns

4.2.3 Pulse Command Multiplier

Switch the input multiplier of position command pulses through switch of the command pulse input multiplier switching input (/P-GAIN) signal. The command pulse input multiplier is a multiplier that multiplies the number of command pulses input to the servo unit. The multiplier can be switched from 1 to n (max. 100). The multiplier is set with the command pulse input multiplier (Pn203).

Whether the multiplier is switched or not can be confirmed by command pulse input multiplier switching output (PSELA) signal.

Related function codes:

Code	Name	Range	Default	Unit
Pn271	External pulse command multiplier selection	0: invalid 1: forced valid 2: DI terminal P-GAIN control valid or not	0	-
Pn203	External pulse command multiplier	1～100	1	-

Related input terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x10	P-GAIN	Command pulse input multiplier switching	This signal is used to change the frequency of the command pulse input during position mode. Invalid: switch to normal pulse input mode; Valid: switch to the set multiplier.	By level	P

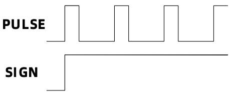
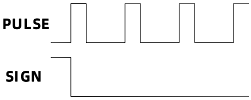
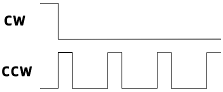
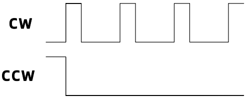
The command pulse input multiplier signal is a general-purpose configurable switching input, see "Control Signal Terminal Wiring" for details.

Precautions

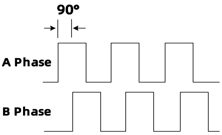
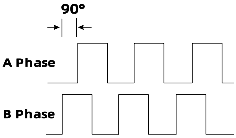
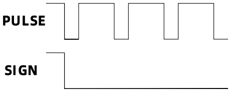
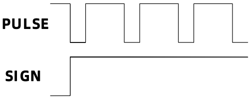
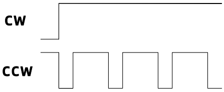
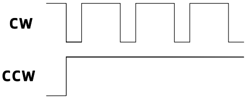
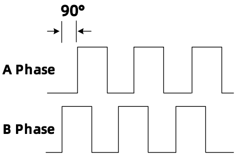
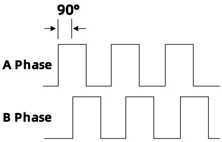
- If the input pulse frequency is too low and the Pn203 is too large, the speed may not be smooth.
- Switch the command pulse multiplier when the position command pulse is 0. If it is not 0, then the servo motor may deviate from the position or lose the position.

4.2.4 Pulse Input Pattern

Table 4-7 Description of pulse input patterns

Pn202.X	Pn201	Command	Forward command	Reverse command
0	0	Pulse + Direction		
0	1	CW+CCW		

Select the pulse input pattern of the servo unit according to the pulse output pattern of the upper system.

0	4	Orthogonal encoding 4x		
1	0	Pulse + Direction		
1	1	CW+CCW		
1	4	Orthogonal encoding 4x		

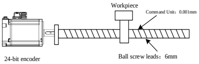
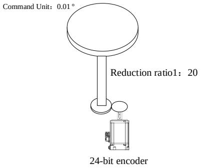
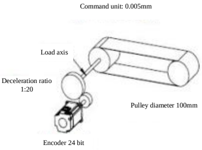
4.2.5 Electronic Gear Ratio

When the machine deceleration ratio between the motor axis and the load side is n/m (the load axis at n revolutions when the motor at m revolutions), the setting value of the electronic gear ratio can be obtained by the following formula:

$$\text{Electronic gear ratio} = \frac{\text{Pn204}}{\text{Pn206}} = \frac{\text{encoder resolution}}{1 - \text{turn movement of load axis (command unit)}} \times \frac{m}{n}$$

Table 4-8 Electronic gear ratio setting routine

Step	**Description**	**Mechanical system composition**		
		Ball screw	**Round table**	**Belt + pulley**

-	-			
1	Specification	Ball screw lead: 6mm Deceleration ratio: 1/1	Rotation angle of 1 turn: 360 ° Deceleration ratio: 1/20	Pulley diameter: 100mm (Pulley circumference: 314mm) Deceleration ratio: 1/20
2	Encoder resolution	16777216(24 bit)	16777216(24 bit)	16777216(24 bit)
3	Command unit	0.001mm	0.01 °	0.005mm
4	1-turn movement of load axis (command unit)	6mm/0.001mm = 6000	360 °/0.01 ≒ 36000	314mm/0.005mm = 62800
5	Electronic gear ratio	$\frac{B}{A}=\frac{16777216}{6000}\times\frac{1}{1}$	$\frac{B}{A}=\frac{16777216}{36000}\times\frac{20}{1}$	$\frac{B}{A}=\frac{16777216}{62800}\times\frac{20}{1}$
6	Parameter	Pn204:16777216	Pn204:16777216	Pn204:16777216
		Pn206:6000	Pn206:1800	Pn206:3140

Precautions

●If the numerator of the electronic gear ratio is 0, the denominator is the number of command pulses corresponding to one revolution of the motor.

● 0. 001⩽ electronic gear ratio (B/A) ⩽ 64000, "Parameter error (Er.040)" occurs if the setting range is exceeded.

● If the electronic gear ratio range is exceeded after the deceleration ratio is calculated in the electronic gear ratio, consider to adjust the pulse input multiplier.

4.2.6 Pulse Deviation Clearing

The deviation clear signal (/CLR) is an input signal to clear the servo drive pulse deviation counter.

Related function codes:

Code	Name	Range	Default	Unit
Pn272	Position deviation clear (CLR) signal	0: position deviation is cleared at high level (H) 1: position deviation is cleared at rising edge	0	-

	status	2: position deviation is cleared at low level (L) 3: positional deviation is cleared at falling edge		
Pn273	Position deviation clear action	0: Servo OFF, position deviation is cleared upon a malfunction; 1: position deviation is not cleared (cleared only by CLR signal); 2: position deviation is cleared upon a malfunction	0	-

Related input terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x11	CLR	Position deviation clear	Clear the position pulse deviation. When this signal is valid, the position pulse deviation accumulated by the servo drive is cleared to zero.	By level	🄿

Precautions
● If the pulse deviation clear is set, then the servo lock function is invalid. In this case, the servo motor rotates at a slight speed due to the drift pulse in the speed loop. ● When operating in position mode, the servo motor stops due to the travel limit, and the position deviation is still maintained, so pay attention to the safety when excluding the travel limit.

4.2.7 Command Pulse Inhibit

The command pulse inhibit (INHIBIT) function stops the counting of command pulse input during position control. When this function is valid, the servo unit cannot receive command pulse input.

Related input terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x0D	INHIBIT	Command pulse inhibit	This signal is used to control the drive from receiving pulse commands. Valid: stops receiving pulse commands and counting. Invalid: allows receiving pulse commands and counting.	By level	🄿 🅂 🅃

4.2.8 Position NEAR

Under positioning near (NEAR) control, the upper unit can receive the position near signal before confirming the positioning completion signal to prepare for the sequence of actions after positioning completion. In this way, the time required for the action at the completion of positioning can be shortened. This signal is usually used in pairs with the positioning completion signal. For details on the position completion signal, refer to the "Position Completion“.

Related output terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x09	NEAR	Position near	When the current position deviation is within the position near signal threshold (Pn260), this signal output is ON. When the current position deviation is beyond the position near signal threshold (Pn260), this signal output is OFF.	By level	🄿 🅂 🅃

The positioning near output condition is that the difference between the number of command pulses from the upper unit and the servo motor movement (position deviation) is lower than the set value of Pn260 (position near signal width), and the signal is output.

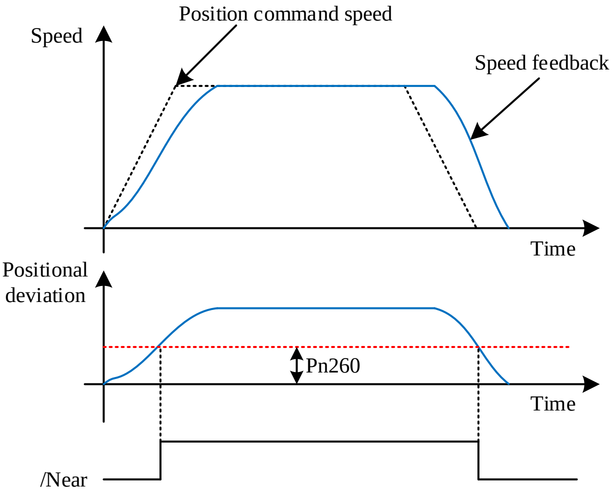


Figure 4.13 Positioning near signal output diagram

4.2.9 Position Completion

Signal (COIN) indicates the position completion of the servo motor during position control.

Position completion related configuration:

Code	Name	Range	Default	Unit
Pn262	Position completion range	0～1073741824	7	User unit
Pn200.W	Position completion signal (COIN) output timing	0: output when the absolute value of position deviation is lower than the positioning completion range (Pn262) 1: output when the absolute value of position deviation is lower than the positioning completion range (Pn262) and the position command after the filter is 0. 2: output when the absolute value of position deviation is lower than the positioning completion range (Pn262) and the position command output is 0.	0	-

Related output terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x02	COIN	Position completion	When the current position deviation is within the position completion signal threshold (Pn262), this signal output is ON. When the current position deviation is beyond the position completion signal threshold (Pn262), this signal output is OFF.	By level	🄿 🅂 🅃

Under position control, a signal indicating completion of servo motor positioning is output when the difference between the number of command pulses from the upper unit and the amount of servo motor movement (position deviation) is lower than the set value of Pn262 is sent to confirm that positioning has been completed by the upper unit. If the setting value of Pn262 is too large and the deviation is small in low-speed operation, the positioning completion signal may be output repeatedly. If this happens, lower the setting value of Pn262.

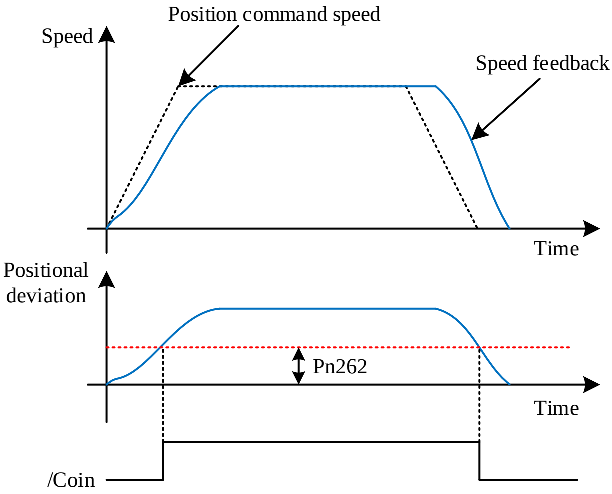


Figure 4.14 Positioning completion signal output diagram

4.2.10 Position Command Smoothing Setting (Position Command Filtering)

Filter the command pulse input to smooth the rotation of the servo motor. This function is valid in the following cases:

1 When there is no acceleration or deceleration by the commanding unit;

2 When the command pulse frequency is extremely low;

③ If the position command smoothing function is set, the response of the system may be reduced, so please use it appropriately.

Related function codes

Code	Name	Range	Default	Unit
Pn211	Position command low-pass filter time constant	0～655	0	ms
Pn212	Position command time moving average filter	0～1000	0	ms

The position command low-pass filter reduces mechanical shocks in case of sudden changes in the input frequency of the pulse command.

The difference between the position command low-pass filtering time constant and the position command moving average filtering time is shown below.

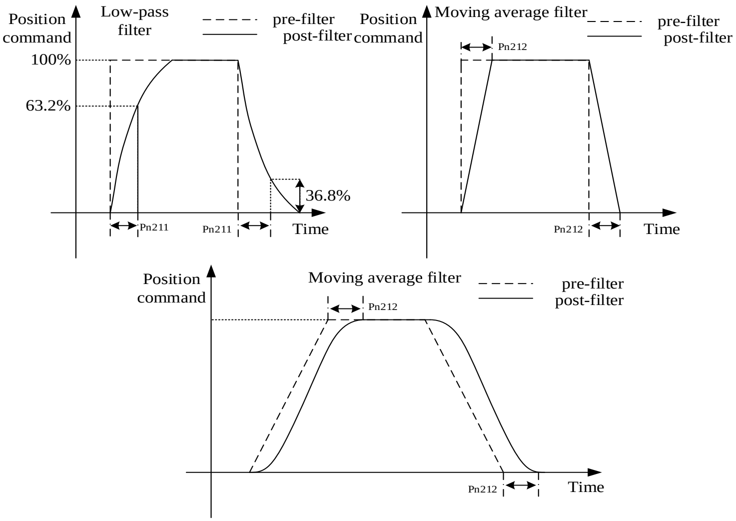


Figure 4.15 Effect of several filters

4.2.11 Position Control Operation

Generally, the maximum open collector pulse command frequency is 200kHz; when users use higher frequency or specific linear output pulse, it is recommended to use linear differential input interface.

For details of pulse wiring, please refer to "Control Signal Terminal Wiring".

Take the linear differential input as an example to introduce the operation of servo driver position control.

Example: PLC linear differential output pulse, orthogonal AB phase, the motor rotates one turn for every 10,000 pulses. The operation steps are shown in Table 4-9.

Table 4-9 External encoder debugging example with 5V differential output

Step	Item	Description
1	Power-up	After the drive is powered up, the PWR green indicator is on and the power is normal.
2	Control mode selection	Pn000.X=0 (control mode selected as position mode); Pn200.X=0 (source of pulse command from multifunction control terminal).
3	Pulse pattern selection	Pn201=4 (pulse input method as " orthogonal AB "); Pn202.X=0 (pulse input with positive logic).
4	Electronic gear ratio setting	Pn204=8388608 (23-bit encoder), Pn206=10000. (For every 10000 pulses received by the drive, the motor runs 1 revolution).
5	Pulse sending to servo	PLC sends pulses at a constant frequency in a certain number of ways at certain intervals.

6	Received pulse frequency and number checking	Monitor function code Un007 to determine whether the speed of the received pulses matches the actual ones sent; Monitor Un006 to check whether the input pulse counter Un006 matches the actual number sent.

4.3 Speed Mode (Internal Setting)

4.3.1 Function Brief

The speed command source supported by this product is mainly set by an internal register.

Set the internal register speed, via the preset motor speed by the internal user parameters in the servo drive, and select it by using the external input signal to perform the speed control operation without external configuration of the speed generator or pulse generator.

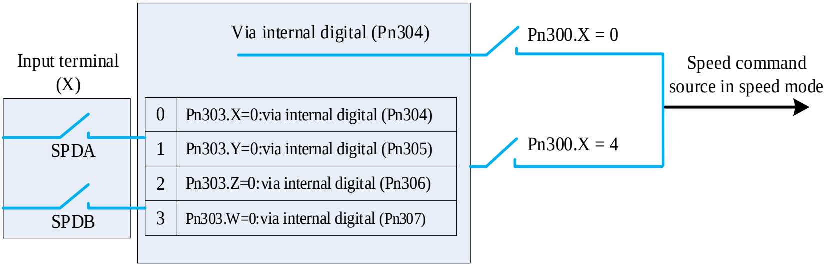


Figure 4.16 Speed command source

Related function codes

Code	Name	Range	Default	Unit
Pn300	Speed command source selection	0: given via internal digit (Pn304); 2: reserved; 3: reserved; 4: given via internal combined digit;	0	-
Pn301	Speed command direction	0: same as speed command 1: opposite to speed command	0	-
Pn302	Speed command low-pass filter	0.00~655.35	0.4	ms
Pn303.X	Speed command source 1	0: given via internal digit (Pn304) 2: reserved	0	-
Pn303.Y	Speed command source 2	0: given via internal digit (Pn305) 2: reserved	0	-
Pn303.Z	Speed command source 3	0: given via internal digit (Pn306) 2: reserved	0	-
Pn303.W	Speed command source 4	0: given via internal digit (Pn306)	0	-

		2: reserved		
Pn313	Max. zero-speed clamp compensation speed	50~10000	1000	r/min
Pn313	Rotation detection value	1~10000	20	r/min
Pn318	Max. motor speed	0~10000	10000	r/min
Pn320	Velocity clamp signal range	0~100	10	r/min

Related input terminals

<table>
<tr><th>Setting</th><th>Mark</th><th>Name</th><th>Description</th><th>Trigger</th><th>Mode</th></tr>
<tr><td>0x08</td><td>SPD-D</td><td>Speed command direction switching in speed mode</td><td>This signal is used to adjust the output direction of the torque command through this terminal in the speed control mode:
Invalid: same as speed command;
Valid: opposite to the speed command.</td><td>By level</td><td>S</td></tr>
<tr><td>0x09</td><td>SPD -A</td><td>Internal register speed command buffer selection 1</td><td rowspan="2"><table><tr><th>SPD-B</th><th>SPD-A</th><th>Command source</th></tr><tr><td>0</td><td>0</td><td>Pn303.X</td></tr><tr><td>0</td><td>1</td><td>Pn304.Y</td></tr><tr><td>1</td><td>0</td><td>Pn305.Z</td></tr><tr><td>1</td><td>1</td><td>Pn306.W</td></tr></table></td><td rowspan="2">By level</td><td rowspan="2">S</td></tr>
<tr><td>0x0A</td><td>SPD -B</td><td>Internal register speed command buffer selection 2</td></tr>
</table>

4.3.2 Soft Start

Soft start is a speed command that converts a step speed command into a smoother constant acceleration or deceleration. Set acceleration and deceleration time, and this function is used when smooth speed control is desired during speed control.

Related function codes:

Code	Name	Range	Default	Unit
Pn310	Soft start acceleration time (ACC) in speed control mode	0～10000	200	ms
Pn311	Soft start deceleration time (ACC) in speed control mode	0～10000	200	ms

Pn310 is the time required for the motor to reach the maximum speed from stop; Pn311 is the time required for the motor from stop to the maximum speed. The actual acceleration and deceleration times are calculated by the following formula.

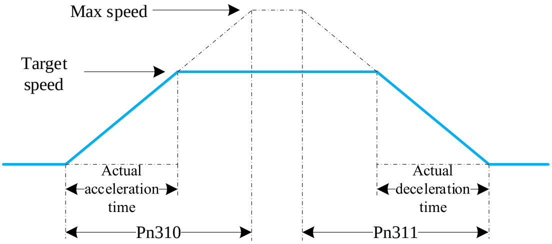


Figure 4.17 Soft start acceleration and deceleration time effect

4.3.3 Zero-speed Clamp

The zero-speed clamp locks the servo when the speed command falls below the zero-speed fixed speed threshold (Pn313) when the zero-speed clamp (/ZCLAMP) is ON. At this time, a position loop is formed inside the servo unit and the speed command is ignored. The servo motor is fixed within ±1 pulse of the zero-speed fixed effective position, and returns to the zero-speed fixed position even if rotation occurs due to an external force.

Related function codes:

Code	Name	Range	Default	Unit
Pn313	Zero-speed fixed speed threshold	0～10000	10	rpm

Related input terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x0C	ZCLAMP	Zero-speed clamp	Lock the servo at high level when the speed command is lower than Pn313.	By level	S

Precautions	
	● When the servo motor is fixed at the zero position, there is a ±1 pulse jump, and even if rotation occurs due to an external force, it returns to the zero fixed position.

4.3.4 Rotation Detection Signal

If the motor speed exceeds the set value to Pn317 (rotation detection value), the switching rotation detection signal (/TGON) is output.

Related parameters:

Code	Name	Range	Default	Unit
Pn317	Rotation detection value	0～10000	20	rpm

Related output terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x04	/TGON	Rotation signal	This signal is output when the motor running speed is lower than the rotation detection value.	By level	🄿 🅂 🅃

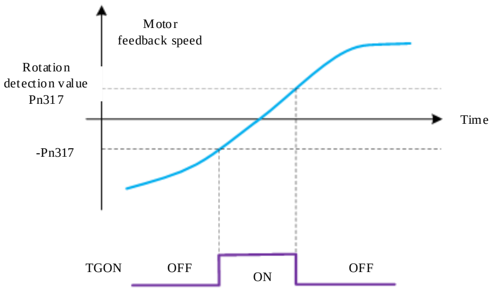


Figure 4.18 Rotation signal output

4.3.5 Velocity Clamp

Velocity clamp signal (/V-CMP) means that when the absolute value of the deviation between the actual feedback speed of the motor and the target command speed is within the range of the set value on Pn320, the corresponding signal will be output.

Example: Pn320 = 50rpm, the target speed is 2000rpm, and the /V-CMP signal is output when the motor speed is in the range of 1950rpm to 2050rpm.

Related function codes:

Code	Name	Range	Default	Unit
Pn320	Velocity clamp threshold value	0～100	10	rpm

Related output terminals:

Setting	Mark	Name	Description	Trigger	Mode
0x03	/V-CMP	Velocity clamp	This signal is output when the deviation between the motor feedback speed and the given speed is lower than Pn320	By level	🄿 🅂 🅃

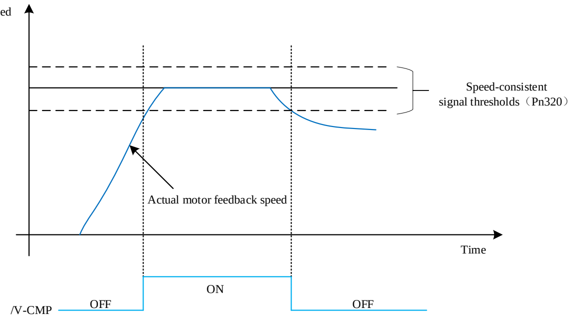


Figure 4.19 Velocity clamp signal output

4.3.6 Speed Control Operation Example

Example 1: Users set the speed through the internal function code register.

Table 4-10 Example of internal digital-giving speed operation

Step	Item	Description
1	Power-up	After the drive is powered up, the PWR green indicator is on and the power is normal.
2	Control mode selection	Pn000.X=1 (control mode is speed mode); Pn300=0 (source of speed command is Pn304).
3	Enable servo	Pn001.X=0, enable the servo
4	Speed adjustment	Set the value on Pn304 to adjust the motor speed. Pn304=100, the motor runs forward at 100rpm; Pn304=-100, the motor runs in reverse at -100rpm; Pn304=0, the motor is stopped and the shaft is locked.

Example 2: Users set the desired target speed via the terminals.

Table 4-11 Example of internal combined speed operation

Step	Item	Description
1	Power-up	After the drive is powered up, the PWR green indicator is on and the power is normal.
2	Control mode selection	Pn000.X=1 (control mode is speed mode) Pn300=4(The source of the speed command is given via internal combined digit)
3	Terminal assignment	Pn601.YX=0x08(set IN1 to SPD-D); Pn602.YX=0x09(set IN2 to SPD-A); Pn603.YX=0x0A(set IN3 to SPD-B)。
4	Speed command source setting	Pn303.X=0(Speed command source set via internal speed on Pn304); Pn303.Y=0(Speed command source set via internal speed on Pn305); Pn303.Z=0(Speed command source set via internal speed on Pn306);

		Pn303.W=0(Speed command source set via internal speed on Pn307);
5	Multi-segment speed value setting	Set Pn304,Pn305,Pn306,Pn307.
6	Servo enable	Set internal enable Pn001.X=1.
8	Switching setting	Adjust three speed switches for speed selection; SPD-D regulates the direction of operation; SPD-A and SPD-B together control the segment number of the internal speed.

4.4 Torque Mode (Internal Setting)

4.4.1 Function Brief

Internal torque setting enables torque control by four preset torque commands in the servo drive by users and external signal input. Any one of the four torques can be used for toque control, and no external torque generator is required.

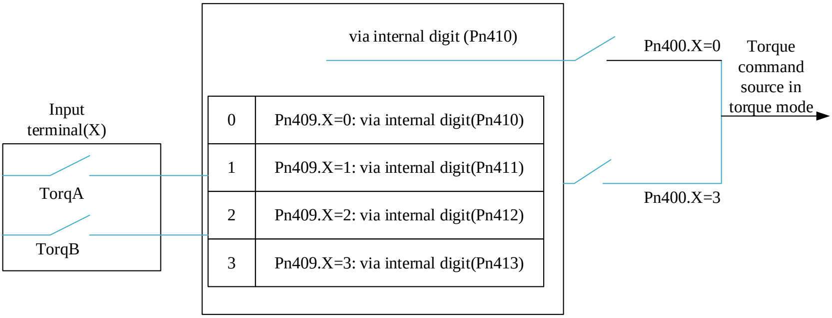


Figure 4.20 Torque command source in torque mode

Related function codes:

Code	Name	Range	Default	Unit
Pn400.X	Command source selection in torque mode	0: via internal digit 2: reserved 3: via combined internal digit 4: single trigger from external control 5: via CANopen	0	-
Pn400.Y	Speed limit source selection in torque control	0: reserved 1: reserved 2: via internal digit 3: via DI terminal 4: via torque command	2	-

Pn403	Torque command direction	0: the same as torque command 1: opposite to torque command	0	rpm
Pn404	Torque command first-order low-pass filter time	0.00～655.35	0.00	ms
Pn409.X	Torque command source 1	0: given via internal digit (Pn410) 1: reserved 2: reserved	0	-
Pn409.Y	Torque command source 2	0: given via internal digit (Pn411) 1: reserved 2: reserved	0	-
Pn409.Z	Torque command source 3	0: given via internal digit (Pn412) 1: reserved 2: reserved	0	-
Pn409.W	Torque command source 4	0: given via internal digit (Pn413) 1: reserved 2: reserved	0	-
Pn415	Internal speed limit value in torque control	0～10000	0	rpm

Related input terminals

<table>
<tr><th>Setting</th><th>Mark</th><th>Name</th><th>Description</th><th>Trigger</th><th>Mode</th></tr>
<tr><td>0x0F</td><td>TPR-D</td><td>Torque command direction switch in torque mode</td><td>This signal is used to adjust the output direction of the torque command through this terminal in the torque control mode:
Invalid: same as the torque command;
Valid: opposite to the torque command.</td><td>By level</td><td>T</td></tr>
<tr><td>0x12</td><td>TOR-A</td><td>Internal register torque command buffer selection 1</td><td rowspan="2"><table><tr><th>TOR-B</th><th>TOR-A</th><th>Command source</th></tr><tr><td>0</td><td>0</td><td>Pn409.X</td></tr><tr><td>0</td><td>1</td><td>Pn409.Y</td></tr><tr><td>1</td><td>0</td><td>Pn409.Z</td></tr><tr><td>1</td><td>1</td><td>Pn409.W</td></tr></table></td><td rowspan="2">By level</td><td rowspan="2">T</td></tr>
<tr><td>0x13</td><td>TOR-B</td><td>Internal register torque command buffer selection 2</td></tr>
</table>

4.4.2 Speed Limit in Torque Control

Speed limit function limits the speed of the servo motor to protect it. In torque control, the servo motor is controlled to output the controlled torque, but the motor speed is not controlled. As a result, when a command torque greater than the machine-side torque is given, the motor speed will increase dramatically, so its speed needs to be limited.

Related function codes

Code	Name	Range	Default	Unit
Pn415	Internal speed limit value in torque control	0～10000	0	rpm

4.4.3 Example of Torque Controlled Operation

Example 1:

Table 4-12 Example of internal torque operation

Step	Item	Description
1	Control mode selection	Pn000.X=2 (control mode is torque mode) Pn400.X=0(torque source is selected from Pn410) Pn400.Y=2(Select the speed limit in torque mode via Pn415)
2	Torque setting	Pn410=0, enable the servo, but motor stays still.
3	Speed limit	Pn415=1000 speed limit is 1000rpm in torque control.)
4	Servo enable	Pn001.X=1
5	Torque adjustment	Pn410 = 20, the motor speed reaches 1000 rpm with no load.

Example 2

Table 4-13 Example of internal combined speed operation

Step	Item	Description
1	Control mode selection	Pn000.X=2 (control mode is torque mode); Pn400.X=3(select the torque source to internal combined digit); Pn400.Y=2(select the speed limit in torque mode via Pn415)
2	Terminal assignment	Pn601.YX=0x0F (set IN1 to TOR-D); Pn602.YX=0x12(set IN2 to TOR-A); Pn603.YX=0x13(set IN3 to TOR--B).
3	Torque command source setting	Pn409.X=0(torque command source set via internal speed on Pn410); Pn409.Y=0(torque command source set via internal speed on Pn411); Pn409.Z=0(torque command source set via internal speed on Pn412); Pn409.W=0(torque command source set via internal speed on Pn413)。
4	Torque command setting	Set internal torque to Pn410, Pn411, Pn412 and Pn413.
5	Speed limit setting	Set the speed limit value to Pn415 in torque mode.
6	Enable servo	Pn001.X=1

7	Switching setting	Switch torque switching signals; SPD-D regulates the direction of operation; SPD-A and SPD-B together control the internal torque command source (Pn409.X～Pn409.W).

4.5 Combined Control Mode

4.5.1 Basic Setting of Combined Control Mode

The servo unit can be switched by combining two modes from various control modes.

Related function codes

Code	Name	Range	Default	Unit
Pn000.X	Control mode selection	0: position control mode 1: speed control mode 2: torque control mode 3: speed-position mode 4: torque-position mode 5: speed-torque mode 6: speed-position-torque mode	0	-

Related input signals:

Setting	Mark	Name	Description	Trigger	Mode
0x0B	C-SEL	Control mode selection	This signal is used to select the control modes.	By level	P S T
0x1A	C-SEL2	Control mode selection	This signal is used to select the control modes.	By level	P S T
0x1B	C-Ctrig	Control mode selection confirmation	This signal is used for confirmation of the control mode selection.	By level	P S T

In combined control mode, switch the combined mode among speed mode, tongue mode, position mode via "C-SEL"

In combined control mode, the mode switching is controlled by the "Control mode selection' terminal signal. (C-SEL).

P000.X	Control mode selection(C-SEL)	
	High level (H)	Low level (L)
3	Position mode	Speed mode
4	Position mode	Torque mode
5	Torque mode	Speed mode

Pn000.X	Control mode selection		C-Trig	Control mode
	C-SEL	C-SEL2		
6	0	0	↑	Speed mode
	0	1		Position mode
	1	0		Torque mode

4.5.2 Speed-Position Control Mode

After setting the control mode selection signal (/C-SEL), users select the corresponding control mode through the upper device.

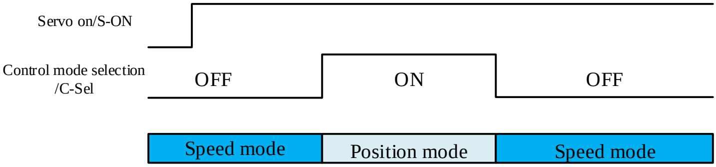


Figure. 4.22 Timing diagram of speed-position control

4.5.3 Torque-Position Control Mode

After setting the control mode selection signal (/C-SEL), users select the corresponding control mode

through the upper device.

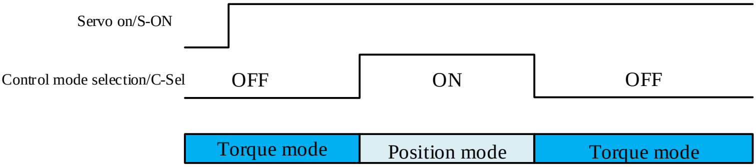


Figure 4.23 Timing diagram of torque-position control

4.5.4 Speed-Torque Control Mode

After setting the control mode selection signal (/C-SEL), users select the corresponding control mode

through the upper device.

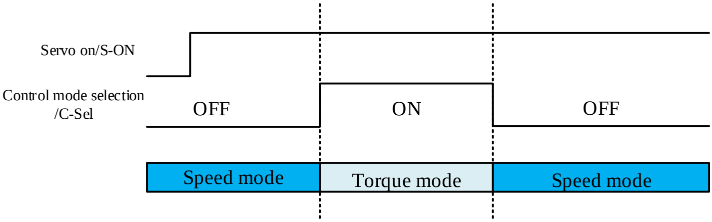


Figure 4.24 Timing diagram of speed-torque control

4.5.5 Speed-Position-Torque Control Mode

After setting the control mode selection signal (/C-SEL), users select the corresponding control mode

through the upper device.

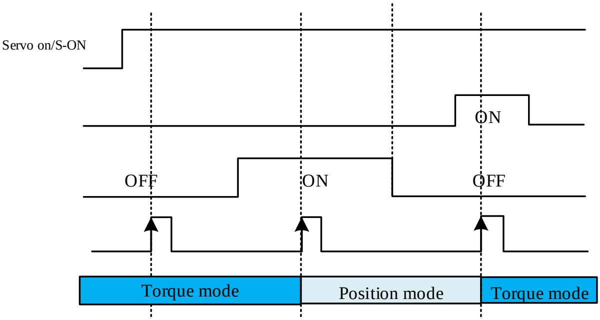


Figure. 4-25 Timing diagram of speed-position-torque control

Precautions	
⚠	●In speed-position-torque mode (Pn000.X-6), after the drive is powered on, the drive is in speed mode before the control mode trigger (C-Trig) rising edge signal is triggered.

4.6 Absolute Encoder

When using a multi-turn absolute encoder, the absolute value detection system can be constructed through the upper device and through which, repeated home return can be saved after power is turned on.

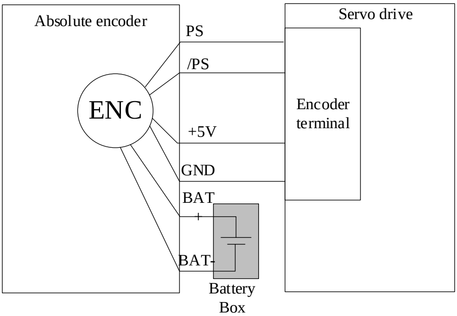
Related function codes:

Code	Name	Range	Default	Unit
Pn040.X	Standard pulse encoder	0: absolute encoder as an absolute value encoder 1: absolute encoder as an incremental encoder	1	-
Pn040.Y	EtherCAT bus encoder	0: absolute encoder as an absolute encoder 1: absolute encoder as an incremental encoder 2- absolute encoder as a single-turn absolute encoder	0	-
Pn041	Motor-side multi-turn absolute encoder undervoltage warning selection	0: set battery undervoltage to fault 1: set battery undervoltage warning	0	-

4.6.1 Connection of Absolute Encoder

To save the position data of the absolute encoder, a battery unit needs to be installed. When it is an encoder cable with a battery box, install the battery inside the box.

Table 4-14 Example of absolute encoder wiring

Absolute encoder wiring	Wiring
Encoder cable with battery box	

4.6.2 Absolute Encoder Data Reading

Read encoder data via communication.

Related function codes:

Code	Name	Range	Default	Unit
Un010	Absolute encoder single-turn value	0～2^{24}	Encoder unit	0xE010
Un011	Absolute encoder multi-turn value	-32768~32767	Encoder unit	0xE011

Un603	Absolute encoder pulse (low 32 bits)	Uint32	Encoder unit	0xE603
Un605	Absolute encoder pulse (high 32 bits)	Int32	Encoder unit	0xE605

4.6.3 Battery Replacing

An “Encoder battery error (Er.830)" or "Absolute encoder battery alarm (AL.930)" will be reported when the battery voltage is below about 2.7V. When Er.830 or AL.930 pops up, check if the battery is loose first; If not, the battery is under voltage, and the encoder battery needs to be replaced at this time.

Table 4-15 Example of absolute encoder battery replacement

Step	Item	Description
1	Power-up	Turn on the control power of the servo drive only.
2	Replace the battery	Install the battery on top of the encoder cable: open the battery box on the absolute encoder cable → remove the old battery → install the new battery → close the battery box again. Install the battery on top of the upper unit: remove the old battery → install the new battery.
3	Clear fault or warning	ERR red indicator is flashing: wait for about 5s after replacing the battery, the warning will be eliminated automatically; ERR red indicator is always on: replace the batteries and repower-up the drive to eliminate the fault.
4	Fault clear conformation	After the drive is repower-up, the ERR green indicator is always on to indicate that the battery replacement is successful.

Precautions	
⚠	● When replacing the battery, please do it when the drive is powered on and the encoder is normally connected, otherwise it will cause the absolute encoder data loss. ● The operation of clearing the encoder multi-turn value can be operated by the "Control panel" on the upper computer software VCSD.exe. If it is a non-multi-turn absolute encoder, operation fail will be reported.

4.7 Max. Turn Number

4.7.1 Overview

When controlling the position of the rotary table, it can only rotate in one direction, so the number of rotation cycles will always exceed the upper limit value of an absolute encoder after a certain period.

For example, suppose that the rotary table below can only move in one direction.

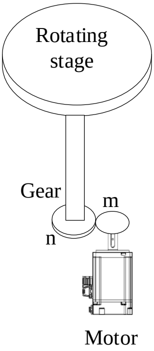
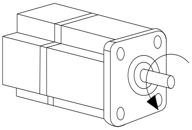
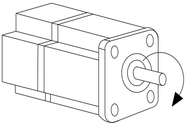


Figure 4.26 Typical mechanical device

After the number of turns has been done, the absolute multi-turn position information will overflow. To address this, users need to adjust the absolute multi-turn upper limit value in position control

Term explanation:

Forward	**Reverse**
 Motor rotates counterclockwise in face of the axis end (CCW)	 Motor rotates clockwise in face of the axis end (CW)

4.7.2 Related Principles

Generally, the display counting range of the multi-turn absolute encoder is [-32768, +32767], as shown in the following figure: when the motor is turning forward for a long time, the number of turns of the encoder will change to the maximum value +32767: When it continues to rotate. the data will overflow. Then users will find that the multi-turn value is no longer suitable for the absolute coordinate system after repower-up.

For example: system transmission ratio n: m=l: 5, that is, the motor rotates 5 turns, the rotary table rotates 1, when the multi-turn value of the absolute coordinate zero position is 0, and the value of the single turn is 0, after the rotary table rotates about 6554 turns, the encoder multi-turn data will overflow. Theoretically when the motor rotates 32770 turns, and rotary table rotates about 6554 turns, and there are 3 more turns, then the feedback of the multi-turn encoder turns into -32766, and the zero position of the rotary table is offset based on the upper computer system calculation.

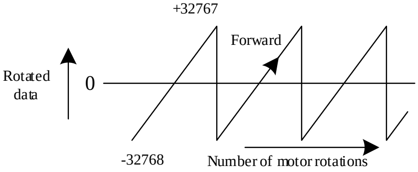


Figure 4.27 Forward encoder revolution overflow

When the upper limit of revolutions is used, the ratio of integers of the motor revolutions and rotary table revolutions will be free of mantissa.

Still taking the above as an example, for a transmission ratio n: m= 1:5 in the system (that is, the motor rotates 5 turns, the table rotates 1), when the upper limit of rotation is set to 5, the table coordinates are no longer affected by the encoder multi-turn overflow.

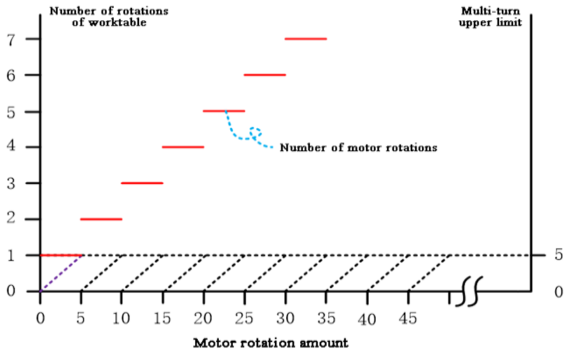
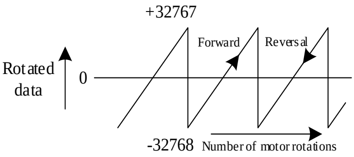
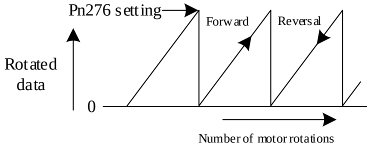


Figure 4.28 The rotation relationship between the table and the motor when the multi-turn is limited

Correspondingly, w the encoder multiturn values (Un011) are shown below when the number of rotations is off and on.

Pn276 = 0	Pn276 ≠ 0
	

4.7.3 Related Function Codes

Code	Name	Range	Default	Unit
Pn276	Upper limit of revolution	0～30000	0	Turn
Pn277.X	Function switch	0: off 1: on	0	-
Pn277.Y	Position direction feedback selection	0: cyclical 1: non-cyclical	0	-

4.7.4 Steps

Method A: the upper computer needs to read periodic position information, such as: rotary table 0 °~360 °:

Step l: set the correct upper limit of revolution (Pn296, Pn297), that is, the value of the motor revolution cycle, according to the actual conditions of machines;

Step 2: enable the multi-turn upper limit overflow function (Pn277.X=1);

Step 3: enable the cycle mode, cyclic position change (Pn277.Y=0);

Step 4: use the upper computer to clear the multi-turn value of the absolute encoder;

Method B: only the current absolute position is needed in the user system;

Step 1: enable multi-turn upper limit overflow function (Pn277.X=1);

Step 2: enable the non-cycle mode, position accumulation (Pn277.Y=1);

Step 3: use the upper computer to clear the multi-turn value of the absolute encoder;

<table>
<tr><th colspan="2">Precautions</th></tr>
<tr><td>⚠</td><td>●This function is only valid when an absolute encoder is used.</td></tr>
</table>

Chapter 5 Tuning

5.1 Precautions before Tuning

5.1.1 Types of Tuning

Adjustment refers to the responsiveness optimization by adjusting the gain of the servo unit.

The servo gain is set by a combination of multiple parameters (speed loop gain, position loop gain, filter, fiction compensation, moment of inertia ratio, etc.), which are interactive, so the balance between the various parameter setpoints must be considered.

The servo gain is factory-set for stability. Please adjust based on the state of the actual mechanical performance to further improve responsiveness.

The types of adjustment include tuning-free function, inertia identification, gain adjustment, filter adjustment, fiction compensation, A vibration suppression control, low-frequency vibration suppression, Easy FFT, etc.

5.1.2 Precautions during Tuning

When adjust the servo unit protection functions shown below should be set to a more appropriate value.

(1) Overtravel setting

For details about overtravel settings, please refer to "4.1.7 Overtravel Setting".

(2) Torque limit

The torque limit is to calculate the torque required for the operation and limit the output torque below this value. The impact can be mitigated in the event of failure of the machinery such as interference or collision. If the torque is set below the value required, overtravel or vibration may occur: See function codes Pn050 to Pn055 for details.

(3) Position deviation threshold

The position deviation warning is to offer effective protection during position control when the servo unit is used. When the motor does not confirm to the command, by setting the appropriate position deviation warning value, the abnormal situation can be detected and then motor running is stopped.

Position deviation refers to the difference between the position command value and the actual position, see function codes Pn264 and Pn266 for details.

The position deviation can be calculated as the following formula for the position loop gain (Pn101) in relation to the motor speed:

$$\text{Position deviation "command unit"} = \frac{\text{motor speed(rpm)}}{60} \times \frac{\text{encoder resolution}}{\text{Pn101}} \times \frac{\text{Pn206}}{\text{Pn204}}$$

When the acceleration and deceleration of the position command exceed the tracking capability of the motor, the tracking lag will become larger, and the position deviation cannot meet the above relation. Please reduce the acceleration and deceleration to the value that the motor can track, or increase the warning value of excessive position deviation.

(4) Excessive position deviation warning when the servo ON

If the servo is set to ON when position deviation keeps accumulating, to make the position deviation become "0", the motor will return to the original position so to cause danger. To avoid this, set the warning value of position deviation when the servo is ON to limit it.

(5) Vibration detection

In the debugging software "one-key tuning", the vibration detection can be started by setting the appropriate value.

5.2 Tuning-free Function

5.2.1 Introduction to the Tuning -free Function

Tuning-free function can be used to obtain a stable response through automatic adjustment regardless of the type of machinery and load fluctuations.

Related function codes:

Code	Name	Range	Default	Unit
Pn175.X	Tuning-free switch	0: tuning-free OFF 1: tuning-free ON	1	-
Pn175.Y	Speed control method during tuning-free operation	0: for speed control 1: for speed control and the upper unit is used for position control	0	-
Pn175.Z	Tuning-free rigidity	0～9	0	-
Pn175.W	Tuning-free load inertia	0 to 9 0: low load inertia 1: medium load inertia 2: large load inertia	0	-

The values of tuning-free rigidity correspond to bandwidths are list below:

Tuning-free rigidity **(Pn175.Z)**	**Description**
0	Response: slow

1	↕
2	
3	
4	
5	
6	
7	
8	
9	Response: fast

5.2.2 Parameters When Tuning -free Function Changes from Valid State to Invalid

When the tuning-free function is valid (Pn175.X-1), the following parameters become invalid:

Item	Name	Code
Gain	Moment of inertia	Pn100
	2nd velocity loop gain	Pn105
	2nd velocity loop integral time	Pn106
	2nd position loop gain	Pn107
	2nd torque command filter time	Pn108
Intelligent applications	Friction compensation function	Pn150.W
	A vibration suppression selection	Pn140.X
Two sets of parameter switches	Gain switching	Pn110.X

5.2.3 Tuning -free Operation

Step	Description
1	Tuning-free function on Pn175.X=1.

<table>
<tr><td>2</td><td>Set tuning-free value on Pn175.Z
To improve responsiveness, increase the value of Pn175. Z. To suppress vibration, reduce the value of Pn175. Z.
<table>
<tr><th>Tuning-free rigidity (Pn175.Z)</th><th>Description</th></tr>
<tr><td>0</td><td>Response: slow</td></tr>
<tr><td>1</td><td>↕</td></tr>
<tr><td>2</td><td></td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td></td></tr>
<tr><td>5</td><td></td></tr>
<tr><td>6</td><td></td></tr>
<tr><td>7</td><td></td></tr>
<tr><td>8</td><td></td></tr>
<tr><td>9</td><td>Response: fast</td></tr>
</table></td></tr>
</table>

Precautions	
⚠	●The tuning-free control function is valid for position control and speed control, but not for torque control. ●When using the motor with a load inertia exceeding the allowable load, the motor may vibrate. In this case, reduce the tuning-free load value (Pn175.W). ●During operation, perform this function when emergency stop is possible at any time to ensure safety.

5.3 Intelligent Setting

5.3.1 Intelligent Setting Overview

Intelligent setting refers to the function that the servo drive automatically adjusts according to the mechanical characteristics when performs automatic operation (forward + reverse reciprocating motion) within the set range of motion.

The intelligent setting function can be implemented through the VCS debugging software. For details, see "Debugging Software".

(1) Advanced automatic adjustment without command input

When the advanced automatic adjustment function of the non-command input is enabled, the following items will be adjusted.

① Moment of inertia ratio

② Gain adjustment (speed loop gain, position loop gain, etc.

③ Filter adjustment (torque instruction filter, notch filter)

④ Friction compensation

⑤ A vibration suppression control

⑥ Vibration suppression

(2) Advanced automatic adjustment with command input

When the advanced automatic adjustment function of the command input is enabled, the following items will be adjusted.

① Gain adjustment (speed loop gain, position loop gain, etc.)

② Filter adjustment (torque command filter, notch filter)

③ Friction compensation

④ A vibration suppression control

⑤ Vibration suppression

Precautions

● Intelligent command settings begin to adjust based on the current speed loop gain (Pn101). If a vibration occurs at the beginning of the adjustment, it will not be possible to make the correct adjustment. At this point, reduce the speed loop gain (Pn101) until the vibration is low, and then re-adjust.

5.3.2 Intelligent Setting Procedure

(1) Items need to be checked before setting

Before intelligent setting. please be sure to confirm the following settings. If it is not set properly, the function will not be performed.

① No overtravel occurred

② Non-torque control

③ Gain switching by manual gain switching (Pn110.X= 0) and 1st gain is set.

④ No alarm or warning occurred

⑤ Tuning-free control function is invalid (Pn175.X = 0)

Precautions

- When performing command-free intelligent setting under speed control state, it will automatically switch to position control for adjustment, and after the adjustment is finished, it returns to the speed control.
- Intelligent setting with command is invalid under tongue control.
- In the process of executing intelligent setting, the switching function of the command pulse input magnification will become invalid.

(2) Examples of failure to perform adjustment or adjustment error

In the following cases, the intelligent settings will not be executed normally

① When the motor is energized (servo ON) and it is under position control (intelligent setting with command)

② When the mechanical system can only operate in one direction

③ When the range of motion is narrow under 0.s turns

④ When the moment of inertia changes within the set operating range

⑤ When the dynamic fiction of the machine is large

⑥ When the rigidity of the machine is low and the vibration occurs during the positioning

⑦ When the speed forward-feedback is input

⑧ Positioning completion signal threshold (Pn262) is low

Precautions

- When the variable inertia load fails to be adjusted intelligently without command please change the adjustment mode via one-key tuning or tuning-free function;
- During intelligent adjustment, please set “electronic gear ratio (Pn204/Pn206)” and “positioning completion range (Pn262)” as the value of the test operation, otherwise the adjustment may fail or the adjustment result is inconsistent with the test operation.

5.4 One-key Tuning

One-key tuning is a method of manual speed command or position command input from the upper device during running. By adjusting one or two values through the bandwidth setting, users can automatically adjust the set value of the relevant servo gain.

One-key tuning is valid for the following items;

① Gain adjustment (speed loop gain, position loop gain, etc.);

② Filter adjustment (torque command filter, notch filter);

③ Friction compensation;

④ A vibration suppression control;

⑤ Model tracking control (model tracking gain);

If the response characteristics are not enough after intelligent setting, please use one-key tuning. If you want to further micro adjust each servo gain afterwards, please refer to "Manual Adjustment" to perform manual tuning

If the setting is not correct, "NO-Op" will pop up and the function cannot be performed. Before bandwidth settings, be sure to confirm the following settings.

① Tuning-free is selected as invalid (Pn175.X-0)

② Tuning mode is set to 0 or 1 when performing tuning via speed control

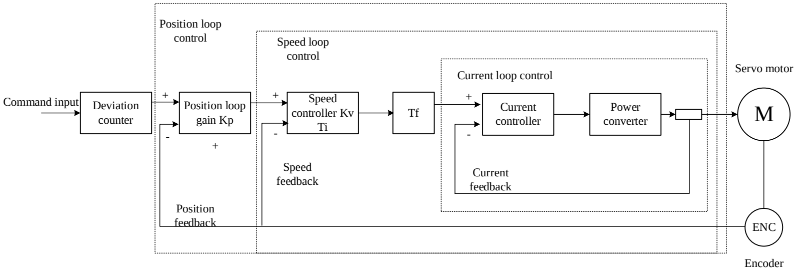
③ One-key tuning can be performed by debugging software, see "Debugging Software" for details.

Precautions

- Please set the moment of inertia ratio (Pn100) correctly before performing one-key tuning.

5.5 Function Tuning

To adjust the servo gain, please adjust the relevant gain parameters of the servo drive one by one based on understanding its composition and characteristics. In most cases, if there is a large change in one parameter, users must adjust the other parameters again. The relevant monitoring waveform can be captured by the relevant debugging tools.



The servo drive is composed of position loop, speed loop and current loop. The more inner the loop is, the more the response characteristics need to be improved. If this principle is not followed, it may lead to poor responsiveness or vibration.

Since the current loop ensures adequate responsiveness, users do not have to adjust the relevant parameters.

By manually adjusting the servo gain, the response characteristics can be improved. Positioning time can be shortened if position control is used.

Please use manual tuning in the following situations:

① When automatic tuning is not possible;

② When it is more necessary to increase the servo gain than the result of automatic tuning;

③ The customer decides the servo gain to moment of inertia ratio.

Precautions	
⚠	● Tuning is recommended from the factory-set gain of each parameter of servo drive. ● Vibration may occur when adjusting the servo drive gain. It is recommended to turn on the warning parameter that detects vibration (Pn185.X-1).

5.5.1 Gain Tuning

Steps:

Step	Description
1	Adjust the torque command filter time (Pn104) and set it to no vibration.
2	Increase the speed loop gain (Pn101) as much as possible within the range of no vibration in the machines, while decrease the speed loop integral time (Pn102).
3	Repeat steps 1 and 2 to reduce the value that has been changed by 10% to 20%.
4	For position control, increase the position loop gain (Pn103) within the range of no vibration.

Precautions	
⚠	● When adjusting the servo drive gain, if one parameter is changed, the other parameters need to be readjusted as well. Do not make large changes to one parameter alone. Make fine adjustments to each servo gain parameter below 5% or so as a standard. ● Please follow the procedure below for servo parameter changes. ① Decrease the torque command filter time (Pn104); ② Increase the speed loop gain (Pn104); ③ Decrease the speed loop integral time (Pn104); ④ Increase the speed loop gain (Pn101); To prevent vibration and overtravel when decreasing the response: ① Increase the torque command filter time(Pn104); ② Decrease the speed loop gain(Pn104); ③ Increase the speed loop integral time(Pn102); ④ Decrease the speed loop gain(Pn101);

(1) Position loop proportional gain adjustment

The response of the servo system is determined by the position loop gain. When the position loop gain is set to a higher value, the response speed increases and the time required for positioning is reduced. In general, the position loop gain cannot be increased beyond the set mechanical system vibration. Therefore, to set a larger position loop gain, it is necessary to increase the rigidity and vibration value.

Code	Name	Range	Default	Unit
Pn103	Position loop proportional gain	1.0～2000.0	40.0	1/s

Precautions

⚠

● The position loop proportional gain (Pn103) must not be set too large when the motor is operating, otherwise an overcurrent warning may occur during high speed. In this case, it will be difficult to detect an excessive position deviation fault, so refer to the following conditions as a criterion for setting the value:

$$\text{Position deviation fault threshold Pn264}=\frac{F_c}{K_p}\times(1.2\sim2.0)$$

In the formula:

F_c: maximum frequency of the position command pulse (pulse/s);

K_p: position loop gain (1/s);

1.2～2.0: Safety coefficient (protection against frequent excessive position deviation).

● When using the position command filter, the transitional deviation will increase depending on the filter time parameter. Please take the filter signal accumulation into consideration during setting.

(2) Speed loop proportional gain and speed loop integral time adjustment

The velocity loop proportional gain (Kp) is a parameter that determines velocity loop responsiveness. Low responsiveness of the speed loop is a delay element of the outer position loop, so overshoot or vibration to the speed command can occur. Therefore, the larger the setting value, the more stable and responsive the servo system will be as it is within the range of no vibration in the mechanical system.

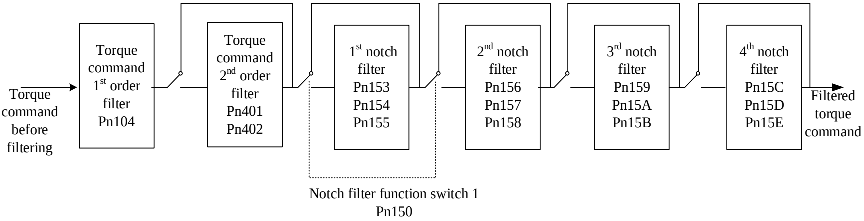
Code	Name	Range	Default	Unit
Pn101	Speed loop proportional gain	1.0～2000.0	40.0	Hz

The speed loop contains an integral element to respond to even small inputs. As this integral element is a delay element for a servo system, when the time parameter is set too large, an overshoot occurs or the positioning time is prolonged to reduce responsiveness.

Code	Name	Range	Default	Unit
Pn102	Speed loop integral time constant	0.15～512	20.0	ms

(3) Torque command filter

The torque command filters are serially configured with primary delay filters, secondary delay filters, and notch filters for different functions.



Precautions	
⚠	● The torque command to 2nd notch filter is not valid when Pn401=5000Hz and is valid when Pn401<5000Hz; ● The 3rd notch filter is not valid when Pn159=5000Hz and is valid when Pn159<5000Hz; ● The 4th notch filter is not valid when Pn15C=5000Hz and is valid when Pn15C<5000Hz.

Low-pass filter

When mechanical vibration may be caused by the servo drive, it is possible to eliminate the vibration by adjusting the torque command filter time.

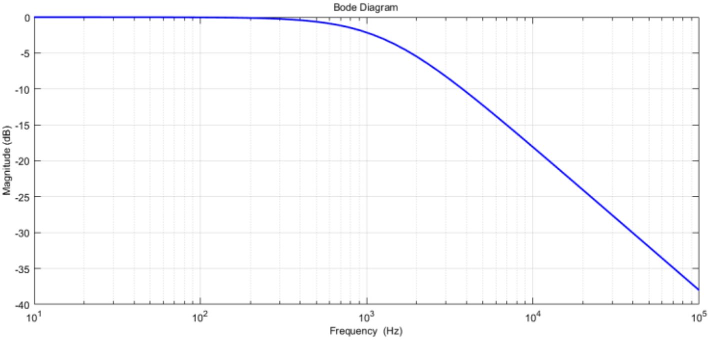
The smaller the value, the more responsive control, but it is subject to mechanical conditions.

Code	Name	Range	Default	Unit
Pn104	Torque command filter time constant	0.00～655.35	1.00	ms
Pn401	Torque command 2nd low-pass filter cutoff frequency	100～5000	5000	Hz
Pn402	Torque command 2nd low-pass filter Q	0.50～1.00	1.00	ms

Precautions	
⚠	● The torque command 2nd filter is not valid when Pn401=5000Hz and is valid when Pn401<5000Hz; ● The 3rd notch filter is not valid when Pn159=5000Hz and is valid when Pn159<5000Hz; ● The 4th notch filter is not valid when Pn15C=5000Hz and is valid when Pn15C<5000Hz.

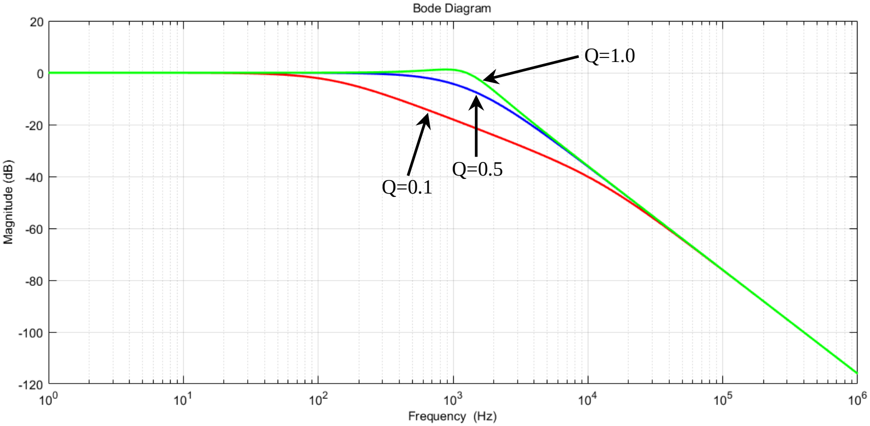
Example 1: torque command filter time Pn104=5ms, the cutoff frequency of the corresponding low-pass filter is 1256Hz, and the corresponding amplitude-frequency characteristics are shown in the figure

below: the amplitude attenuation -3DB at 1256Hz.



Precautions	
⚠	● The low-pass filter frequency characteristics above are simulated from the theoretical model calculations, so there are some differences from the actual characteristics.

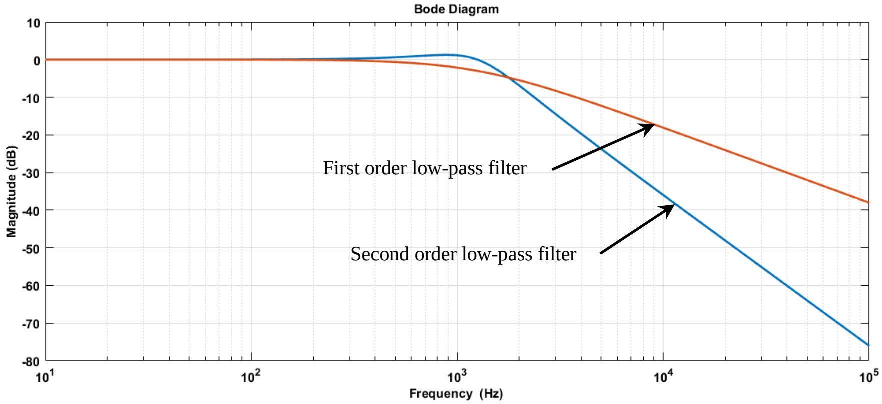
Example 2: Torque command 2nd filter with cutoff frequency Pn401= 1256 Hz, the attenuation of the amplitude diminishes with the gradual increase of the Q value.



Precautions

- The low-pass filter frequency characteristics above are simulated from the theoretical model calculations, so there are some differences from the actual characteristics.

Example 3: A torque-commanded 1st low-pass filter has a cutoff frequency of 1256 Hz, a torque-commanded 2nd filter has a cutoff frequency of Pn401= 1256 Hz, and the filter frequency characteristics at Q = 1.0 are shown below.

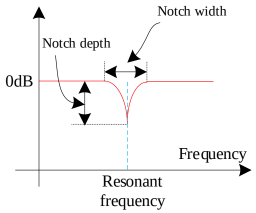


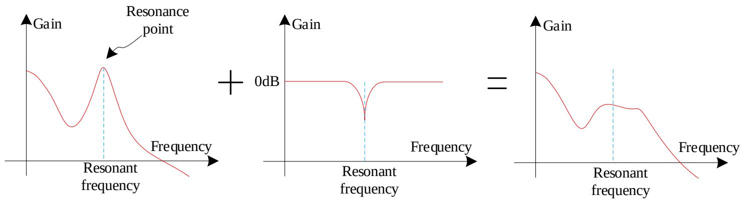
Precautions

- The filter above frequency characteristics are simulated from the theoretical model calculations, so there are some differences from the actual characteristics.

Notch filter

Notch filters are used to remove specific vibration frequency components caused by resonance of the ball screw shaft, etc. The gain curve is shown below: a specific frequency (hereinafter referred to as the notch frequency) in a notch shape. This characteristic makes it possible to eliminate or reduce the frequency components near the notch frequency. The notch filter is set by three parameters: the notch filter frequency, the notch filter Q value, and the notch filter depth.





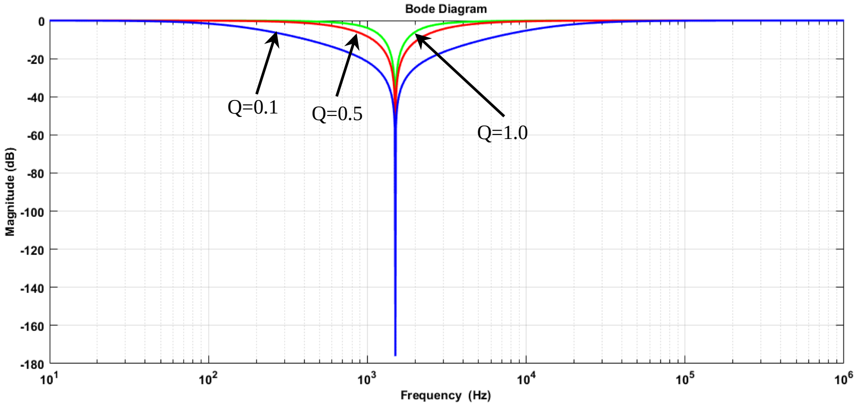
The notch filter Q value and notch filter depth D are explained below.

Notch filter Q

The notch filter Q determines the width of the notch filter at a certain notch filter frequency. The width of the notch varies depending on the Q value.

The smaller the notch filter Q, the wider the notch, and the wider the filter frequency width is.

Example: When the center frequency of the notch filter is 1500Hz and depth D=0, the amplitude attenuation at different setting values of the notch filter Q value is shown in the following diagram.



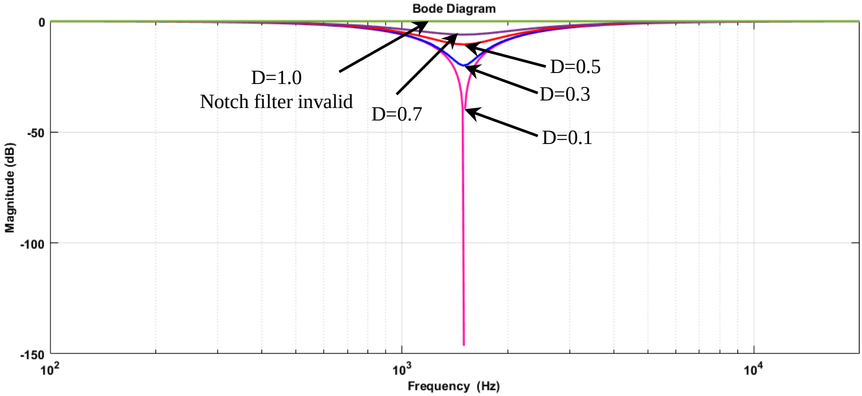
Precautions	
	●The notch filter above frequency characteristics are simulated from the theoretical model calculations, so there are some differences from the actual characteristics.

Notch filter depth

Notch filter depth refers to the depth (amplitude) of the notch at a certain determined notch center frequency. The depth of notch (amplitude) varies depending on the notch filter depth (D).

The smaller the notch filter depth (D) is, the deeper the notch is, the better the vibration suppression control is, but if it is too small, it will increase the vibration.

Example: Notch filter center trap frequency 1500Hz, notch filter width Q = 0.7. Here is the effect of amplitude attenuation at different notch filter depth (D).



Precautions	
	●The notch filter above frequency characteristics are simulated from the theoretical model calculations, so there are some differences from the actual characteristics.

Related function codes

Code	Name	Range	Default	Unit
Pn153	Notch filter1 frequency	50～5000	5000	Hz
Pn154	Notch filter1 Q	0.50～10.00	7.00	-
Pn155	Notch filter1 depth	0.000～1.000	0.000	-

Pn156	Notch filter2 frequency	50～5000	5000	Hz
Pn157	Notch filter2 Q	0.50～10.00	7.00	-
Pn158	Notch filter2 depth	0.000～1.000	0.000	-
Pn159	Notch filter3 frequency	50～5000	5000	Hz
Pn15A	Notch filter3 Q	0.50～10.00	7.00	-
Pn15B	Notch filter3 depth	0.000～1.000	0.000	-
Pn15C	Notch filter4 frequency	50～5000	5000	Hz
Pn15D	Notch filter4 Q	0.50～10.00	7.00	-
Pn15E	Notch filter4 depth	0.000～1.000	0.000	-

5.5.2 Gain Switching

The gain switching consists of "manual gain switching", which uses an external input signal, and "automatic gain switching", which performs the switching automatically.

The gain switching increases the gain and shortens the time during positioning, and decreases the gain and suppresses vibration when the motor is stopped.

Code	Name	Range	Default	Unit
Pn110.X	Gain switching selection	0: manual switching 1: auto switching	0	-
Pn110.Y	Auto switching conditions for position control gain	0: position completion signal ON 1: position completion signal OFF 2: position near signal ON 3: position near signal OFF 4: position command filtered to 0 and pulse input OFF 5: position command pulse input ON	0	-
Pn112	Gain switching transition time1	0～65535	0	Ms
Pn113	Gain switching transition time2	0～65535	0	Ms
Pn114	Gain switching waiting time1	0～65535	0	Ms
Pn115	Gain switching waiting time2	0～65535	0	Ms

Gain combinations for switching:

Name	1st gain	2nd gain
Speed loop proportional gain	Pn101	Pn105
Speed loop integral time constant	Pn102	Pn106
Position loop proportional gain	Pn103	Pn107
Torque command filter time	Pn104	Pn108
Model tracking gain	Pn241	Pn246
Model tracking gain attenuation factor	Pn242	Pn247

Precautions

- Gain switching of model tracking gain and model tracking attenuation factor is available only for "manual gain switching".
- Gain switching of the model tracking gain and model tracking attenuation factor is valid only when there is no command from the drive and the motor is stopped.

Gain switching method:

① Manual switching

② Auto switching

When switching manually, it is necessary to configure the external input signal to control the gain switching, and when switching automatically, it is necessary to set the conditions to determine whether to switch or not.

(1) Manual switching

Related input signals:

Setting	Mark	Name	Description	Trigger	Mode
0x0E	/G-SEL	Gain switching	This signal is used to select the two gains of the speed mode and the position mode. Invalid: switch to 1st gain. Valid: switch to 2nd gain.	By level	P S T

(2) Auto switching

"Auto gain switching" is valid only for position control, and the switching conditions is performed by the following settings.

Parameter	Condition	Gain	Waiting time	Transition time

Pn110.Y corresponds to condition A	Condition A is valid	1st gain → 2nd gain	Waiting time 1(Pn114)	Transition time1(Pn112)
	Condition A is not valid	2nd gain → 1st gain	Waiting time 2(Pn115)	Transition time2(Pn113)

Example: In the auto-switching gain mode with the condition that the position completion signal (/COIN) is ON, assume that the gain is switched from the position loop gain Pn103 to the 2nd position loop gain Pn107. The /COIN signal of the switching condition is ON, and after the waiting time Pn114 from the time when the switching condition has been completed, the gain is changed linearly from Pn103 to Pn107 during the transition time Pn112.

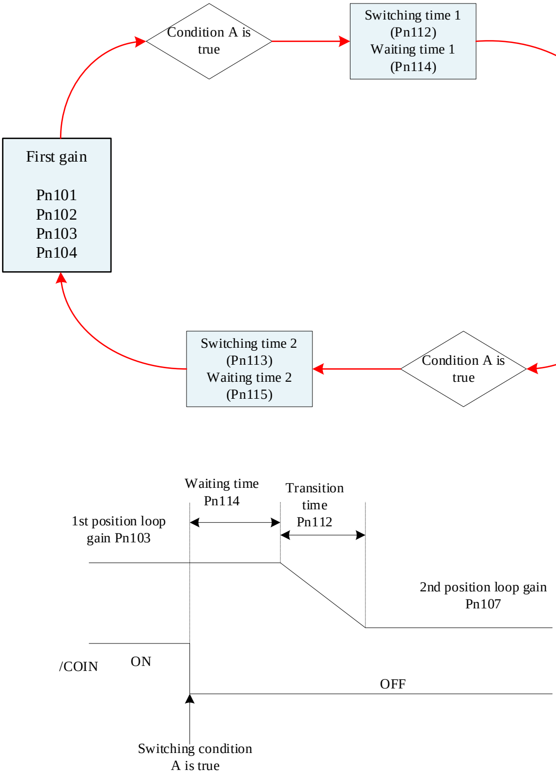
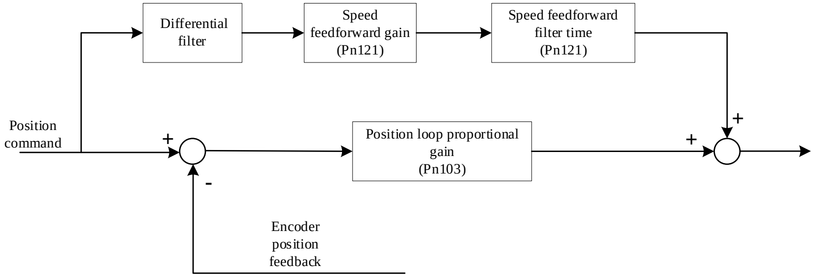


Figure 5.1 Logic diagram

5.5.3 Speed Feedforward

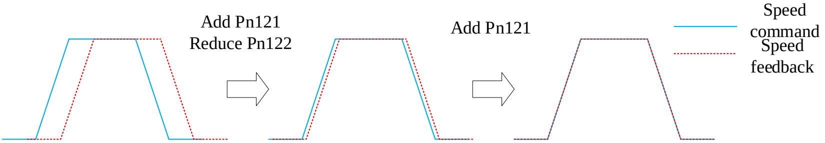
Speed feedforward is a function that reduces position time by feedforward compensation during position control.



Related function codes:

Code	Name	Range	Default	Unit
Pn121	Speed feedforward gain	0～100	0	%
Pn122	Speed feedforward filter time	0.00～64.00	0.00	ms

When the speed feedforward gain is on, when the speed control command changes smoothly, the speed feedforward gain increases to improve speed tracking error; if the speed control command does not change smoothly, the gain decreases to reduce the mechanism vibration. Speed feedforward gain Pn121 is close to 100%, the more complete the front compensation, the smaller the dynamic tracking error.

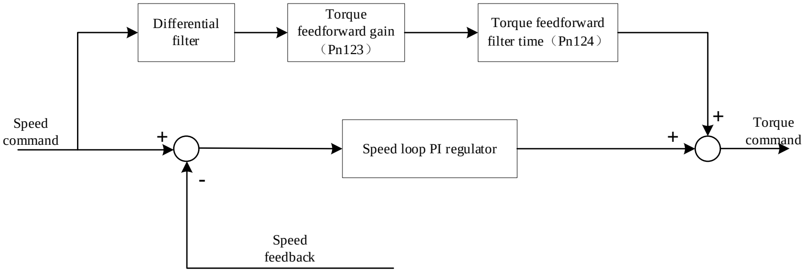


Precautions

- If the speed feedforward gain is set too high, it may cause the equipment to vibrate, so please set the value to 80% or lower.
- When the speed feedforward gain Pn121 is set to 0%, the speed feedforward function is invalid.

5.5.4 Torque Feedforward

In position control mode, internal torque feedforward is used to improve the torque command response and reduce the position deviation at fixed acceleration and deceleration; in speed control mode, torque feedforward is used to improve the torque command response and reduce the speed deviation at fixed speed.



Related function codes:

Code	Name	Range	Default	Unit
Pn123	Torque feedforward gain	0～100	0	%
Pn124	Torque feedforward filter time	0.00～64.00	0.00	ms

Precautions	
	● When the torque feedforward gain Pn123 is set to 0%, the torque feedforward function is invalid.

5.5.5 PI/P Switching

PI-P control can be switched under speed control or position control. When it is a combined control mode, it is valid only when it is switched to speed and position modes. PI-P switching can be performed by the manual PI-P switching signal (/P-CON), and when the /P-CON signal is set to ON, it becomes P control. The conditions for auto-switching can also be selected via speed loop PI-P switching condition (Pn130).

(1) Manual switching

Here is configuration of manual PI-P control.

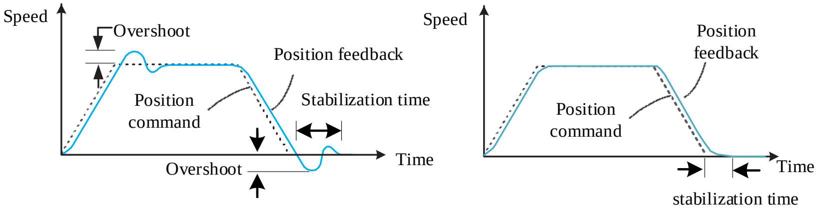
Related input signals:

Setting	Mark	Name	Description	Trigger	Mode
0x05	P-CON	Speed loop PI-P	This signal is used to switch the PI	By level	P S T

			(Proportional/Integral) and P (Proportional) regulators of the drive's speed loop. Invalid: PI controller (proportional/integral). Valid: change to P controller (proportional).		

(2) Auto switching

For auto PI-P switching, the switching condition is set via Pn131, and the switching condition is set from Pn10C to Pn10F. By setting the switching conditions and condition values appropriately, overshooting during acceleration and deceleration can be suppressed and stabilization time can be shortened.



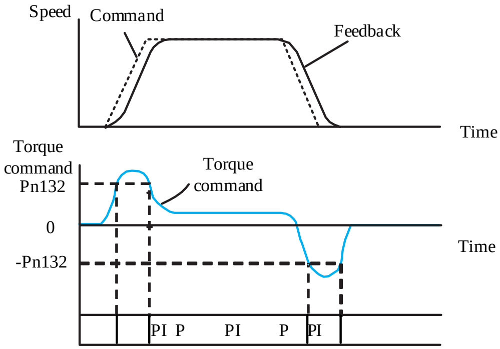
Unswitched PI

Auto-switching PI-P

Code	Name	Range	Default	Unit
Pn130.X	Speed loop PI-P switching condition selection	0: on internal torque command 1: on speed command 2: conditioned by acceleration 3: on position deviation pulse 4: non-mode switching function	0	—
Pn132	Speed loop PI-P switching condition (torque command)	0～800	200	%
Pn133	Speed loop PI-P switching condition (speed command)	0～10000	0	rpm
Pn134	Speed loop PI-P switching condition (acceleration)	0～30000	0	rpm/s
Pn135	Speed loop PI-P switching condition (position deviation)	0～10000	0	Command unit

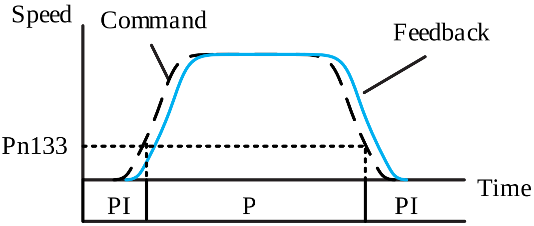
Set the switching condition to torque command

If the switching condition is torque command (factory default), the torque command exceeds Pn132, and the speed loop switches to P control, as shown in Figure 6.8. The torque command value is set to 200% at the factory.



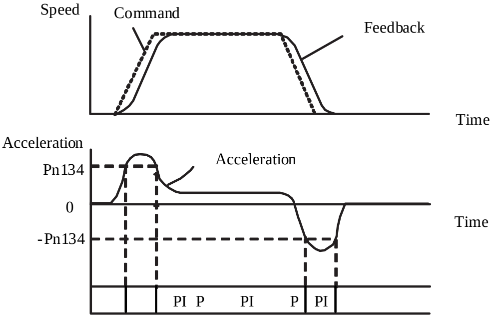
Set the switching condition to speed command

If the switching condition is speed command, the speed loop switches to P control when the speed command exceeds the speed set in Pn133.



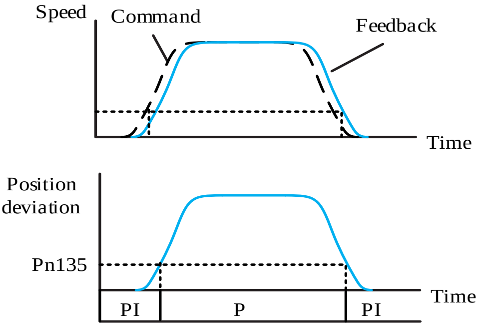
Set the switching condition to acceleration command

When the switching condition is acceleration command, the speed loop switches to P control when the speed command exceeds the acceleration in Pn134.



Set switching condition to position deviation

When the switching condition is position deviation, the speed loop switches to P control when the position deviation exceeds Pn135. It should be noted that this setting is valid only for position control.



5.5.6 Friction Compensation

The friction compensation is to compensate for viscous friction variations and fixed load variations.

Auto-tuning auxiliary functions for friction compensation are:

① intelligent tuning without command input;

② intelligent tuning with command input;

③ one-key tuning.

The following describes the manual tuning of the friction compensation parameters.

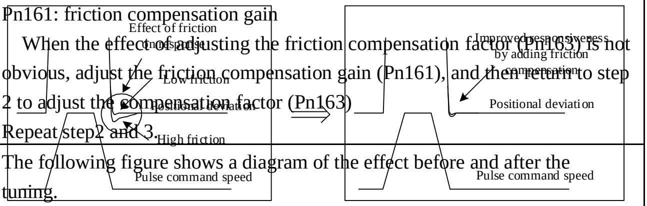
(1) Related function codes

Code	Name	Range	Default	Unit
Pn150.W	Friction compensation enable	0: friction compensation off 1: friction compensation on	1	-
Pn161	Friction compensation gain	10～1000	100	%
Pn162	2nd friction compensation gain	10～1000	100	%
Pn163	Friction compensation factor	0～100	0	%
Pn164	Friction compensation frequency correction	1.0～1000.0	0.0	Hz
Pn165	Friction compensation gain correction	0～1000	100	%

Precautions

	● When using the friction compensation function, set the inertia ratio (Pn100) as accurate as possible. If the inertia ratio is set incorrectly, it may cause vibration.

(2) Friction compensation procedure

Step	Item	Description
1	Related parameter setting	Pn161=100 (friction compensation gain at 100%); Pn162=100 (2nd friction compensation gain at 100%). Pn163=0 (friction compensation factor is 0, no compensation); Pn164=0 (friction compensation frequency corrected to 0 Hz). Pn165=100 (friction compensation gain corrected to 100%). Note: Please keep Pn164 and Pn165 at factory setting.
2	Friction compensation factor tuning	Pn163: friction compensation factor During the operation, the position deviation is dynamically monitored by means of a debugging software oscilloscope. At the same time, progressively change the friction compensation factor (Pn163) to check whether the actual position deviation is improved.
3	Friction compensation gain tuning	Pn161: friction compensation gain When the effect of adjusting the friction compensation factor (Pn163) is not obvious, adjust the friction compensation gain (Pn161), and then return to step 2 to adjust the compensation factor (Pn163) Repeat step2 and 3.
4	Tuning effect comparison	The following figure shows a diagram of the effect before and after the tuning.  Before friction compensation After friction compensation

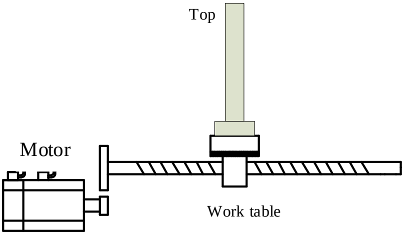
Precautions	
	● The higher the setting of the friction compensation gain (Pn161), the better the responsiveness to external disturbances, but if the setting is too high, it is prone to vibration; ● The higher the setting of the friction compensation factor (Pn163), the better the effect, but if the setting is too high, it is prone to vibration; It is recommended that users set the factor to 90% or lower.

5.5.7 Low-frequency Vibration Suppression

During servo system operation, if the system rigidity is insufficient, the mechanical transmission end will continue to oscillate even if the motor is nearly still at the end of the positioning command, and the low-frequency vibration suppression function is used to slow down the oscillation on the mechanical transmission end.

The low-frequency vibration suppression range is 1.0 Hz to 100.0 Hz.

The low-frequency vibration suppression parameters are described below.



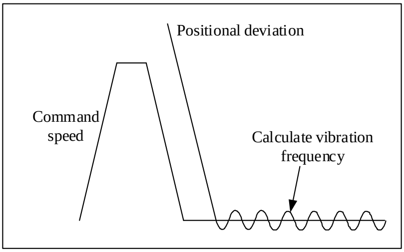
Related function codes:

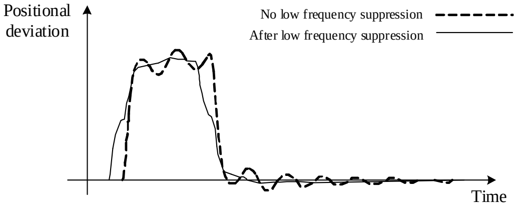
Code	Name	Range	Default	Unit
Pn232	Low frequency vibration detection sensitivity (Positioning completion signal threshold)	0.1～300.0	40.0	%
Pn233	Low-frequency vibration suppression1 frequency A	1.0～250.0	50.0	Hz
Pn234	Low-frequency vibration suppression1 frequency B	1.0～250.0	70.0	Hz
Pn235	Low-frequency vibration suppression2 frequency	1.0～200.0	80.0	Hz
Pn236	Low-Frequency vibration suppression2 compensation	10～1000	100	%

Precautions

- Vibration detection = Pn232 × Pn262, the smaller the threshold setting for low-frequency vibration detection, the easier it is to detect vibration.

Low-frequency vibration procedure

Step	Item	Description
1	Vibration frequency detection	Use the debugging software digital oscilloscope to monitor the real-time positional deviation, and obtain the corresponding frequency of it. 
2	Parameter setting	Pn235: Low-frequency vibration suppression2 frequency (Pn235) Set the vibration frequency acquired in step 1 to Pn235.

<table>
<tr>
<td>3</td>
<td>Tuning effect comparison</td>
<td>After the vibration suppression frequency set in step 2, check whether the suppression effect is satisfactory, and do fine tuning around the set vibration suppression frequency until the expected effect is achieved.

 </td>
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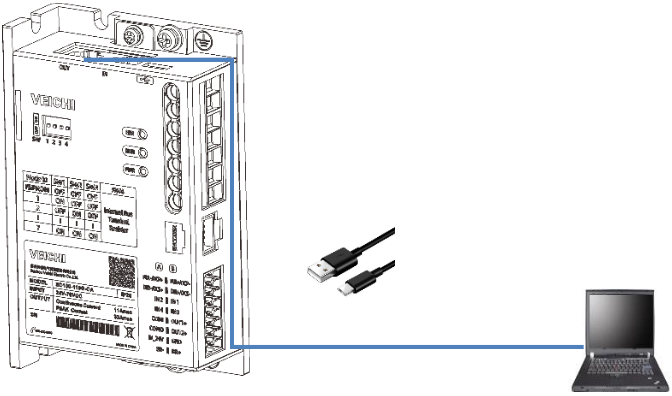
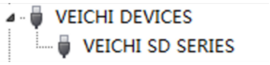
</table>

Chapter 6 Debugging Software

6.1 VCDSoft Servo Debugging Software

VCDSoft is the PC monitoring and debugging software for SD100 servo drive. Customers can connect the servo drive to PC via USB to Type-C cable and install the specified debugging software and USB drive program to debug the servo function and performance.



VCDSoft	Debugging software requirement
Version	SDSoft V1.11.26 Compatible with SD100/SD700/SD710 debugging software
Software environment	Windows 7/Windows10/Windows11
Software drive	 VEICHI DEVICES VEICHI SD SERIES Drive software path: \SDSoft V1.11.26\driver
Connectivity	USB to Type-C
Website	https://www.veichi.com/service/datadownload/

6.2 Basic Procedure

6.2.1 Connection

Open the debugging software, connect the debugging software through the USB and RS485, and choose the corresponding drive.

