Content

Chapter 1 Safety Precautions

The following symbols are used for the safety-related contents of this manual. The contents of the descriptions of the work safety signs are very important, so please be sure to observe them..

Danger

Danger caused by failure to operate as required, which may result in serious injury or even death.

Note

Hazards caused by failure to operate as required, which may result in moderate injuries or minor injuries, and equipment damage

1.1 Safety Precautions

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

Danger
● Make sure the AC 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. ● It is forbidden to connect the input power cable to the output terminal, otherwise the drive will be damaged. ● The drive cannot be tested for insulation withstand voltage, and the control circuit of the drive cannot be tested with a megohmmeter. ● The drive must be connected to the motor in the correct phase sequence, otherwise it will cause the drive to malfunction or damage the drive. ● Before trial operation of the servo motor, to avoid accidents, disconnect the motor load and run the motor alone. ● Before the machine starts running, please make sure you can disconnect the power from the drive at any time by the emergency stop switch. ● It is necessary to set the corresponding parameters before running, otherwise the drive may not operate properly or may have an unanticipated action due to the load. ● Ask an electrical engineer to do the wiring, otherwise there is a risk of electric shock or fire. ● Do not touch the conductive parts directly, and do not connect or short circuit the output line of the drive to the housing, otherwise there is a risk of electric shock or short circuit. ● Disconnect the power and wait 15 minutes before rewiring the drive, otherwise there is a risk of electric shock.

- Contact current can reach 0.5mA, be sure to take reliable grounding measures, otherwise there is a risk of electric shock.
- During operation, do not touch the heat sink or external braking resistor, otherwise a scalding accident may occur due to high temperature.
- Please make sure to install overcurrent protector, leakage current protector and emergency stop device, and make sure they are effective after wiring is completed, otherwise there may be danger of electric shock, injury and fire.
- The leakage current of the driver may exceed 3.5mA during operation. Be sure to use reliable grounding and ensure that the grounding resistance is less than 10Ω, and that the conductivity of the PE grounding conductor is the same as that of the phase conductor (using the same cross-sectional area).
- The components in the driver contain heavy metals, and the driver must be disposed of as industrial waste after scrapping.

1.2 Confirmation of Product Notes

Confirmation Items	Instructions
Whether the product arrives in the same model as the one you ordered	The box contains a simple user's manual and SD780 Servo Drive you ordered. Please check by the nameplate model of servo motor and servo drive.
Whether the product is damaged	Please check the appearance of the whole machine and whether the product has been damaged during transportation. If you find some kind of omission or damage, please contact our company or your supplier immediately.
Whether the servo motor rotary axis runs smoothly	It is normal if it can be turned gently by hand. Except for servo motor with holding brake.

1.3 Handling and Storage Precautions

Attention

- Do not store or place in the following environment, otherwise it may lead to fire, electric shock or machine damage.
- In places exposed to direct sunlight, places where the ambient temperature exceeds the storage temperature, places where the relative humidity exceeds the storage humidity, places where there is a large temperature difference or condensation, places near corrosive gases or flammable gases, places where there is a lot of dust, dirt, salt and metal dust, places where water, oil and medicine

drip, places where vibration or shock can be transmitted to the main body, do not hold the cable or Motor shaft for handling, otherwise it may cause injury or malfunction.

- Do not stack the product too much during handling or storage, as this may cause injury or malfunction

1.4 Precautions for Installation

Attention

- Do not install this product in places where water can be splashed or in environments where corrosion is likely to occur.
- Do not use this product near flammable gases and combustible materials, as there is a risk of electric shock or fire.
- Do not sit on the product or place heavy objects on it, as this may result in injury.
- Please install the product in a cabinet that provides fire protection and electrical protection, otherwise it may cause a fire.
- Do not block the suction and exhaust ports or allow foreign objects to enter the product, as this may lead to malfunction and fire due to the aging of the internal components.
- Be sure to comply with the installation orientation requirements, as failure may result in malfunction.
- When setting up, make sure to keep the specified separation distance between the servo driver and the inner surface of the electric cabinet and other machines, otherwise it may lead to fire or malfunction.
- Do not apply excessive shocks as they may cause malfunction.

1.5 Precautions When Wiring

Attention

- Do not connect three-phase power to the output terminals U, V, and W of the Servo Drive, as this may result in injury or fire.
- Please connect the output U, V, W of the servo driver and U, V, W of the servo motor directly, and do not pass through the electromagnetic contactor on the way to the wiring, otherwise abnormal operation and malfunction may result.
- Please connect the power terminal and motor terminal firmly, otherwise it may cause fire.
- Please do not pass power and signal wires through the same conduit or bundle them together. When wiring, the power supply cable and signal cable should be more than 30cm away from each other.
- Please use double-stranded shielded cable for signal and encoder cables, and ground the shielding layer at both ends.

- The maximum wiring length for the command input line is 3m, and the maximum wiring length for the encoder is 20m.
- Even if the power is turned off, high voltage may remain inside the Servo Drive, so do not touch the power terminals for a while (5 minutes).
- Do not touch the power terminals for a while (5 minutes). Make sure that the indicator light is off before checking.
- Do not turn on/off the power frequently. If it is necessary to turn on/off the power repeatedly and continuously, please limit it to less than once a minute.
- Since the power supply part of the servo driver has a capacitor, a large charging current (charging time 0.2 seconds) will flow when the power is turned 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.
- When wiring the main circuit connector, observe the following precautions.

① Detach the connector from the Servo Drive when wiring.

② Only one wire can be inserted into one wire socket of the connector. When inserting the wires, do not short-circuit the core wire to the adjacent wire.

③ Do not connect the 220V Servo Drive directly to the 380V power supply, as this may damage the Servo Drive.

④ Please do the wiring correctly and reliably, otherwise the motor may be out of control, injured or malfunction.

⑤ Please use the specified power supply voltage, otherwise it may cause the machine to burn out.

⑥ When using under poor power condition, make sure that the input power is supplied within the specified voltage variation range, otherwise the machine may be damaged.

⑦ Install safety devices such as circuit breakers to prevent short-circuiting of external wiring; otherwise, a fire may result.

- Please take adequate and appropriate shielding measures when in the following places, otherwise the machine may be damaged.

① When interference is generated due to static electricity.

② Places where strong electric or magnetic fields are generated.

③ Places where radiation may be emitted.

④ Places where there are power lines nearby.

1.6 Precautions During Operation

Attention

- During trial operation, to prevent accidents, test run the servo motor with no load (state not connected to the drive shaft), otherwise injury may result.
- Never touch the rotating part of the servo motor while it is running, as this may cause injury.
- When installing the servomotor on an ancillary machine and starting operation, set the user parameters in advance to match the machine. If operation is started without parameter setting, the machine may go out of control or malfunction.
- The signals of positive limit (P-OT) and negative limit (N-OT) are invalid when home return is performed.
- When using a servo motor in the vertical axis, set a safety device to prevent the workpiece from falling in case of alarm or overtravel. Also, set the servo lock stop when overtravel occurs, otherwise the workpiece may fall in the overtravel condition.
- When not using online auto-tuning, be sure to set the correct inertia ratio, otherwise vibration may be caused.
- When the power is on or just after the power is cut off, the heat sink of the servo driver, external braking resistor, motor, etc. are in a high temperature state, so please do not touch them or they may cause burns.
- Since extreme user parameter adjustments and setting changes can cause the servo system to become unstable in operation, do not set extreme parameters, as this may cause injury.
- When an alarm occurs, please reset and restart operation after removing the cause and ensuring safety, otherwise it may cause injury.
- Do not use the holding brake of the holding motor for normal braking, as this may lead to malfunction.

1.7 Precautions for maintenance and inspection

Attention

- The operation of turning on and off the power supply should be carried out by professional operators.
- When performing the insulation resistance test of the drive, please disconnect all circuits connected to the drive first, otherwise it may cause the drive to malfunction.
- Do not use gasoline, thinner, alcohol, acidic and alkaline detergent to avoid discoloration or breakage of the housing.
- When replacing the servo drive, please transfer the user parameters of the servo drive to be replaced to the new servo drive before restarting operation, otherwise the machine may be damaged.
- Do not change the wiring while the power is on, as this may cause electric shock.
- Do not disassemble the Servo Motor as this may result in electric shock or injury.

1.8 Maintenance and Inspection of the Servo Unit

Servo systems are made up of many parts, and only when all parts are functioning properly can the equipment perform its proper function. Among mechanical parts and electronic parts, certain parts need to be maintained depending on the conditions of use, and they must be regularly checked or replaced according to their service life to ensure that the servo motor and servo driver can operate normally for a long time.