Configuration selection

Communication method selection

● USB ○ RS485

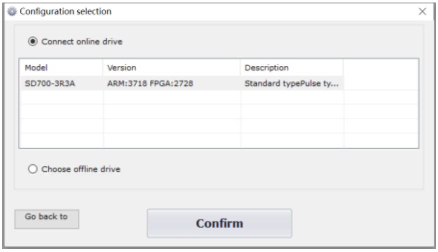
Communication parameters

Serial port number:

Baud rate: 19200

Data Format: (E,8,1) Even parity

Address number: 1



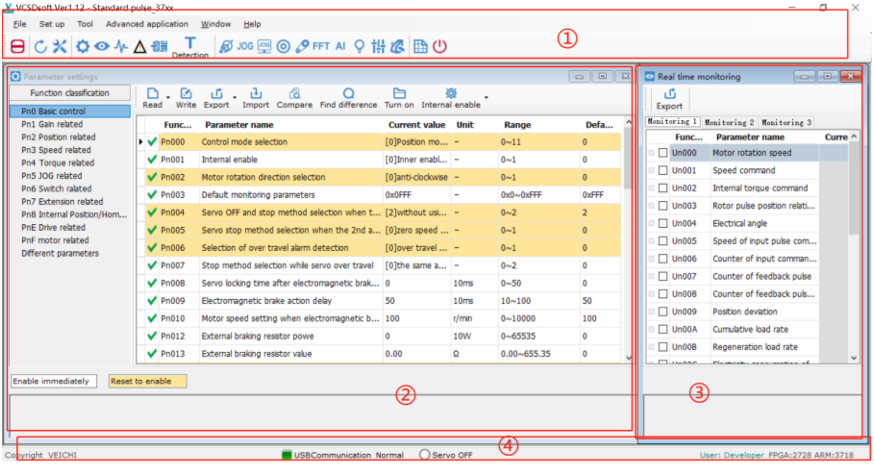
Configuration selection

● Connect online drive

Model	Version	Description
SD700-3R3A	ARM:3718 FPGA:2728	Standard typePulse ty...

○ Choose offline drive

Once the connection is successful, the main interface of VCDSoft will be displayed.



VCSDsoft Ver1.12 - Standard pulse_37xx

	Func...	Parameter name	Current value	Unit	Range	Defa...
✓	Pn000	Control mode selection	[0]Position mo...	–	0~11	0
✓	Pn001	Internal enable	[0]Inner enabl...	–	0~1	0
✓	Pn002	Motor rotation direction selection	[0]anti-clockwise	–	0~1	0
✓	Pn003	Default monitoring parameters	0x0FFF	–	0x0~0xFFF	0xFFF
✓	Pn004	Servo OFF and stop method selection when t...	[2]without usi...	–	0~2	2
✓	Pn005	Servo stop method selection when the 2nd a...	[0]zero speed ...	–	0~1	0
✓	Pn006	Selection of over travel alarm detection	[0]over travel ...	–	0~1	0
✓	Pn007	Stop method selection while servo over travel	[0]the same a...	–	0~2	0
✓	Pn008	Servo locking time after electromagnetic brak...	0	10ms	0~50	0
✓	Pn009	Electromagnetic brake action delay	50	10ms	10~100	50
✓	Pn010	Motor speed setting when electromagnetic b...	100	r/min	0~10000	100
✓	Pn012	External braking resistor powe	0	10W	0~65535	0
✓	Pn013	External braking resistor value	0.00	Ω	0.00~655.35	0

	Func...	Parameter name	Curre
☐	Un000	Motor rotation speed	
☐	Un001	Speed command	
☐	Un002	Internal torque command	
☐	Un003	Rotor pulse position relati...	
☐	Un004	Electrical angle	
☐	Un005	Speed of input pulse com...	
☐	Un006	Counter of input comman...	
☐	Un007	Counter of feedback pulse	
☐	Un008	Counter of feedback puls...	
☐	Un009	Position deviation	
☐	Un00A	Cumulative load rate	
☐	Un00B	Regeneration load rate	

Copyright VEICHI USBCommunication Normal ○ Servo OFF User: Developer FPGA:2728 ARM:3718

① **Toolbar:** including communication disconnection, communication connection, JOG, program JOG, soft reset, restore factory settings, parameter setting, monitoring parameters, exit and other functions.

② **Parameter setting column:** all Pn parameters reading and writing, and supports for batch data import and export;

③ **Real-time monitoring column:** real-time reading of all Un parameters.

④ **Status bar:** including the current communication status and servo work status.

6.2.2 Parameter Setting and Monitoring

Write and read all Pn parameters in the parameter setting interface, which supports the following functions:

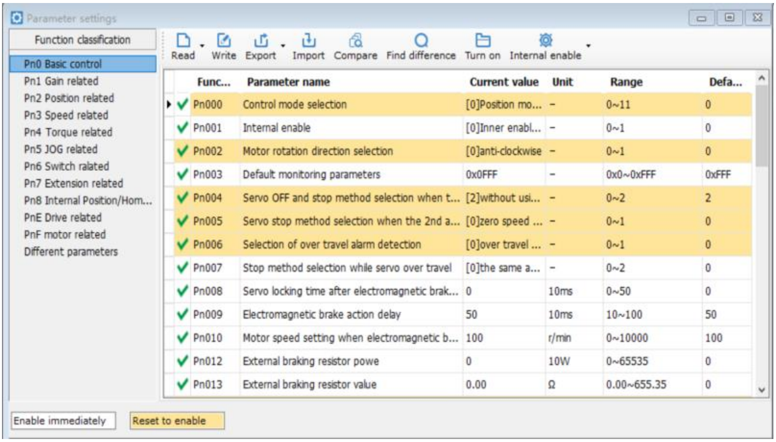
(1) Write individual Pn parameters: select the function code to be modified, enter the appropriate parameter value, and then enter the “Enter” to write it effectively.

(2) Parameter batch reading: click on Read, to batch read the parameters of the current group and all groups.

(3) Parameter batch import and export: the modified parameters can be exported to the current parameter group in .sd file, so users can batch import of .sd files to match the previous parameter records.

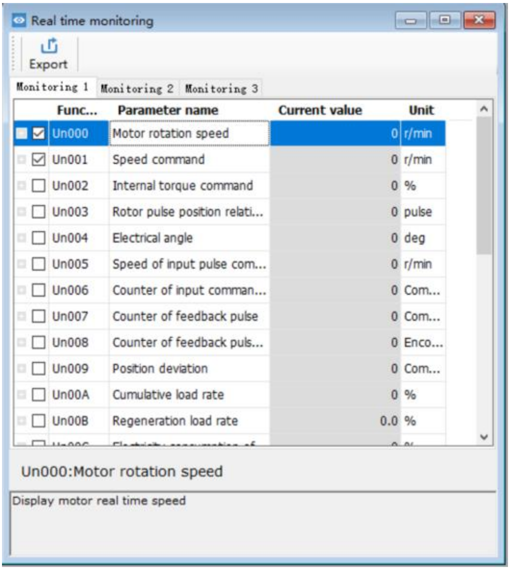
(4) Common parameter records: common parameters will be added to the common parameter column to facilitate parameter modification.

(5) Comparison of different parameters: compare the current parameters with the default parameters or the previous .sd files to get the modified parameters, which is convenient for comparison and analysis of differences.



	Func...	Parameter name	Current value	Unit	Range	Defa...
✓	Pn000	Control mode selection	[0]Position mo...	-	0~11	0
✓	Pn001	Internal enable	[0]Inner enabl...	-	0~1	0
✓	Pn002	Motor rotation direction selection	[0]anti-clockwise	-	0~1	0
✓	Pn003	Default monitoring parameters	0x0FFF	-	0x0~0xFFF	0xFFF
✓	Pn004	Servo OFF and stop method selection when t...	[2]without usi...	-	0~2	2
✓	Pn005	Servo stop method selection when the 2nd a...	[0]zero speed ...	-	0~1	0
✓	Pn006	Selection of over travel alarm detection	[0]over travel ...	-	0~1	0
✓	Pn007	Stop method selection while servo over travel	[0]the same a...	-	0~2	0
✓	Pn008	Servo locking time after electromagnetic brak...	0	10ms	0~50	0
✓	Pn009	Electromagnetic brake action delay	50	10ms	10~100	50
✓	Pn010	Motor speed setting when electromagnetic b...	100	r/min	0~10000	100
✓	Pn012	External braking resistor powe	0	10W	0~65535	0
✓	Pn013	External braking resistor value	0.00	Ω	0.00~655.35	0

All Un parameters can be read in real time in the real-time monitoring interface. Select the frequently used parameters in the monitoring parameters and to read the data in real time in a cycle.



	Func...	Parameter name	Current value	Unit
☑	Un000	Motor rotation speed	0	r/min
☑	Un001	Speed command	0	r/min
☐	Un002	Internal torque command	0	%
☐	Un003	Rotor pulse position relati...	0	pulse
☐	Un004	Electrical angle	0	deg
☐	Un005	Speed of input pulse com...	0	r/min
☐	Un006	Counter of input comman...	0	Com...
☐	Un007	Counter of feedback pulse	0	Com...
☐	Un008	Counter of feedback puls...	0	Enco...
☐	Un009	Position deviation	0	Com...
☐	Un00A	Cumulative load rate	0	%
☐	Un00B	Regeneration load rate	0.0	%

Un000:Motor rotation speed

Display motor real time speed

6.2.3 Quick Setup

To avoid tedious parameterization, click 装机向导 in the toolbar to configure the basic functions step by step. After the configuration of the current interface is completed, click [Next] to proceed to the next step.

旋转方向选择(Pn002)

● 0-以CCW为正转方向

○ 1-以CW为正转方向

编码器脉冲输出极性选择(Pn072.X)

● 0-正极性输出

○ 1-负极性输出

电机每圈输出脉冲个数(四倍频前)设置(Pn070)

2500 (单位:PUU/rev 范围:35~32767)

编码器分频脉冲Z信号宽度(Pn071)

4

脉冲分频输出说明

信号名称	输出形式	输出端口	最大脉冲频率
A相信号	差分输出	PAO+	PAO-
B相信号	差分输出	PBO+	PBO-
Z相信号	差分输出	PZO+	PZO-

注：A/B相脉冲宽度由电机转速决定，Z脉冲宽度可以调整。

The configuration items are listed in the following table:

Item	**Description**
Direction of rotation and crossover output	By Pn002, the direction of rotation of the motor can be changed without changing the polarity of the input command. The Pn070, Pn071, Pn072 function codes are crossover output pulse for different applications. (Low-voltage servo SD100 does not support the function of crossover output now.)
Control mode	Control mode selection (position, speed, torque) and corresponding command source selection. (Only internal modes are supported in speed and torque modes)
Command input	Position mode: 1. Manual/Auto setting of electronic gear ratio to match user unit. Automatic setting is based on automatic calculation of gear ratio according to the relevant parameters of load mechanical structure (supporting ball screw, round table, belt+pulley structure); 2. Pulse input pattern and polarity selection, positioning completion threshold setting. Speed mode setting: 1. internal speed setting; 2. acceleration and deceleration setting, speed completion threshold setting. Position mode setting: 1. Internal torque setting; 2. Low-pass filter time setting and internal speed limit.
Stop mode	Servo OFF stop, OT overtravel stop and Gr1/2 stop mode (SD100 does not support DB dynamic braking stop)
Braking resistor	External braking resistance and power setting
Input/output	Input/output terminal function and polarity configuration (SD100 only supports X1~X4, Y1 and Y2 configuration)

Precautions	
⚠	● SD100 does not support crossover output function at present; ● In speed and torque mode, only internal mode is supported; ● SD100 does not support DB dynamic brake stop; ● SD100 only supports external braking resistor; ● SD100 only supports X1~X4, Y1 and Y2 input/output terminals.

When all the items are configured, click [Apply], enter the parameter list interface -> click [Write Drive] -> repower up, and all the configurations are valid.

功能名称	调整前	调整后	单位
1、旋转方向与分频输出设定>>			
旋转方向选择(Pn002)	0-以CCW为正转方向	0-以CCW为正转方向	
编码器脉冲输出极性选择(Pn072.X)	0-正极性输出	0-正极性输出	
电机每圈输出脉冲个数(四倍频前)设置(P...	2500	2500	PUU/rev
2、控制模式设定>>			
控制模式选择(Pn000.X)	0-位置控制模式	0-位置控制模式	
控制指令源选择(Pn200)	未知	0-外部低速脉冲序列	
脉冲输入形态选择(Pn201)	0-脉冲+方向	0-脉冲+方向	
脉冲输入极性选择(Pn202.X	0-正极性	0-正极性	
3、指令输入设定>>			
电子齿轮比设置(Pn204)	1	1	
电子齿轮比设置(Pn206)	1	1	
定位完成阀值设定(Pn262)	7	7	指令单位
4、停机模式设定>>			
Gr.1类报警时的停止方法(Pn004)	2-不使用DB，将电机设为自由运行...	2-不使用DB，将电机设为自由运行...	
Gr.2类报警时的停止方法(Pn005)	1-DB停止或自由运行停机（同Pn004）	1-DB停止或自由运行停机（同Pn004）	
超程(OT)时的停止方法(Pn007)	1-将Pn053的值作为最大减速转矩...	1-将Pn053的值作为最大减速转矩...	
5、制动电阻设定>>			
外部制动电阻功率(Pn012)	0	0	(10W)
外部制动电阻阻值(Pn013)	0	0	Ω
6、输入输出信号>>			

☐ 仅显示不同项

6.2.4 Power-up Trial Operation

(1) JOG operation

JOG operation confirms the functions of servo motor by speed control. Debugging software steps are as follows:

Step 1: Select JOG in the toolbar to enter the JOG interface;

Step 2: Set the speed of JOG operation -> [Turn on] -> long press [Forward], observe if the motor is running normally;

Step 3: Long press [Reverse], observe if the motor is running normally;

Step 4: If the operation is normal, click [Back] to exit the current interface.

Jog speed (rpm) 1000 (Range:0~10000)

Motor rotation speed (r/min) --

Speed command (r/min) --

Precautions

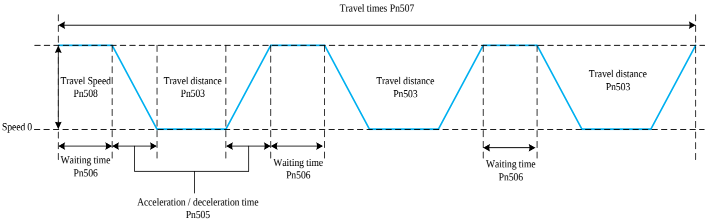
- Set the appropriate JOG speed value;
- Make sure that the JOG movement is within the operating range;
- The power of the main circuit should be turned on;
- No alarm occurs.
- Servo is OFF.

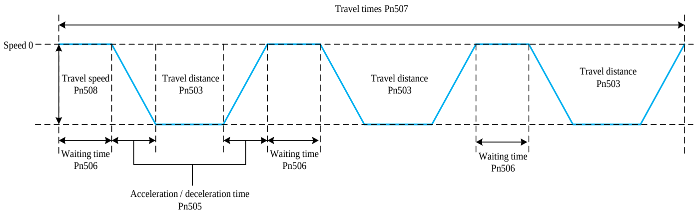
(2) Program JOG operation

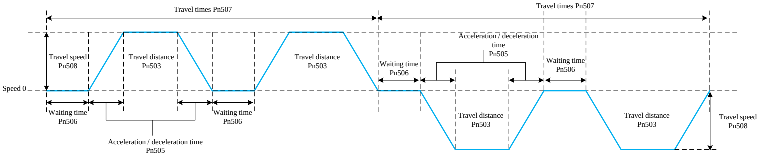
This function enables simple positioning to be performed without a PLC by position controlling the motor in JOG mode

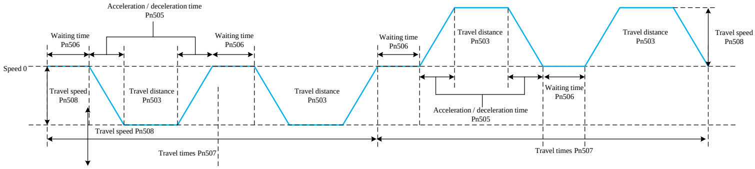
Program JOG operation is a function that operates continuously with pre-set operation mode (Pn502), travel distance (Pn503), acceleration/deceleration time (Pn505), waiting time (Pn506), number of moves (Pn507), and travel speed (Pn508).

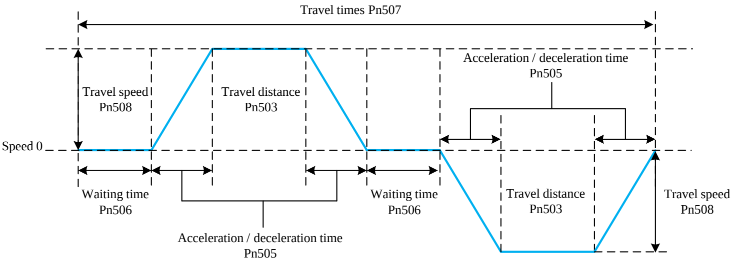
An example of the program JOG operation mode is shown below.

Pn502=0	**(Waiting time Pn506→forward movement Pn503) × number of movement Pn507**
Speed diagram	 Note: Set Pn507 (number of movement) to "0" for unlimited runs.

Pn502=1	**(Waiting time Pn506→forward movement Pn503) × number of movement Pn507**
Speed diagram	 Note: Set Pn507 (number of movement) to "0" for unlimited runs.

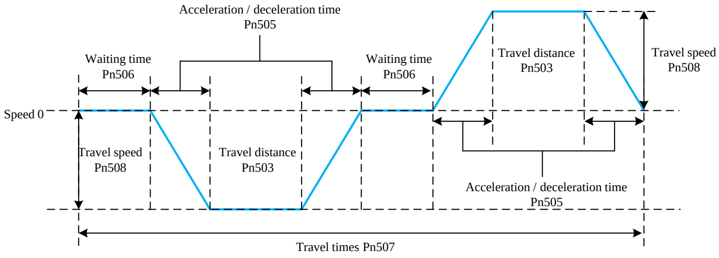
Pn502=2	**(Waiting time Pn506→forward movement Pn503→waiting time Pn506→forward movement Pn503)×number of movement Pn507** **(Waiting time Pn506→reverse movement Pn503→waiting time Pn506→reverse movement**
Speed diagram	 Note: Set Pn507 (number of movement) to "0" for unlimited runs.

Pn502 = 3	**(Waiting time Pn506→reverse movement Pn503→waiting time Pn506→reverse movement Pn503)×number of movement Pn507** **(Waiting time Pn506→forward movement Pn503→waiting time Pn506→forward movement Pn503)×number of movement Pn507**
Speed diagram	 Note: Set Pn507 (number of movement) to "0" for unlimited runs.

Pn502=4	**(Waiting time Pn506→forward movement Pn503→waiting time Pn506→forward movement Pn503)×number of movement Pn507**
Speed diagram	 Note: Set Pn507 (number of movement) to "0" for unlimited runs.

Pn502=5	**(Waiting time Pn506→reverse movement Pn503→waiting time Pn506→reverse movement**

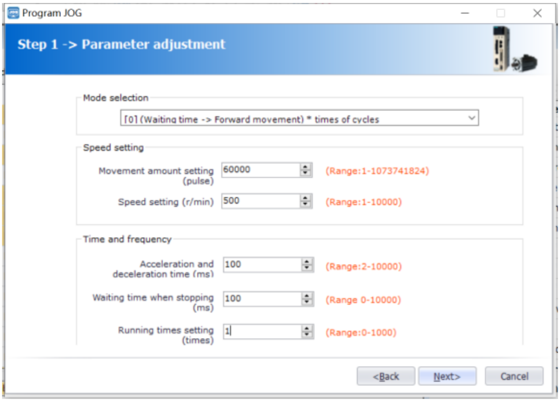
Speed diagram



Note: Set Pn507 (number of movement) to "0" for unlimited runs.

The program JOG is set up to perform the following steps：

Step 1: select in the toolbar, click [Next] to enter the program JOG interface.



Step 1 -> Parameter adjustment

Mode selection

[0] (Waiting time -> Forward movement) * times of cycles

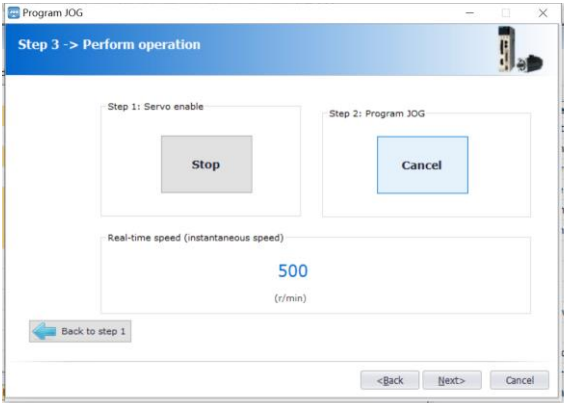
Speed setting

Movement amount setting (pulse)	60000	(Range:1-1073741824)
Speed setting (r/min)	500	(Range:1-10000)

Time and frequency

Acceleration and deceleration time (ms)	100	(Range:2-10000)
Waiting time when stopping (ms)	100	(Range 0-10000)
Running times setting (times)	1	(Range:0-1000)

Step2 :Configuration completed -> Click [Next] → [Write] → [Next] - [Enable], then it will automatically execute the program JOG in accordance with the set configuration.



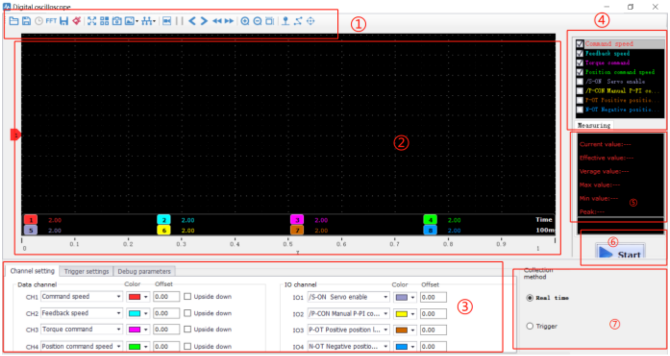
Real-time speed (instantaneous speed): 500 (r/min)

Precautions

- Set the appropriate JOG speed value;
- Make sure that the JOG movement is within the operating range;
- When over-travel occurs during operation, the corresponding over-travel protection will be activated;
- Set the travel distance and travel speed with consideration to the operating range of the machine and the safe travel speed;
- Program JOG operation is position control, but pulse commands cannot be input to the servo unit;
- The position command filtering function can be performed during program JOG operation.

6.3 Oscilloscope

The digital oscilloscope collects data at high speed and displays them in the form of graphic curves, which is convenient for data analysis. The interface structure is as follows.



Data channel		Color	Offset	
CH1	Command speed	🟥	0.00	☐ Upside down
CH2	Feedback speed	🟦	0.00	☐ Upside down
CH3	Torque command	🟪	0.00	☐ Upside down
CH4	Position command speed	🟩	0.00	☐ Upside down

IO channel		Color	Offset
IO1	/S-ON Servo enable	🟪	0.00
IO2	/P-CON Manual P-PI co...	🟨	0.00
IO3	P-OT Positive position l...	🟧	0.00
IO4	N-OT Negative positio...	🟦	0.00

① Toolbar: the toolbar includes functions such as open, save, full screen, style (switching the display background), settings, screenshot, legend, timeline, back, forward, fast forward, fast forward, zoom in, zoom out, adaptive, zero, point/line, measurement, etc.

② Curve display area: different curves to provide visual display and measurement results to display.

③ Channel setting and trigger setting: provide channel-related parameter setting and trigger-related parameter setting. Parameter setting includes trigger condition setting and channel setting.

④ Waveform display selection area: provide the selection of waveforms to display or hide.

⑤ Measured value digital display area: provide display of current value, valid value, average value, maximum value, minimum value, peak value, etc.

⑥ Waveform recording operation button: provide display of current value, valid value, average value, maximum value, minimum value and peak value, etc.

⑦ Acquisition mode selection: to select the recording mode, real-time or triggered acquisition, the minimum sampling period can be set to 125us in trigger mode.

Precautions

- The oscilloscope does not function properly when executing the debugging software auxiliary function.

6.4 Advanced Applications

6.4.1 Inertia Detection

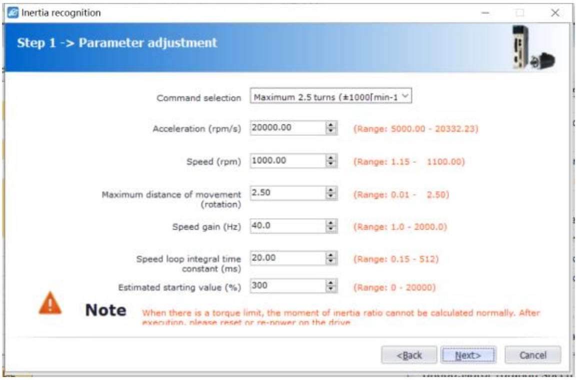
The ratio of rotational inertia (the ratio of load rotational inertia to motor rotor inertia) is the reference parameter for performing gain adjustment, and it is important to set the correct value as much as possible. The load moment of inertia can be calculated based on the weight and composition of each part of the machine, but it is cumbersome to do so. With this function, a highly accurate value of the load moment of inertia can be obtained by driving the motor in the positive or negative direction several times.

The debugging software is implemented as follows.

Step 1: Select in the toolbar, click [Next], enter the interface of inertia detection.

Step 2: Set inertia detection parameters and plan acceleration and deceleration curves->click [Next].

Step 3: Write parameters->Click [Next].



Command selection: Maximum 2.5 turns (±1000[min-1

Acceleration (rpm/s): 20000.00 (Range: 5000.00 - 20332.23)

Speed (rpm): 1000.00 (Range: 1.15 - 1100.00)

Maximum distance of movement (rotation): 2.50 (Range: 0.01 - 2.50)

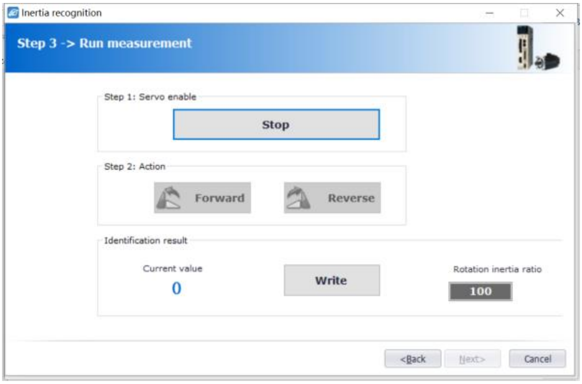
Speed gain (Hz): 40.0 (Range: 1.0 - 2000.0)

Speed loop integral time constant (ms): 20.00 (Range: 0.15 - 512)

Estimated starting value (%): 300 (Range: 0 - 20000)

Note When there is a torque limit, the moment of inertia ratio cannot be calculated normally. After execution, please reset or re-power on the drive

Step 4: Enable the servo, repeat the forward and reverse rotation more than 3 times in a row, and then click [Write] to complete the parameter detection after obtaining the result.



Current value: 0

Rotation inertia ratio: 100

6.4.2 Bandwidth Setting

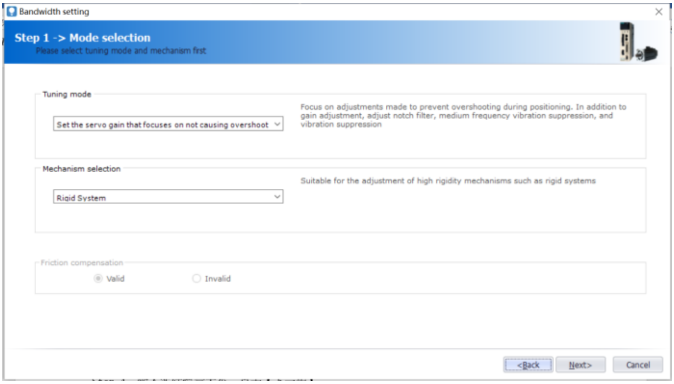
Bandwidth setting is a method of manually adjusting a speed command or position command by inputting it from a host computer during operation. Adjust one or two values via tuning setting, the relevant servo gain can be adjusted automatically.

The commissioning software operates as follows.

Step 1: Enable the motor, confirm the safety range, and run in speed mode or position mode in forward and reverse continuously.

Step 2: Select 💡 in the toolbar, click [Next] to enter the bandwidth setting interface.

Step 3: Set according to the mechanical load structure and tuning requirements, choose whether to open the friction compensation, and click [Next] into the bandwidth setting interface;



Bandwidth setting

Step 1 -> Mode selection

Please select tuning mode and mechanism first

Tuning mode: Set the servo gain that focuses on not causing overshoot

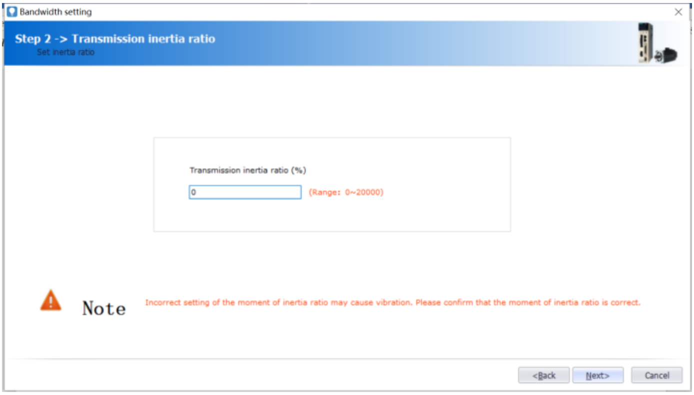
Focus on adjustments made to prevent overshooting during positioning. In addition to gain adjustment, adjust notch filter, medium frequency vibration suppression, and vibration suppression

Mechanism selection: Rigid System

Suitable for the adjustment of high rigidity mechanisms such as rigid systems

Friction compensation: ● Valid ○ Invalid

Step 4: Enter the actual inertia size, click [Next];



Bandwidth setting

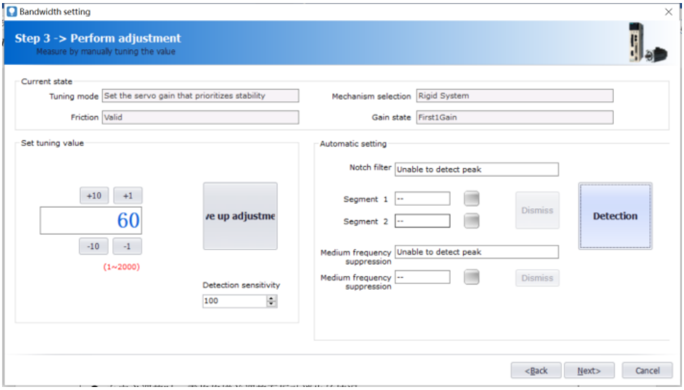
Step 2 -> Transmission inertia ratio

Set inertia ratio

Transmission inertia ratio (%): 0 (Range: 0~20000)

Note Incorrect setting of the moment of inertia ratio may cause vibration. Please confirm that the moment of inertia ratio is correct.

Step 5: Click [Start Tuning] from the initial tuning value to start debugging, and gradually change the adjustment value. When the motor has obvious high-frequency vibration, it will start vibration detection and vibration suppression automatically; if it can't be effectively suppressed, reduce the adjustment value appropriately; Adjust the gain until the vibration disappears and performance meets the user's requirements of the response;



Bandwidth setting

Step 3 -> Perform adjustment

Measure by manually tuning the value

Current state

Tuning mode: Set the servo gain that prioritizes stability

Mechanism selection: Rigid System

Friction: Valid

Gain state: First1Gain

Set tuning value: 60 (1~2000)

Detection sensitivity: 100

Automatic setting

Notch filter: Unable to detect peak

Segment 1: --

Segment 2: --

Medium frequency suppression: Unable to detect peak

Medium frequency suppression: --

Step 6: When the response is satisfactory, end the tuning, click [Next] to automatically match the current response conditions under the gain parameters.

Precautions

- Confirm the safe range and perform commissioning under servo operation.
- If the response changes drastically during commissioning, use emergency stop or disconnect the power supply.
- When making customized adjustments, adjust the gain so that the vibration disappears.

6.4.3 Smart Setting

Smart setting is divided into automatic adjustment with command input and without command input.

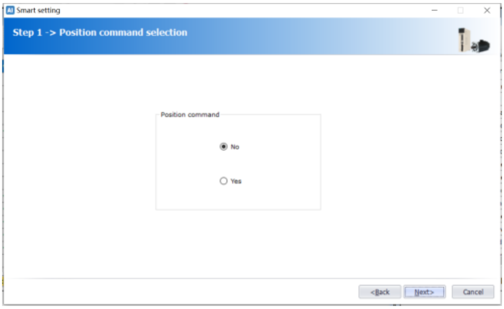
Type	Description	Item
Input without command	Smart setting without command input refers to a function with which the servo drive automatically adjusts itself according to the mechanical characteristics during automatic operation (forward and reverse reciprocating motions) within a set range. The drive can perform the smart setting without connecting to a host computer	Ratio of inertia Gain adjustment (speed loop gain, position loop gain, etc.) Filter adjustment (torque command filter, notch filter) Friction compensation A-type vibration suppression control Vibration suppression
Input with command	Smart setting with command input is a function that automatically tunes the operating commands from the host device to optimize the relevant parameters for the operating. If the moment of inertia of the load is known to the user, only perform this function and save the non-command smart setting	Gain adjustment (speed loop gain, position loop gain, etc.) Filter adjustment (torque command filter, trap filter) Friction compensation A-type vibration suppression control Vibration suppression

Debugging software operation is as follows.

Step 1: Select AI in the toolbar and click [Next] to enter the smart setting interface.

Step 2: Select no position command or auto tuning of command input->click [Next]-> [Yes] or [No] ->click [Next].

No position command:



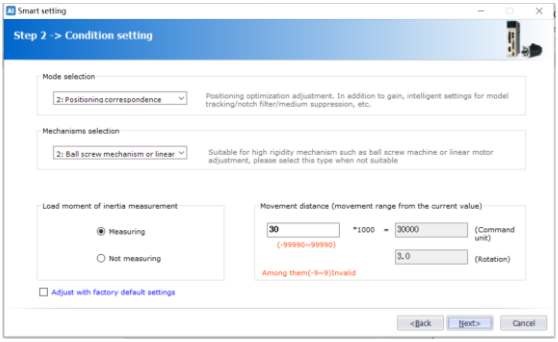
Smart setting

Step 1 -> Position command selection

Position command

● No

○ Yes



Smart setting

Step 2 -> Condition setting

Mode selection

2: Positioning correspondence

Positioning optimization adjustment. In addition to gain, intelligent settings for model tracking/notch filter/medium suppression, etc.

Mechanisms selection

2: Ball screw mechanism or linear

Suitable for high rigidity mechanism such as ball screw machine or linear motor adjustment, please select this type when not suitable

Load moment of inertia measurement

● Measuring

○ Not measuring

Movement distance (movement range from the current value)

30 *1000 = 30000 (Command unit)

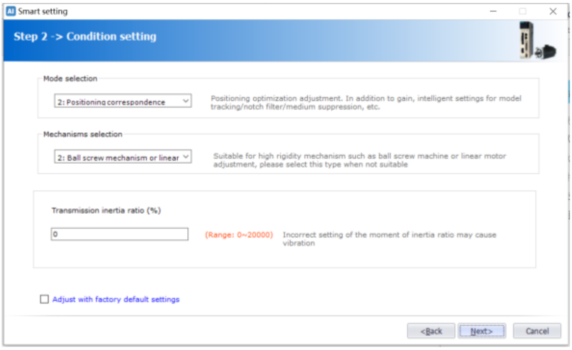
(-99990~99990)

3.0 (Rotation)

Among them(-9~9)Invalid

☐ Adjust with factory default settings

With position command:



Smart setting

Step 2 -> Condition setting

Mode selection

2: Positioning correspondence

Positioning optimization adjustment. In addition to gain, intelligent settings for model tracking/notch filter/medium suppression, etc.

Mechanisms selection

2: Ball screw mechanism or linear

Suitable for high rigidity mechanism such as ball screw machine or linear motor adjustment, please select this type when not suitable

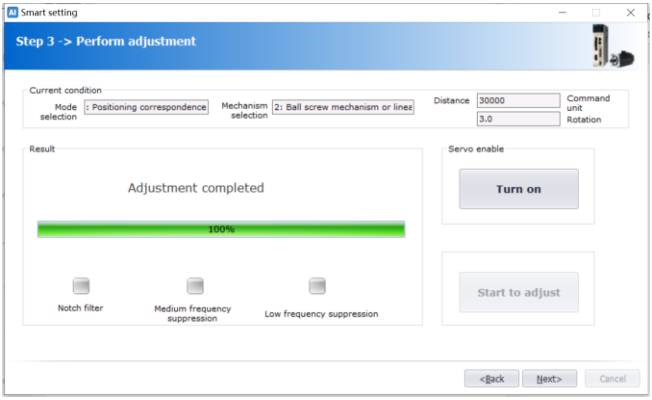
Transmission inertia ratio (%)

0

(Range: 0~20000) Incorrect setting of the moment of inertia ratio may cause vibration

☐ Adjust with factory default settings

Step 3: When there is no command input, click [Turn on] -> click [Start to adjust]; and when there is command input, directly click [Start to adjust].



Smart setting

Step 3 -> Perform adjustment

Current condition

Mode selection: Positioning correspondence

Mechanism selection: 2: Ball screw mechanism or linea

Distance: 30000 Command unit

3.0 Rotation

Result

Adjustment completed

100%

Servo enable

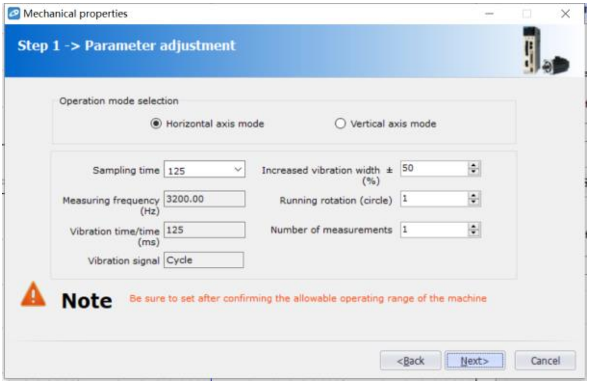
Step 4: After the adjustment is completed, click [Next] to automatically match the gain parameters under the current response conditions.

6.4.4 Mechanical Characteristics Analysis

Mechanical characteristics are analyzed by the servo unit for automatic operation (forward and reverse reciprocating motion), and the resonance frequency of the mechanical system is assumed during operation.

The operation steps of the debugging software are as follows:

Step 1: Select in the toolbar, click [Start Measuring] → [Next] to enter the parameter adjustment interface, adjust the corresponding parameters according to the actual situations, as shown in the figure below.



Step 1 -> Parameter adjustment

Operation mode selection

● Horizontal axis mode ○ Vertical axis mode

Sampling time 125

Measuring frequency (Hz) 3200.00

Vibration time/time (ms) 125

Vibration signal Cycle

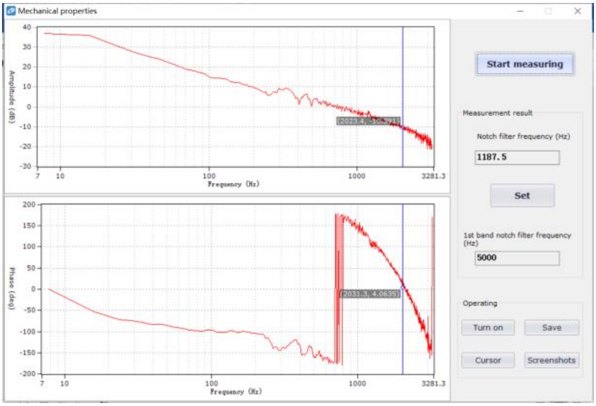
Increased vibration width ± (%) 50

Running rotation (circle) 1

Number of measurements 1

Note Be sure to set after confirming the allowable operating range of the machine

Step 2: Click [Next] → [Write] → [Next] → [Turn on] → [Forward] → [Turn on] → [Reverse] → [Next] → [OK] to enter the FFT analysis screen of mechanical characteristics, as shown in the following figure:



Measurement result

Notch filter frequency (Hz) 1187.5

1st band notch filter frequency (Hz) 5000

Step 3: Resonance frequency point, amplitude and phase can be analyzed as the steps above, click [Set] to set the 1st section of the notch filter frequency, close the screen after the setting is completed, and the operation of mechanical characteristics is completed.

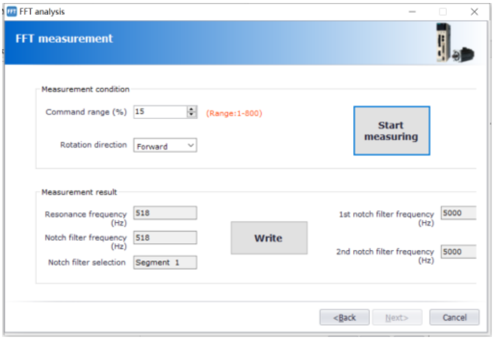
6.4.5 FFT

EasyFFT transmits a periodic waveform command from the servo unit to the servo motor, and rotates the servo motor a few times within a certain period, causing the machine to vibrate. The servo unit detects the resonance frequency based on the vibration generated from the machine, and then sets the corresponding notch filter according to the resonance frequency. Notch filter can effectively remove high-frequency vibration and noise.

Debugging software FFT analysis steps are as follows.

Step 1: Select FFT in the toolbar and click [Next] to enter the FFT interface.

Step 2: Enter the FFT measurement interface, set the command range and rotation direction in the measurement conditions, click [Start measuring], and the first notch filter frequency can be measured, as shown in the figure below.



Measurement condition

Command range (%) 15 (Range:1-800)

Rotation direction Forward

Measurement result

Resonance frequency (Hz) 518

Notch filter frequency (Hz) 518

Notch filter selection Segment 1

1st notch filter frequency (Hz) 5000

2nd notch filter frequency (Hz) 5000

Step 3: Click [Start measuring] to measure the first notch, and then click [Write] to write the first notch filter frequency;

Step 4: Click [Start measuring] to measure the second notch, and then click [Write] to write the second notch filter frequency;

Step 5: Click [Next] → [Done] to close the operation process interface, FFT analysis is completed.

Precautions

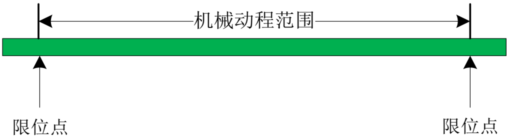
- When this function is executed, the servomotor rotates slightly. Do not touch the servomotor or equipment during operation, as this may cause injury.
- This function must be used when the gain is low, like the initial stage of servo tuning. If the Easy FFT function is executed with a high gain setting, the machine may vibrate due to the mechanical characteristics and gain balance.

6.5 Other Functions

6.5.1 Soft Limit Setting

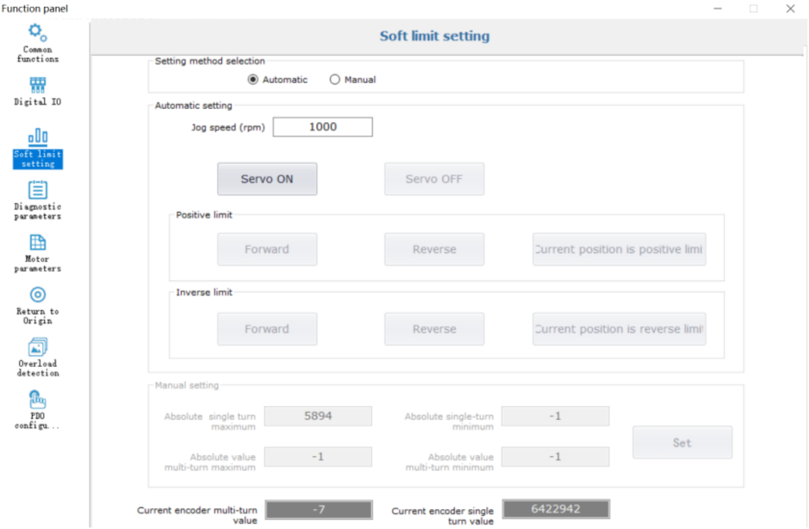
Soft limit setting is to limit the left and right positions by means of the single and multi-turn values inside the absolute encoder in the absence of external limit switches.

Mechanical stroke



The automatic mode setting is as follows:

Set the jog speed -> Servo ON -> Long press [Forward] or [Reverse] to the positive limit position-> Set the current position as positive limit -> Long press [Forward] or [Reverse] position to the negative limit position-> Set the current position as negative limit



Setting method selection: ● Automatic ○ Manual

Automatic setting

Jog speed (rpm) 1000

Manual setting

Absolute single turn maximum 5894

Absolute single-turn minimum -1

Absolute value multi-turn maximum -1

Absolute value multi-turn minimum -1

Current encoder multi-turn value -7

Current encoder single turn value 6422942

6.5.2 Home Setting

The steps for setting and performing the origin return mode through the debugging software are as follows:

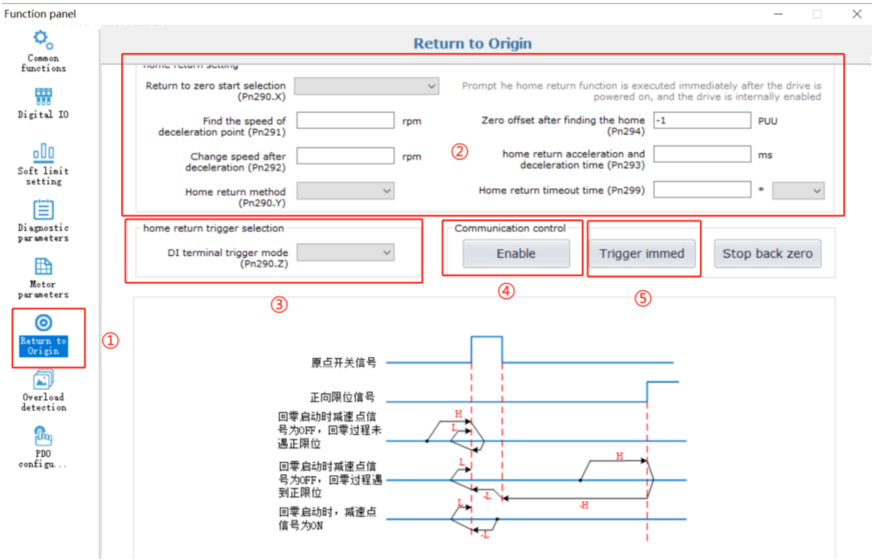
Step 1: Select the home return in the function panel;

Step 2: Set return modes and the related function settings;

Step 3: Select the trigger mode of home position DI;

Step 4: Click [Enable] to enable the servo motor;

Step 5: Then click [Trigger Immediately] to start the operation.



Prompt 'he home return function is executed immediately after the drive is powered on, and the drive is internally enabled

Zero offset after finding the home (Pn294): -1

Precautions

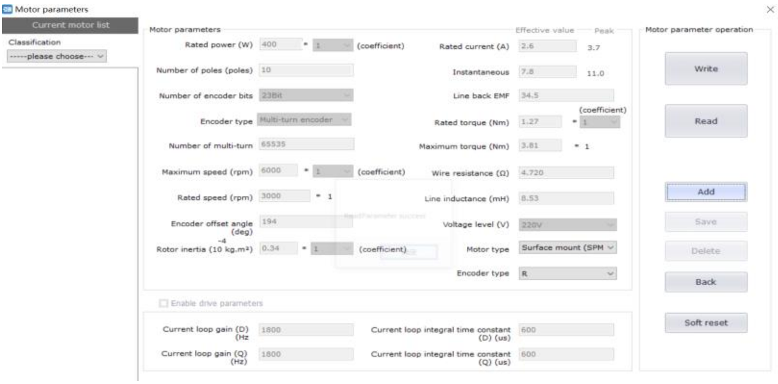
- Please set the appropriate speed value;
- Make sure that it is within the mechanical operating range;
- Make sure that the soft limit switch function is not turned on (Pn00A.W = 0).

6.5.3 Motor Parameter Setting

The interface mainly contains the following two functions:

(1) Write and read motor parameters: the preset motor parameters can be written to the EEPROM of the serial encoder, and the current motor parameters can be read through the EEPROM;

(2) Motor pole position detection: this function is used to realize the detection of the initial zero position of the motor.



Classification: -----please choose---

Motor parameters

Rated power (W) 400 * 1 (coefficient)

Number of poles (poles) 10

Number of encoder bits 23Bit

Encoder type Multi-turn encoder

Number of multi-turn 65535

Maximum speed (rpm) 6000 * 1 (coefficient)

Rated speed (rpm) 3000 * 1

Encoder offset angle (deg) 194

Rotor inertia (10^{-4} kg.m^2) 0.34 * 1 (coefficient)

Effective value / Peak

Rated current (A) 2.6 3.7

Instantaneous 7.8 11.0

Line back EMF 34.5

Rated torque (Nm) 1.27 * 1 (coefficient)

Maximum torque (Nm) 3.81 * 1

Wire resistance (Ω) 4.720

Line inductance (mH) 8.53

Voltage level (V) 220V

Motor type Surface mount (SPM

Encoder type R

☐ Enable drive parameters

Current loop gain (D) (Hz 1800

Current loop integral time constant (D) (us) 600

Current loop gain (Q) (Hz) 1800

Current loop integral time constant (Q) (us) 600

Precautions

- For third-party motors with unknown offset angle, the encoder offset angle must be found by motor pole detection before operation;
- Only supports writing and reading parameters of third-party motors with serial encoders;
- The parameters of the third-party motor must strictly refer to the motor parameters provided by the manufacturer, and incorrect settings may cause abnormal motor operation.

6.5.4 Absolute Encoder Setting

The absolute encoder must be set (initialized) in the following cases:

① When the machine is initially started;

② When [Encoder Backup Alarm (ER.810)] occurs;

③ When the serial data of the rotational amount of the absolute encoder is to be initialized.

Precautions

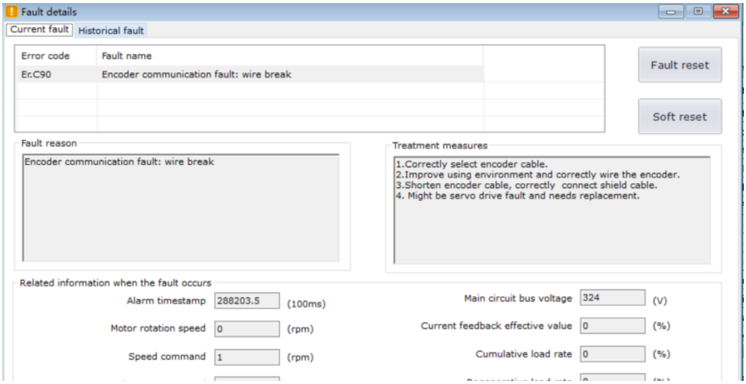
- When an absolute encoder is set, the rotation data is a value in the range of -2 to +2 revolutions. Please determine the reference position of the upper unit according to the set position since the reference position of the mechanical system may change.
- If the motor is operated without positioning the upper unit, unexpected mechanical action may occur resulting in personal accidents or damage to the machines. Be careful during operation.
- Perform the basic settings (initialization) in the servo-off state.
- The "Encoder Backup Alarm (ER.810)" cannot be accessed by the servo unit's alarm reset (/ALM-RST) signal. Be sure to set (initialize) via Fn008.
- If an encoder internal monitoring alarm (ER.8☐☐) occurs, do not turn off the power to cancel the alarm.

Debugging software operation:

Select the common function interface in the function panel and click [Clear Er.810/Er.860 Fault].

6.5.5 Fault Reset and Search

The fault interface displays the current fault, historical fault, fault causes, measures and fault occurrence information, as well as the fault reset operation.



Error code	Fault name
Er.C90	Encoder communication fault: wire break

Fault reason

Encoder communication fault: wire break

Treatment measures

1.Correctly select encoder cable.
2.Improve using environment and correctly wire the encoder.
3.Shorten encoder cable, correctly connect shield cable.
4. Might be servo drive fault and needs replacement.

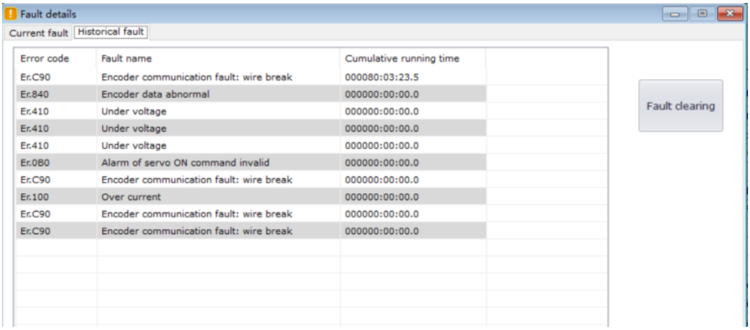
Related information when the fault occurs

Alarm timestamp 288203.5 (100ms)
Motor rotation speed 0 (rpm)
Speed command 1 (rpm)
Main circuit bus voltage 324 (V)
Current feedback effective value 0 (%)
Cumulative load rate 0 (%)

Up to ten errors can be displayed retrospectively in the fault history. The traceability includes

① the code number of the error;

② the time of error occurrence.



Error code	Fault name	Cumulative running time
Er.C90	Encoder communication fault: wire break	000080:03:23.5
Er.840	Encoder data abnormal	000000:00:00.0
Er.410	Under voltage	000000:00:00.0
Er.410	Under voltage	000000:00:00.0
Er.410	Under voltage	000000:00:00.0
Er.0B0	Alarm of servo ON command invalid	000000:00:00.0
Er.C90	Encoder communication fault: wire break	000000:00:00.0
Er.100	Over current	000000:00:00.0
Er.C90	Encoder communication fault: wire break	000000:00:00.0
Er.C90	Encoder communication fault: wire break	000000:00:00.0

Precautions

- When the same error occurs consecutively, it will not be saved if the time interval between occurrence is shorter than one hour, but will be saved if the time interval between occurrence of the errors is longer than one hour;
- Error records can be cleared by "Fault clearing". Alarm records cannot be cleared even if users reset the alarms or cut off the main circuit power to the servo unit.

6.5.6 Pulse Setting and Feedback Clearing

Clear the values of the monitoring function codes Un006, Un007, Un008 and Un00F.

Debugging software operation:

Select [Function Panel] -> [Diagnostic Parameter] -> Clear external pulse or encoder feedback.

Diagnostic parameters

External input pulse count (Un006): 0

Motor encoder feedback

Encoder unit (Un007): 0

User unit (Un008): -11

6.5.7 Soft Reset and Factory Reset

(1) Soft reset

The servo drive is reset internally by software. This is used when the power needs to be turned on again after changing the parameter settings. It is also possible to make the settings valid without turning the power back on.

Debugging software operation:

Select ↻ in the toolbar, and all is set.

Precautions

- This function must be operated when the servo is OFF.
- This function is independent of other devices, and it resets the servo drive with the same effect as power on, and the servo drive will output the ALM signal, and other output signals may be changed forcibly.

(2) Factory reset

This function is used when restoring the parameters to the factory settings.

Debugging software operation:

Select [Factory Reset] in the [Common] in the function panel.

Precautions

- The initialization of the parameter setting must be performed in the servo-off state, and cannot be performed in the servo-on state.
- To make the setting valid, the power to the servo unit must be turned on again after operation.
- After initializing the parameter setting, turn the power to the servo unit back on.

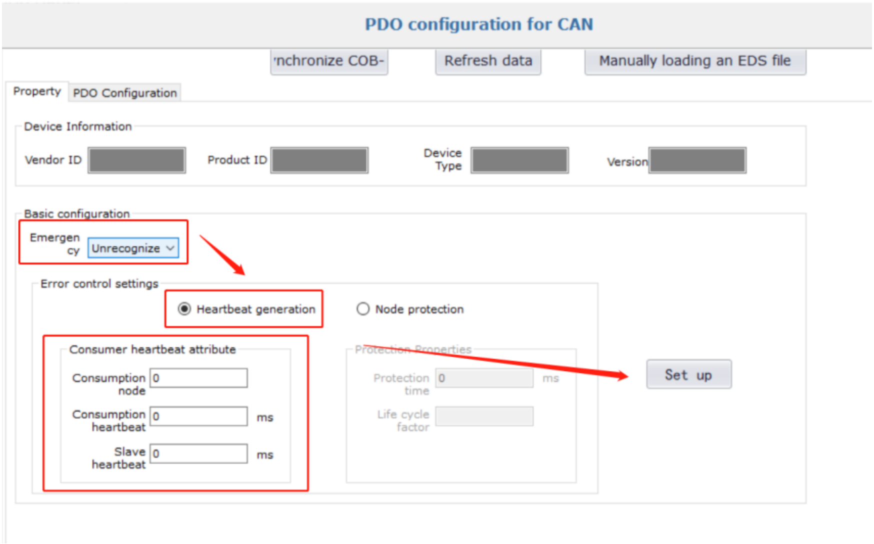
6.5.8 CAN Communication Configuration Interface

CAN master is not required in the CAN communication configuration interface to complete the CAN communication power saving protection, heartbeat setting, emergency message, PDO mapping and other settings.

The configuration steps are as follows.

(1) Before the communication is set up, load the EDS file manually to get the default configuration;

(2) Configure the emergency message, heartbeat attribute and power saving protection in the attribute configuration interface;



Vendor ID [redacted]

Product ID [redacted]

Device Type [redacted]

Version [redacted]

Emergency: Unrecognize

● Heartbeat generation ○ Node protection

Consumer heartbeat attribute

Consumption node: 0

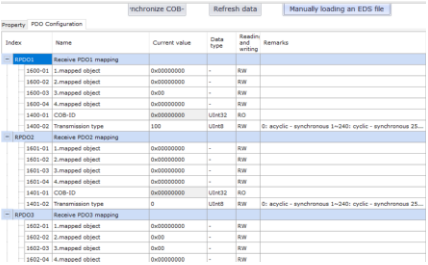
Consumption heartbeat: 0 ms

Slave heartbeat: 0 ms

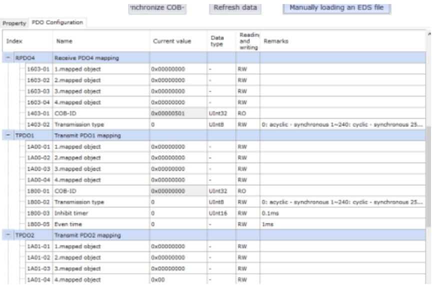
Protection time: 0 ms

Life cycle factor:

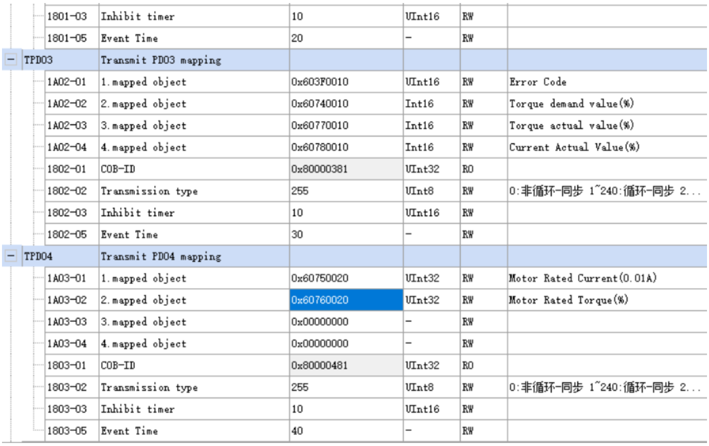
(3) Delete the mapping in PDO and re-add the new mapping parameters.



Index	Name	Current value	Data type	Reading and writing	Remarks
RPDO1	Receive PDO1 mapping				
1600-01	1.mapped object	0x00000000	-	RW	
1600-02	2.mapped object	0x00000000	-	RW	
1600-03	3.mapped object	0x00	-	RW	
1600-04	4.mapped object	0x00000000	-	RW	
1400-01	COB-ID	0x00000000	UInt32	RO	
1400-02	Transmission type	100	UInt8	RW	0: acyclic - synchronous 1~240: cyclic - synchronous 25...
RPDO2	Receive PDO2 mapping				
1601-01	1.mapped object	0x00000000	-	RW	
1601-02	2.mapped object	0x00000000	-	RW	
1601-03	3.mapped object	0x00000000	-	RW	
1601-04	4.mapped object	0x00000000	-	RW	
1401-01	COB-ID	0x00000000	UInt32	RO	
1401-02	Transmission type	0	UInt8	RW	0: acyclic - synchronous 1~240: cyclic - synchronous 25...
RPDO3	Receive PDO3 mapping				
1602-01	1.mapped object	0x00000000	-	RW	
1602-02	2.mapped object	0x00	-	RW	
1602-03	3.mapped object	0x00	-	RW	
1602-04	4.mapped object	0x00000000	-	RW	



Index	Name	Current value	Data type	Reading and writing	Remarks
RPDO4	Receive PDO4 mapping				
1603-01	1.mapped object	0x00000000	-	RW	
1603-02	2.mapped object	0x00000000	-	RW	
1603-03	3.mapped object	0x00000000	-	RW	
1603-04	4.mapped object	0x00000000	-	RW	
1403-01	COB-ID	0x00000501	UInt32	RO	
1403-02	Transmission type	0	UInt8	RW	0: acyclic - synchronous 1~240: cyclic - synchronous 25...
TPDO1	Transmit PDO1 mapping				
1A00-01	1.mapped object	0x00000000	-	RW	
1A00-02	2.mapped object	0x00000000	-	RW	
1A00-03	3.mapped object	0x00000000	-	RW	
1A00-04	4.mapped object	0x00000000	-	RW	
1800-01	COB-ID	0x00000000	UInt32	RO	
1800-02	Transmission type	0	UInt8	RW	0: acyclic - synchronous 1~240: cyclic - synchronous 25...
1800-03	Inhibit timer	0	UInt16	RW	0.1ms
1800-05	Even time	0	-	RW	1ms
TPDO2	Transmit PDO2 mapping				
1A01-01	1.mapped object	0x00000000	-	RW	
1A01-02	2.mapped object	0x00000000	-	RW	
1A01-03	3.mapped object	0x00000000	-	RW	
1A01-04	4.mapped object	0x00	-	RW	



1801-03	Inhibit timer	10	UInt16	RW	
1801-05	Event Time	20	–	RW	
TPDO3	Transmit PDO3 mapping				
1A02-01	1.mapped object	0x603F0010	UInt16	RW	Error Code
1A02-02	2.mapped object	0x60740010	Int16	RW	Torque demand value(%)
1A02-03	3.mapped object	0x60770010	Int16	RW	Torque actual value(%)
1A02-04	4.mapped object	0x60780010	Int16	RW	Current Actual Value(%)
1802-01	COB-ID	0x80000381	UInt32	RO	
1802-02	Transmission type	255	UInt8	RW	0:非循环-同步 1~240:循环-同步 2...
1802-03	Inhibit timer	10	UInt16	RW	
1802-05	Event Time	30	–	RW	
TPDO4	Transmit PDO4 mapping				
1A03-01	1.mapped object	0x60750020	UInt32	RW	Motor Rated Current(0.01A)
1A03-02	2.mapped object	0x60760020	UInt32	RW	Motor Rated Torque(%)
1A03-03	3.mapped object	0x00000000	–	RW	
1A03-04	4.mapped object	0x00000000	–	RW	
1803-01	COB-ID	0x80000481	UInt32	RO	
1803-02	Transmission type	255	UInt8	RW	0:非循环-同步 1~240:循环-同步 2...
1803-03	Inhibit timer	10	UInt16	RW	
1803-05	Event Time	40	–	RW	

(4) Power up and down again to start the network operation, then the data interaction between the CAN communication network and the master station can be started according to the updated mapping object.

Precautions
● The CAN communication upper position needs to be configured before setting up the CANopen network.

Chapter 7 Parameters

7.1 Parameter Classification

The SD100 drive has a total of 11 sets of Pn parameters and 1 set of Un monitoring parameters. All parameters are categorized as follows.

Group	Function
Pn0xx	Basic parameters on control mode, brake control, encoder reset, and communication.
Pn1xx	Gain parameters on basic speed and position loop and speed loop gain as well as self-tuning, tuning-free, A vibration suppression, auto notch filter, friction compensation, speed observation, disturbance observation, and other advanced debugging functions.
Pn2xx	Position parameters on position command, electronic gear, gear backlash compensation, home return, positioning control output, etc., and position control functions such as low-frequency suppression and model tracking control.
Pn3xx	Speed parameters on internal speed, acceleration/deceleration, zero-speed clamping, and speed output control.
Pn4xx	Torque parameters on internal torque, torque filter, speed limit, and other torque control.
Pn5xx	Auxiliary parameters on JOG operation.
Pn6xx	Terminal parameters on the functions and polarity configuration of DI/DO switches, and virtual I/O functions.
Pn7xx	Expansion parameters
Pn8xx	Motion control parameters on Pr internal position.
PnExx	Drive parameters on internal drive, not recommended for modification.
PnFxx	Motor parameters on internal setting, not recommended for modification.
Unxxx	Monitoring parameters.

7.2 Pn Parameter Format

7.2.1 Parameter Format of “Value Setting”

Parameter No.

※ indicates user parameters

☆ indicates factory parameters

Function code enable time

○ enable immediately

■ enable after re-power-up

Communication address

★ means 32-bit data

Address in hexadecimal

Pn204	**Electronic gear numerator**	■	**Address:0x0204★**
Factory value: 4	**Range: 1～1073741824**	**Unit: Command unit**	**Control mode:** P

Mode for this parameter
P: position control
S: speed control
T: torque control

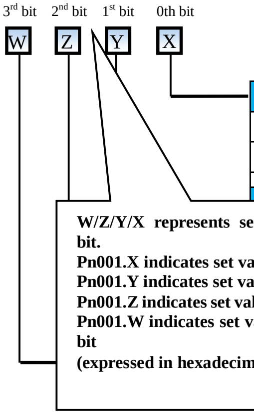
7.2.2 Parameter Format of "Function Selection"

Parameter No.
※ indicates user parameters
☆ indicates factory parameters

Function code enable time
○ enable immediately
■ enable after re-power-up

Communication address
★ means 32-bit data
Address in hexadecimal

Pn001	**Function selection basic switch1**	○	**Address:0x0001**
Factory value: 0x0000	**Range: 0x0000～0x0011**	**Unit: N/A**	**Control mode:** P S T



Servo enable	
0	Servo OFF
1	Servo ON

Servo enable storage (Power-off storage)

ameters (Not ready for use)

ameters (Not ready for use)

W/Z/Y/X represents setting on each bit.
Pn001.X indicates set values on 0-3 bit
Pn001.Y indicates set values on 4-7 bit
Pn001.Z indicates set values on 7-11 bit
Pn001.W indicates set values on 11-12 bit
(expressed in hexadecimal)

7.2.3 Parameter Format of Switches

Parameter No.
※ indicates user parameters
☆ indicates factory parameters

Function code enable time
○ enable immediately
■ enable after re-power-up

Communication address

Pn630	**Internal software setting for input terminal (X) state**	○	**Address: 0x0630**
Factory value: 0000	**Range: 0000～03FF**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Internal setting for input terminal status group1	
Bit0	Virtual input terminal X1
Bit1	Virtual input terminal X2
Bit2	Virtual input terminal X3
Bit3	Virtual input terminal X4

Internal setting for input terminal status group2	
Bit4	Virtual input terminal X5
Bit5	Virtual input terminal X6
Bit6	Virtual input terminal X7
Bit7	Virtual input terminal X8

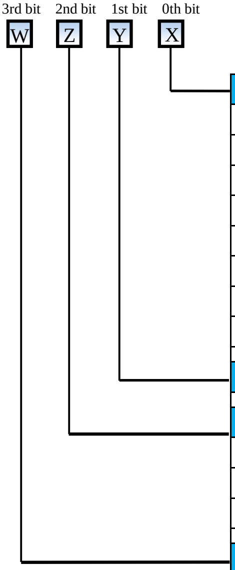
Internal setting for input terminal status group3	
Bit8	Virtual input terminal X9

Reserved parameters (Not ready for use)

7.3 Pn Parameter Overview

7.3.1 Basic Parameter (Pn0xx)

Pn000	**Function selection basic switch0**	**■**	**Address: 0x0000**
Factory value: 0x0000	**Range: 0x0000～0x2217**	**Unit: N/A**	**Mode: P S T**



Control mode selection	
0	Position control mode
1	Speed control mode
2	Torque control mode
3	Speed-Position control mode
4	Torque-Position control mode
5	Speed-Torque control mode
6	Speed-Position-Torque control mode
7	I-F control mode

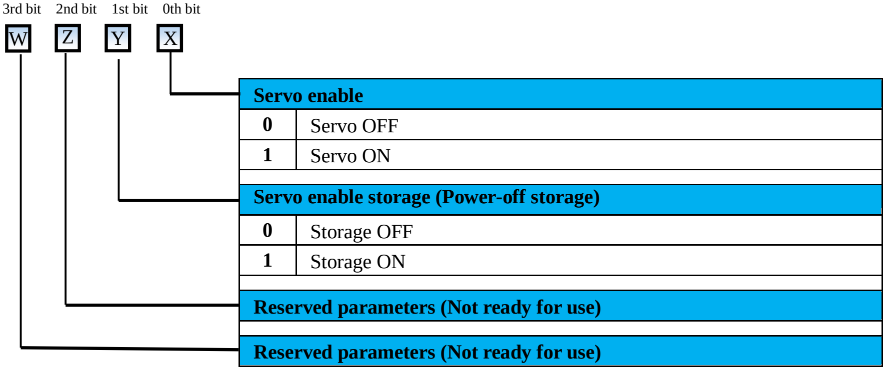
Reserved parameters (Not ready for use)

Drive model selection	
0	Standard pulse
1	CANopen
2	EtherCAT

Motor selection	
0	Rotary motor
1	Liner motor
2	Virtual motor

Description	**Control mode selection**: to set the command signal source of the drive, command source under position mode via Pn200; command source under speed mode via Pn300; command source under torque mode via Pn400.

Pn001	**Function selection basic switch1**	○	**Address: 0x0001**
Factory value: 0x0000	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode:** P S T



Servo enable	
0	Servo OFF
1	Servo ON

Servo enable storage (Power-off storage)	
0	Storage OFF
1	Storage ON

Reserved parameters (Not ready for use)

Reserved parameters (Not ready for use)

Pn002	**Motor rotation direction**	■	**Address: 0x0002**
Factory value: 0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode:** P S T

To set the absolute encoders with batteries:

Setting	Description	Remark
0	CCW forward direction (counterclockwise)	-
1	CW as forward direction (clockwise)	-

counterclockwise in face of the axis end (CCW) clockwise in face of the axis end (CW)

Pn004	**Stop mode during Servo OFF and Gr.1 warning**	■	**Address: 0x0004**
Factory value: 0x0002	**Range: 0x0000～0x0002**	**Unit: N/A**	**Mode:** P S T

To set the drive stop mode during OFF and a 1st fault type warning

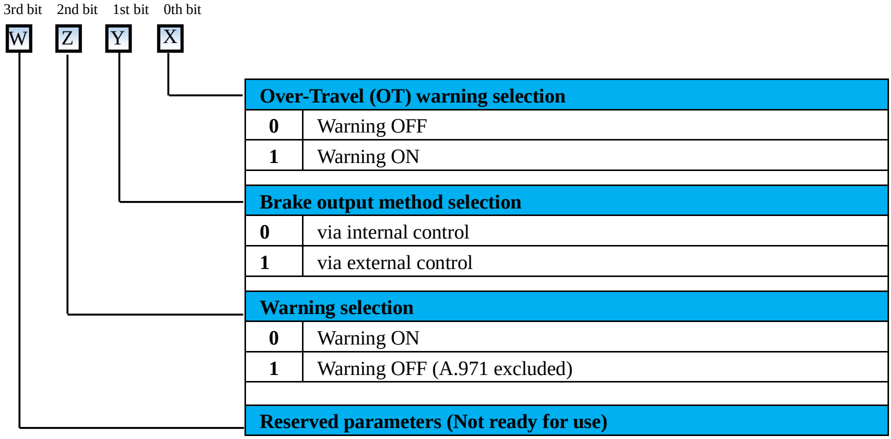
Setting	Description	Remark
2	Free stop	By default,

Pn005	**Stop mode during Gr.2 warning**	■	**Address: 0x0005**
Factory value: 0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode:** P S T

To set the drive stop mode during 2nd fault type warning

Setting	Description	Remark
0	Zero-speed stop	-
1	Stop method is the same as Pn004	Vary by model

Pn006	**Function selection basic switch6**	■	**Address: 0x0006**
Factory value: 0x1001	**Range: 0x0000～0x4121**	**Unit: N/A**	**Mode:** P S T



Over-Travel (OT) warning selection	
0	Warning OFF
1	Warning ON

Brake output method selection	
0	via internal control
1	via external control

Warning selection	
0	Warning ON
1	Warning OFF (A.971 excluded)

Reserved parameters (Not ready for use)

Pn007	**Stop mode during drive overtravel (OT)**	■	**Address: 0x0007**
Factory value: 0x0001	**Range: 0x0000～0x0012**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X:

Overtravel (OT) warning selection	
0	DB stop or free stop (the same as Pn004).
1	Pn053 as the max. torque to stop motor and lock servo.
2	Pn053 as the max. torque to stop motor and free stop.

Y:

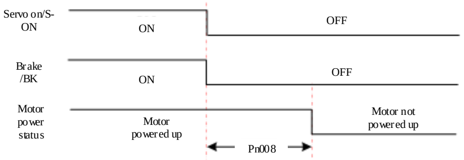
Pulse deviation reset during overtravel (OT)	
0	Reset OFF.
1	Reset ON when Positive Limit (POT) or Negative Limit (NOT) is disabled.

Z: **Reserved parameters (not for modification)**

W: **Reserved parameters (not for modification)**

Precautions
● For the vertical axis, after entering overtravel, the workpiece may fall due to the holding brake (/BK) signal being turned ON (the holding brake released). To prevent the workpiece from falling, set "Fix servomotor at zero position after stop (Pn007=1)". ● When an external force is applied, the motor becomes base-blocked after stop during overtravel, and the load axis end may be pushed back by the external force. To prevent the servo motor from being pushed back by an external force, set "Fix the servo motor at zero position after stop (Pn007=1)".

Pn008	**Brake command output delay time when servo OFF during standstill**	○	**Address: 0x0008**
Factory value: 10	**Range: 0～2000**	**Unit: ms**	**Mode: P S T**
Description	When the servomotor stops, the brake (/BK) signal and the servo ON (/S-ON) signal are turned OFF at the same time, and the time from when the servo ON (/S-ON) signal is turned OFF to when the motor power is down, and it can be changed by setting this function code. When used for vertical axes, the self-weight of or external force may cause slight movement of the mechanical moving part. By setting this function code, it is possible to extend the energized state of the motor after the brake has been actuated to eliminate the slight movement.		



Note: the servomotor immediately enters the de-energized state when a warning occurs regardless of this setting, and at this time the mechanism sometimes moves before the brake is actuated due to the self-weight

Pn009	**Brake command output delay time when servo OFF during rotation**	○	**Address: 0x0009**
Factory value: 500	**Range: 100～2000**	**Unit: ms**	**Mode:** P S T

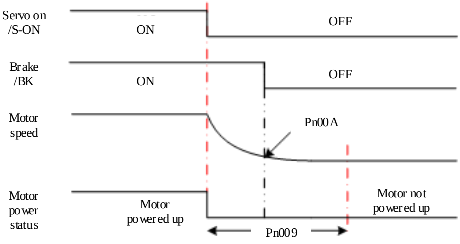
Pn00A	**Speed setting for electromagnetic brake release during rotation**	○	**Address: 0x000A**
Factory value: 100	**Range: 0～10000**	**Unit: rpm**	**Mode:** P S T

Description

When a warning occurs during servomotor rotation, the servomotor stops and the brake signal (/BK) is OFF. In this case, the brake signal (/BK) output time can be adjusted by setting the brake command-output speed and brake command- servo OFF waiting time. When any of the following conditions is true, the brake will operate:

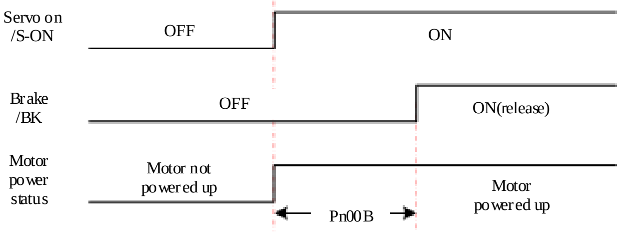
After the motor enters the de-energized state, the motor speed is lower than the motor speed setting when the electromagnetic brake is released;

When the brake command-servo OFF waiting time is passed after the motor enters the de-energized state.



Precautions

- When a warning occurs under zero-speed stop, the system outputs a brake signal (/BK) via Pn007 after stopping the motor by a zero-speed command;
- Even if Pn009 exceeds the max. speed of the servomotor, it is still limited to the max. speed.

Pn00B	**Brake command release delay time when servo ON**	○	**Address: 0x000B**
Factory value: 10	**Range: 0～2000**	**Unit: ms**	**Mode:** P S T
Description	When the servo motor starts up, the holding brake release delay time (Pn00B) for the motor can be set to control the time from ON reception of the servo to when the motor enters the energized state. When used for vertical axes, the self-weight of or external force may cause slight movement of the mechanical moving part. Set this function code to release the brake after enable the motor. 		

Precautions

- For single-tube circuits, after the servo enable signal (/S-ON) becomes ON when Pn00B=0, the holding brake output signal (/BK) is released after about 20ms.

Pn00D	**Function selection basic switchD**	■	**Address: 0x000D**
Factory value: 0x0000	**Range: 0x0000～0x2111**	**Unit: N/A**	**Mode:** P S T

第 3 位 第 2 位 第 1 位 第 0 位

W Z Y X

Speed detection method selection	
0	Speed detection method0
1	Speed detection method1
2	Speed detection method2
3	Speed detection method3

Absolute position limit switches (soft limit switches)	
0	Absolute position soft limit OFF
1	Absolute position soft limit ON, set via Pn030 and Pn032
2	Absolute position soft limit ON, set via object dictionary 【607Dh】

Precautions

- The absolute soft limit switch can only be switched on if both of the following conditions are valid.

① It is an absolute encoder for the motor encoder (PnF00.W = 1);

② The absolute encoder is normal(Pn040 = 1).

- The external input terminal limit switch is always ON (when configured) when absolute limit switch is ON or OFF.

Pn00E	**Function selection basic switchE**	■	**Address: 0x000E**
Factory value: 0x4000	**Range: 0x0000～0x4111**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Absolute encoder multi-turn overflow fault (ER.C21)	
0	Report ON
1	Report OFF

Drive and motor voltage match detection switch	
0	ON
1	OFF

Virtual motor encoder type	
0	Incremental
1	Absolute

Virtual motor encoder bit	
0	16 bits
1	17 bits
2	20 bits
3	23 bits
4	24 bits

Precautions

- The absolute encoder multi-turn count overflow monitoring function is ON only when both of the following conditions are valid.

① The motor encoder is an absolute encoder (PnF00.W = 1).

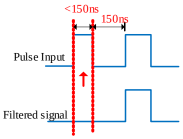
② Absolute encoder is normal(Pn040 = 1).

- The absolute encoder multi-turn counting range is [-32768, 32767], beyond which an ER.C21 fault is generated.
- When the rotation limit function (Pn276 not 0) is ON, the absolute multiturn overflow fault detection turns OFF automatically.

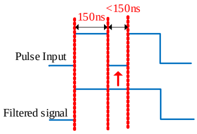
<table>
<tr><td>Pn011</td><td>Customize external pulse signal filter time</td><td>○</td><td>Address: 0x0011</td></tr>
<tr><td>Factory value: 400</td><td>Range: 0～5000</td><td>Unit: 12.5ns</td><td>Mode: P</td></tr>
<tr><td>Description</td><td colspan="3">

To set the filter time for external pulse command signals.

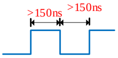
When Pn011 = 12 (12×12.5ns=150ns), the filter width duration less than 150ns will be regarded as an interference signal.



When the pulse bandwidth of this segment is less than 150ns, it is considered to be low collimation, so the two input pulses are considered to be one pulse



When the pulse bandwidth of this segment is less than 150ns, it is considered to be low collimation, so the two output pulses are considered to be one pulse



When the width of the High and Low duty pulses is greater than 150ns, it is ensured that the pulse commands are not filtered out.

Calculation method: The maximum pulse frequency sent by the host computer is f kHz, then

$$Pn011 = \frac{40000}{f} + 1$$

Note: The customized time is based on the calculation when the hardware filter is turned OFF, and the customized time will be adjusted according to the actual working condition after the hardware filter is turned ON.

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

<table>
<tr><td>Pn012</td><td>External regenerative resistor power</td><td>○</td><td>Address: 0x0012</td></tr>
<tr><td>Factory value: 0</td><td>Range: 0～65535</td><td>Unit: 10W</td><td>Mode: P S T</td></tr>
<tr><td>Description</td><td colspan="3">

When connecting an external regenerative resistor, set the power accordingly.

Note: The setting value varies according to the cooling condition of the external regenerative resistor. When a warning occurs and the temperature of the regenerative resistor is not high, the corresponding power value can be set to a larger value; conversely, set a smaller value.

Self-cooling (natural): Set the regenerative resistor power to 20% or lower (W).

Forced air cooling: Set the regenerative resistor power to 50% or lower (W).

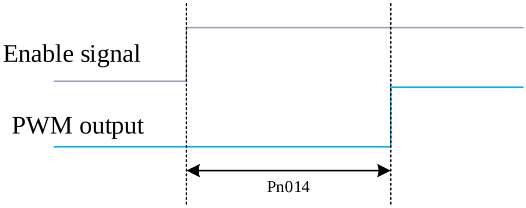
For example, if the power of self-cooling external regenerative resistor is 100W, 100W×20%=20W, Pn012 should be set to "2" (Setting Unit: 10W).

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

Precautions	
⚠	● If the drive is equipped with a built-in regenerative braking resistor as standard, the drive protects the built-in resistor when the setting is 0. ● If the setting value is inappropriate, the drive may display ER.320 alarm.

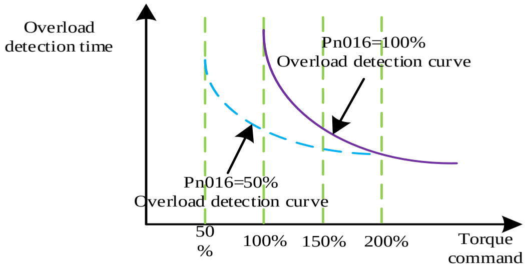
Pn013	**External regenerative resistance**	○	**Address: 0x0013**
Factory value: 0	**Range: 0～65535**	**Unit: 1Ω**	**Mode:** P S T
Description	When an external regenerative resistor is connected, the resistance is set accordingly.		

Precautions	
⚠	● The min. regeneration resistance allowed for each power band is different, see "Setting Regeneration Resistance" for details, otherwise the internal components of the servo unit may be damaged.

<table>
<tr><td>Pn014</td><td>Servo drive power-up enable delay time</td><td>○</td><td>Address: 0x0014</td></tr>
<tr><td>Factory value: 0</td><td>Range: 0～6000</td><td>Unit: ms</td><td>Mode: P S T</td></tr>
<tr><td>Description</td><td colspan="3">To delay for a set period after the bus voltage is built up before power-up is enabled.
 </td></tr>
</table>

Pn015	**Motor overload warning**	■	**Address: 0x0015**
Factory value: 50	**Range: 1～100**	**Unit: %**	**Mode:** P S T

Pn016	**Motor overload base current derating setting**	■	**Address: 0x0016**

Factory value: 100	**Range: 10～100**	**Unit: %**	**Mode: P S T**
Description	An overload (continuous and max.) fault (ER.720) can be reported in advance to prevent the motor from being overloaded, which can cause motor burnout. Set the base current derating in the following formula to shorten the time for overload detection. Note that the overload detection (instantaneous and max.) alarm (ER.710) cannot be changed. Motor base current after derating = Motor base current × Motor overload base current derating. **Term description:** Motor base current: The motor current threshold at which the overload alarm is started to be calculated. Motor overload base current derating: Derating rate of motor base current. For example, if Pn018 is set to 50%, the motor overload is calculated from 50% of the base current, so an overload alarm can be detected earlier. If Pn018 is changed, the overload alarm detection time will be changed, and the overload alarm detection time will be changed accordingly.  		