1.8.1 Servo Motor Overhaul

Since AC servo motors are not equipped with brushes, only routine and simple maintenance is required. The maintenance period in the table is a general standard. Please judge according to the usage and environment and decide the most appropriate maintenance period..

Table 1-1 Servo motor maintenance breakdown

Inspection items	Inspection time	Inspection, maintenance essentials	Remarks
Confirmation of vibration and sound	Daily	Judging by touch and hearing	No increase compared to usual
Exterior Inspection	Depending on the defacement	Wipe with a cloth or use an air gun to sweep	-
Insulation resistance measurement	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 less, please contact our maintenance department 。
Oil seal replacement	At least once every 5000 hours	Please contact our agent or technical support	Servo motor with oil seal only
Comprehensive overhaul	At least 20,000 hours or once every 5 years		-

1.8.2 Servo Drive Maintenance

Although the Servo Drive Unit does not require routine maintenance, please have it serviced more than once a year. See Table 1-2 for specific maintenance details.

Table 1-2 Servo drive maintenance details

Inspection	Inspection	Inspection and maintenance essentials	Processing

items	time		method
Exterior Inspection	At least once a year	No garbage, dust, oil stains, etc.	Wipe with a cloth or Clean with air gun
Loosening of screws		Terminal block, connector mounting screws, etc. must not be loose	Please tighten further

1.8.3 Approximate Criteria for replacement of Internal Parts of the Servo Unit

Electrical and electronic components are subject to mechanical wear and aging. To ensure safety, please have them serviced regularly.

Also, please contact our agency or sales office using the standard replacement years in Table 1-3 as an approximate standard. We will judge whether replacement parts are necessary after investigation. The servo unit repaired by our company has its user parameters set back to the factory settings. Be sure to reset the user parameters to those in use before operation.

Table 1-3 Servo Drive internal parts replacement mark

Parts Name	Standard replacement year	Conditions of use
Cooling Fan	4 years to 5 years	Ambient temperature: annual average 30℃ Load factor: less than 80% Operating rate: less than 20 hours/day
Smoothing Capacitor	7 to 8 years	
Relays	Depending on actual	
Aluminum electrolytic capacitors on printed	5 years	

1.9 UL certification

Products sold in the United States and Canada need to be marked with the UL/cUL mark, where the product with the UL/cUL listing mark, indicating that a representative sample of the product meets the relevant UL safety standards. The product and other major components built into the electrical product can carry the UL/cUL mark after the product has been tested and evaluated by a UL agency to complete compliance.

This product has been tested and confirmed to meet the requirements of the UL standard by North American Safety Standard UL 61800-5-1 and CSA C22.2 NO.274-17 related conditions. In order for the customer to use the machinery and devices of this product in compliance with UL standards, the customer must meet the following requirements when using the product.

1.9.1 Installation site

Please set this product in places with overvoltage class III and pollution class 2 or less as specified in North American safety standard UL 61800-5-1.

1.9.2 Ambient temperature

Depending on the protection class, the ambient temperature should be maintained in the following range：Open type ambient air temperature: 0℃~40℃(40℃～50℃,for every 1℃ rise, the derate decreases by 2%).

1.93 Installation requirements

Open type product installation requirements：SD780 series are Open type products, which are installed in the control cabinet and need to be installed in the final system for use. The final system should provide the corresponding fireproof enclosure, electrical enclosure and mechanical enclosure, etc., and comply with local laws and regulations and relevant NEC standard requirements.

1.94 Servo Drives

1.94.1 Environmental conditions

(1) Use temperature: 0℃~40℃ (40℃～50℃,for every 1℃ rise, the derate decreases by 2%).

(2) Storage temperature: -20℃~65℃.

(3) Use of humidity: 95% RH (not freezing, frost)

(4) storage humidity: 95% RH (not freezing, frost)

(5) Vibration resistance: 4.9m/s2.

(6) Impact strength: 19.6m/s2.

(7) Protection class: IPX0.

(8) altitude: below 1000m (1000m~2000m,derate by 1% for every 100 meter).

(9) Other: no electrostatic interference, strong electric field, strong magnetic field, radiation, etc.

1.95 Servo Motor

1.95.1 Environmental conditions

V7U series motor use range:

V7U series AC servo motors are matched with adapted servo drive devices. Suitable for machine tools, manipulators, robots, lifting machinery, material processing, textiles, printing, packaging, artillery, radar and other types of automation control equipment.