Pn017	**Derating percentage of servo overload current during single-phase power input**	■	**Address: 0x0017★**
Factory value:50	**Range: 10～100**	**Unit:%**	**Mode: PST**

Pn030	**Software limit switches – max. absolute single turn limit**	○	**Address: 0x0030★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: encoder unit**	**Mode: P S T**

Pn032	**Soft limit switches – max. absolute multi-turn limit**	○	**Address: 0x0032**
Factory value: 32767	**Range: -32768～32767**	**Unit: turn**	**Mode: P S T**

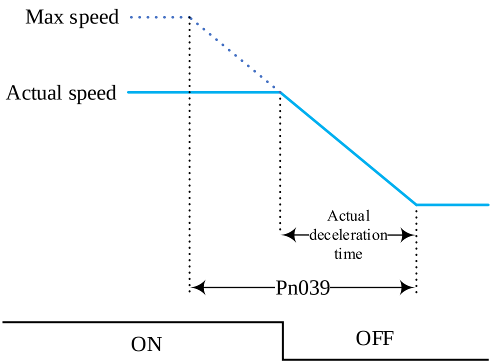
Description	The internal position feedback of the drive is compared with the set limit, and when the limit is exceeded, a warning is given immediately and the relevant operation is executed. Users can make relevant selections via Pn00D.W. **Note:** ● When (Pn030×one turn pulse count+Pn032) is lower than (Pn035×one turn pulse count+Pn033), the absolute position limit minimum and maximum values will be interchanged; ● Only applicable to absolute encoders.

Pn033	**Software limit switches – min. absolute single turn limit**	○	**Address: 0x0033★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: Encoder unit**	**Mode:** P S T

Pn035	**Soft limit switches – min. absolute multi-turn limit**	○	**Address: 0x0035**
Factory value: -32768	**Range: -32768～32767**	**Unit: turn**	**Mode:** P S T
Description	Compare with the set limit with the internal position feedback of the drive, and report the warning and execute the related operation immediately when the limit is exceeded. Users can make relevant selections via Pn00D.W. **Note:** ● When (Pn030×one turn pulse count+Pn032) is lower than (Pn035×one turn pulse count+Pn033), the absolute position limit minimum and maximum values will be interchanged; ● Only applicable to absolute encoders.		

Pn036	**Soft limit switches-absolute position limit hysteresis**	○	**Address: 0x0036**
Factory value: 200	**Range: 0～30000**	**Unit: Encoder unit**	**Mode:** P S T
Description	When using this function, since it is encoder unit for soft limit, frequent entering and exiting may occur after entering soft limit state. Set the corresponding hysteresis according to the actual situation to effectively avoid this problem.		

Pn039	**Servo OFF deceleration stop time (DEC)**	○	**Address: 0x0039**
Factory value: 0	**Range: 0～10000**	**Unit: 1ms**	**Mode:** P S T

Description	

Precautions	
	● When Pn039 is set to 0, the deceleration stop function is invalid when the servo is OFF. ● The servo OFF stop function is valid only for the external input terminal and internal Pn001.X, and is not valid for other enable modes; ● Valid for position mode, speed mode, and torque mode.

Pn040	**Absolute encoder instruction**	■	**Address: 0x0040**
Factory value: 0x0001	**Range: 0x0000～0x0021**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Standard pulse-type servo absolute encoder	
0	Use as an absolute encoder
1	Use as an incremental encoder

EtherCAT servo absolute encoder	
0	Use as an absolute encoder
1	Use as an incremental encoder
2	Use as a single-turn absolute encoder

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

Precautions
● An externally equipped battery is required when it is used as an absolute encoder, otherwise the drive generates a battery undervoltage warning or fault alarm.

Pn041	**Absolute encoder battery undervoltage alarm/alarm**	○	**Address: 0x0041**
Factory value: 0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode:** P S T

To set the way to use the absolute encoder with batteries.

Setting	**Description**	**Remark**
0	Set battery undervoltage to warning (Er.830)	-
1	Set battery undervoltage to alarm (AL.930)	-

● Er.830: The drive checks whether the encoder backup battery is normal within 8 seconds after power-up and no longer check it afterwards.

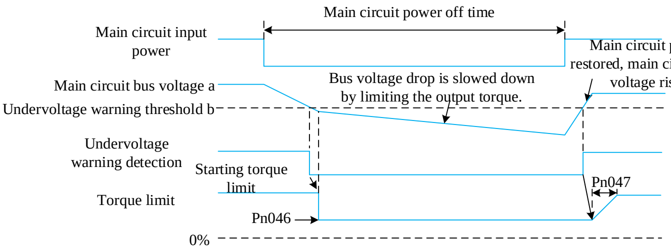
● AL.930: The drive dynamically checks the voltage of the encoder backup battery in time after power-up and generates a corresponding alarm if it is below the set value, and the alarm disappears automatically if it is above the set value.

Pn045	**Main circuit (DC) undervoltage function**	○	**Address: 0x0045**
Factory value: 0x0000	**Range: 0x0000～0x0002**	**Unit: N/A**	**Mode:** P S T

To set the torque limit threshold for the drive output.

Setting	**Description**	**Remark**
0	Undervoltage report OFF	-
1	Undervoltage report ON	-
2	Undervoltage report ON and torque limitation is executed via Pn046 and Pn047.	-

Pn046	**Torque limit when main circuit voltage drops**	○	**Address: 0x0046**
Factory value: 50	**Range: 0～100**	**Unit: 1%**	**Mode:** P S T
Description	Percentage to the rated torque of the motor.		

Pn047	**Torque limit release time when main circuit voltage drops**	○	**Address: 0x0047**
Factory value: 100	**Range: 0～1000**	**Unit: 1ms**	**Mode:** P S T
Description	Torque limitation is performed within the servo drive based on the undervoltage warning. When the undervoltage warning is released, the torque limit value is controlled according to the set time.  		

Pn050	**Torque limit method selection**	○	**Address: 0x0050**
Factory value: 0x0002	**Range: 0x0000～0x0005**	**Unit: N/A**	**Mode:** P S T

To set the torque limit threshold for the drive output.

Setting	**Description**	**Remark**
0	Reserved	-
1	Reserved	-
2	Internal forward/reverse limit(Pn051)	-
3	Internal forward limit (Pn051) and internal reverse limit(Pn052)	-
4	External terminal limit selection	-
5	Limit after pulse command is 0 and position is completed	-

Torque limit method selection description:

Pn050		Forward	Reverse	Description
0		Reserved		-
1		Reserved		-
2		Pn051		Limit the max. torque for forward/reverse rotation by Pn051.
3		Pn051	Pn052	Set the max. torque for forward rotation by Pn051. Set the max. torque for reverse rotation by Pn052.
4	**OFF**	Pn054		The torque limit is selected via the external terminals. When TL-SEL is low (OFF), set Pn054 to limit the max. torque for forward /reverse rotation; When TL-SEL is high (ON), set Pn055 to limit the max. torque for forward/reverse rotation.
	ON	Pn055		
5	**OFF**	Pn051		① When the external pulse command is 0 (after filtering);and ② Positioning is complete. When either of the two conditions is not true, the max. torque for forward/reverse rotation is limited by Pn051; When both conditions are true, the max. torque for forward/reverse rotation is limited by Pn052.
	ON	Pn052		

Precautions

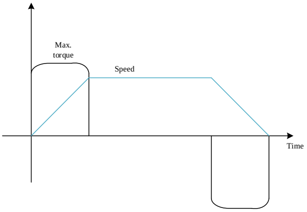
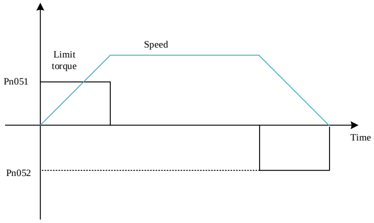
- The torque limit method is only valid for non-torque mode. Torque limit in torque mode can only be performed by:

① Forward torque limit and reverse torque limit by Pn051;

② External torque limit, external X terminal to switch to external torque limit Pn051.

Pn051	**Internal forward torque limit**	○	**Address: 0x0051**
Factory value: vary by model	**Range: 0～500**	**Unit: 1%**	**Mode:** P S T

Pn052	**Internal reverse torque limit**	○	**Address: 0x0052**
Factory value: vary by model	**Range: 0～500**	**Unit: 1%**	**Mode:** P S T

Description	The output torque can be limited for the protecting the machine. Internal torque limit method always limits the maximum output torque by its parameter. **Note:** (1) The setting unit is a percentage of the rated torque of the motor. (2) If the torque limit setting is too small, the servo motor may not have enough torque during acceleration and deceleration. **Without internal torque limit**  **With internal torque limit** 

Pn053	**Emergency stop torque**	○	**Address: 0x0053**
Factory value: 800	**Range: 0～800**	**Unit: 1%**	**Mode:** P S T
Description	Maximum torque display for emergency stop in specific cases and overtravel.		

Pn054	**External torque limit1**	○	**Address: 0x0054**
Factory value: 100	**Range: 0～500**	**Unit: 1%**	**Mode:** P S T

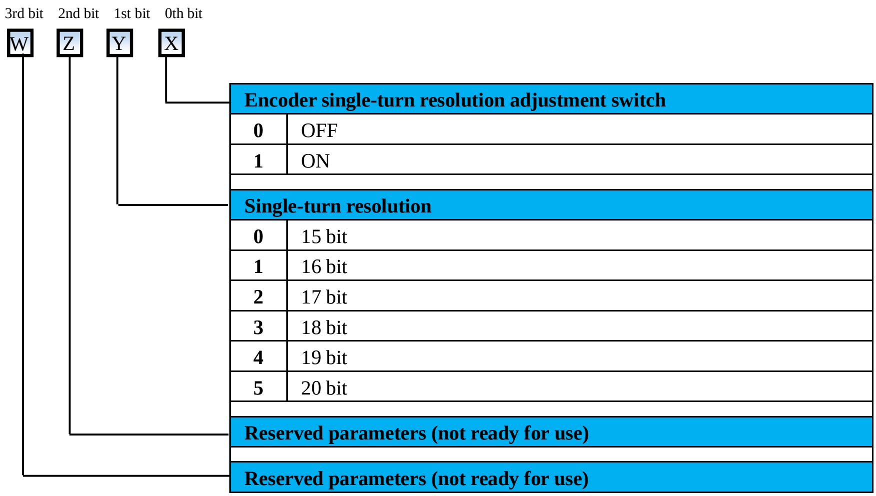
Pn055	**External torque limit2**	○	**Address: 0x0055**
Factory value: 100	**Range: 0～500**	**Unit: 1%**	**Mode:** P S T

Pn056	**Stall torque threshold**	○	**Address: 0x0056**
Factory value: 100	**Range: 0～255**	**Unit: 1%**	**Mode:** P S T
Description	When the current torque is larger than the threshold set by Pn056 and the speed is larger than the threshold set by Pn057, the stall detection is ON. **Note:**①This torque threshold is the max. torque; ②When Pn056 is set to 0, the stall detection function is OFF.		

Pn057	**Stall speed threshold**	○	**Address: 0x0057**
Factory value: 20	**Range: 0～200**	**Unit: 1%**	**Mode:** P S T
Description	When the current torque is larger than the threshold set by Pn056 and the speed is larger than the threshold set by Pn057, the stall detection is ON. **Note:** This speed is the max. overspeed threshold.		

Pn059	**KTY type- temperature sensor warning threshold**	○	**Address: 0x0059**
Factory value: 0	**Range: 0～180**	**Unit: 1℃**	**Mode:** P S T
Description	For over-temperature protection of motors configured with KTY-type sensors, when the motor temperature is higher than this set threshold, a corresponding over-temperature error (ER.42A) will be reported. **Note:** ① When it is set to 0, the over-temperature monitoring function is OFF. ② Valid only for motors configured with KTY type temperature sensors.		

Pn076	**Serial encoder single-turn resolution**	■	**Address: 0x0076**
Factory value: 0x0020	**Range: 0x0000～0x0051**	**Unit: N/A**	**Mode:** P S T



Encoder single-turn resolution adjustment switch	
0	OFF
1	ON

Single-turn resolution	
0	15 bit
1	16 bit
2	17 bit
3	18 bit
4	19 bit
5	20 bit

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

Precautions	
⚠	● Valid only for serial encoders. ● Refer to the actual encoder resolution if the set resolution is lower than the actual encoder resolution.

Pn07F	**Serial encoder multi-turn and fault reset**		○	**Address: 0x007F**
Factory value: 0x0000	**Range: 0x0000～0xFFFF**	**Unit: N/A**		**Mode:** P S T
Description	For multi-turn and battery failure reset of the serial encoder. Write 1 to this function code, the effect is the same as the auxiliary function Fn008, so users can reset the multi-turn of absolute encoder via RS485.			

Precautions	
⚠	● Valid only for absolute serial encoders. ● Pn07F is not saved when power is OFF and is automatically reset when execution is completed. ● Execution under drive enable state is prohibited.

Pn080	**Local communication address (485 & CANopen)**		■	**Address: 0x0080**
Factory value: 1	**Range: 0～255**	**Unit: N/A**		**Mode:** P S T
Description	To set the drive axis address. 0: Broadcast address, the host computer can write to all drives by broadcasting the address, and the drives receive the frame of the broadcast address to perform accordingly, but do not respond. 1～255:When multiple servo drives are networked, each drive can only have a unique address, otherwise it will lead to abnormal communication or no communication. **Note:** For CANopen models, the allowed max. value of this communication address is 63.			

Pn081	**Local communication format**	■	**Address: 0x0081**
Factory value: 0x0502	**Range: 0x0000～0x0655**	**Unit: N/A**	**Mode: P S T**

第 3 位 第 2 位 第 1 位 第 0 位

W Z Y X

485 communication baud rate	
0	4800bps
1	9600bps
2	19200bps
3	38400bps
4	57600bps
5	115200bps

485 communication parity mode	
0	No parity, 8-bit data, 1 stop bit (N-8-1)
1	Even parity, 8 bits data, 1 stop bit (N-8-1)
2	Odd parity, 8-bit data, 1 stop bit (O-8-1)
3	No parity, 8-bit data, 2 stop bits (N-8-2)
4	Even parity, 8-bit data, 2 stop bits (N-8-2)
5	Odd parity, 8-bit data, 2 stop bits (N-8-2)

CAN communication baud rate	
0	20K
1	50K
2	100K
3	125K
4	250K
5	500K
6	1000K(1M)

CanOpen 配置	
0	Speed command in pps
1	Speed command in rpm

Precautions

● The baud rate and communication checksum method of the servo drive must be the same as that of the host computer, otherwise communication is not performed.

Pn082	**EtherCat station alias**	■	**Address : 0x0082**
Factory value:0	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode: P S T**

Pn083	**EtherCat master type**	○	**Address: 0x0083**
Factory value:0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode: P S T**

Used to set the EtherCat master type.

Setting	Description	Comment
0	Others	-
1	Omron NJ series controller	-

Pn084	**EtherCat synchronized frame count limit**	■	**Address: 0x0084**
Factory value:0x0000	**Range:0x0000～0x000F**	**Unit: N/A**	**Mode: P S T**

Pn085	**Communication writing function code to EEPROM storage**	○	**Address: 0x0085**
Factory value: 0x0000	**Range: 0x0000～0x0111**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X:

485 communication	
0	OFF
1	ON

Y:

CANopen communication	
0	OFF
1	ON

Z:

EtherCat communication	
0	OFF
1	ON

W:

Reserved parameters (not for modification)

Description	If the changed parameter does not need to be stored during power down, please set the corresponding function to storage off, otherwise, large-volume modification of function code data for a long period of time and storing it into the EEPROM will lead to damage of the EEPROM, and the drive will generate Er.021.

Pn087	**485 communication register address mapping**	○	**Address: 0x0087**
Factory value: 0x0000	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit
W Z Y X

1# register address mapping	
0	OFF
1	ON

2# register address mapping	
0	OFF
1	ON

Reserved parameters (not ready for use)

32 位寄存器高低位顺序	
0	Low 16-bit - High 16-bit
1	High 16-bit - Low 16-bit

Pn088	**1# Register mapping source address**	○	**Address: 0x0088**
Factory value: 0x0000	**Range: 0x0000～0x1FFF**	**Unit: N/A**	**Mode: P S T**

Pn089	**1# Register mapping target address**	○	**Address: 0x0089**
Factory value: 0x0000	**Range: 0x0000～0x1FFF**	**Unit: N/A**	**Mode: P S T**

Pn08A	**2# Register mapping source address**	○	**Address: 0x008A**
Factory value: 0x0000	**Range: 0x0000～0x1FFF**	**Unit: N/A**	**Mode: P S T**

Pn08B	**2# Register mapping target address**	○	**Address: 0x008B**
Factory value: 0x0000	**Range: 0x0000～0x1FFF**	**Unit: N/A**	**Mode: P S T**

7.3.2 Gain Parameter (Pn1xx)

Pn100	**Moment of inertia ratio (J)**	○	**Address: 0x0100**
Factory value: 100	**Range: 0～20000**	**Unit: 1%**	**Mode:** P S T
Description	Set the total inertia to motor rotor inertia ratio. $\text{Pn100}=\frac{\text{load inertia} + \text{motor rotor inertia}}{\text{motor rotor inertia}} \times 100\%$		

Pn101	**Speed loop proportional gain (ASR_KP)**	○	**Address: 0x0101**
Factory value: 40.0	**Range: 1.0～2000.0**	**Unit: Hz**	**Mode:** P S T
Description	Set the speed regulator gain (ASR_KP) to determine the responsiveness of the speed control loop. The larger the ASR_KP value is, the higher the speed loop response frequency and the better it follows speed commands. The response characteristics of the servo system can be improved by increasing the speed loop gain. However, if the ASR_KP is too large, vibration is likely to be caused.		

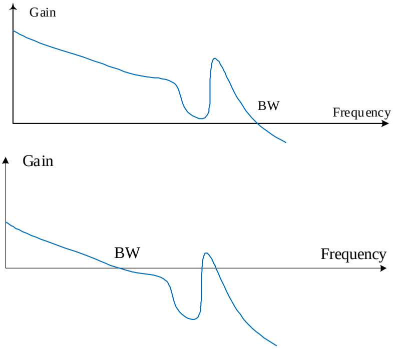
Pn102	**Speed loop integral time constant (ASR_KI)**	○	**Address: 0x0102**
Factory value: 20.00	**Range: 0.15～512.00**	**Unit: ms**	**Mode:** P S T
Description	Set the integral time of the speed regulator (ASR_Ki) to determine the responsiveness of the speed control loop. The smaller the ASR_Ki value is, the higher the response frequency of the speed loop and the better it follows speed commands. The response characteristics of the servo system can be improved by reducing this setting. However, vibration is easily caused when the ASR_Ki setting is too small.		

Pn103	**Position loop proportional gain (APR_KP)**	○	**Address: 0x0103**
Factory value: 40.0	**Range: 1.0～2000.0**	**Unit: 1/s**	**Mode:** P S T
Description	Set the position regulator gain (APR_KP) determines the responsiveness of the position control system. The larger the APR_KP value is, the higher the position response frequency, the better it follows position commands, the smaller the position deviation, and the shorter the positioning setup time. However, if the APR_KP value is set too high, it is easy to cause vibration.		

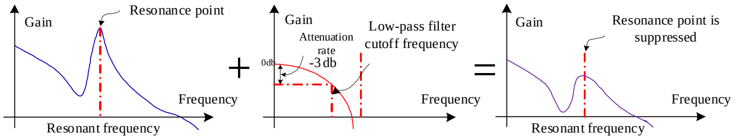
Pn104	**Moment command filter time constant**	○	**Address: 0x0104**
Factory value: 1.00	**Range: 0.00～655.35**	**Unit: ms**	**Mode:** P S T

Description

Set the resonance suppression low-pass filter time constant. When the constant is set to 0, the low-pass filter function is OFF. When the resonance occurs in the mechanical structure, it is possible that the rigidity of the drive control system is too large or the corresponding bandwidth is too fast, so the resonance of the control system can be suppressed by this parameter together with the parameter of resonance suppression notch filter without changing the control parameters.



When the torque command filter time parameter is gradually increased from 0, the corresponding BW point will become smaller and smaller. Resonance frequency generation will be solved, but the bandwidth and phase boundaries of the system response will be reduced at the same time.



Suppress by low-pass filter: The co-band will get smaller and smaller as the low-pass filter is turned up from 0. Although the resonance generation is solved, the system response bandwidth and phase boundaries are also reduced and the system becomes more unstable.

Recommendation:

Adjust value of stable control range:Pn104[ms] $= \frac{1000}{2\pi \times \text{Pn102[Hz]} \times 4}$

Adjust value of limit control range:Pn104[ms] $= \frac{1000}{2\pi \times \text{Pn102[Hz]} \times 1}$

Pn105	**2nd speed loop proportional gain**	○	**Address: 0x0105**
Factory value: 40.0	**Range: 1.0～2000.0**	**Unit: Hz**	**Mode:** P S T

Pn106	**2nd speed loop integral time constant**	○	**Address: 0x0106**
Factory value: 20.0	**Range: 0.15～512.00**	**Unit: ms**	**Mode:** P S T

Pn107	**2nd position loop proportional gain**	○	**Address: 0x0107**
Factory value: 40.0	**Range: 1.0～2000.0**	**Unit: 1/s**	**Mode:** P S T

Pn108	**2nd torque command filter time constant**	○	**Address: 0x0108**
Factory value: 1.00	**Range: 0.00～655.35**	**Unit: 1ms**	**Mode:** P S T

Pn10A	**Auto tuning mode selection**	○	**Address: 0x010A**
Factory value: 0	**Range: 0～1**	**Unit: -**	**Mode:** P S T

Setting	Description	Remark
0	Manual tuning	-
1	Standard rigidity table	-

Pn10B	**Rigidity level setting**	○	**Address: 0x010B**
Factory value: 15	**Range: 1～32**	**Unit: -**	**Mode:** P S T

Pn110	**Auto gain switching**	○	**Address: 0x0110**
Factory value: 0x0000	**Range: 0x0000～0x0051**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Gain switching	
0	Gain switching selector switch Manual gain switching, manual gain switching by external gain signal (G-SEL)
1	Auto switching When switching condition, A is true, the gain is automatically switched from the 1st gain to the 2nd gain. When switching condition A is not true, the gain is automatically switched from the 2nd gain to the 1st gain.

Switching condition A	
0	Positioning completion signal (/COIN) ON
1	Positioning completion signal (/COIN) OFF
2	Positioning near signal (/NEAR) ON
3	Positioning near signal (/NEAR) OFF
4	Position command filter output equal to 0 and command input OFF
5	Position command pulse input ON

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Pn112	**Gain switching time1**	○	**Address: 0x0112**
Factory value: 0	**Range: 0～65535**	**Unit: ms**	**Mode: P S T**

Pn113	**Gain switching time2**	○	**Address: 0x0113**
Factory value: 0	**Range: 0～65535**	**Unit: ms**	**Mode: P S T**

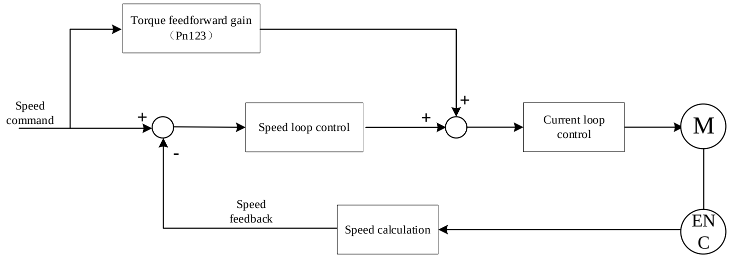
Pn114	**Gain switching waiting time1**	○	**Address: 0x0114**
Factory value: 0	**Range: 0～65535**	**Unit: ms**	**Mode: P S T**

Pn115	**Gain switching waiting time2**	○	**Address: 0x0115**
Factory value: 0	**Range: 0～65535**	**Unit: ms**	**Mode: P S T**
Pn120	**Position integral time constant**	○	**Address: 0x0120**

Factory value: 0.0	**Range: 0.0～5000.0**	**Unit: ms**	**Mode: P**
Description	The integral function of the position loop when the position integral is set for electronic cams and electronic shafts. **Note:** The position loop integral is OFF when it is set to 0.		

Pn121	**Speed feedforward gain**	○	**Address: 0x0121**
Factory value: 0	**Range: 0～100**	**Unit: 1%**	**Mode: P**
Description	Speed feedforward shortens the positioning time, and this function is ON when the servo drive is in position control the speed feedforward is generated by differentiating the position command from the upper unit. When the position control command is smooth, increase the gain to reduce position following tolerance. If the position control command is not smooth, decrease the gain to reduce mechanism vibration. Feed-forward gain: Reduce the phase backward error.		

Pn122	**Speed feedforward filter time**	○	**Address: 0x0122**
Factory value: 2.00	**Range: 0.00～64.00**	**Unit: ms**	**Mode: P**

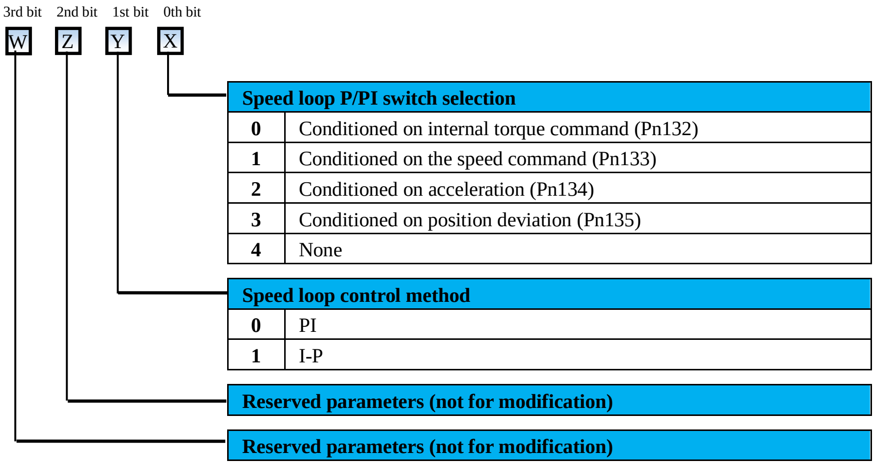
Pn123	**Torque feedforward gain**	○	**Address: 0x0123**
Factory value: 0	**Range: 0～500**	**Unit: %**	**Mode: P S**
Description	Torque feedforward is only valid for position and speed control. 		

Pn124	**Torque feedforward filter time**	○	**Address: 0x0124**
Factory value: 2.00	**Range: 0.00～64.00**	**Unit: ms**	**Mode: P S**

Pn125★	**Speed feedback low-pass filter time constant**	○	**Address: 0x0125**

Factory value: 0.00	**Range: 0.00～655.35**	**Unit: ms**	**Mode: P S T**
Description	A first-order low-pass filter is set in the speed loop feedback. The speed contains resonance and high-frequency interference signals, and noise can be eliminated by this parameter. Set this value to smooth the feedback speed and reduce vibration. If a larger value is input, it delays and reduces the corresponding performance, resulting in a slower loop response.		

Pn130	**Speed loop P/PI control**	■	**Address: 0x0130**
Factory value: 0x0000	**Range: 0x0000～0x0114**	**Unit: N/A**	**Mode: P S T**



Speed loop P/PI switch selection	
0	Conditioned on internal torque command (Pn132)
1	Conditioned on the speed command (Pn133)
2	Conditioned on acceleration (Pn134)
3	Conditioned on position deviation (Pn135)
4	None

Speed loop control method	
0	PI
1	I-P

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Pn132	**Speed loop P/PI switching condition (torque command)**	○	**Address: 0x010C**
Factory value: 200	**Range: 0～800**	**Unit: 1%**	**Mode: P S T**

Pn133	**Speed loop P/PI switching condition (speed command)**	○	**Address: 0x010D**
Factory value: 0	**Range: 0～10000**	**Unit: 1rpm**	**Mode: P S T**

Pn134	**Speed loop P/PI switching condition (acceleration)**	○	**Address: 0x010E**
Factory value: 0	**Range: 0～30000**	**Unit: 1rpm/s**	**Mode: P S T**

Pn135	**Speed ring P/PI switching condition (position deviation)**	○	**Address: 0x010F**

Factory value: 0	**Range: 0～10000**	**Unit: Command unit**	**Mode: P S T**

Pn140	**A-type vibration suppression switch**	○	**Address: 0x0140**
Factory value: 0x0010	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode: P S**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X:

A-type vibration suppression switch	
0	OFF
1	ON

Y:

A-type vibration suppression tuning	
0	Auto tuning without auxiliary function
1	Auto tuning with auxiliary function

Z: **Reserved parameters (not for modification)**

W: **Reserved parameters (not for modification)**

Pn141	**A-type vibration suppression gain compensation**	○	**Address: 0x0141**
Factory value: 100	**Range: 1～1000**	**Unit: %**	**Mode: P S T**

Pn142	**A-type vibration suppression frequency**	○	**Address: 0x0142**
Factory value: 100.0	**Range: 1.0～2000.0**	**Unit: Hz**	**Mode: P S T**

Pn143	**A-type vibration suppression damping gain**	○	**Address: 0x0143**
Factory value: 0	**Range: 0～300**	**Unit: %**	**Mode: P S T**

Pn144	**A-type vibration suppression filter constant1 compensation**	○	**Address: 0x0144**
Factory value: 0	**Range: -10.00～10.00**	**Unit: ms**	**Mode: P S T**

Pn145	**A-type vibration suppression filter constant2 compensation**	○	**Address: 0x0145**
Factory value: 0	**Range: -10.00～10.00**	**Unit: ms**	**Mode: P S T**

Pn14A	**II notch filter1 suppression frequency**	○	**Address: 0x014A**

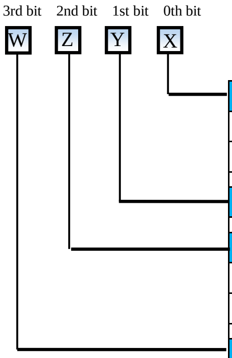
Factory value: 5000	**Range: 50～5000**	**Unit: Hz**	**Mode:** P S T
Description: Set the center frequency of the 1st notch filter.			

Pn14B	**II notch filter1 attenuation rate**	○	**Address: 0x014B**
Factory value: 0	**Range: 0～32**	**Unit: dB**	**Mode:** P S T
Description: Set the attenuation rate of the 1st notch filter, if it is 0, the new notch filter1 function will be turned off.			

Pn14C	**II notch filter2 suppression frequency**	○	**Address: 0x014C**
Factory value: 5000	**Range: 50～5000**	**Unit: Hz**	**Mode:** P S T
Description: Set the center frequency of the 2nd notch filter.			

Pn14D	**II notch filter2 attenuation rate**	○	**Address: 0x014D**
Factory value: 0	**Range: 0～32**	**Unit: dB**	**Mode:** P S T
Description: Set the attenuation rate of the 2nd notch filter, if it is 0, the function of the new notch filter2 is turned off.			

Pn150	**Notch filter function switch 1**	○	**Address: 0x0150**
Factory value: 0x0000	**Range: 0x0000～0x1101**	**Unit: N/A**	**Mode:** P S T



Notch filter1 selection	
0	Section 1 notch filter OFF
1	Section 1 notch filter ON

Reserved parameters (not for modification)

Notch filter2 selection	
0	Section 2 notch filter OFF
1	Section 2 notch filter ON

Friction compensation	
0	Friction compensation OFF
1	Friction compensation ON

Pn151	**Notch filter function switch 2**	○	**Address: 0x0151**

Factory value: 0x0101	**Range: 0x0000～0x0101**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X:

Notch filter2 selection	
0	Section1 notch filter is not auto adjusted by the auxiliary function.
1	Section1 notch filter is auto adjusted by the auxiliary function.

Y: **Reserved parameters (not for modification)**

Z:

Notch filter2 tuning selection	
0	Section2 notch filter is not auto adjusted by the auxiliary function.
1	Section2 notch filter is auto adjusted by the auxiliary function.

W: **Reserved parameters (not for modification)**

Pn152	**Auto notch resonance detection sensitivity**		○	**Address: 0x0152**
Factory value: 100	**Range: 1～200**	**Unit: %**		**Mode: P S T**

Pn153	**Notch filter1 frequency**		○	**Address: 0x0153**
Factory value: 5000	**Range: 50～5000**	**Unit: Hz**		**Mode: P S T**

Pn154	**Notch filter1 Q**		○	**Address: 0x0154**
Factory value: 0.70	**Range: 0.50～10.00**	**Unit: N/A**		**Mode: P S T**

Pn155	**Notch filter1 depth**		○	**Address: 0x0155**
Factory value: 0.000	**Range: 0.000～1.000**	**Unit: N/A**		**Mode: P S T**

Pn156	**Notch filter2 frequency**		○	**Address: 0x0156**
Factory value: 5000	**Range: 50～5000**	**Unit: Hz**		**Mode: P S T**

Pn157	**Notch filter2 Q**		○	**Address: 0x0157**
Factory value: 0.70	**Range: 0.50～10.00**	**Unit: N/A**		**Mode: P S T**

Pn158	**Notch filter2 depth**	○	**Address: 0x0158**

Factory value: 0.000	**Range: 0.000～1.000**	**Unit: N/A**	**Mode:** P S T

Pn159	**Notch filter3 frequency**	○	**Address: 0x0159**
Factory value: 5000	**Range: 50～5000**	**Unit: Hz**	**Mode:** P S T
Description: Set the center frequency of the notch filter. When the notch filter frequency is set to 5000, it is invalid.			

Pn15A	**Notch filter3 Q**	○	**Address: 0x015A**
Factory value: 0.70	**Range: 0.50～10.00**	**Unit: N/A**	**Mode:** P S T

Pn15B	**Notch filter3 depth**	○	**Address: 0x015B**
Factory value: 0.000	**Range: 0.000～1.000**	**Unit: N/A**	**Mode:** P S T

Pn15C	**Notch filter4 frequency**	○	**Address: 0x015C**
Factory value: 5000	**Range: 50～5000**	**Unit: Hz**	**Mode:** P S T
Description: Set the center frequency of the notch filter. When the notch filter frequency is set to 5000, it is invalid.			

Pn15D	**Notch filter4 Q**	○	**Address: 0x015D**
Factory value: 0.70	**Range: 0.50～10.00**	**Unit: N/A**	**Mode:** P S T

Pn15E	**Notch filter4 depth**	○	**Address: 0x015E**
Factory value: 0.000	**Range: 0.000～1.000**	**Unit: N/A**	**Mode:** P S T

Pn161	**Friction compensation gain**	○	**Address: 0x0161**
Factory value: 100	**Range: 10～1000**	**Unit: %**	**Mode:** P S

Pn162	**2nd Friction compensation gain**	○	**Address: 0x0162**
Factory value: 100	**Range: 10～1000**	**Unit: %**	**Mode:** P S

Pn163	**Friction compensation coefficient**	○	**Address: 0x0163**
Factory value: 0	**Range: 0～100**	**Unit: %**	**Mode:** P S

Pn164	**Friction compensation frequency correction**	○	**Address: 0x0164**
Factory value: 0.0	**Range: 0.0～1000.0**	**Unit: Hz**	**Mode:** P S

Pn165	**Friction compensation gain correction**	○	**Address: 0x0165**
Factory value: 100	**Range: 0～1000**	**Unit: %**	**Mode:** P S

Pn175	**Tuning-free switch**	■	**Address: 0x0175**
Factory value: 0x1400	**Range: 0x0000～0x2911**	**Unit: N/A**	**Mode:** P

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Tuning-free switch	
0	OFF
1	ON

Tuning-free speed control method	
0	For speed control
1	For speed control with the upper unit position control

Tuning-free rigidity		
0	Rigidity 0	Response: slow
1	Rigidity 1	↕
2	Rigidity 2	
3	Rigidity 3	
4	Rigidity 4	
5	Rigidity 5	
6	Rigidity 6	
7	Rigidity 7	
8	Rigidity 8	
9	Rigidity 9	Response: fast

Tuning-free load inertia	
0	Low
1	Medium
2	High

Pn17A	**Tuning-free interference compensation gain**	○	**Address: 0x017A**

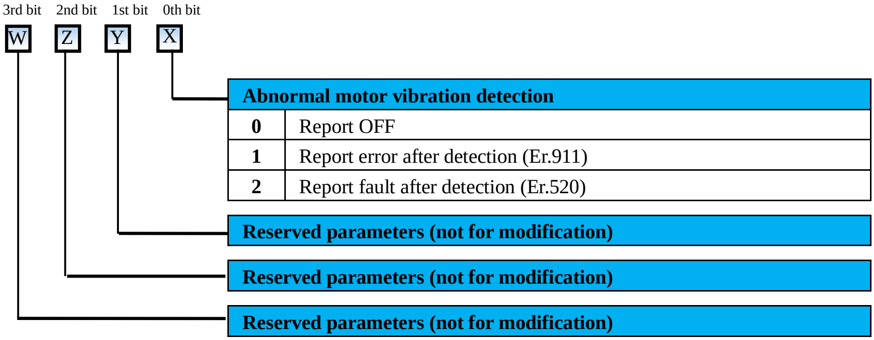
Factory value: 600.0	**Range: 0:0～6553.5**	**Unit: Hz**	**Mode:** P S

Pn17B	**Tuning-free load inertia correction factor**	○	**Address: 0x017B**
Factory value: 100	**Range: 0～100**	**Unit: %**	**Mode:** P S

Pn17C	**Tuning-free torque filter time factor**	○	**Address: 0x017C**
Factory value: 0.10	**Range: 0:00～655.35**	**Unit: ms**	**Mode:** P S

Pn17D	**Tuning-free speed feedback low-pass filter time**	○	**Address: 0x017D**
Factory value: 0.10	**Range: 0:00～655.35**	**Unit: ms**	**Mode:** P S

Pn185	**Abnormal motor vibration**	○	**Address: 0x0185**
Factory value: 0x0000	**Range: 0x0000～0x0002**	**Unit: N/A**	**Mode:** P



Abnormal motor vibration detection	
0	Report OFF
1	Report error after detection (Er.911)
2	Report fault after detection (Er.520)

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Pn186	**Abnormal motor vibration detection sensitivity**	○	**Address: 0x0186**
Factory value: 100	**Range: 50～500**	**Unit: %**	**Mode:** P S T

Pn187	**Abnormal motor vibration detection value**	○	**Address: 0x0187**
Factory value: 50	**Range: 0～5000**	**Unit: rpm**	**Mode:** P S T
Description	Set the vibration detection threshold, vibration detection value = Pn186 × Pn187. The smaller the setting, the easier it is to detect vibration, but too small a setting may falsely detect vibration during normal operation.		

Pn192	**Position overshoot sensitivity during advanced tuning (relative positioning completed)**	○	**Address: 0x0192**
Factory value: 100	**Range: 0～100**	**Unit: %**	**Mode:** P S T

Pn193	**Max. gain search during advanced tuning**	○	**Address: 0x0193**
Factory value: 300.0	**Range: 1.0～400.0**	**Unit: Hz**	**Mode:** P S T

7.3.3 Position Parameter (Pn2xx)

Pn200	**Position command source selection**	■	**Address: 0x0200**
Factory value: 0x0020	**Range: 0x0000～0x0084**	**Unit: N/A**	**Mode:** P

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X: **External pulse command logic**

0	External high-speed pulse train
1	External low-speed pulse train
2	Reserved
3	Internal position

Y: **External pulse command filter time (software filter) selection**

0	Pulse filter 1 (~52Kpps, 9.6us)
1	Pulse filter 2 (~104Kpps, 4.8us)
2	Pulse filter 3 (～208Kpps, 2.4us)
3	Pulse filter 4 (～416Kpps, 1.2us)
4	Pulse filter 5 (～832Kpps, 0.6us)
5	Pulse filter 6 (～1664Kpps, 0.3us)
6	Pulse filter 7 (～3328Kpps, 0.15us)
7	Pulse filter 8 (~4Mpps, 0.125us)
8	Pulse filter time setting Pn011

Z: **Reserved parameters (not for modification)**

W: **Reserved parameters (not for modification)**

Precautions

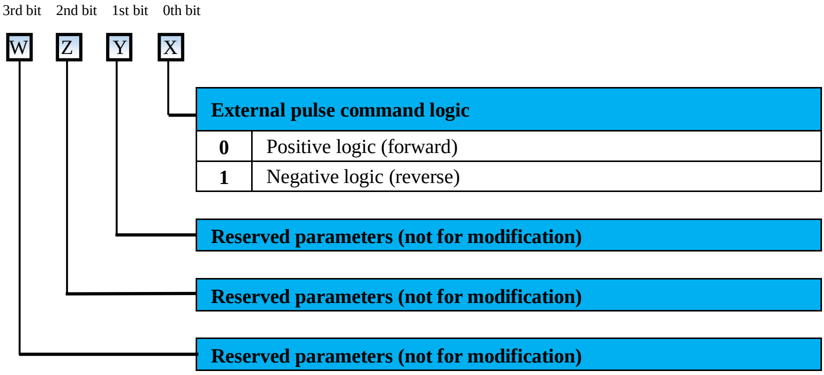
- The max. pulse frequency of the open collector pulse is 200 kHz, pulse filter 0 to 2 is valid.
- There are differences in the interface connection definitions for open collector inputs and differential pulse inputs, so please refer to typical wiring for connection.

Pn201	**External pulse command logic**	■	**Address: 0x0202**
Factory value: 0x0000	**Range: 0x0000～0x0004**	**Unit: N/A**	**Mode: P**

The type of pulse used to set the drive in position mode.

Setting	Description	Remark
0	Pulse + Direction	-
1	Forward pulse train and reverse pulse train (CW+CCW)	-
2～3	Reserved	-
4	90 °phase difference orthogonal pulse AB (4x frequency)	-

Pn202	**External pulse command logic**	■	**Address: 0x0202**
Factory value: 0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode: P**



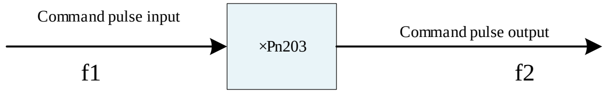
External pulse command logic	
0	Positive logic (forward)
1	Negative logic (reverse)

Reserved parameters (not for modification)

Reserved parameters (not for modification)

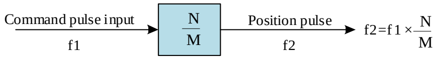
Reserved parameters (not for modification)

Pn203	**External pulse command multiplier**	○	**Address: 0x0203**
Factory value: 1	**Range: 1～100**	**Unit: ×1**	**Mode: P**
Des crip	Used to perform corresponding multiplication of external pulse commands, which can be switched via DI terminal X (P-GAIN） from 1x to Nx (max. 100x).		

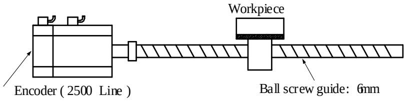
tion	 **Note:** The multiplication rate is valid only for external pulse commands, but not for internal programs such as JOG and intelligent tuning.

Pn204	**Electronic gear numerator (N)**	○	**Address: 0x0204★**
Factory value: 1	**Range: 0～1073741824**	**Unit: N/A**	**Mode: P**
Description	Used to set the numerator value for the electronic gear ratio.		

Precautions	
⚠	● When this function code is set to 0, the drive automatically sets the electronic gear numerator internally with the resolution of the encoder. **Example.** When the serial encoder resolution is 17 bits and is set to 0, the drive sets N=131072. When the serial encoder resolution is 24 bits and is set to 0, the drive sets N=16777216. When the serial encoder resolution is 23 bits and set to 0, the drive sets N=8388608.

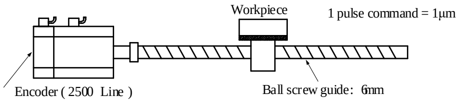
Pn206	**Electronic gear denominator (M)**	○	**Address: 0x0206★**
Factory value: 1	**Range: 1～1073741824**	**Unit: NA**	**Mode: P**
Description	The electronic gearing function is designed to provide easy proportional travel changes. Large electronic gear ratios usually result in a step change in the position command, which can be improved by smoothing it out with an S-curve or a low-pass filter. For example, when the electronic gear ratio is equal to 1, the motor encoder enters the weekly pulse number of 10000ppr, when the electronic gear ratio is equal to 0.5, every two pulses on the command side corresponds to one pulse wave of motor rotation. The servo motor is prone to surge when set incorrectly, so please set the electronic gear ratio reasonably.  When the deceleration ratio on the motor shaft and load side is N/M (N revolutions of the motor for M revolutions of the load), the setting of the electronic gear ratio can be obtained by the above formula. ●Electronic gear ratio		

Example: The servo motor encoder resolution is 10000p/rev, the ball screw lead is 6mm, and the number of pulses output from the upper unit is input when the workpiece moves 10mm.



Without electronic gear ratio

The servo motor rotates one turn when the screw moves 6mm, and when it moves 10mm, the servo motor needs to rotate 10÷6=1.6666 turns, then it needs 1.6666×2500×4=16666 pulses, and the command from the upper computer outputs 16666 pulses.



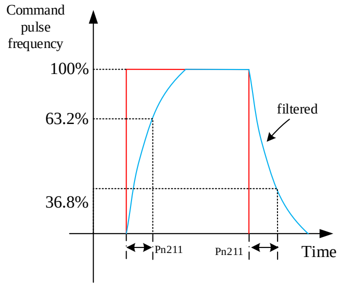
With electronic gear ratio

1 pulse is set to 1 μm when the servo motor rotates to move the workpiece away 10 mm (10000 μm), one pulse is equivalent to 1 μm, so 10000 ÷ 1 = 10000 is required, and the upper computer outputs 10000 pulses.

Precautions

- It is recommended that the users change the electronic gear ratio after the motor stops or at low speed, otherwise it may cause large vibrations. If vibration occurs during switching, use the position smoothing parameter to reduce the vibration.
- When using internal multi-segment position for control, when the servo driver executes a certain segment of positioning, the electronic gear ratio changes during that time but not act on the current position immediately until the current position segment is completed and the next position segment is executed.
- When an external pulse command is used, a change in the electronic gear ratio is immediately applied to the input pulse.
- An ER.d04 error occurs when the setting range for the electronic gear ratio is exceeded.

Pn211	**Position command low-pass filter time constant**	○	**Address: 0x0211**
Factory value: 0.0	**Range: 0.0～655.0**	**Unit: ms**	**Mode:** P
Description	Position command low-pass filter, mainly to provide buffer processing for excessive changes in the input pulse command signal. **Note: This low-pass filter is OFF when set to 0.**		



Generally used for:

① The upper computer does not have acceleration and deceleration function.

② The electronic gears are relatively large.

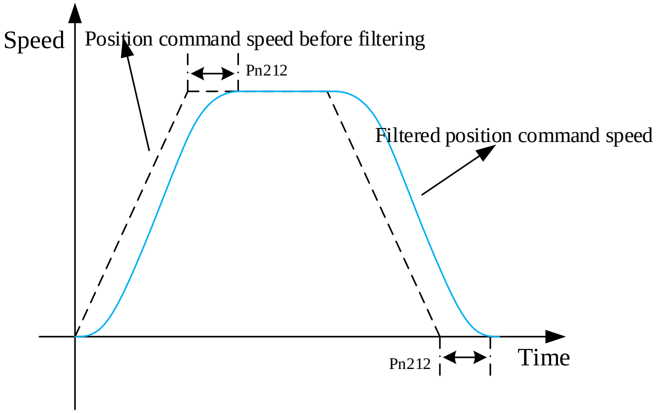
③ Low pulse command frequency.

⑤ Stepping, phase step and instability in the motor operation, etc.

Pn212	**Position command smoothing average filter**	○	**Address: 0x0212**
Factory value: 0.0	**Range: 0.0～1000.0**	**Unit: ms**	**Mode: P**

Description

Perform smoothing on position commands. The smoothing effect occurs at the beginning and end of the step command, but causes a delay in the position command.



Precautions
● When set to 0, the position command linear filter function is turned off.

Pn220	**Backlash compensation**	■	**Address: 0x0220**
Factory value: 0x0000	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode: P**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X:

Backlash compensation switch	
0	OFF
1	ON

Y:

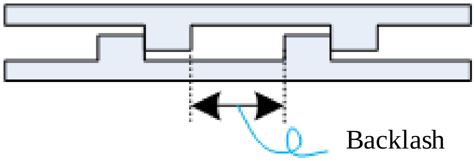
Backlash compensation direction	
0	Forward
1	Reverse

Z: **Reserved parameters (not ready for use)**

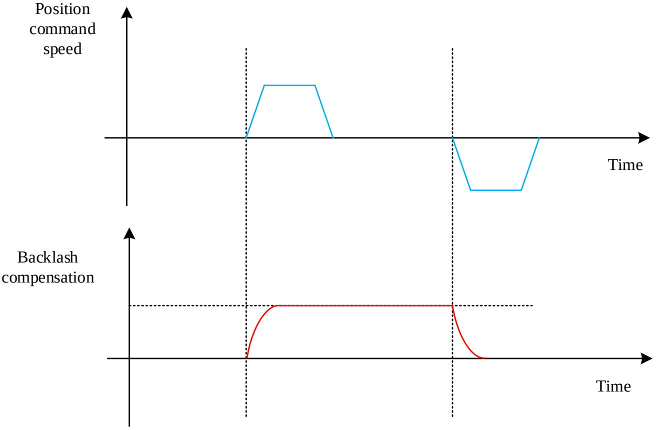
W: **Reserved parameters (not ready for use)**

Description

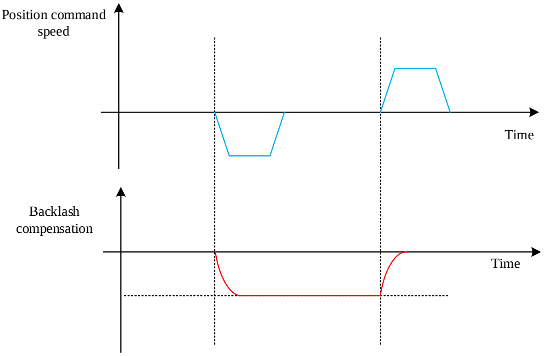
For ball screws and other similar drive mechanisms, there will be a repeatability error after a long period of wear and tear, and set backlash compensation at this time to reduce the error caused by the design of the mechanism.



Pn220.Y=0 (positive compensation)

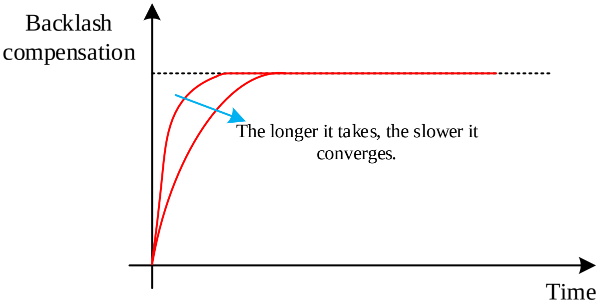


Pn220.Y=1 (negative compensation)



Pn221	**Backlash compensation**	○	**Address: 0x0221★**
Factory value: 0.0	**Range: -5000.0～5000.0**	**Unit: 0.1 command unit**	**Mode: P**

Pn223	**Backlash compensation filter time constant**	○	**Address: 0x0223**
Factory value: 10.00	**Range: 0.00～100.00**	**Unit: ms**	**Mode: P**
Description	The amount of backlash compensation shows an exponential relationship with time when performing a fixed point start/stop and is used to determine the rate of convergence of this compensation curve.		

Pn232	**Low-frequency vibration detection sensitivity (relative to positioning completion signal threshold)**	○	**Address: 0x0232**
Factory value: 40.0	**Range: 0.1～300.0**	**Unit: %**	**Mode: P**
Description	Set the threshold for low-frequency vibration detection, vibration detection value = Pn232 × Pn262. the smaller the setting, the easier it is to detect vibration.		

Pn233	**Low frequency vibration suppression1 frequency A**	○	**Address: 0x0233**
Factory value: 50.0	**Range: 1.0～250.0**	**Unit: Hz**	**Mode: P**

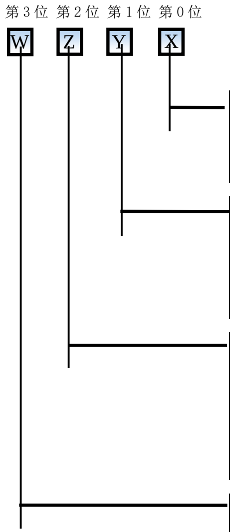
Pn234	**Low frequency vibration suppression1 frequency B**	○	**Address: 0x0234**
Factory value: 70.0	**Range: 1.0～250.0**	**Unit: Hz**	**Mode: P**

Pn235	**Low-frequency vibration suppression2 frequency**	○	**Address: 0x0235**
Factory value: 200.0	**Range: 1.0～200.0**	**Unit: Hz**	**Mode: P**
Description	To set the suppression center frequency for low frequency vibration, this function is on when this function code is not 200.0Hz. When this function is turned on, the response of the driver is reduced. After the model tracking function is turned on (Pn240.X=1), this function can be turned on with Pn240.Y=2.		

Pn236	**Low-frequency vibration suppression2 gain**	○	**Address: 0x0236**
Factory value: 100	**Range: 10～1000**	**Unit: %**	**Mode: P**

Description	To set the suppression gain for low-frequency vibration, the smaller the setting of this function code, the more obvious the suppression of vibration, and if it is too small, it may lead to excessive positioning time.

Pn240	**MFC function**	○	通讯地址：0x0240
出厂值：0x0100	设定范围：0x0000～0x1121	单位：N/A	控制模式：P



MFC function	
0	MFC OFF
1	MFC ON

Low frequency vibration suppression selection	
0	Vibration suppression OFF
1	Additional vibration suppression for specific frequencies
2	Additional vibration suppression for two different frequencies

Low-frequency vibration suppression adjustment selection	
0	Low-frequency vibration suppression is not automatically adjusted by auxiliary functions
1	Low-frequency vibration suppression is automatically adjusted by the auxiliary function.

Position command feedforward/torque feedforward selection	
0	Either MFC or position feedforward - torque feedforward on
1	Both MFC or position feedforward - torque feedforward on

Pn241	**Model tracking for gain**	○	**Address: 0x0241**
Factory value: 50.0	**Range: 1.0～2000.0**	**Unit: 1/s**	**Mode: P**

Pn242	**Model tracking for gain compensation**	○	**Address: 0x0242**
Factory value: 100.0	**Range: 50.0～200.0**	**Unit: %**	**Mode: P**

Pn243	**Model tracking for speed feedforward compensation**	○	**Address: 0x0243**
Factory value: 100.0	**Range: 0.0～1000.0**	**Unit: %**	**Mode: P**

Pn244	**Model tracking for bias (forward)**	○	**Address: 0x0244**

Factory value: 100.0	**Range: 0.0～1000.0**	**Unit: %**	**Mode: P**

Pn245	**Model tracking for bias (reverse)**	○	**Address: 0x0245**
Factory value: 100.0	**Range: 0.0～1000.0**	**Unit: %**	**Mode: P**

Pn246	**2nd model tracking for gain**	○	**Address: 0x0246**
Factory value: 50.0	**Range: 1.0～2000.0**	**Unit: 1/s**	**Mode: P**

Pn247	**2nd model tracking for gain compensation**	○	**Address: 0x0247**
Factory value: 100.0	**Range: 50.0～200.0**	**Unit: %**	**Mode: P**

Pn248※	**Control selection switches**	■	**Address: 0x0248**
Factory value: 0x0001	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

MFC control mode selection	
0	Type I MFC
1	Type II MFC

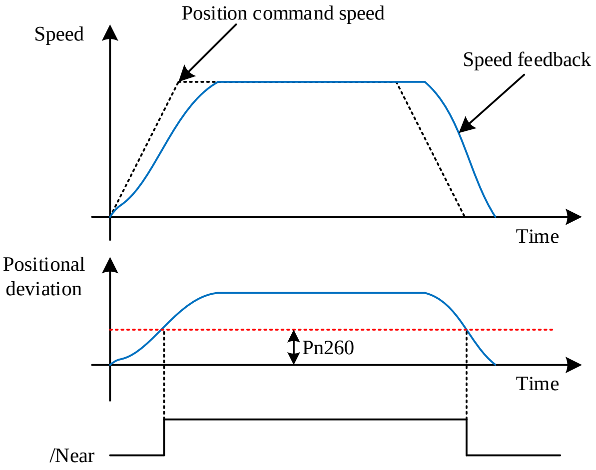
Tuning-free selection	
0	Type I tuning-free
1	Type II tuning-free

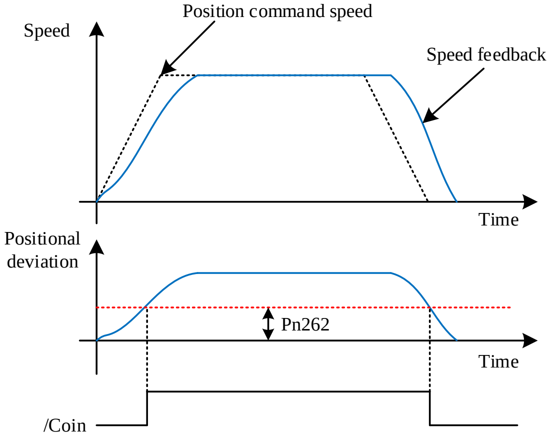
Reserved parameters (not for modification)

Reserved parameters (not for modification)

Pn260	**Position near signal (/Near) threshold**	○	**Address: 0x0260★**
Factory value: 1073741824	**Range: 1～1073741824**	**Unit: Command unit**	**Mode: P**

Description	A signal is output when the difference between the command pulse number of the upper unit and the servomotor movement amount (position deviation) is lower than the Pn260. In position control, the upper unit can receive a position near signal before positioning completion signal to prepare for the sequence of movements or other operations that are to be performed after the positioning is completed. Note: Set a value greater than the positioning completion width (Pn262).

<table>
<tr><td>Pn262</td><td colspan="2">Position completion signal (/COIN) threshold</td><td>○</td><td>Address: 0x0262</td></tr>
<tr><td colspan="2">Factory value: 7</td><td>Range: 0～1073741824</td><td>Unit: Command unit</td><td>Mode: P</td></tr>
<tr><td>Description</td><td colspan="4">A signal is output when the difference between the command pulse number of the upper unit and the servomotor movement (position deviation) is lower than Pn262.

Note: ① This parameter has no effect on the final positioning accuracy.
② If the setting value is too large, position completion signal (/Coin) may be output for a</td></tr>
</table>

	long time when the deviation is small in low-speed operation. When a long position signal is output, the position completion threshold is lowered until the signal is no longer output.

Pn264	**Excessive position deviation error threshold**	○	**Address: 0x0264★**
Factory value: 5242880	**Range: 1～1073741824**	**Unit: Command unit**	**Mode: 🄿**
Description	If the deviation between the position command and the actual feedback during motor operation exceeds this threshold, a position deviation fault is generated. The position deviation during normal operation varies according to the setting of operation speed, gain, feedforward, etc. Therefore, it is set by the following formula during actual use. $\text{Pn264}=\frac{F_c}{K_p}\times(1.2\sim2.0)$ In the formula F_c : max. frequency of position command pulse (pulse/s). K_p :position loop gain (1/s). 1.2 to 2.0: safety factor (to prevent excessive frequent position deviation)		

Pn266	**Excessive position deviation alarm threshold**	○	**Address: 0x0266**
Factory value: 100	**Range: 10～100**	**Unit: %**	**Mode: 🄿**
Description	Set the excessive position deviation alarm threshold. The drive generates an excessive position deviation alarm when the current position deviation value is over this setting.		

Pn267	**Max. error threshold for excessive position deviation at servo-ON**	○	**Address: 0x0267★**
Factory value: 5242880	**Range: 1～1073741823**	**Unit: Command unit**	**Mode: 🄿**
Description	When the position deviation exceeds the value of this function code now of servo-ON during motor operation, the drive generates an excessive servo-ON position deviation error.		

Pn269	**Max. alarm threshold for excessive position deviation at servo-ON**	○	**Address: 0x0269**
Factory value: 100	**Range: 10～100**	**Unit: %**	**Mode: 🄿**
Description	When the position deviation exceeds the value of this function code now of servo-ON during motor operation, the drive generates an excessive servo-ON position deviation alarm.		

Pn270	**Speed limit value at servo-ON**	○	**Address: 0x0270**
Factory value: 1000	**Range: 0～10000**	**Unit: rpm**	**Mode: P**

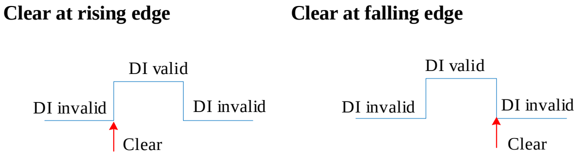
Pn271	**External pulse command multiplier**	■	**Address: 0x0271**
Factory value: 0x0000	**Range: 0x0000～0x0002**	**Unit: N/A**	**Mode: P**

Pn272	**External terminal clearing (CLR) position deviation method**	■	**Address: 0x0272**
Factory value: 0x0000	**Range: 0x0000～0x0003**	**Unit: N/A**	**Mode: P**

In position mode, this is used to set the method of clearing the position deviation generated by the drive.

Setting	Description	Remark
0	Clear position deviation at high level (H)	-
1	Clear position deviation at rising edge	-
2	Clearing position deviation at low level (L)	-
3	Clear position deviation at falling edge	-

Position deviation clear (CLR) signal status:



Pn273	**Position deviation clear**	■	**Address: 0x0273**
Factory value: 0x0000	**Range: 0x0000～0x0002**	**Unit: N/A**	**Mode: P**

Position deviation clear is performed when the corresponding conditions are satisfied at different set values.

Setting	Description	Remark
0	Servo OFF, clear on malfunction	-
1	Clear by CLR signal only	-
2	Clear on failure	-

Pn274	**Position completion signal (COIN) output timing**	○	**Address: 0x0274**

Factory value: 0x0000	**Range: 0x0000～0x0002**	**Unit: N/A**	**Mode:** P

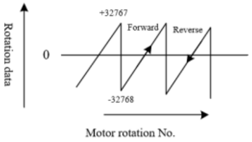
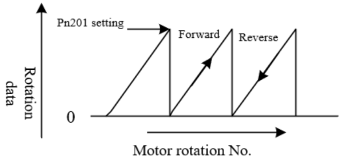
In position mode, this is used to set the timing of the position completion signal output.

Setting	Description	Remark
0	when the absolute value of position deviation is lower than Pn262.	-
1	when the absolute value of position deviation is lower than Pn262 and the position command filtered command is 0.	-
2	when the absolute value of position deviation is lower than Pn262) and the position command input is 0.	-

Pn276	**Upper limit of revolution**	■	**Address: 0x0276**
Factory value: 0	**Range: 0～30000**	**Unit: turn**	**Mode:** P S T

Description

The upper limit of the number of revolutions can be used for position control of rotary objects such as rotary tables. The upper limit of the number of revolutions is used to keep the number of revolutions of the motor and the number of revolutions of the rotary table as an integer ratio and to avoid the generation of decimals.

Pn201 is 0	Pn201 is not 0
	

Precautions

- The setting of the upper limit of the number of revolutions is valid only when an absolute encoder is used;
- When Pn201=0, the setting of the upper limit of the number of rotations is invalid.

Pn277	**Encoder unidirectional operation**	■	**Address: 0x0277**
Factory value: 0x0000	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Function switch

0	OFF
1	ON

Position feedback direction selection

0	Periodic
1	Non-periodic accumulation

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Precautions
● If the direction of motor rotation (Pn277) is set incorrectly, an absolute position abnormality is caused, resulting in ER.840.

Pn290	**Home mode**	○	**Address: 0x0290**
Factory value: 0.100	**Range: 0x0000～0x23B4**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Home enable

0	OFF
1	Enable by DI terminal signal
2	Enable after power-up, and the drive is enabled after home is
3	Enable immediately
4	Take the current position as the home position

Home mode

0	Forward, deceleration and home position are home switches
1	Reverse, deceleration and home position are both home switch
2	Forward, deceleration and home position are motor Z signal
3	Reverse, deceleration and home position are motor Z signal
4	Forward, deceleration position is the home switch, home is the motor Z signal

5	Reverse, deceleration position is the home switch, home is the motor Z signal
6	Forward, deceleration and home position are positive overtravel switches
7	Reverse, deceleration and home position are positive overtravel switches
8	Forward, deceleration and home position are motor Z signal
9	Reverse, deceleration and home position are motor Z signal
A	Absolute position homing
B	Take the current position as the home position

Terminal trigger mode selection for home	
0	Trigger at low level and stop at high
1	Trigger at rising edge
2	Trigger at falling edge
3	Trigger at high level and stop at low

Home timeout unit	
0	1ms
1	10ms
2	100ms

Pn291	**Home high speed**	○	**Address: 0x0291**
Factory value: 100.0	**Range: 0.0～3000.0**	**Unit: rpm**	**Mode: P**
Description	First find the reference point during homing (deceleration point), to determine the homing range; the speed of finding the reference point should not be too slow, or it may report the home timeout fault.		

Pn292	**Home low speed**	○	**Address: 0x0292**
Factory value: 10.0	**Range: 0.0～1000.0**	**Unit: rpm**	**Mode: P**
Description	First determine the home range and then decelerate to locate the home position and lock it. Zeroing speed should not be too fast, or home position may be lost or the difference may be large.		

Pn293	**Home acceleration/deceleration time**	○	**Address: 0x0293**
Factory value: 3000	**Range: 0～3000**	**Unit: ms**	**Mode: P**
Description	Home acceleration time is the time required for the motor to accelerate from 0rpm to 3000rpm; Home deceleration time is the time required for the motor to accelerate from 0rpm to 3000rpm.		

Pn294	**Home offset position**	○	**Address: 0x0294★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: Command unit**	**Mode:** P
Description	The home offset position means that the motor needs to travel a further distance after finding the home position, and this distance is the motor's home offset position, i.e., the motor's absolute position coordinates.		

Pn296	**Absolute position home multi-turn value**	○	**Address: 0x0296**
Factory value: 0	**Range: -32768～32767**	**Unit: rev**	**Mode:** P S T

Pn297	**Absolute position home single-turn value**	○	**Address: 0x0297★**
Factory value: 0	**Range: 0～2147483647**	**Unit: encoder unit**	**Mode:** P S T
Description	The multi-turn value and the single-turn value of the absolute position home point together indicate the target absolute position of the motor, which is used to set the target position of the motor when the servo selects the absolute position to home, i.e., the multi-turn and the single-turn value of the motor at the time of the final shutdown are equal to or close to the set value.		

Pn299	**Home timeout**	○	**Address: 0x0299**
Factory value: 10000	**Range: 0～65535**	**Unit: ms**	**Mode:** P S T
Description	To set the maximum time to search for a home signal. If this function code is set too small or the home signal is not searched within the time set by this function code, the drive will generate the home timeout fault ER.8A1. **Note:** 0 disables this function.		

7.3.4 Speed Parameter (Pn3xx)

Pn300	**Speed command source selection**	○	**Address: 0x0300**
Factory value: 0000	**Range: 0x0000～0x0005**	**Unit: N/A**	**Mode:** S

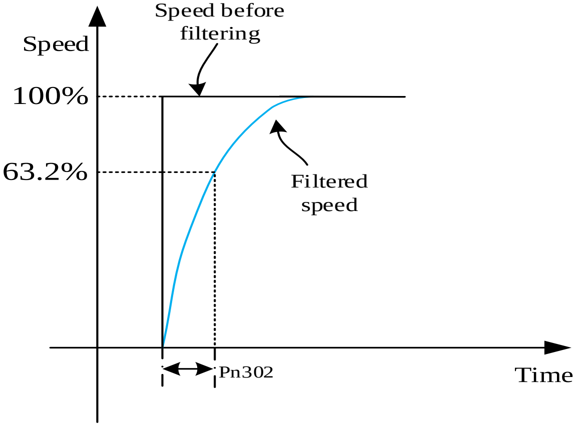
To select the speed command source in speed mode.

<table>
<tr><th>Setting</th><th>Description</th><th>Remark</th></tr>
<tr><td>0</td><td>Given by internal digit</td><td>by Pn304</td></tr>
<tr><td>2</td><td>Reserved</td><td>-</td></tr>
<tr><td>3</td><td>Reserved</td><td>-</td></tr>
<tr><td>4</td><td>Given by internal combined digits</td><td>
<table>
<tr><th>SPDB</th><th>SPDA</th><th>Command source</th></tr>
<tr><td>0</td><td>0</td><td>Pn303.X</td></tr>
<tr><td>0</td><td>1</td><td>Pn303.Y</td></tr>
<tr><td>1</td><td>0</td><td>Pn303.Z</td></tr>
<tr><td>1</td><td>1</td><td>Pn303.W</td></tr>
</table>
</td></tr>
<tr><td>5</td><td>Reserved</td><td>-</td></tr>
</table>

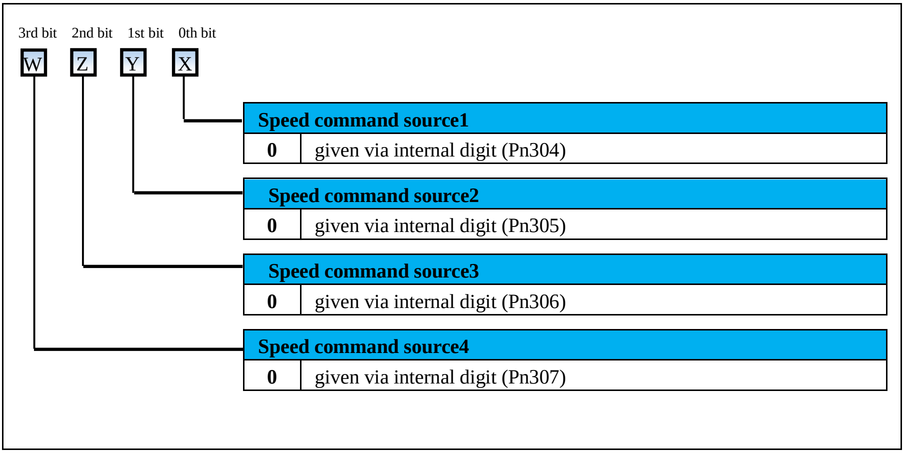
Pn301	**Speed command direction**	○	**Address: 0x0301**
Factory value: 0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode: S**

Setting	Description	Remark
0	Same direction as current speed command	-
1	Opposite to the current speed command	-

Pn302	**Speed command low-pass filter**	○	**Address: 0x0302**
Factory value: 0.40	**Range: 0.00～655.35**	**Unit: ms**	**Mode: S**
Description	Applying 1 low-pass filter to the speed command input to smooth it.		

Pn303	**Speed control switch1**	■	**Address: 0x0303**
Factory value: 0x0000	**Range: 0x0000～0x2222**	**Unit: N/A**	**Mode:** S



Speed command source1	
0	given via internal digit (Pn304)

Speed command source2	
0	given via internal digit (Pn305)

Speed command source3	
0	given via internal digit (Pn306)

Speed command source4	
0	given via internal digit (Pn307)

Pn304	**Internal speed0**	○	**Address: 0x0304**
Factory value: 100	**Range: -10000～10000**	**Unit: 1rpm**	**Mode:** S

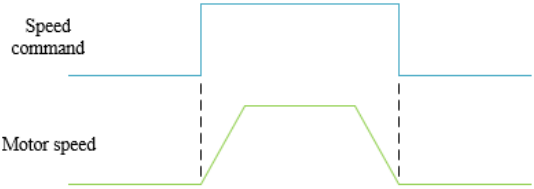
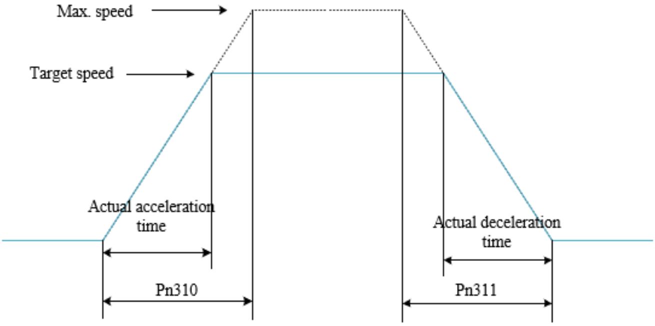
Pn305	**Internal speed1**	○	**Address: 0x0305**
Factory value: 200	**Range: -10000～10000**	**Unit: 1rpm**	**Mode:** S

Pn306	**Internal speed2**	○	**Address: 0x0306**
Factory value: 300	**Range: -10000～10000**	**Unit: 1rpm**	**Mode:** S

Pn307	**Internal speed3**	○	**Address: 0x0307**
Factory value: 400	**Range: -10000～10000**	**Unit: 1rpm**	**Mode:** S

Pn310	**Soft start acceleration time (ACC) in speed control mode**	○	**Address: 0x0310**
Factory value: 200	**Range: 0～10000**	**Unit: 1ms**	**Mode:** S

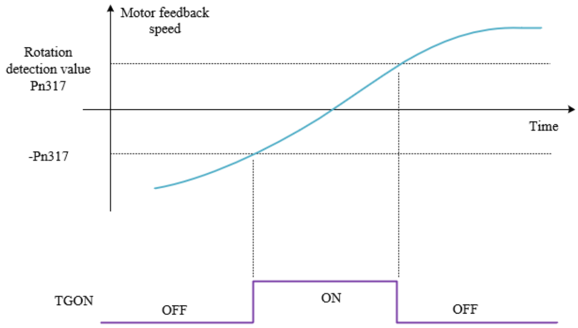
Pn311	**Soft start deceleration time (DEC) in speed control mode**	○	**Address: 0x0311**
Factory value: 200	**Range: 0～10000**	**Unit: 1ms**	**Mode:** S

Description	The soft start function refers to the conversion of a step speed command into a smoother constant acceleration and deceleration speed command, the acceleration and deceleration time can be set.  Pn310: The time required for the motor to reach the maximum speed of the motor from the stop state. Pn311: The time required for the motor to reach the motor stop from the maximum speed. The actual acceleration and deceleration times are calculated by the following formula. 

Pn313	**Zero clamp speed threshold**	○	**Address: 0x0313**
Factory value: 10	**Range: 0～10000**	**Unit: rpm**	**Mode:** S
Description	This function is to lock servo when the input voltage of the speed command is lower than the speed set here when the zero clamp(/ZCLAMP) is ON. In this case, a position loop is formed inside the servo unit and the speed command is ignored. For speed control, no position loop is constructed from the upper unit.		

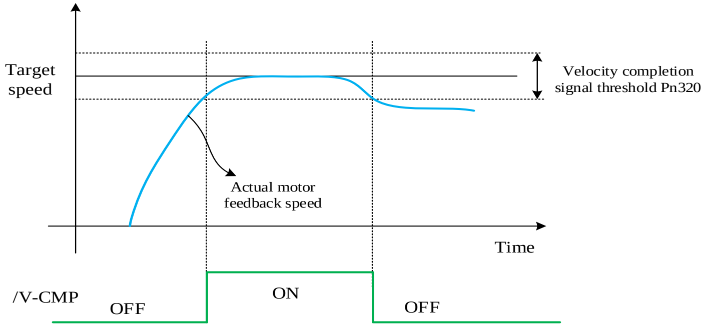
Precautions	
⚠	●When the servo motor is fixed at the zero position, there is a ±1 pulse jump, and even if rotation occurs due to an external force, it returns to the zero fixed position.

Pn314	**Zero clamp compensation max. speed**	○	**Address: 0x0314**
Factory value: 1000	**Range: 50～10000**	**Unit: rpm**	**Mode:** 🅂
Description	When the servomotor is fixed in the zero position, it will return even if rotation occurs by an external force, set this code to limit the maximum speed during return.		

Pn317	**Rotation detection**	○	**Address: 0x0317**
Factory value: 20	**Range: 1～10000**	**Unit: rpm**	**Mode:** 🄿 🅂 🅃
Description	To set the condition range of the /TGON signal. When the actual feedback speed of the motor is within the range set by this function code, report the corresponding TGON signal.  		

Pn318	**Maximum running speed**	○	**Address: 0x0318**
Factory value: 10000	**Range: 0～10000**	**Unit: rpm**	**Mode:** 🄿 🅂
Description	Set the maximum running speed of the servo motor. When this limit value is greater than the maximum motor speed, the maximum motor speed is the maximum operating speed.		

Pn320	**Velocity completion threshold**	○	**Address: 0x0320**
Factory value: 10	**Range: 0～100**	**Unit: rpm**	**Mode:** 🄿 🅂 🅃

Description	Set the time used to determine whether the actual speed reaches the set target speed threshold. If the deviation value between the motor feedback speed and the speed given is within the threshold value, it means that the user speed is reached, and the /V-CMP signal assigned to the output terminal is output at a high level (ON). **Example:** Pn320=50rpm, the target speed is 2000rpm, the motor speed is in the range of 1950rpm to 2050rpm, output /V-CMP signal. 

7.3.5 Torque Parameter (Pn4xx)

Pn400	**Torque control switch1**	■	**Address: 0x0400**
Factory value: 0x0020	**Range: 0x0000～0x0045**	**Unit: N/A**	**Mode: T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

<table>
<tr><th colspan="3">Command source selection in torque control</th></tr>
<tr><td>0</td><td>Given by internal digit</td><td>By Pn410</td></tr>
<tr><td>1</td><td>Reserved</td><td>-</td></tr>
<tr><td>2</td><td>Reserved</td><td>-</td></tr>
<tr><td>3</td><td>Given by internal combined digit</td><td>
<table>
<tr><th>TorqB</th><th>TorqA</th><th>Command source</th></tr>
<tr><td>0</td><td>0</td><td>Pn409.X</td></tr>
<tr><td>0</td><td>1</td><td>Pn409.Y</td></tr>
<tr><td>1</td><td>0</td><td>Pn409.Z</td></tr>
<tr><td>1</td><td>1</td><td>Pn409.W</td></tr>
</table>
</td></tr>
<tr><td>4</td><td>Single trigger mode</td><td></td></tr>
<tr><td>5</td><td>Given by CANopen</td><td></td></tr>
</table>

Speed limit source selection in torque control		
0	Reserved	-
1	Reserved	-
2	Given by internal digit	by Pn415
3	Given by DI terminal	OFF: Pn415; ON: Pn416
4	Torque command direction	forward: Pn415; reverse: Pn416

Reserved parameters (not

Reserved parameters (not for modification)

Pn401	**Torque command 2nd low-pass filter cutoff frequency**	○	**Address: 0x0401**
Factory value: 5000	**Range: 100～5000**	**Unit: Hz**	**Mode: T**
Description	Filter is invalid when set to 5000		

Pn402	**Torque command 2nd low-pass filter Q**	○	**Address: 0x0402**
Factory value: 0.50	**Range: 0.50～1.00**	**Unit: N/A**	**Mode: T**

Pn403	**Torque command direction**	○	**Address: 0x0403**
Factory value: 0x0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode:** 🅃

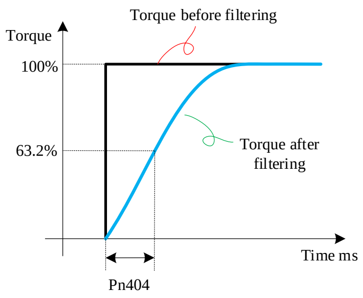
Setting	Description	Remark
0	Same as the torque command	-
1	Opposite to torque command	-

Precautions

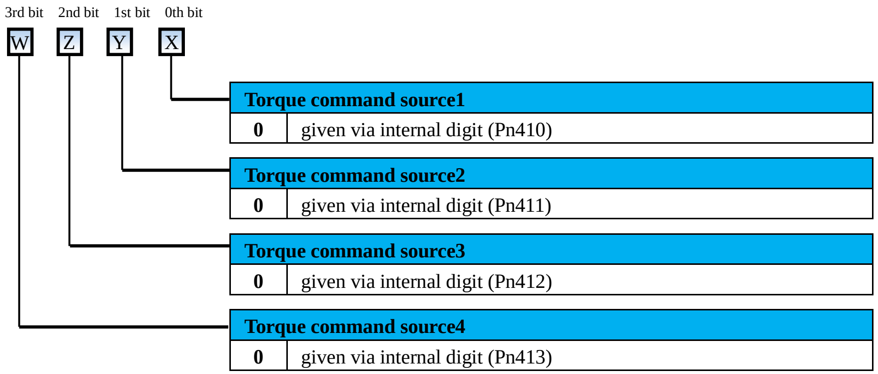
- Pn403 and external terminal torque command direction (TPR-D) are valid for internal register torque commands.
- The logic for combining Pn403 with the direction of external terminal torque command (TPR-D) is as follows (CCW direction as positive as a reference):

Given torque command	External terminal TPR-D	Pn403.X	Actual command direction
Forward	OFF	0	Forward
		1	Reverse
	ON	0	Reverse
		1	Forward
Reverse	OFF	0	Reverse
		1	Forward
	ON	0	Forward
		1	Reverse

Pn404	**Torque command filter time**	○	**Address: 0x0404**
Factory value: 0.00	**Range: 0.00～655.35**	**Unit: ms**	**Mode:** 🅃
Description	A 1st order low-pass filter is applied to the torque command input to smooth the torque command.		

Pn409	**Torque control switch3**	○	**Address: 0x0409**
Factory value: 0x0000	**Range: 0x0000～0x2222**	**Unit: N/A**	**Mode: T**



Torque command source1	
0	given via internal digit (Pn410)

Torque command source2	
0	given via internal digit (Pn411)

Torque command source3	
0	given via internal digit (Pn412)

Torque command source4	
0	given via internal digit (Pn413)

Pn410	**Internal torque command1**	○	**Address: 0x0410**
Factory value: 0.0	**Range: -500.0～500.0**	**Unit: %**	**Mode: T**

Pn411	**Internal torque command2**	○	**Address: 0x0411**
Factory value: 0.0	**Range: -500.0～500.0**	**Unit: %**	**Mode: T**

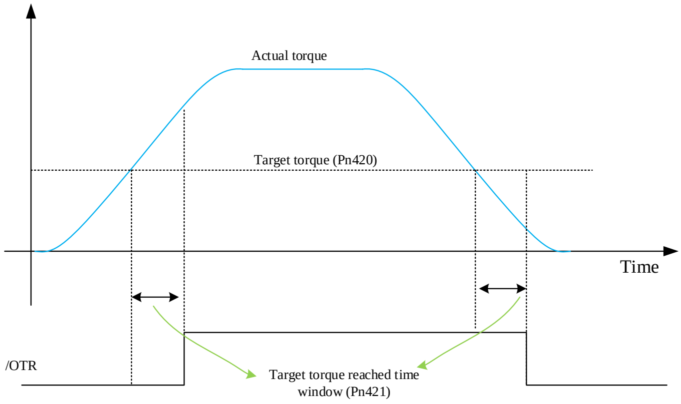
Pn412	**Internal torque command3**	○	**Address: 0x0412**
Factory value: 0.0	**Range: -500.0～500.0**	**Unit: %**	**Mode: T**

Pn413	**Internal torque command4**	○	**Address: 0x0413**
Factory value: 0.0	**Range: -500.0～500.0**	**Unit: %**	**Mode:** T

Pn415	**Internal speed limit1 in torque control**	○	**Address: 0x0415**
Factory value: 1000	**Range: 0～10000**	**Unit: rpm**	**Mode:** T

Pn416	**Internal speed limit2 in torque control**	○	**Address: 0x0416**
Factory value: 1000	**Range: 0～10000**	**Unit: rpm**	**Mode:** T

Pn420	**Target torque reaches set value**	○	**Address: 0x0420**
Factory value: 100.0	**Range: 0.0～500.0**	**Unit: %**	**Mode:** P S T

Pn421	**Target torque reaches time window**	○	**Address: 0x0421**
Factory value: 5	**Range: 0～1000**	**Unit: ms**	**Mode:** P S T
Description	When the torque output from the drive is greater than the set target torque and lasts longer than the set time window time, the target torque arrival signal is output.  		

Pn430	**Torque control switch2**	○	**Address: 0x0430**
Factory value: 0x0001	**Range: 0x0000～0x0013**	**Unit: N/A**	**Mode:** T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Reserved parameters (not for modification)

Control priority in torque mode	
0	Speed first
1	Torque first

Reserved parameters (not for modification)

Reserved parameters (not for modification)

7.3.6 Auxiliary Parameter (Pn5xx)

Pn500	**JOG speed**		○	**Address: 0x0500**
Factory value: 200	**Range: 0～3000**	**Unit: rpm**		**Mode: P S T**

Pn502	**JOG travel mode**		○	**Address: 0x0502**
Factory value: 0x0000	**Range: 0x0000～0x0005**	**Unit: N/A**		**Mode: P S T**

第 3 位 第 2 位 第 1 位 第 0 位

W Z Y X

JOG operation mode	
0	(Waiting time Pn535→Forward Pn531) ×Travel times Pn536
1	(Waiting time Pn535→Reverse Pn531) ×Travel times Pn536
2	(Waiting time Pn535→Forward Pn531) ×Travel times Pn536 (Waiting time Pn535→Reverse Pn531) ×Travel times Pn536
3	(Waiting time Pn535→Reverse Pn531) ×Travel times Pn536 (Waiting time Pn535→Forward Pn531) ×Travel times Pn536
4	(Waiting time Pn535→ Forward Pn531→ Waiting time Pn535→Reverse Pn531) ×Travel times Pn536
5	(Waiting time Pn535→ Reverse Pn531→ Waiting time Pn535→ Forward Pn531) × Travel times Pn536

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Reserved parameters (not for modification)

Pn503	**JOG travel distance**	○	**Address: 0x0503★**
Factory value: 60000	**Range: 1～1073741824**	**Unit: Command unit**	**Mode:** P S T

Pn505	**JOG acceleration and deceleration time**	○	**Address: 0x0505**
Factory value: 100	**Range: 2～10000**	**Unit: ms**	**Mode:** P S T

Pn506	**JOG waiting time**	○	**Address: 0x0506**
Factory value: 100	**Range: 0～10000**	**Unit: ms**	**Mode:** P S T

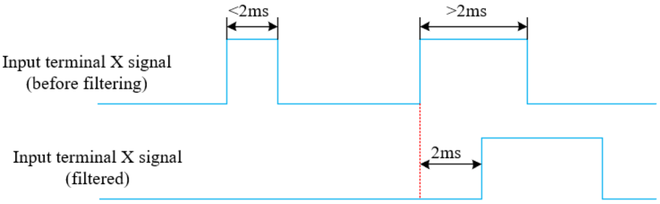
Pn507	**JOG travel times**	○	**Address: 0x0507**
Factory value: 1	**Range: 0～1000**	**Unit: times**	**Mode:** P S T
Description	Used to set the number of cycle times during JOG.		