Use environment: 20℃~50℃.

Use altitude: ≤1000m.

Use ambient temperature: relative humidity <90% (no frost conditions).

1.95.2 Servo motor installation and use

1.95.2.1 Storage and Transportation

The motor should be placed in a dry, dust-free place and avoid impact during transportation and storage.

1.95.2.2 Installation

(1) need to check whether the motor structure form, protection level, nameplate data, etc. are consistent with the use conditions before installation.

(2) motor shaft up installation, should ensure that there is no liquid (water, coolant, oil, etc.) from the top bearing room into the internal motor and cause damage.

(3) When installing the motor, it is forbidden to knock or apply pressure from the shaft section to avoid causing damage to the optical encoder.

(4) The motor should be installed in the area of heat dissipation and ventilation.

(5) motor mounting screws for hexagonal bolts (with anti-loosening elastic washers).

(6) the surface temperature of the motor may reach 90 ℃, prohibit hand touch to avoid contact with wire components, etc.;

(7) all accessories (such as brakes) need to check whether they are in working condition,

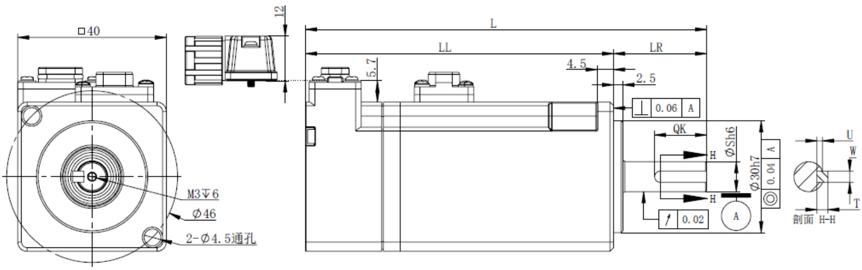
check whether each moveable part is independent to prevent friction.

(8) can not exceed the rated parameters of the motor nameplate use.

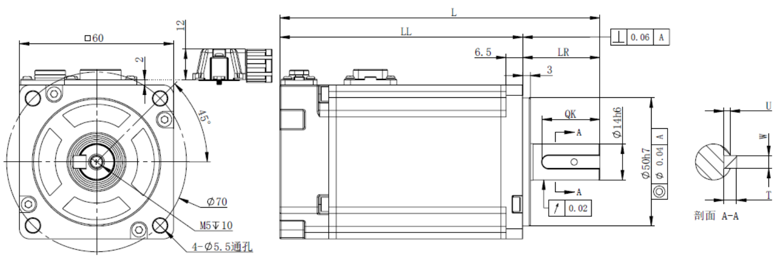
1.95.3、Servo motor form factor

The shape and dimensions of each flange series motor of V7U are shown in the following figure.

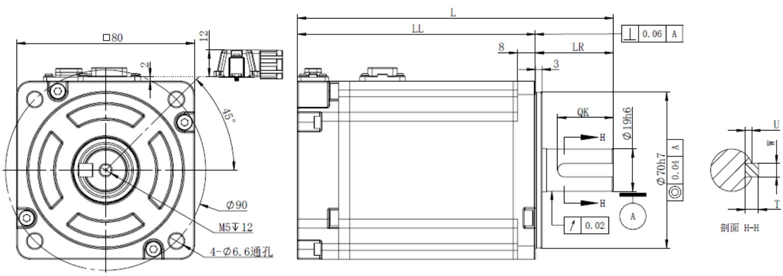
40 Flange:



60 Flange:



80 Flange:



In the drawings of the above series, the real size is the definite size, and the size marked with letters is the variable size, which will change with the power, speed range, torque size and whether the motor holds the brake (see the selection manual for details).

1.95.4、Weitron servo motor after-sales service matters

(1) All repair and maintenance work must be completed by the production plant or other designated institutions to guide, otherwise the resulting damage is borne by the user.

(2) Safety tips: When repairing and maintaining the motor, the main power supply and all power sources must be cut off. The standard steps should follow the following principles: stop the equipment for inspection; disconnect the power supply; and isolate it from live parts.

(3) returns: conventional goods in the arrival of ten days found that the selection error and other reasons can not be used, in the case of the product does not affect our secondary sales can be returned, the resulting freight costs borne by the buyer; custom products will not be returned.

(4) Exchange: If the conventional goods cannot be used for reasons such as wrong selection within thirty days of arrival, the products can be exchanged if they do not affect the secondary sales of our company, and the difference in price will be refunded according to different products, and the resulting freight cost will be borne by the buyer.

(5) Maintenance: Our products provide a 12-month quality assurance period, free of charge during the warranty period, the following cases do not belong to the scope of free maintenance.

①improper installation, such as: shaft deformation caused by excessive radial force, broken shaft, rotor jammed not rotating, etc.

②improper operation, such as: motor knocking deformation, falling, and the resulting damage to the encoder, etc.

③external working environment, resulting in water and oil inside the motor, motor high temperature burned coils, etc.

④private disassembly, modification, processing of the motor.

⑤improper use, overload operation or incorrect parameter setting causing motor burned coils, etc.

⑥missing protection warnings, missing labels, resulting in product barcode models cannot be identified.

(6) arrange to send back the returned products, please inform in advance so that our company can record and arrange the three packages in time, our company will give the

treatment opinion within a week after receiving the repair products.

1.96 Wiring and Installation

1.96.1 Main circuit wiring requirements

(1) Do not connect the input power cable to the output U, V, or W. Otherwise, the servo driver will be damaged.

(2) When the cable is bundled and used in a pipe, etc., consider the allowable current reduction rate because the heat dissipation conditions become worse.

(3) When the temperature inside the cabinet is higher than the cable temperature limit, please use a cable with a larger cable temperature limit, and it is recommended that the cable wire use Teflon wire; when the surrounding low-temperature environment, please pay attention to the cable warming measures, the general cable surface in the low-temperature environment is easy to harden and break.

(4) Please ensure that the bending radius of the cable is more than 10 times the outer diameter of the cable itself to prevent long-term bending resulting in the breakage of the inner core of the cable.

(5) Please do not pass or bundle the power cable and signal cable together from the same pipe, to avoid interference, the distance between the two is more than 30cm.

(6) After the power is turned off, high voltage may still remain inside the driver. Please do not touch the power terminals within 5 minutes.

(7) Do not turn on/off the power frequently. When repeatedly turning on/off the power continuously, please limit it to less than 1 time/minute. The power supply part of the servo driver has capacitors, and a large charging current will flow when the power supply is ON. Frequent ON/OFF power supply will cause the performance of the main circuit components inside the driver to deteriorate.

(8) Please use a ground wire with the same cross-sectional area as the main circuit cable. If the cross-sectional area of the main circuit wire is less than 1.6mm2, please use a 2.0mm2 ground wire.

(9) Please connect the servo driver to the earth reliably.

(10) Do not apply power when the terminal block screw is loose or the cable is loose, it may cause fire.

1.96.2 Spring-type connector wiring method

Spring-loaded connector type terminals are used for servo drives with 750W or lower power ratings. The following is a detailed explanation of how to wire the spring-type terminals.

(1) Removing the terminal block from the servo driver

The terminal block must be removed from the Servo Drive before wiring. If wiring is done directly without removing the terminal block, damage to the Servo Drive may occur.

(2) Wire stripping

Strip the outer skin of the used wire 8mm to 9mm.

(3) Open the wire insertion slot in the terminal block

There are two ways to open the wire insertion slot, as shown below:
①Pry open the slot with the control bar that comes with the servo drive.
②Insert a "one-piece" screwdriver into the terminal opening (end width 3.0 mm to 3.5 mm) and press firmly to open the slot.
(4) Inserting the wire into the slot
After the slot is opened, insert the wires, and then close the slot by releasing the pressure of the control bar or screwdriver.
(5) Reinstall the terminal blocks into the servo driver
After connecting all terminals, insert the terminal blocks back into their original positions on the servo driver.
(6) Caution.
①Do not operate with electricity when wiring.
②Do not short-circuit adjacent cores when inserting cables.
③The stripped wire ends need to be twisted tightly to ensure that no cores are exposed when inserted into the terminal.