Precautions	
⚠	● When Pn502 is set to 2 or 3 and Pn507 is set to 0, the JOG is invalid. ● When Pn507 = 0, the JOG move times is not limited.

Pn508	**JOG travel speed**	○	**Address: 0x0508**
Factory value: 500	**Range: 1～10000**	**Unit: rpm**	**Mode:** P S T

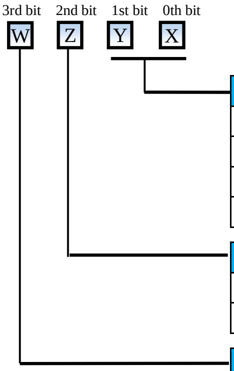
7.3.7 Terminal Parameter (Pn6xx)

Pn600	**Switching input terminal X filter time**	○	**Address: 0x0600**
Factory value: 2	**Range: 0～3000**	**Unit: ms**	**Mode:** P S T
Description	Used to set the filter time for external signals input to the drive from the X terminal. **Example:** When Pn600 filter time is 2ms, signals smaller than 2ms are filtered out.		

Precautions	
⚠	● The filter time of switching input terminal X is valid from X1 to X4; ● The monitoring function code Un100 monitors the input terminal X status after filtering.

Pn601	**Input terminalIN1**	○	**Address: 0x0601**
Factory value: 0x0001	**Range: 0x0000～0x112F**	**Unit: N/A**	**Mode: P S T**



Functional assignment	
00	OFF
01	See " Appendix 1 Input Terminal Function Definitions".
…	
2F	

Input terminal contact properties	
0	ON
1	OFF

Input terminal signal source	
0	Given by external hardware terminal X1
1	Given by internal software status bit 1 Pn630.Bit0

Pn602	**Input terminal IN2**	○	**Address: 0x0602**
Factory value: 0x0002	**Range: 0x0000～0x112F**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Functional assignment	
00	OFF
01	See " Appendix 1 Input Terminal Function Definitions".
…	
2F	

Input terminal contact properties	
0	ON
1	OFF

Input terminal signal source	
0	Given by external hardware terminal X2
1	Given by internal software status bit 1 Pn630.Bit1

Pn603	**Input terminal IN3**	○	**Address: 0x0603**
Factory value: 0x0003	**Range: 0x0000～0x112F**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Functional assignment	
00	OFF
01	See " Appendix 1 Input Terminal Function Definitions".
…	
2F	

Input terminal contact properties	
0	ON
1	OFF

Input terminal signal source	
0	Given by external hardware terminal X3
1	Given by internal software status bit 1 Pn630.Bit2

Pn604	**Input terminal IN3**	○	**Address: 0x0604**
Factory value: 0x0005	**Range: 0x0000～0x112F**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Functional assignment	
00	OFF
01	See " Appendix 1 Input Terminal Function Definitions".
…	
2F	

Input terminal contact properties	
0	ON
1	OFF

Input terminal signal source	
0	Given by external hardware terminal X4
1	Given by internal software status bit 1 Pn630.Bit3

Pn611	**Output terminal OUT1**	○	**Address: 0x0611**
Factory value: 0x0001	**Range: 0x0000～0x110F**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Functional assignment	
00	See " Attachment 1 Input Terminal Function Definitions".
…	
0F	

Input terminal contact properties	
0	ON
1	OFF

Input terminal signal source	
0	by Pn610 for signal assignment
1	by Pn631.Bit0

Pn612	**Output terminal OUT2**	○	**Address: 0x0612**
Factory value: 0x0002	**Range: 0x0000～0x110F**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Functional assignment	
00	See " Attachment 2 Input Terminal Function Definitions".
…	
0F	

Input terminal contact properties	
0	ON
1	OFF

Input terminal signal source	
0	by Pn610 for signal assignment
1	by Pn631.Bit1

Pn630	**Input terminal (X) status given by internal software**	○	**Address: 0x0630**
Factory value: 0x0000	**Range: 0x0000～0x03FF**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

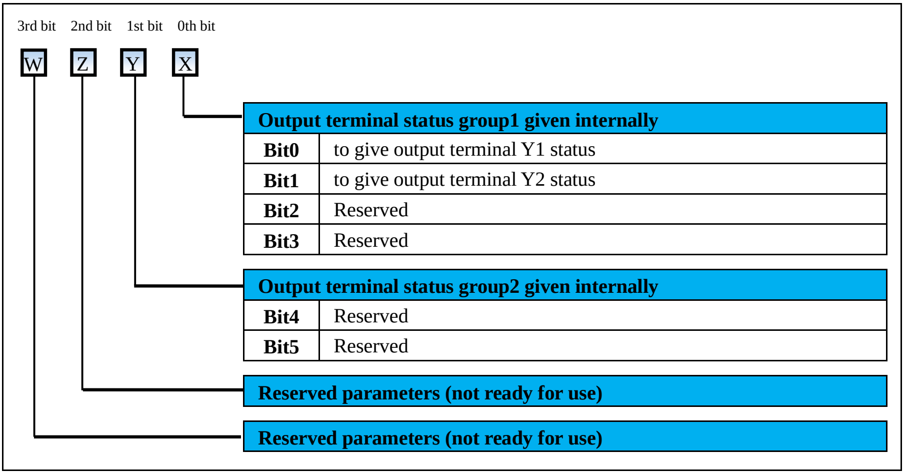
Input terminal status group1 given internally	
Bit0	Virtual input terminalX1
Bit1	Virtual input terminalX2
Bit2	Virtual input terminalX3
Bit3	Virtual input terminalX4

Input terminal status group2 given internally	
Bit4	Reserved
Bit5	Reserved
Bit6	Reserved
Bit7	Reserved

Input terminal status group3 given internally	
Bit8	Reserved

Reserved parameters (not ready for use)

Pn631	**Input terminal (Y) status given by internal software**	○	**Address: 0x0631**
Factory value: 0x0000	**Range: 0x0000～0x003F**	**Unit: N/A**	**Mode:** P S T



Output terminal status group1 given internally	
Bit0	to give output terminal Y1 status
Bit1	to give output terminal Y2 status
Bit2	Reserved
Bit3	Reserved

Output terminal status group2 given internally	
Bit4	Reserved
Bit5	Reserved

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

7.3.8 Expanded Parameters (Pn7xx)

Pn702	**Advanced adjustable range**	○	**Address: 0x0702**
Factory value: 3.0	**Range: 0.5～10.0**	**Unit: Turn**	**Mode: P S T**

Pn705	**Inertia detection initial value**	○	**Address: 0x0705**
Factory value: 300	**Range: 0～20000**	**Unit: %**	**Mode: P S T**

Pn706	**Vibration threshold in inertia detection**	○	**Address: 0x0706**
Factory value: 250	**Range: 0～5000**	**Unit: rpm**	**Mode: P S T**

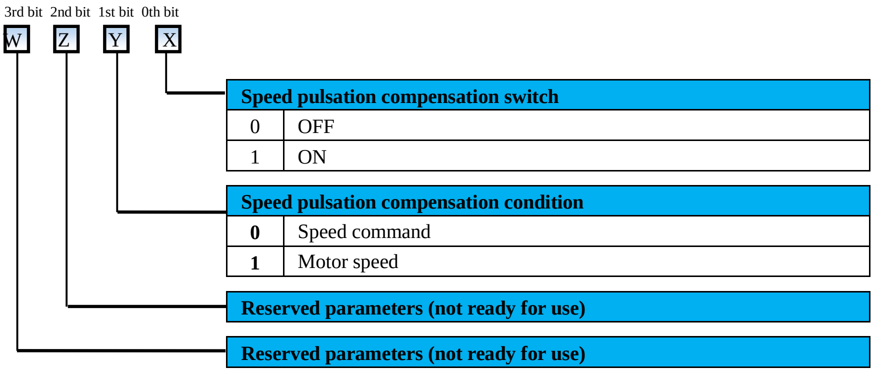
Pn720※	**EasyFFT sweep frequency start**	○	**Address: 0x0720**
Factory value: 400	**Range: 1～5000**	**Unit: Hz**	**Mode: P S T**

Pn721※	**EasyFFT sweep frequency end**	○	**Address: 0x0721**
Factory value: 4000	**Range: 50～5000**	**Unit: Hz**	**Mode: P S T**

Pn722※	**EasyFFT lower limit of resonance frequency detection**	○	**Address: 0x0722**
Factory value: 500	**Range: 50～5000**	**Unit: Hz**	**Mode: P S T**

Pn723※	**EasyFFT scanning torque command amplitude**	○	**Address: 0x0723**
Factory value: 15	**Range: 1～800**	**Unit: %**	**Mode:** P S T
Description	Used to set the amplitude value for the EasyFFT scanning torque command.		

Pn740※	**Speed pulsation compensation**	○	**Address: 0x0740**
Factory value: 0x0000	**Range: 0x0000～0x0011**	**Unit: N/A**	**Mode:** P S T



Speed pulsation compensation switch	
0	OFF
1	ON

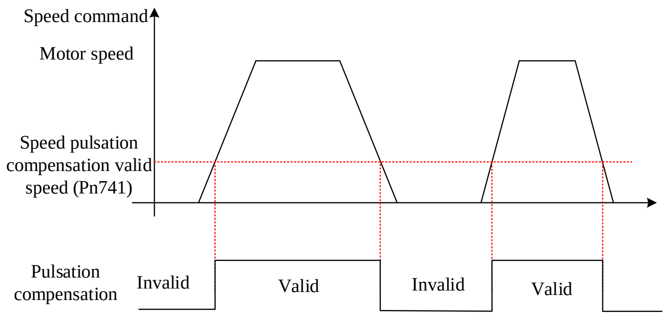
Speed pulsation compensation condition	
0	Speed command
1	Motor speed

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

Description	Used to turn the Speed pulsation compensation on and off.

Pn741※	**Speed pulsation compensation speed**	■	**Address: 0x0741**
Factory value: 0	**Range: 0～10000**	**Unit: rpm**	**Mode:** P S T
Description	When the speed pulsation compensation function is enabled, even when the speed command is 0 or the motor speed is 0, fluctuation compensation will still be processed to reduce the fluctuation. To prevent this problem, the effective speed of fluctuation compensation needs to be set accordingly.		

Pn742※	**Speed pulsation compensation gain**		■	**Address: 0x0742**
Factory value: 80	**Range: 0～100**	**Unit: %**		**Mode: P S T**

Pn743※	**Speed pulsation compensation 1st component frequency**		■	**Address: 0x0743**
Factory value: 0	**Range: 0～100**	**Unit: N/A**		**Mode: P S T**

Pn744※	**Speed pulsation compensation 1st component amplitude (max.current)**		■	**Address: 0x0744**
Factory value: 0.0	**Range: -10.0%～10.0%**	**Unit: %**		**Mode: P S T**

Pn745※	**Speed pulsation compensation 1st component phase**		■	**Address: 0x0745**
Factory value: 0	**Range: 0～360**	**Unit: °(deg)**		**Mode: P S T**

Pn746※	**Speed pulsation compensation 2nd component frequency**		■	**Address: 0x0746**
Factory value: 0	**Range: 0～100**	**Unit: N/A**		**Mode: P S T**

Pn747※	**Speed pulsation compensation 2nd component amplitude (max. current)**		■	**Address: 0x0747**
Factory value: 0.0	**Range: -10.0%～10.0%**	**Unit: %**		**Mode: P S T**

Pn748※	**Speed pulsation compensation 2nd component phase**		■	**Address: 0x0748**
Factory value: 0	**Range: 0～360**	**Unit: °(deg)**		**Mode: P S T**

Pn749※	**Speed fluctuation compensation 3rd component frequency**	■	**Address: 0x0749**
Factory value: 0	**Range: 0～100**	**Unit: N/A**	**Mode: P S T**

Pn74A※	**Speed pulsation compensation 3rd component amplitude (max. current)**	■	**Address: 0x074A**
Factory value: 0.0	**Range: -10.0%～10.0%**	**Unit: %**	**Mode: P S T**

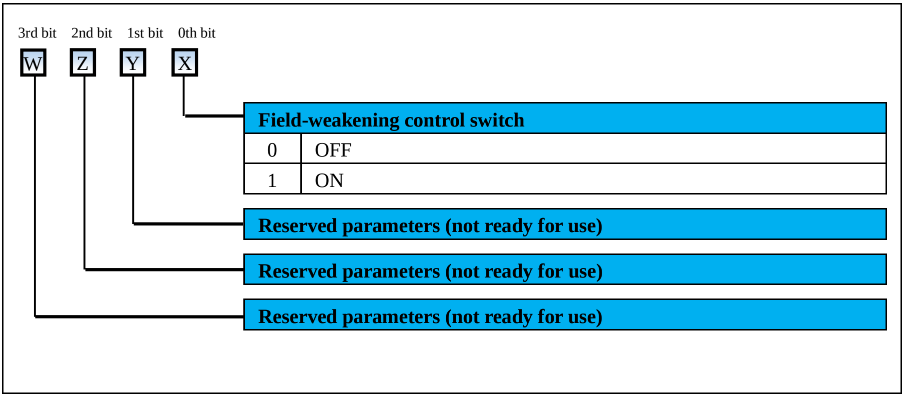
Pn74B※	**Speed pulsation compensation 3rd component phase**	■	**Address: 0x074B**
Factory value: 0	**Range: 0～360**	**Unit: °(deg)**	**Mode: P S T**

Pn74C※	**Speed fluctuation compensation 4th component frequency**	■	**Address: 0x074C**
Factory value: 0	**Range: 0～100**	**Unit: N/A**	**Mode: P S T**

Pn74D※	**Speed pulsation compensation 4th component amplitude (max. current)**	■	**Address: 0x074D**
Factory value: 0.0	**Range: -10.0%～10.0%**	**Unit: %**	**Mode: P S T**

Pn74E※	**Speed pulsation compensation 4th component phase**	■	**Address: 0x074E**
Factory value: 0	**Range: 0～360**	**Unit: °(deg)**	**Mode: P S T**

Pn755	**Field-weakening control switch**	○	**Address: 0x0755**
Factory value: 0x0001	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode: P S T**



Pn756	**Field-weakening for circuit proportional gain**	○	**Address: 0x0756**
Factory value: 30	**Range: 10～1000**	**Unit: Hz**	**Mode:** P S T

Pn757	**Field-weakening for circuit integral time constant**	○	**Address: 0x0757**
Factory value: 16	**Range: 10～1000**	**Unit: us**	**Mode:** P S T

Pn758	**Field-weakening for circuit integral upper limit**	○	**Address: 0x0758**
Factory value: 100	**Range: 0～200**	**Unit: %**	**Mode:** P S T

Pn759	**Field-weakening for voltage threshold**	○	**Address: 0x0759**
Factory value: 115	**Range: 50～150**	**Unit: %**	**Mode:** P S T

Pn75A	**Max. weak magnet current in field-weakening control**	○	**Address: 0x075A**
Factory value: 95	**Range: 50～150**	**Unit: %**	**Mode:** P S T

Pn75B	**Main circuit voltage filter time in field-weakening control**	○	**Address: 0x075B**
Factory value: 2.0	**Range: 1.0～10.0**	**Unit: ms**	**Mode:** P S T
Description	The smooth filter times to the DC voltages used for weak magnetism calculations are averaged.		

Pn781※	**Drive bus overvoltage point**	■	**Address: 0x0781**

Factory value: vary by model	**Range: 0～1000**	**Unit: V**	**Mode:** 🄿 🅂 🅃
Description	Set the bus voltage over-voltage point threshold, when the bus voltage is greater than this value it will report over-voltage fault. For DC 48V model, the default value of driver overvoltage is 85V, and the setting range is 80V~90V. **Note:** Do not change the parameters without the factory's permission, or it may cause irreversible damage to the machine!		

Pn782※	**Drive regenerative braking point**	■	**Address: 0x0782**
Factory value: vary by model	**Range: 0～1000**	**Unit: V**	**Mode:** 🄿 🅂 🅃
Description	Set the threshold value when the bus regenerative voltage is braked to release the capacitor charge to drop the bus voltage. For DC 48V model, the default value of drive drain point is 75V and the setting range is 70V~80V.		

Pn783※	**Regeneration OFF hysteresis loop width**	■	**Address: 0x0783**
Factory value: vary by model	**Range: 0～50**	**Unit: V**	**Mode:** 🄿 🅂 🅃
Description	For DC 48V models, the default value is 3V. To avoid frequent access to the bus drain, this function code can effectively reduce the number of frequent access to regenerative braking. It should not be set too large, as it is likely to cause large fluctuations in the DC bus.		

Pn784※	**Drive bus undervoltage point**	■	**Address: 0x0784**
Factory value: vary by model	**Range: 0～500**	**Unit: V**	**Mode:** 🄿 🅂 🅃
Description	Set the bus voltage undervoltage point threshold value, when the bus voltage is lower than this value, it will report undervoltage fault. For DC 48V model, the default value of drive undervoltage point is 18V, and the setting range is 18V~20V.		

Pn785※	**Drive bus undervoltage detection filter time constant**	■	**Address: 0x0785**
Factory value: 10	**Range: 0～2000**	**Unit: ms**	**Mode:** 🄿 🅂 🅃

Pn786※	**Drive bus undervoltage warning value**	■	**Address: 0x0785**
Factory value: vary by model	**Range: 0～1000**	**Unit: V**	**Mode:** 🄿 🅂 🅃
Description	Set the bus voltage undervoltage point threshold value, when the bus voltage is lower than		

	this value, it will report undervoltage warning. For DC 48V models, the drive undervoltage warning value defaults to 20V.

Pn788	**Motor max. speed fine-tuning**	■	**Address: 0x0788**
Factory value: 0	**Range: 0～2**	**Unit: 100rpm**	**Mode:** P S T

Pn790※	**Motor code setting**	○	**Address: 0x0790**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T
Description	Used to set the motor type assigned to the drive, the specific code setting value is based on the motor nameplate only for photoelectric incremental encoder motors. **Serial encoder motor (factory value): 0x1000.** When this function code is set to 0x1000, the drive recognizes the encoder type by itself. Currently, only Nikon 24-bit encoders and Tamagawa 17-bit or 23-bit encoders are supported. At the same time, the drive will update the corresponding recognized encoder to function code Pn791. **Note:** When Pn790 is set to 0x1000, the set value of function code Pn791 is invalid. **Incremental encoder motor (set according to ID value).** **Custom serial encoder motor:0x3000** When this function code is set to 0x3000, the drive processes serial communication according to the encoder set by function code Pn791.		

Pn791※	**Encoder control switch**	○	**Address: 0x0791**
Factory value: vary by model	**Range: 0x0000～0x000A**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

X:

Encoder type	
0	Non-wire-saving incremental encoder (2500 wires)
1	Wire-saving incremental encoder (2500 wires)
2	Tamagawa 17-bit absolute encoder
3	Tamagawa 23-bit absolute encoder
4	Nikon 20-bit single-turn encoder
5	Nikon 20-bit multi-turn encoder
6	Nikon 24-bit single-turn encoder
7	Nikon 24-bit single-turn encoder
8	Serial incremental encoder (10000 wires)
9	Nikon 24-bit encoder
10	Veichi self developed encoder

Y: **Reserved parameters (not ready for use)**

Z: **Reserved parameters (not ready for use)**

W: **Reserved parameters (not ready for use)**

Description	Used to set the encoder type.

Precautions

- When using a motor equipped with an absolute encoder, set the value in Pn790 (Motor code setting) to 1000, and set the corresponding value to function code Pn791 (Encoder type) according to the actual encoder installed.
- When the value set in Pn790 is an incremental encoder motor in the motor bank, the encoder type is set automatically and function code Pn791 is invalid.
- Pn790 has the highest priority. The drive automatically judges the encoder type based on the value in Pn790 before.

Pn792※	**Motor zero pole position**	○	**Address: 0x0792**
Factory value: vary by model	**Range: -360～360**	**Unit: °**	**Mode: P S T**
Description	It is used to display the reference position of the motor's zero pole. The auxiliary function Fn080 will update the value of this function code when it finishes recognizing it, and it is exclusively used for serial encoders.		

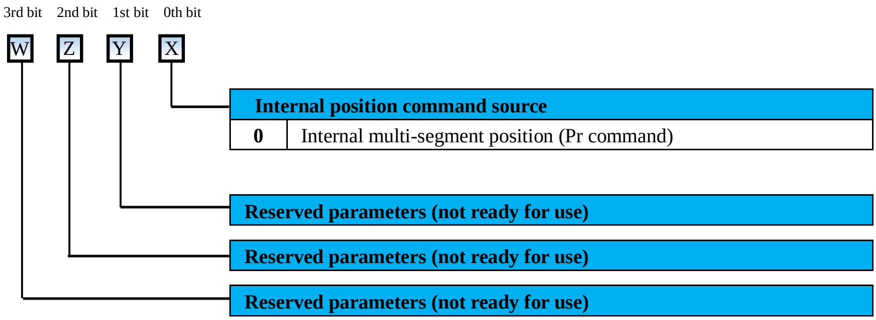
Pn793※	**Position sensor resolution**		■	**Address: 0x0793★**
Factory value: 10000	**Range: 1～2^{31}**	**Unit: N/A**		**Mode: P S T**
Description	Used to set the encoder resolution for customized motor parameters. For incremental encoder, the set value is the value after 4 times of frequency. **Example:** Incremental encoder is 2500 wires, then the value of position sensor resolution is 10000.			

Pn79E	**Reserved**		■	**Address: 0x079E**
Factory value: 0000	**Range: 00000～65535**	**Unit: N/A**		**Mode: P S T**

Pn79F	**User password**		○	**Address: 0x079F**
Factory value: 0x0000	**Range: 0x0000～0xFFFF**	**Unit: N/A**		**Mode: P S T**

7.3.9 Motion Parameter (Pn8xx)

Pn800	**Internal position command**		■	**Address: 0x0800**
Factory value: 0x0000	**Range: 0x0000～0x0000**	**Unit: N/A**		**Mode: P**



Internal position command source

0	Internal multi-segment position (Pr command)

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

Pn802	**Internal multi-segment position (speed) operation mode**	○	**Address: 0x0802**

Factory value: 0x0000	**Range: 0x0000～0x1113**	**Unit: N/A**	**Mode:** 🄿

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Internal position operation mode	
0	Single segment operation (input terminal X or communication)
1	Stop at the end of a single run
2	Cyclic operation
3	Sequential operation

Remaining path handling in multi-segment operation mode	
0	Continue to run the unfinished path
1	Restart from path 1

Single-segment operation mode update	
0	Non-immediate update
1	Immediately after the communication command is given

Absolute position starting point selection	
0	Motor position after home as the starting point of the absolute position.
1	Absolute zero (Pn296, Pn297) as the starting point of the absolute position.

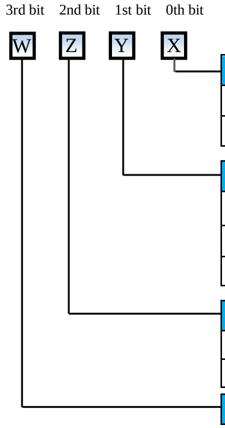
Description	When Pn802.Z=0, the DI terminal or the communication is stored in the buffer after the Pr command is given, and the command given in the previous communication is taken out from the buffer after the current command is executed. When Pn802.Z=1, the communication command is executed immediately after it is given.

Pn803	**Multi-segment position (speed) endpoint path**	○	**Address: 0x0803**
Factory value: 1	**Range: 1～15**	**Unit: N/A**	**Mode:** 🄿

Pn804	**Sequential running start path**	○	**Address: 0x0804**
Factory value: 1	**Range: 0～15**	**Unit: N/A**	**Mode:** 🄿
Description	① The first round of sequential operation starts from Pr1 and runs to the path pointed to by Pn803. ② If Pn804=0 or Pn804＞Pn803, the sequence runs for 1 round and then stops. ③ If Pn804≤Pn803, the first round is followed by cyclic operation, and the starting segment number is Pn804; ④ The enable signal CTRG is valid at high level.		

Pn806	**Pr command communication parameters (single segment operation)**	○	**Address: 0x0806**
Factory value: 10000	**Range: 0～65535**	**Unit: N/A**	**Mode: P**
Description	① DI terminal switching mode is valid, input 1～15 to trigger the corresponding Pr path, input 1000 to force the end of the current operation mode; ② In position mode, input 0 to trigger home, input 1000 to force end home.		

Pn810	**PR path1 control word L**	○	**Address: 0x0810**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**



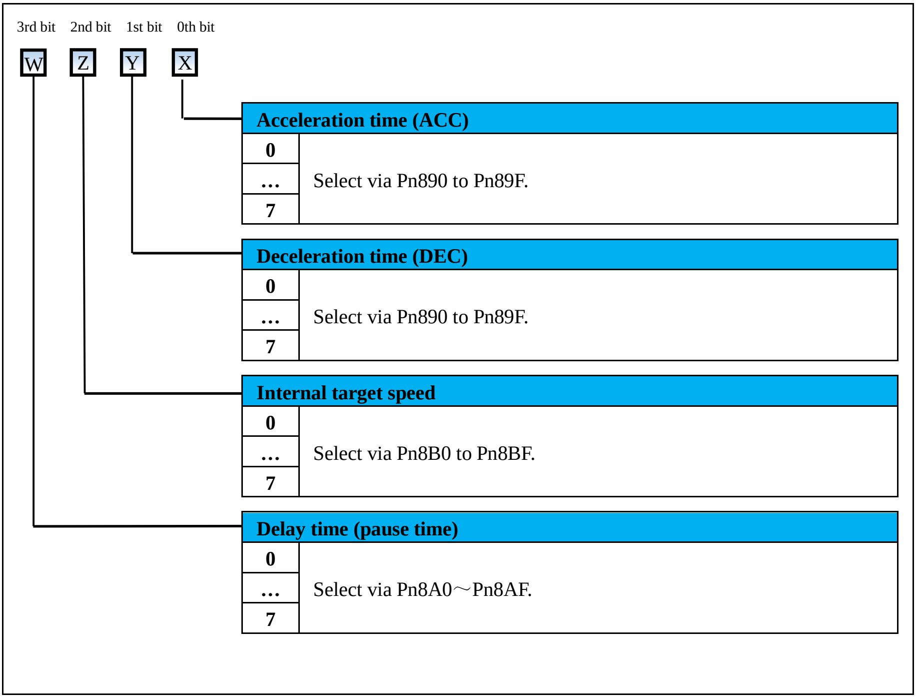
PR type	
0	Position control
1	Speed control

Position control type	
0	Position control for incremental position
1	Position control for absolute position
2	Position control for relative position

Speed control	
0	Speed unit 0.1rpm
1	Speed unit PPS

Reserved parameters (not ready for use)

Pn811	**PR path1 control word H**	○	**Address: 0x0811**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode: P**



Acceleration time (ACC)	
0	Select via Pn890 to Pn89F.
…	
7	

Deceleration time (DEC)	
0	Select via Pn890 to Pn89F.
…	
7	

Internal target speed	
0	Select via Pn8B0 to Pn8BF.
…	
7	

Delay time (pause time)	
0	Select via Pn8A0～Pn8AF.
…	
7	

Pn812	**PR1 information**	○	**Address: 0x0812★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode: P**

Pn814	**PR2 control word L**	○	**Address: 0x0814**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**

Pn815	**PR2 control word H**	○	**Address: 0x0815**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode: P**

Pn816	**PR2 information**	○	**Address: 0x0816★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode: P**

Pn818	**PR3 control word L**	○	**Address: 0x0818**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**

Pn819	**PR3 control word H**	○	**Address: 0x0819**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** P

Pn81A	**PR3 information**	○	**Address: 0x081A★**
Factory value: 0	**Range: -2^{31}～$2^{31}-1$**	**Unit: N/A**	**Mode:** P

Pn81C	**PR4 control word L**	○	**Address: 0x081C**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** P

Pn81D	**PR4 control word H**	○	**Address: 0x081D**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** P

Pn81E	**PR4 information**	○	**Address: 0x081E★**
Factory value: 0	**Range: -2^{31}～$2^{31}-1$**	**Unit: N/A**	**Mode:** P

Pn820	**PR5 control word L**	○	**Address: 0x0820**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** P

Pn821	**PR5 control word H**	○	**Address: 0x0821**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** P

Pn822	**PR5 information**	○	**Address: 0x0822★**
Factory value: 0	**Range: -2^{31}～$2^{31}-1$**	**Unit: N/A**	**Mode:** P

Pn824	**PR6 control word L**	○	**Address: 0x0824**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** P

Pn825	**PR6 control word H**	○	**Address: 0x0825**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** P

Pn826	**PR6 information**	○	**Address: 0x0826★**
Factory value: 0	**Range: $-2^{31}\sim2^{31}-1$**	**Unit: N/A**	**Mode:** 🄿

Pn828	**PR7 control word L**	○	**Address: 0x0828**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** 🄿

Pn829	**PR7 control word H**	○	**Address: 0x0829**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** 🄿

Pn82A	**PR7 information**	○	**Address: 0x082A★**
Factory value: 0	**Range: $-2^{31}\sim2^{31}-1$**	**Unit: N/A**	**Mode:** 🄿

Pn82C	**PR8 control word L**	○	**Address: 0x082C**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** 🄿

Pn82D	**PR8 control word H**	○	**Address: 0x082D**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** 🄿

Pn82E	**PR8 information**	○	**Address: 0x082E★**
Factory value: 0	**Range: $-2^{31}\sim2^{31}-1$**	**Unit: N/A**	**Mode:** 🄿

Pn830	**PR9 control word L**	○	**Address: 0x0830**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** 🄿

Pn831	**PR9 control word H**	○	**Address: 0x0831**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** 🄿

Pn832	**PR9information**	○	**Address: 0x0832★**
Factory value: 0	**Range: $-2^{31}\sim2^{31}-1$**	**Unit: N/A**	**Mode:** 🄿

Pn834	**PR10 control word L**	○	**Address: 0x0834**

Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**

Pn835	**PR10 control word H**	○	**Address: 0x0835**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode: P**

Pn836	**PR10 information**	○	**Address: 0x0836★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode: P**

Pn838	**PR11 control word L**	○	**Address: 0x0838**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**

Pn839	**PR11 control word H**	○	**Address: 0x0839**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode: P**

Pn83A	**PR11 information**	○	**Address: 0x083A★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode: P**

Pn83C	**PR12 control word L**	○	**Address: 0x083C**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**

Pn83D	**PR12 control word H**	○	**Address: 0x083D**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode: P**

Pn83E	**PR12 information**	○	**Address: 0x083E★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode: P**

Pn840	**PR13 control word L**	○	**Address: 0x0840**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode: P**

Pn841	**PR13 control word H**	○	**Address: 0x0841**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode: P**

Pn842	**PR13 information**	○	**Address: 0x0842★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode:** P

Pn844	**PR14 control word L**	○	**Address: 0x0844**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** P

Pn845	**PR14 control word H**	○	**Address: 0x0845**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** P

Pn846	**PR14 information**	○	**Address: 0x0846★**
Factory value: 0	**Range: -2^{31}～2^{31}-1**	**Unit: N/A**	**Mode:** P

Pn848	**PR15 control word L**	○	**Address: 0x0848**
Factory value: 0x0000	**Range: 0x0000～0x0121**	**Unit: N/A**	**Mode:** P

Pn849	**PR15 control word H**	○	**Address: 0x0849**
Factory value: 0x0000	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** P

Pn890	**Acceleration/deceleration time (No. #0)**	○	**Address: 0x0890**
Factory value: 30	**Range: 0～65500**	**Unit: ms**	**Mode:** P
Description	PR mode acceleration and deceleration time indicates the acceleration time from 0rpm to 3000rpm, the same below.		

Pn891	**Acceleration/deceleration time (No. #1)**	○	**Address: 0x0891**
Factory value: 50	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn892	**Acceleration/deceleration time (No. #2)**	○	**Address: 0x0892**
Factory value: 200	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn893	**Acceleration/deceleration time (No. #3)**	○	**Address: 0x0893**

Factory value: 300	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn894	**Acceleration/deceleration time (No. #4)**	○	**Address: 0x0894**
Factory value: 500	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn895	**Acceleration/deceleration time (No. #5)**	○	**Address: 0x0895**
Factory value: 600	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn896	**Acceleration/deceleration time (No. #6)**	○	**Address: 0x0896**
Factory value: 800	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn897	**Acceleration/deceleration time (No. #7)**	○	**Address: 0x0897**
Factory value: 900	**Range: 0～65500**	**Unit: ms**	**Mode:** P

Pn898	**Delay time after position arrival (No. #0)**	○	**Address: 0x0898**
Factory value: 0	**Range: 0～60000**	**Unit: ms**	**Mode:** P
Description	The delay time after PR mode completion, below.		

Pn899	**Delay time after position arrival (No. #1)**	○	**Address: 0x0899**
Factory value: 100	**Range: 0～60000**	**Unit: ms**	**Mode:** P

Pn89A	**Delay time after position arrival (No. #2)**	○	**Address: 0x089A**
Factory value: 200	**Range: 0～60000**	**Unit: ms**	**Mode:** P

Pn89B	**Delay time after position arrival (No. #3)**	○	**Address: 0x089B**
Factory value: 400	**Range: 0～60000**	**Unit: ms**	**Mode:** P

Pn89C	**Delay time after position arrival (No. #4)**	○	**Address: 0x089C**
Factory value: 500	**Range: 0～60000**	**Unit: ms**	**Mode:** P

Pn89D	**Delay time after position arrival (No. #6)**	○	**Address: 0x089D**

Factory value: 800	**Range: 0～60000**	**Unit: ms**	**Mode:** 🄿

Pn89E	**Delay time after position arrival (No. #6)**	○	**Address: 0x089E**
Factory value: 1000	**Range: 0～60000**	**Unit: ms**	**Mode:** 🄿

Pn89F	**Delay time after position arrival (No. #7)**	○	**Address: 0x089F**
Factory value: 1500	**Range: 0～60000**	**Unit: ms**	**Mode:** 🄿

Pn8A0	**Internal target speed (No. #0)**	○	**Address: 0x08A0**
Factory value: 20.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿
Description	PR mode target speed setting, below.		

Pn8A1	**Internal target speed (No. #1)**	○	**Address: 0x08A1**
Factory value: 100.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿

Pn8A2	**Internal target speed (No. #2)**	○	**Address: 0x08A2**
Factory value: 100.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿

Pn8A3	**Internal target speed (No. #3)**	○	**Address: 0x08A3**
Factory value: 200.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿

Pn8A4	**Internal target speed (No. #4)**	○	**Address: 0x08A4**
Factory value: 300.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿

Pn8A5	**Internal target speed (No. #5)**	○	**Address: 0x08A5**
Factory value: 500.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿

Pn8A6	**Internal target speed (No. #6)**	○	**Address: 0x08A6**
Factory value: 600.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** 🄿

Pn8A7	**Internal target speed (No. #7)**	○	**Address: 0x08A7**

Factory value: 800.0	**Range: 0.0～6000.0**	**Unit: rpm**	**Mode:** P

7.3.10 Drive Parameter (PnExx)

PnE00☆	**Servo drive model selection**	■	**Address: 0x0E00**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T
Description	Set the servo drive model, and re-power-up is required to take effect after the setting is completed.		

Setting	Servo drive No.	Remark
0x110A	SD100-110A	Rated current 11A, main circuit power supply specification: DC 48V
0x210A	SD100-210A	Rated current 21A, Main circuit power supply specification: DC 48V
0x300A	SD100-300A	Rated current 30A, Main circuit power supply specification: DC 48V
0x400A	SD100-400A	Rated current 40A, Main circuit power supply specification: DC 48V
0x800A	SD100-800A	Rated current 80A, Main circuit power supply specification: DC 48V

PnE01☆	**Servo drive power**	■	**Address: 0x0E01**
Factory value: vary by model	**Range: 0～65535**	**Unit: W**	**Mode:** P S T

nE02☆	**Drive voltage rating**	■	**Address: 0x0E02**
Factory value: vary by model	**Range: 0x0000～0x0004**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Drive voltage rating	
0	AC 100V (reserved)
1	AC 220V
2	AC 380V
3	DC 24V
4	DC 48V

Reserved parameters (not for modification)

Reserved parameters (not for modification)

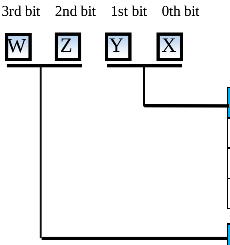
Reserved parameters (not for modification)

PnE03☆	**Servo drive rated current (peak)**	■	**Address: 0x0E03**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: A**	**Mode:** P S T

PnE04☆	**Max. servo drive current (peak)**	■	**Address: 0x0E04**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: A**	**Mode:** P S T

PnE05☆	**Drive module overheat threshold**	■	**Address: 0x0E05**
Factory value: vary by model	**Range: 60.0～100.0**	**Unit:** ℃	**Mode:** P S T
Description	Used to set the threshold for the drive module temperature detection alarm, when the temperature value of the module is greater than this threshold, the drive will send out a module overheat fault.		

PnE06☆	**Drive overload current**	■	**Address: 0x0E06**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T



Drive overload base current	
00	Range: 0～255,Unit: 1%
…	
FF	

Drive overload intermediate current	
00	Range: 0～255,Unit: 10%
…	
FF	

PnE07☆	**Drive overload time**	■	**Address: 0x0E07**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Drive overload intermediate time

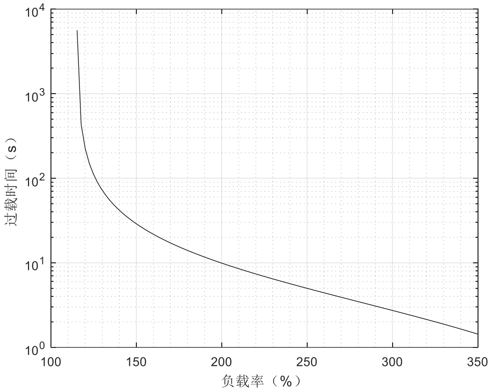
00	Setting range 0 to 255, unit 1s.
…	
FF	

Max. time for drive overload detection

00	Setting range 0 to 255, unit 1s.
…	
FF	

Description

Used to set the drive's overload protection time.



PnE08☆	**Drive overload time fine-tuning**		■	**Address: 0x0E08**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**		**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Drive overload intermediate time fine tuning

00	Setting range 0～255, unit: 1%
…	
FF	

Drive overload max. time fine-tuning

00	Setting range 0～255, unit: 1%
…	
FF	

PnE09☆	**Motor overload time fine-tuning**	■	**Address: 0x0E09**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Motor overload intermediate time fine -tuning	
00 **…** **FF**	Setting range 0～255, unit: 1%

Motor overload max. time fine-tuning	
00 **…** **FF**	Setting range 0～255, unit: 1%

PnE0A☆	**Low 8 bits (L): reserved parameters** **High 8 bits (H): motor overspeed point threshold fine-tuning**	■	**Address: 0x0E0A**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Reserved parameters (not ready for use)	
00 **…** **FF**	Reserved parameters

Motor overspeed point threshold tuning	
00 **…** **FF**	The setting range is 0 to 255, and the overspeed point fine-tuning is calculated as follows.

PnE0B☆	**Built-in regenerative braking resistance**	■	**Address: 0x0E0B**
Factory value: vary by model	**Range: 0～65535**	**Unit: Ω**	**Mode:** 🄿 🅂 🅃

PnE0C☆	**Built-in regenerative resistance capacity**	■	**Address: 0x0E0C**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: %**	**Mode:** 🄿 🅂 🅃

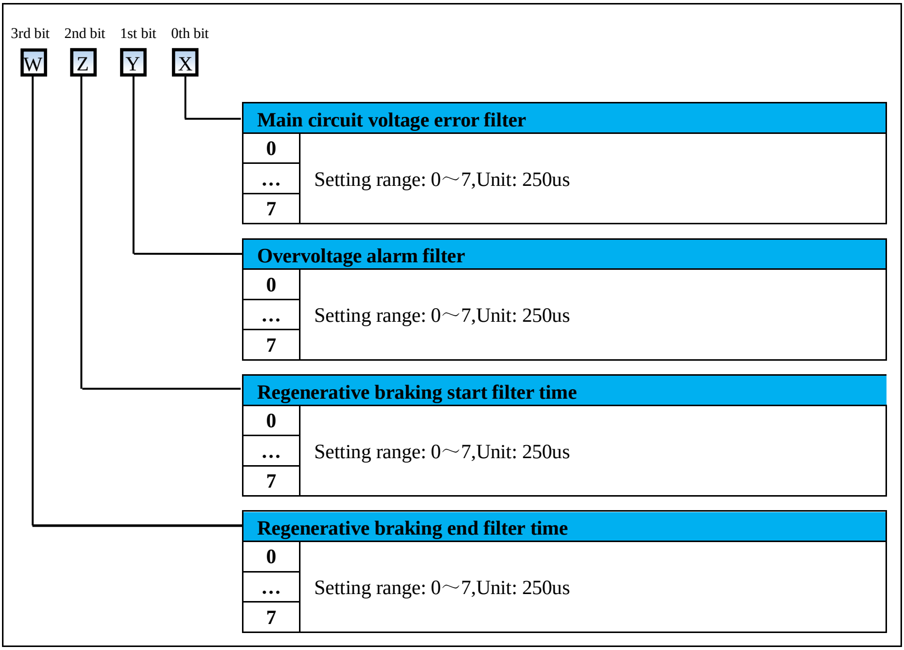
PnE10☆	**P-N voltage detection level (max. detectable voltage by the hardware)**	■	**Address: 0x0E10**
Factory value: vary by model	**Range: 0～1000**	**Unit: V**	**Mode:** 🄿 🅂 🅃
Description	Set the calibration value for bus voltage detection, which is adjusted based on the hardware section. For DC48V models, set to 123V. Note: Do not change the parameters without the manufacturer's permission, as this may cause irrecoverable damage to the machine!		

PnE11☆	**P-N voltage detection low-pass filtering time constant**	■	**Address: 0x0E11**
Factory value: 0	**Range: 0～10000**	**Unit: us**	**Mode:** 🄿 🅂 🅃

PnE12☆	**P-N voltage detection zeroing**	○	**Address: 0x0E12**
Factory value: factory setting	**Range: -50～50**	**Unit: V**	**Mode:** 🄿 🅂 🅃

PnE13☆	**P-N voltage detection gain fine-tuning**	○	**Address: 0x0E13**
Factory value: 0	**Range: -127～127**	**Unit: N/A**	**Mode:** 🄿 🅂 🅃
Description	**Set the linearity of busbar voltage detection for relevant adjustments.** $U_{dc} \times \frac{256+PnE13}{256}$ **Note:** Do not change the parameters without the factory's permission, or it may cause irreversible damage to the machine!		

PnE14☆	**Main circuit detection filter selection**	■	**Address: 0x0E14**
Factory value: 0x0055	**Range: 0x0000～0x7777**	**Unit: N/A**	**Mode:** 🄿 🅂 🅃



Main circuit voltage error filter	
0	Setting range: 0～7,Unit: 250us
…	
7	

Overvoltage alarm filter	
0	Setting range: 0～7,Unit: 250us
…	
7	

Regenerative braking start filter time	
0	Setting range: 0～7,Unit: 250us
…	
7	

Regenerative braking end filter time	
0	Setting range: 0～7,Unit: 250us
…	
7	

PnE15☆	**Alarm blocking switch1**	■	**Address: 0x0E15**
Factory value: 0x0000	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

System switch A	
Bit0	Er.BF4 fault detection switch (0: ON; 1: OFF)
Bit1	Motor and drive capacity ratio check switch within 4 times (0: monitoring ON; 1: monitoring OFF)
Bit2	Motor and drive overload monitoring (0: monitoring ON; 1: monitoring OFF)
Bit3	Serial encoder over-temperature monitoring Er.860(0: monitoring ON; 1: monitoring OFF)

System switch B	
Bit4	Drive-supported operation mode detection switch [EtherCAT] (0: OFF;1: ON)
Bit5	FPGA backup operation detection switch (0: OFF;1: ON)
Bit6	Non-standard CANopen life protection auto switch (0: OFF;1: ON)
Bit7	Reserved

Reserved parameters (not ready for use)	
Bit8	FPGA backup operation detection switch (0: OFF;1: ON)
Bit9	MicroChip ESC manual selection (0:9253; 1:9252)
Bit10	MicroChip ESC selection method (0: auto;1: manual)
Bit11	Reserved

Reserved parameters (not ready for use)

PnE17☆	**Single tube fail-safe time & bootstrap charging time**	■	**Address: 0x0E17**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T

3rd bit	2nd bit	1st bit	0th bit
W	Z	Y	X

Rated speed

Range: 0~255
Unit:1ms
Incremental encoder

Maximum speed

Range: 0~255
Unit:1ms
Incremental encoder

PnE1C☆	**System switch2**	■	**Address: 0x0E1C**

Factory value: 0x0003	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

System switch2A	
Bit0	Regenerative braking protection switch (0: OFF;1: ON)
Bit1	Phase compensation switch (0: ON;1: OFF)
Bit2	DB brake protection switch (0: ON;1: OFF)
Bit3	ESC manufacturer selection (0: MicroChip;1: BeckOff)

System switch2B	
Bit4	Incremental encoder AB signal (Er.C91) error detection switch (0: ON;1: OFF)
Bit5	Incremental encoder Z signal (Er.C92) error detection switch (0:
Bit6	FPGA to ARM watchdog monitor (Error) detection switch (0: ON;1: OFF)
Bit7	EtherCat model auto-detect switch (0: ON;1: OFF)

System switch2C	
Bit8	ACR working mode (0: mode 1;1: mode 2)
Bit9	Current feedback mode selection (0: mode 0;1: mode 1)
Bit10	Silent mode switch (0: OFF;1: ON)
Bit11	Single-tube bootstrap charging manual switch (0: ON;1: OFF)

System switch2D	
Bit12	Single-tube bootstrap mode switch (0: ON;1: OFF)
Bit113	Current sampling chip manual(0:C796/NSI1306;1:AM1305)
Bit14	Power level detection switch (0: ON;1: OFF)
Bit15	Single-tube model current sampling chip auto-recognition switch (0: ON;1: OFF)

PnE1D☆	**System switch3**	■	**Address: 0x0E1D**
Factory value: 0000	**Range: 0x0000～0x0001**	**Unit: N/A**	**Mode:** P

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

System switch3A	
0	Function code parameters writing is allowed
1	Function code parameters writing not allowed

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

PnE1E☆	**Serial communication consecutive failure times allowed**	■	**Address: 0x0E1E**
Factory value: vary by model	**Range: 0x0000～0x00FF**	**Unit: N/A**	**Mode: P S T**

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Serial communication consecutive failure times allowed	
00 **…** **FF**	Setting range: 0～255,Unit: times

Reserved parameters (not ready for use)

Description	Set the drive to generate Er.C90 if the number of consecutive communication failures with the serial encoder is greater than the set value.

PnE1F☆	**Silent mode filter time constant**	■	**Address: 0x0E1F**
Factory value: vary by model	**Range: 1～65535**	**Unit: us**	**Mode: P S T**

PnE20☆	**Current loop gain (D-axis)**	■	**Address: 0x0E20**
Factory value: vary by model	**Range: 100～10000**	**Unit: Hz**	**Mode: P S T**

PnE21☆	**Current loop gain (Q-axis)**	■	**Address: 0x0E21**
Factory value: vary by model	**Range: 100～10000**	**Unit: Hz**	**Mode: P S T**

PnE22☆	**Current loop integral time constant (D-axis)**	■	**Address: 0x0E22**
Factory value: vary by model	**Range: 0～65535**	**Unit: us**	**Mode:** 🄿 🅂 🅃

PnE23☆	**Current loop integral time constant (Q-axis)**	■	**Address: 0x0E23**
Factory value: vary by model	**Range: 0～65535**	**Unit: us**	**Mode:** 🄿 🅂 🅃

PnE24☆	**Current loop integral limit (D-axis)**	■	**Address: 0x0E24**
Factory value: 10430	**Range: 0～65535**	**Unit: N/A**	**Mode:** 🄿 🅂 🅃

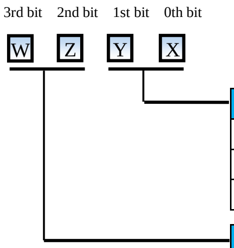
PnE25☆	**Current loop integral limit (Q-axis)**	■	**Address: 0x0E25**
Factory value: 10430	**Range: 0～65535**	**Unit: N/A**	**Mode:** 🄿 🅂 🅃

PnE28☆	**Current detection gain1**	■	**Address: 0x0E28**
Factory value: vary by model	**Range: 0～16384**	**Unit: N/A**	**Mode:** 🄿 🅂 🅃
Description	Set the hardware current detection factor of the drive. $\mathrm{PnE28}=\frac{\text{current detection resistance}(\mathrm{m}\Omega)\times\text{drive max. current PnE15(peak, 0.1A)}}{\text{analog}-\text{to}-\text{digital converter chip full}-\text{scale voltage(320mV)}}\times 8192$ **Note:** Do not change the parameters without the factory's permission, or it may cause irreversible damage to the machine!		

PnE29☆	**Voltage compensation gain**	■	**Address: 0x0E29**
Factory value: 115	**Range: 0～300**	**Unit: %**	**Mode:** 🄿 🅂 🅃
Description	Set voltage compensation gain.		

PnE2A☆	**Carrier frequency**	■	**Address: 0x0E2A**
Factory value: vary by model	**Range: 2000～16000**	**Unit: HZ**	**Mode:** 🄿 🅂 🅃
Description	Set the carrier (PWM) frequency of the servo drive.		

PnE2B☆	**Dead band compensation gain|Deadtime**	■	**Address: 0x0E2B**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode: P S T**



Deadtime	
00	Setting range: 1.6～6.0,Unit: 0.1us
…	
FF	

Deadband compensation gain	
00	Setting range: 0～100, Unit:1%
…	
FF	

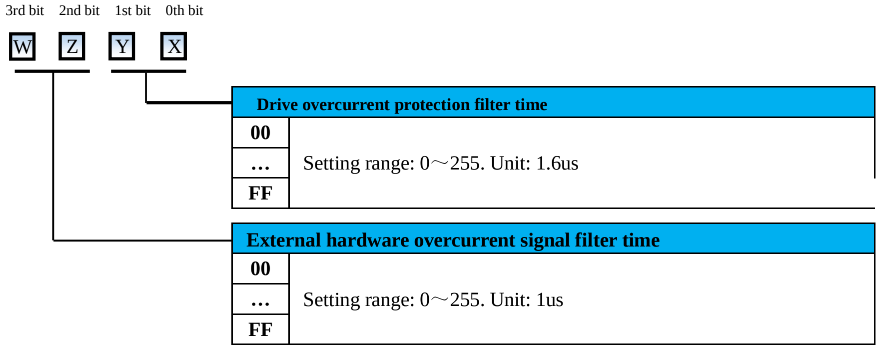
PnE2C☆	**Current prediction gain**	■	**Address: 0x0E2C**
Factory value: vary by model	**Range: 0.00～100.00**	**Unit: N/A**	**Mode: P S T**

PnE2D☆	**Current prediction gain2**	■	**Address: 0x0E2D**
Factory value: vary by model	**Range: 0～16384**	**Unit: N/A**	**Mode: P S T**

PnE30☆	**Max. drive overvoltage allowed**	■	**Address: 0x0E30**
Factory value: vary by model	**Range: 0～1000**	**Unit: V**	**Mode: P S T**
Description	Set the max. overvoltage of the servo drive allowed.		

PnE31☆	**Minimum allowed drive overvoltage**	■	**Address: 0x0E31**
Factory value: vary by model	**Range: 0～1000**	**Unit: V**	**Mode: P S T**
Description	Set the minimum value allowed for servo drive overvoltage.		

PnE32☆	**Drive overcurrent protection filter time**	■	**Address: 0x0E32**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: NA**	**Mode: P S T**



Drive overcurrent protection filter time	
00 **…** **FF**	Setting range: 0～255. Unit: 1.6us

External hardware overcurrent signal filter time	
00 **…** **FF**	Setting range: 0～255. Unit: 1us

PnE33☆	**Drive overcurrent protection threshold**	■	**Address: 0x0E33**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: A**	**Mode: P S T**
Description	Set the hardware overcurrent threshold of the drive, and the value is different for different models, do not change the parameter on your own without the manufacturer's permission, or it may cause irreversible damage to the machine!		

PnE35☆	**Allowable upper limit of drive PWM frequency**	■	**Address: 0x0E34**
Factory value: vary by model	**Range: 3000～16000**	**Unit: Hz**	**Mode: P S T**
Description	Set the upper limit frequency of the servo driver PWM.		

PnEA8☆	**2nd speed feedback filter time constant**	■	**Address: 0x0EA8**
Factory value: vary by model	**Range: 0.02～655.35**	**Unit: ms**	**Mode: P S T**

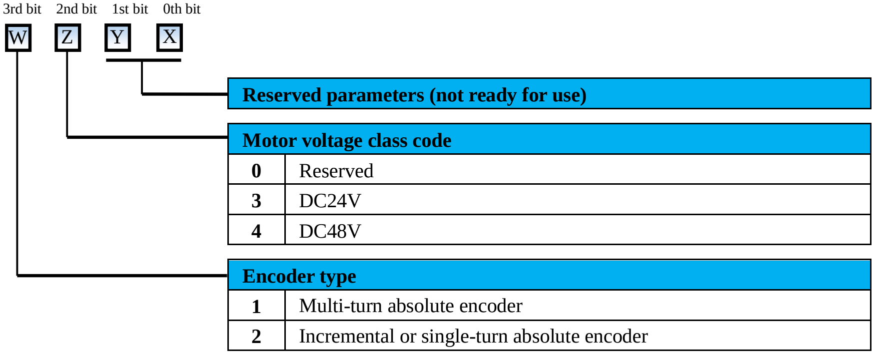
PnEF3	**I-F acceleration/deceleration times**	○	**Address: 0x0EF3**
Factory value: 5.0	**Range: 0.1～3600.0**	**Unit:s**	**Mode: PST**

PnEF4	**I-F frequency setting**	○	**Address: 0x0EF4**
Factory value: 20.0	**Range: -400.0～400.0**	**Unit:Hz**	**Mode: ST**

PnEF5	**I-F current setting**	○	**Address: 0x0EF5**
Factory value: 0.0	**Range: 0.0～500.0**	**Unit:%**	**Mode: PST**

7.3.11 Motor Parameter (PnFxx)

PnF00☆	**Encoder type & motor voltage class code**	■	**Address: 0x0F00**
Factory value: vary by model	**Range: 0x0000～0x22FF**	**Unit: N/A**	**Mode: P S T**



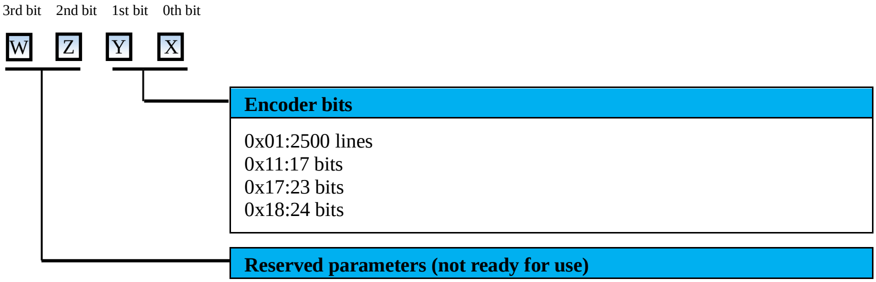
Reserved parameters (not ready for use)

Motor voltage class code	
0	Reserved
3	DC24V
4	DC48V

Encoder type	
1	Multi-turn absolute encoder
2	Incremental or single-turn absolute encoder

PnF02☆	**Motor power**	■	**Address: 0x0F02**
Factory value: vary by model	**Range: 0～65535**	**Unit: W**	**Mode: P S T**

PnF03☆	**Encoder bits (resolution)**	■	**Address: 0x0F03**
Factory value: vary by model	**Range: 0x0000～0x00FF**	**Unit: N/A**	**Mode: P S T**



Encoder bits

0x01:2500 lines
0x11:17 bits
0x17:23 bits
0x18:24 bits

Reserved parameters (not ready for use)

PnF05☆	**Max. speed & rated speed**	■	**Address: 0x0F05**

Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Rated speed

Range: 0 ～ 255
Unit: 100rpm
Incremental encoder

Max. speed

Range: 0 ～ 255
Unit:100rpm
Incremental encoder

PnF06☆	**Motor poles & overspeed detection threshold**	■	**Address: 0x0F06**
Factory value: vary by model	**Range: 0x0000～0xFF32**	**Unit: N/A**	**Mode:** P S T

3rd bit 2nd bit 1st bit 0th bit

W Z Y X

Overspeed detection threshold

Range: 0x00～0x32
Unit: %
Incremental encoder

Motor poles

06	6-pole motor (3 pairs)
08	8-pole motor (4 pairs)
0A	10-pole motor (5 pairs)

PnF07☆	**Rated torque**		■	**Address: 0x0F07**
Factory value: vary by model	**Range: 0.00～655.35**	**Unit: Nm**		**Mode:** P S T

PnF08☆	**Max. torque**		■	**Address: 0x0F08**
Factory value: vary by model	**Range: 0～65535**	**Unit: %**		**Mode:** P S T

PnF09☆	**Motor rated current (peak)**		■	**Address: 0x0F09**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: A**		**Mode:** P S T

PnF0A☆	**Max. instantaneous motor current (peak)**	■	**Address: 0x0F0A**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: A**	**Mode: P S T**

PnF0B☆	**Reverse potential (RMS)**	■	**Address: 0x0F0B**
Factory value: vary by model	**Range: 0.0～6553.5**	**Unit: mV /rpm**	**Mode: P S T**

PnF0C☆	**Motor rotor inertia**	■	**Address: 0x0F0C**
Factory value: vary by model	**Range: 0～65535**	**Unit: 10^{-6}kgm^2**	**Mode: P S T**

PF0D☆	**Motor stator resistance (line resistance R)**	■	**Address: 0x0F0D**
Factory value: vary by model	**Range: 0.000～65.535**	**Unit: Ω**	**Mode: P S T**

PF0E☆	**Motor inductance (line inductance)**	■	**Address: 0x0F0E**
Factory value: vary by model	**Range: 0.00～655.35**	**Unit: mH**	**Mode: P S T**

PnF0F☆	**Motor overload base current**	■	**Address: 0x0F0F**
Factory value: vary by model	**Range: 0～65535**	**Unit: %**	**Mode: P S T**

PnF10☆	**Motor overload intermediate current**	■	**Address: 0x0F10**
Factory value: vary by model	**Range: 0～65535**	**Unit: %**	**Mode: P S T**

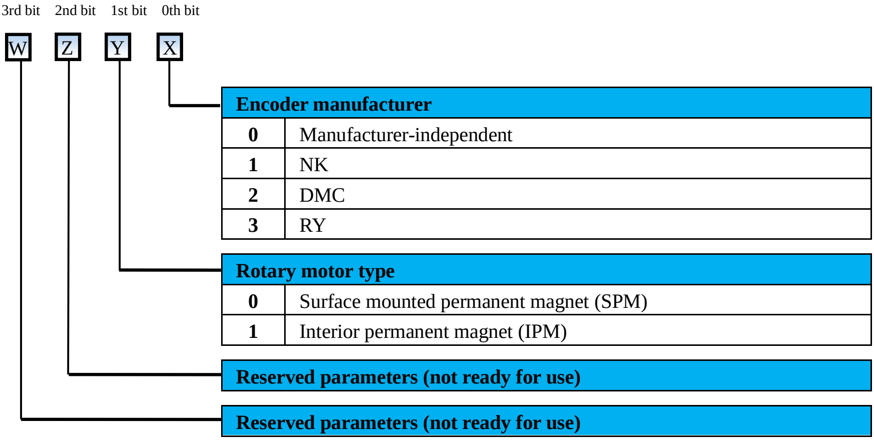
PnF11☆	**Motor overload intermediate current duration**	■	**Address: 0x0F11**
Factory value: vary by model	**Range: 0～65535**	**Unit: 10S**	**Mode: P S T**

PnF12☆	**Max. motor overload current**	■	**Address: 0x0F12**
Factory value: vary by model	**Range: 0～65535**	**Unit: %**	**Mode: P S T**

PnF13☆	**Max. motor overload current duration**	■	**Address: 0x0F13**
Factory value: vary by model	**Range: 0～65535**	**Unit: S**	**Mode: P S T**

PnF15☆	**Rotary motor types & encoder manufacturer**	■	**Address: 0x0F15**

Factory value: 0000	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T



Encoder manufacturer	
0	Manufacturer-independent
1	NK
2	DMC
3	RY

Rotary motor type	
0	Surface mounted permanent magnet (SPM)
1	Interior permanent magnet (IPM)

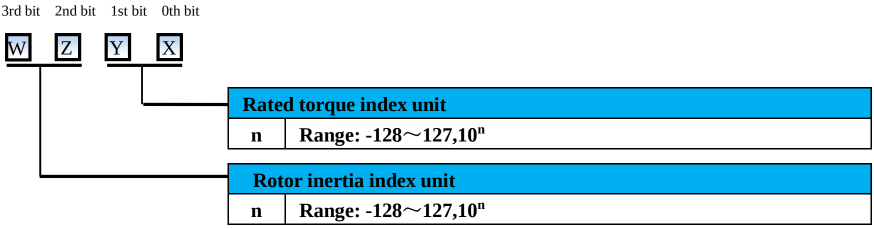
Reserved parameters (not ready for use)

Reserved parameters (not ready for use)

PF16☆	**Convex-pole motor inductance Lq**	■	**Address: 0x0F16**
Factory value: vary by model	**Range: 0.00～655.35**	**Unit: mH**	**Mode:** P S T

PF17☆	**Convex-pole motor inductance Ld**	■	**Address: 0x0F17**
Factory value: vary by model	**Range: 0.00～655.35**	**Unit: mH**	**Mode:** P S T

PnF18☆	**Rotor inertia index unit|Rated torque index unit**	■	**Address: 0x0F18**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode:** P S T

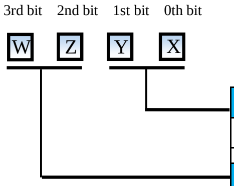


Rated torque index unit	
n	**Range: -128～127,10^n**

Rotor inertia index unit	
n	**Range: -128～127,10^n**

PnF19☆	**Speed index unit|Power index unit**	■	**Address: 0x0F19**

Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode: P S T**

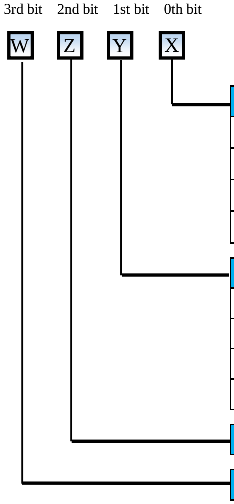


Power index unit	
n	10^n

Speed index unit	
n	10^n

PnF1B☆	**Motor pole start position value**	■	**Address: 0x0F1B**
Factory value: vary by model	**Range: -360～360**	**Unit: deg**	**Mode: P S T**

PnF1E☆	**Associated flag bit (FLAG)**	■	**Address: 0x0110**
Factory value: vary by model	**Range: 0x0000～0xFFFF**	**Unit: N/A**	**Mode: P S T**



Flag position switch1	
Bit0	Reserved
Bit1	Reserved
Bit2	Speed feedback 2nd filter on (0: OFF;1: ON)
Bit3	Reserved

Flag position switch2	
Bit4	Reserved
Bit5	Reserved
Bit6	Reserved
Bit7	Reserved

Reserved parameters (not for modification)

Reserved parameters (not for modification)

7.4 Un Parameter Overview

The monitor display function starts with Un for displaying the status of input and output signals and related information of the servo drive.

Un No.	Display	Unit	Data type①	Address
Un000	Motor feedback speed	rpm	int16	0xE000
Un001	Speed command	rpm	int16	0xE001
Un002	Internal torque command	%	int16	0xE002
Un004	Rotary angle (angle from the origin of the magnetic poles [electrical angle])	deg	uint16	0xE004
Un005	Input command pulse speed (valid only for position control)	rpm	int16	0xE005
Un006	Input command pulse counter	Command unit	int32	0xE006
Un007	Motor encoder feedback pulse counter1	Command unit	int32	0xE007
Un008	Motor encoder feedback pulse counter2	Encoder unit	int32	0xE008
Un009	Position deviation (valid only for position control)	User unit	int32	0xE009
Un00A	Accumulated load ratio (100% of rated torque, valid for 10s)	%	uint16	0xE00A
Un00B	Regenerative load factor (display of regenerative power consumption for a 10s cycle with the value at 100% of the regenerative power that can be handled)	%	uint16	0xE00B
Un00D	Effective gain monitoring (1: 1st gain; 2: 2nd gain)	-	uint16	0xE00D
Un00E	Total power-up duration of the drive	0.1s	uint32	0xE00E
Un00F	Port input monitoring signal	-	uint16	0xE00F
Un010	Absolute encoder single-turn value	Encoder unit	uint32	0xE010
Un011	Absolute encoder multi-turn value	rev	int16	0xE011
Un017	Number of encoder Z signal output	-	int32	0xE017
Un018	Number of unidirectional encoder Z signal output	-	int32	0xE018
Un02A	Internal control state1	-	uint16	0xE02A
Un02B	Internal control state (input terminal)2	-	uint16	0xE02B
Un02C	Internal control status (input terminal)3	-	uint16	0xE02C
Un02D	Internal control status (output terminal)4	-	uint16	0xE02D
Un02E	CAN status		uint16	0xE02E
Un02F	CAN command word		uint16	0xE02F
Un030	Servo operation status	-	uint16	0xE030
Un031	CANopen operation status	-	uint16	0xE031
Un035	MCU master version	-	uint16	0xE035
Un036	FPGA version (master version)	-	uint16	0xE036
Un037	MCU secondary version	-	uint16	0xE037
Un038	FPGA secondary version	-	uint16	0xE038

Un087	Serial encoder communication error counter	times	uint16	0xE087
Un089	Module temperature	0.1℃	uint16	0xE089
Un100	Input signal monitor	-	uint16	0xE100
Un101	Output signal monitor	-	uint16	0xE101
Un105	Position tuning time	0.1ms	uint16	0xE105
Un106	Position overshoot	Command unit	uint16	0xE106
Un10B	KTY temperature sensor detection	1℃	uint16	0xE10B
Un10D	Internal chip temperature (ambient temperature)	0.1℃	uint16	0xE10D
Un140	Bus voltage	1V	uint16	0xE140
Un141	Current detection value (RMS value)	0.1A	uint16	0xE141
Un142	Accumulated load ratio (value at 100% of rated torque, RMS value for 2ms period displayed)	0.1%	uint16	0xE142
Un143	Regenerative load accumulation	0.1%	uint16	0xE143
Un144	DB load accumulation	%	uint16	0xE144
Un203	Function code number for abnormal parameters setting (Er.040)	-	uint16	0xE203
Un212	System time monitoringA(Avg)	0.1us	uint16	0xE212
Un213	System time monitoringA (Max)	0.1us	uint16	0xE213
Un214	System time monitoringB(Avg)	0.1us	uint16	0xE214
Un215	System time monitoringB (Max)	0.1us	uint16	0xE215
Un216	System time monitoringC(Avg)	0.1us	uint16	0xE216
Un217	System time monitoringC(Max)	0.1us	uint16	0xE217
Un218	System time monitoringR(Avg)	0.01ms	uint16	0xE218
Un219	System time monitoringR(Max)	0.01ms	uint16	0xE219
Un511	U phase current zero value	-	int16	0xE511
Un512	V phase current zero value	-	int16	0xE512
Un513	W phase current zero value	-	int16	0xE513
Un603	Absolute encoder pulse 【low 32 bits】	Encoder unit	uint32	0xE603
Un605	Absolute encoder pulse 【high 32 bits】	Encoder unit	uint32	0xE605
Un607	Mechanical absolute position【low 32 bits】	Encoder unit	uint32	0xE607
Un609	Mechanical absolute position 【high 32 bits】	Encoder unit	uint32	0xE609
Un800	Current error or alarm code	-	uint16	0xE800
Un801	Code at alarm occurrence	-	uint16	0xE801
Un802	Time stamp at alarm occurrence	100ms	uint32	0xE802
Un803	Actual motor speed at alarm occurrence	rpm	int16	0xE803
Un804	Speed command at alarm occurrence	rpm	int16	0xE804
Un805	Internal torque command at alarm occurrence	%	int16	0xE805
Un806	Input command pulse speed at alarm occurrence	rpm	int16	0xE806

Un807	Deviation counter (positional deviation) at alarm occurrence	pulse	int32	0xE807
Un808	Main circuit bus voltage at alarm occurrence	V	uint16	0xE808
Un809	Current feedback RMS value at alarm occurrence	A	int16	0xE809
Un80A	Accumulated load factor [2ms] at alarm occurrence	%	uint16	0xE80A
Un80B	Regenerative load factor at alarm occurrence [2ms]	%	uint16	0xE80B
Un80C	DB resistor power consumption at alarm occurrence [2ms]	%	uint16	0xE80C
Un80D	Max. cumulative load rate at alarm occurrence	%	uint16	0xE80D
Un80E	Moment of inertia ratio at alarm occurrence	%	uint16	0xE80E
Un80F	Serial encoder communication abnormality count at alarm occurrence	-	uint16	0xE80F
Un810	Internal signal monitoring at alarm occurrence	-	uint32	0xE810
Un814	Internal input signal monitoring at alarm occurrence	-	uint32	0xE814
Un818	Internal output signal monitoring at alarm occurrence	-	uint32	0xE818
Un820	Alarm record 0	-	uint16	0xE820
Un821	Alarm record 1	-	uint16	0xE821
Un822	Alarm record 2	-	uint16	0xE822
Un823	Alarm record 3	-	uint16	0xE823
Un824	Alarm record 4	-	uint16	0xE824
Un825	Alarm Record 5	-	uint16	0xE825
Un826	Alarm Record 6	-	uint16	0xE826
Un827	Alarm Record 7	-	uint16	0xE827
Un828	Alarm Record 8	-	uint16	0xE828
Un829	Alarm record 9	-	uint16	0xE829
Un830	Alarm record0 occurrence time	0.1s	uint32	0xE830
Un832	Alarm record1 occurrence time	0.1s	uint32	0xE832
Un834	Alarm record2 occurrence time	0.1s	uint32	0xE834
Un836	Alarm record3 occurrence time	0.1s	uint32	0xE836
Un838	Alarm record4 occurrence time	0.1s	uint32	0xE838
Un83A	Alarm record5 occurrence time	0.1s	uint32	0xE83A
Un83C	Alarm record6 occurrence time	0.1s	uint32	0xE83C
Un83E	Alarm record7 occurrence time	0.1s	uint32	0xE83E
Un840	Alarm record8 occurrence time	0.1s	uint32	0xE840
Un842	Alarm record9 occurrence time	0.1s	uint32	0xE842

Note:

The data type definitions marked ① in the above table are described as follows.

Data type	Description
int16	Signed words (16 bits)
uint16	Unsigned word (16 bits)
int32	Signed words (32 bits)
uint32	Unsigned word (32 bits)

② The monitoring function code Un00E may actually have a deviation of ±1 hour.

Chapter 8 Troubleshooting

8.1 Classification of Errors and Alarms

Errors and alarms for servo drives are categorized into two types: Group 1 (referred to as "Gr.1") and Group 2 (referred to as "Gr.2").

Stop mode in case of malfunction:

Gr.1: The stop mode in case of a malfunction depends on Pn004, and the factory setting is free stop.

Gr.2: The stop mode in case of a malfunction depends on Pn005, and the factory setting is a zero-speed stop with zero speed command.

Fault reset:

Yes: Fault can be cleared by fault reset.

No: Faults cannot be cleared by fault reset.

The term "can be cleared by fault reset" means that the user can cancel the fault display by the "reset signal". Specific operation methods are as follows.

Method 1: Reset the fault through the upper computer.

Method 2: Reset the fault through DI input terminal X.

Related fault clearing terminal function No.

Address:0x04			
Mark	**Fault reset**	**Trigger**	**Control mode**
ALM-RST	This signal is used to reset fault alarms in the drive. Invalid: alarm reset OFF. Valid: alarm reset ON.	By high and low level	P S T

Precautions	
	● For some resetable faults, the cause of the fault must be removed by changing the relevant settings. ● For some non-resettable faults, it is necessary to reapply the control power (DC+, DC-) to clear the fault, and it is necessary to investigate the cause of the fault before power-up or before enabling.

8.2 Errors and Warnings List

Table 8-1 List of error messages

Code	Name	Group	Reset
ER.020	User function code parameter and parity error	**Gr.1**	**No**
ER.021	Function code parameter formatting error	**Gr.1**	**No**
ER.022	Manufacturer's function code parameter formatting error	**Gr.1**	**No**
ER.023	MCU and FPGA communication error	**Gr.1**	**No**
ER.030	FPGA backup program running	**Gr.1**	**No**
ER.040	Function code parameter setting error	**Gr.1**	**No**
ER.042	Parameter combination error	**Gr.1**	**No**
ER.050	Inconsistency between drive and motor voltage or power difference of more than 4 times.	**Gr.1**	**No**
ER.051	Drive power level setting error	**Gr.1**	**No**
ER.0b0	Invalid servo ON command	**Gr.2**	**No**
ER.100	Drive overcurrent (software)	**Gr.1**	**No**
ER.102	Single tube failure protection	**Gr.1**	**No**
ER.320	Regenerative overload	**Gr.1**	**No**
ER.400	Overvoltage	**Gr.1**	**No**
ER.410	Undervoltage	**Gr.2**	**Yes**
ER.42A	KTY temperature sensor over-temperature	**Gr.1**	**Yes**
ER.450	Repeated function assignment of DI terminal X	**Gr.2**	**Yes**
ER.451	Repeated function assignment of DO terminal Y	**Gr.2**	**Yes**
ER.520	Vibration fault	**Gr.2**	**Yes**
ER.521	Tuning-free vibration	**Gr.2**	**Yes**
ER.710	Instantaneous drive overload	**Gr.2**	**Yes**
ER.711	Instantaneous motor overload	**Gr.2**	**Yes**
ER.720	Continuous drive overload	**Gr.2**	**Yes**
ER.721	Continuous motor overload	**Gr.2**	**Yes**
ER.7A0	Drive over temperature	**Gr.2**	**Yes**
ER.810	Multiturn data error in absolute encoder	**Gr.1**	**No**
ER.820	Data parity error in absolute encoder	**Gr.1**	**No**
ER.830	Battery undervoltage in absolute encoder	**Gr.1**	**No**
ER.840	Multi-turn upper limit direction error	**Gr.1**	**No**
ER.860	Over temperature in absolute encoder	**Gr.1**	**No**
ER.890	Motor code not present	**Gr.1**	**No**
ER.8A1	Home timeout	**Gr.2**	**No**

ER.B31	U-phase circuit error	**Gr.1**	**No**
ER.B32	V-phase circuit error	**Gr.1**	**No**
ER.BF0	System operation error1	**Gr.1**	**No**
ER.BF1	System operation error2	**Gr.1**	**No**
ER.BF2	MCU data write to FPGA error	**Gr.1**	**No**
ER.BF4	Drive overcurrent (hardware)	**Gr.1**	**No**
ER.C10	Stall	**Gr.1**	**No**
ER.C21	Multi-turn count overflow in absolute encoder	**Gr.1**	**No**
ER.C90	Serial encoder disconnection	**Gr.1**	**No**
ER.C91	Encoder acceleration error	**Gr.1**	**No**
ER.d00	Excessive position deviation	**Gr.1**	**No**
ER.d01	Excessive position deviation during servo-ON	**Gr.1**	**No**
ER.d02	Excessive position deviation due to speed limit at servo-ON.	**Gr.1**	**Yes**
ER.d04	Electronic gear ratio overrun	**Gr.1**	**No**
ER.E03	Home setting error (CANopen & EtherCAT mode)	**Gr1**	**No**
ER.E05	Operation mode not supported by the drive	**Gr1**	**No**
ER.E20	Can master disconnection (life factor)	**Gr1**	**No**
ER.E21	Can master disconnection (consumer time)	**Gr1**	**No**

Table 8-2 List of alarm messages

Code	**Name**	**Description**
AL.900	Excessive position deviation	Accumulated position deviation exceeds the set value.
AL.901	Excessive position deviation during servo-ON	Accumulated position deviation exceeds the set value during servo-ON.
AL.910	Motor or drive overload	Display before the servo motor or servo drive is about to reach an overload (ER.710 or ER.720) fault. If operation continues, an ER.710 or ER.720 fault may be reported.
AL.911	Motor vibration alarm	Abnormal vibration on the motor during operation is detected by the servo drive. The threshold for detecting abnormal vibration is the same as the ER.520 fault value. This can be turned off or on by function code Pn185.X.
AL.920	Regeneration overload alarm	Display before the servo drive is about to reach a regenerative overload (ER.320) fault. If operation continues, an ER.320 fault may occur.
AL.930	Absolute encoder battery undervoltage	Absolute encoder battery low voltage alarm detected by the servo drive.
AL.931	External terminal JOG signal error	When the external terminal is jogging (JOGP/JOGN), both positive and negative JOG signals are given at the same

		time. The positive JOG or negative jogging signal is given separately normally.
AL.940	Servo-ON signal error (Enable when bus voltage is not completed)	If the DC bus voltage has not been completed, the enable signal is given by the input terminal (S-ON) or the internal register. Wait until the drive bus voltage is completed before giving the corresponding enable signal normally.
AL.941	Function code takes effect after repower-up	The function code needs repower-up to take effect.
AL.950	Single-tube bootstrap error	When enabled, the motor speed is greater than the rated speed.
AL.955	External power supply power down	The external power supply is down.
AL.971	Undervoltage alarm	Report alarm when the current main circuit bus voltage of the servo drive is lower than Pn786. If operation continues, an undervoltage (ER.410) fault may occur.
AL.9A0	Positive overtravel alarm	The servo has detected an overtravel signal (P-OT) during operation.
AL.9A1	Negative overtravel alarm	The servo has detected an overtravel signal (N-OT) during operation.
AL.9A2	Speed limit during Servo-ON	The servo's speed may exceed the set value of Pn270 at the moment of servo ON or the moment of limit release, set this value to limit the speed appropriately for work safety.

8.3 Alarm Causes and Solutions

Alarm code	**ER.020**	**User function code parameter and checksum error**
Cause:	The drive unit internally checks the function code (user parameter group), and a function code parameter checksum error occurs when the it fails.	

Procedures:

Cause	Check	Solution
1. Instantaneous drop in control power supply voltage.	◆ Measure the power supply voltage.	Set the power supply voltage within the specified range and initialize the parameter settings.
2. Instantaneous power loss during parameter writing.	◆ Confirm that the parameter has not been momentarily disconnected during storage.	After initializing the values, reset the function code parameters.
3. Frequent parameter writing.	◆ Check whether the parameter change operation is performed frequently by the upper unit.	The servo drive may be faulty. Replace the servo drive and change the parameter writing method.
4. Data storage error due to noise from power supply, grounding and static electricity.	◆ After resetting the function code parameters after initialization of the parameter set value, it still occurs frequently.	Take measures to prevent noise interference.
5. Servo unit failure	◆ After resetting the function code parameters after initialization of the parameter set value, it still occurs.	The servo drive may be faulty. Replace the servo drive.

Alarm code	ER.021	Function code parameter formatting error
Cause:	The total number of function codes has changed, usually after updating the software. The software version number is updated. The drive's power level code is not set.	

Procedures:

Cause	Check	Solution
1. The software has been updated	◆ Confirm that the software has been updated.	Reset the drive model (PnE00)
2. The drive power level code is not set	◆ Check whether the drive function code PnE00 is 0.	Reset the drive model (PnE00)
3.Servo unit failure	◆ After resetting the function code parameters after initialization of the parameter set value, it still occurs.	The servo drive may be faulty. Replace the servo drive.

Alarm code	ER.022	Manufacturer's function code parameters and checksum error

Cause:	The drive unit internally checks the function code (factory parameter group), and a function code parameter checksum error occurs when the it fails.

Procedures:

Cause	Check	Solution
1. Instantaneous drop in control power supply voltage.	◆ Measure the power supply voltage.	Set the power supply voltage within the specified range and reset the factory parameters.
2. Instantaneous power loss during parameter writing.	◆ Confirm that the parameter has not been momentarily disconnected during storage.	Reset the factory parameters.
3. Frequent parameter writing.	◆ Check whether the parameter change operation is performed frequently by the upper unit.	The servo drive may be faulty. Replace the servo drive and change the parameter writing method.
4. Data storage error due to noise from power supply, grounding and static electricity.	◆ After resetting the function code parameters after initialization of the parameter set value, it still occurs frequently.	Take measures to prevent noise interference.
5. Servo unit failure	◆ After resetting the function code parameters after initialization of the parameter set value, it still occurs.	The servo drive may be faulty. Replace the servo drive.

Alarm code	**ER.023**	**MCU and FPGA communication error**
Cause:	MCU writes the relevant data to the specific address of FPGA during initialization and then reads the relevant data from the specific address, so as to verify the state of the address bus, data bus and relevant signals between MCU and FPGA.	

Procedures:

Cause	Check	Solution
1. Servo unit failure	◆ If the power is turned on and off several times and the fault is still reported, the servo drive is faulty.	Replace the servo drive.

Alarm code	**ER.030**	**FPGA uses backup codes**
Cause:	FPGA used the backup codes.	

Procedures:

Cause	Check	Solution
1. Whether the drive FPGA firmware has been upgraded before this alarm.	◆ Check if there is any upgrade operation of FPGA firmware.	If there is then re-update the relevant firmware.
2. This alarm occurs during power-up.	◆ Program loading abnormality may be caused by external interference during startup.	Repower-up.

Alarm code	ER.040	Parameter setting error
Cause:	The function code parameter setting value exceeds its specified range.	

Procedures:

Cause	Check	Solution
1.The function code parameter setting value exceeds its specified range.	◆ Confirm the setting range of the changed parameter.	Determine the abnormal function code address by monitoring function code Un203 so that the changed parameter is a value within the setting range.

Alarm code	ER.042	Parameter combination error
Cause:	Parameter combination error	

Procedures:

Cause	Check	Solution
1. The speed at which the program JOG runs does not comply with the specified range due to a change in the electronic gear ratio or servo motor encoder resolution.	◆ Confirm that the detection condition formula is valid.	Reduce the value of the electronic gear ratio.
2. The speed at which the program JOG runs does not comply with the specified range due to a change in the program JOG travel speed (Pn508).		Increase the value of the program JOG move speed (Pn508).
3. The advanced tuning travel speed does not comply with the specified range due to a change		Reduce the value of the electronic gear ratio.

in the electronic gear ratio or servomotor encoder resolution.		

Alarm code	**ER.050**	**Wrong combination of motor capacity**
Cause:	**Capacity mismatch between motor and drive.**	

Procedures:

Cause	Check	Solution
1. The capacity of the servo unit does not match the capacity of the servo motor.	◆ Check if $\frac{1}{4} \le \frac{\text{motor capacity}}{\text{servo drive capacity}} \le 4$	Match the capacity of the servo drive and servo motor with each other.
2. Abnormal servo motor parameters.	◆ Check whether the parameters of the motor are consistent with the actual specification parameters.	Set the motor specification parameters correctly.
3. Abnormal servo drive parameters.	◆ Check whether the parameters of the servo drive are consistent with the actual specification parameters.	Set the servo drive specifications correctly.

Alarm code	**ER.051**	**Abnormal drive power level setting**
Cause:	**The power level set by the drive does not match the actual hardware**	

Procedures:

Cause	Check	Solution
1. Check whether the setting value of PnE00 matches the model.	◆ Check the setting value of PnE00.	Set the drive specification parameters correctly.

Alarm code	**ER.0B0**	**Invalid servo ON command**
Cause:	When certain auxiliary functions are used, the servo drive is simultaneously enabled in the same way.	

Procedures:

Cause	Check	Solution
1. Internal enable (Pn001.X = 1).	◆ Confirm that the auxiliary function is used while the internal terminal is enabled.	Disable the internal enable setting.
2. External enable signal (S-ON) is valid.	◆ Confirm that the auxiliary function is used and the external terminal is enabled at the same time.	Set the external X-terminal S-ON signal to invalid.

Alarm code	ER.100	Servo drive overcurrent (software)

Alarm code	ER.BF4	Servo drive overcurrent (hardware)
Cause:	The output current of the drive exceeds the set threshold.	

Procedures:

Cause	Check	Solution
1. Motor cable U, V, W shorted.	◆ Check motor power cable U, V, W for short circuit and connector wires for burrs.	Connect the motor cable correctly.
2. Motor cable U, V, W grounded.	◆ Check the insulation resistance between the motor power cable U, V, W and the motor cables. Measure the insulation resistance between the U, V, W ends and the ground wire (PE) for megohm (MΩ) level values.	Replace the motor with a new one if the insulation is bad.
3. Motor burnout.	◆ Check whether the resistance between the motor cables is balanced.	Replace motor if unbalanced.
4.Poor contact of motor power cables	◆ Check that the U, V, and W connector terminals of the motor connection section are not disconnected.	Tighten if terminals are loose or detached.
5. Unreasonable gain setting causing vibration during motor operation.	◆ Check if the motor vibrates or rattles during startup and operation.	Perform gain adjustment.
6.Braking resistor too small or short circuit.	◆ If external braking resistor is used, make sure to measure the resistance value of external braking resistor between RB+/RB-.	If resistance value is infinity "∞", the braking resistor is internally disconnected. If external braking resistor is used, replace with a new one

		and reconnect between RB+/RB-.
7. Encoder wiring error or loose plugs.	◆ Check whether to use our standard encoder cables and whether the connectors are loose. ◆ Turn off the servo enable signal and rotate the motor shaft by hand to see if the encoder feedback position changes with the motor shaft rotation.	Re-solder, plug tight or replace the encoder cable.
8.Servo drive failure.	◆ Re-connecting the main circuit power after several power downs, but it still reports this fault.	Replace the servo drive.

Alarm code	**ER.102**	**Single-tube failure protection**
Cause:	Abnormal drive single-tube drive voltage	

Procedures:

Cause	Check	Solution
1. Output phase loss or rotor locked	◆Check whether the drive has output out of phase. ◆ Check whether the rotor is locked.	Check whether the load exceeds the actual allowable load range of the motor.

Alarm code	**ER.320**	**Regenerative overload**
Cause:	The heat accumulation of the regenerative braking resistor exceeds the fault threshold.	

Procedures:

Cause	Check	Solution
1. Power supply voltage beyond the specification range.	◆ Measure the power supply voltage.	Set the power supply voltage within the specification range.
2. External regeneration resistor value or regeneration resistor capacity is insufficient or in continuous regeneration state.	◆ Check the operation conditions or capacity.	Change the regenerative resistance and capacity.
3. The set capacity is lower than the actual capacity of the external regenerative resistance.	◆ Check the connection and capacity value of the regenerative resistor.	Calibrate the regenerative resistor capacity.
4. Excessive external regenerative	◆ Check whether the regenerative resistance is correct.	Set the regenerative resistance and capacity

resistance.		correctly.
5. Regenerative state affected by external operation.	◆ Check whether the operation is affected by external operation.	Correctly set the system including servo and mechanical operating conditions, and use a common DC bus.
6. Large load inertia results in regenerative energy during deceleration, causing the DC voltage of the drive to rise and the regenerative energy to be insufficiently absorbed.	◆ Check the deceleration time of the motor during deceleration. ◆ Check the regenerative resistor loading rate. ◆ Check the regeneration alarm display.	Increase the capacity of motor and drive, and reduce the deceleration time. Set the regenerative resistor externally.
7. Excessive motor rotation speed fails to absorb the regeneration within the specified deceleration time.	◆ Check the deceleration time of the motor during deceleration. ◆ Check the regenerative resistor loading rate. ◆ Check the regeneration alarm display.	Increase the capacity of motor and drive, and reduce the deceleration time. Set the regenerative resistor externally.
8. Servo drive failure.	◆ Re-connecting the main circuit power after several power downs, but it still reports this fault.	Replace the servo drive.

Alarm code	**ER.400**	**Overvoltage**
Cause:	DC bus voltage between DC+ and DC- exceeds the fault value: normal value 48V, fault value 80V.	

Procedures:

Cause	**Check**	**Solution**
1. The input voltage of the main circuit is too high.	◆ Check the specifications of the drive input power supply, and measure whether the input voltage on the drive side of the main circuit meets the following specifications: Normal value: 48V, allowable deviation: ±10% (43V-53V)	Replace or adjust the input power supply by referring to the specifications on the left.
2. The power supply is unstable or has been affected by a lightning strike.	◆ Monitor whether the drive input power supply has been affected by a lightning strike, and measure whether the input power supply is stable and meets the above specifications.	After connecting the surge suppressor, turn on the control power supply and main circuit power supply, and then replace the servo drive if failure still occurs.
3. The external	◆ If an external braking resistor is	If the resistance value is

braking resistor fails.	used, measure the resistance between RB+/RB-.	infinity "∞", the braking resistor is disconnected. If external braking resistor is used, replace it with a new one and reconnect it between RB+/RB-.
4. External braking resistance is too large; the maximum energy is not fully absorbed.	◆ Measure the resistance value between RB+/RB- and compare with the recommended value.	Replace the external braking resistor with an advancing value and reconnect it between P /B2.
5. The motor is running with rapid deceleration, the max. braking energy exceeds the absorbable value.	◆ Confirm the deceleration time in operation, measure the DC bus voltage between DC+ and DC-, and confirm whether the voltage exceeds the fault value when it is in the deceleration section.	Ensure that the main circuit input voltage is within the specifications of the drive, and increase the deceleration time if allowed.
6. The measured value of bus voltage has a large deviation.	◆ Measure the DC bus voltage between DC+ and DC- to check if it is in accordance with the value of Un140.	Consult our technical support.
7. Running above the allowable inertia.	◆ Confirm that the inertia ratio is within the allowable inertia ratio.	Extend the deceleration time or reduce the load.
8. Servo drive failure.	◆ Re-connect the main circuit power after powering down several times, and see if it still reports a fault.	Replace the servo drive.

Alarm code	**ER.410**	**Undervoltage**
Cause:	DC bus voltage between DC+ and DC- is below fault value: 48V for normal value, 18V for fault value.	

Procedures:

Cause	**Check**	**Solution**
1. The main circuit power supply is unstable or an instantaneous power failure occurs.	◆ Check the specifications of the drive input power supply, and measure whether the input voltage on the drive side of the main circuit meets the following specifications: normal value: 48V, allowable deviation: ±10% (43V-53V)	Replace or adjust the input power supply by referring to the specifications on the left.
2. Power supply voltage drop during operation.	◆ Detect the power supply voltage on the input side of the drive and check whether the main circuit power supply is too large, resulting in insufficient power supply capacity and reduced voltage.	Replace or adjust the input power supply.

3. Poor contact of DC power supply.	◆ Check whether the main circuit wiring is correct and reliable.	Replace the cables and connect the main circuit power cables correctly.
4. Large deviation of bus voltage measurement.	◆ Measure the DC bus voltage value between DC+ and DC- to see if it matches Un140.	Consult our technical support.
5. Servo drive failure.	◆ Re-connect the main circuit power supply after powering down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.42A**	**KTY temperature sensor over-temperature**
Cause:	The temperature value detected by the KTY temperature sensor is higher than the set over-temperature threshold (Pn055).	

Procedures:

Cause	**Check**	**Solution**
1. The over-temperature threshold is set too small.	◆ Check if the set value of function code Pn055 is too small.	Set the over-temperature threshold appropriately.
2. Whether the motor heat dissipation is abnormal.	◆ Check if the motor cooling duct is blocked.	Clear air duct clogging.
3. Motor load beyond the model.	◆ Check whether the motor has been running for a long time in exceeding the rated torque.	Select a model appropriately.
4. Servo drive failure.	◆ Reconnect the main circuit power after powering down for several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.450**	**Repeated function assignment of DI terminal X**
Cause:	The same function is assigned to different DI terminals X or the assigned function is abnormal.	

Procedures:

Cause	**Check**	**Solution**
1. The same function is assigned to different input terminals X.	◆ Check if the same function number is set for function codes Pn601.YX - Pn609.YX.	Readjust the input terminal X with the same function number assigned, assign a different function number, and then reset the fault to take effect.
2. The function number of input terminal X is set	◆ Check if the set function number exists.	Correctly set a function number that does not exist in the setup.

abnormally.		

Alarm code	**ER.451**	**Repeated function assignment of DO terminal Y**
Cause:	The same function is assigned to different digital output terminal Y or the assigned function number is abnormal.	

Procedures:

Cause	Check	Solution
1. The same function is assigned to different output terminal Y.	◆ Check if the same function number is set for function codes Pn611.YX - Pn614.YX.	Readjust the output terminal Y that is assigned with the same function number, assign a different function number, and then reset the fault to take effect.
2. The function number of output terminal Y is set abnormally.	◆ Check if the set function number exists.	Correctly set the function number that does not exist in the setting.

Alarm code	**ER.520**	**Vibration fault**
Cause:	The drive detects the maximum, minimum, and period of the speed during operation, and a vibration fault occurs when they are higher than the set thresholds.	

Procedures:

Cause	Check	Solution
1. Abnormal vibration due to motor speed.	◆ Confirm if there is abnormal sound, or if speed and torque waveforms are fluctuating greatly during motor operation.	Reduce the motor speed or the speed loop gain.
2. Larger moment of inertia ratio than the actual value or a larger change during operation.	◆ Confirm the ratio of inertia.	Set the system's moment of inertia ratio correctly.

Alarm code	**ER.521**	**Vibration in advanced auto tuning**
Cause:	The drive detects the maximum, minimum, and period of the speed during operation, and a vibration fault occurs when they are higher than the set thresholds.	

Procedures:

Cause	Check	Solution
1. The motor is vibrating heavily.	◆Confirm the speed waveform during motor operation.	Reduce the load to below the allowable moment of inertia ratio, or reduce the rigidity value.

Alarm code	**ER.710**	**Instantaneous drive overload**

Alarm code	**ER.711**	**Instantaneous motor overload**

Alarm code	**ER.720**	**Continuous drive overload**

Alarm code	**ER.721**	**Continuous motor overload**
Cause:	Accumulated heat is too high and greater than the fault threshold.	

Procedures:

Cause	Check	Solution
1. Excessive load rate (load is large).	◆ Check if the average load ratio Un142 is large (more than 100%) and if the overload characteristics of the system are exceeded.	Re-select the drive and choose a drive with higher power.
2. Bad wiring or connection of motor power cables.	◆ Check the wiring.	Confirm that the motor wiring is correct.
3. Wrong setting of drive parameters.	◆ Check if the drive model setting is accurate.	Set the corresponding parameter according to the drive model.
4. Wrong setting of motor parameters.	◆ Check if the motor parameters are set accurately.	Set the corresponding parameter according to the motor model.
5. Motor blocking due to mechanical factors, resulting in excessive load during operation.	◆ Check if the motor speed is 0 while the speed command is not in different modes.	Exclude mechanical factors.
6. The brake of the motor with holding brake is not opened.	◆ Check if the holding brake terminal power-up pressure is normal.	Exclude the problem of the brake.
7. Gain parameters are not set reasonably, resulting in vibration and swing. The motor vibrates and rattles.	◆ Check if drive-related gain parameter setting is proper.	Re-adjust the gain parameters.
8. Misconnect the motor cables	◆ Check if the motor power	Correctly connect the

to other axes in multiple mechanical wiring, or incorrect wiring.	cables and encoder cables are correctly connected to the corresponding motor shaft.	motor power cables and encoder cables to the corresponding motor shafts.
9. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.7A0**	**Drive over temperature**
Cause:	The module temperature of the servo drive exceeds the set fault value.	

Procedures:

Cause	**Check**	**Solution**
1. Too high ambient temperature	◆ Measure the ambient temperature.	Improve the heat dissipation and cooling conditions of the servo drive to reduce the ambient temperature.
2. Blocked cooling duct	◆ Check if the cooling duct is blocked.	Clear the air duct.
3. Unreasonable installation direction and distance of the servo drive	◆ Check if the servo drive is installed reasonably.	Install according to the installation standard of the servo drive.
4. Repeat running after resetting overload fault.	◆ Check if the drive is overloaded.	Increase the capacity of the drive and motor, increase the acceleration and deceleration time, and reduce the load.
5. Servo drive failure	◆ Repeatedly power down and power up again, to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.810**	**Multiturn data error in absolute encoder**

Cause:	The backup battery of the absolute encoder has had a power failure and the multi-turn data is abnormal. [Valid only for multi-turn absolute encoders].

Procedures:

Cause	Check	Solution
1. The power of the absolute encoder was turned on for the first time.	◆ Check if it is the first time the power is turned on.	Set the encoder (write 1 to Pn07F).
2.e encoder cable was removed and connected again.	◆ Check if it is the first time the power is turned on.	Confirm the connection of the encoder and set the encoder (write 1 to Pn07F).
3. The control power supply (+5V) of the servo drive as well as the battery has failed.	◆ Check if the motor and plug status of the encoder plug are correct.	After restoring power to the encoder (replacing the battery, etc.), set the encoder (write 1 to Pn07F).
4. The servo drive's battery voltage is lower than the encoder's allowed voltage when the control power supply is disconnected.	◆ Check if the battery voltage is within the allowed range.	After replacing the battery, set the encoder (write 1 to Pn07F).
5. Absolute encoder failure.	◆ Set the encoder several times (Fn008) to see if it still reports the fault.	Replace the servo motor.
6. Servo drive failure.	◆ Repower-up after power-down several times see if it still reports the fault.	Replace the servo drive.

Alarm code	ER.820	Stored data checksum error in absolute encoders
Cause:	◆When the drive reads the parameters from the serial encoder ROM, it finds that the parameters have not been stored or that the parameters do not correspond to the agreed values.	

Procedures:

Cause	Check	Solution
1. Mismatch between drive and motor type.	◆ Check if it is our servo drive and servo motor according to the nameplates.	Replace with a drive and motor that match each other and power up again. When using our servo drives with serial encoder motors, make sure that Pn790 = 1000 and Pn791 is the encoder that is matched.
2. Parameter	◆ Check if our standard encoder cable is	Use our standard encoder

checksum error in serial encoder ROM or no parameters stored.	used and the cable has no broken skin, no wire breakage, no bad contact at both ends of the cable, and is reliably connected. ◆ Measure the signals at both ends of the encoder cable: PS+, PS-, +5V, GND, check whether the signals at both ends are the same.	cables, make sure the terminals are securely connected at the motor end and tightened at the drive end. Replace the encoder cable with a new one if necessary. Do not bundle the encoder cables with the power cables (R, S, T, U, V, W), they should be routed separately.
3. Drive failure	◆ Repeat power-up to see if it still reports the fault.	Replace servo drives.
4.Motor encoder failure	◆ Repeat power-up to see if it still reports the fault.	Replace a servo motor and encoder.

Alarm code	**ER.830**	**Absolute encoder with low battery**
Cause:	◆ The battery voltage of the absolute encoder is below the specified value.	

Procedures:

Cause	Check	Solution
1. Battery poorly connected or disconnected.	◆ Check the battery connection.	Connect the battery correctly.
2. Battery voltage below specified value (2.7V).	◆ Measure the battery voltage.	Replace the battery.
3.Servo drive failure.	◆Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.840**	**Multi-turn upper limit direction error**
Cause:	◆ The direction of motor encoder operation is different from the direction set by function code Pn277.	

Procedures:

Cause	Check	Solution
1. Incorrect parameter setting.	◆ Check if the function code Pn277 is set correctly.	Set parameter values correctly.
2. Different direction from the set direction during actual operation.	◆ Check if there is the opposite direction to the set direction during the actual operation.	Control the running direction correctly.
3. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.860**	**Over temperature in absolute encoders**
Cause:	Motor encoder temperature is greater than the set fault value.	

Procedures:

Cause	Check	Solution
1. Servo motor ambient temperature is too high.	◆ Measure the ambient temperature of the servo motor.	Adjust the ambient temperature of the servo motor within a reasonable temperature.
2. The servo motor runs at a load that exceeds the rated value.	◆ Confirm the motor load by the accumulated load ratio (Un009).	Adjust the load of the servo motor within the rated value before running.
3. Servo motor selection does not match the actual demand.	◆ Confirm the actual load by accumulating the load ratio (Un009).	Select the appropriate capacity according to the actual situation.
4. Encoder failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo motor.
5. Encoder failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.890**	**Motor code not present**
Cause:	The set motor ID number does not match the actual supported ID number.	

Procedures:

Cause	Check	Solution
1. Abnormal motor ID number setting	◆ Check the actual set ID number (Pn790).	Set the motor ID number correctly.

Alarm code	**ER.8A1**	**Home timeout**
Cause:	The home timeout value is set too small or the home signal is not found within the time set by this function code.	

Procedures:

Cause	Check	Solution
1. The home timeout value is set too small.	◆ Check if the length of time from the start of home to alarm exceeds the Pn299.	Set the home timeout value reasonably.
2. Check if the home signal is normal.	◆ Check if the home signal is normal by forcing the given home signal method.	Set the home signal reasonably.

Alarm code	**ER.B31**	**U-phase circuit error**

Alarm code	**ER.B32**	**V-phase circuit error**
Cause:	Abnormal current zero signal sampled by the drive	

Procedures:

Cause	**Check**	**Solution**
1. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.BF0**	**System operation error1**

Alarm code	**ER.BF1**	**System operation error2**
Cause:	System operation failure.	

Procedures:

Cause	**Check**	**Solution**
1. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.BF2**	**MCU data writing to FPGA error**
Cause:	The MCU writes special data to the FPGA and then reads back the written data. If the read data is not the same as the written data, the corresponding fault occurs.	

Procedures:

Cause	**Check**	**Solution**
1. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.C10**	**Stall**
Cause:	◆ Torque command direction is opposite to speed feedback direction. ◆ Speed feedback is opposite to the direction of speed command.	

Procedures:

Cause	**Check**	**Solution**
1.U/V/W phase sequence wiring error	◆ Check if the drive power cable ends and the motor cable U/V/W end and the drive U/V/W end are connected accordingly.	Wire in the correct U/V/W phase sequence.
2. When power-up, the interference signal causes the initial phase detection error of the motor rotor	◆ The phase sequence of U/V/W is correct, but ER.C10 is reported when the servo drive is enabled.	Repower-up.
3. Wrong encoder model or wiring error	◆ Check if it is our servo drive and servo motor according to the	Replace servo drives and motors with matching

	nameplates.	ones. When using our drives and serial encoder motors, make sure that Pn790=1000 and Pn791 are the corresponding encoder codes.
4. Encoder wiring error, cable aging and corrosion, loose encoder plugs	◆ Check if the standard encoder cable of our company is used, and make sure that the cable has no aging, corrosion and loose joints. ◆Rotate the motor shaft without enabling the servo drive to see if there is any change in the motor feedback pulse.	Re-solder, plug tight or replace the encoder cable.
5. Excessive gravity load on vertical axis.	◆ Check if the vertical axis load is too large, adjust the holding brake parameters, and whether the fault can be eliminated.	Reduce the vertical axis load or increase the rigidity of the servo drive, or shut down the fault without jeopardizing safety and performance.

Alarm code	**ER.C21**	**Multi-turn count overflow in absolute encoder**
Cause:	Overflow of the absolute encoder multiturn count value is detected.	

Procedures:

Cause	**Check**	**Solution**
1. Absolute encoder multi-turn count overflow.	-	After clearing the relevant faults via the upper computer, repower-up to ensure that the device travels within the range of the multiturn count.

Alarm code	**ER.C90**	**Encoder disconnection**
Cause:	The drive has not received answer feedback from the encoder several times consecutively (serial encoder).	

Procedures:

Cause	**Check**	**Solution**
1. The port for encoder connection has poor contact, or the plug is wired incorrectly.	◆ Check the status of the port for encoder connection.	Plug in the encoder plug again to confirm the encoder wiring.
2. Broken or shorted encoder cable, or cable with impedance	◆ Check the status of the encoder cable.	Use the encoder cable as required.

exceeding the specified impedance is used.		
3. Malfunction due to noise interference.	◆ Check the operating environment.	Perform the wiring of the encoder outer devices correctly. Do not bundle the encoder cables with the power cables (R, S, T, U, V, W), but route them separately.
4. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.D00**	**Excessive position deviation**
Cause:	Position deviation is larger than the set threshold in position control mode.	

Procedures:

Cause	Check	Solution
1. Drive U, V, W output are out of phase or in the wrong phase sequence.	◆ Check the wiring when the motor cannot be operated.	Rewire or replace the cables according to the correct wiring.
2. Drive U, V, W disconnection.	◆ Check the wiring.	Rewire to make sure that the servo motor power cable and the drive power cable U, V, and W are correct.
3. Motor blocked due to mechanical factors.	◆ Check if the internal torque command is not 0 and the motor speed is 0 in the case of a given command.	Exclude mechanical factors.
4. Low servo drive gain.	◆ Check if the servo drive position loop and speed loop gain are reasonable.	Adjust the gain.
5. The position deviation fault threshold is too small relative to the operating conditions.	◆ Check if the position deviation fault threshold is set too low.	Set a reasonable fault threshold for excessive position deviation.
6. High input pulse frequency.	◆ Check if the input pulse frequency is too high when the position command source is a pulse command. ◆ Check if the pulse command speed acceleration/deceleration time is 0 or too low. ◆Check if the electronic gear ratio is large.	Reduce the frequency of position commands or reduce the electronic gear ratio. When using the position pulse output from the upper unit, a certain acceleration and deceleration time can be set in the upper unit. If the acceleration/deceleration time cannot be set in the upper unit, the position command

		smoothing time of the drive can be used.
7. Internal speed limit	◆ Check the limit value of the maximum running speed of the motor (function code Pn316) to see if the limit value is much lower than the pulse command speed.	Correctly set the maximum motor operating speed.
8. Servo drive failure.	◆ Repower up after power down several times to see if it still reports the fault.	Replace the servo drive.

Alarm code	**ER.D01**	**Excessive position deviation during servo-ON**
Cause:	The instantaneous position deviation of the servo drive is greater than the fault threshold when it is ON.	

Procedures:

Cause	Check	Solution
1. When the servo is OFF, the position deviation is greater than the set fault threshold.	◆ Confirm the amount of position deviation under servo-off (Un009).	Clear the amount of position deviation when the servo is OFF. Set the fault value of excessive position deviation at servo-ON.

Alarm code	**ER.D02**	**Excessive position deviation due to speed limit under servo-ON.**
Cause:	A malfunction that occurs when the amount of position deviation caused by speed limitation is greater than the malfunction threshold when the servo driver is ON.	

Procedures:

Cause	Check	Solution
1. Enable servo ON in the position deviation accumulation state to limit the speed by the speed limit value during servo is ON. A position command is input in this state that exceeds the position deviation excessive fault value.	◆ Confirm the amount of position deviation under servo-off (Un009).	Clear the amount of position deviation when the servo is OFF. Set the fault value of excessive position deviation under servo-ON. Set the speed limit value when the servo is ON to the correct value.

Alarm code	**ER.F10**	**External input power supply power down**

Cause: No power input to DC+ and DC- when main circuit power is ON

Procedures:

Cause	Check	Solution
1. External input power supply voltage dropout.	◆ Check that there is no external power loss. ◆ Check if DC+ and DC- wiring is correct.	Wire correctly.
2. External input power supply power down to detect if the filter time is too small.	◆ Check if the set value of function code Pn780 is reasonable.	Set function code values correctly.

Chapter 9 Communication

9.1 485 Communication

The servo drive’s upper computer communication uses the standard Modbus protocol based on the 485 interface.

Modbus is a serial, asynchronous communication protocol with a common language for its application to PLCs or other controllers. This protocol defines a message structure that a controller can recognize and use, regardless of the network via which it is transmitted. The Modbus protocol does not require a dedicated interface, and the typical physical interface is RS485.

The function codes of the servo drives are divided into 16-bit and 32-bit according to the data length. The Modbus RTU protocol enables data reading and writing operations to the function codes, and the command codes differ according to the data length when writing the function codes.

Code	Description
03h	Read 16/32-bit function codes
06h	Read 16-bit function codes
10h	Read 32-bit function codes

9.1.1 Communication Parameter Setting

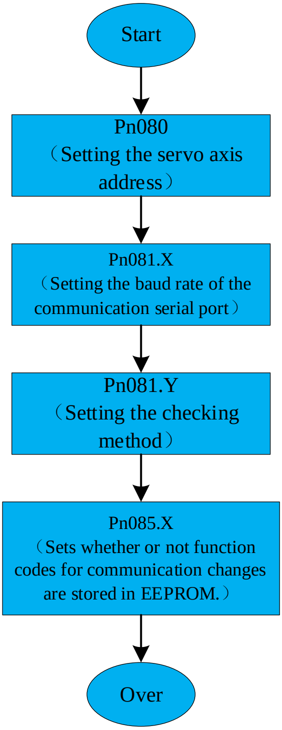


Figure 9-1 Communication parameter setting

(1) Pn080: Servo axis address

The host device can write to all slave drives by broadcasting the address, and the slave drives receive frames from the broadcast address to operate accordingly, but do not reply.

Station No.	Description	Default
0	Broadcast address	1
1~255	Slave address	

(2) Pn081.X: Communication serial port baud rate

The communication rate of the servo driver and that of the host computer must be set the same, otherwise communication is invalid. When multi-status servo drives are networked, a drive whose communication baud rate does not match that of the host computer will cause communication errors in that axis or affect communication in other axes.

Code	Description	Default

Pn081.X=0	4800bps	Pn081.X=2
Pn081.X=1	9600bps	
Pn081.X=2	19200bps	
Pn081.X=3	38400bps	
Pn081.X=4	57600bps	
Pn081.X=5	115200bps	

(3) Pn081.Y: Checking type

The SD100 provides 6 types of verification.

Code	Description	Default
Pn081.Y = 0 [N, 8, 1]	No parity, data bit: 8, stop bit: 1	Pn081.Y=0
Pn081.Y = 1 [E, 8, 1]	Even parity, data bit: 8, stop bit: 1	
Pn081.Y = 2 [0, 8, 1]	Odd parity, data bit: 8, stop bit: 1	
Pn081.Y = 3 [N, 8, 2]	No parity, data bit: 8, stop bit: 2	
Pn081.Y = 4 [E, 8, 2]	Even parity, data bit: 8, stop bit: 2	
Pn081.Y = 5 [0, 8, 2]	Odd parity, data bit: 8, stop bit: 2	

(4) Pn085.X: Communication function code storage EEPROM selection

The servo drive provides function code real-time saving function, the corresponding function code value is stored in EEPROM in real time after being modified, and it supports the function of power-down saving.

Code	Description	Default
Pn085.X=0	Not store	Pn085.X=0
Pn085.X=1	Store	

9.1.2 Modbus Communication Protocol

(1) Transmission mode

The transmission modes are divided into two modes: ASCII or RTU.

This product supports RTU mode only. Characters sent in RTU mode are represented as hexadecimal numbers. For example, to send 30H, users can enter 30H directly into the packet.

(2) Baud rate

Range: 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps.

(3) Data frame format

The data frame format for RTU mode is as follows:

Table 9-1 RTU data frame format

Start	Address	Command	Data	CRC check	End
T1-T2-T3-T4	1 byte	1 byte	N bytes	2 bytes	T1-T2-T3-T4

(4) 03H command code reads N consecutive words

Function: read N words, up to 16 words continuously.

Example: 2 consecutive words are read from the start address 0290H of the servo drive at 01H. The command and the response messages are as follows:

Table 9-2 0x03 command format

Command message (Master)		**Response message (Slave)**	
Address	01H	Address	01H
Command	03H	Command	03H
Start data address	02H (high byte)	Number of data (in bytes)	02H
	90H (low byte)		
Number of data (in words)	00H	Data	01H
	01H		01H
CRC check (low)	85H	CRC check (low)	78H
CRC check (high)	9FH	CRC check (high)	14H

(5) 06H command code writes 1 word

Function: write 1 byte.

Example: write 1000 (03E8H) to address 0A00H of the servo drive at 01H.

Table 9-3 0x06 command writes one word

Command (Master)		**Response (Slave)**	
Address	01H	Address	01H
Command	06H	Command	06H
Starting data address	0AH	Starting data address	0AH
	00H		00H
Data content	03H	Data	03H
	E8H		E8H
CRC check code	8AH	CRC check code	8AH
	ACH		ACH

(6) 10H command code writes 2N words

Function: write N words, $N \geqslant 2$.

Example: write 100 to the 0100H slave address of the servo drive at 01H, and 400 to the 0101H slave address of the drive at 01H.

Table 9-4 0x06 command writes 2N words

Command (Master)		**Response (Slave)**	
Address	01H	Address	01H
Command	10H	Command	10H
Write data address	01H	Write data address	01H
	00H		00H
Number of data	00H	Number of data	00H
	02H		02H
Byte No.	04H		40H

Data content 1st word high	00H	CRC check code	34H
Data content 1st word low	64H	-	-
Data content 2nd word high	01H	-	-
Data content 2nd word high	90H	-	-
CRC check code	BEH	-	-
	1CH		-

(7) RTU mode check code calculation

RTU mode uses CRC (Cyclic Redundancy Check) for error checking.

The CRC calculation is illustrated as follows:

Step 1: Preset a 16-bit register with the contents of FFFFH, called it as CRC register.

Step 2: Perform XOR operation of the first byte (Address) of the command message and the low byte of the 16-bit CRC register, and the result is stored back into the CRC register.

Step 3: Check the lowest bit (LSB) of CRC register, if this bit is 0, then shift right one bit; if this bit is 1, then shift right one bit of CRC register value and then perform the XOR operation with A001H.

Step 4: Go back to step 3 until step 3 has been performed 8 times. When it done, go to Step 5.

Step 5: Repeat Step 2 through 4 for the next byte of the command message until all bytes have been completely processed. At this time, the content of CRC register is the CRC error detection value.

Explanation: After the CRC error value is calculated, the low bit of CRC must be filled at first in the command message, and then the high bit of CRC can be filled.

Example: Read 2 words from address 0004H of servo drive with station number 01H. The last content of the CRC register calculated from Address to the last byte of the data number is CA85H, then the command message is shown below, and it should be noted that 85H is transmitted before CAH.

Table 9-5 CRC check code calculation

Item	Command content
Address	01H
Command	03H
Starting data address	00H (high byte)
	04H (low byte)
Number of data (in words)	00H
	02H
CRC check (low)	85H
CRC check (high)	CAH

(8) Error message

The driver replies with the corresponding error code to the master when a command error, function code address exception, and CRC check error are sent from the master.

9.1.3 Communication-related settings

(1) 485 bus structure

The servo drive uses RS485 half-duplex communication. 485 bus requires a hand-over-hand structure, not a star or bifurcated structure. Star or bifurcated structures tend to generate reflected signals, which can affect the 485 communication.

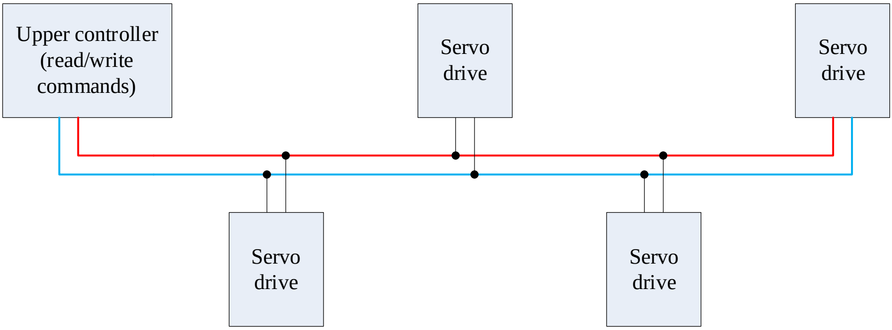


Figure 9-2 Connection of the 485 communication bus

Users must use shielded twisted-pair cable, try to stay away from strong power, do not parallel with power lines, and do not bundle them together. It should be noted that in a half-duplex connection, only one servo drive can communicate with the master computer at one time. If two or more Servo Drives upload data at the same time, bus contention will occur. Not only will this result in communication failure, but it may also cause high currents to some components and damage them.

(2) Grounding and terminal

Terminal resistors of 120Ω are to be used for the terminal of RS485 networks to weaken the reflection of the signal. Terminal resistor cannot be used for intermediate networks.

No point in the RS485 network should be directly grounded. All devices in the network are to be well grounded through their own ground terminal. It should be noted that under no circumstances should the ground wire form a closed loop.

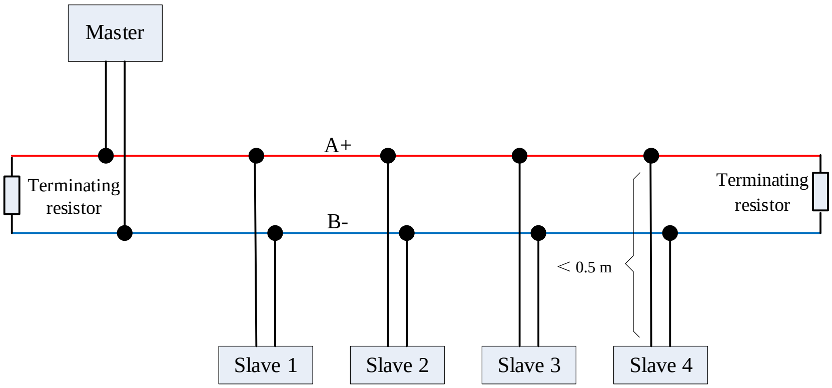


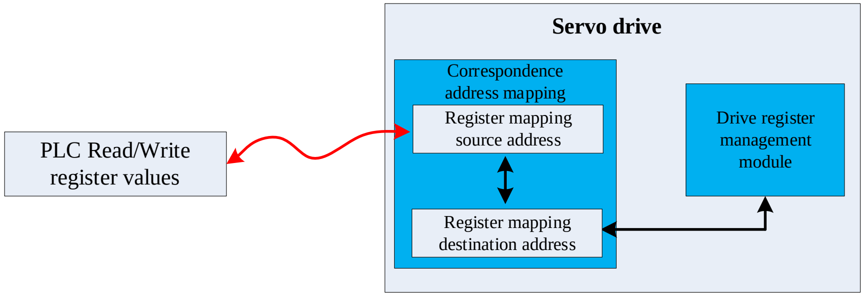
Figure 9-3 Connection diagram for the terminal resistors

Recommendation: terminal resistor resistance of 120Ω.

<table>
<tr><th colspan="2">Caution</th></tr>
<tr><td>⚠</td><td>● Write the function code parameters of the drive through the Modbus communication protocol. Due to the limitation of the erasable times of the data storage chip EEPROM, users cannot write and store the parameters to EEPROM frequently, otherwise the data storage chip may be caused.
Example: write the function code Pn300.
If the expected data is not only written into RAM, but also stored in EEPROM, the corresponding address is 0x0300;
If the expected data is only written into RAM, but not stored in EEPROM, the corresponding address is 0x1300.</td></tr>
</table>

9.1.4 Register Address Mapping

The register address mapping function refers to the user's expectation to read or write the corresponding register address without changing some specific register address in the existing configuration software (HMI) or PLC program in the process of using 485 communications.



Related function code

Code	Name	Range	Default
Pn087.X	485 communication register address mapping switch	0~1	0
Pn087.Y		0~1	0
Pn088	1# register mapping source address	0x000~0x1FFF	0
Pn089	1# register mapping destination address	0x000~0x1FFF	0
Pn08A	2# register mapping source address	0x000~0x1FFF	0
Pn08B	2# register mapping destination address	0x000~0x1FFF	0

Example: With the PLC program unchanged, the existing PLC program maps this address to the address in this product by writing the speed command value to address 0x0A00 and using the register address mapping function.

Step	Content
1	Set the communication address (Pn080)
2	Set the communication baud rate (Pn081.X)
3	Set the communication check method (Pn081.Y)
4	Turn on the 485 communication register address mapping switch (Pn087.X=1)
5	Set 1# register mapping source address (Pn088=0x0A00)
6	Set 1# register mapping destination address (Pn089=0x0304)

Cautions

- The register address mapping function is valid only for 485 communication, and has no effect on USB communication.

9.2 CANopen Communication

9.2.1 CANopen Performance Parameter

Table 9- 6 CAN performance parameter description

Name	Description
Link layer protocol	CAN bus
Application layer protocol	CANopen protocol
CAN-ID type	11bit- CAN2.0A
Baud rate	1Mbit/s(default), 500Kbit/s, 250 Kbit/s, 125Kbit/s, 100 Kbit/s, 50 Kbit/s, 20 Kbit/s
Max. node number	63
CAN frame length	0~8

Application layer CAN frame type	Standard frame
Terminal resistance	120Ω
Sub-protocol	CiA-301 V4.02: CANopen application layer and communication protocols DSP-402 V2.0: Drive and motion control sub-protocols
Services	NMT: Network Management Terminal SDO: Service Data Object PDO: Process Data Object SYNC: Synchronization
PDO transmission type	Event trigger, synchronous trigger
PDO data	RPDO x4, TPDO x4
SDO transmission method	Accelerated SDO transmission
Servo operation mode	PP: Profile Position mode PV: Profile Velocity mode PT: Profile Torque mode HM: Homing mode IP: Interpolation mode

The CANopen communication function of the servo drive supports the following different baud rates. The communication distance is related to baud rate and the communication cable.

Table 9-7 Supported baud rate description

Data transmission rate	Bus length
1 Mbit/s	25
500kbit/s	100
250kbit/s	250
125kbit/s	500
50kbit/s	1000
25kbit/s	2500

Table 9-8 Relationship among CAN communication transmission distance, rate and nodes

No.	Transmission distance	Speed rate	Node	Wire diameter
①	25m	1Mbps	64	0.205mm^2
②	95m	500Kbps	64	0.34mm^2
③	560m	100Kbps	64	0.5mm^2
④	1100m	50Kbps	64	0.75mm^2

9.2.2 Communication Object

(1) SDO (Service Data Object)

① R-SDO (Receive- Service Data Object) and T-SDO (Transmit- Service Data Object);

② Customers access to the device object dictionary via SDO when using indexes and sub-indexes;

③ Each SDO request and response message contains 8 bytes;

④ SDO is implemented through the CMS object in CAL, which can transmit data of different byte lengths and will actively split into groups of messages when the data exceeds 4 bytes.

(2) PDO (Process Data Object)

① R-PDO (Receive- Service Data Object) and T-PDO (Transmit- Service Data Object);

② PDO data transmit 1 to 8 bytes real-time data to one or more receivers;

③ The communication parameters corresponding to the PDO determine synchronous or asynchronous transmission;

④ Each CANopen device contains 4 transmission PDO channels and 4 receiving PDO channels.

(3) SYNC (Synchronization)

The synchronized object is a message broadcast periodically to the CAN bus by the CANopen master to implement the basic network clock signal. Each device can decide whether to use this event to synchronize communication with other network devices according to its own configuration.

(4) NMT (Network Management Terminal)

NMT includes boot-up messages, Heartbeat protocols and NMT messages. Based on master-slave communication mode, NMT is used to manage and monitor each node in the network mainly for three functions: node status control, error control and node startup.

(5) EMCY (Emergency Message)

Messages sent when inner device communication failure or application failure occurs.

9.2.3 Network Parameter Configuration

9.2.3.1 Communication Object Identifier

The Communication Object Identifier (COB-ID) specifies object priority and object identification during communication. COB-ID corresponds to the 11-bit frame ID in CAN, and the 11-bit COB-ID consists of two parts, a 4-bit object function code and a 7-bit node address, as shown in Table 9-9.

Table 9-9 COB-ID composition description

10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Function code				Node ID						

Each communication object of CANopen has a default COB-ID, which can be read by SDO and partially modified by SDO. The list of objects is shown in Table 9-10 below.

Table 9-10 COB-ID

Object	Code	Address	COB-ID	Object index
NMT	0000b	0	0h	-
Synchronized object	0001b	0	80h	1005h, 1006h
Emergency message	0001b	0~127	80h+Node-ID	1014h
TPDO1	0011b	0~127	180h+Node-ID	1800h
RPDO1	0100b	0~127	200h+Node-ID	1400h
TPDO2	0101b	0~127	280h+Node-ID	1801h
RPDO2	0110b	0~127	300h+Node-ID	1401h
TPDO3	0111b	0~127	380h+Node-ID	1802h
RPDO3	1000b	0~127	400h+Node-ID	1402h
TPDO4	1001b	0~127	480h+Node-ID	1803h
RPDO4	1010b	0~127	500h+Node-ID	1403h
T-SDO	1011b	0~127	580h+Node-ID	1200h
R-SDO	1100b	0~127	600h+Node-ID	1200h
NMT error	1110b	0~127	700h+Node-ID	1016h, 1017h

Example: COB-ID of the R-SDO of No. 2 slave is 600h+2h=602h

9.2.3.2 System Parameter Setting

In order to enable the servo drive to access the CANopen fieldbus network, the relevant function codes of the servo drive need to be set.

Table 9-11 System setting function code

Code	Name	Range	Value
Pn000.Z	Drive model	0: Standard pulse 1: CANopen	1
Pn080	Can Node-ID	1~127	1 (default)
Pn081.Z	Can communication baud rate	0: 20kbit/s 1: 50kbit/s 2: 100kbit/s 3: 125kbit/s 4: 250kbit/s 5: 500kbit/s 6: 1 Mbit/s	4 (default)

9.2.3.3 NMT Service

The Network Management System (NMT), part of the master-slave system, is responsible for initializing, starting and stopping the network. There is and only one Network Management System (NMT) host in the entire CANopen network that can configure the CANopen network including itself. Part of this conversion is automatically implemented internally and part of it must be implemented by the NMT messages sent from host.

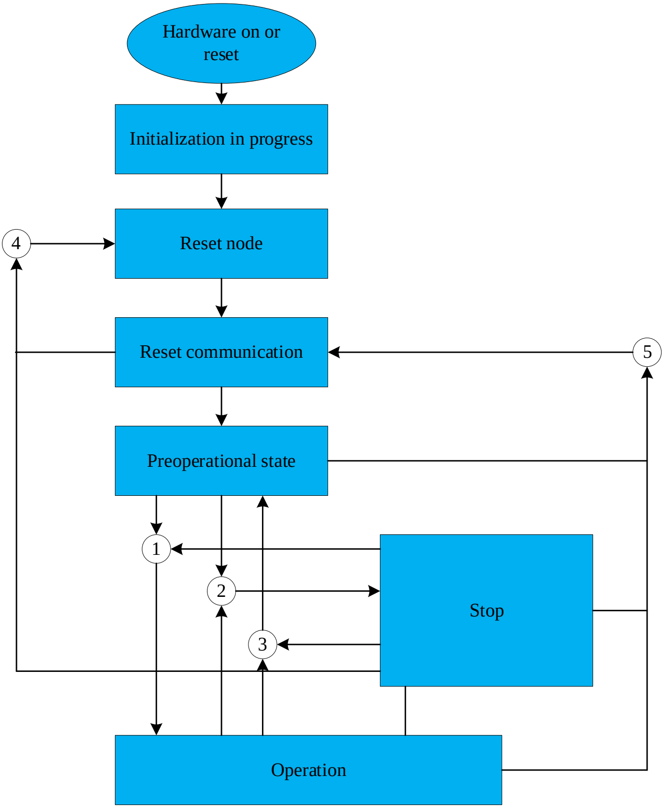


Figure 9-4 NMT status

The Network Management System (NMT) message format is shown in Table 9-12.

Table 9-12 NMT message format

COB-ID	**RTR**	**Data (bytes)**	
		0	**1**
0x000	0	Command word	Node_ID

COB-ID of NMT message is fixed to "0x000".

Data area consists of two bytes, the first one is a command word indicating the control role of that frame, as shown in Table 9-13.

Table 9-13 NMT message command

Command word	**No.**	**Description**
01h	①	Run command (all networks are running)

02h	②	Stop command (only NMT works in the whole network)
80h	③	Pre-run command (only SDO, heartbeat, NMT work)
81h	④	Reset node command
82h	⑤	Reset communication command

The second byte represents the node address of CANopen. If it is set to "0", it signifies a broadcast message that is applicable to all slave devices within the network.

Table 9-14 Status

	Initialization	**Pre-run**	**Run**	**Stop**
PDO			○	
SDO		○	○	
SYNC		○	○	
EMCY		○	○	
Boot-Up	○			
NMT		○	○	○

Note: ○ represents valid.

Example: If the SDO operation of the drive is turned on (drive node address is 1), a command word of 80h can be sent.

Frame format	**COB-ID**	**RTU**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Data format	00	0	80	01	-	-	-	-	-	-

9.2.3.4 NMT Error Control

NMT error control is mainly used to detect whether the devices in the network are online and their status including node protection/life protection and heartbeat. In practice, simultaneous life protection and heartbeat are prohibited, and the time of node protection/life protection and heartbeat should not be set too short to avoid increased network load.

(1) Node/lifetime protection

Node protection is that the NMT master periodically checks the NMT slaves' status via remote frames; lifetime protection is that the slaves indirectly monitor the status of the master via the interval of remote frames which are received originally to monitor the slave. Node protection follows a master-slave model, where each remote frame must be answered.

The objects associated with node/lifetime protection include the protection time 100Ch and the lifetime factor 100Dh. The value of 100Ch is the node protection remote frame interval in ms under normal conditions, and the product of 100Ch and 100Dh determines the latest time for host queries. Under normal conditions, node protection is achieved. Lifetime protection is activated when both node 100Ch and 100Dh are not 0 and a node protection request frame is received.

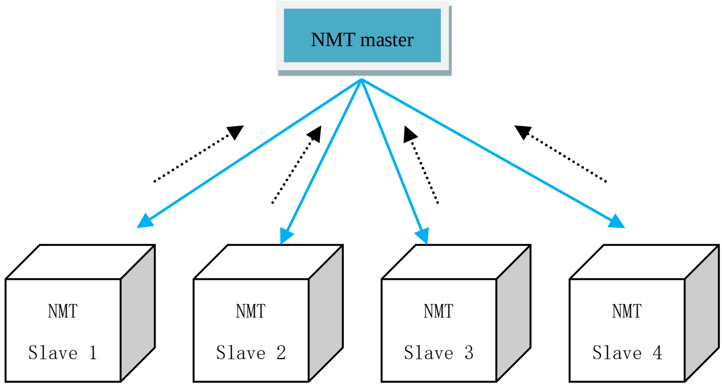


Figure 11-5 Link diagram

The NMT master sends the remote frame of node protection every 100Ch, and the slave must response, otherwise the slave is considered to be disconnected; if the slave does not receive the node protection remote frame within 100Ch × 100Dh, the master is considered to be disconnected.

The NMT master sends remote frames in the format shown in Table 9-15.

Table 9- 15 Remote frame messages of node protection

COB-ID	RTR
0x700+Node-ID	1

The response messages returned from the NMT slaves are shown in Table 9-16.

Table 9-16 Node protection response messages

COB-ID	RTR	Data
0x700+Node-ID	0	status word

Data segment is a one-byte status word with the data format shown in Table 9-17.

Table 9-17 Data segment description

Data bit	Description
bit7	Alternate "0" and "1" each time
bit6~0	4: in stop state 5: in running state 127: in pre-running state

(2) Heartbeat

Heartbeat is a producer-consumer model.

The CANopen device can send heartbeat messages according to the period set by the producer heartbeat interval object 1017h in ms. The node in the CAN network with the consumer heartbeat function monitors this producer according to the consumer time set by object 1016h and considers the node to be faulty once the producer heartbeat of the corresponding node is not received within the consumer heartbeat time range.

After configuring the producer heartbeat time interval 1017h, the node heartbeat function is activated and starts generating heartbeat messages. After configuring a valid subindex of consumer heartbeat 1016h, monitoring starts after a frame of heartbeat from the corresponding node is received.

Master sends heartbeat messages according to its producer time. If the slave of the monitoring master does not receive a heartbeat message within the object 1016h subindex time, the master is considered disconnected. The object 1016h subindex time ⩾ host producer time × 2, otherwise it causes the slave to mistakenly judge that the master is disconnected.

Each object in 1017h time of the slave sends a heartbeat message to the master that monitors the slave, and if the heartbeat message is not received within the consumer time, the slave is considered to be disconnected.

The heartbeat message format is shown in Table 9-18.

Table 9-18 Heartbeat message format

COB-ID	RTR	Data
0x700+Node-ID	0	status word

The data segment has only one byte, and the highest bit is fixed to "0".

Table 9-19 Data segment description

Data bit	Description
bit7	fixed to "0"
bit6~bit0	4: in stop state 5: in running state 127: in pre-running state

9.2.4 Service Data Object (SDO)

The Service Data Object (SDO) is linked to the object dictionary through object indexes and sub-indexes, through the object contents in the object dictionary can be read or partly modified if allowed via SDO.

9.2.4.1 SDO Transmission Mode

The SDO transmission follows the client-server mode, that is, the ask-and-answer mode, similar to free in serial communications. The SDO is initiated by the SDO client in the CAN bus network and answered by the SDO server. The data exchange between SDOs requires at least two CAN messages, and their CAN identifiers should not be the same. The transmission mode is shown in the following figure:

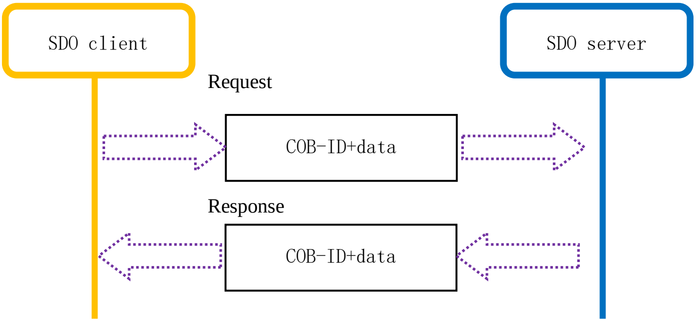


Figure 9-6 SDO client read and write the object dictionary in SDO server

9.2.4.2 SDO Transmission Format

SDO transmission is divided into object data transmission of no more than 4 bytes and higher than 4 bytes. The accelerated SDO transmission mode is used when it is not higher than 4 bytes, and the segmented transmission or block transmission mode is used when it is higher than 4 bytes. SD700 series drives only support accelerated SDO transmission mode. The SDO communication message composition: COB-ID + command code + index + subindex + data. The data segments are arranged in the "little-endian" mode where the lower bits are before the higher bits. SDO transmission message format is shown in Table 9-20.

Table 9-20 SDO transmission message

COB-ID	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
600h+Node-ID	Command word	Index		Sub-index	Data area			
580h+Node-ID		Index		Sub-index	Data area			

Example: If the data area needs to send or receive data 32-bit 0x11223344, it is arranged as 44 33 22 11.

(1) SDO accelerated writing transmission message

For reading and writing not higher than 4 bytes, accelerated SDO transmission is used. The transmission messages vary according to the inconsistency of reading/writing method and data length. The format of the accelerated SDO write message is shown in Table 9-21.

Table 9-21 Explanation of accelerated SDO message format

	COB-ID	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client →	600h+Node-ID	23H	Index		Subindex	Data			
		2BH				Data		-	-
		2FH				Data	-	-	-

<table>
<tr><td rowspan="2">Server
←</td><td rowspan="2">580h+Node-ID</td><td>60H</td><td rowspan="2">Index</td><td rowspan="2">Subindex</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>80H</td><td colspan="4">Stop code</td></tr>
</table>

Note:

1. "-" means that data is available but not considered. It is recommended to write 0 when writing data.

2. The servo drive currently supports the following command words:

Table 9-22 SDO write command word

Command	Description
2Fh	Write 1 byte
2Bh	Write 2 byte
23h	Write 4 byte

Example 1: If the slave Node-ID is 1 and use SDO to write the object 100Dh(00), which is 8 bits, and write data 64h to this object, the data command is sent as follows:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	601	2F	0D	10	00	64	-	-	-

If the parameter is written successfully, the returned data frame is:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	581	60	0D	10	00	-	-	-	-

Example 2: If the slave Node-ID is 1, and write the manufacturer parameter Pn500 [2003h(01)] with SDO, which is 16 bits, and the data 64h needs to be written to this object, the data command is sent:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	601	2B	05	20	01	64	00	-	-

If the parameter is written successfully, the returned data frame is:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	581	60	05	20	01	-	-	-	-

(2) SDO accelerated reading transmission messages

The SDO data reading is accelerated when the object message is not higher than 4 bytes. The format of the accelerated SDO reading message is shown in Table 9-23.

Table 9-23 Explanation of accelerated SDO message format

	COB-ID	0	1	2	3	4	5	6	7
Client →	600h+ Node-ID	40	Index		Sub-index	-	-	-	-
Server	580h+	43H	Index		Sub-	Data			

<table>
<tr><td rowspan="3">←</td><td rowspan="3">Node-ID</td><td>4BH</td><td rowspan="3"></td><td rowspan="3">index</td><td colspan="2">Data</td><td>-</td><td>-</td></tr>
<tr><td>4FH</td><td>Data</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>80H</td><td colspan="4">Stop code</td></tr>
</table>

Example 1: Slave Node-ID 1, read object 100Dh(00) with SDO, sends the following command:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	601	40	0D	10	-	-	-	-	-

In normal cases, the returned data frame is:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	581	4F	0D	10	00	00	-	-	-

Example 2: slave Node-ID 1, read manufacturer parameter P204 [2002h(05)] with SDO, and send the following command:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	601	40	02	20	05	-	-	-	-

If the drive electronic gear ratio is 16777216: 10000, that is, Pn204=16777216, then the data frame returned under normal conditions is:

Frame	COB-ID	0	1	2	3	4	5	6	7
Data format	581	4B	02	20	05	00	00	00	01

9.2.5 Process Data Object (PDO)

Process Data Object (PDO) are used to transmit real-time data and are the main data transmission mode in CANopen. Since PDO transmission does not require a response, and the PDO must be no longer than 8 bytes in length, the transmission is quite fast.

The PDO mapping configuration process is as follows:

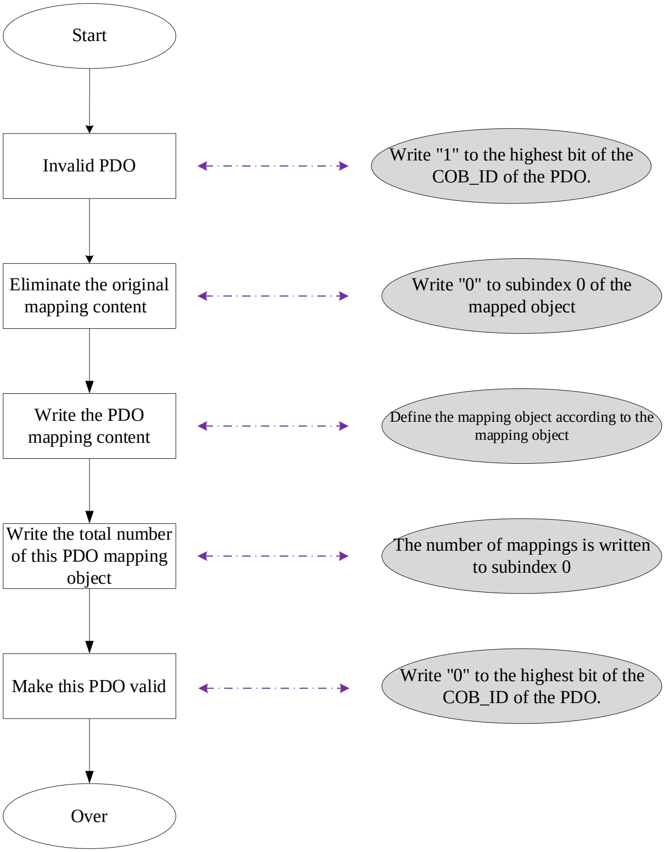


Figure 9-7 PDO mapping configuration process

(1) PDO transmission mode

PDO uses a production-consumption-end mode, where each network node can listen to messages from the transmitting node and also determines whether a message needs to be processed after it is received. PDO data can be done on a one-to-one or one-to-many basis. Each PDO message contains a transmit PDO (TxPDO) and a receive PDO (RxPDO), and its transmission mode is defined in the PDO communication parameter index. The transmission mode is shown below:

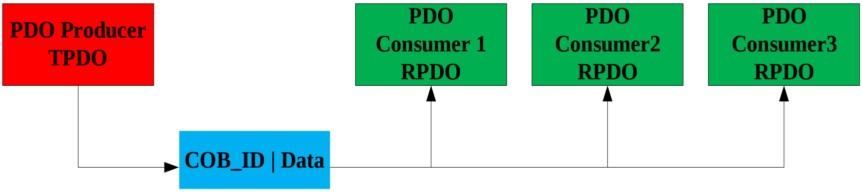


Figure 9-8 PDO transmission mode

(2) PDO

PDO can be divided into the receive PDO (RPDO) and transmit PDO (TPDO). PDO is determined by communication parameters and mapping parameters simultaneously to decide the way and content of transmission. This servo drive is designed with 4 RPDOs and 4 TPDOs to realize the data transmission of PDO, and the list of related objects is shown in Table 9-24.

Table 9-24 PDO list

Name		COB-ID	Communication object	Mapping
RPDO	RPDO1	200h+Node-ID	1400h	1600h
	RPDO2	300h+Node-ID	1401h	1601h
	RPDO3	400h+Node-ID	1402h	1602h
	RPDO4	500h+Node-ID	1403h	1603h
TPDO	TPDO1	180h+Node-ID	1800h	1A00h
	TPDO2	280h+Node-ID	1801h	1A01h
	TPDO3	380h+Node-ID	1802h	1A02h
	TPDO4	480h+Node-ID	1803h	1A03h

(3) PDO communication parameter

The COB-ID of the PDO contains control bits and identification data to determine the bus priority of this PDO. COB-ID is located on sub-index 01 of the communication parameters (RPDO: 1400h to 1403h; TPDO: 1800h to 1803h) and the highest bit determines whether this PDO is valid or not.

MSB **LSB**

31	30 0
0: on 1: off	1400h～1403h + Node-ID 1800h～1803h + Node-ID

Example: For the node with Node-ID 1, COB-ID is "80000201h" when RPDO is invalid, and writing "00000201h" to this COB-ID will activate RPDO1.

(4) PDO transmission type

The transmission type of PDO is located on sub-index 02 of the communication parameters (RPDO: 1400h~1403h; TPDO: 1800h~1803h).

Table 9- 25 PDO transmission type

Communication type	Synchronization		Asynchronization
	Cyclic	Non-cyclic	
0		○	
1~240	○	-	-

241~253	--		
254~255	-	-	○

When the transmission type of TPDO is 0, TPDO is sent if the mapping data is changed and a synchronization frame is received;

When the transmission type of TPDO is 1 to 240, TPDO is sent when the corresponding number of synchronization frames is received;

When the transmission type of TPDO is 254 or 255, TPDO is sent when the mapping data is changed or the event timer arrives;

When the output type of the RPDO is 0 to 240, update the latest data of this RPDO to the application whenever a synchronization frame is received;

When the transmission type of RPDO is 254 or 255, update the received data directly to the application.

(5) Inhibit time

The inhibit time is set for TPDO and stored in subindex 03 of the communication parameter (1800h to 1803h) to prevent the CAN network from being occupied by PDOs with lower priorities. The time unit of this parameter is 125us. After setting the value, the transmission interval of the same TPDO should not be shorter than the corresponding time of this parameter.

For example, if the inhibit time of TPDO1 is 16, the minimum transmission interval of TPDO1 is 2ms.

Cautions	
⚠	● The inhibit time should not be too short, otherwise bus overload may be caused when the data keep changing. Please set the inhibit time properly. Please set the inhibit time properly.

(6) Event timer

For TPDO with asynchronous transmission (transmission type 254 or 255), define an event timer on sub-index 05 of the communication parameter (1800h to 1803h). The event timer can also be seen as a trigger time (timer) that triggers the corresponding TPDO when the set time is reached.

(7) PDO mapping parameter

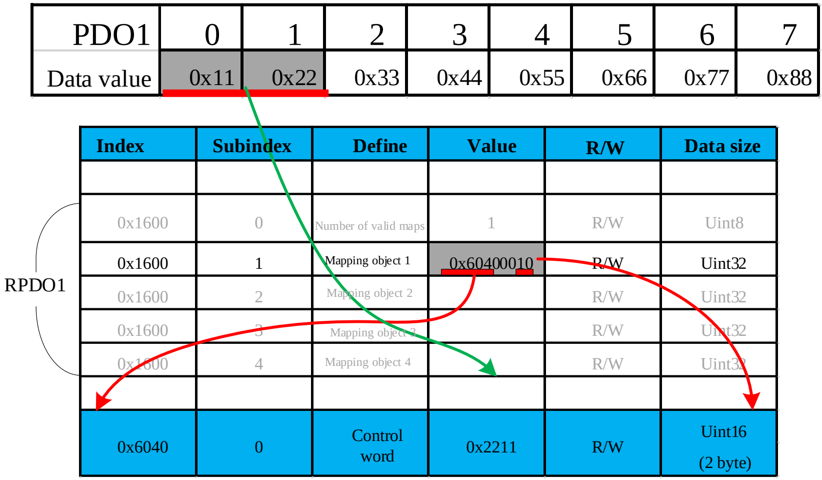
All PDO transmission data must be mapped to the corresponding index area through the object dictionary. During mapping, users need to configure indexes, sub-indexes, and mapping object lengths in the corresponding format. Each PDO data length cannot exceed 8 bytes for mapping one or more objects simultaneously. Index 0 records the number of objects mapped to the PDO, and sub-indexes 1 to 4 indicate the mapping content. The mapping parameters are defined as follows:

Table 9-26 PDO mapping parameter content definition

<table>
<tr><th>Bit</th><th>31</th><th>…</th><th>16</th><th>15</th><th>…</th><th>8</th><th>7</th><th>…</th><th>0</th></tr>
<tr><td>Definition</td><td colspan="3">Index</td><td colspan="3">Subindex</td><td colspan="3"><table><tr><th>Object length</th><th>Bit length</th></tr><tr><td>08h</td><td>8 bits</td></tr><tr><td>10h</td><td>16 bits</td></tr><tr><td>20h</td><td>32 bits</td></tr></table></td></tr>
</table>

Example:

RPDO1 mapping object 6040h

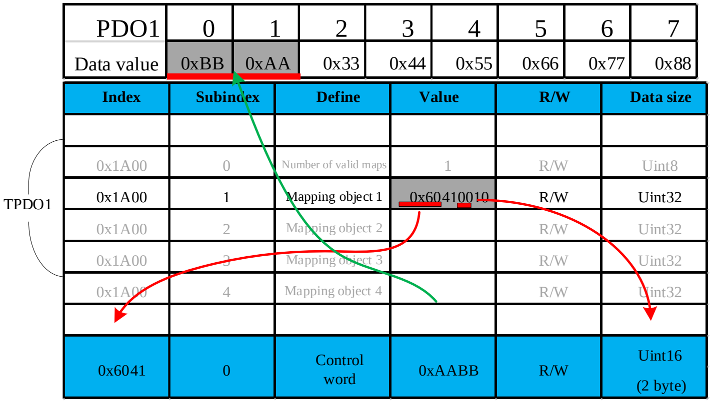


PDO1	0	1	2	3	4	5	6	7
Data value	0x11	0x22	0x33	0x44	0x55	0x66	0x77	0x88

Index	Subindex	Define	Value	R/W	Data size
0x1600	0	Number of valid maps	1	R/W	Uint8
0x1600	1	Mapping object 1	0x60400010	R/W	Uint32
0x1600	2	Mapping object 2		R/W	Uint32
0x1600	3	Mapping object 3		R/W	Uint32
0x1600	4	Mapping object 4		R/W	Uint32
0x6040	0	Control word	0x2211	R/W	Uint16 (2 byte)

Figure 9- 9 RPDO1 mapping

TPDO1 mapping object 6041h



PDO1	0	1	2	3	4	5	6	7
Data value	0xBB	0xAA	0x33	0x44	0x55	0x66	0x77	0x88

Index	Subindex	Define	Value	R/W	Data size
0x1A00	0	Number of valid maps	1	R/W	Uint8
0x1A00	1	Mapping object 1	0x60410010	R/W	Uint32
0x1A00	2	Mapping object 2		R/W	Uint32
0x1A00	3	Mapping object 3		R/W	Uint32
0x1A00	4	Mapping object 4		R/W	Uint32
0x6041	0	Control word	0xAABB	R/W	Uint16 (2 byte)

Figure 9- 10 TPDO1 mapping

9.2.6 Synchronization (SYNC)

The servo drive can not only synchronize the consumer, but also the producer. The objects can be synchronized are COB-ID (1005h) and cyclic period (1006h).

The second highest bit of the synchronization object COB-ID (1005h) determines whether the synchronization is activated or not:

MSB		**LSB**
31	**30**	**29 0**
0	0:OFF 1: ON	0x80

Similar to PDO transmission, the output of synchronization objects follows the producer-consumer mode. In a CANopen network, only one sends the synchronization object (SYNC), and the sender is the producer while the receiver is the consumer, and the transmission framework is shown in Figure 9-10.

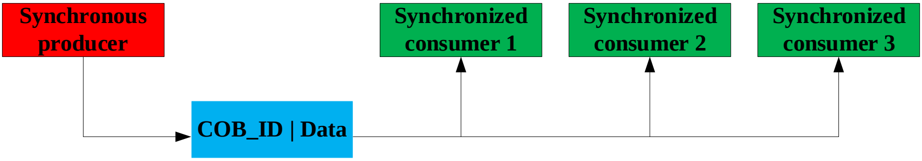


Figure 9-11 Synchronization transmission mode

The synchronization in CANopen is realized by sending control data to each slave with PDO. Each slave that receives control commands from the master only saves the commands temporarily, and only after all the slave commands are sent will the master send out a synchronization (SYNC) broadcast message, and all slaves that support synchronization transmission mode will execute the previously received control commands at the same time after they have received the synchronization (SYNC) message.

PDO synchronization transmission is closely linked to synchronization frames and its specific application is shown below:

Figure 9-27 PDO trigger method

Communication type	**Synchronization**		**Asynchronization**
	Cyclic	**Non-cyclic**	
0		○	
1~240	○	-	-
241~253	--		

254~255	-	-	○

When the transmission type of TPDO is 0, TPDO is sent if the mapping data is changed and a synchronization frame is received;

When the transmission type of TPDO is 1 to 240, TPDO is sent when the corresponding number of synchronization frames is received;

When the transmission type of TPDO is 254 or 255, TPDO is sent when the mapping data is changed or the event timer arrives;

When the output type of the RPDO is 0 to 240, update the latest data of this RPDO to the application whenever a synchronization frame is received;

When the transmission type of RPDO is 254 or 255, update the received data directly to the application.

9.2.7 Emergency (EMCY)

When a CANopen node fails, it sends an emergency message according to the table conversion mechanism. Emergency messages follow the producer-consumer model. After a node fault is sent, other nodes in the CAN network can choose to handle the fault. This servo driver only acts as an emergency message producer and does not process emergency messages from other nodes.

When a node fails, the drive updates the error register (1001h) and predefined error field (1003h) regardless of whether emergency messages are activated.

Users need to activate the emergency messages for use.

MSB	LSB
31	**30 0**
0: ON 1: OFF	0x80+Node-ID

The format of the emergency message sent by the servo drive is:

COB-ID	0	1	2	3	4	5	6	7
0x80+Node-ID	Error code		Error register	NA	Auxiliary byte			

Note: The error register is consistent with 1001h:

(1) The error code shall be consistent with the requirements of DS301, and the auxiliary byte shall be zero in case of abnormal communication.

(2) In case of an exception specified by the user, the error code is 0xFF00, and the auxiliary byte displays that specified code.

For example, enable emergency message on node 1 (Pn080=1).

(1) Node pre-running (turning on SDO running is valid)

Frame	COB-ID	0	1
Data format	00	80	01

Note: Frames mean remote frames.

(2) Activate the emergency message object 1014h, in which Bit31 is used to turn on /off the emergency message. Accordingly, the data sent by the upper computer is: (write data 0x00000081)

COB-ID	0	1	2	3	4	5	6	7
601H	23	14	10	00	81	00	00	00

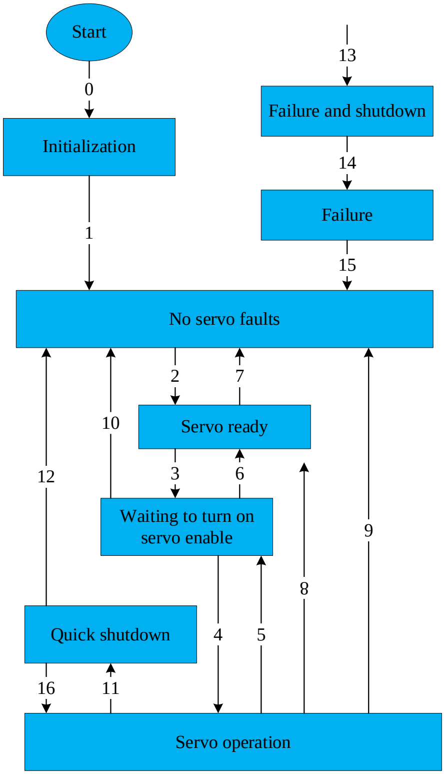
Note: Frames mean data frames.

(3) Use the monitoring code Un031(the communication address is 0xE031) to check whether the drive has activated emergency messages.

9.2.8 Servo Status

9.2.8.1 Servo Status

The SD700 CANopen drive is controlled according to the standard CiA402 protocol. The overall running status diagram is as follows:



Status in the figure above are described as follows:

CiA Status description table:

CiA status	Description
Initialization	The drive is initialized and the internal self-inspection is complete. Drive parameters cannot be set and drive does not run.
Servo no faults	The drive is fault-free and the drive parameters can be set.
Switch on	The drive is ready and the drive parameters can be set.
Wait to enable servo	The drive is waiting for servo to be enabled and drive parameters can be set.
Enable operation	The drive is running normally, a servo mode has been enabled, and the motor is powered. The drive parameters can be modified based on the specific mode.
Quick stop	Quick stop is activated and the drive is executing it. The drive parameters can be modified based on the specific mode.
Fault stop	Faults occur and drive is performing this function. Drive parameters can be modified based on the specific mode. The drive parameters can be modified based on the specific mode.
Fault	When the fault stop is completed and all functions of the drive are disabled, users can change the parameters of the corresponding drive to troubleshoot the fault.

	Example: for a resettable fault, run the control word 6040h=0x80 to reset the fault.

Control commands and status switching are shown in the following table:

CiA402 status switching		6040h (control word)	6041h (status word) bit 0~9[1]
0	Power-on → Initialization	Natural transition, no control commands required.	0x0000
1	Initialization → Servo no faults	Natural transition, no control commands required. If an error occurs during the initialization, jump to Step 13	0x0250
2	Servo no fault → Switch on	0x06	0x0231
3	Switch on → Wait to enable servo	0x07	0x0233
4	Wait to enable servo → Enable operation	0x0F	0x0237
5	Enable operation → Wait to enable servo	0x07	0x0233
6	Wait to enable servo → Switch on	0x06	0x0231
7	Switch on → Servo no faults	0x00	0x0250
8	Enable operation → Switch on	0x06	0x0231
9	Enable operation → Servo no faults	0x00	0x0250
10	Wait to enable servo → Servo no faults	0x00	0x0250
11	Enable operation → Quick stop	0x02	0x0217
12	Quick stop → Servo no faults	No need any control commands, natural transition after the quick stop is completed.	0x0250
13	→Fault stop	No control command is required and the system switches to the fault stop state in face of faults.	0x021F
14	Fault stop→Fault	No need any control command, natural transition and self-switching after the fault stop is completed.	0x0218
15	Fault→Servo no faults	0x80 fault reset	0x0250
16	Quick stop→Enable operation	Send 0x0F when stop is completed.	0x0237

Note: [1] Bit10~bit15 of 6041h status word is related to the running state of each servo mode, so it is represented by "0".

9.2.8.2 Status Word 6041h

Object 6041h		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6041_h**					
Name	**Status Word**					
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535	
Mapping	Y	**Access**	RO	**Factory setting**	0	
Function description	Bit definition of a status word:					

Bit	**Name**	**Bit definition**
0	Switch on	1: valid 0: invalid
1	Wait to enable servo	1: valid 0: invalid
2	Enable operation	1: valid 0: invalid
3	Fault	0: no faults 1: fault
4	Power on the main circuit	1: valid 0: invalid
5	Quick stop	0: valid 1: invalid
6	Power-on and running allowed	1: valid 0: invalid
7	Warning	1: valid 0: invalid
8	Factory-defined	
9	Remote control	0: non-CANopen mode 1: CANopen remote control mode
10	Target reached	Speed mode: 0: target speed is not reached 1: target speed reached Position mode: 0: target position is not 1: target position is reached
11	Software internal position exceeds the limit	0: position command or feedback does not reach the internal position limit of the software 1: position command or feedback reaches the internal position limit of the software
12~13	Relate to control mode	
14	NA	
15	Home return completed	0: home return is not performed or not completed 1: home return is completed and the reference point has been found

9.2.8.3 Stop Mode

SD700 CANopen supports the following stop methods:

(1) Disable the servo to stop

When servo is disabled OFF, servo stops running.

(2) Servo fault stop

When servo fault or warning occurs, servo automatically enters stop status.

(3) Quick stop

In the non-fault state, if the control word 6040h:bit2=0 , quick stop function is performed and the stop method is selected via 605Ah.

<table>
<tr><th>Object 605Ah</th><th colspan="4"></th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>$605A_h$</td><td colspan="8"></td></tr>
<tr><td>Name</td><td colspan="9">Quick Stop Option Code</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int16</td><td colspan="3">Data range</td><td colspan="3">0~2</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td colspan="3">Factory setting</td><td colspan="3">2</td></tr>
<tr><td>Function description</td><td colspan="9">
<table>
<tr><th>Display</th><th>Control mode</th></tr>
<tr><td>0</td><td>Free stop, and free running after free stop is completed.</td></tr>
<tr><td>1</td><td>Ramp stop at deceleration speed set at 6084h (hm: 609Ah), and free running after stop is completed.</td></tr>
<tr><td>2</td><td>Ramp stop at deceleration speed set at 6085h, and free running after stop is completed.</td></tr>
</table>
</td></tr>
</table>

(4) Halt stop

When the control word 6040h.bit8=1 in the non-fault state, stop will be halted, and the stop mode is selected via 605Dh.

<table>
<tr><th>Object 605Dh</th><th colspan="4"></th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>$605D_h$</td><td colspan="8"></td></tr>
<tr><td>Name</td><td colspan="9">Halt Stop Option Code</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int16</td><td colspan="3">Data range</td><td colspan="3">1~3</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td colspan="3">Factory setting</td><td colspan="3">1</td></tr>
<tr><td>Function description</td><td colspan="9">
<table>
<tr><th>Display</th><th>Control mode</th></tr>
<tr><td>1</td><td>Ramp stop as setting at 6084h/6087h (hm:609Ah), and position is locked after stop is completed.</td></tr>
<tr><td>2</td><td>Ramp stop as setting at 6085h/6087h, and position is locked after stop is completed.</td></tr>
<tr><td>3</td><td>Emergency torque stop, and position is locked after stop is completed.</td></tr>
</table>
</td></tr>
</table>

9.2.8.4 Servo Running Mode

SD100 CANopen supports 5 servo running modes.

Servo operation modes can be set by object dictionary 6060h. The current running mode of the servo can be viewed through object dictionary 6061h.

(1) Mode selection at 6060h

Object 6060h		PP	PV	PT	HM	IP

<table>
<tr><td>Index</td><td>6060$_h$</td><td colspan="4"></td></tr>
<tr><td>Name</td><td colspan="5">Operation Modes</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int8</td><td>Data range</td><td>0~7</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RW</td><td>Factory setting</td><td>1</td></tr>
<tr><td>Function description</td><td colspan="5">Set servo running mode:
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>0</td><td>NA</td></tr>
<tr><td>1</td><td>Profile position mode (PP)</td></tr>
<tr><td>3</td><td>Profile velocity mode (PV)</td></tr>
<tr><td>4</td><td>Profile torque mode (PT)</td></tr>
<tr><td>6</td><td>Homing mode (HM)</td></tr>
<tr><td>7</td><td>Interpolation mode (IP)</td></tr>
</table></td></tr>
</table>

(2) Mode display 6061h

<table>
<tr><th>Object 6061h</th><th colspan="3"></th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>6061$_h$</td><td colspan="7"></td></tr>
<tr><td>Name</td><td colspan="8">Operation Display Modes</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int8</td><td colspan="4">Data range</td><td>0~7</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RO</td><td colspan="4">Factory setting</td><td>0</td></tr>
<tr><td>Function description</td><td colspan="8">
<table>
<tr><th>Display</th><th>Control mode</th></tr>
<tr><td>0</td><td>NA</td></tr>
<tr><td>1</td><td>Profile position mode (PP)</td></tr>
<tr><td>3</td><td>Profile velocity mode (PV)</td></tr>
<tr><td>4</td><td>Profile torque mode (PT)</td></tr>
<tr><td>6</td><td>Homing mode (HM)</td></tr>
<tr><td>7</td><td>Interpolation mode (IP)</td></tr>
</table></td></tr>
</table>

9.2.8.5 Conversion Factor Setting

Encoder unit: drive drives the motor directly, and position feedback of the motor is pulse quantity, and the encoder unit is the pulse unit.

Command unit: command units and encoder units are converted via gear ratio $\frac{\text{Pn204}}{\text{Pn206}}$ and gear ratio $\frac{\text{0x6091:01}}{\text{0x6091:02}}$.

If the encoder unit and command unit are not the same, it will cause the motor operation abnormality. Therefore, before operating the servo drive, the conversion factor must be set correctly, through which the proportional relationship between the two units is established as follows:

$$\text{6063h}=\text{6064h}\times\left(\frac{\text{6091:01h}}{\text{6091:02h}}\right)\times\left(\frac{\text{Pn204}}{\text{Pn206}}\right)$$

Example: $\frac{Pn204}{Pn206}=\frac{8388608}{10000}$, $\frac{6091:01h}{6091:02h}=\frac{2}{1}$.

When 6064h = 10000 (command unit)， $6063h=6064h\times\left(\frac{6091:01h}{6091:02h}\right)\times\left(\frac{Pn204}{Pn206}\right)=16777216$ (encoder unit).

Object 6091h					**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6091_h**								
Name	Gear Ratio								
Object structure	ARR	**Data type**	Uint32	**Data range**	Uint32				
Mapping	Y	**Access**	RW	**Factory setting**	-				
Function description	Position factor is used to establish a user-specified proportional relationship between load displacement and motor displacement: Motor displacement (motor unit) = Load displacement(user unit) × Position factor The setting of the position factor is related to the mechanical reduction ratio, the parameters related to the mechanical dimensions, and the motor resolution. The calculations are as follows: $\text{Position factor}=\frac{\text{motor resolution}\times\text{gear ratio}}{\text{load feeding}}$								

Subindex	**00h**				
Name	**Subindex Number**				
Object structure	VAR	**Data type**	Uint8	**Data range**	2
Mapping	Y	**Access**	RO	**Factory setting**	2

Subindex	**01h**				
Name	**Motor Resolution**				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	Y	**Access**	RW	**Factory setting**	1

Subindex	**02h**	

Name	**Shaft Resolution**				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	Y	**Access**	RW	**Factory setting**	1

9.2.9 Control Mode

9.2.9.1 Profile Position Mode (PP)

When in profile position mode, the master sends a dictionary of relevant objects such as the required target position (absolute or relative), velocity, acceleration and deceleration of the position profile to the servo drive, which generates the target profile command based on the relevant data and commands received.

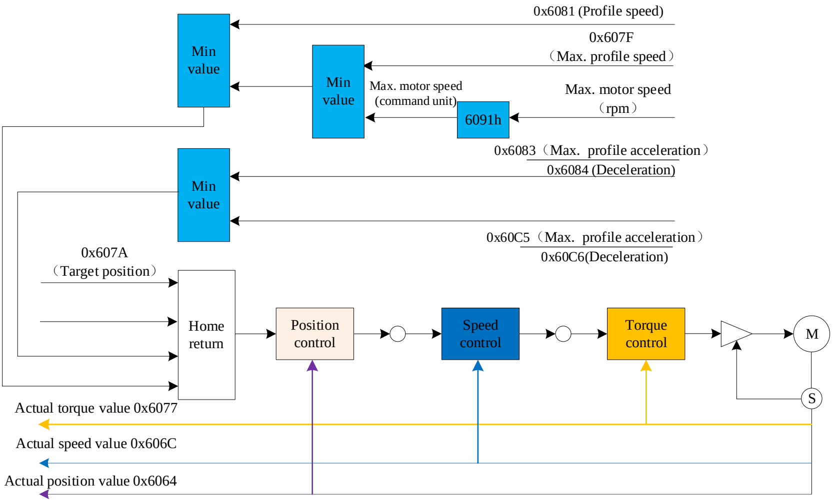
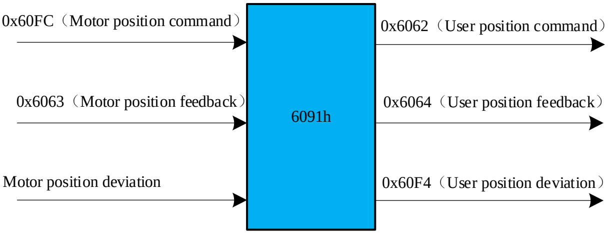


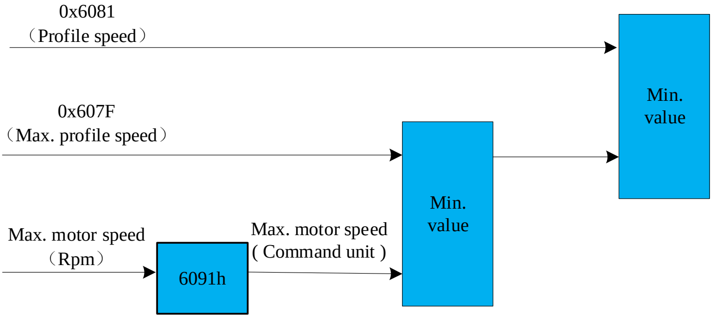
Figure 9-12 Profile position mode control diagram

The conversion of user and encoder unit in profile position mode via 0x6091 is illustrated as follows:



$0x6091(\text{gear ratio})=\frac{0x6091:01}{0x6091:02}$ The relationship between 0x6063 (motor position feedback) and 0x6064 (user position feedback): $$0x6063(\text{encoder unit})=0x6064(\text{command unit})\times\frac{0x6091{:}01}{0x6091{:}02}\times\left(\frac{Pn204}{Pn206}\right)$$

The relationship of 0x6081 (profile speed), 0x607F (user max. speed) and motor max. speed after conversion is as follows:



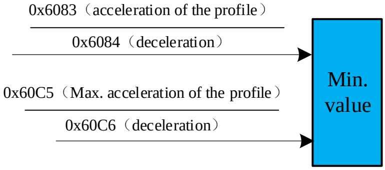
The relationship between Motor speed (rpm) and load shaft speed (command unit/s):

$$\text{Motor speed}(\text{rpm})=\frac{\text{load shaft speed}\times\dfrac{0x6091{:}01}{0x6091{:}02}}{\text{encoder resolution}}\times 60$$

Example: The gear ratio is set to 1:1, and a 23-bit motor is used.

$$\text{Motor speed} = 500\text{rpm}\big(0x6081(\text{load shaft speed})\big) = 500\times\frac{8388608}{60}=69905066(\text{command unit / s})$$

The relationship between $\frac{0x6083}{0x6084}$ (profile acceleration/deceleration) and $\frac{0x60C5}{0x60C6}$ (max. profile acceleration/deceleration) is as follows:



Example: The gear ratio is set to 1:1, and a 23-bit motor is used.

$$\text{Motor acc./dec.} = 500\text{rpm/s}(\text{load shaft speed}) = 500\times\frac{8388608}{60}=69905066\left(\text{command unit / s}^2\right)$$

Related object dictionaries:

Control word 6040h		
Bit	**Name**	**Description**

0	Switch on and servo ready	0: invalid; 1: valid
1	Enable voltage	0: invalid; 1: valid
2	Quick stop	0: valid; 1: invalid
3	Enable operation	0: invalid; 1: valid
4	New set-point (New target position)	Rising edge triggers a new target position
5	Change setting immediately	0: non-immediate change; 1: immediate change
6	Abs/Rel	0: target position is an absolute position command 1: target position is a relative position command

Status word 6041h		
Bit	**Name**	**Description**
10	Target reached	0: target position not reached 1: target position reached
12	Change target position (Set point acknowledge)	0: target position changeable; 1: target position unchangeable
13	Following error	0: no excessive position deviation fault 1: excessive position deviation fault
15	Home return	0: home return not completed 1: home return completed

Index	**Subindex**	**Name**	**R/W**	**Data**	**Unit**	**Setting**
0x603F	00$_h$	Error code	RO	UINT16	-	0~65535
0x6040	00	Control word	RW	UINT16	-	0~65535
0x6041	00	status word	RO	UINT16	-	0~65535
0x6060	00	Running mode	RW	INT8	-	0~10
0x6061	00	Mode display	RO	INT8	-	0~10
0x6062	00	Position command	RO	DINT32	Command unit	-
0x6063	00	Motor position feedback	RO	INT32	Encoder unit	-

0x6064	00	User position feedback	RO	INT32	Command unit	-
0x606C	00	Real speed feedback	RO	INT32	Command unit/s	-
0x607A	00	Target position	RW	INT32	Command unit	-2^{31}~$(2^{31}-1)$
0x6081	00	Profile velocity	RW	UINT32	Command unit/s	0~$(2^{32}-1)$
0x6083	00	Acceleration	RW	UINT32	Command unit/s^2	0~$(2^{32}-1)$
0x6084	00	Deceleration	RW	UINT32	Command unit/s^2	0~$(2^{32}-1)$

The following table shows the steps for setting up the profile position running mode:

Item	Step	Parameter	Status word (6041h)
Profile position parameter assignment	0	607Ah=10000	0x0250
	1	6081h=1000	0x0250
	2	6083h=200	0x0250
	3	6084h=200	0x0250
Control mode switching	4	6060h= 0x01	0x0250
Servo enabling	5	6040h= 0x06	0x0231
	6	6040h= 0x07	0x0233
	7	6040h= 0x0F	0x0637
Absolute/relative position selection	8	6040h Bit6 set 1 (relative position)	0x0637
Position command triggering	9	6040hBit4 set 1 (rising edge)	0x1237
Positioning completed	10	6041h Bit10 set 1	0x0637
Bit reset triggering for next use	11	6040hBit4 reset	0x0637

Description of control word 6040h and status word 6041h in profile position mode:

Object 6040h		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6040$_h$**					
Name	**Control word**					
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535	

Mapping	Y	**Access**	RW	**Factory setting**	0

Function description

Bit definition of the control word:

Bit	**Description**	**Bit definition**
0	Switch on	0: invalid; 1: valid
1	Enable voltage	0: invalid; 1: valid
2	Quick stop	1: invalid; 0: valid
3	Enable operation	0: invalid; 1: valid
4	Enable the new position command	0→1: when there is a new segment of position command to be changed, whether it is valid or not is determined by the servo status; 1→0: change 6041h: bit12 from 1to 0, whether success is determined by servo status
5	Position command (change mode)	0: non-immediate change; 1: immediate change
6	Position command (type)	0: 607Ah indicates an absolute position command; 1: 607Ah indicates a relative position command
7	Fault reset	bit7 rising edge is valid; bit7 is held to 1. All other control commands are invalid
8	Halt	0: invalid; 1: valid
9~10	NA	-
11~15	Factory-defined	-

Note: Each bit in the control word needs to be used together with other bits to form a control command.