1.96.3 Cable Requirements

For the selection of wire size, please follow the requirements of NEC (National Electrical Code) and CEC (Canadian Electrical Code Part 1) as well as relevant local laws.
(1) Do not bend the cable or subject it to tension. The core of the signal cable is only 0.2mm or 0.3mm in diameter, so it is easy to break, so be careful when using it.
(2) When you need to move the cable, please use a flexible cable, ordinary cable will be easily damaged after long-term bending. Small power motors with their own cables can not be used for cable movement.
(3) When using the cable protection chain, please ensure that.
①The bending diameter of the cable is at least 10 times the outer diameter of the cable.
②Do not fix or bundle the wiring in the cable protection chain, but only at the two immovable ends of the cable protection chain.
③Do not tangle or twist the cable.
④The duty cycle within the cable protection chain is ensured to be below 60%.
⑤Do not mix cables with too different shapes to prevent thick wires from crushing thin wires; if you must mix cables, please set up a partition device in the middle of the

cable.

1.96.4、Electrical wiring anti-interference requirements

To suppress interference, please take the following measures.
(1) The command input cable length should be 3m or less, and the encoder cable should be 20m or less.
(2) Use thick wire (2mm² or more) for ground wiring if possible.
①It is recommended to use D type or higher grounding (grounding resistance of 100Ω or less).
②Must be grounded for 1 point.
(3) Use a noise filter to prevent RF interference. When using in a residential environment or 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 method can be used.
①Install the upper unit and the noise filter as close as possible to the servo drive.
②Surge suppressors are installed on the coils of relays, solenoids, and electromagnetic contactors.
③Separate the strong power lines from the weak power lines when wiring, and keep more than 30cm interval. Do not put them into the same pipe or bundle them together.
④Do not share the 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 line.

1.96.5 Terminal cable selection

In order to comply with UL 61800-5-1 and CSA C22.2 NO.274-17, SD780 series power cables shall meet.
(1) Servo power cable specifications in accordance with NEC, NFPA 70 Table 310-16.
(2) Servo power cable shall use copper conductors with a rated temperature of not less than 75° C (167° F).
(3) Servo power cable specifications minimum 14AWG.
(4) The rated voltage of the wire must be not less than the rated voltage of the servo product.
(5) It is recommended to use our recommended motor main circuit cable conforming to UL 758 Style 2517, Style 2586.

1.96.6、Protection device requirements

To comply with the requirements of North American Safety Standard UL61800-5-1, be sure to connect a fuse/circuit breaker on the input side to prevent accidents caused by a short circuit in the internal circuit.

Install adequate branch circuit short-circuit protection in accordance with applicable regulations and this manual. This product is suitable for circuits with a rated fusing capacity of 5000A or less and a maximum voltage of 480Vac (400V class).

Description：

For standard fault short circuit current rating, the driver shall be marked ”Suitable For Use on a Circuit Capable of Delivering Not More Than 5,000 rms Symmetrical Amperes, 240 Volts Maximum.” or equivalent. Branch circuit protection was provided by UL listed fuse (JDDZ/7) refer to below table for details

Driver model	Class CC fuse, Rating
SD780-1R8A-PA	600Vac, 6A
SD780-1R8A-CA	600Vac, 6A
SD780-1R8A-EA	600Vac, 6A
SD780-3R3A-PA	600Vac, 10A
SD780-3R3A-CA	600Vac, 10A
SD780-3R3A-EA	600Vac, 10A
SD780-5R5A-PA	600Vac, 15A
SD780-5R5A-CA	600Vac, 15A
SD780-5R5A-EA	600Vac, 15A

Driver model	Class CC fuse, Rating
SD780-1R8A-PA-FS	600Vac, 6A
SD780-1R8A-CA-FS	600Vac, 6A
SD780-1R8A-EA-FS	600Vac, 6A
SD780-3R3A-PA-FS	600Vac, 10A
SD780-3R3A-CA-FS	600Vac, 10A
SD780-3R3A-EA-FS	600Vac, 10A
SD780-5R5A-PA-FS	600Vac, 15A
SD780-5R5A-CA-FS	600Vac, 15A
SD780-5R5A-EA-FS	600Vac, 15A

1.10 Markings

Marking - The following markings shall be appeared on the device by molded, die-stamped, paint-stenciled, stamped, laser engraved or etched in metal or indelibly stamped on an aluminum, pressure-sensitive label secured by adhesive. Unless otherwise specified, pressure sensitive labels which contain any of the required markings, shall be R/C (PGDQ2), R/C (PGJI2) or R/C (PGGU2) which Printing Material suitable for the surfaces and use conditions indicated in the individual Recognitions. The printing of the label shall be done using compatible printing equipment.