Object 6041h				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6041$_h$**							
Name	**Status Word**							
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535			
Mapping	Y	**Access**	RO	**Factory setting**	0			
Function description	Bit definition of a status word:							

Bit	**Description**	**Bit definition**
0	Switch on	1: valid 0: invalid
1	Wait to enable servo	1: valid 0: invalid
2	Enable operation	1: valid 0: invalid
3	Fault	0: no faults 1: fault
4	Enable voltage	1: valid 0: invalid
5	Quick stop	0: valid 1: invalid
6	Power-on and running allowed	1: valid 0: invalid
7	Warning	1: valid 0: invalid
8	Factory-defined	
9	Remote control	0: non-CANopen mode 1: CANopen remote control mode
10	Target reached	0: target position is not 1: target position is reached
11	Software internal position exceeds the limit	0: position command or feedback does not reach the internal position limit of the software 1: position command or feedback reaches the internal position limit of the software
12	Position command change signal	0: new positions allowed; 1: new position not allowed
13	Position deviation status	0: position deviation within 6065h range; 1: position deviation outside 6065h range

	14	NA	-
	15	Home return completed	0: home return is not performed or not completed 1: home return is completed and the reference point has been found

When running in the profile position mode, there are two ways to change the commands, namely, immediate change and non-immediate change. The specific process of implementing these two ways is explained below.

(1) Absolute position command or relative position command, immediate change

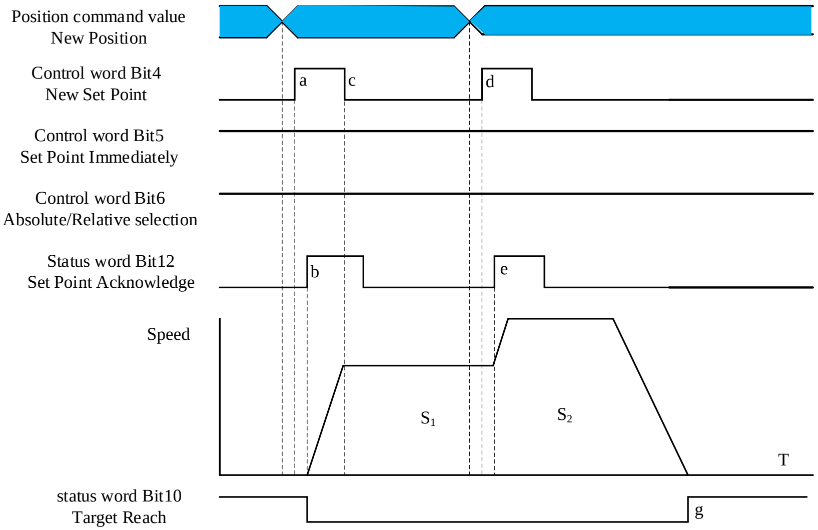


Figure 9-13 Timing sequence of relative position command value in immediate change mode

0x6040: bit5=1 immediate change mode, run the 1st stage S1 position command, and before its completion, 0x6040: bit4 and then bit12 are changed into 0 from 1, this means new position command S2 needs to be changed. When 0x6040: bit4 and then bit 12 are changed into 1 from 0, that means new position command is changed and will be performed immediately.

0x6040: bit6=1 relative position command, when the 2nd segment position command is completed, the total displacement command = 1st segment 0x607A target position + 2nd segment 0x607A target position.

0x6040: bit6=0 absolute position command, when the 2nd segment position command is completed, the total displacement command = 2nd segment 0x607A target position.

Running steps corresponding to the order shown in Figure 9-13 are shown in the following table:

Step	Control word (6040h)	Status word (6041h)	Description (relative position mode)
1	0x0006	0x1231	No new commands can be received, servo ready.
2	0x0007	0x1233	No new commands can be received, the servo is ready and waiting to enable the servo.
3	0x006F	0x0637	New command can be received, servo enabled. (Note 1: 6040h: bit5=1 means the position command is changed immediately, bit6=1 means it is a relative position command) (Note 2: At this time 6041h: bit10=1 since the initial target position is 0, target position is reached by default)
4	0x007F	0x1237	The servo has received the profile target position (607Ah), the profile target running speed (6081h), the profile acceleration (6083h), and the profile deceleration (6084h), and runs them immediately.
5	If there are no new position commands to be changed immediately, proceed to step 6 and wait for the end. If there is a new position command that needs to be changed immediately, proceed to step 7.		
6	0x007F	0x1637	6041h: bit10=1 target position is reached and the running is over.
7	0x006F	0x0237	6040h: bit10 changed into 0 from 1, and then 6041h: bit12 changed into 0 from 1, a new position command can be received.
8	0x007F	0x1237	The servo has received a new position command, and immediately changes and runs the relevant position command, cycling from step 5. (Note: If there are only two segment commands: relative position target = 1st segment relative position + 2nd segment

			relative position)

Step	Control word (6040h)	Status word (6041h)	Description (absolute position mode)
1	0x0006	0x1231	No new commands can be received, servo ready.
2	0x0007	0x1233	No new commands can be received, the servo is ready and waiting to enable the servo.
3	0x002F	0x0637	New command can be received, servo enabled. (Note 1: 6040h: bit5=1 means the position command is changed immediately, bit6=1 means it is an absolute position command) (Note 2: At this time 6041h: bit10=1 since the initial target position is 0, target position is reached by default)
4	0x003F	0x1237	The servo has received the profile target position (607Ah), the profile target running speed (6081h), the profile acceleration (6083h), and the profile deceleration (6084h), and runs them immediately.
5	If there are no new position commands to be changed immediately, proceed to step 6 and wait for the end. If there is a new position command that needs to be changed immediately, proceed to step 7.		
6	0x003F	0x1637	6041h: bit10=1 target position is reached and the running is over.
7	0x002F	0x0237	6040h: bit10 changed into 0 from 1, and then 6041h: bit12 changed into 0 from 1, a new position command can be received.
8	0x003F	0x1237	The servo has received a new position command, and immediately changes and runs the relevant position command, cycling from step 5. (Note: If there are only two segment

			commands: absolute position target = 2nd segment absolute position)

(2) Absolute position command or relative position command, non-immediate change

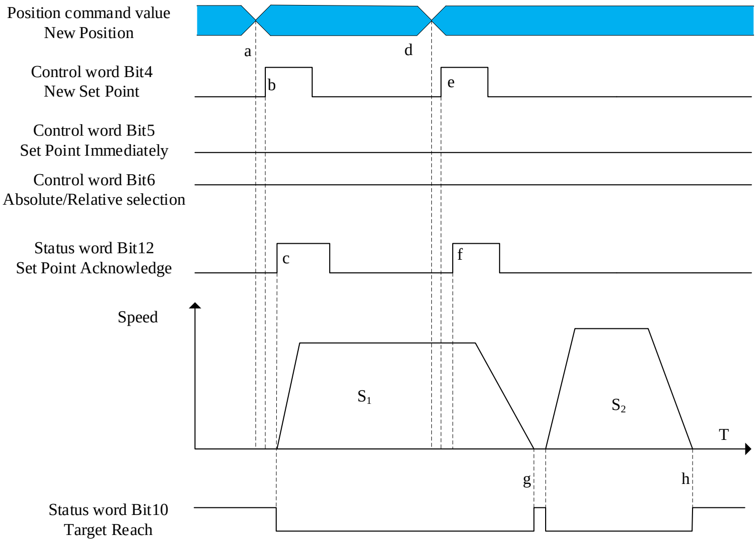


Figure 9-14 Timing sequence of relative position command value in non-immediate change mode

0x6040: bit5=1 immediate change mode, run the 1st segment S_1 position command, 0x6040: bit4 and then bit12 are changed into 0 from 1 before the command is not finished, it means that there is a new position command S_2 needs to be changed. When 0x6040: bit4 and then bit12 are changed into 1 from 0, it means that the new position command has been changed, but it is necessary to wait until the 1st segment position command is finished before running the 2nd segment position command.

Running steps corresponding to the order shown in Figure 9-14 are shown in the following table:

Step	Control word (6040h)	Status word (6041h)	Description (relative position mode)
1	0x0006	0x1231	No new commands can be received, servo ready.
2	0x0007	0x1233	No new commands can be received, the servo is ready and waiting to enable the servo.
3	0x004F	0x0637	New command can be received, servo enabled. (Note 1: 6040h: bit5=0 means the position command is not changed immediately, bit6=1 means it is a

			relative position command) (Note 2: At this time 6041h: bit10=1 since the initial target position is 0, target position is reached by default)
4	0x005F	0x1237	The servo has received the profile target position (607Ah), the profile target running speed (6081h), the profile acceleration (6083h), and the profile deceleration (6084h), and runs them immediately.
5	If there is no new position command, proceed to step 6 and wait for the end. If there is a new position command, proceed to step 7.		
6	0x005F	0x1637	6041h: bit10=1 target position is reached and the running is over.
7	0x004F	0x0237	6040h: bit10 changed into 0 from 1, and then 6041h: bit12 changed into 0 from 1, a new position command can be received.
8	0x005F	0x1237	The servo has received a new position command, and runs the next command after the 1st segment command is over, cycling from step 5. (Note: If there are only two segment commands: relative position target = 1st segment relative position + 2nd segment relative position).

Step	**Control word (6040h)**	**Status word (6041h)**	**Description (absolute position mode)**
1	0x0006	0x1231	No new commands can be received, servo ready.
2	0x0007	0x1233	No new commands can be received, the servo is ready and waiting to enable the servo.
3	0x000F	0x0637	New command can be received, servo enabled. (Note 1: 6040h: bit5=0 means the position command is not changed immediately, bit6=0 means it is an absolute position command.) (Note 2: At this time 6041h: bit10=1 since the initial

			target position is 0, target position is reached by default.)
4	0x001F	0x1237	The servo has received the profile target position (607Ah), the profile target running speed (6081h), the profile acceleration (6083h), and the profile deceleration (6084h), and runs them immediately.
5	If there is no new position command, proceed to step 6 and wait for the end. If there is a new position command, proceed to step 7.		
6	0x001F	0x1637	6041h: bit10=1 target position is reached and the running is over.
7	0x000F	0x0237	6040h: bit10 changed into 0 from 1, and then 6041h: bit12 changed into 0 from 1, a new position command can be received.
8	0x001F	0x1237	The servo has received a new position command but will not run it immediately, and it will run the next command after the 1st segment command is over, cycling from step 5. (Note: If there are only two segment commands: absolute position target = 1st segment absolute position + 2nd segment absolute position).

9.2.9.2 Profile Velocity Mode (PV)

In profile velocity mode, the master transmits the required target velocity, acceleration time and deceleration time to the servo drive, which performs the speed and torque adjustment.

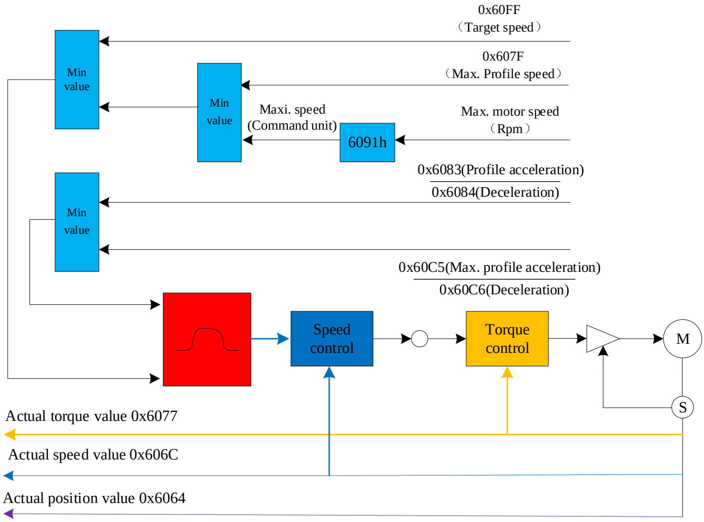
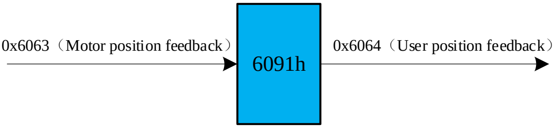


Figure 9-15 Profile velocity mode control diagram

The conversion of user and encoder unit in profile velocity mode via 0x6091 is illustrated as follows:

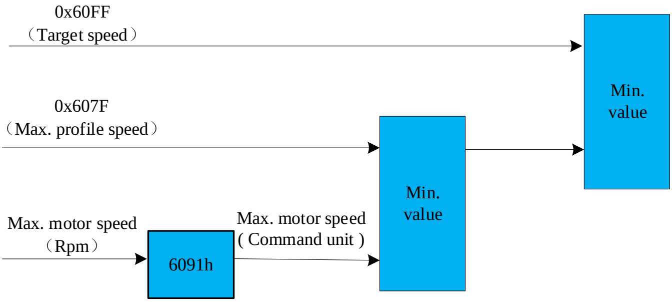


$$0x6091(\text{gear ratio})=\frac{0x6091:01}{0x6091:02}$$

The relationship between 0x6063 (motor position feedback) and 0x6064 (user position feedback):

$$0x6063(\text{encoder unit})=0x6064(\text{command unit})\times\frac{0x6091:01}{0x6091:02}\times\left(\frac{Pn204}{Pn206}\right).$$

The relationship of 0x60FF (target speed), 0x607F (user max. speed) and motor max. speed after conversion is as follows:



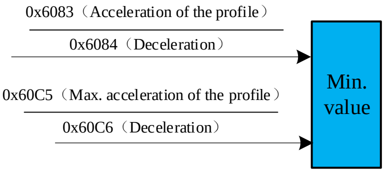
The relationship between motor speed (rpm) and load shaft speed (command unit/s):

$$\text{Motor speed}(\text{rpm}) = \frac{\text{load shaft speed} \times \frac{\text{0x6091:01}}{\text{0x6091:02}}}{\text{encoder resolution}} \times 60$$

Example: the gear ratio is set to 1:1, and a 23-bit motor is used.

$$\text{Motor speed = 500rpm}\left(\text{0x60FF}\left(\text{load shaft speed}\right)\right) = 500 \times \frac{8388608}{60} = 69905066\left(\text{command unit / s}\right)$$

The relationship between $\frac{\text{0x6083}}{\text{0x6084}}$ (profile acceleration/deceleration) and $\frac{\text{0x60C5}}{\text{0x60C6}}$ (max. profile acceleration/deceleration speed) is as follows:



Example: The gear ratio is set to 1:1, and a 23-bit motor is used.

$$\text{Motor acc./dec. = 500rpm/s}\left(\text{load shaft speed}\right) = 500 \times \frac{8388608}{60} = 69905066\left(\text{command unit / s}^2\right)$$

Related object dictionaries:

Index	Subindex	Name	Read/Write	Data	Unit	Setting
0x603F	00_h	Error code	RO	UINT16	-	0~65535
0x6040	00_h	Control word	RW	UINT16	-	0~65535
0x6041	00_h	Status word	RO	UINT16	-	0~65535
0x6060	00_h	Running mode	RW	INT8	-	0~7
0x6061	00_h	Mode display	RO	INT8	-	0~7
0x606C	00_h	Real speed feedback	RO	INT32	Command unit/s	-
0x607F	00_h	Maximum profile speed	RW	UINT32	Command unit/s	0~(2^{32}-1)
0x6083	00_h	Acceleration	RW	UINT32	Command	0~(2^{32}-1)

					unit/s^2	
0x6084	00$_h$	Deceleration	RW	UINT32	Command unit/s^2	0~(2^{32}-1)
0x60FF	00$_h$	Target speed	RW	INT32	Command unit/s	-2^{31}~(2^{31}-1)

Note: The speed limit value is determined by the smaller value between 0x607F and the maximum motor speed.

The operating procedure for the profile velocity mode is shown in the following table:

Item	**Step**	**Parameter input**	**Status word display (6041h)**
Profile velocity parameter assignment	1	6083h=200	0x1250
	2	6084h=200	0x1250
	3	60FFh=10000	0x1250
Control mode selection	4	6060h= 0x03	0x1250
Servo enabling	5	6040h= 0x06	0x1231
	6	6040h= 0x07	0x1233
	7	6040h= 0x0F	0x0637

Description of control word 6040h and status word 6041h in the profile velocity mode:

Object 6040h		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6040$_h$**					
Name	**Control word**					
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535	
Mapping	Y	**Access**	RW	**Factory setting**	0	

<table>
<tr>
<td>Function description</td>
<td>Bit definition of the control word:
<table>
<tr><th>Bits</th><th>Description</th><th>Bit definition</th></tr>
<tr><td>0</td><td>Switch on</td><td>0: invalid; 1: valid</td></tr>
<tr><td>1</td><td>Enable voltage</td><td>0: invalid; 1: valid</td></tr>
<tr><td>2</td><td>Quick stop</td><td>1: invalid; 0: valid</td></tr>
<tr><td>3</td><td>Enable operation</td><td>0: invalid; 1: valid</td></tr>
<tr><td>4~6</td><td>NA</td><td></td></tr>
<tr><td>7</td><td>Fault reset</td><td>bit7 rising edge is valid;
bit7 is held to 1, and all other control commands are invalid</td></tr>
<tr><td>8</td><td>Halt</td><td>0: invalid; 1: valid</td></tr>
<tr><td>9~10</td><td>NA</td><td></td></tr>
<tr><td>11~15</td><td>Factory-defined</td><td></td></tr>
</table>
Note: Each bit in the control word needs to be used together with other bits to form a control command.</td>
</tr>
</table>

Object 6041h		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6041$_h$**					
Name	**Status word**					
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535	
Mapping	Y	**Access**	RO	**Factory setting**	0	
Function description	Bit definition of a status word:					

Bit	**Description**	**Bit definition**
0	Switch on	1: valid 0: invalid
1	Wait to enable servo	1: valid 0: invalid
2	Enable operation	1: valid 0: invalid
3	Fault	0: no faults 1: fault
4	Enable voltage	1: valid 0: invalid
5	Quick stop	0: valid 1: invalid
6	Power-on and running allowed	1: valid 0: invalid
7	Warning	1: valid 0: invalid
8	Factory-defined	
9	Remote control	0: non-CANopen mode 1: CANopen remote control mode
10	Target reached	0: target speed is not reached 1: target speed reached
11	Software internal position exceeds the limit	0: position command or feedback does not reach the internal position limit of the software 1: position command or feedback reaches the internal position limit of the software
12	Zero-speed signal	0: user speed is non- zero; 1: user speed is zero
13~14	NA	

	15	Home return completed	0: home return is not performed or not completed 1: home return is completed and the reference point has been found

In profile velocity mode, the velocity command is changed immediately, and its timing sequence diagram is shown in Figure 9-16.

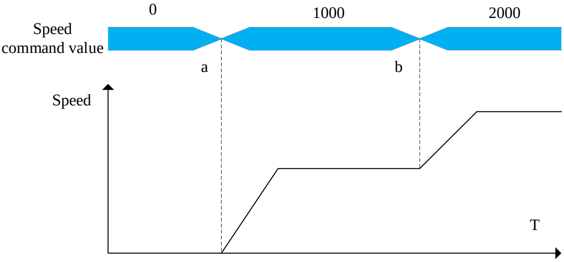


Figure 9-16 Timing sequence for profile velocity mode operation

Running steps corresponding to the order shown in Figure 9-16 are shown in the below:

Step	Item	Operation
1	Speed command giving	After the speed command is given, the servo-controlled motor runs at the set speed
2	Speed command change	After the speed command changes, the servo-controlled motor changes speed to the set speed

9.2.9.3 Profile Torque Mode (PT)

In profile torque mode, the master sends the target torque command 6071h and torque ramp constant 6087h to the servo drive, and the torque regulator is performed internally by the servo drive. When the speed reaches the maximum speed limit, it will enter the speed regulation phase.

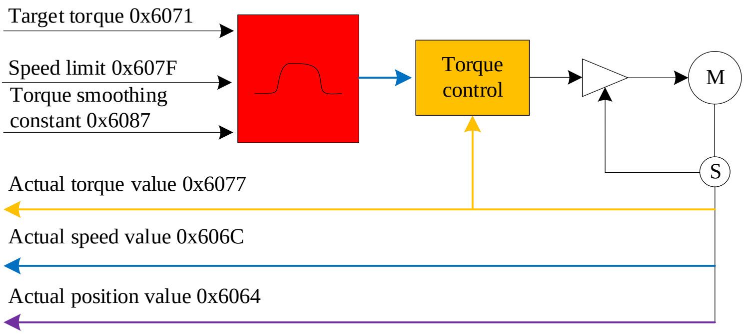


Figure 9-17 Timing sequence for profile torque mode operation

Related object dictionaries:

Index	Subindex	Name	Read/Write	Data	Unit	Setting
0x603F	00_h	Error code	RO	UINT16	-	0~65535
0x6040	00_h	Control word	RW	UINT16	-	0~65535
0x6041	00_h	Status word	RO	UINT16	-	0~65535
0x6060	00_h	Running mode	RW	INT8	-	0~10
0x6061	00_h	Mode display	RO	INT8	-	0~10
0x606C	00_h	Real speed feedback	RO	INT32	Command unit/s	-
0x6071	00_h	Target torque	RW	INT16	0.1%	-3000~3000
0x6072	00_h	Maximum torque	RW	UINT16	0.1%	0~3000
0x6074	00_h	Torque command	RO	INT16	0.1%	-
0x6077	00_h	Real torque	RO	UINT16	1%	-
0x6087	00_h	Torque ramp time	RW	UINT32	0.1%/s	$0\sim(2^{32}-1)$

The steps for the profile torque mode are shown in the following table:

Item	Step	Parameter input	Status word display (6041h)
Profile torque parameter	1	6071h=50	0x0250
	2	6087h=50	0x0250

assignment			
Control mode selection	3	6060h= 0x04	0x0250
Servo enabling	4	6040h= 0x06	0x0231
	5	6040h= 0x07	0x0233
	6	6040h= 0x0F	0x0637

Description of control word 6040h and status word 6041h in the profile torque mode:

<table>
<tr><th>Object 6040h</th><th colspan="4"></th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>6040_h</td><td colspan="8"></td></tr>
<tr><td>Name</td><td colspan="9">Control word</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td colspan="5">0~65535</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RW</td><td>Factory setting</td><td colspan="5">0</td></tr>
<tr><td>Function description</td><td colspan="9">Bit definition of the control word:
<table>
<tr><th>Bits</th><th>Description</th><th>Bit definition</th></tr>
<tr><td>0</td><td>Switch on</td><td>0: invalid; 1: valid</td></tr>
<tr><td>1</td><td>Enable voltage</td><td>0: invalid; 1: valid</td></tr>
<tr><td>2</td><td>Quick stop</td><td>1: invalid; 0: valid</td></tr>
<tr><td>3</td><td>Enable operation</td><td>0: invalid; 1: valid</td></tr>
<tr><td>4~6</td><td>NA</td><td></td></tr>
<tr><td>7</td><td>Fault reset</td><td>bit7 rising edge is valid;
bit7 is held to 1, and all other control commands are invalid</td></tr>
<tr><td>8</td><td>Halt</td><td>0: invalid; 1: valid</td></tr>
<tr><td>9~10</td><td>NA</td><td></td></tr>
<tr><td>11~15</td><td>Factory-defined</td><td></td></tr>
</table>
Note: Each bit in the control word needs to be used together with other bits to form a control command.</td></tr>
</table>

<table>
<tr><th>Object
6041h</th><th colspan="4"></th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>6041h</td><td colspan="8"></td></tr>
<tr><td>Name</td><td colspan="9">Status word</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td colspan="5">0~65535</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RO</td><td>Factory setting</td><td colspan="5">0</td></tr>
<tr><td>Function description</td><td colspan="9">Bit definition of a status word:
<table>
<tr><th>Bit</th><th>Description</th><th>Definition</th></tr>
<tr><td>0</td><td>Switch on</td><td>1: valid 0: invalid</td></tr>
<tr><td>1</td><td>Wait to enable servo</td><td>1: valid 0: invalid</td></tr>
<tr><td>2</td><td>Enable operation</td><td>1: valid 0: invalid</td></tr>
<tr><td>3</td><td>Fault</td><td>0: no faults 1: fault</td></tr>
<tr><td>4</td><td>Enable voltage</td><td>1: valid 0: invalid</td></tr>
<tr><td>5</td><td>Quick stop</td><td>0: valid 1: invalid</td></tr>
<tr><td>6</td><td>Power-on and running allowed</td><td>1: valid 0: invalid</td></tr>
<tr><td>7</td><td>Warning</td><td>1: valid 0: invalid</td></tr>
<tr><td>8</td><td>Factory-defined</td><td></td></tr>
<tr><td>9</td><td>Remote control</td><td>0: non-CANopen mode
1: CANopen remote control mode</td></tr>
<tr><td>10</td><td>NA</td><td></td></tr>
<tr><td>11</td><td>Software internal position exceeds the limit</td><td>0: position command or feedback does not reach the internal position limit of the software
1: position command or feedback reaches the internal position limit of the software</td></tr>
<tr><td>12~14</td><td>NA</td><td></td></tr>
<tr><td>15</td><td>Home return completed</td><td>0: home return is not performed</td></tr>
</table></td></tr>
</table>

			or not completed 1: home return is completed and the reference point has been found

9.2.9.4 Homing mode (HM)

The homing mode is used to find the mechanical home point and the position relationship between the mechanical home point and mechanical zero point.

Mechanical home: a fixed position on the machinery, corresponding to a certain determined home position signal switch.

Mechanical zero: mechanical zero point = mechanical home + 0x607C (home offset), if 0x607C = 0, the mechanical zero point is equal to the mechanical home point.

The servo drive will stop at the mechanical zero point after the home return return is completed, and adjust the position relationship between the mechanical home point and the mechanical zero point by setting the value of 0x607C in the object dictionary.

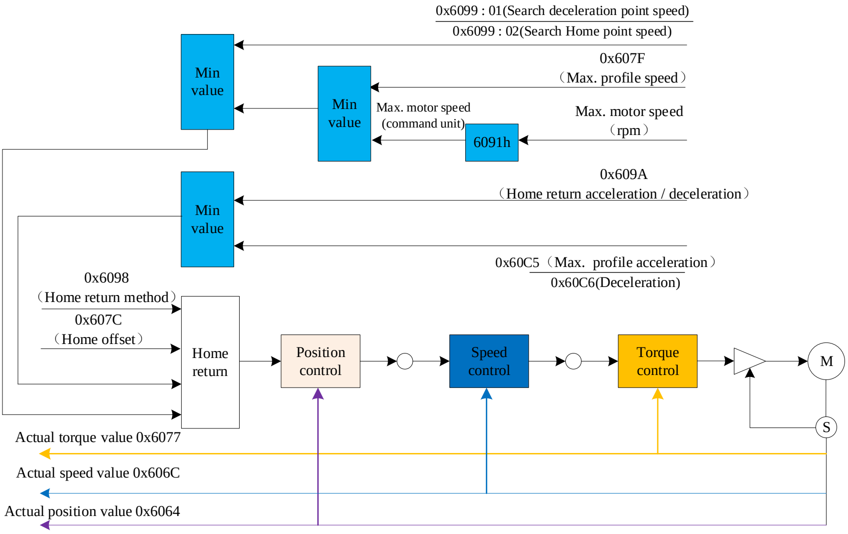
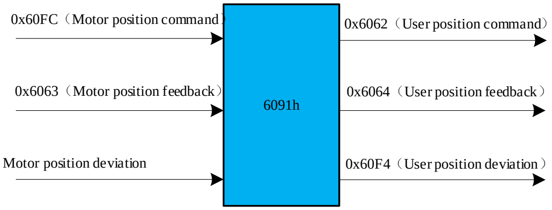


Figure 9-18 Homing mode control diagram

The conversion of user unit and encoder unit in home return mode via 0x6091 is illustrated as follows:

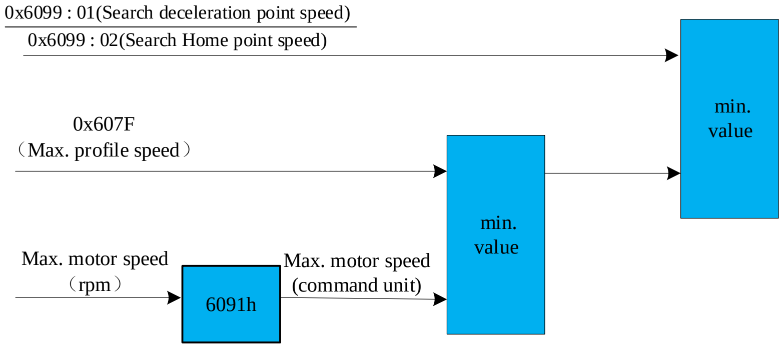


$$0x6091(\text{gear ratio})=\frac{0x6091:01}{0x6091:02}$$

The relationship between 0x6063 (motor position feedback) and 0x6064 (user position feedback):

$$0x6063(\text{encoder unit})=0x6064(\text{command unit})\times\frac{0x6091:01}{0x6091:02}\times\left(\frac{\text{Pn204}}{\text{Pn206}}\right)$$

The relationship between 0x6099-01 (search deceleration point speed), 0x6099-02 (search home speed) and the corresponding maximum speed of the motor after transformation exists as follows:



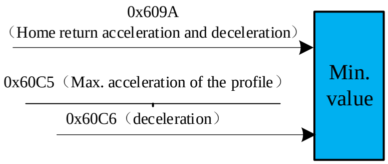
The relationship between motor speed (rpm) and load shaft speed (command unit/s):

$$\text{Motor speed}(\text{rpm})=\frac{\text{load shaft speed}\times\frac{0x6091:01}{0x6091:02}}{\text{encoder resolution}}\times 60$$

Example: The gear ratio is set to 1:1, and a 23-bit motor is used.

$$\text{Motor speed}=500\text{rpm}\big(0x6099(\text{load shaft speed})\big)=500\times\frac{8388608}{60}=69905066(\text{command unit / s})$$

The relationship exists between 0x609A (home return acceleration/deceleration) and $\frac{0x60C5}{0x60C6}$ (maximum profile acceleration/deceleration):



Example: The gear ratio is set to 1:1, and a 23-bit motor is used.

$$\text{Motor acc./dec.} = 500\text{rpm/s}\left(\text{load shaft speed}\right) = 500 \times \frac{8388608}{60} = 69905066\left(\text{command unit / s}^2\right)$$

Related object dictionaries

Index	Sub index	Name	R/W	Type	Unit	Range
0x603F	00_h	Error code	RO	UINT16	-	0~65535
0x6040	00_h	Control word	RW	UINT16	-	0~65535
0x6041	00_h	Status word	RO	UINT16	-	0~65535
0x6060	00_h	Running mode	RW	INT8	-	0~7
0x6061	00_h	Mode display	RO	INT8	-	0~7
0x6064	00_h	User position feedback	RO	INT32	Command unit	-
0x606C	00_h	Real speed feedback	RO	INT32	Command unit/s	-
0x6098	00_h	Home return method	RW	INT8	-	1~35
0x6099	01_h	High-speed search for deceleration position	RW	UINT32	Command unit/s	0~(2^{32}-1)
	02_h	Low speed search for home signal	RW	UINT32	Command unit/s	0~(2^{32}-1)
0x609A	00_h	Home return acceleration/deceleration	RW	UINT32	Command unit/s^2	0~(2^{32}-1)

Description of control word 6040h and status word 6041h in the homing mode:

Object 6040h			**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6040_h**						
Name	**Control word**						

<table>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td>0~65535</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RW</td><td>Factory setting</td><td>0</td></tr>
<tr><td>Function description</td><td colspan="5">Bit definition of the control word:
<table>
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<tr><td>0</td><td>Switch on</td><td>0: invalid; 1: valid</td></tr>
<tr><td>1</td><td>Enable voltage</td><td>0: invalid; 1: valid</td></tr>
<tr><td>2</td><td>Quick stop</td><td>1: invalid; 0: valid</td></tr>
<tr><td>3</td><td>Enable operation</td><td>0: invalid; 1: valid</td></tr>
<tr><td>4</td><td>Enable home return</td><td>0: home return not enabled;
0→1: home return enabled;
1: home return in operation;
1→0: halt home return</td></tr>
<tr><td>5~6</td><td>NA</td><td></td></tr>
<tr><td>7</td><td>Fault reset</td><td>bit7 rising edge is valid;
bit7 is held to 1, and all other control commands are invalid</td></tr>
<tr><td>8</td><td>Halt</td><td>0: invalid; 1: valid</td></tr>
<tr><td>9~10</td><td>NA</td><td></td></tr>
<tr><td>11~15</td><td>Factory-defined</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Object
6041h</th><th></th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>6041_h</td><td colspan="5"></td></tr>
<tr><td>Name</td><td colspan="6">Status word</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td colspan="2">0~65535</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RO</td><td>Factory setting</td><td colspan="2">0</td></tr>
<tr><td>Function description</td><td colspan="6">Bit definition of a status word:
<table>
<tr><th>Bits</th><th>Description</th><th>Bit definition</th></tr>
<tr><td>0</td><td>Switch on</td><td>1: valid 0: invalid</td></tr>
<tr><td>1</td><td>Wait to enable servo</td><td>1: valid 0: invalid</td></tr>
<tr><td>2</td><td>Enable operation</td><td>1: valid 0: invalid</td></tr>
<tr><td>3</td><td>Fault</td><td>0: no faults 1: fault</td></tr>
<tr><td>4</td><td>Enable voltage</td><td>1: valid 0: invalid</td></tr>
<tr><td>5</td><td>Quick stop</td><td>0: valid 1: invalid</td></tr>
<tr><td>6</td><td>Power-on and running allowed</td><td>1: valid 0: invalid</td></tr>
<tr><td>7</td><td>Warning</td><td>1: valid 0: invalid</td></tr>
<tr><td>8</td><td>Factory-defined</td><td></td></tr>
<tr><td>9</td><td>Remote control</td><td>0: non-CANopen mode
1: CANopen remote control mode</td></tr>
<tr><td>10</td><td>Target reached</td><td>0: target position is not
1: target position is reached</td></tr>
<tr><td>11</td><td>Software internal position exceeds the limit</td><td>0: position command or feedback does not reach the internal position limit of the software
1: position command or feedback reaches the internal position limit of the software</td></tr>
<tr><td>12</td><td>Home return completed</td><td>0: home return not completed
1: home return completed</td></tr>
<tr><td>13</td><td>Home return error</td><td>0: no error occurred;</td></tr>
</table>
</td></tr>
</table>

		1: home return error at the origin
14	NA	
15	Home return completed	0: home return is not performed or not completed 1: home return is completed and the reference point has been found

The steps to turn on the home return mode are shown below:

Item	**Step**	**Parameter input**	**Status word display (6041h)**
Home return parameter assignment	0	609Ah=1000	0x0250
	1	6099:01h =1000	0x0250
	2	6099:02h = 100	0x0250
	3	6098h=0x01	0x0250
Control mode switching	4	6060h=0x06	0x0250
Servo enabling	5	6040h= 0x06	0x0231
	6	6040h= 0x07	0x0233
	7	6040h= 0x0F	0x0637
	8	6040h= 0x1F	0x0237
Home found	10	6040h= 0x1F	0x9637

9.2.7.5 Interpolation Mode (IP)

In interpolation position mode, the upper computer sends a position value (corresponding to the object dictionary [0x60C1]) during every synchronization cycle, which takes the value of the object dictionary 0x60C1 as the absolute position. For example, if the value of 0x60C1 is 0 at the beginning, then that's the starting point of the absolute position. After the servo drive receives the interpolated position value in the first cycle, it starts to plan the curve path; when the second cycle comes and a new position value is sent, the path curve planned in the previous cycle is sent to the servo unit for running, and at the same time, it starts to plan a new position curve.

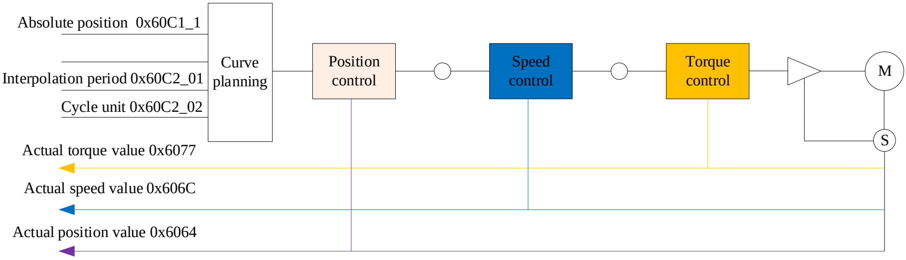
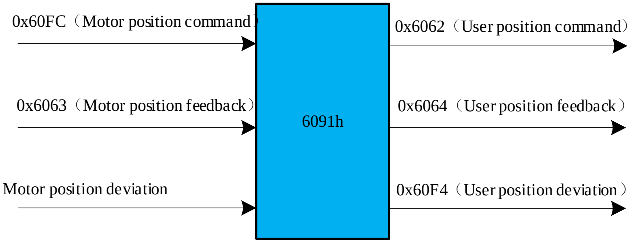


Figure 9-19 Interpolation mode control block diagram

The conversion of user unit and encoder unit in interpolation mode via 0x6091 is illustrated below:



As shown in Figure 9-20, at the moment t0, the upper computer sends an interpolated position command value, and the servo drive plans the motion trajectory POS0 according to the received interpolated position value and sends the motion trajectory POS0 to the execution unit at the moment t1, and at the same time plans the motion trajectory POS1 according to the new interpolated position value. At t2 the motion trajectory POS1 is executed again and at the same time the motion trajectory POS2 is planned and so on. The drive always plans the motion trajectory at the current moment for the next moment to ensure the smooth operation of the servo motor.

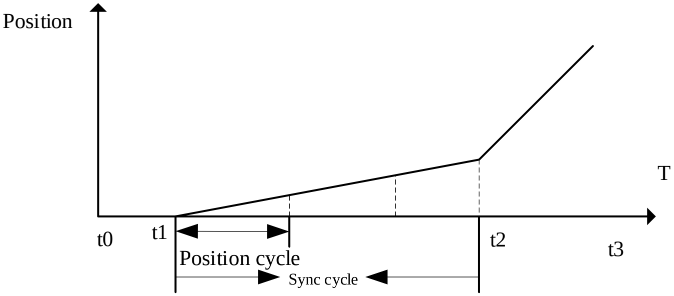


Figure 9-20 Interpolation position diagram

As shown in Figure 9-18, at the moment t0, the upper computer sends an interpolated position command value, and the servo drive plans the motion trajectory POS0 according to the received interpolated position value and sends the motion trajectory POS0 to the execution unit at the moment t1, and at the same time plans the motion trajectory POS1 according to the new interpolated position value. At t2 the motion trajectory POS1 is executed again and at the same time the motion trajectory POS2 is planned and so on. The drive always plans the motion trajectory at the current moment for the next moment to ensure the smooth operation of the servo motor.

Related object dictionaries:

Index	Sub index	Name	R/W	Data type	Unit	Range
0x603F	00_h	Error code	RO	UINT16	—	0~65535
0x6040	00_h	Control word	RW	UINT16	—	0~65535
0x6041	00_h	Status word	RO	UINT16	—	0~65535
0x6060	00_h	Running mode	RW	INT8	—	0~7
0x6061	00_h	Mode display	RO	INT8	—	0~7
0x6064	00_h	User position feedback	RO	INT32	Command unit	$-2^{31}\sim(2^{31}-1)$
0x6065	00_h	Excessive position deviation threshold	RW	UINT32	Command unit	$0\sim(2^{32}-1)$
0x6067	00_h	Position reach threshold	RW	UINT32	Command unit	$0\sim(2^{32}-1)$
0x6068	00_h	Position reach time	RW	UINT16	0.1ms	0~65535
0x607A	00_h	Target position	RW	INT32	Command unit	$-2^{31}\sim(2^{31}-1)$
0x607D	01_h	Min. software limit	RW	INT32	Command unit	$-2^{31}\sim(2^{31}-1)$
	02_h	Max. software limit	RW	INT32	Command unit	$-2^{31}\sim(2^{31}-1)$
0x60C1	01_h	Absolute interpolation position	RW	INT32	Command unit	$-2^{31}\sim(2^{31}-1)$
0x60C2	01_h	Interpolation cycle	RW	UINT8	—	1~20
	02_h	Interpolation cycle unit	RW	INT8	—	-3

Description of control word 6040h and status word 6041h in interpolation mode:

Object		PP	PV	PT	HM	IP

6040h					
Index	**6040$_h$**				
Name	**Control word**				
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Bit definition of the control word:				

Bits	**Description**	**Bit definition**
0	Switch on	0: invalid; 1: valid
1	Enable voltage	0: invalid; 1: valid
2	Quick stop	1: invalid; 0: valid
3	Enable operation	0: invalid; 1: valid
4	Enable interpolation mode	0: halt interpolation; 1: enable interpolation
5~6	NA	
7	Fault reset	bit7 rising edge is valid; bit7 is held to 1, and all other control commands are invalid.
8	Halt	0: invalid; 1: valid
9~10	NA	
11~15	Factory-defined	

Note: Each bit in the control word needs to be used together with other bits to form a control command.

Object 6041h		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6041$_h$**					
Name	**Status word**					
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535	
Mapping	Y	**Access**	RO	**Factory setting**	0	

<table>
<tr>
<td>Function description</td>
<td>Bit definition of a status word:
<table>
<tr><th>Bits</th><th>Description</th><th>Bit definition</th></tr>
<tr><td>0</td><td>Switch on</td><td>1: valid 0: invalid</td></tr>
<tr><td>1</td><td>Wait to enable servo</td><td>1: valid 0: invalid</td></tr>
<tr><td>2</td><td>Enable operation</td><td>1: valid 0: invalid</td></tr>
<tr><td>3</td><td>Fault</td><td>0: no faults 1: fault</td></tr>
<tr><td>4</td><td>Enable voltage</td><td>1: valid 0: invalid</td></tr>
<tr><td>5</td><td>Quick stop</td><td>0: valid 1: invalid</td></tr>
<tr><td>6</td><td>Power-on and running allowed</td><td>1: valid 0: invalid</td></tr>
<tr><td>7</td><td>Warning</td><td>1: valid 0: invalid</td></tr>
<tr><td>8</td><td>Factory-defined</td><td></td></tr>
<tr><td>9</td><td>Remote control</td><td>0: non-CANopen mode
1: CANopen remote control mode</td></tr>
<tr><td>10</td><td>Target reached</td><td>0: target position is not
1: target position is reached</td></tr>
<tr><td>11</td><td>Software internal position exceeds the limit</td><td>0: position command or feedback does not reach the internal position limit of the software
1: position command or feedback reaches the internal position limit of the software</td></tr>
<tr><td>12</td><td>Enable interpolation mode</td><td>0: interpolation mode not enabled;
1: interpolation mode enabled</td></tr>
<tr><td>13~14</td><td>NA</td><td></td></tr>
<tr><td>15</td><td>Home return completed</td><td>0: home return is not performed or not completed
1: home return is completed and the reference point has been found</td></tr>
</table>
</td>
</tr>
</table>

The interpolation command value is planned by the upper computer planning during each synchronization cycle, and sends it through PDO to the servo driver to control the motor running. The interpolation mode is shown in the following table:

Item	Step	Parameter input	Status word display

			(6041h)
Interpolation cycle assignment	0	60C2_01h = 200 (or 0xC8)	0x0250
	1	60C2_02h = -3 (or 0xFD)	0x0250
Interpolation position assignment	2	60C1h=10000	0x0250
Control mode selection	3	6060h= 0x07	0x0250
Servo enabling	4	6040h= 0x06	0x0231
	5	6040h= 0x07	0x0233
	6	6040h= 0x0F	0x0637
	7	6040h= 0x1F	0x0237
Positioning completed	8	6040h= 0x1F	0x0637

9.2.10 Object Dictionary

9.2.10.1 Object Properties Description

Explanation of terms

Index: specifies the position of each object in the object dictionary, in hexadecimal (h).

Data type: See Table 9-28 for details.

Table 9-28 Data type description

Data type	Range	Data length	DS301
Int8	-128~127	1 byte	2
Uint8	0~255	1 byte	5
Int16	-32768~+32767	2 bytes	3
Uint16	0~65535	2 bytes	6
Int32	-2147483648~+2147483647	4 bytes	4
Uint32	0~4294967295	4 bytes	7
String	ASCII	-	9

"Read/Write type": please refer to Table 9-29 for details.

Table 9-29 Read/Write type description

Read/Write	Description
RW	Read and write
WO	Write only
RO	Read only

CONST	Constant, read only

"Object structure": please refer to Table 9-30 for details.

Table 9-30 Description of the object structure

Object structure	Description	DS301
VAR	Simple values containing the data types in Table 3-1	7
ARR	Data blocks of the same type	8
REC	Data blocks of different types	9

9.2.10.2 1000h Group Object List

Index	Subindex	Description	Structure	Data type	R/W	Map
1000h	-	Device type	VAR	Uint16	RO	N
1001h	-	Error register	VAR	Uint8	RO	N
1003h	-	Predefined error field	ARR	Uint32	RO	N
	00_h	Number of errors	VAR	Uint8	RW	N
	$01\sim04_h$	Error field	VAR	Uint32	RO	N
1005h	-	COB-ID SYNC message	VAR	Uint32	RW	N
1006h	-	SYNC cycle	VAR	Uint32	RW	N
100Ch	-	Node guarding time	VAR	Uint16	RW	N
100Dh	-	Lifetime factor	VAR	Uint8	RW	N
1010h	-	Save parameter	ARR	Uint32	RW	N
	00_h	Maximum subindex supported	VAR	Uint8	RO	N
	02_h	Save all object parameter	VAR	Uint16	RW	N
1011h	-	Restore default parameter	ARR	Uint32	RW	N
	00_h	Maximum subindex	VAR	Uint8	RO	N
	02_h	Restore all default parameter	VAR	Uint16	RW	N
1014h	-	COB-ID emergency message	VAR	Uint32	RW	N
1016h	-	Consumer heartbeat time	ARR	-	-	-
	00_h	Maximum subindex	VAR	Uint8	RO	N
	01_h	Consumer heartbeat time	VAR	Uint32	RW	N
1017h	-	Producer heartbeat time	VAR	Uint16	RW	N
1018h	-	Device object description	REC	-	-	-
	00_h	Maximum subindex	VAR	Uint8	RO	N

	01_h	Manufacturer ID	VAR	Uint16	RO	N
	02_h	Device code	VAR	Uint16	RO	N
	03_h	Device revision number	VAR	Uint16	RO	N
1029h	-	Error behavior object	ARR	-	-	-
	00_h	Maximum subindex	VAR	Uint8	RO	N
	01_h	Communication error	VAR	Uint8	RW	N
1200h	-	SDO server parameter	ARR	-	-	-
	00_h	Maximum subindex	VAR	Uint8	RO	N
	01_h	Client-to-Server COB-ID	VAR	Uint32	RW	N
	02_h	Server-to-Client COB-ID	VAR	Uint32	RW	N
1400h	-	RPDO1 mapping parameter	REC	-	-	-
	00_h	RPDO1 maximum subindex	VAR	Uint8	RO	N
	01_h	RPDO1 COB-ID	VAR	Uint32	RW	N
	02_h	RPDO1 transmission type	VAR	Uint8	RW	N
1401h	-	RPDO2 mapping parameter	REC	-	-	-
	00_h	RPDO2 maximum subindex	VAR	Uint8	RO	N
	01_h	RPDO2 COB-ID	VAR	Uint32	RW	N
	02_h	RPDO2 transmission type	VAR	Uint8	RW	N
1402h	-	RPDO3 mapping parameter	REC	-	-	-
	00_h	RPDO3 maximum subindex	VAR	Uint8	RO	N
	01_h	RPDO3 COB-ID	VAR	Uint32	RW	N
	02_h	RPDO3 transmission type	VAR	Uint8	RW	N
1403h	-	RPDO4 mapping parameter	REC	-	-	-
	00_h	RPDO4 maximum subindex	VAR	Uint8	RO	N
	01_h	RPDO4 COB-ID	VAR	Uint32	RW	N
	02_h	RPDO4 transmission type	VAR	Uint8	RW	N
1600h	-	RPDO1 mapping parameter	REC	-	-	-
	00_h	RPDO1valid mapping No.	VAR	Uint8	RW	N
	01_h	RPDO1 mapping object 1	VAR	Uint32	RW	N
	02_h	RPDO1 mapping object 2	VAR	Uint32	RW	N
	03_h	RPDO1 mapping object 3	VAR	Uint32	RW	N
	04_h	RPDO1 mapping object 4	VAR	Uint32	RW	N

1601h	-	RPDO2 mapping parameter	REC	-	-	-
	00_h	RPDO2 valid mapping No.	VAR	Uint8	RW	N
	01_h	RPDO2 mapping object 1	VAR	Uint32	RW	N
	02_h	RPDO2 mapping object 2	VAR	Uint32	RW	N
	03_h	RPDO2 mapping object 3	VAR	Uint32	RW	N
	04_h	RPDO2 mapping object 4	VAR	Uint32	RW	N
1602h	-	RPDO3 mapping parameter	REC	-	-	-
	00_h	RPDO3 valid mapping No.	VAR	Uint8	RW	N
	01_h	RPDO3 mapping object 1	VAR	Uint32	RW	N
	02_h	RPDO3 mapping object 2	VAR	Uint32	RW	N
	03_h	RPDO3 mapping object 3	VAR	Uint32	RW	N
	04_h	RPDO3 mapping object 4	VAR	Uint32	RW	N
1603h	-	RPDO4 mapping parameter	REC	-	-	-
	00_h	RPDO4 valid mapping No.	VAR	Uint8	RW	N
	01_h	RPDO4 mapping object 1	VAR	Uint32	RW	N
	02_h	RPDO4 mapping object 2	VAR	Uint32	RW	N
	03_h	RPDO4 mapping object 3	VAR	Uint32	RW	N
	04_h	RPDO4 mapping object 4	VAR	Uint32	RW	N
1800h	-	TPDO1 parameter	REC	-	-	-
	00_h	TPDO1 maximum subindex	VAR	Uint8	RO	N
	01_h	TPDO1 COB-ID	VAR	Uint32	RW	N
	02_h	TPDO1 transmission type	VAR	Uint8	RW	N
	03_h	Inhibit time	VAR	Uint16	RW	N
	04_h	NA	VAR	Uint8	RW	N
	05_h	Event timer	VAR	Uint16	RW	N
1801h	-	TPDO2 parameter	REC	-	-	-
	00_h	TPDO2 maximum subindex	VAR	Uint8	RO	N
	01_h	TPDO2 COB-ID	VAR	Uint32	RW	N
	02_h	TPDO2 transmission type	VAR	Uint8	RW	N
	03_h	Inhibit time	VAR	Uint16	RW	N
	04_h	NA	VAR	Uint8	RW	N
	05_h	Event timer	VAR	Uint16	RW	N

1802h	-	TPDO3 parameter	REC	-	-	-
	00_h	TPDO3 maximum subindex	VAR	Uint8	RO	N
	01_h	TPDO3 COB-ID	VAR	Uint32	RW	N
	02_h	TPDO3 transmission type	VAR	Uint8	RW	N
	03_h	Inhibit time	VAR	Uint16	RW	N
	04_h	NA	VAR	Uint8	RW	N
	05_h	Event timer	VAR	Uint16	RW	N
1803h	-	TPDO4 parameter	REC	-	-	-
	00_h	TPDO1 maximum subindex	VAR	Uint8	RO	N
	01_h	TPDO4 COB-ID	VAR	Uint32	RW	N
	02_h	TPDO4 transmission type	VAR	Uint8	RW	N
	03_h	Inhibit time	VAR	Uint16	RW	N
	04_h	NA	VAR	Uint8	RW	N
	05_h	Event timer	VAR	Uint16	RW	N
1A00h	-	TPDO1 mapping parameter	REC	-	-	-
	00_h	TPDO1 valid mapping No.	VAR	Uint8	RW	N
	01_h	TPDO1 mapping object 1	VAR	Uint32	RW	N
	02_h	TPDO1 mapping object 2	VAR	Uint32	RW	N
	03_h	TPDO1 mapping object 3	VAR	Uint32	RW	N
	04_h	TPDO1 mapping object 4	VAR	Uint32	RW	N
1A01h	-	TPDO4 mapping parameter	REC	-	-	-
	00_h	TPDO2 valid mapping No.	VAR	Uint8	RW	N
	01_h	TPDO2 mapping object 1	VAR	Uint32	RW	N
	02_h	TPDO2 mapping object 2	VAR	Uint32	RW	N
	03_h	TPDO2 mapping object 3	VAR	Uint32	RW	N
	04_h	TPDO2 mapping object 4	VAR	Uint32	RW	N
1A02h	-	TPDO3 mapping parameter	REC	-	-	-
	00_h	TPDO3 valid mapping No.	VAR	Uint8	RW	N
	01_h	TPDO3 mapping object 1	VAR	Uint32	RW	N
	02_h	TPDO3 mapping object 2	VAR	Uint32	RW	N
	03_h	TPDO3 mapping object 3	VAR	Uint32	RW	N
	04_h	TPDO3 mapping object 4	VAR	Uint32	RW	N

1A03h	-	TPDO4 mapping parameter	REC	-	-	-
	00_h	TPDO4 valid mapping No.	VAR	Uint8	RW	N
	01_h	TPDO4 mapping object 1	VAR	Uint32	RW	N
	02_h	TPDO4 mapping object 2	VAR	Uint32	RW	N
	03_h	TPDO4 mapping object 3	VAR	Uint32	RW	N
	04_h	TPDO4 mapping object 4	VAR	Uint32	RW	N

2000h group object dictionary is the mapping of internal parameters of the drive. The object dictionaries 2000h~2007h correspond to the parameter groups of Pn0xx~Pn7xx respectively; 2E00h~2E03h correspond to the monitoring parameters of Un0xx~Un3xx. The specific function code of the drive corresponds to the sub-index of the object dictionary of the 2000h group, and the specific correspondence rule is that the last two digits of the function code plus 1 is the corresponding object dictionary sub-index.

The following table shows the correspondence between the 2000h object dictionary index number and the function code of the drive, the specific meaning of the function code is detailed in “Chapter 9 Parameter Description” and “Chapter 8 Monitoring Parameters”.

Index	**Sub index**	**Description**	**Type**	**R/W**	**Map**
2000h	-	Pn0xx basic control parameters	-	-	-
	00_h	Maximum subindex supported	Uint8	RO	N
	01_h	Pn000: function selection basic switch 0	Uint16	RW	N
	02_h	Pn001: function selection basic switch 1	Uint16	RW	N
	03_h	Pn002: motor rotation direction selection	Uint16	RW	N
	…	…	…	RW	N
	82_h	Pn081: native communication format	Uint16	RW	N
	86_h	Pn085: Communication writing function code storage EEPROM selection	Uint16	RW	N
2001h	-	Pn1xx gain parameter	-	-	N
	00_h	Maximum subindex supported	Uint8	RO	N
	01_h	Pn100: rotational inertia ratio	Uint16	RW	N
	02_h	Pn101: speed loop proportional gain	Uint16	RW	N
	…	…	…	RW	N
	94_h	Pn193: maximum gain during advanced tuning	Uint16	RW	N
2002h	-	Pn2xx position parameters	-	-	N

	00_h	Maximum subindex supported	Uint8	RO	N
	01_h	Pn200: position command source selection	Uint16	RW	N
	02_h	Pn201: external pulse input type	Uint16	RW	N
	03_h	Pn202: position control function switch 1	Uint16	RW	N
	04_h	Pn203: external pulse command multiplier	Uint16	RW	N
	…	…	…	RW	N
	98_h	Pn297: absolute zero single-turn value	Uint16	RW	N
	$9A_h$	Pn299: homing timeout	Uint16	RW	N
2003h	-	Pn3xx speed parameters	-	-	N
	00_h	Maximum subindex supported	Uint8	RO	N
	01_h	Pn300: speed command source selection	Int16	RW	N
	02_h	Pn301: speed command direction	Int16	RW	N
	…	…	…	RW	N
	21_h	Pn320: speed-consistent signal range	Uint16	RW	N
2004h	-	Pn4xx speed parameters	-	-	N
	00_h	Maximum subindex supported	Uint8	RO	N
	01_h	Pn400: torque control switch 1	Uint16	RW	N
	02_h	Pn401: torque command 2nd order low-pass filter cut-off frequency	Uint16	RW	N
	…	…	…	RW	N
	31_h	Pn430: torque control switch 2	Uint16	RW	N
2005h	-	Pn5xx speed parameters	-	-	N
	00_h	Maximum subindex	Uint8	RO	N
	01_h	Pn500: jogging speed	Uint16	RW	N
	02_h	Pn502: program JOG operation method	Uint16	RW	N
	…	…	…	RW	N
	09_h	Pn508: program JOG movement speed	Uint16	RW	N
2006h	-	Pn6xx speed parameters	-	-	N
	00_h	Maximum subindex	Uint8	RO	N
	01_h	Pn600: switching input terminal X filter time	Uint16	RW	N
	02_h	Pn601: switching input terminal X1	Uint16	RW	N
	…	…	…	RW	N

	31_h	Pn630: software giving the status of input terminal (X)	Uint16	RW	N
2E00h	-	Un0xx monitoring parameters	-	-	N
	00_h	Maximum subindex	Uint8	RO	N
	01_h	Un000: motor feedback speed	Int16	RO	N
	02_h	Un001: command speed	Int16	RO	N
	…	…	…	RO	N
	38_h	Un038: MCU version (sub-version No.)	Uint16	RO	N
	39_h	Un039: FPGA version (sub-version No.)	Uint16	RO	N
2E01h	-	Un1xx monitoring parameters	-	-	N
	00_h	Maximum subindex	Uint8	RO	N
	01_h	Un100: Input signal monitoring	Uint16	RO	N
	02_h	Un101: Output signal monitoring	Uint16	RO	N
	06_h	Un105: position rectification time	Uint16	RO	N
	…	…	…	RO	N
	45_h	Un144: DB load accumulation	Uint16	RO	N
2E02h	-	Un2xx monitoring parameters	-	-	N
	00_h	Maximum subindex	Uint8	RO	N
	04_h	Un203: abnormal parameter function code number (Er040)	Uint16	RO	N
	13_h	Un212: system monitoring time A (average)	Uint16	RO	N
	…	…	…	RO	N
	$1A_h$	Un219: system monitoring time R (max)	Uint16	RO	N
2E05h	-	Un5xx monitoring parameters	-	-	N
	00_h	Maximum subindex supported	Uint8	RO	N
	12_h	Un511: U-phase current zero point value	Uint16	RO	N
	13_h	Un512: V-phase current zero point value	Uint16	RO	N
2E06h	-	Un6xx: monitoring parameters	-	-	N
	00_h	Maximum subindex supported	Uint8	RO	N
	04_h	Un603: absolute encoder pulses (low 32 bits)	Uint32	RO	N
	06_h	Un605: absolute encoder pulses (high 32 bits)	Uint32	RO	N
2E08h	-	Un8xx monitoring parameters	-	-	N

	00_h	Maximum subindex	Uint8	RO	N
	01_h	Un800: existing fault or warning codes	Uint16	RO	N
	02_h	Un801: warning codes	Uint16	RO	N
	…	…	…	RO	N
	43_h	Un842: Warning log 9 occurrence time	Uint32	RO	N

Cautions	
⚠	●The last two digits of the function codes correspond to the subindex. The function code is a hexadecimal number, and so is the subindex. Example: when reading or writing to function code Pn299, the corresponding object dictionary is 2002: 9Ah.

9.2.10.4 6000h Group Object List

The CANopen6000h group object dictionary assignment is shown in the following table:

Index	Sub index	Name	W/R	Map	Type	Unit	Range
603Fh	00_h	Error code	RO	Y	UINT16	-	UINT16
6040h	00_h	Control word	RW	Y	UINT16	-	UINT16
6041h	00_h	Status word	RO	Y	UINT16	-	UINT16
605Ah	00_h	Quick stop method	RW	Y	UINT16		UINT16
605Dh	00_h	Halt stop method	RW	Y	UINT16		UINT16
6060h	00_h	Running mode	RW	Y	INT8	-	INT8
6061h	00_h	Mode display	RO	Y	INT8	-	INT8
6062h	00_h	User position command	RO	Y	INT32	Command unit	INT32
6063h	00_h	Motor position feedback	RO	Y	INT32	Encoder unit	INT32
6064h	00_h	User position feedback	RO	Y	INT32	Command unit	INT32
6065h	00_h	Excessive position deviation threshold	RW	Y	UINT32	Command unit	UINT32
6067h	00_h	Position reach threshold	RW	Y	UINT32	Command unit	UINT32

6068h	00_h	Position reach time	RW	Y	UINT16	0.1ms	UINT16
606Bh	00_h	Speed command value	RO	Y	INT32	Command unit/s	INT32
606Ch	00_h	Real speed feedback value	RO	Y	INT32	Command unit/s	INT32
606Dh	00_h	Speed reach threshold	RW	Y	UINT16	0.1rpm	UINT16
606Eh	00_h	Speed reach time window	RW	Y	UINT16	ms	UINT16
606Fh	00_h	Zero-speed threshold	RW	Y	UINT16	0.1rpm	UINT16
6070h	00_h	Zero-speed time window	RW	Y	UINT16	ms	UINT16
6071h	00_h	Target torque	RW	Y	INT16	0.1%	INT16
6072h	00_h	Maximum torque	RW	Y	UINT16	0.1%	UINT16
6074h	00_h	Torque command	RO	Y	INT16	0.1%	INT16
6075h	00_h	Rated current	RO	Y	UINT32	mA	UINT32
6076h	00_h	Rated torque	RO	Y	UINT32	mNm	UINT32
6077h	00_h	Real torque	RO	Y	INT16	0.1%	INT16
6078h	00_h	Real current	RO	Y	INT16	0.1%	INT16
607Ah	00_h	Target position value	RW	Y	INT32	Command unit	INT32
607Ch	00_h	Home return bias	RW	Y	INT32	Command unit	INT32
607Dh	01_h	Min. software limit	RW	Y	INT32	Command unit	INT32
	02_h	Max. software limit	RW	Y	INT32	Command unit	INT32
607F	00_h	Max speed limit	RW	Y	UINT32	Command unit/s	UINT32
6080h	00_h	Max. motor speed	RW	Y	UINT32	rpm	UINT32
6081h	00_h	Profile position target speed	RW	Y	INT32	Command unit/s	INT32
6083h	00_h	Acceleration	RW	Y	UINT32	Command	UINT32

						unit/s^2	
6084h	00_h	Deceleration	RW	Y	UINT32	Command unit/s^2	UINT32
6085h	00_h	Profile emergency stop deceleration	RW	Y	UINT32	Command unit/s^2	UINT32
6086h	00_h	Motor running profile type	RW	Y	INT16		INT16
6087h	00_h	Torque smoothing time	RW	Y	UINT32	0.1%/s	UINT32
6091h	01_h	Electronic gear numerator	RW	Y	UINT32	-	UINT32
	02_h	Electronic gear denominator	RW	Y	UINT32	-	UINT32
6098h	00_h	Home return method	RW	Y	INT8	-	INT8
6099h	01_h	Home return high speed setting	RW	Y	UINT32	Command unit/s	UINT32
	02_h	Home return low speed setting	RW	Y	UINT32	Command unit/s	UINT32
609Ah	00_h	Home return acceleration/deceleration	RW	Y	UINT32	Command unit/s^2	UINT32
60C1h	01_h	Absolute interpolation position value	RW	Y	INT32	Command unit	INT32
60C2h	01_h	Interpolation cycle value	RW	Y	UINT8	-	UINT8
	02_h	Interpolation cycle unit	RW	Y	INT8	-	INT8
60C5h	00_h	Max. profile acceleration	RW	Y	UINT32	Command unit/s^2	UINT32
60C6h	00_h	Max. profile deceleration	RW	Y	UINT32	Command unit/s^2	UINT32

60E0h	00_h	Forward torque limit	RW	Y	UINT16	0.1%	UINT16
60E1h	00_h	Reverse torque limit	RW	Y	UINT16	0.1%	UINT16
60F4h	00_h	User position deviation	RO	Y	INT32	Command unit	INT32
60FCh	00_h	Motor position command	RO	Y	INT32	Encoder unit	INT32
60FDh	00_h	Digital input status	RO	Y	UINT32	-	UINT32
60FEh	00_h	No. of digital output	RO	N	UINT8	-	UINT8
	01_h	Digital output status	RO	Y	UINT32	-	UINT32
60FFh	00_h	Profile speed target value	RW	Y	INT32	Command unit/s	INT32
6502h	00_h	Running mode of servo drive	RO	Y	UINT16	-	UINT16

9.2.10.5 1000h Detailed Object Description

<table>
<tr><th colspan="6">Object 1000h</th></tr>
<tr><td>Index</td><td>1000_h</td><td colspan="4">-</td></tr>
<tr><td>Name</td><td colspan="5">Device Type</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td>Uint16</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RO</td><td>Factory setting</td><td>0x20192</td></tr>
<tr><td>Function description</td><td colspan="5">The Device type parameter is used to describe the device subprotocol or application specification.
<table>
<tr><th>Bits</th><th>Name</th><th>Description</th></tr>
<tr><td>0~15</td><td>Device sub-protocol</td><td>402(0x192): device sub-protocol</td></tr>
<tr><td>16~23</td><td>Type</td><td>02: servo drive</td></tr>
<tr><td>25~31</td><td>Mode</td><td>Factory-defined</td></tr>
</table></td></tr>
</table>

<table>
<tr><th colspan="3">Object 1001h</th></tr>
<tr><td>Index</td><td>1001_h</td><td>-</td></tr>
</table>

Name	**Error Register**				
Object structure	VAR	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RO	**Factory setting**	0x0
Function description	Contain error type information by bit, as shown in the following table:				

Bit	Description	Bit	Description
0	General	**4**	Communication
1	Current	**5**	Sub-protocol
2	Voltage	**6**	NA
3	Temperature	**7**	Factory-defined

When an error occurs, the corresponding bit of the error is "1", and bit 0 must be "1".

Object 1003h					
Index	**1003h**	-			
Name	**Pro-defined Error Field**				
Object structure	ARR	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RO	**Factory setting**	-

Subindex	**00h**	-			
Name	**Number of Errors**				
Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RW	**Factory setting**	0x0
Function description	Only 0 can be written here, and all error records are cleared.				

Subindex	1~4h	-
Name	**Standard Error Field**	

<table>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RO</td><td>Factory setting</td><td>0x0</td></tr>
<tr><td>Function description</td><td colspan="5">When the subindex is 0, it is not readable; when there is an error, the error is stored in the following format:
<table>
<tr><td colspan="2">MSB</td><td colspan="2">LSB</td></tr>
<tr><td>31</td><td>16</td><td>15</td><td>0</td></tr>
<tr><td colspan="2">Factory error code</td><td colspan="2">Standard error code</td></tr>
</table></td></tr>
</table>

Object 1005h					
Index	**1005**$_{h}$	-			
Name	COB-ID SYNC Message				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RW	**Factory setting**	0x80
Function description	Only 0x80 and 0x40000080 can be written. When 0x80 is written, synchronization is off; When 0x40000080 is written, synchronization is on. The synchronization cycle 1006h must be configured to be non-zero before activating synchronization.				

Object 1006h					
Index	**1006**$_{h}$	-			
Name	**Communication Cycle Period**				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RW	**Factory setting**	0x0
Function description	Cycle time in units of 125us for synchronization.				

Object 1008h					
Index	**1008h**	-			
Name	**Manufacturer Device Name**				
Object structure	REC	**Data type**	Uint8	**Data range**	-
Mapping	NO	**Access**	RO	**Factory setting**	Servo Device

Object 100Ah					
Index	**100Ah**	-			
Name	**Software Version**				
Object structure	REC	**Data type**	Uint8	**Data range**	-
Mapping	NO	**Access**	RO	**Factory setting**	Determined by model

Object 100Ch					
Index	**100C**$_h$	-			
Name	**Guard Time**				
Object structure	VAR	**Data type**	Uint16	**Data range**	Uint16
Mapping	NO	**Access**	RW	**Factory setting**	0x0
Function description	For SYNC only in ms. Used in conjunction with lifetime factor for node protection.				

Object 100Dh					
Index	**100D**$_h$	-			
Name	**Life Time Factor**				
Object structure	VAR	**Data type**	Uint8	**Data range**	Uint8

Mapping	NO	**Access**	RW	**Factory setting**	0x0
Function description	Must be larger than 1 when used.				

<table>
<tr><th colspan="6">Object 1010h</th></tr>
<tr><td>Index</td><td>1010_h</td><td colspan="4">-</td></tr>
<tr><td>Name</td><td colspan="5">Store Parameters</td></tr>
<tr><td>Object structure</td><td>ARR</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td>0x0</td></tr>
<tr><td>Function description</td><td colspan="5">
Save parameter is to save the current value to EEPROM, and the next time the EEPROM is loaded (re-powered, node or communication reset), the saved value will be loaded.
When users need to save a parameter, write "save" according to ASCII code in addition to specifying the subindex corresponding to the save area. Other values written will not save the parameters successfully.
The correspondence of writing is as follows:
MSB LSB
<table>
<tr><th>ASCII</th><th>e</th><th>v</th><th>a</th><th>s</th></tr>
<tr><td>Hexadecimal</td><td>65h</td><td>76</td><td>61h</td><td>73h</td></tr>
</table>
The corresponding subindex read return value indicates how the parameter is saved in the subindex. Return value format and meaning is as follows:
MSB LSB
<table>
<tr><th>31 2</th><th>1</th><th>0</th></tr>
<tr><td>NA</td><td>0/1</td><td>0/1</td></tr>
</table>
<table>
<tr><th>Value</th><th>Description</th></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>0</td><td>No automatic saving of parameters, and no saving of parameters by command</td></tr>
<tr><td>1</td><td>Save parameters by command only, no automatic saving</td></tr>
<tr><td>2</td><td>Only save parameters automatically, no saving of parameters by command</td></tr>
<tr><td>3</td><td>Save parameters by command and automatically</td></tr>
</table>
</td><td></td></tr>
</table>

<table>
<tr><th colspan="6">Object 1011h</th></tr>
<tr><td>Index</td><td>1011_h</td><td colspan="4">-</td></tr>
<tr><td>Name</td><td colspan="5">Restore Default Parameters</td></tr>
<tr><td>Object structure</td><td>ARR</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>-</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td></td></tr>
<tr><td>Function description</td><td colspan="5">Restoring default parameters is restoring the default parameters to the EEPROM and does not take effect immediately. Next time when EEPROM is loaded (power-on, node or communication reset), the default values (factory settings) are loaded. To restore the default parameters, in addition to specifying the sub-index of the recovery area, users need to write "load" according to ASCII code, and writing other values will not restore the default values successfully.
The correspondence of writing is as follows:
MSB LSB
<table>
<tr><th>ASCII</th><th>d</th><th>a</th><th>o</th><th>1</th></tr>
<tr><td>Hexadecimal</td><td>64h</td><td>61h</td><td>6Fh</td><td>6Ch</td></tr>
</table>
The corresponding sub-index read return value indicates the way the sub-index saves the parameters. Return format and meaning are as follows:
MSB LSB
<table>
<tr><th>31 1</th><th>0</th></tr>
<tr><td>NA</td><td>0/1</td></tr>
</table>
</td></tr>
</table>

Value	Description
0	Default parameters cannot be restored
1	Default parameters can be restored

<table>
<tr><th colspan="6">Object 1014h</th></tr>
<tr><td>Index</td><td>1014$_h$</td><td colspan="4">-</td></tr>
<tr><td>Name</td><td colspan="5">COB-ID Emergency Message</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td>0x80+Node-ID</td></tr>
<tr><td>Function description</td><td colspan="5">0 on Bit31 means Emergency (EMCY) function is on (servo will send EMCY command);
1 on Bit31 means Emergency (EMCY) function is off (servo will not send EMCY command).
MSB LSB
<table><tr><th>31</th><th>30
11</th><th>10
0</th></tr><tr><td>0/1</td><td>0x0</td><td>11-bits verified COB-ID</td></tr></table>When an emergency message takes effect, its COB-ID must be consistent with this object.</td></tr>
</table>

Object 1016h

<table>
<tr><th>Index</th><th>1016$_h$</th><th colspan="4">-</th></tr>
<tr><td>Name</td><td colspan="5">Consumer Heartbeat Time</td></tr>
<tr><td>Object structure</td><td>ARR</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td></td></tr>
<tr><td>Function description</td><td colspan="5">The parameters include the address of the monitored node and the actual consumer time, and this time must be greater than the heartbeat producer time (in ms) of the corresponding node. It is not possible to set two consumer times for the same node.
The parameters are as follows:
MSB LSB
<table>
<tr><th>31 24</th><th>23 16</th><th>15 0</th></tr>
<tr><td>NA</td><td>Monitored address</td><td>Monitored time</td></tr>
</table>
The corresponding sub-index read return value indicates which way the sub-index restores the default parameters.</td></tr>
</table>

Subindex	**00$_h$**	-			
Name	**Entry Number**				
Object structure	-	**Data type**	Uint8	**Data range**	1
Mapping	NO	**Access**	RO	**Factory setting**	1
Function description	Only 0 can be written, and all error records are cleared.				

Subindex	**01$_h$**	-			
Name	**Consumer Heartbeat Time**				
Object structure	-	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RW	**Factory setting**	0

Function description	Save all parameters of the object dictionary list.

Object 1017h					
Index	**1017$_h$**	-			
Name	**Producer Heartbeat Time**				
Object structure	VAR	**Data type**	Uint16	**Data range**	Uint16
Mapping	NO	**Access**	RW	**Factory setting**	
Function description	Unit (ms).				

Object 1018h					
Index	**1018h**	-			
Name	Device Object Description **(Producer Heartbeat Time)**				
Object structure	REC	**Data type**	Uint16	**Data range**	-
Mapping	NO	**Access**	RO	**Factory setting**	

Subindex	**00$_h$**	-			
Name	**Entry Number**				
Object structure	-	**Data type**	Uint8	**Data range**	3
Mapping	NO	**Access**	RO	**Factory setting**	3

Subindex	**01h**	-			
Name	**Vendor-ID**				
Object structure	-	**Data type**	Uint16	**Data range**	Uint16

Mapping	NO	**Access**	RO	**Factory setting**	0x3B9
Function description	A unique number assigned by the CiA.				

<table>
<tr><th>Subindex</th><th>02_h</th><th colspan="4">-</th></tr>
<tr><td>Name</td><td colspan="5">Product Code</td></tr>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint16</td><td>Data range</td><td>Uint16</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RO</td><td>Factory setting</td><td>-</td></tr>
<tr><td>Function description</td><td colspan="5">The equipment code corresponds to the product series and product model on the electronic label, and the correspondence is as follows:
MSB LSB
<table>
<tr><th>31 16</th><th>15 0</th></tr>
<tr><td>Product Series</td><td>Product Model</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Subindex</th><th>03_h</th><th colspan="4">-</th></tr>
<tr><td>Name</td><td colspan="5">Revision Number</td></tr>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint16</td><td>Data range</td><td>Uint16</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RO</td><td>Factory setting</td><td>-</td></tr>
<tr><td>Function description</td><td colspan="5">Correspond to the software version number 100Ah, the specific meaning is as follows:
MSB LSB
<table>
<tr><th>31 16</th><th>15 0</th></tr>
<tr><td>Main revision version</td><td>Sub-revision version</td></tr>
</table>
</td></tr>
</table>

Object 1029h		
Index	**1029_h**	-
Name	**Error Behavior**	

Object structure	ARR	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RW	**Factory setting**	-
Function description	The state control to which the NMT of CANopen communication needs to automatically shift when different types of errors occur. NMT shifts to different states according to different values.				

Value	**Description**
0	Turn to the pre-running status from the current running status.
1	Keep the current status.
2	Enter the stop status.
Others	NA.

Subindex	**01$_h$**	**-**			
Name	**Communication Error**				
Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RW	**Factory setting**	0
Function description	Communication errors include: NMT error control timeout, PDO length error, and bus detachment.				

Subindex	**00$_h$**	**-**			
Name	**Largest Sub-index Supported**				
Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RO	**Factory setting**	1

Subindex	**01_h**	**-**			
Name	**Communication Error**				
Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RW	**Factory setting**	0
Function description	Communication errors include: NMT error control timeout, PDO length error, and bus detachment.				

<table>
<tr><th colspan="6">Object 1200h</th></tr>
<tr><td>Index</td><td>1200_h</td><td colspan="4">-</td></tr>
<tr><td>Name</td><td colspan="5">SDO Server Parameter</td></tr>
<tr><td>Object structure</td><td>REC</td><td>Data type</td><td>-</td><td>Data range</td><td>-</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RO</td><td>Factory setting</td><td>-</td></tr>
<tr><td>Function description</td><td colspan="5">The highest bit is "0" to indicate that the SDO is valid, and the highest bit is "1" to indicate that the SDO is invalid. The default SDO is always present and is a read-only constant.
MSB LSB
<table>
<tr><th>31</th><th>30 11</th><th>10 0</th></tr>
<tr><td>0/1</td><td>0x0</td><td>11-bits verified COB-ID</td></tr>
</table></td></tr>
</table>

Subindex	**00_h**	**-**			
Name	**Entry Numbers**				
Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RO	**Factory setting**	2

Subindex	**01_h**	**-**
Name	**COB-ID Client → Server(rx)**	

Object structure	-	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RW	**Factory setting**	0x600+Node-ID

Subindex	**02_h**	**-**			
Name	**COB-ID Server → Client(tx)**				
Object structure	-	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RW	**Factory setting**	0x580+Node-ID

Object 1400h: RPDO Communication Parameter

Object 1402h: RPDO Communication Parameter

Object 1403h: RPDO Communication Parameter

Object 1404h: RPDO Communication Parameter

Index	1400_h~1403_h	-			
Name	**RPDO Message COB-ID**				
Object structure	REC	**Data type**	-	**Data range**	-
Mapping	NO	**Access**	RW	**Factory setting**	-

Subindex	**00_h**	**-**			
Name	**Largest Sub-index Supported**				
Object structure	-	**Data type**	Uint8	**Data range**	0~2
Mapping	NO	**Access**	RO	**Factory setting**	2

<table>
<tr><th>Subindex</th><th>01_h</th><th colspan="4">-</th></tr>
<tr><td>Name</td><td colspan="5">RPDO COB-ID</td></tr>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td>See Function description</td></tr>
<tr><td>Function description</td><td colspan="5">Only the highest bit can be changed. "0" indicates that the PDO is valid, and "1" indicates that the PDO is invalid.
MSB LSB<table><tr><th>31</th><th>30 11</th><th>10 0</th></tr><tr><td>0/1</td><td>0</td><td>11-bits verified COB-ID</td></tr></table>Factory setting: (Node-ID default value is 1):
1400h: 0x80000200 + Node-ID
1401h: 0x80000300 + Node-ID
1402h: 0x80000400 + Node-ID
1403h: 0x80000500 + Node-ID</td></tr>
</table>

<table>
<tr><th>Subindex</th><th>02_h</th><th colspan="4">-</th></tr>
<tr><td>Name</td><td colspan="5">RPDO Reception type</td></tr>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint8</td><td>Data range</td><td>Uint8</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td>0</td></tr>
<tr><td>Function description</td><td colspan="5">This value can only be modified when the PDO is invalid.
Different values represent different PDO transmission types, as in the following table:<table><tr><th>Value</th><th>Description</th></tr><tr><td>0</td><td>Synchronous non-cycle</td></tr><tr><td>1~240</td><td>Synchronous cycle</td></tr><tr><td>254,255</td><td>Asynchronous non-cycle</td></tr></table></td></tr>
</table>

Object 1600h: RPDO1 Mapping Parameter **Object 1601h: RPDO2 Mapping Parameter** **Object 1602h: RPDO3 Mapping Parameter** **Object 1603h: RPDO4 Mapping Parameter**					
Subindex	1600_h~1603_h	-			
Name	**RPDO Mapping Parameter**				
Object structure	REC	**Data type**	-	**Data range**	-
Mapping	NO	**Access**	RW	**Factory setting**	-
Function description	This object can be modified only when PDO is off. The total bit length of the mapped object must not exceed 64 bits, and only per-byte mapping is supported, not per-bit mapping.				

Subindex	**00_h**	**-**			
Name	**Number of valid mapped objects in PDO**				
Object structure	-	**Data type**	Uint8	**Data range**	0~4
Mapping	NO	**Access**	RW	**Factory setting**	-
Function description	When writing 0, the other sub-index mapping object is invalid.				

Subindex	1_h~4_h	**-**			
Name	**RPDO Mapped Object**				
Object structure	-	**Data type**	Uint32	**Data range**	Uint32
Mapping	NO	**Access**	RW	**Factory setting**	-

<table>
<tr>
<td>Function description</td>
<td>The mapped object content, index and sub-index must exist in the object dictionary list, in writable state and be mappable. Write the corresponding sub-index in the following format:
MSB LSB
<table>
<tr><th>31 16</th><th>15 8</th><th>7 0</th></tr>
<tr><td>Index</td><td>Subindex</td><td>Object length</td></tr>
</table>
</td>
</tr>
</table>

RPDO default mapping content:

(1) RPDO1(1600_h)

Sub-index	Value	Description
0	1	Map 1 object
1	0x60400010	Command word

(2) RPDO2(1601_h)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Control word
2	0x60600008	Running mode selection

(3) RPDO3(1602_h)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Control word
2	0x607A0020	Target position (position command)

(4) RPDO4(1603_h)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Control word
2	0x60FF0020	Target speed (speed command)

Object 1800h: TPDO1 Communication Parameter

Object 1801h: TPDO2 Communication Parameter

Object 1802h: TPDO3 Communication Parameter

Object 1803h: TPDO4 Communication Parameter

Index	1800_h~1803_h	

Name	**TPDO Communication Parameter**				
Object structure	REC	**Data type**	-	**Data range**	-
Mapping	NO	**Access**	RW	**Factory setting**	-

Subindex	**00_h**	-			
Name	**Largest Sub-index Supported**				
Object structure	-	**Data type**	Uint8	**Data range**	0~4
Mapping	NO	**Access**	RO	**Factory setting**	5

<table>
<tr><th>Subindex</th><th>01_h</th><th colspan="4">-</th></tr>
<tr><td>Name</td><td colspan="5">TPDO COB-ID</td></tr>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td>See Function description</td></tr>
<tr><td>Function description</td><td colspan="5">Only the highest bit can be changed. "0" indicates that the TPDO is valid, and "1" indicates that the TPDO is invalid.
MSB LSB
<table>
<tr><th>31</th><th>30</th><th>11</th><th>10</th><th>0</th></tr>
<tr><td>0/1</td><td colspan="2">0</td><td colspan="2">11-bits verified COB-ID</td></tr>
</table>
Factory setting: (Node-ID default value is 1):
1800h: 0x80000180 + Node-ID
1801h: 0x80000280 + Node-ID
1802h: 0x80000380 + Node-ID
1803h: 0x80000480 + Node-ID</td></tr>
</table>

Subindex	**02_h**	-
Name	**TPDO transmission type**	

Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RW	**Factory setting**	255
Function description	This value can only be modified when the PDO is invalid. Different values represent different PDO transmission types, as in the following table:				

Value	Description
0	Synchronous non-cycle
1~240	Synchronous cycle
255	Asynchronous cycle

Subindex	**03_h**	**-**			
Name	**Inhibit Time**				
Object structure	-	**Data type**	Uint16	**Data range**	Uint16
Mapping	NO	**Access**	RW	**Factory setting**	8
Function description	This object can be modified only when PDO is off. Unit is 125us. Note: The inhibit time is invalid when set to 0.				

Subindex	**04_h**	**-**			
Name	**Reserved**				
Object structure	-	**Data type**	Uint8	**Data range**	Uint8
Mapping	NO	**Access**	RW	**Factory setting**	0

Subindex	**05_h**	**-**
Name	**Event Timer**	

Object structure	-	**Data type**	Uint16	**Data range**	Uint16
Mapping	NO	**Access**	RW	**Factory setting**	2
Function description	This object can be modified only when PDO is off. Unit is 1ms. Note: When set to 0, the time timer is invalid.				

Object 1A00h: TPDO1 Mapping Parameter **Object 1A01h: TPDO2 Mapping Parameter** **Object 1A02h: TPDO3 Mapping Parameter** **Object 1A03h: TPDO3 Mapping Parameter**					
Index	$1A00_h$~$1A03_h$				
Name	**TPDO Mapping Parameter**				
Object structure	REC	**Data type**	-	**Data range**	-
Mapping	NO	**Access**	RW	**Factory setting**	-
Function description	This object can be modified only when PDO is off. The total bit length of the mapped object must not exceed 64 bits, and only per-byte mapping is supported, not per-bit mapping.				

Subindex	**00_h**	-			
Name	**Number of valid mapped objects in PDO**				
Object structure	-	**Data type**	Uint8	**Data range**	0~4
Mapping	NO	**Access**	RW	**Factory setting**	-
Function description	When writing 0, the sub-index mapping object is invalid.				

Subindex	1_h~4_h	-
Name	**TPDO Mapped Object (Application Object)**	

<table>
<tr><td>Object structure</td><td>-</td><td>Data type</td><td>Uint32</td><td>Data range</td><td>Uint32</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td>Factory setting</td><td>-</td></tr>
<tr><td>Function description</td><td colspan="5">The mapped object content, index and sub-index must exist in the object dictionary list, in writable state and be mappable.
Write the corresponding mapped object in the following format:
MSB LSB
<table>
<tr><td>31 16</td><td>15 8</td><td>7 0</td></tr>
<tr><td>Index</td><td>Subindex</td><td>Object length</td></tr>
</table>
</td></tr>
</table>

TPDO default mapping content:

(1) TPDO1($1A00_h$)

Subindex	**Value**	**Description**
0	1	Map 1 objects
1	0x60410010	Status word

(2) TPDO2($1A01_h$)

Subindex	**Value**	**Description**
0	2	Map 2 objects
1	0x60410010	Status word
2	0x60610008	Current running mode

(3) TPDO3($1A02_h$)

Subindex	**Value**	**Description**
0	2	Map 2 objects
1	0x60410010	Status word
2	0x60640020	Current position

(4) TPDO4($1A03_h$)

Subindex	**Value**	**Description**
0	2	Map 2 objects
1	0x60410010	Status word
2	0x606C0020	Current speed

9.2.10.6 6000h Detailed Object Description

Object 603Fh	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**603F$_h$**	-							
Name	**Error Code**								
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535				
Mapping	Y	**Access**	RO	**Factory setting**	-				
Function description	The fault code is the error that occurred the last time. See the fault list for details.								

Object 6040h	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6040$_h$**	-							
Name	**Control word**								
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535				
Mapping	Y	**Access**	RW	**Factory setting**	0				
Function description	Bit definition of the control word:								

Bit	Description	Description
0	Switch on	0: invalid; 1: valid
1	Enable voltage	0: invalid; 1: valid
2	Quick stop	1: invalid; 0: valid
3	Enable operation	0: invalid; 1: valid

<table>
<tr><td></td><td>
<table>
<tr><td>4~6</td><td>Mode-related</td><td>
<table>
<tr><th rowspan="2">Bit</th><th colspan="4">Running mode</th></tr>
<tr><th>PP</th><th>PV</th><th>PT</th><th>HM</th></tr>
<tr><td>4</td><td>New position rising edge triggered</td><td>NA</td><td>NA</td><td>Home return on</td></tr>
<tr><td>5</td><td>0: non-immediate update
1: immediate update</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>6</td><td>0: absolute position
1: relative position</td><td>NA</td><td>NA</td><td>NA</td></tr>
</table>
</td></tr>
<tr><td>7</td><td>Fault reset</td><td>bit7 rising edge is valid;
bit7 is held to 1, and all other control commands are invalid</td></tr>
<tr><td>8</td><td>Halt</td><td>0: invalid; 1: valid</td></tr>
<tr><td>9~10</td><td>NA</td><td></td></tr>
<tr><td>11~15</td><td>Factory-defined</td><td></td></tr>
</table>
Note: Each bit in the control word needs to be used together with other bits to form a control command.
</td></tr>
</table>

Object 6041h	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6041$_h$**	-				
Name	**Status Word**					
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535	
Mapping	Y	**Access**	RO	**Factory setting**	0	

<table>
<tr>
<td>Function description</td>
<td>Bit definition of a status word:
<table>
<tr><th>Bit</th><th>Name</th><th>Bit definition</th></tr>
<tr><td>0</td><td>Switch on</td><td>1: valid 0: invalid</td></tr>
<tr><td>1</td><td>Wait to enable servo</td><td>1: valid 0: invalid</td></tr>
<tr><td>2</td><td>Enable operation</td><td>1: valid 0: invalid</td></tr>
<tr><td>3</td><td>Fault</td><td>0: no faults 1: fault</td></tr>
<tr><td>4</td><td>Enable voltage</td><td>1: valid 0: invalid</td></tr>
<tr><td>5</td><td>Quick stop</td><td>0: valid 1: invalid</td></tr>
<tr><td>6</td><td>Power-on and running allowed</td><td>1: valid 0: invalid</td></tr>
<tr><td>7</td><td>Warning</td><td>1: valid 0: invalid</td></tr>
<tr><td>8</td><td>Factory-defined</td><td>-</td></tr>
<tr><td>9</td><td>Remote control</td><td>0: non-CANopen mode
1: CANopen remote control mode</td></tr>
<tr><td>10</td><td>Target reached</td><td>Speed mode:
0: target speed is not reached
1: target speed reached
Position mode:
0: target position is not
1: target position is reached</td></tr>
<tr><td>11</td><td>Software internal position exceeds the limit</td><td>0: position command or feedback does not reach the internal position limit of the software
1: position command or feedback reaches the internal position limit of the software</td></tr>
<tr><td>12~13</td><td>Relate to control mode</td><td>-</td></tr>
<tr><td>14</td><td>NA</td><td>-</td></tr>
<tr><td>15</td><td>Home return completed</td><td>0: home return is not performed or not completed
1: home return is completed and the reference point has been found</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><th>Object
605Ah</th><th colspan="2">-</th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>605A$_h$</td><td colspan="6">-</td></tr>
<tr><td>Name</td><td colspan="7">Quick Stop Option Code</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int16</td><td colspan="2">Data range</td><td colspan="2">0~2</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td colspan="2">Factory setting</td><td colspan="2">2</td></tr>
<tr><td>Function description</td><td colspan="7">
<table>
<tr><th>Displayed value</th><th>Control mode display</th></tr>
<tr><td>0</td><td>Free stop, and free running after free stop is completed.</td></tr>
<tr><td>1</td><td>Ramp stop at deceleration speed set at 6084h (hm: 609Ah), and free running after stop is completed.</td></tr>
<tr><td>2</td><td>Ramp stop at deceleration speed set at 6085h, and free running after stop is completed.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Object
605Dh</th><th colspan="2">-</th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>605D$_h$</td><td colspan="6">-</td></tr>
<tr><td>Name</td><td colspan="7">Halt Stop Option Code</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int16</td><td colspan="2">Data range</td><td colspan="2">1~3</td></tr>
<tr><td>Mapping</td><td>NO</td><td>Access</td><td>RW</td><td colspan="2">Factory setting</td><td colspan="2">1</td></tr>
<tr><td>Function description</td><td colspan="7">
<table>
<tr><th>Displayed value</th><th>Control mode display</th></tr>
<tr><td>1</td><td>Ramp stop as setting at 6084h/6087h (hm:609Ah), and position is locked after stop is completed.</td></tr>
<tr><td>2</td><td>Ramp stop as setting at 6085h/6087h, and position is locked after stop is completed.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>3</td><td>Emergency torque stop, and position is locked after stop is completed.</td></tr></table></td></tr>
</table>

<table>
<tr><th>Object
6060h</th><th colspan="4">-</th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>6060$_h$</td><td colspan="8">-</td></tr>
<tr><td>Name</td><td colspan="9">Modes of Operation</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int8</td><td>Data range</td><td colspan="5">0~7</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RW</td><td>Factory setting</td><td colspan="5">1</td></tr>
<tr><td>Function description</td><td colspan="9">Set servo running mode:<table>
<tr><th>Set Value</th><th>Description</th></tr>
<tr><td>0</td><td>NA</td></tr>
<tr><td>1</td><td>Profile position mode (PP)</td></tr>
<tr><td>3</td><td>Profile velocity mode (PV)</td></tr>
<tr><td>4</td><td>Profile torque mode (PT)</td></tr>
<tr><td>6</td><td>Homing mode (HM)</td></tr>
<tr><td>7</td><td>Interpolation mode (IP)</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Object
6061h</th><th colspan="4">-</th><th>PP</th><th>PV</th><th>PT</th><th>HM</th><th>IP</th></tr>
<tr><td>Index</td><td>6061$_h$</td><td colspan="8">-</td></tr>
<tr><td>Name</td><td colspan="9">Modes of Operation Display</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int8</td><td>Data range</td><td colspan="5">0~7</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RO</td><td>Factory setting</td><td colspan="5">0</td></tr>
</table>

	Displayed value	Control mode display
Function description	**0**	NA
	1	Profile position mode (PP)
	3	Profile velocity mode (PV)
	4	Profile torque mode (PT)
	6	Homing mode (HM)
	7	Interpolation mode (IP)

Object 6062h	-		**PP**	**HM**	**IP**
Index	**6062h**	-			
Name	**Position Command**				
Object structure	VAR	**Data type**	Int 32	**Data range**	-2^{31}~$(2^{31}-1)$
Mapping	Y	**Access**	RO	**Factory setting**	0
Function description	Position command value (Unit: Command unit).				

Object 6063h	-		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6063h**	-					
Name	**Motor Position Feedback (Position Actual Value)**						
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$		
Mapping	Y	**Access**	RO	**Factory setting**	0		
Function description	Reflect real-time motor absolute position feedback (Unit: Encoder unit).						

Object	-	**PP**	**PV**	**PT**	**HM**	**IP**

6064h					
Index	**6064$_h$**	-			
Name	**User Position Feedback (Position Actual Value)**				
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$
Mapping	Y	**Access**	RO	**Factory setting**	0
Function description	Real-time absolute motor position feedback (Unit: Command unit). User position feedback 6064h × Gear ratio (6091h) = Motor position feedback 6063h.				

Object 6065h	-		**PP**	**HM**	**IP**
Index	**6065$_h$**	-			
Name	**Excessive Position Deviation Threshold (Following Error Window)**				
Object structure	VAR	**Data type**	Uint32	**Data range**	0~$(2^{31}-1)$
Mapping	Y	**Access**	RW	**Factory setting**	3840000
Function description	Set the excessive position deviation threshold (Unit: Command unit). If the difference between user position command 6062h and user position feedback 6064h exceeds ±6065h, an excessive position deviation fault (ER. d00) occurs. When 6065h is set to 4294967295, the servo does not monitor excessive position deviation.				

Object 6067h	-		**PP**	**HM**	**IP**
Index	**6067$_h$**	-			
Name	**Position Reach Threshold (Position Window)**				
Object structure	VAR	**Data type**	Uint32	**Data range**	0~$(2^{31}-1)$
Mapping	Y	**Access**	RW	**Factory setting**	100

Function description	Set the threshold value for position reaching (unit: Command unit). The difference between the user position command 6062h and the actual user position feedback 6064h is within ±6067h, and the position is considered to be reached when the time reaches 6068h, and status word 6041 bit10=1 in profile position mode.

Object 6068h	-		**PP**	**HM**	**IP**
Index	**6068$_h$**	-			
Name	**Position Reach Time Window (Position Window Time)**				
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Set the time window for judging the validity of the position arrival (unit: 0.1ms). The difference between the user position command 6062h and the actual user position feedback 6064h is within ±6067h, and the position is considered to be reached when the time reaches 6068h, and status word 6041 bit10=1 in profile position mode.				

Object 606Bh	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**606B$_h$**	-				
Name	**User Actual Speed Command (Velocity Demand Value)**					
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$	
Mapping	Y	**Access**	RO	**Factory setting**	-	
Function description	Reflect the actual user speed command (unit: Command unit/s). In position-related modes, it reflects the speed command corresponding to the output of the position regulator; In speed-related modes, it reflects the input command of the speed regulator.					

Object	-	**PP**	**PV**	**PT**	**HM**	**IP**

606Ch					
Index	**606C$_h$**	-			
Name	**User Actual Velocity Feedback (Velocity Actual Value)**				
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$
Mapping	Y	**Access**	RO	**Factory setting**	-
Function description	Reflect the actual user speed feedback value (unit: Command unit/s).				

Object 606Dh	-				**PV**
Index	**606D$_h$**	-			
Name	**Velocity Reach Threshold (Velocity Window)**				
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	100
Function description	Set the threshold value for speed reaching (unit: 0.1rpm). When the difference between the target speed 60FFh and the actual user speed 606Ch is within ±606Dh and the time reaches 606Eh, the speed is considered to be reached and status word 6041h bit10 = 1 in the profile speed mode. Conversely, status word 6061h bit10 = 0.				

Object 606Eh	-				**PV**
Index	**606E$_h$**	-			
Name	**Velocity Reach Window Time (Velocity Window Time)**				
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	0

Function description	Set the time window (unit: ms) for judging the speed arrival validity. When the difference between the target speed 60FFh and the actual user speed 606Ch is within ±606Dh and the time reaches 606Eh, the speed is considered to be reached and status word 6041h bit10 = 1 in the profile speed mode. Conversely, status word 6061h bit10 = 0.

Object 606Fh	-				**PV**
Index	**606Fh**	-			
Name	**Zero-Speed Threshold (Velocity Threshold)**				
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	10
Function description	Set the threshold to judge whether the user speed is 0 (unit: 1rpm). User speed feedback 606Ch within ±606Fh, and the time reaching 6070h set value means that the user speed is 0, at this time the status word 6041h bit12 = 1; either of the two conditions nor met means that the user speed is not 0, at this time the status word 6041h bit12 of = 0.				

Object 6070h	-				**PV**
Index	**6070h**	-			
Name	**Zero-speed Window Time**				
Object structure	VAR	**Data type**	Uint16	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Set the time window to judge whether the user speed is 0 (unit: 2ms). User speed feedback 606Ch within ±606Fh, and the time reaching 6070h set value means that the user speed is 0, at this time the status word 6041h bit12 = 1; either of the				

	two conditions nor met means that the user speed is not 0, at this time the status word 6041h bit12 of = 0.

Object 6071h	-				**PT**
Index	**6071h**	-			
Name	**Target Torque**				
Object structure	VAR	**Data type**	Int16	**Data range**	-5000~5000
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	For commanding the target value (unit: 0.1%) in profile torque mode and cycle synchronous torque mode.				

Object 6072h	-			**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6072h**	-						
Name	**Maximum Torque**							
Object structure	VAR	**Data type**	Uint16	**Data range**	-5000~5000			
Mapping	Y	**Access**	RW	**Factory setting**	3000			
Function description	Set the maximum output torque value of the servo (unit: 0.1%).							

Object 6074h	-			**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6074h**	-						
Name	**Torque Command (Torque Demand Value)**							
Object structure	VAR	**Data type**	Uint16	**Data range**	-5000~5000			

Mapping	Y	**Access**	RO	**Factory setting**	-
Function description	Display the current torque command (unit: 0.1%).				

Object 6075h	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6075**$_h$	-				
Name	**Motor Rated Current**					
Object structure	VAR	**Data type**	Uint 32	**Data range**	Uint 32	
Mapping	Y	**Access**	RO	**Factory setting**	0	
Function description	The rated current (in mA) on the motor nameplate. All current-related parameters are related to this parameter.					

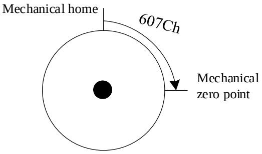
Object 6076h	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6076**$_h$	-				
Name	**Motor Rated Torque**					
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32	
Mapping	Y	**Access**	RO	**Factory setting**	0	
Function description	The rated torque (in mNm) on the motor nameplate. All torque related parameters are related to this parameter.					

Object 6077h	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6077**$_h$	-				
Name	Motor feedback torque (Motor actual torque)					

Object structure	VAR	**Data type**	Int16	**Data range**	Int16
Mapping	Y	**Access**	RO	**Factory setting**	0
Function description	Reflect the instantaneous torque output of the servo motor (unit: 0.1%).				

Object 6078h	-			**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6078$_\text{h}$**	-						
Name	Instantaneous current output (Current actual value)							
Object structure	VAR	**Data type**	Int16	**Data range**	Int16			
Mapping	Y	**Access**	RO	**Factory setting**	0			
Function description	Reflect the instantaneous current output of the servo motor (unit: 0.1%).							

Object 607Ah	-				**PP**
Index	**607A$_\text{h}$**	-			
Name	**Target Position**				
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Set the servo target position (unit: Command unit) in profile position mode. When control word 6040h bit6 is 0, 607Ah is the absolute target position of the current segment; When control word 6040h bit6 is 1, 607Ah is the target incremental displacement of the current segment.				

Object 607Ch	**-**				**HM**
Index	**607C$_h$**	**-**			
Name	**Home Offset**				
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	In the position-related control mode, the mechanical zero-point deviates from the physical position of the motor origin (unit: Command unit). Mechanical zero point = mechanical home position + 607Ch (home offset). When set to 0, the home point is not offset. 				

Object 607Dh	**-**	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**607D$_h$**	**-**				
Name	**Software Absolute Position Limit (Software position Limit)**					
Object structure	ARR	**Data type**	Int32	**Data range**	Int32	
Mapping	Y	**Access**	RW	**Factory setting**	0	

Function description	Set the minimum and maximum value of the software absolute position limit. Minimum absolute position limit = (607D-01h) Maximum absolute position limit = (607D-02h) Software absolute position limit setting: 1. When both (607D-01h) and (607D-02h) are set to the default value, the software limit is invalid. 2. When the minimum absolute position limit (607D-01h) is greater than the maximum absolute position limit (607D-02h), the software internal automatically adjust its value. 3. When the position command or position feedback reaches the software limit value, the servo will take the position limit as the target position in position mode, and stop when it reaches the position limit, and then prompt the over-travel warning. Input reverse command to exit position exceeding state of motor. 4. Absolute position limit is relative to the motor feedback position 6064h (user unit).

Subindex	**00_h**	**-**			
Name	**Subindex Number**				
Object structure	VAR	**Data type**	Uint8	**Data range**	2
Mapping	Y	**Access**	RO	**Factory setting**	2

Subindex	**01_h**	**-**			
Name	**Minimum Software Absolute Position Limit (Min. Position Limit)**				
Object structure	VAR	**Data type**	Int32	**Data range**	Int32
Mapping	Y	**Access**	RW	**Factory setting**	-231

Subindex	**02_h**	**-**
Name	**Maximum Software Absolute Position Limit (Max. Position Limit)**	

Object structure	VAR	**Data type**	Int32	**Data range**	Int32
Mapping	Y	**Access**	RW	**Factory setting**	231

Object 607Eh	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**607E$_h$**	-							
Name	**Command Polarity**								
Object structure	VAR	**Data type**	Uint8	**Data range**	Int8				
Mapping	Y	**Access**	RW	**Factory setting**	0				
Function description	Set the polarity of position command, speed command and torque command.								

MSB LSB

7	**6**	**5**	**4** **0**
Position polarity	Speed polarity	Torque polarity	NA

Bit7 = 1, standard position mode, reverses the motor as the position command ×(-1). In profile position mode and synchronous cycle position mode, the position command and target position are reversed.

Bit6 = 1, speed mode, speed command (60FFh) ×(-1), reverse the motor.

Bit5 = 1, torque mode, torque command ×(-1).

Object 607Fh	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**607F$_h$**	-							
Name	**Max. Profile Velocity**								
Object structure	VAR	**Data type**	Uint32	**Data range**	0~(2^{32}-1)				
Mapping	Y	**Access**	RW	**Factory setting**	838860800				

Function description	Set the maximum running speed (unit: Command unit/s). The set value is valid when the slave speed command is changed. $\text{Max profile speed(rpm)} = \frac{607\text{Fh} \times \frac{6091:01\text{h}}{6091:02\text{h}}}{\text{encoder resolution}} \times 60$ Note: in various modes, the maximum running speed is limited by the function code Pn318 in addition to the 607Fh limit. The smaller of the two is taken as the limit.

Object 6080h	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6080$_h$**	-				
Name	**Max. Motor Speed**					
Object structure	VAR	**Data type**	Uint32	**Data range**	0~(2^{32}-1)	
Mapping	Y	**Access**	RW	**Factory setting**	Max Speed Limit	
Function description	The maximum allowable running speed of the motor can be obtained from the servo motor manual (unit: rpm).					

Object 6081h	-				**PP**
Index	**6081$_h$**	-			
Name	**Position Profile Velocity**				
Object structure	VAR	**Data type**	Uint32	**Data range**	0~(2^{32}-1)
Mapping	Y	**Access**	RW	**Factory setting**	8388608
Function description	The running speed (in command unit/s) reaches the speed of uniform section after the completion of acceleration section in profile position mode. $\text{Motor speed(rpm)} = \frac{6081\text{h} \times \frac{6091:01\text{h}}{6091:02\text{h}}}{\text{Encoder resolution}} \times 60$				

Object 6083h	-	**PP**	**PV**

Index	**6083_h**	-			
Name	**Profile Acceleration**				
Object structure	VAR	**Data type**	Uint32	**Data range**	0~(2^{32}-1)
Mapping	Y	**Access**	RW	**Factory setting**	83886080
Function description	Set the acceleration (unit: Command unit/s^2) during profile position mode and profile speed mode. In position profile mode, the change is effective before this segment command is triggered, and after this segment command is triggered, it is valid when the current segment is finished. In profile speed mode, it takes effect immediately. When the parameter is set to 0, it is forced to 1 internally by the software.				

Object 6084h	-			**PP**	**PV**
Index	**6084_h**	-			
Name	**Profile Deceleration**				
Object structure	VAR	**Data type**	Uint32	**Data range**	0~(2^{32}-1)
Mapping	Y	**Access**	RW	**Factory setting**	83886080
Function description	Set the deceleration (unit: command unit/s^2) during profile position mode and profile speed mode. In profile speed mode, it takes effect immediately. When the parameter is set to 0, it is forced to 1 internally by the software.				

Object 6085h	-	**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6085_h**	-				
Name	**Quick Stop Deceleration**					

Object structure	VAR	**Data type**	Uint32	**Data range**	$0\sim(2^{32}-1)$
Mapping	Y	**Access**	RW	**Factory setting**	2147483647
Function description	Valid when quick stop 6040h: bit2=0 and when 605Ah (Quick stop mode) = 2, it runs at the speed of deceleration section.				

Object 6086h	-			**PP**	**PV**
Index	**6086_h**	-			
Name	**Motion Running Profile Type**				
Object structure	VAR	**Data type**	Int16	**Data range**	Int16
Mapping	Y	**Access**	RW	**Factory setting**	-
Function description	Profile type of motor position command or speed command				

Object 6087h	-				**PT**
Index	**6087_h**	-			
Name	**Torque Ramp Time**				
Object structure	VAR	**Data type**	Uint32	**Data range**	0~65535
Mapping	Y	**Access**	RW	**Factory setting**	1000
Function description	Set the torque command acceleration in profile torque mode, which indicates the torque command increment per second (0.1%/s). In contour torque mode, a deceleration stop will be performed by 6087h for quick stop 605Ah=1 or 2, or halt stop 605Dh=1 or 2. The parameter will be forced to convert to 1 when set to 0.				

Object 6091h	-		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**6091_h**	-					
Name	Gear Ratio						
Object structure	ARR	**Data type**	Uint32	**Data range**	Uint32		
Mapping	Y	**Access**	RW	**Factory setting**	-		
Function description	Position factor is used to establish a user-specified proportional relationship between load displacement and motor displacement: $\text{Motor displacement (motor unit)} = \text{load displacement (user unit)} \times \text{position factor}$ The setting of the position factor is related to the mechanical reduction ratio, the parameters related to the mechanical dimensions, and the motor resolution. The calculations are as follows: $\text{Position factor} = \frac{\text{motor resolution} \times \text{gear ratio}}{\text{load feeding}}$ The gear ratio setting of 6091h is in series with the gear ratio settings of Pn204 and Pn206. The setting of the electronic gear ratio in the CAN model: $\text{Gear ratio} = \frac{Pn204}{Pn206} \times \frac{6091:01h}{6091:02h}$						

Subindex	**00_h**	-			
Name	**Subindex Number**				
Object structure	VAR	**Data type**	Uint8	**Data range**	2
Mapping	Y	**Access**	RO	**Factory setting**	2

Subindex	**01_h**	-
Name	**Motor Resolution**	

Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	Y	**Access**	RW	**Factory setting**	1

Subindex	**02_h**	**-**			
Name	**Shaft Resolution**				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	Y	**Access**	RW	**Factory setting**	1

Object 6098h	**-**				**HM**
Index	**6098_h**	-			
Name	**Homing Mode**				
Object structure	VAR	**Data type**	Int8	**Data range**	0~35
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Select the homing mode:				

Value	**Description**
1	Home in face of reverse limit switches and Z pulse signals
2	Home in face of forward limit switches and Z pulse signals
3, 4	Home in face of forward home switches and Z pulse signals
5, 6	Home in face of reverse home switches and Z pulse signals
7~14	Home in face of home switches and Z pulse signals
15~16	NA

	17~30	Home without reference to the Z pulse signals
	31~32	NA
	33~34	Home without reference to the Z pulse signals
	35	Current position as zero point

Cautions	
⚠	●ER.E03 alarm occurs when setting data other than those above.

Object **6099h**	**-**				**HM**
Index	**6099$_h$**	**-**			
Name	**Homing Speed**				
Object structure	ARR	**Data type**	Uint8	**Data range**	Uint32
Mapping	Y	**Access**	RW	**Factory setting**	-
Function description	The 2 speed value settings included in the home mode: 6099-01h search for deceleration point signal speed (unit: command unit/s); 6099-02h search for the home signal speed (unit: command unit/s).				

Subindex	**00$_h$**	**-**			
Name	**Subindex Number**				
Object structure	VAR	**Data type**	Uint8	**Data range**	2
Mapping	Y	**Access**	RO	**Factory setting**	2

Subindex	**01$_h$**	**-**			
Name	**Speed During Search for Switch**				
Object structure	VAR	**Data type**	Uint32	**Data range**	$0\sim2^{32}-1$

Mapping	Y	**Access**	RW	**Factory setting**	27962027
Function description	This subindex is used to set the search deceleration point signal speed, this speed can be set to a higher value to prevent too long homing time which may result in home return timeout faults.				

Subindex	**02_h**	**-**			
Name	**Speed During Search for Zero**				
Object structure	VAR	**Data type**	Uint32	**Data range**	1~500
Mapping	Y	**Access**	RW	**Factory setting**	5592405

Cautions	
⚠	● When home returning, the slave station will decelerate running after finding the deceleration point; ● During deceleration, the slave station shields the change of the home signal, and in order to avoid meeting the home signal during deceleration, the switch position of the deceleration point signal should be set reasonably; such as leaving enough deceleration distance and increasing the acceleration of returning, etc.

Object 609Ah	**-**				**HM**
Index	**$609A_h$**	**-**			
Name	**Homing Acceleration/Homing Deceleration**				
Object structure	VAR	**Data type**	Uint32	**Data range**	$0 \sim 2^{32}-1$
Mapping	Y	**Access**	RW	**Factory setting**	83886080
Function description	Set the acceleration and deceleration in home return mode (unit: command unit/s^2).				

Object 60C1h	-				**IP**
Index	**60C1$_h$**	-			
Name	**Interpolation Data Record**				
Object structure	ARR	**Data type**	Int32	**Data range**	Int32
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Interpolation mode command parameter setting.				
Subindex	**00$_h$**	-			
Name	**Subindex Number**				
Object structure	VAR	**Data type**	Uint8	**Data range**	3
Mapping	N	**Access**	RO	**Factory setting**	3

Subindex	**01$_h$**	-			
Name	Absolute Position Command				
Object structure	VAR	**Data type**	Int32	**Data range**	Int32
Mapping	Y	**Access**	RW	**Factory setting**	0
Function description	Interpolation mode absolute position command value, unit: command unit.				

Object 60C2h	-	**IP**
Index	**60C2$_h$**	-
Name	**Interpolation Cycle**	

Object structure	ARR	**Data type**	Uint8	Data range	Uint8
Mapping	Y	**Access**	RW	Factory setting	0

Subindex	**00_h**	-			
Name	Subindex Number				
Object structure	VAR	**Data type**	Uint8	**Data range**	2
Mapping	N	**Access**	RO	**Factory setting**	2
Function description	Number of sub-indexes of the Object dictionary for the interpolation cycle.				

Subindex	01_h	-			
Name	Interpolation Cycle Time Constant				
Object structure	VAR	**Data type**	Uint8	**Data range**	Uint8
Mapping	Y	**Access**	RW	**Factory setting**	1
Function description	The interpolation cycle time unit is given by 60C2_02h. Example: If 60C2_02h is -3, and 60C2_01h is 1, it means the interpolation period currently set is 1ms. Note: The interpolation cycle and the synchronization cycle must be the same.				

Subindex	**02_h**	-			
Name	Interpolation Cycle Time Index				
Object structure	VAR	**Data type**	Int8	**Data range**	Int8
Mapping	Y	**Access**	RW	**Factory setting**	-3

Function description	Set interpolation period unit. Give -3, the interpolation period unit is ms. Give -4, the interpolation period unit is 0.1ms. Give -2, the interpolation period unit is 10ms.

Object 60C5h	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**60C5h**	-							
Name	**Max. Profile Acceleration**								
Object structure	VAR	**Data type**	Uint32	**Data range**	$0\sim(2^{32}-1)$				
Mapping	Y	**Access**	RW	**Factory setting**	2147483647				
Function description	Profile maximum acceleration (unit: Command unit/s^2)								

Object 60C6h	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**60C6h**	-							
Name	**Max. Profile Deceleration**								
Object structure	VAR	**Data type**	Uint32	**Data range**	$0\sim(2^{32}-1)$				
Mapping	Y	**Access**	RW	**Factory setting**	2147483647				
Function description	Profile maximum deceleration (unit: Command unit/s^2)								

Object 60E0h	-				**PP**	**PV**	**PT**	**HM**	**IP**
Index	**60E0h**	-							
Name	**Forward Torque Limit Value**								

<table>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td>Uint16</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RW</td><td>Factory setting</td><td>3000</td></tr>
<tr><td>Function description</td><td colspan="5">Limit the maximum value of forward torque (unit: 0.1%).</td></tr>
</table>

<table>
<tr><td>Object 60E1h</td><td colspan="3">-</td><td>PP</td><td>PV</td><td>PT</td><td>HM</td><td>IP</td></tr>
<tr><td>Index</td><td>60E1$_h$</td><td colspan="7">-</td></tr>
<tr><td>Name</td><td colspan="8">Negative Torque Limit</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td colspan="4">Uint16</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RW</td><td>Factory setting</td><td colspan="4">3000</td></tr>
<tr><td>Function description</td><td colspan="8">Limit the maximum value of negative torque (unit: 0.1%).</td></tr>
</table>

<table>
<tr><td>Object 60F4h</td><td colspan="4">-</td><td>PP</td><td>HM</td><td>IP</td></tr>
<tr><td>Index</td><td>60F4$_h$</td><td colspan="6">-</td></tr>
<tr><td>Name</td><td colspan="7">User position deviation (Following Error Actual Value)</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Int32</td><td>Data range</td><td colspan="3">-2^{31}~$(2^{31}-1)$</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RO</td><td>Factory setting</td><td colspan="3">0</td></tr>
<tr><td>Function description</td><td colspan="7">Real-time position deviation (unit: user unit).</td></tr>
</table>

<table>
<tr><td>Object 60FCh</td><td colspan="4">-</td><td>PP</td><td>HM</td><td>IP</td></tr>
<tr><td>Index</td><td>60FC$_h$</td><td colspan="6">-</td></tr>
</table>

Name	**Motor position command (Position Demand Value*)**				
Object structure	VAR	**Data type**	Int32	**Data range**	-2^{31}~$(2^{31}-1)$
Mapping	Y	**Access**	RO	**Factory setting**	0
Function description	Real-time motor position command (unit: encoder unit). User position command (6062h) × Electronic gear ratio = Motor position command (60FCh)				

Object 60FDh	-		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**60FD$_{h}$**	-					
Name	**Digital Input**						
Object structure	VAR	**Data type**	Uint32	**Data range**	0~$(2^{32}-1)$		
Mapping	Y	**Access**	RO	**Factory setting**	0		
Function description	Reflects the current DI terminal logic of the drive, 0 means invalid, 1 means valid. The DI signals indicated by each of them are as follows:						

MSB LSB

31 6	15 4	3	2	1	0
Factory-defined	NA	Undefined	Undefined	Forward overtravel switch	Forward overtravel switch

Object 60FEh	-		**PP**	**PV**	**PT**	**HM**	**IP**
Index	**60FE$_{h}$**	-					
Name	**Digital Output**						
Object structure	ARR	**Data type**	Uint32	**Data range**	Uint32		

Mapping	Y	**Access**	RO	**Factory setting**	0

Subindex	**00_h**	**-**			
Name	**Subindex Number**				
Object structure	VAR	**Data type**	Uint8	**Data range**	1
Mapping	N	**Access**	RO	**Factory setting**	1

Subindex	**01_h**	**-**			
Name	**Physical Output**				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping	Y	**Access**	RO	**Factory setting**	0
Function description	Reflect the drive's current DO terminal logic, 0 indicating invalid and 1 indicating valid.				

MSB **LSB**

31 16	**15 1**	**0**
Factory-defined	NA	Holding brake output

Object 60FFh	**-**				**PV**
Index	**$60FF_h$**	**-**			
Name	**Target Velocity**				
Object structure	VAR	**Data type**	Int32	**Data range**	Int32
Mapping	Y	**Access**	RW	**Factory setting**	0

Function description	User speed command (unit: command unit/s) in profile speed mode.

<table>
<tr><th colspan="6">Object 6502h: Running Mode Supported</th></tr>
<tr><td>Index</td><td>6502_h</td><td colspan="4">-</td></tr>
<tr><td>Name</td><td colspan="5">Servo operation mode supported</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint16</td><td>Data range</td><td>Uint16</td></tr>
<tr><td>Mapping</td><td>Y</td><td>Access</td><td>RO</td><td>Factory setting</td><td>6D_h</td></tr>
<tr><td>Function description</td><td colspan="5">Running Mode Supported, 0 means not supported, 1 means supported.
<table>
<tr><th>Bit</th><th>Description</th><th>Value</th></tr>
<tr><td>0</td><td>Profile position mode</td><td>1</td></tr>
<tr><td>1</td><td>NA</td><td>0</td></tr>
<tr><td>2</td><td>Profile velocity mode</td><td>1</td></tr>
<tr><td>3</td><td>Profile torque mode</td><td>1</td></tr>
<tr><td>4</td><td>NA</td><td></td></tr>
<tr><td>5</td><td>Homing mode</td><td>1</td></tr>
<tr><td>6</td><td>Interpolation mode</td><td>1</td></tr>
<tr><td>7~15</td><td>NA</td><td>0</td></tr>
</table>
</td></tr>
</table>

9.2.11 CANopen Transmission Halt Code

Stop code	Description
0x05040001	Control commands are invalid (SDO only supports 0x40, 0x2F, 0x2B, 0x23 commands)
0x06010002	Attempting to write a read-only object
0x06020000	The object in the object dictionary does not exist
0x06040041	The object cannot be mapped to PDO
0x06040042	Number and length of mapped objects exceed the PDO length
0x06070010	Inconsistent written length (the length of the object dictionary definition does not

	match that of the written object)
0x06070012	Inconsistent data type, Inconsistent service parameter length
0x06090011	Sub-index does not exist
0x06090031	Written parameter value is too large
0x06090032	Written parameter value is too small

9.3 CANopen Troubleshooting Information

Display	Name	Error code	Auxiliary code
Er.020	Abnormal user function code parameters and parity	0x6000	0x00000020
Er.021	Abnormal function code parameter formatting	0x6001	0x00000021
Er.022	Abnormal manufacturer parameters and parity	0x6002	0x00000022
Er.023	Abnormal communication between MCU and FPGA	0x6003	0x00000023
Er.030	FPGA backup program	0x6004	0x00000030
Er.040	Abnormal function code parameter setting	0x6005	0x00000040
Er.042	Abnormal combination of parameters	0x6007	0x00000042
Er.050	Inconsistent drive and motor voltage or power difference of more than 4 times	0x6009	0x00000050
Er.0B0	Invalid servo ON command	0x600D	0x000000B0
Er.100	Drive overcurrent (software)	0x600E	0x00000100
Er.101	Drive overcurrent (hardware)	0x600F	0x00000101
Er.320	Regenerative overload	0x6010	0x00000320
Er.400	Overvoltage	0x6012	0x00000400
Er.410	Undervoltage	0x6013	0x00000410
Er.42A	KTY type temperature sensor over-temperature	0x6014	0x0000042A
Er.450	Repeated digital input terminal X function assignment	0x6015	0x00000450
Er.451	Repeated digital input terminal Y function assignment	0x6016	0x00000451
Er.452	Abnormal distribution of analog signal AI in torque mode	0x6017	0x00000452
Er.520	Vibration fault	0x6018	0x00000520

Er.521	Vibration in tuning-free mode	0x6019	0x00000521
Er.710	Instantaneous drive overload	0x601A	0x00000710
Er.711	Instantaneous motor overload	0x601B	0x00000711
Er.720	Drive continuous overload	0x601C	0x00000720
Er.721	Motor continuous overload	0x601D	0x00000721
Er.730	DB overload	0x601E	0x00000730
Er.7A0	Drive overtemperature	0x6020	0x000007A0
Er.810	Abnormal multi-turn data in absolute encoder	0x6023	0x00000810
Er.820	Abnormal data parity in absolute encoder	0x6024	0x00000820
Er.830	Abnormal battery of absolute encoder	0x6025	0x00000830
Er.840	Abnormal direction at the upper limit of encoder turns	0x6026	0x00000830
Er.860	Over temperature in absolute encoder	0x6028	0x00000860
Er.890	Motor code does not exist	0x6029	0x00000890
Er.8A1	Home return timeout	0x602C	0x000008A1
Er.B31	Abnormal U-phase circuit	0x6034	0x00000B31
Er.B32	Abnormal V-phase circuit	0x6035	0x00000B32
Er.B33	STO input protection	0x6036	0x00000B33
Er.BF0	Abnormal system running	0x6039	0x00000BF0
Er.BF2	MCU data writing to FPGA exception	0x603B	0x00000BF2
Er.BF3	Abnormal pulse command source selection	0x603C	0x00000BF3
Er.C10	Stall detected	0x603E	0x00000C10
Er.C21	Absolute encoder multi-turn overflow	0x6040	0x00000C21
Er.C80	Abnormal incremental encoder frequency division setting	0x6047	0x00000C80
Er.C90	Encoder disconnected	0x6048	0x00000C90
Er.C91	Abnormal encoder acceleration	0x6049	0x00000C91
Er.C92	Incremental encoder Z signal loss	0x604A	0x00000C92
Er.C95	Abnormal encoder UVW signal	0x604B	0x00000C95
Er.D00	Excessive position deviation	0x6050	0x00000D00
Er.D01	Excessive position deviation during servo is ON	0x6051	0x00000D01
Er.D02	Excessive position deviation due to speed limit	0x6052	0x00000D02

	when servo is ON		
Er.D03	Excessive mixing deviation (motor feedback position and optical scale deviation are too large)	0x6053	0x00000D03
Er.D04	Electronic gear ratio setting over limit	0x6054	0x00000D04
Er.E03	Abnormal home return	0x6058	0x00000E03
Er.E05	Running modes not supported by the drive	0x605A	0x00000E05
Er.E20	CAN master disconnected (lifetime factor)	0x6064	0x00000E20
Er.E21	CAN master disconnected (consumer time)	0x6065	0x00000E21

9.4 Home Mode Description

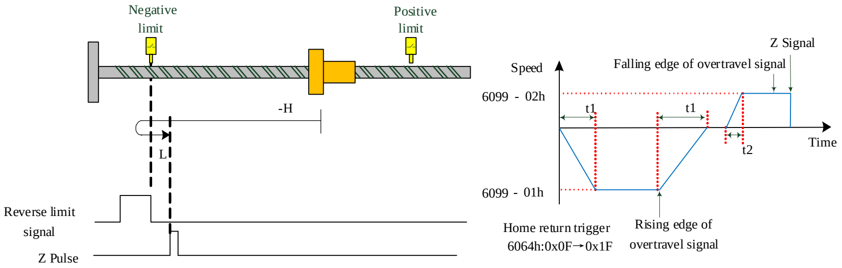
9.4.1 Mode 1 (6098h = 1)

Home signal: Z signal

Deceleration point signal: N-OT (reverse overtravel) signal

(1) The deceleration point signal is OFF during homing

Trajectory: N-OT=0, homing starts at reverse high speed until the rising edge of N-OT, and then decelerates → reverses → forwards at low speed, and stop at the first Z signal after the falling edge of N-OT.

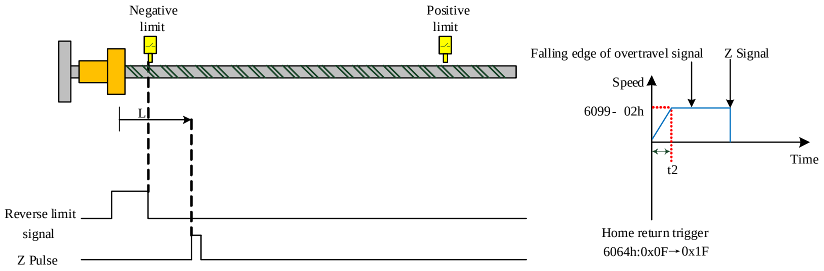


$$t_1=\frac{6099:01h}{609Ah}(s)\text{,}\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=1,initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: N-OT=1 when homing, it starts directly at forward low speed, and stops at the first Z signal after the falling edge of N-OT.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=1, initial deceleration point signal=ON

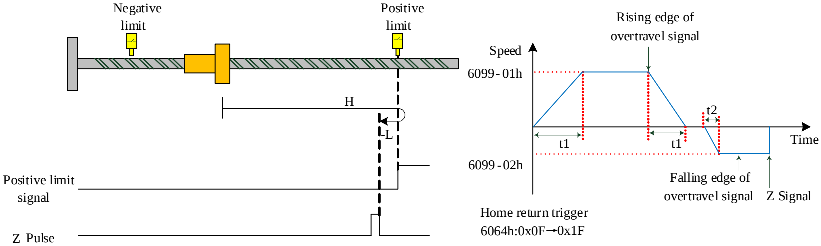
9.4.2 Mode (6098h = 2)

Home signal: Z signal

Deceleration point signal: P-OT (forward overtravel) signal

(1) The deceleration point signal is OFF during homing

Trajectory: P-OT=0 when homing starts at forward high speed until the rising edge of P-OT, and then decelerates→reverses→reverses at low speed, and stops at the first Z signal after the falling edge of P-OT.

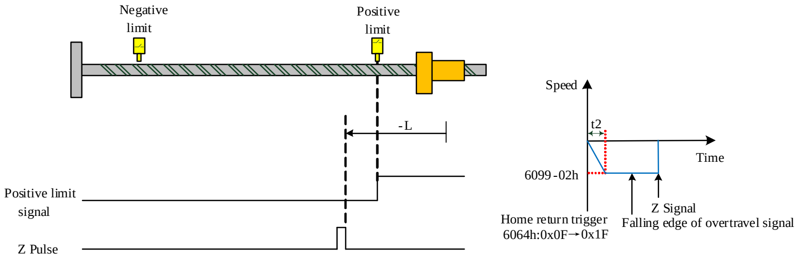


$$t_1=\frac{6099:01h}{609Ah}(s),\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=2, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

P-OT=1 when homing, it starts directly at reverse low speed, and stops at the first Z signal after the falling edge of P-OT.



$$t_2 = \frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=2, initial deceleration point signal=ON

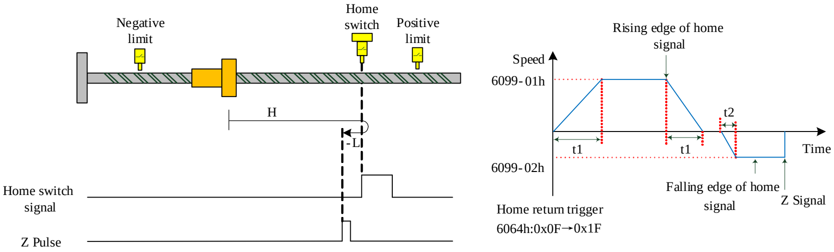
9.4.3 Mode 3 (6098h = 3)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW, decelerates → reverses → reverses at low speed, and stops at the first Z signal after the falling edge of HW.

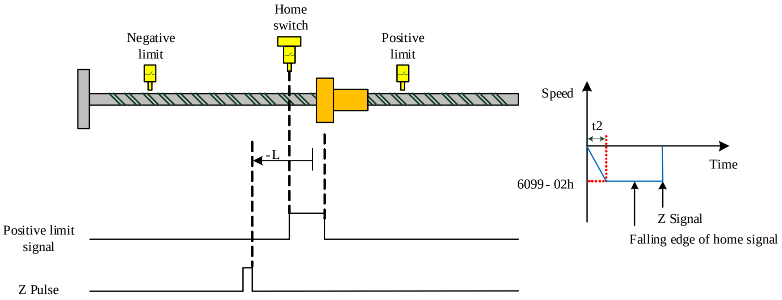


$$t_1 = \frac{6099{:}01h}{609Ah}(s), \quad t_2 = \frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=3, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts directly at reverse low speed, and stops at the first Z signal after the falling edge of HW.



$$t_2 = \frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=3, initial deceleration point signal=ON

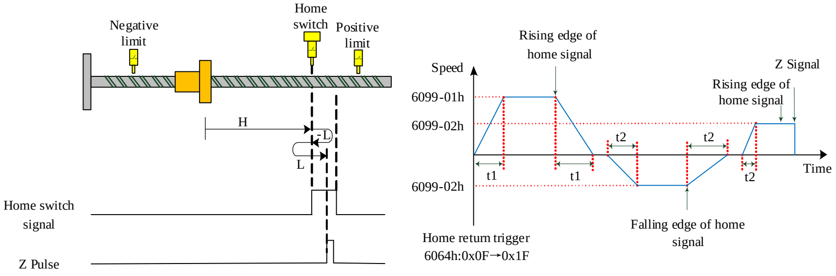
9.4.4 Mode 4 (6098h = 4)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW, and then decelerates → reverses → reverses at low speed until the falling edge of HW, decelerates → reverses → that is, resumes forward low speed running, and stops at the first Z signal after the rising edge of HW.



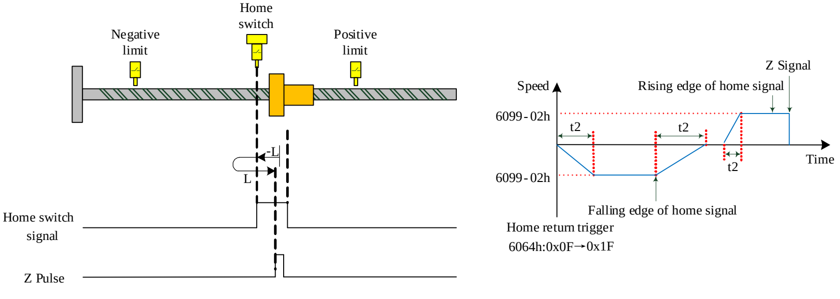
$$t_1 = \frac{6099{:}01h}{609Ah}(s),\ t_2 = \frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=4, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts at reverse low speed until the falling edge of HW, and decelerates

→ reverses → forwards at low speed, and stops at the first Z signal after the rising edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=4, initial deceleration point signal=ON

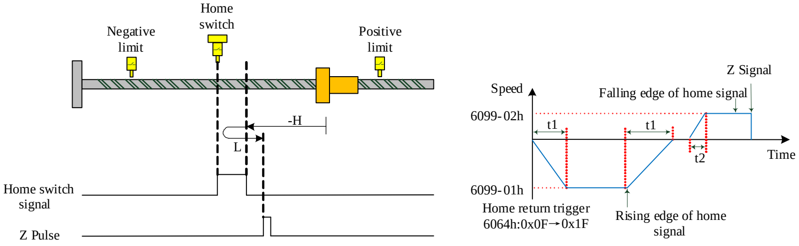
9.4.5 Mode 5 (6098h = 5)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW, and then decelerates → reverses → forwards at low speed until the rising edge of HW, decelerates → reverses → forwards at low speed and stops at the first Z signal after the falling edge of HW.

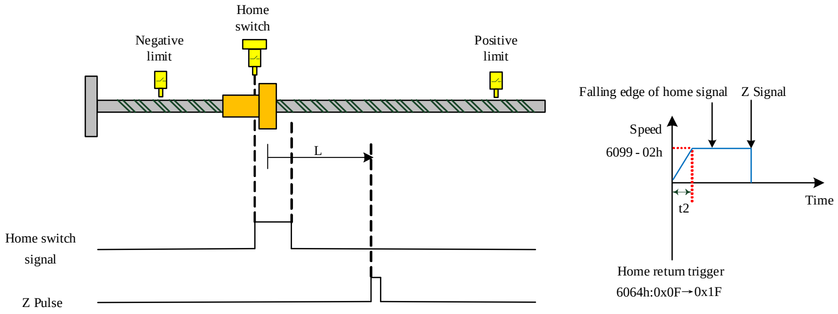


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=5, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts directly at forward low speed, and stops at the first Z signal after the falling edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=5, initial deceleration point signal=ON

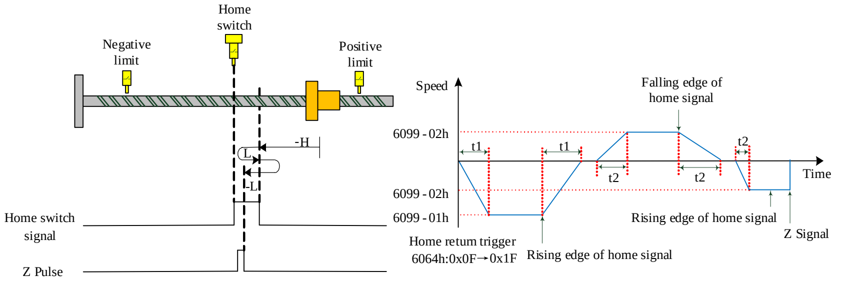
9.4.6 Mode 6 (6098h = 6)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW, and then decelerates → reverses → forwards at low speed until the falling edge of HW, decelerates → reverses → that is resumes reverse low speed running, and stops at the first Z signal after the rising edge of HW.

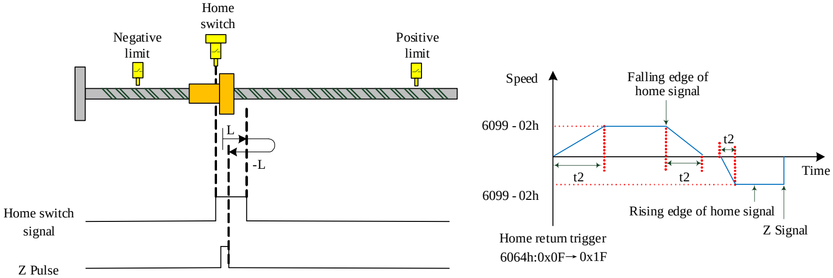


$$t_1=\frac{6099:01h}{609Ah}(s)\;,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=6, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts directly at forward low speed until the HW falling edge, and then decelerates → reverses → reverses at low speed, and stops at the first Z signal after the rising edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=6, initial deceleration point signal=ON

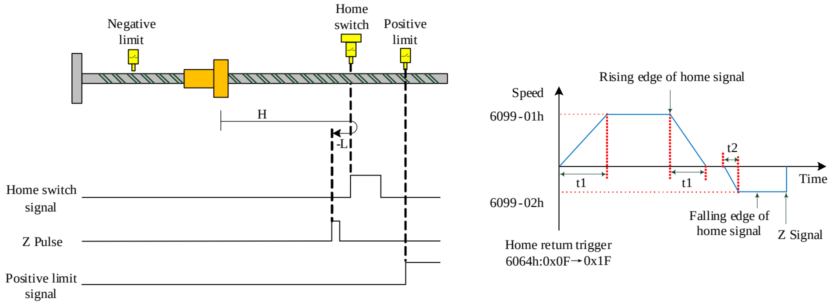
9.4.7 Mode 7 (6098h = 7)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW if there is no limit switch in-between, and then decelerates → reverses → reverses at low speed, and stops at the first Z signal after the falling edge of HW.

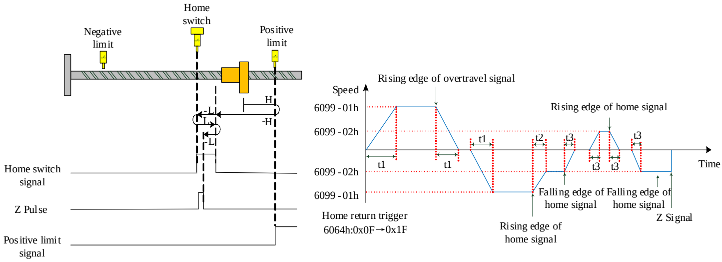


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=7, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed, and if there is a limit switch, reverses automatically at high speed until the rising edge of HW, and then decelerates and goes on reverse running at low speed until the falling edge of HW, decelerates again and reverses, goes on forward running at low speed until the HW rising edge, decelerates and reverses running until it stops at the first Z signal after the falling edge of HW.

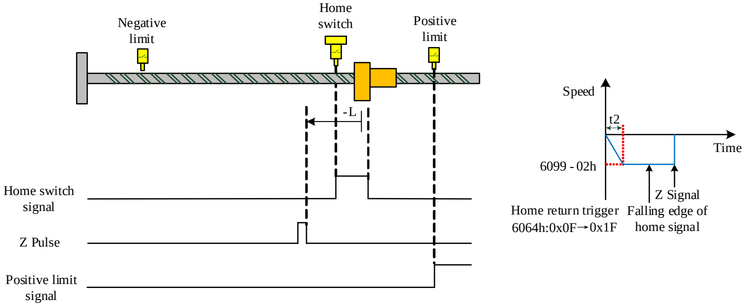


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s)\ ,\quad t_3=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=7, initial deceleration point signal=OFF without forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed, and stops at the first Z signal after the falling edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

c. 6098h=7, initial deceleration point signal=ON without forward limit signal

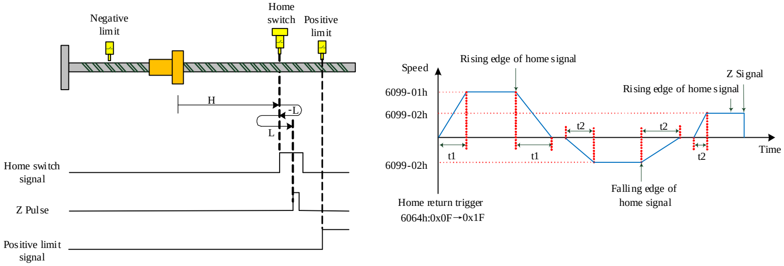
9.4.8 Mode 8 (6098h = 8)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW if there is no limit switch in-between, and then decelerates → reverses → reverses at low speed until the falling edge of HW, and then reverses→forwards at low speed, and stops at the first Z signal after the rising edge of HW.

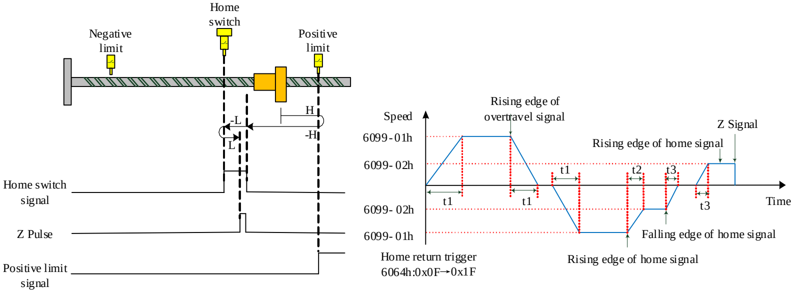


$$t_1 = \frac{6099:01h}{609Ah}(s), \quad t_2 = \frac{6099:02h}{609Ah}(s)$$

a. 6098h=8, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed, and if there is a limit switch, reverses automatically at high speed until the rising edge of HW, and then decelerates and goes on reverse running at low speed until the falling edge of HW, reverses again and goes on forward running at low speed, and stops at the first Z signal after the rising edge of HW.

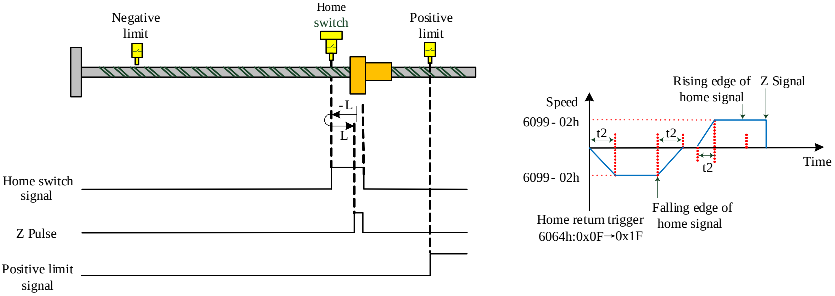


$$t_1 = \frac{6099:01h}{609Ah}(s), \quad t_2 = \frac{(6099:01h)-(6099:02h)}{609Ah}(s), \quad t_3 = \frac{6099:02h}{609Ah}(s)$$

b. 6098h=8, initial deceleration point signal=OFF with forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed until the HW falling edge, and then reverses and goes on forward running at low speed, and stops at the first Z signal after the rising edge of HW.



$$t_2 = \frac{6099:02h}{609Ah}(s)$$

c. 6098h=8, initial deceleration point signal=ON without forward limit signal

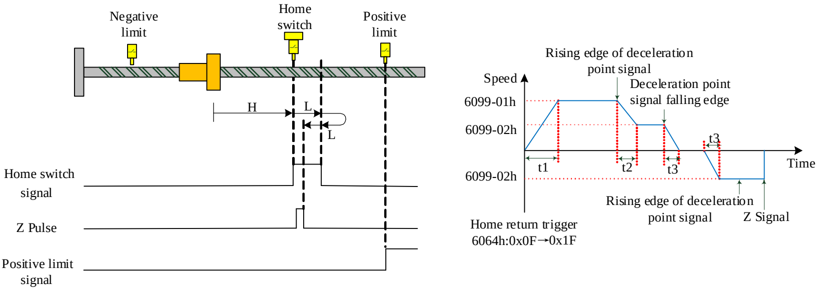
9.4.9 Mode 9 (6098h = 9)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW if there is no limit switch in-between, and then decelerates, goes on forward running at low speed until the HW falling edge, reserves and goes on reverse running at low speed, and stops at the first Z signal after the rising edge of HW.

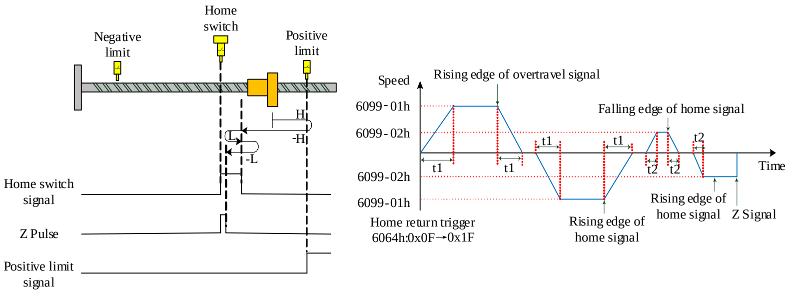


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s),\quad t_3=\frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=9, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed, and if there is a limit switch, reverses automatically and goes on reverse running at high speed until the rising edge of HW, and then decelerates and reverses and resumes forward running at low speed until the falling edge of HW, reverses and goes on reverse running at low speed until it stops at the first Z signal after the rising edge of HW.

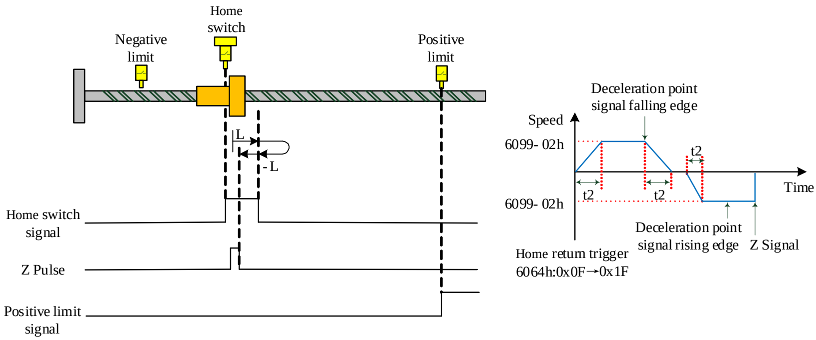


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=9, initial deceleration point signal=OFF with forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at forward high speed until the HW falling edge, and then decelerates, reverses and goes on reverse running at low speed, and stops at the first Z signal after the rising edge of HW.



$$t_2 = \frac{6099{:}02h}{609Ah}(s)$$

c. 6098h=9, initial deceleration point signal=ON without forward limit signal

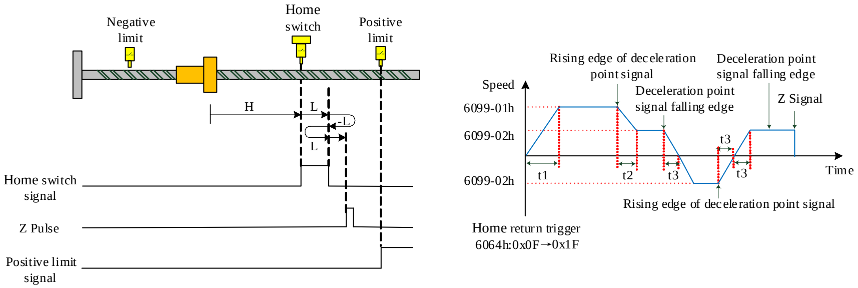
9.4.10 Mode 10 (6098h = 10)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW, and then decelerates and forwards at low speed until the falling edge of HW, and then decelerates and goes reverse at low speed to the rising edge of HW, decelerates and reverses again, runs forward at low speed and stops at the first Z signal after the falling edge of HW.

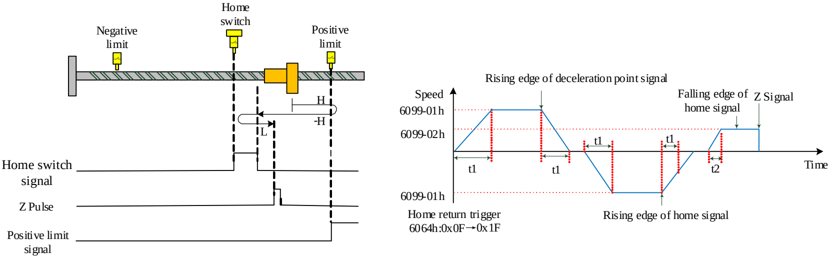


$$t_1 = \frac{6099{:}01h}{609Ah}(s), \quad t_2 = \frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s), \quad t_3 = \frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=10, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed, and reverses automatically if there is no limit switch in-between, goes on reverse running at high speed until the rising edge of HW, and then decelerates →reverses→that is resumes forward running at low speed, and stops at the first Z signal after the falling edge of HW.

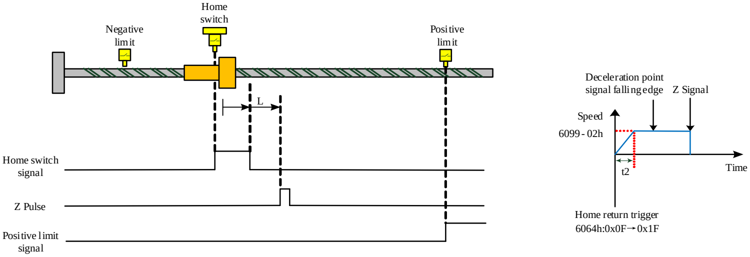


$$t_1 = \frac{6099:01h}{609Ah}(s) \quad , \quad t_2 = \frac{6099:02h}{609Ah}(s)$$

b. 6098h=10, initial deceleration point signal=OFF with forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at forward low speed, and stops at the first Z signal after the falling edge of HW.



$$t_2 = \frac{6099:02h}{609Ah}(s)$$

c. 6098h=10, initial deceleration point signal=ON without forward limit signal

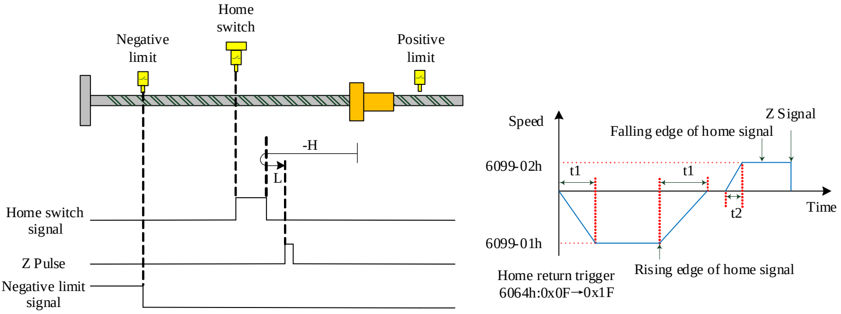
9.4.11 Mode 11 (6098h = 11)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW if there is no limit switch in-between, and then decelerates, goes on forward running at low speed, and stops at the first Z signal after the falling edge of HW.

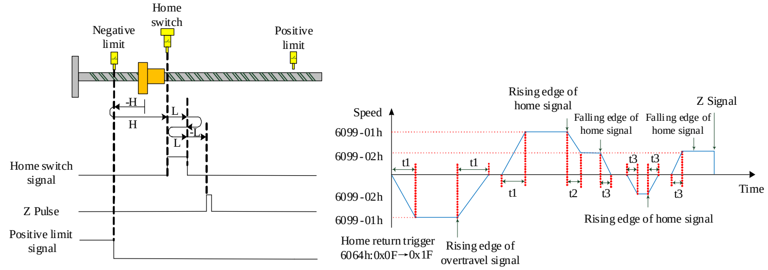


$$t_1=\frac{6099:01h}{609Ah}(s)\quad , \quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=11,initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, reverses automatically, forwards at high speed until the rising edge of HW, and then decelerates and goes on forward running at low speed until the falling edge of HW, decelerates again and reverses, goes on reverse running at low speed until the HW rising edge, decelerates and reverses to forward at low speed, and stops at the first Z signal after the falling edge of HW.

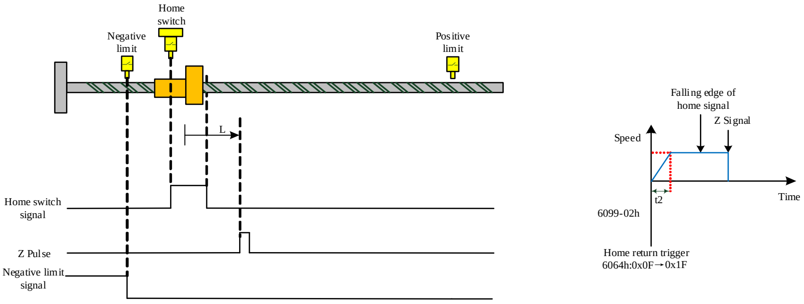


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s),\quad t_3=\frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=11, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at forward low speed, and stops at the first Z signal after the falling edge of HW.



$$t_2=\frac{6099{:}02h}{609Ah}(s)$$

c. 6098h=11, initial deceleration point signal=ON without the reverse limit signal

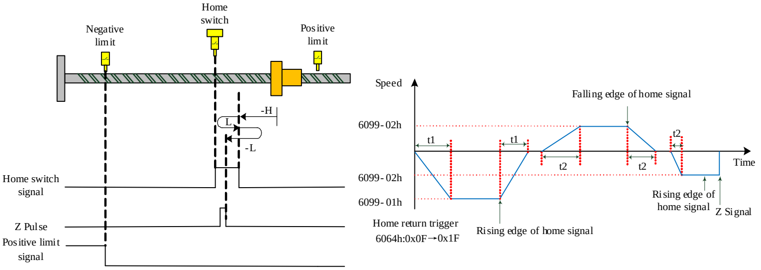
9.4.12 Mode 12 (6098h = 12)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW if there is no limit switch in-between, and then decelerates → reverses forwards at low speed until the HW falling edge, then reverses runs reversely at low speed and stops at the first Z signal after the rising edge of HW.

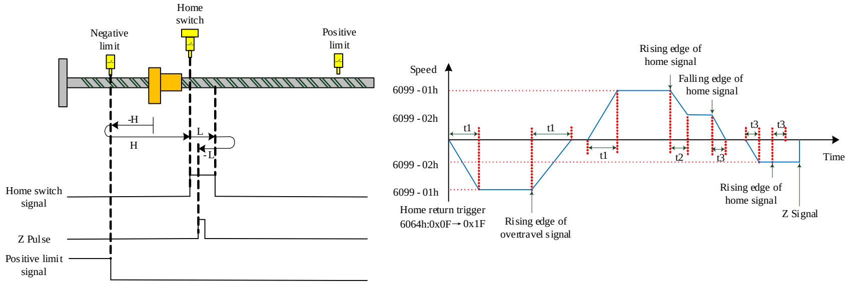


$$t_1 = \frac{6099{:}01h}{609Ah}(s), \quad t_2 = \frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=12, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, reverses automatically and forwards at high speed until the rising edge of HW, and then decelerates and goes on forward running at low speed until the falling edge of HW, reverses again and goes on reverse running at low speed, and stops at the first Z signal after the rising edge of HW.

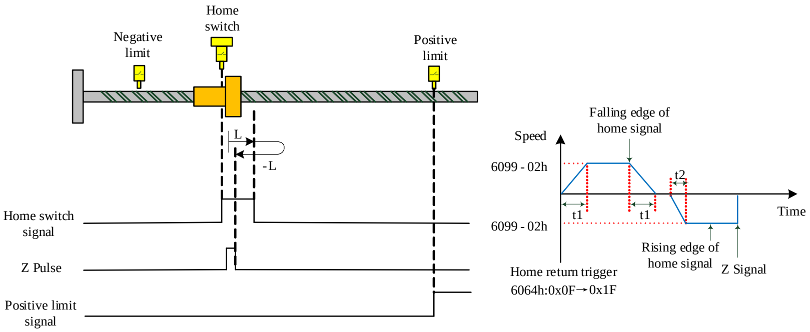


$$t_1 = \frac{6099{:}01h}{609Ah}(s), \quad t_2 = \frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s), \quad t_3 = \frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=12, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts at forward low speed until the falling edge of HW, and then reverses → runs reversely at low speed, and stops at the first Z signal after the rising edge of HW.



$$t_2 = \frac{6099{:}02h}{609Ah}(s)$$

c. 6098h=12, initial deceleration point signal=ON without the reverse limit signal

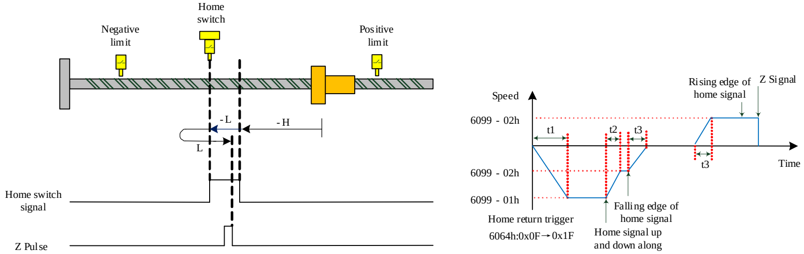
9.4.13 Mode 13(6098h = 13)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the falling edge of HW if there is no limit switch in-between, and then reverses and goes on forward running at low speed, and stops at the first Z signal after the rising edge of HW.

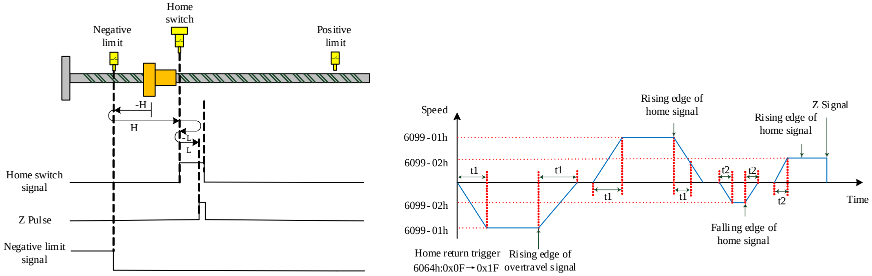


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s),\quad t_3=\frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=13, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, reverses automatically and forward at high speed until the rising edge of HW, and then decelerates →reverses →and goes on reverse running at low speed until the falling edge of HW, reverses again →goes on forward running at low speed until it stops at the first Z signal after the rising edge of HW.

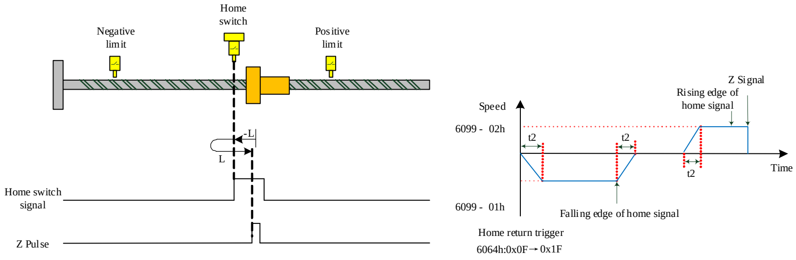


$$t_1 = \frac{6099:01h}{609Ah}(s) \; , \quad t_2 = \frac{6099:02h}{609Ah}(s)$$

b. 6098h=13, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed until the HW falling edge, and then reverses and goes on forward running at low speed, and stops at the first Z signal after the rising edge of HW.



$$t_2 = \frac{6099:02h}{609Ah}(s)$$

c. 6098h=13, initial deceleration point signal=ON without the reverse limit signal

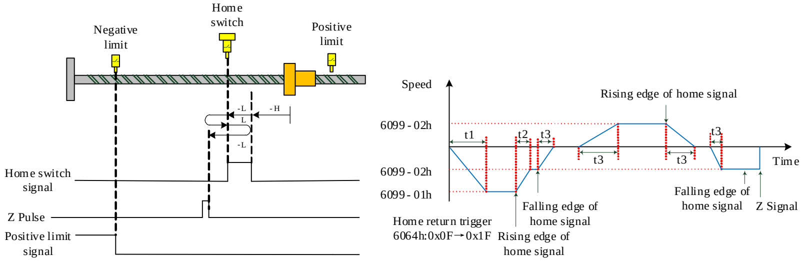
9.4.14 Mode 14 (6098h = 14)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW, and then decelerates → runs reversely at low speed until the falling edge of HW, decelerates → reverses →forwards at low speed until the HW rising edge, decelerates → reverses→ runs reversely at low speed, and stops at the first Z signal after the falling edge of HW.

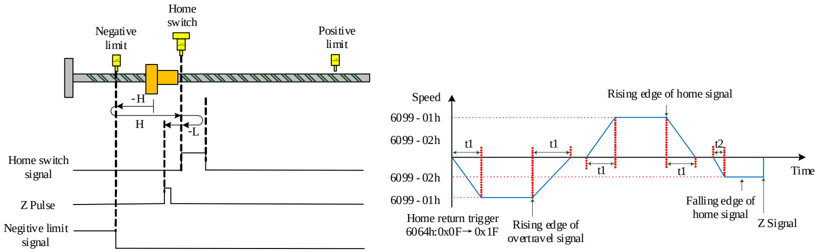


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s)\ ,\quad t_3=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=14, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, reverses automatically, forwards at high speed until the rising edge of HW, and then decelerates → reverses → and runs reversely at low speed until the falling edge of HW, and stops at the first Z signal.

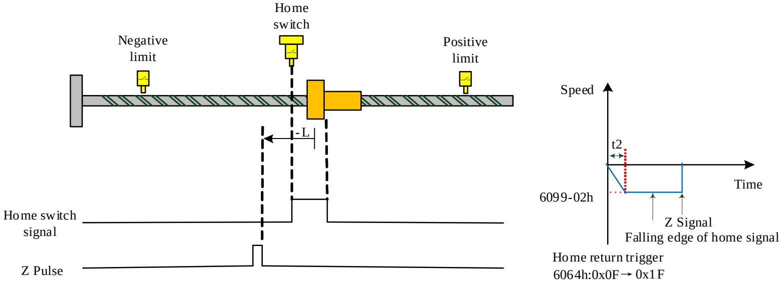


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=14, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed, and stops at the first Z signal after the falling edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

c. 6098h=14, initial deceleration point signal=ON without the reverse limit signal

9.4.15 Mode 15 (6098h =15), Mode 16 (6098h =16)

These two modes of zero return are not defined in the standard 402 protocol

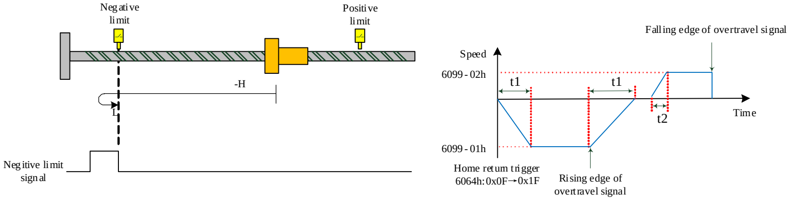
9.4.16 Mode 17 (6098h = 17)

Home signal: N-OT signal (reverse overtravel) falling edge

Deceleration point signal: N-OT (reverse overtravel) signal

(1) The deceleration point signal is OFF during homing

Trajectory: N-OT=0 when homing starts at reverse high speed until N-OT rising edge, and then decelerates → reverses → forwards at low speed until it stops immediately at the N-OT falling edge.

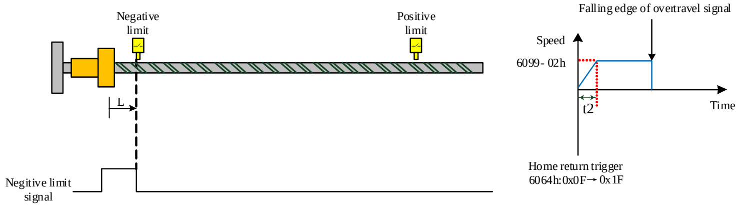


$$t_1 = \frac{6099:01h}{609Ah}(s) \quad , \quad t_2 = \frac{6099:02h}{609Ah}(s)$$

a. 6098h=17, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: N-OT=1 when homing starts directly at forward low speed until it stops immediately at the N-OT falling edge.



$$t_2 = \frac{6099:02h}{609Ah}(s)$$

b. 6098h=17, initial deceleration point signal=ON

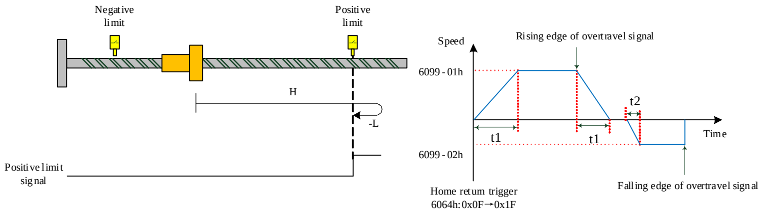
9.4.17 Mode 18 (6098h = 18)

Home signal: P-OT signal (forward overtravel) falling edge

Deceleration point signal: P-OT (forward overtravel) signal

(1) The deceleration point signal is OFF during homing

Trajectory: P-OT=0 when homing starts at forward high speed until P-OT rising edge, and then decelerates → reverses → runs reversly at low speed until it stops immediately at the P-OT falling edge.

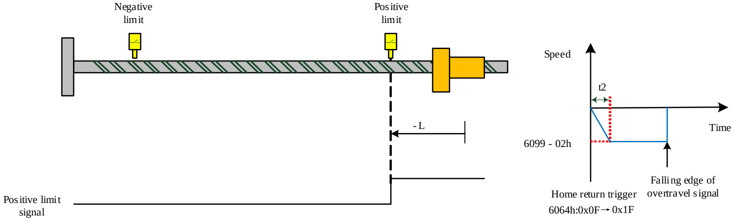


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=18, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: P-OT=1 when homing starts directly at reverse low speed until it stops immediately at the P-OT falling edge.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=18, initial deceleration point signal=ON

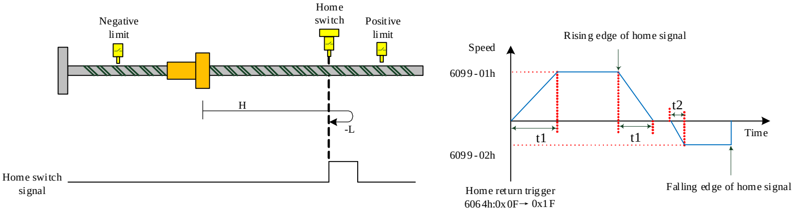
9.4.18 Mode 19 (6098h = 19)

Home signal: HW (home switch) signal falling edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW, decelerates → reverses →runs reversely at low speed, and stops at the falling edge of HW.

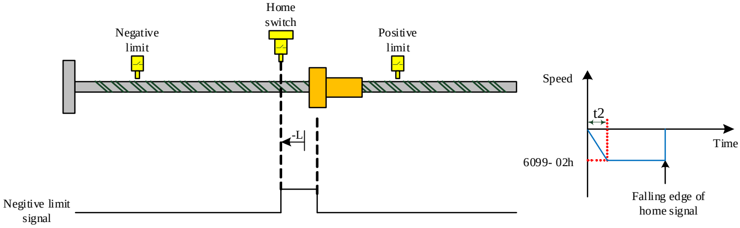


$$t_1=\frac{6099:01h}{609Ah}(s) , \quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=19, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts directly at reverse low speed until it stops immediately at the HW falling edge.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=19, initial deceleration point signal=ON

9.4.19 Mode 20 (6098h = 20)

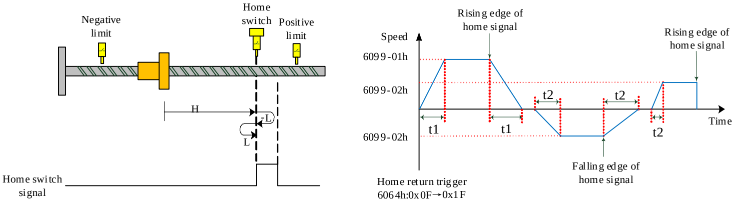
Home signal: HW (home switch) signal rising edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW, decelerates

→ reverses →runs reversely at low speed until the falling edge of HW, and decelerates → reverses→ resumes forward low speed running and it stops immediately at the HW rising edge.

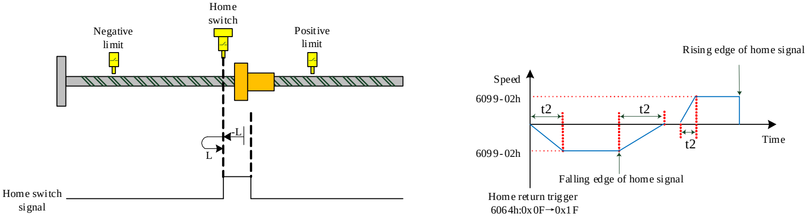


$$t_1=\frac{6099:01h}{609Ah}(s)\quad,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=20, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts directly at reverse low speed until the HW falling edge, and then decelerates → reverses→forwards at low speed and it stops immediately at the HW rising edge.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=20, initial deceleration point signal=ON

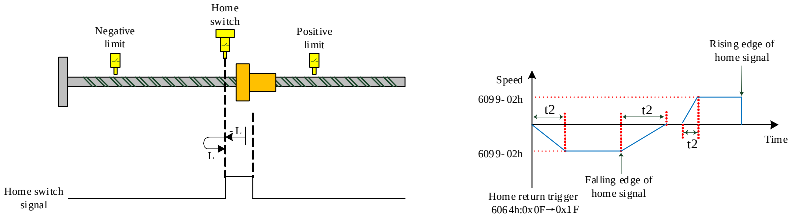
9.4.20 Mode 21 (6098h = 21)

Home signal: HW (home switch) signal falling edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW, decelerates → reverses → forwards at low speed and it stops immediately at the HW falling edge.

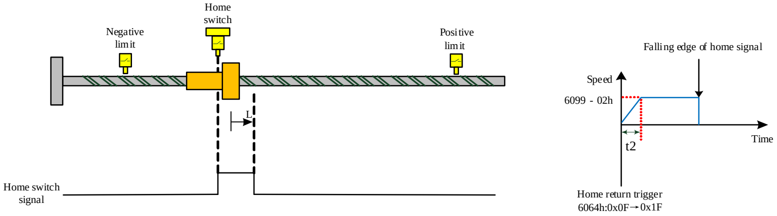


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=21, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts directly at forward low speed, and it stops immediately at the HW falling edge.



$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=21, initial deceleration point signal=ON

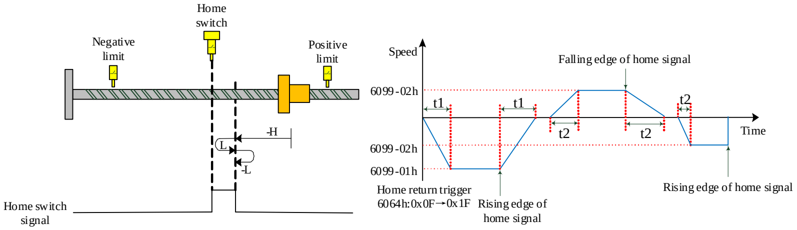
9.4.21 Mode 22 (6098h = 22)

Home signal: HW (home switch) signal rising edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW, decelerates → reverses → forwards at low speed until the HW falling edge, decelerates → reverses → resumes reverse running at low speed and it stops immediately at the HW rising edge.

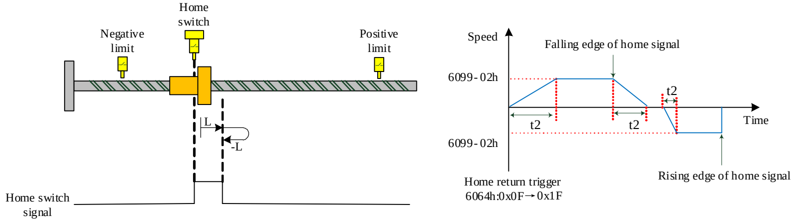


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=22, initial deceleration point signal=OFF

(2) The deceleration point signal is ON during homing

Trajectory: HW=1 when homing starts at forward high speed until the falling edge of HW, decelerates → reverses → runs reversely at low speed, and it stops immediately at the HW rising edge.



$$t_2=\frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=22, initial deceleration point signal=ON

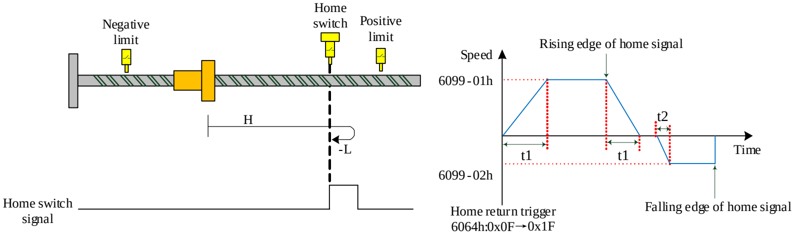
9.4.22 Mode 23 (6098h = 23)

Home signal: HW (home switch) signal falling edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW if there is no limit switch, and then decelerates → reverses → runs reversely at low speed and it stops immediately at the HW falling edge.

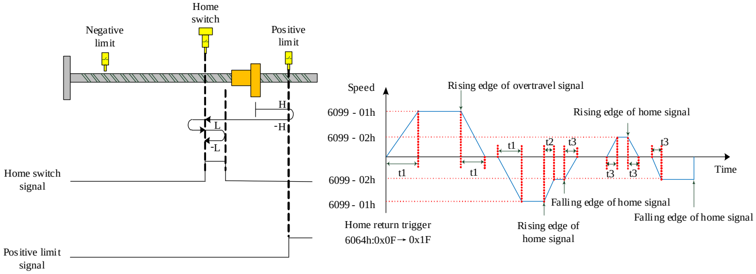


$$t_1=\frac{6099:01h}{609Ah}(s),\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=23, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed if there is a limit switch, decelerates → reverses → runs reversely at high speed until the rising edge of HW, decelerates and runs reversely at low speed until the falling edge of HW, decelerates → reverses → forwards at low speed until the rising edge of HW, decelerates and runs reversely at low speed, and then stops immediately at the HW falling edge.

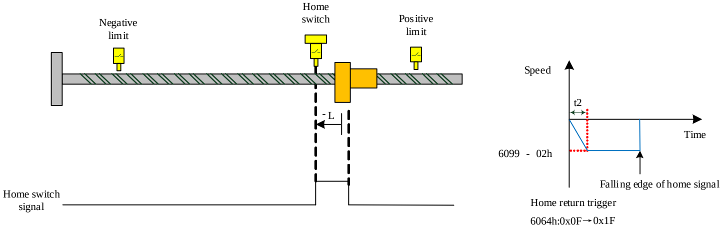


$$t_1=\frac{6099:01h}{609Ah}(s),\quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s),\quad t_3=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=23, initial deceleration point signal=OFF without forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed, and it stops immediately at the HW falling edge.



$$t_2 = \frac{6099:02h}{609Ah}(s)$$

c. 6098h=23, initial deceleration point signal=ON without forward limit signal

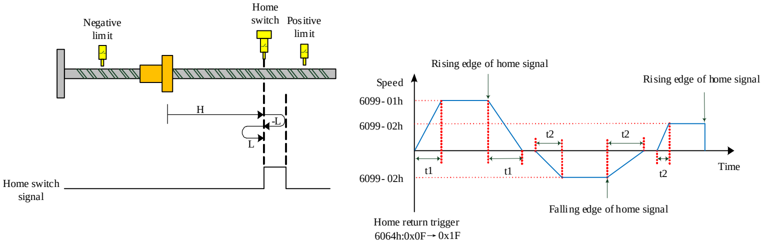
9.4.23 Mode 24 (6098h = 24)

Home signal: HW (home switch) signal rising edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW if there is no limit switch, decelerates → reverses →runs reversely at low speed until the falling edge of HW, and reverses →forwards at low speed and it stops immediately at the HW rising edge.

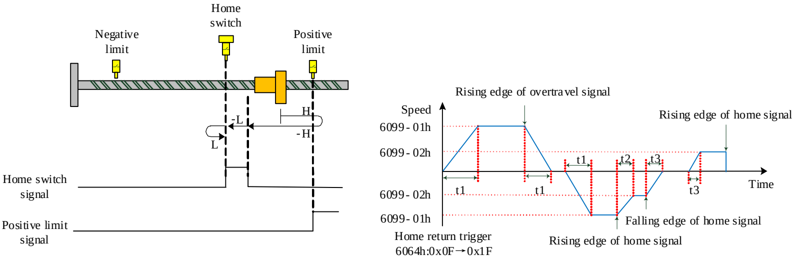


$$t_1 = \frac{6099:01h}{609Ah}(s) \quad , \quad t_2 = \frac{6099:02h}{609Ah}(s)$$

a. 6098h=24, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed if there is a limit switch, decelerates → reverses → runs reversely at high speed until the rising edge of HW, decelerates and runs reversely at low speed until the falling edge of HW, reverses → forwards at low speed until the rising edge of HW and then stops immediately.

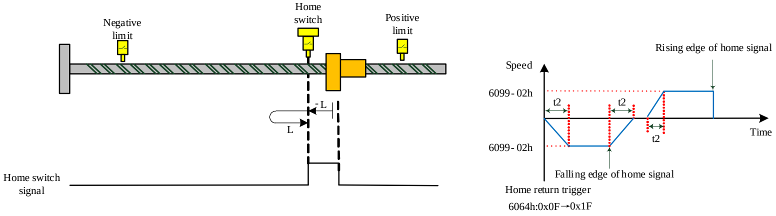


$$t_1=\frac{6099:01h}{609Ah}(s)\quad , \quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s)\quad , \quad t_3=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=24, initial deceleration point signal=OFF with forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed until the falling edge of HW, reverses and forwards at low speed, , and stops immediately at the rising edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

c. 6098h=24, initial deceleration point signal=ON without forward limit signal

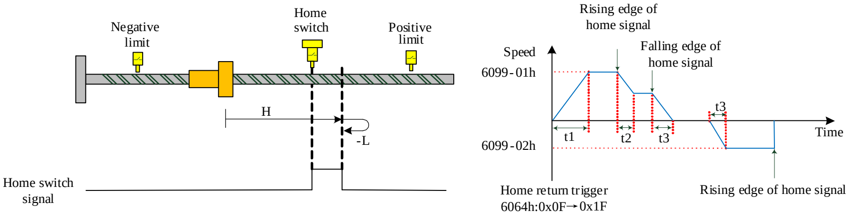
9.4.24 Mode 25 (6098h = 25)

Home signal: HW (home switch) signal rising edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW if there is no limit switch, decelerates →forwards at low speed until the falling edge of HW, and reverses→runs reversely at low speed and it stops immediately at the HW rising edge.

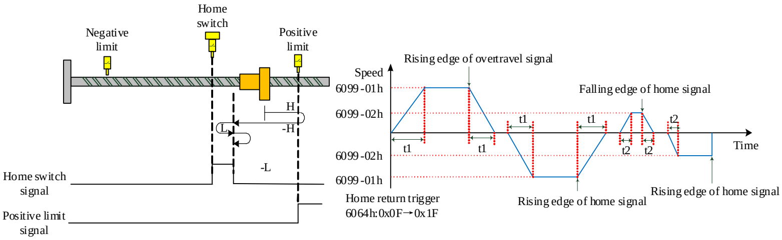


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s),\quad t_3=\frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=25, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed, and if there is a limit switch, reverses automatically and goes on reverse running at high speed until the rising edge of HW, and then decelerates and reverses and resumes forward running at low speed until the falling edge of HW, reverses and goes on reverse running at low speed until it stops at the rising edge of HW.

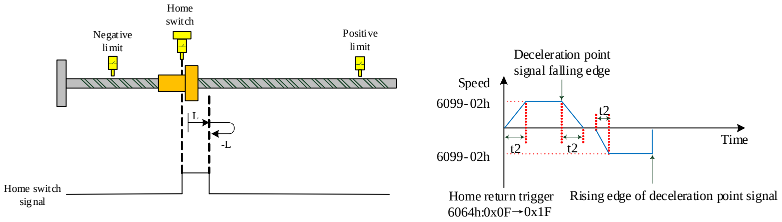


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=25, initial deceleration point signal=OFF with forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts at forward high speed until the falling edge of HW, decelerates → reverses → runs reversely at low speed, and it stops immediately at the HW rising edge.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

c. 6098h=25, initial deceleration point signal=ON without forward limit signal

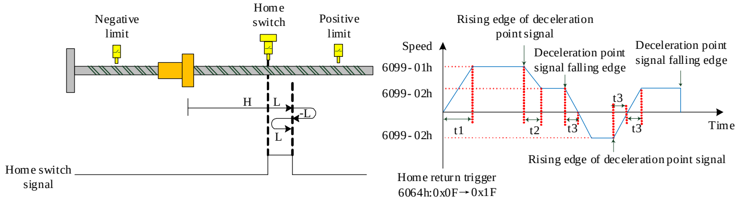
9.4.25 Mode 26 (6098h =26)

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed until the rising edge of HW, decelerates →forwards at low speed until the falling edge of HW, and decelerates → reverses→ runs reversely at low speed until the rising edge of HW, decelerates → reverses→ reseumes forward low speed running until the HW falling edge, and it stops immediately.

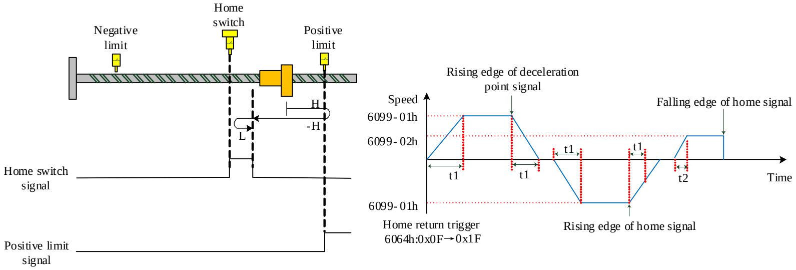


$$t_1=\frac{6099:01h}{609Ah}(s),\quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s),\quad t_3=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=26, initial deceleration point signal=OFF without forward limit signal

(2) The deceleration point signal is OFF during homing without forward limit signal

Trajectory: HW=0 when homing starts at forward high speed, and if there is a limit switch, reverses automatically and goes on reverse running at high speed until the rising edge of HW, and then decelerates and reverses and resumes forward running at low speed until the falling edge of HW, and then it stops immdiately.

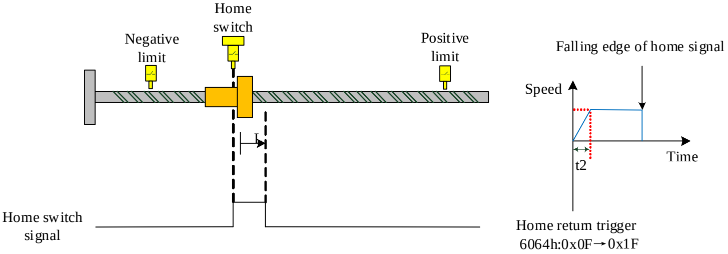


$$t_1 = \frac{6099{:}01h}{609Ah}(s) \quad , \quad t_2 = \frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=26, initial deceleration point signal=OFF with forward limit signal

(3) The deceleration point signal is ON during homing without forward limit signal

Trajectory: HW=1 when homing starts directly at forward low speed, and it stops immediately at the HW falling edge.



$$t_2 = \frac{6099{:}02h}{609Ah}(s)$$

c. 6098h=26, initial deceleration point signal=ON without forward limit signal

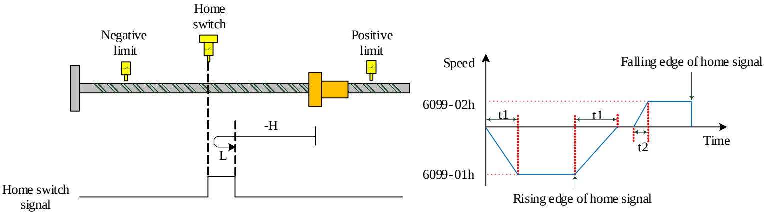
9.4.26 Mode 27 (6098h =27)

Home signal: HW (home switch) signal falling edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW if there is no limit switch, decelerates→ reverses → forwards at low speed until the HW falling edge, and it stops immediately.

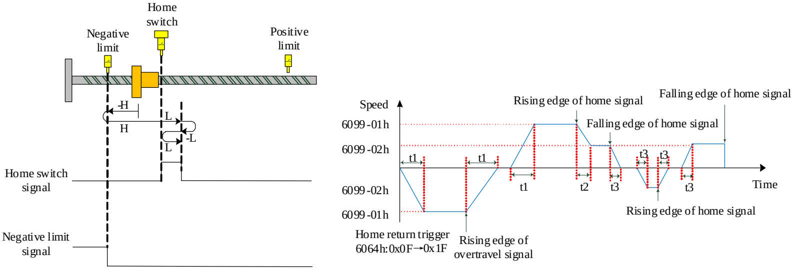


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

a. 6098h=27, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, if there is a limit switch, decelerates→ reverses → forwards at high speed until the HW rising edge, decelerates→ forwards at low speed until the HW falling edge, decelerates→ reverses → runs reversely at low speed until the HW rising edge, decelerates→ reverses and forwards at low speed until the HW falling edge, and it stops immediately.

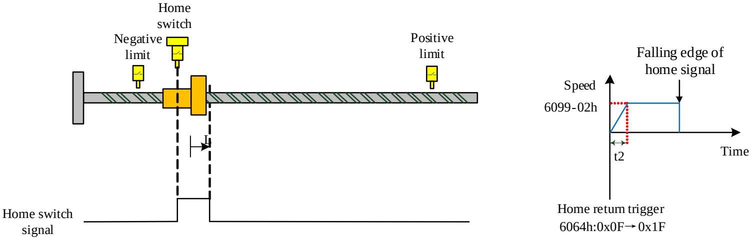


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s)\ ,\quad t_3=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=27, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at forward low speed, and stops immediately at the falling edge of HW.



$$t_2 = \frac{6099{:}02h}{609Ah}(s)$$

c. 6098h=27, initial deceleration point signal=ON without the reverse limit signal

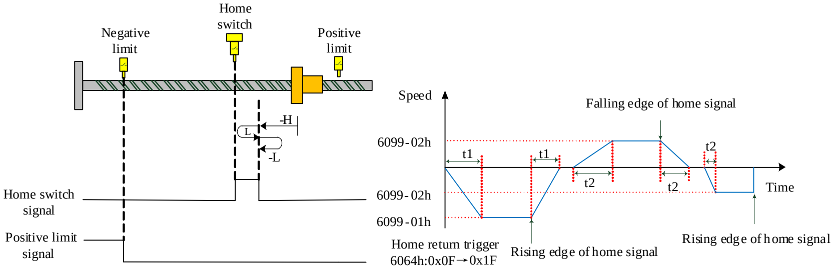
9.4.27 Mode 28 (6098h =28)

Home signal: HW (home switch) signal falling edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW if there is no limit switch, decelerates→ reverses → forwards at low speed until the HW falling edge, reverses to run reversely at low speed until the the rising edge of HW, and it stops immediately.

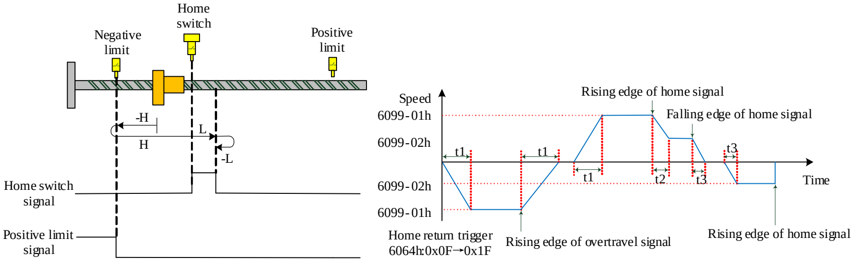


$$t_1 = \frac{6099{:}01h}{609Ah}(s), \quad t_2 = \frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=28, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, reverses automatically and it turns to high speed forward running until the rising edge of HW, and then decelerates and goes on forward running at low speed until the falling edge of HW, reverses and runs reversely at low speed until the HW rising edge, and then it stops.

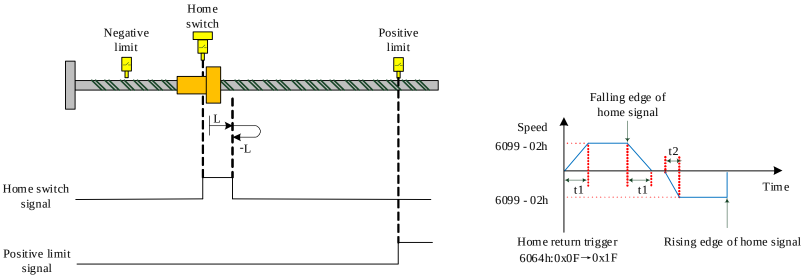


$$t_1=\frac{6099:01h}{609Ah}(s),\quad t_2=\frac{(6099:01h)-(6099:02h)}{609Ah}(s),\quad t_3=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=28, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at forward low speed until the HW falling edge, and then reverses →runs reversely at low speed, and then stops at the rising edge of HW.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

c. 6098h=28, initial deceleration point signal=ON without the reverse limit signal

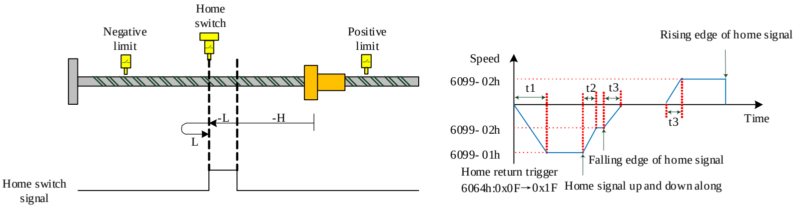
9.4.28 Mode 29 (6098h =29)

Home signal: HW (home switch) signal rising edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the falling edge of HW if there is no limit switch in-between, and then reverses → forwards at low speed until the rising edge of HW, and it stops.

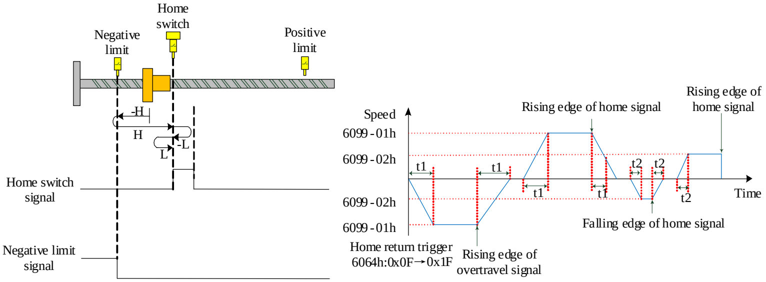


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{(6099{:}01h)-(6099{:}02h)}{609Ah}(s),\quad t_3=\frac{6099{:}02h}{609Ah}(s)$$

a. 6098h=29, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, decelerates and reverses automatically and it turns to high speed forward running until the rising edge of HW, and then decelerates and reverses, so it turns into reverse running at low speed until the falling edge of HW, reverses again and forwards at low speed until the HW rising edge, and then it stops.

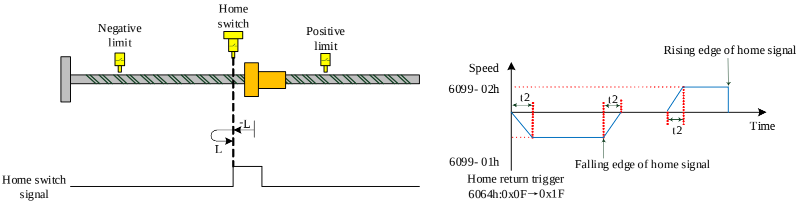


$$t_1=\frac{6099{:}01h}{609Ah}(s),\quad t_2=\frac{6099{:}02h}{609Ah}(s)$$

b. 6098h=29, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed until the falling edge of HW, and reverses and forwards at low speed, and it stops immediately at the rising edge of HW.



$$t_2 = \frac{6099:02h}{609Ah}(s)$$

c. 6098h=29, initial deceleration point signal=ON without the reverse limit signal

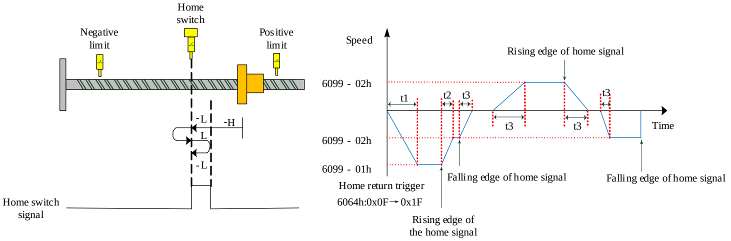
9.4.29 Mode 30 (6098h =30)

Home signal: HW (home switch) signal falling edge

Deceleration point signal: HW (home switch) signal

(1) The deceleration point signal is OFF during homing without the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed until the rising edge of HW, decelerates → runs reversely at low speed until the HW falling edge, decelerates →reverses→ runs forward at low speed until the HW rising edge, decelerates→reverses→resumes reverse running at low speed until the HW falling edge, and it stops.

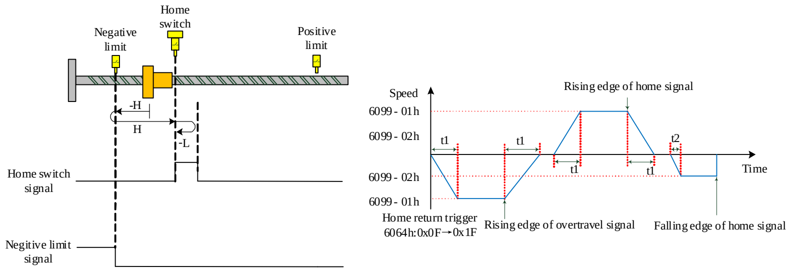


$$t_1 = \frac{6099:01h}{609Ah}(s), \quad t_2 = \frac{(6099:01h)-(6099:02h)}{609Ah}(s), \quad t_3 = \frac{6099:02h}{609Ah}(s)$$

a. 6098h=30, initial deceleration point signal=OFF with the reverse limit signal

(2) The deceleration point signal is OFF during homing with the reverse limit signal

Trajectory: HW=0 when homing starts at reverse high speed, and if there is a limit switch, decelerates and reverses automatically and it turns to high speed forward running until the rising edge of HW, and then decelerates and reverses, so it turns into reverse running at low speed until the falling edge of HW, and then it stops.

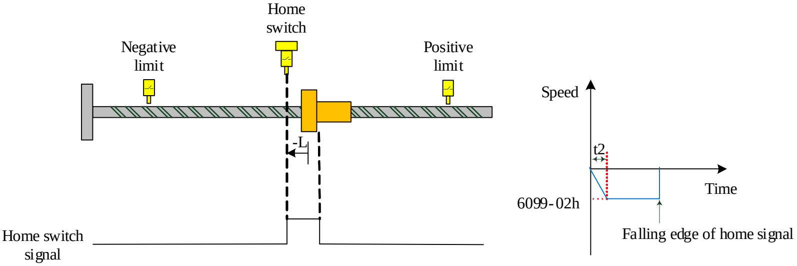


$$t_1=\frac{6099:01h}{609Ah}(s)\ ,\quad t_2=\frac{6099:02h}{609Ah}(s)$$

b. 6098h=30, initial deceleration point signal=OFF with the reverse limit signal

(3) The deceleration point signal is ON during homing without the reverse limit signal

Trajectory: HW=1 when homing starts directly at reverse low speed until the falling edge of HW, and it stops immediately.



$$t_2=\frac{6099:02h}{609Ah}(s)$$

c. 6098h=30, initial deceleration point signal=ON without the reverse limit signal

9.4.30 Mode 31(6098h=31), Mode 32(6098h=32)

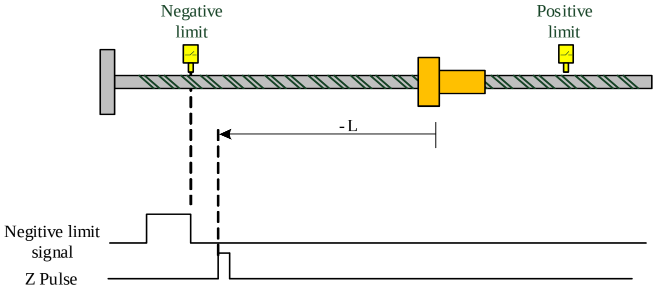
These two modes of zero return are not defined in the standard 402 protocol

9.4.31 Mode 33 (6098h=33)

Home signal: Z signal

Deceleration point signal: none

Trajectory: reverse low speed running until the first Z signal.

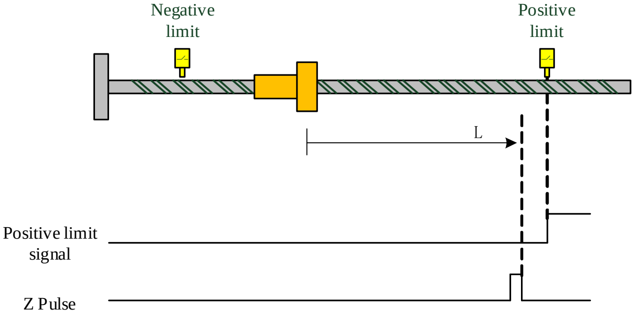


9.4.32 Mode 34 (6098h=34)

Home signal: Z signal

Deceleration point signal: none

Trajectory: forward low speed running until the first Z signal.



9.4.33 Mode 35 (6098h=35)

Take the current position as the mechanical home position, and after triggering homing mode, the user position (6064h) = home position offset (607Ch).

Chapter 10 Motion Control

10.1 Home

10.1.1 Brief Introduction of Home

Home position: mechanical home position, means the home switch or motor Z signal position, set by function code

Zero position: mechanical zero position, means home position+ Pn294(home offset), when Pn294=0, the two position overlap completely.

The home process means the servo drive controls the motor to be positioned to the home or zero position according to the set way in the position mode.

The home signal source can be given by three ways: limit signal, mechanical home signal and Z pulse. Generally, it can be represented by a level signal with a certain pulse width. To accurately locate the home signal, it is necessary to select the positive direction rising edge or the negative rising edge while selecting the home signal source, as shown in Fig. 10.1.

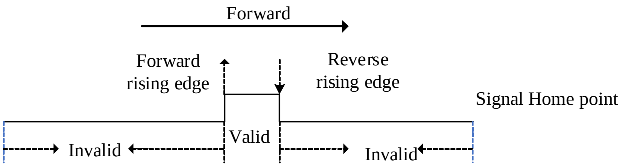


Figure 10.1 Home signal direction selection

Give a large speed value when home starts to ensure the searching speed for home; the first home signal encountered is defined as a deceleration point. After the deceleration point, the home speed is lowered to find the home position accurately. During the whole process, the accuracy of the home position is affected by the low-speed home finding speed; the higher the speed is, the larger the pulse deviation of the signal edge.

Related input terminals:

Setting	Name	Function	Description	Trigger	Mode
0x02	P-OT	Positive limit	Forward motor rotation is prohibited at high level.	By level	P
0x03	N-OT	Negative limit	Reverse motor rotation is prohibited at high level.	By level	P
0x27	ORGEN	Home enable	This terminal signal is used to trigger home mode in position control mode.	By level	P
0x28	ORGS	Mechanical	It is fed back to the drive as a home signal	By level	P

		home signal	during home.		

Related output terminals:

Setting	Name	Function	Description	Trigger	Mode
0x15	ORGC	Home completion signal	Home not performed, home interrupted. When home fails: OFF is output. When home succeeds: ON is output.	By level	P

Home-related function codes:

Code	Name	Description	Default
Pn000.X	Control mode selection	0: Position control mode 1: Speed control mode 2: Torque control mode 3: Speed-Position control mode 4: Torque-Position control mode 5: Speed-Torque control mode	0
Pn290.X	Home enable control	0: Home disabled 1: Trigger home via DI terminal 2: Home immediately after power-up and servo enabled 3: Home immediately 4: Take the current point as the home position	0
Pn290.Y	Home mode	0～10(see Table 10-1 for details)	0
Pn290.Z	Home trigger method	0: Run at low level, stop at high level (falling edge triggering) 1: Rising edge triggering 2: Falling edge triggering 3: Run at high level, stop at low level (rising edge triggering)	1
Pn290.W	Home timeout unit	0:1ms 1:10ms 2:100ms	0
Pn291	High home speed	0(1rpm)～3000(1rpm)	100

Pn292	Low home speed	0(1rpm)～1000(1rpm)	10
Pn293	Home acceleration/deceleration time	0(ms)～3000(ms)	3000
Pn294	Zero bias value after finding home position	-2147483648～21474883647	0
Pn296	Absolute zero multi-turn value setting	-32768～32767	0
Pn297	Absolute zero single-turn value setting	0～21474883647	0
Pn299	Home timeout	0(ms)～65535(ms)	10000

10.1.2 General Overview of Home Modes

The home modes can be categorized according to the home signal source, home direction, deceleration point type, and whether the Z-pulse is used for processing, as shown in Table 10-1.

Table 10-1 Classification of SD710 home modes

No.	Initial direction	Deceleration position	Home position
0	Positive	Home switch	Home switch
1	Negative	Home switch	Home switch
2	Positive	Home switch	Z signal
3	Negative	Home switch	Z signal
4	Positive	Positive limit	Positive limit
5	Negative	Negative limit	Negative limit
6	Positive	Positive limit	Z signal
7	Negative	Negative limit	Z signal
8	Positive	Z signal	Z signal
9	Negative	Z signal	Z signal
10	Home from the absolute position to the specified position (This absolute position is set by Pn296 and Pn297)		

10.1.2.1 Home Mode 0

Home signal (home switch) rising edge signal

Deceleration point signal: HW (home switch) signal

(1) Home mode 0trajectory 1

Home mode0 trajectory 1 starts at forward high speed until the positive home signal rising edge, decelerates → reverses → runs at reverse low speed until the positive home signal falling edge, decelerates → reverses → runs at forward low speed until the deceleration point, which is the home signal. See Figure 10.2.

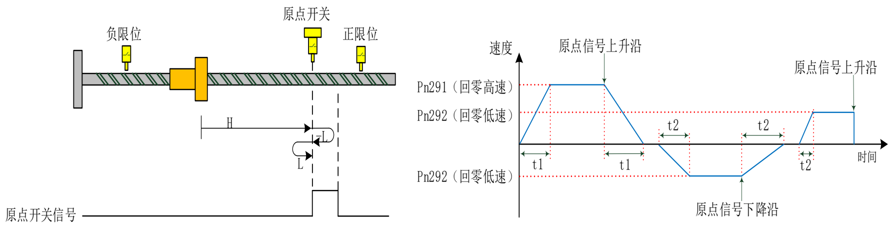


Figure 10.2 Home mode0 trajectory 1

(2) Home mode0 trajectory 2

Home mode0 trajectory 2 starts at forward high speed until the positive limit rising edge, decelerates → reverses → runs at reverse high speed until the negative home signal rising edge, decelerates → reverses → runs at reverse low speed until the positive home signal falling edge, decelerates → reverses → runs at forward low speed until the deceleration point, which is the home signal. See Figure 10.3.

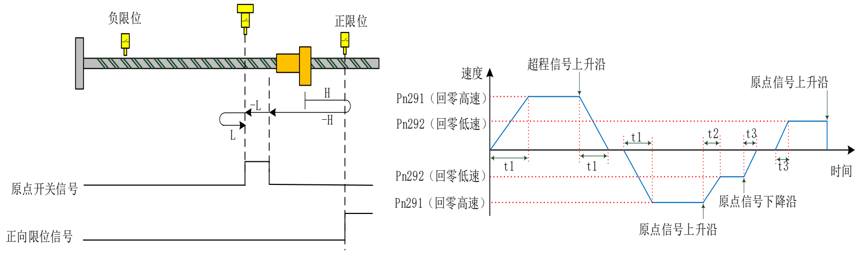


Figure 10.3 Home mode0 trajectory 2

(3) Home mode0 trajectory 3

Home mode0 trajectory 3 starts when home signal is high level, means it is at the deceleration point already, so it directly runs at reverse low speed until negative home signal falling edge, decelerates → reverses → runs at forward low speed until the deceleration point, which is the home signal. See Figure 10.4.

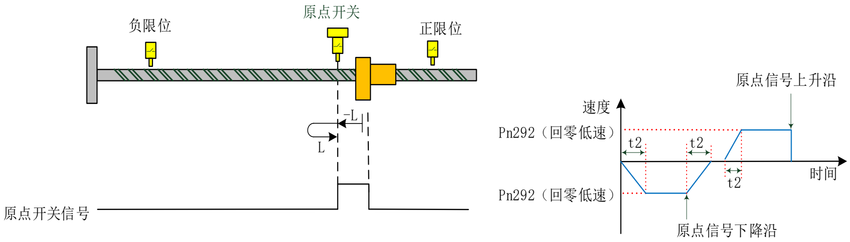


Figure 10.4 Home mode0 trajectory 3

10.1.2.2 Home Mode 1

Home signal (home switch) rising edge signal

Deceleration point signal: HW (home switch) signal

(1) Home mode1 trajectory 1

Home mode1 trajectory 1 starts at reverse high speed until negative home signal rising edge, decelerates → reverses → runs at forward low speed until the negative home signal falling edge, decelerates → reverses → runs at forward low speed until the deceleration point, which is the home signal. See Figure 10.5.

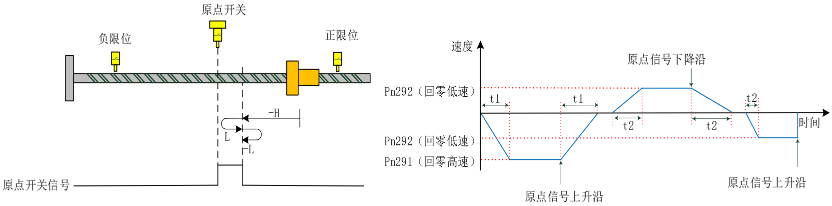


Figure 10.5 Home mode1 trajectory 1

(2) Home mode1trajectory 2

Home mode1 trajectory 2 starts at reverse high speed until negative limit rising edge, decelerates → reverses → runs at forward high speed until the positive home signal rising edge, decelerates → runs at forward low speed until negative home signal falling edge, decelerates → reverses → runs at reverse low speed until the deceleration point, which is the home signal. See Figure 10.6.

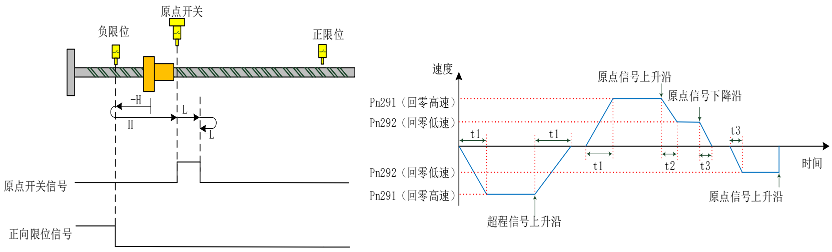


Figure 10.6 Home mode1 trajectory 2

(3) Home mode1trajectory 3

Home mode1 trajectory 3 starts when home signal is high level, means it is at the deceleration point already, so it directly runs at forward low speed until negative home signal falling edge, decelerates → reverses → runs at reverse low speed until the deceleration point, which is the home signal. See Figure 10.7.

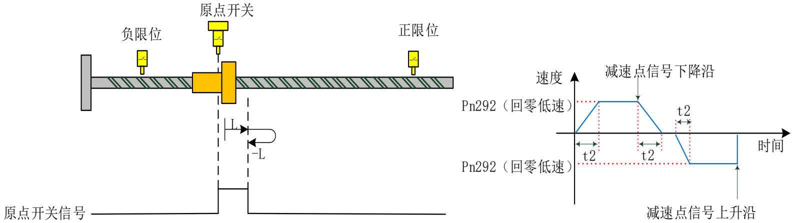


Figure 10.7 Home mode1 trajectory 3

10.1.2.3 Home Mode 2

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) Home mode2 trajectory 1

Home mode2 trajectory 1 starts at forward high speed until positive home signal rising edge, decelerates → reverses → runs at reverse low speed until the positive home signal falling edge, decelerates → reverses → runs at forward low speed until the positive home signal rising edge, take the first Z pulse signal in the forward direction as the home signal. See Figure 10.8.

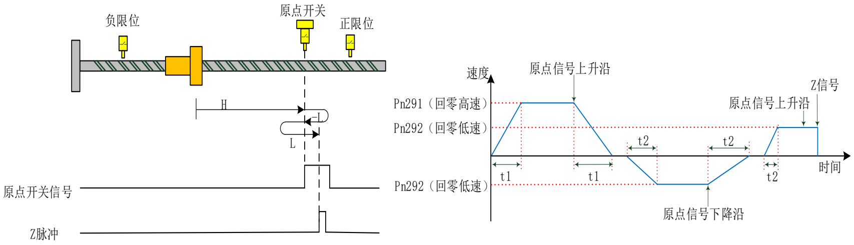


Figure 10.8 Home mode2 trajectory 1

(2) Home mode2trajectory 2

Home mode2 trajectory 2 starts at forward high speed until positive limit signal rising edge, decelerates → reverses → runs at reverse high speed until the negative home signal rising edge, decelerates → runs at reverses low speed until the positive home signal falling edge, decelerates → reverses → runs at forward low speed until the positive home signal rising edge, take the first Z pulse signal in the forward direction as the home signal. See Figure 10.9.

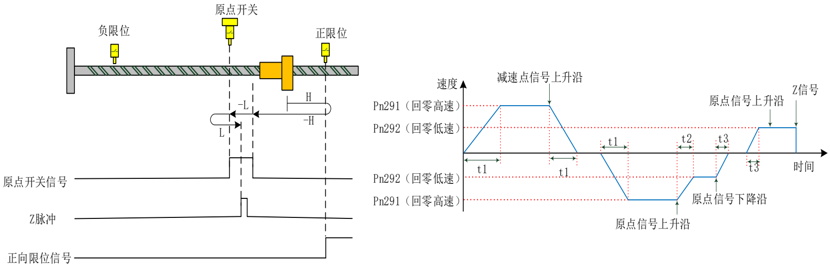


Figure 10.9 Home mode2 trajectory 2

(3) Home mode2 trajectory 3

Home mode2 trajectory 3 starts at reverse low speed until the positive home signal falling edge, decelerates → reverses → runs at forward low speed until the positive home signal rising edge, take the first Z pulse signal in the forward direction as the home signal. See Figure 10.10.

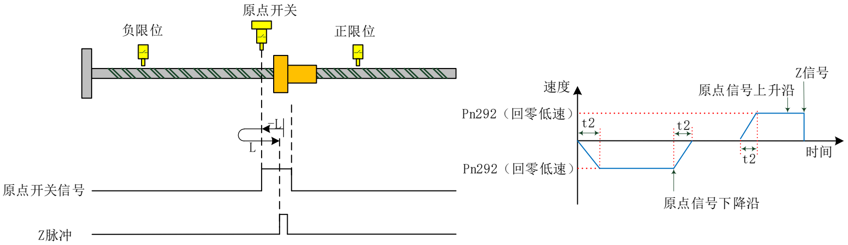


Figure 10.10 Home mode2 trajectory 3

10.1.2.4 Home Mode 3

Home signal: Z signal

Deceleration point signal: HW (home switch) signal

(1) Home mode3 trajectory 1

Home mode3 trajectory 1 starts at reverse high speed until negative home signal falling edge, decelerates → reverses → runs at forward low speed until the negative home signal rising edge, decelerates → reverses → runs at reverse low speed until the negative home switch rising edge, take the first Z pulse signal in the reverse direction as the home signal. See Figure 10.11.

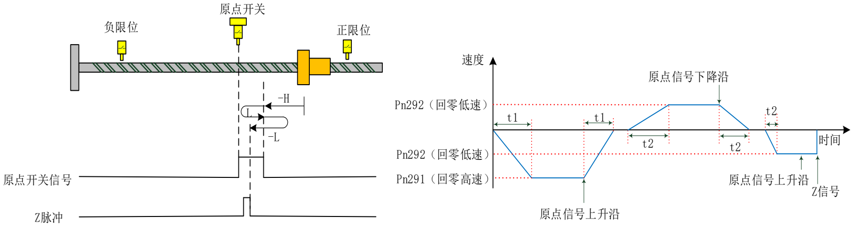


Figure 10.11 Home mode3 trajectory 1

(2) Home mode3 trajectory 2

Home mode3 trajectory 2 starts at reverse high speed until negative limit rising edge, decelerates → reverses → runs at forward high speed until the positive home signal rising edge, decelerates → runs at forward low speed until the negative home signal falling edge, decelerates → reverses → runs at forward low speed until the negative home signal rising edge, take the first Z pulse signal in the reverse direction as the home signal. See Figure 10.12.

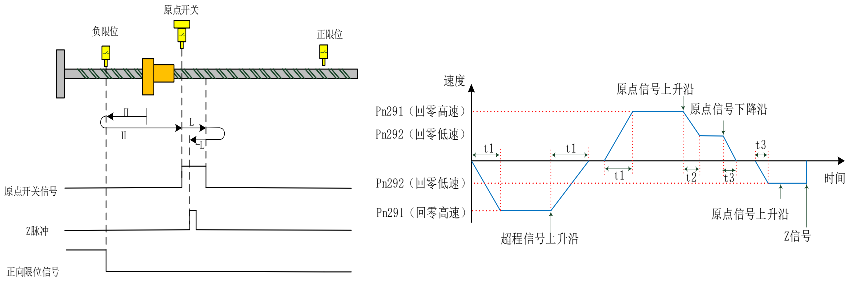


Figure 10.12 Home mode3 trajectory 2

(3) Home mode3 trajectory 3

Home mode3 trajectory 3 starts at forward low speed until home signal falling edge, decelerates → reverses → runs at reverse low speed until the negative home signal rising edge, take the first Z pulse signal in the reverse direction as the home signal. See Figure 10.13.

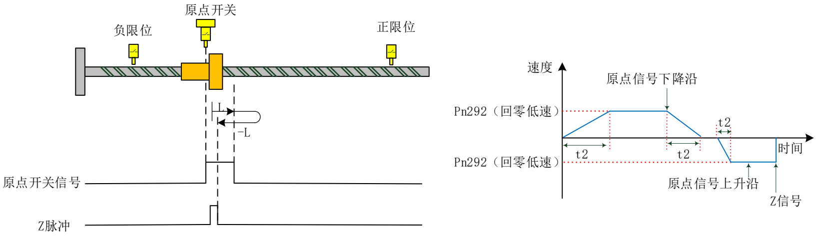


Figure 10.13 Home mode3 trajectory 3

10.1.2.5 Home Mode 4

Home signal: P-OT (positive overtravel) falling edge

Deceleration point signal: N-OT (negative overtravel) signal

(1) Home mode4 trajectory 1

Home mode4 trajectory 1 starts at forward high speed until positive limit rising edge, decelerates → reverses → runs at reverse low speed until the positive limit falling edge, which is the home signal. See Figure 10.14.

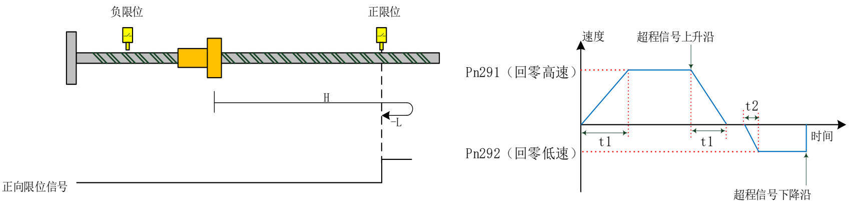


Figure 10.14 Home mode4 trajectory 1

(2) Home mode4 trajectory 2

Home mode4 trajectory starts at reverse low speed until positive limit falling edge, which is the home signal. See Figure 10.15.

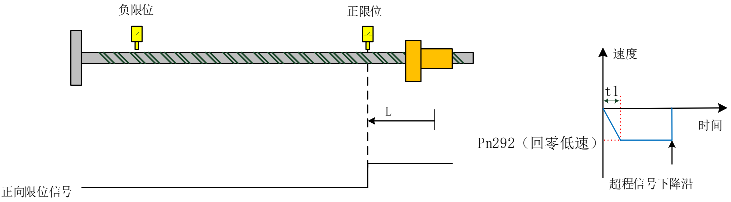


Figure 10.15 Home mode4 trajectory 2

10.1.2.6 Home Mode 5

Home signal: N-OT (negative overtravel) falling edge

Deceleration point signal: N-OT (negative overtravel) signal

(1) Home mode5 trajectory 1

Home mode5 trajectory 1 starts at reverse high speed until negative limit rising edge, decelerates → reverses → runs at forward low speed until the negative limit falling edge, which is the home signal. See Figure 10.16.

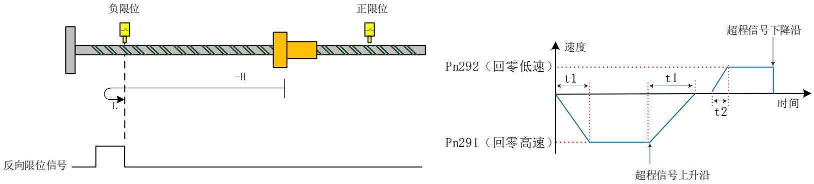


Figure 10.16 Home mode5 trajectory 1

(2) Home mode5 trajectory 2

Home mode5 trajectory 2 starts at forward low speed until negative limit falling edge, which is the home signal. See Figure 10.17.

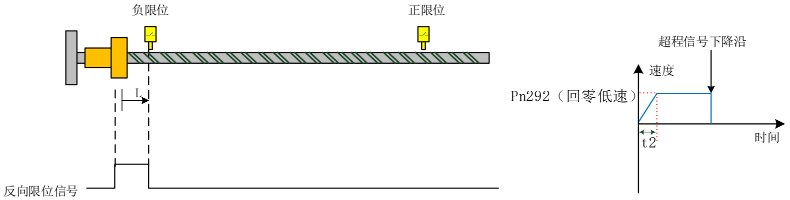


Figure 10.17 Home mode5 trajectory 2

10.1.2.7 Home Mode 6

Home signal: Z signal

Deceleration point signal: P-OT (positive overtravel) signal

(1) Home mode6 trajectory 1

Home mode6 trajectory 1 starts at forward high speed until positive limit rising edge, decelerates → reverses → runs at reverse low speed until the positive limit falling edge, take the first Z pulse signal afterwards as the home signal. See Figure 10.18.

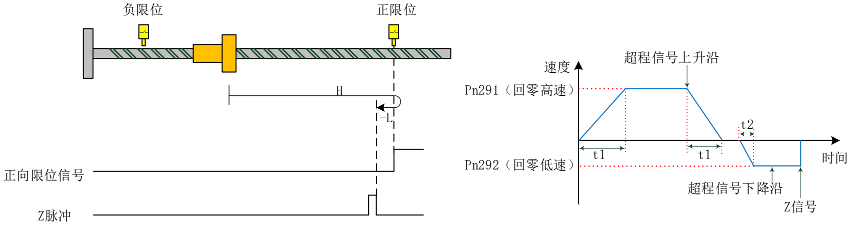


Figure 10.18 Home mode6 trajectory 1

(2) Home mode6 trajectory 2

Home mode6 trajectory 2 starts at reverse low speed until positive limit falling edge, take the first Z pulse signal afterwards as the home signal. See Figure 10.19.

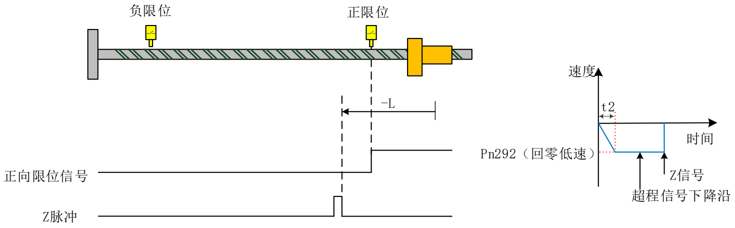


Figure 10.19 Home mode6 trajectory 2

10.1.2.8 Home Mode 7

Home signal: Z signal

Deceleration point signal: N-OT (negative overtravel) signal

(1) Home mode7 trajectory1

Home mode7 trajectory 1 starts at reverse high speed until negative limit rising edge, decelerates → reverses → runs at forward low speed until the negative limit falling edge, take the first Z pulse signal afterwards as the home signal. See Figure 10.20.

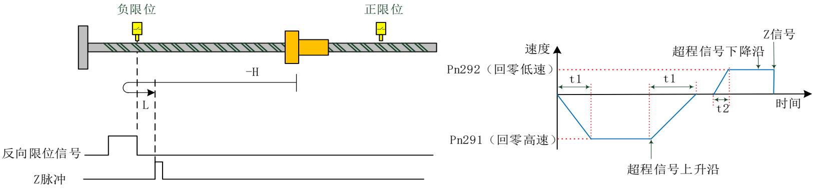


Figure 10.20 Home mode7 trajectory 1

(2) Home mode7 trajectory2

Home mode7 trajectory 2 starts at forward low speed until negative limit rising edge, take the first Z pulse signal afterwards as the home signal. See Figure 10.21.

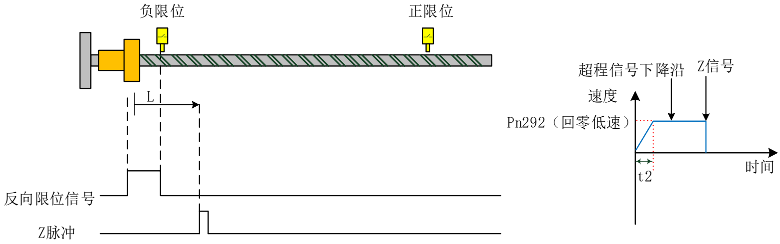


Figure10.21 Home mode7 trajectory 2

10.1.2.9 Home Mode 8

Home signal: Z signal

Deceleration point signal: none

Home mode8 starts in forward direction until the first Z pulse signal afterwards and decelerates to 0 and stops. The process of searching for the home signal in Home Mode 8 is shown in Figure 10.22.

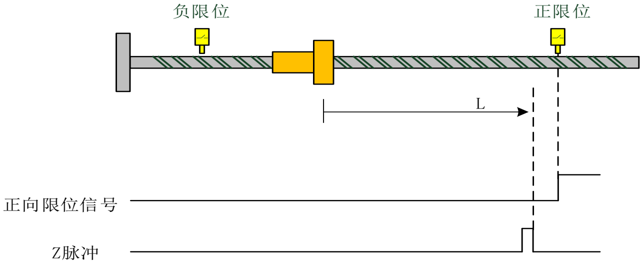


Figure 10.22 Home mode 8

10.1.2.10 Home Mode 9

Home signal: Z signal

Deceleration point signal: none

Home mode9 starts in reverse direction until the first Z pulse signal afterwards and decelerates to 0 and stops. The process of searching for the home signal in Home Mode 9 is shown in Figure 10.23.

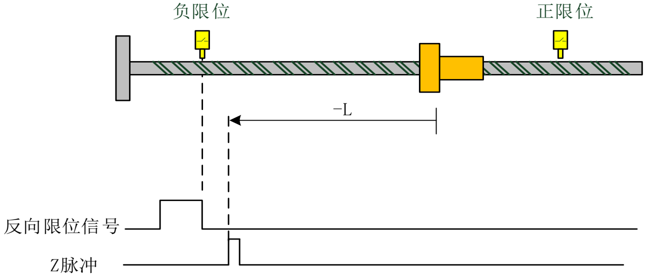


Figure 10.23 Home mode 9

10.1.2.11 Home Mode 10

Home mode 10 is zero running to the absolute position.

Through Pn296 and Pn297 to set the zero value of the absolute position. When it is selected to zero return to the absolute position, the motor will directly home at high speed from the current position to the zero point of the set absolute value. This home mode needs to be used with the multi-turn absolute encoder.

Example: the current encoder absolute position of the motor is 5 turns 0 pulse, set the absolute value of the zero multi-turn value to 10, single-turn value to 0, then the motor directly runs 5 turns at high speed.

10.2 Internal Multi-Segment Position

10.2.1 Basic Settings for Internal Positions

Code	Name	Description	Setting

Pn000.X	Control mode selection	0: Position control mode 1: Speed control mode 2: Torque control mode 3: Speed-Position control mode 4: Torque-Position control mode 5: Speed-Torque control mode	0
Pn202.X	Position mode command source selection	0: External low-speed pulse train 1: External high-speed pulse train 2:NA 3: Internal position setting 4: CanOpen setting	2
Pn204	Electronic gear numerator (B)	0～1073741824	1
Pn206	Electronic gear denominator (A)	1～1073741824	1

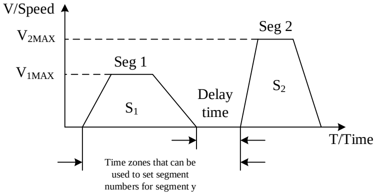
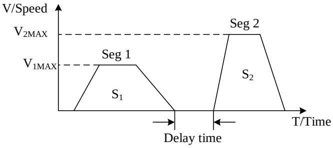
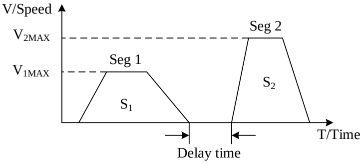
Precautions

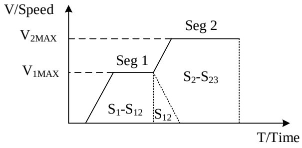
- When the numerator of the electronic gear ratio is 0, the denominator setting is the number of command pulses corresponding to one revolution of the motor.
- If the setting range: 0.001 ≤ electronic gear ratio (B/A) ≤ 64000 exceeds this setting range, a "parameter error (Er.d04)" occurs.

10.2.2 Internal Multi-Segment Position Mode

Table 12-2 Internal multi-segment position mode

Pn802.X	Mode	Remark	Waveform

0	Single segment position	The segment number is controlled by the communication function code (Pn806) or the DI terminal (CTRG and POS0 to POS3). When running the current segment number, the next segment number can be set, and the motor stops after the current segment number command is completed. Rising edge of CTRG triggers operation.	 V_{1max} and V_{2max} are max working speed (target speed) of the 1-seg and 2-seg respectively. S_1 and S_2 are displacement of 1-seg and 2-seg respectively.
1	Single multi-segment position	Auto incremental switching between segment numbers, delay time can be set between segments, stop after 1 round; Valid at high level of CTRG, stop at low level.	 V_{1max} and V_{2max} are max working speed (target speed) of the 1-seg and 2-seg respectively. S_1 and S_2 are displacement of 1-seg and 2-seg respectively.
2	Cyclic multi-segment position	Auto incremental switching between segment numbers, delay time can be set between segments, starting path with Pr1 each time; Valid at high level of CTRG, stop at low level.	

3	Sequential multi-segment position	Automatic incremental switching between segment numbers, no delay time between segments. Cyclic operation or only 1 round (Pn804=0 or Pn804＞Pn803 only 1 round). The 1st round takes Pr1 as the starting path; the starting segment number after the 1st round is Pn804. Valid at CTRG high level, and stop at low.	 S_{12} is $S_1$the displacement during deceleration, which is directly skipped and run while performing S2

Precautions

- When multi-segment position (Pn802.X=1, 2, 3), operation can also be triggered by Pn806=1 (communication, panel).
- When Pn806=1000, all position modes (home and internal multi-segment position) can be forced to stop.

Related function codes:

Code	Name	Description	Default
Pn802.X	Internal position operation mode	0: Single segment 1: Single continuous operation 2: Cyclic continuous operation 3: Sequential operation	0
Pn802.Y	Multi-segment position margin processing mode	0: Continue to run the unfinished path (start from the next section of the pause) 1: Restart the run from Pr1	0
Pn802.Z	Single-segment position new command processing	0: Non-immediate update. When there is a new command, execute the current command and then go to the new command (delay time is valid)	0

		1: Immediate update (delay time is invalid)	
Pn802.W	Absolute position start point selection	0: Start from initial power-up or motor position after zero return 1: Absolute zero-point set by Pn296 and Pn297 as the starting point	0
Pn803	Multi-segment position (velocity) endpoint path	1～15	1
Pn804	Sequential operation start path	0～15	1
Pn806	Pr command communication parameters (single-segment)	0～65535	10000
Pn810.X	PR type (TYPE)	0: Positioning control 1: Fixed-speed control	0
Pn810.Y	Position control type	0: Incremental position 1: Absolute position 2: Relative position	0
Pn810.Z	Fixed speed control unit	0: Speed unit is 0.1rpm 1: Speed unit is PPS	0
Pn811.X	Acceleration time (ACC)	0～7:for Pn890～Pn897	0
Pn811.Y	Deceleration time (DEC)	0～7: for Pn890～Pn897	0
Pn811.Z	Positioning control target speed	0～7: for Pn8A0～Pn8A7	0
Pn811.W	Delay time	0～7: for Pn898～Pn89F	0
Pn812	Pr1 path information	-2^{31}～$2^{31}-1$	0
…	...	…	…
Pn890～Pn897	Pr acceleration/deceleration time 0 to 7	0～60000	-
Pn898～Pn89F	Pr delay time 0～7	0～60000	-
Pn8A0～Pn8A7	Pr target speed 0～7	0～60000	-

Precautions

- The first round of sequential operation starts from Pr1 and runs to the path pointed by Pn803;
- If Pn804 = 0 or Pn804 > Pn803 during sequential operation, it stops after 1 round.
- If Pn804≤Pn803 during sequential operation, the cycle runs after the 1st round and the starting segment number is Pn804.

10.2.3 Internal Multi-Segment Position Parameter

The position function programs the corresponding trajectory according to the set speed, acceleration and deceleration time, delay time, and target position value. The operating parameters of the first position command segment are explained as an example.

(1) Position mode

In position mode, the position command pulse number is given by Pn804+ POSNUM*4. The position command unit is the user unit. The number of position command pulses per turn is given by the electronic gear ratios Pn204 and Pn206.

In position mode, the target position can be incremental position, relative position and absolute position.

① The reference point of the incremental position is the target value of the current position command. As shown in Fig. 12.13, the first segment of the position command is set to PosCmd0, and after running the pulse of Pos0, it ends the operation, and the remaining pulse of PosRem0 is not completed. If the second segment incremental position command PosCmd1 is inserted at this time, the total number of pulses run by the second segment position command is PosCmd1+ PosRem0, and the final running position value is PosCmd0+ PosCmd1.

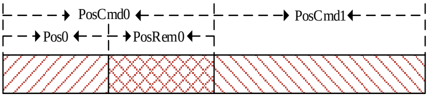


Figure 12.13 Incremental position command operation

② The relative position command uses the actual position value as the reference point. The position command value of the latter segment uses the actual position as the reference point to calculate the target position. As shown in Fig. 12.14, the set value of the first segment position command is PosCmd0, and after running the pulse of Pos0, the second segment relative position command PosCmd1 is inserted, so that the total number of pulses run by the second segment position command is PosCmd1, and the final running position value is Pos0+PosCmd1.

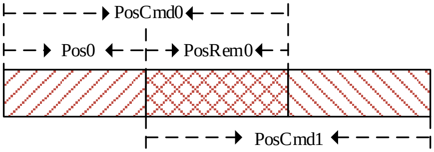


Figure 12.14 Relative position command operation

③ The absolute position command takes the position relative to the absolute zero point (set by Pn296 and Pn297) as the reference point. As shown in Figure 12.15, the first position command is set to PosCmd0, and after running the pulse of Pos0, the second absolute position command PosCmd1 is inserted, so that the total number of pulses run by the second position command, is PosCmd1-Pos0, and the final running position is PosCmd1.

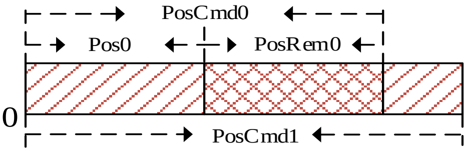


Figure12.15 Absolute position command operation

(2) Acceleration and deceleration time

The acceleration and deceleration time of motor operation during the operation of the position control are calculated with an acceleration and deceleration base 3000rpm. For example, if the acceleration time is set to 300ms and the target speed is 1000rpm, it means that it takes 300ms to accelerate the motor from 0rpm to 3000rpm; and 100ms to accelerate the motor from 0rpm to the target speed of 1000rpm.

(3) Speed control

The internal multi-segment position speed giving is categorized into two types: position control mode and speed control mode.

① For the position control mode, the desired speed is given by bit8 to bit11 of the higher 16 bits of Pr command segment control words(e.g., the control words of Pr1 are Pn810 and Pn811, and its speed is set by Pn811.Z). The set speed value can only be positive, and the direction of the actual speed is determined by the positive or negative value of the target position.

② For the speed control mode, the target speed value is given by the corresponding Pr information when the speed command is planned. For example, if Pr1 is speed control, the unit of target speed (0.1rpm or PPS) is selected by setting Pn810.Z, and then set Pn812 to control the target speed of Pr1; if the motor is expected to run in the reverse direction, Pn812 can be set to a negative value.

(4) Delay time

① For single segment position, single multi-segment position and cyclic multi-segment position modes, the delay time takes effect. Set the delay time for Pr1 to T (ms), and after the Pr1 command is completed, it takes a delay time of T (ms) before the next Pr command can be executed. If the delay time is 0, the deceleration process of the current Pr command or the acceleration process of the next Pr command will be skipped. For example, the target speed of Pr1 is 800rpm, and the target speed of Pr2 is 1000rpm, when switching from Pr1 to Pr2, the delay time is 0, it accelerates directly from 800rpm to 1000rpm.

② For sequential multi-segment position, the delay time is not effective, and the deceleration process or acceleration process will be skipped between segments, and it will directly start at the deceleration point of the previous segment and run to the target speed of the next segment. For example, if the target speed of Pr1 is 1000rpm and the target speed of Pr2 is 800rpm, when switching from Pr1 to Pr2, it will directly decelerate from 1000rpm to 800rpm.

10.2.4 Single-segment Position Operation

For the single segment operation mode (Pn802.X=0) in the multi-segment position, it means that the user changes and triggers the Pr command segment through the external DI terminal or communication function code (Pn806). When the Pr path is selected through an external terminal, the terminal and Pr path relationship is shown in Table 12-3. When triggered by the communication function code, the home mode is executed when Pn806=0, and the corresponding Pr path is executed when it is 1 to 15. During operation Pn806=10000+Num (Num is the Pr path segment, for example when running Pr1, Num=1); after the end of operation, Pn806=20000+Num.

Table 12-3 Terminals and corresponding Pr paths during single-segment position operation

POS3	**POS2**	**POS1**	**POS0**	**CTRG↑ execute command**	**CTRG↓ execute command**
0	0	0	0	Home	Immediate stop
0	0	0	1	Pr1	
0	0	1	0	Pr2	
0	0	1	1	Pr 3	
0	1	0	0	Pr 4	
0	1	0	1	Pr 5	
0	1	1	0	Pr 6	
0	1	1	1	Pr 7	
1	0	0	0	Pr 8	

1	0	0	1	Pr 9	
1	0	1	0	Pr 10	
1	0	1	1	Pr 11	
1	1	0	0	Pr 12	
1	1	0	1	Pr 13	
1	1	1	0	Pr 14	
1	1	1	1	Pr 15	

Table 12-4 Example of single-segment position operation

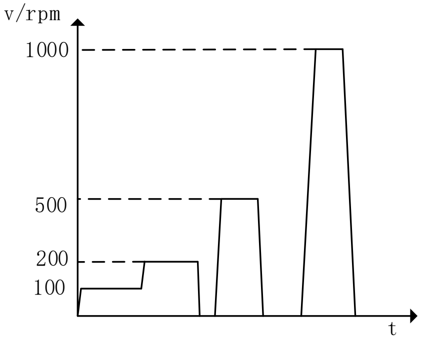
Step	**Item**	**Description**
1	Mode selection	Pn000.X=0 (control mode is position control) Pn200.X=3 (give by internal position) Pn802.X=0 (selection of single-segment operation mode) Pn204=0, Pn206=20000 (23-bit encoder motor with electronic gear ratio 8388608:20000)
2	Terminal assignment	Pn601.YX=0x01 (assigns terminal X1 as servo enable terminal S-ON) Pn604.YX=0x20 (assigns terminal X4 as internal position trigger terminal CTRG) Pn605.YX=0x21 (assigns terminal X5 as internal position selection POS0)
3	Acceleration/deceleration time setting	Pn890=600 (Acceleration and deceleration time for segment 0 is 600, acceleration from 0rpm to 3000rpm or deceleration from 3000rpm to 0 is 600ms)
4	Pr1 command control word setting	Pn810.X=0, Pn810.Y=0 (i.e., selected as incremental positioning mode) Pn811=0x0000 (target speed is Pn8A0, i.e. 100rpm; acceleration/deceleration time is Pn890, i.e. 600ms; delay time is Pn898, i.e. 0ms, no delay)
5	Terminal triggering operation Pr1	Servo enable, POS0=1, Pr1 path is selected Pn812=100000, Pr1information is 100000 pulses Toggle CTRG from 0 to 1, then run Pr1 with 100000 pulses at 100rpm Un013 has increased by 100000 from the value before the operation
6	Communication triggering operation Pr1	Make Pn812=200000, Pn806=1, then the servo runs the internal position Pr1, running 200000 pulses; make Pn806=1000 during running then the servo stops immediately.

10.2.5 Single Continuous Operation

The single multi-segment position (Pn802.X=1) is a type of operation of the internal multi-segment position, which runs from Pr1 and only runs once per trigger. The end segment of the internal position is controlled by Pn803, for example, Pn803=3, and the single multi-segment position runs from Pr1 to Pr3 when triggered.

Table 12-5 Example of a single multi-segment position

Step	Item	Description
1	Mode selection	Pn000.X=0 (control mode is position control) Pn200.X=3 (give by internal position) Pn802.X=1 (selection of single-segment operation mode) Pn204=0, Pn206=20000 (23-bit encoder motor with electronic gear ratio 8388608:20000)
2	Terminal assignment	Pn601.YX=0x01 (assigns terminal X1 as servo enable terminal S-ON) Pn604.YX=0x20 (assigns terminal X4 as internal position trigger terminal CTRG)
3	Multi-stage position Pr command setting	Pn803=4, (Internal multi-segment position endpoint set to Pr4) Pr1:Pn810=0x0000, Pn811=0x0000, Pn812=100000 Pr2:Pn814=0x0000, Pn815=0x1111, Pn816=200000 Pr3:Pn818=0x0000, Pn819=0x2222, Pn81A=300000 Pr4:Pn81C=0x0000, Pn81D=0x3333, Pn81E=400000 Acceleration and deceleration time 0 to 3, target speed 0 to 3, and delay time 0 to 3 are default values.
4	Terminal triggering single multi-segment position	Enable servo: Toggle CTRG from 0 to 1 to trigger a single multi-segment command. The running speed waveform is shown below, and the encoder position feedback pulse increment is 100000PUU.

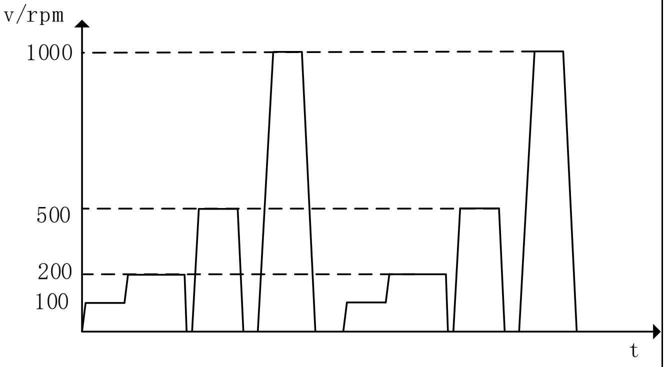
		

10.2.6 Cyclic Continuous Operation

Cyclic continuous operation (Pn802.X=2) is the second operation mode of internal multi-segment position, running from Pr1, the end segment is controlled by the value of Pn803. For example, Pn803=3, the cyclic multi-segment position triggers to run from Pr1 to Pr3, and the cycle repeats.

Table 12-6 Cyclic multi-segment position running example

Step	**Item**	**Description**
1	Mode selection	Pn000.X=0 (control mode is position control); Pn200.X=3 (give by internal position) Pn802.X=2(select cyclic continuous operation mode) Pn204=0, Pn206=20000 (23-bit encoder motor with electronic gear ratio 8388608:20000)
2	Terminal assignment	Pn601.YX=0x01 (assigns terminal X1 as servo enable terminal S-ON) Pn604.YX=0x20 (assigns terminal X4 as internal position trigger terminal CTRG)
3	Multi-stage position Pr command setting	Pn803=4 (internal multi-segment position endpoint set to Pr4) Pr1:Pn810=0x0000, Pn811=0x0000, Pn812=100000 Pr2:Pn814=0x0000, Pn815=0x1111, Pn816=200000 Pr3:Pn818=0x0000, Pn819=0x2222, Pn81A=300000 Pr4:Pn81C=0x0000, Pn81D=0x3333, Pn81E=400000 Acceleration and deceleration time 0 to 3, target speed 0 to 3, and delay time 0 to 3 are default values.
4	Terminal triggering cycle multi-	Enable servo: Toggle CTRG from 0 to 1 to trigger a single multi-segment command. The running speed waveform is shown below, run Pr1to Pr4, and then Pr1 again.

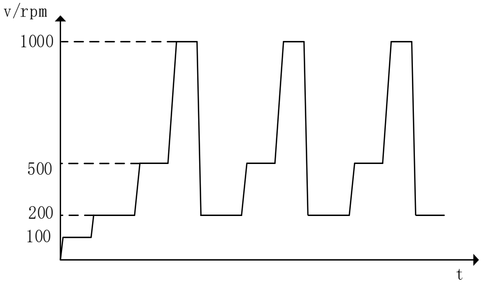
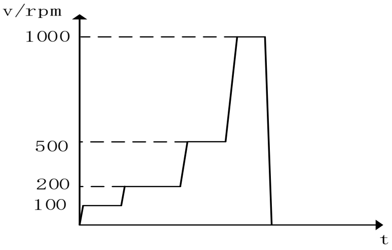
	segment position	Repeat the cycle. 

10.2.7 Sequential Operation

Sequential operation (Pn802.X=3) is the third type of the internal multi-segment position, which starts from Pr1 and the end segment is controlled Pn803. For example, Pn803=4, the sequential multi-segment position runs from Pr1 to Pr4 after it is triggered. After the first round, the starting point is controlled by Pn804, and if Pn804=0 or Pn804>Pn803, the operation ends after the first round. If 0<Pn804≤Pn803, the starting point becomes the path pointed by Pn804 after the first round. There is no delay time during the sequential multi-segment position operation.

Table 12-7 Example of sequential multi-segment position operation

Step	Item	Description
1	Mode selection	Pn000.X=0 (control mode is position control) Pn200.X=3 (give by internal position) Pn802.X=3 (select sequential mode of operation) Pn204=0, Pn206=20000 (23-bit encoder motor with electronic gear ratio 8388608:20000)
2	Terminal assignment	Pn601.YX=0x01 (assigns terminal X1 as servo enable terminal S-ON) Pn604.YX=0x20 (assigns terminal X4 as internal position trigger terminal CTRG)
3	Multi-stage position Pr command setting	Pn803=4, (Multi-stage position Pr command setting) Pr1:Pn810=0x0000, Pn811=0x0000, Pn812=100000 Pr2:Pn814=0x0000, Pn815=0x1111, Pn816=200000 Pr3:Pn818=0x0000, Pn819=0x2222, Pn81A=300000 Pr4:Pn81C=0x0000, Pn81D=0x3333, Pn81E=400000

		Acceleration and deceleration time 0 to 3, target speed 0 to 3, and delay time 0 to 3 are default values.
4	Terminal triggering sequence multi-segment position	Enable the servo, make Pn804=2 (0<Pn804<Pn 803), and then toggle CTRG from 0 to 1, then the single multi-segment command is triggered. The running speed waveform is shown as follows. 
5	Modify Pn804 to run again	Toggle CTRG from 1 to 0 to stop sequential multi-stage positional operation Make Pn804=5 (Pn804>Pn803 or Pn804=0) Trigger the single multi-stage operation command again, and the running speed waveform is shown as follows. 

Appendix

Attachment 1 Input Terminal Function Definitions

Setting:0x01

Mark	Servo enable	Trigger	Control mode
S-ON	This signal is used to start the servo (Servo-ON). Invalid: Servo motor is not enabled (Servo-OFF). Valid: Servo motor is enabled (Servo On).	By high/low level	🄿 🅂 🅃

Setting:0x02

Mark	Forward operation OFF	Trigger	Control mode
P-OT	This signal is used to disable the motor from forward operation when a forward command is sent externally. Invalid: motor continues to run forward. Valid: motor is still.	By high/low level	🄿 🅂 🅃

Setting:0x03

Mark	Reverse operation OFF	Trigger	Control mode
N-OT	This signal is used to disable the motor from reverse operation when a forward command is sent externally. Invalid: motor continues to run reversely. Valid: motor is still.	By high/low level	🄿 🅂 🅃

Setting:0x04

Mark	Alarm reset	Trigger	Control mode
ALM-RST	This signal is used to reset fault alarms in the drive. Invalid: alarm reset OFF. Valid: alarm reset ON.	By high/low level	🄿 🅂 🅃

Setting:0x05

Mark	Speed loop PI<->P switching	Trigger	Control mode
P-CON	This signal is used to switch the PI (Proportional/Integral)	By	🄿 🅂 🅃

	and P (Proportional) regulators of the drive's speed loop. Invalid: PI controller (proportional/integral). Valid: change to P controller (proportional).	high/low level	

Setting:0x06			
Mark	**Torque limit selection**	**Trigger**	**Control mode**
TL-SEL	This signal is used to limit the forward and reverse torque of the drive. Invalid: limit forward and reverse torque by Pn053. Valid: limit forward and reverse torque by Pn054.	By high/low level	P S T

Setting:0x08			
Mark	**Speed command direction in speed mode**	**Trigger**	**Control mode**
SPD-D	This signal is used to adjust the direction of the speed command in speed mode. Invalid: the same as the original speed command. Valid: opposite to the original speed command.	By high/low level	S

Setting:0x09,0x0A			
Mark	**Internal register speed command buffer**	**Trigger**	**Control mode**
SPD-A **SPD-B**	SPD-A: internal register speed command buffer selection 1 SPD-B: internal register speed command buffer selection 2	By high/low level	S

SPDB	**SPDA**	**Command source**
0	0	Pn303.X
0	1	Pn303.Y
1	0	Pn303.Z
1	1	Pn303.W

Setting:0x0B			
Mark	**Control mode selection**	**Trigger**	**Control mode**

<table>
<tr>
<td>C-SEL</td>
<td>This signal is used to select the control modes.
<table>
<tr><th rowspan="2">P000.X Setting</th><th colspan="2">Control mode selection(C-SEL)</th></tr>
<tr><th>High level (H)</th><th>Low level (L)</th></tr>
<tr><td>3</td><td>Speed mode</td><td>Position mode</td></tr>
<tr><td>4</td><td>Torque mode</td><td>Position mode</td></tr>
<tr><td>5</td><td>Speed mode</td><td>Torque mode</td></tr>
</table>
</td>
<td>By high/low level</td>
<td>P S T</td>
</tr>
</table>

Setting:0x0C			
Mark	**Zero clamp**	**Trigger**	**Control mode**
ZCALMP	This signal is used to give the zero clamping command signal to the drive. Invalid: zero clamp OFF. Valid: zero clamp ON.	By high/low level	S

Setting:0x0D			
Mark	**Command pulse inhibit**	**Trigger**	**Control mode**
INHIBIT	This signal is used to control the drive to stop receiving pulse commands. Invalid: inhibit reception of pulse commands and counting. Valid: allow reception of pulse commands and counting.	By high/low level	P

Setting:0x0E			
Mark	**Gain selection**	**Trigger**	**Control mode**
G-SEL	This signal is used to select between the two gains in speed and position mode. Invalid: switch to 1st gain. Valid: switch to 2nd gain.	By high/low level	P S T

Setting:0x0F			
Mark	**Torque command direction switch in torque mode**	**Trigger**	**Control mode**
TPR-D	This signal is used to adjust the output direction of the	By	S T

	torque command via this terminal in the torque control mode: Invalid: same as the torque command; Valid: opposite to the torque command	high/low level	

Setting:0x10			
Mark	**Command pulse input multiplier switching**	**Trigger**	**Control mode**
P-GAIN	This signal is used to change the frequency of command pulse input in position mode. Invalid: switch to normal pulse input mode. Valid: switch to the set multiplication rate.	By high/low level	P

Setting:0x11			
Mark	**Pulse deviation clear**	**Trigger**	**Control mode**
CCLR	This signal is used to clear the pulse counting buffer by Pn200. Y. When this signal is valid, the position pulse error accumulated by the servo drive is cleared to zero.	By edge and high/low level	P

<table>
<tr><th colspan="4">Setting:0x12,0x13</th></tr>
<tr><th>Mark</th><th>Internal register torque command buffer selection</th><th>Trigger</th><th>Control mode</th></tr>
<tr><td>TOR-A
TOR-B</td><td>TOR-A: internal register torque command buffer1.
TOR-B: internal register torque command buffer2.
<table>
<tr><th>TOR-B</th><th>TOR-A</th><th>Command source</th></tr>
<tr><td>0</td><td>0</td><td>Pn409.X</td></tr>
<tr><td>0</td><td>1</td><td>Pn409.Y</td></tr>
<tr><td>1</td><td>0</td><td>Pn409.Z</td></tr>
<tr><td>1</td><td>1</td><td>Pn409.W</td></tr>
</table></td><td>By high/low level</td><td>T</td></tr>
</table>

Setting:0x15			
Mark	**Torque mode speed limit source selection**	**Trigger**	**Control mode**
T-SLMT	This signal is used to select the desired speed limit source in torque control.	By edge and	T

	Invalid: limit by Pn415. Valid: limit by Pn416.	high/low level	

Setting:0x17			
Mark	**Positive jog**	**Trigger**	**Control mode**
JOGP	This terminal is used to input a jog speed command to the drive. Invalid: jog speed command input OFF. Valid: jog speed command input ON.	By high/low level	P S T

Setting:0x18			
Mark	**Negative jog**	**Trigger**	**Control mode**
JOGN	This terminal is used to input a jog speed command to the drive. Invalid: jog speed command input OFF. Valid: jog speed command input ON.	By high/low level	P S T

Setting:0x19			
Mark	**Emergency stop**	**Trigger**	**Control mode**
EMSTOP	This terminal is used to input an emergency stop command to the drive. Invalid: the servo drive maintains the current operating status. Valid: zero-speed stop, maintains locked position.	By high/low level	P S T

Setting:0x1A			
Mark	**Three control mode selection 2**	**Trigger**	**Control mode**
C-SEL2	This signal is used for control mode switching selection when Pn000.X=6.	By high/low level	P S T

<table>
<tr><th colspan="4">Setting:0x1B</th></tr>
<tr><th>Mark</th><th>Three control mode selection trigger</th><th>Trigger</th><th>Control mode</th></tr>
<tr><td>C-Trig</td><td>This terminal is used to confirm the selected control mode at Pn000.X=6.
<table>
<tr><th rowspan="2">Pn000.X</th><th colspan="2">Control mode signal</th><th rowspan="2">C-Trig</th><th rowspan="2">Control mode</th></tr>
<tr><th>C-SEL</th><th>CSEL2</th></tr>
<tr><td rowspan="3">6</td><td>0</td><td>0</td><td rowspan="3">↑</td><td>Speed mode</td></tr>
<tr><td>0</td><td>1</td><td>Position mode</td></tr>
<tr><td>1</td><td>0</td><td>Torque mode</td></tr>
</table></td><td>By edge</td><td>P S T</td></tr>
<tr><th colspan="4">Setting:0x20</th></tr>
<tr><th>Mark</th><th>Internal position command trigger</th><th>Trigger</th><th>Control mode</th></tr>
<tr><td>CTRG</td><td>In the PR mode, the position commands selected from POS0 to POS5 are read into the controller at the moment of CTRG conduction (rising edge).</td><td>By high/low level</td><td>P</td></tr>
</table>

Setting:0x27			
Mark	**Home enable**	**Trigger**	**Control mode**
ORGEN	In position mode, when the terminal triggers home return, the home command is read into the controller.	By edge and high/low level	P

Setting:0x28			
Mark	**Mechanical home signal**	**Trigger**	**Control mode**
ORGS	This signal is used as a home signal source during home return. Invalid: home signal is not touched. Valid: home signal is touched.	By rising edge	P

Attachment 2 Output Terminal Function Definitions

Setting:0x01			
Mark	**Servo ready**	**Trigger**	**Control mode**
RDY	If the servo drive is ready and there is no fault at present, the output of this signal is ON. If the servo is ready or currently faulty, this signal output is OFF.	By high/low level	P S T

Setting:0x02			
Mark	**Position completion**	**Trigger**	**Control mode**
COIN	When the current position deviation is within the position completion signal threshold (Pn262), this signal output is ON. When the current position deviation is outside the position completion signal threshold (Pn262), this signal is output as OFF.	By high/low level	P

Setting:0x03			
Mark	**Velocity completion**	**Trigger**	**Control mode**
V-CMP	When the deviation between the motor feedback speed and the given speed is within the range of the speed consistency signal threshold (Pn315), this signal is ON. When the deviation between the motor feedback speed and the given speed is not within the range of the speed consistency signal threshold (Pn315), this signal is OFF.	By high/low level	P S T

Setting:0x04			
Mark	**Motor rotation signal**	**Trigger**	**Control mode**
TGON	When the motor running speed is lower than the motor rotation detection threshold (Pn317), this signal is OFF. When the motor running speed is greater than the motor	By high/low level	P S T

	rotation detection threshold (Pn317), this signal is ON.		

Setting:0x05			
Mark	**Torque limit**	**Trigger**	**Control mode**
TLT	When the output torque of the motor is within the set range, this signal is ON. When the output torque is not within the set range, this signal is OFF.	By high/low level	🄿 🅂 🅃

Setting:0x06			
Mark	**Velocity limit**	**Trigger**	**Control mode**
VLT	In torque mode： When the motor speed is not within the set speed limit, this signal is ON. When the motor speed is within the set speed limit, this signal is OFF.	By high/low level	🅃

Setting:0x07			
Mark	**Brake**	**Trigger**	**Control mode**
BK	When this signal is invalid, the power supply of holding brake will be disconnected, the holding brake will be activated, and the motor will be locked in the position. When this signal is invalid, the power supply of the holding brake is disconnected, the holding brake will be lifted, and the motor will be able to rotate.	By high/low level	🄿 🅂 🅃

Setting:0x08			
Mark	**Warning**	**Trigger**	**Control mode**
WARN	When the current drive is in the warning signal state, this signal is ON. When there is no warning signal state in the current drive, this signal is OFF.	By high/low level	🄿 🅂 🅃

Setting:0x09

Mark	Position near signal	Trigger	Control mode
NEAR	When the current position deviation is within the position near signal threshold (Pn260), this signal is ON. When the current position deviation is not within the range of the position near signal threshold (Pn260), this signal is OFF.	By high/low level	P S T

Setting:0x0A

Mark	Command pulse input multiplier	Trigger	Control mode
PSELA	When the pulse input multiplier signal state is entered, this signal is ON. When the pulse input multiplier signal state is not entered, this signal is OFF.	By high/low level	P S T

Setting:0x0B

Mark	Alarm	Trigger	Control mode
Alarm	When the drive has a fault signal state, this signal is ON. When the drive does not have a fault signal state, this signal is OFF.	By high/low level	P S T

Setting:0x0C

Mark	Torque reach	Trigger	Control mode
TorqR	The corresponding timing is set via function codes Pn420 and Pn421.	By high/low level	P S T