1. Listee’s name or Trademark
2. Model designation
3. The electrical ratings
4. Factory Identification if necessary

Installation and Operating Instructions are provided with each device. The following markings shall appear in one of the following locations: shipped separately with the device; on a separable, self-adhesive permanent label that is shipped with the device; or anywhere on the device itself.

1. “Maximum surrounding air temperature rating of 40 ℃” or equivalent.
2. “Solid State Motor Overload Protection: 350% of motor FLA for driver rated 1.8A and 3.3A, 270% of motor FLA for driver rated 5.5A.” or equivalent. When the protection level is adjustable, it shall be provided with instructions for adjustment, or make reference to the manual for adjustment instructions.
3. “Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes” or equivalent.
4. “This equipment is to be installed in an enclosure that provides a Pollution Degree 2 (controlled) environment.” or equivalent.
5. “Motor over temperature protection is not provided by the drive.” Or equivalent.
6. Field Wiring Terminal Markings – Wiring terminals shall be marked to indicate the proper connections for power supply and load, or a wiring diagram coded to the terminal marking shall be securely attached to the device.

“Use 60°C or 75°C Copper wire” or equiva

Chapter 2 Product Information

NOTE

2.1 Servo Drive Introduction

2.1.1 Servo Drive nameplate and model description

SD 780 — 3R3 A — P A — FS

Marking	Product Marking
SD	Servo

Marking	Product Marking
780	780

Marking	Rated current
1R8	1.8A
3R3	3.3A
5R5	5.5A

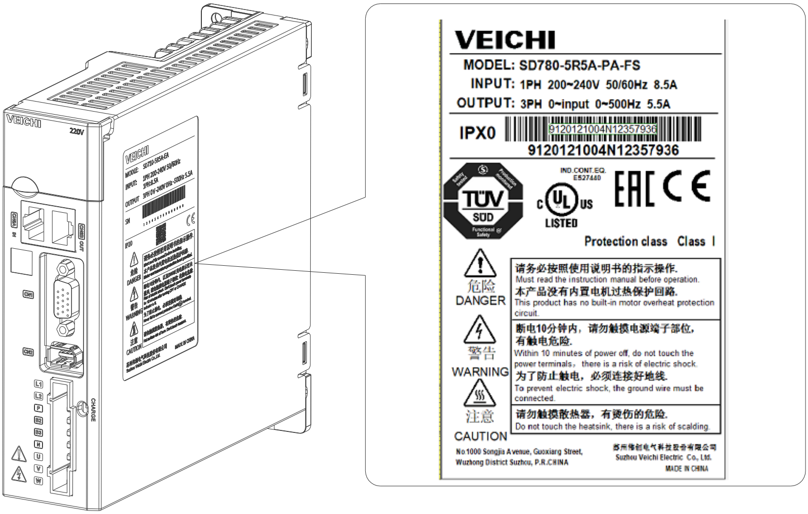
Marking	Function
FS	STO

Marking	Encoder type
A	Serial Encoder

Marking	Product Type
P	Pulse
C	CanOpen
E	Ethercat

Marking	Voltage Rating
A	220V

Fig.2.1 Nameplate and model description


VEICHI
MODEL: SD780-5R5A-PA-FS
INPUT: 1PH 200~240V 50/60Hz 8.5A
OUTPUT: 3PH 0~input 0~500Hz 5.5A
IPX0
9120121004N12357936
IND.CONT.EQ.
E527440
LISTED
Protection class Class I
请务必按照使用说明书的指示操作.
Must read the instruction manual before operation.
本产品没有内置电机过热保护回路.
This product has no built-in motor overheat protection circuit.
危险
DANGER
断电10分钟内，请勿触摸电源端子部位，有触电危险.
Within 10 minutes of power off, do not touch the power terminals，there is a risk of electric shock.
为了防止触电，必须连接好地线.
To prevent electric shock, the ground wire must be connected.
警告
WARNING
请勿触摸散热器，有烫伤的危险.
Do not touch the heatsink, there is a risk of scalding.
注意
CAUTION
No1000 Songjia Avenue, Guoxiang Street, Wuzhong District Suzhou, P.R.CHINA
苏州伟创电气科技股份有限公司
Suzhou Veichi Electric Co., Ltd.
MADE IN CHINA
220V
CHARGE

2.1.2 Parts Description

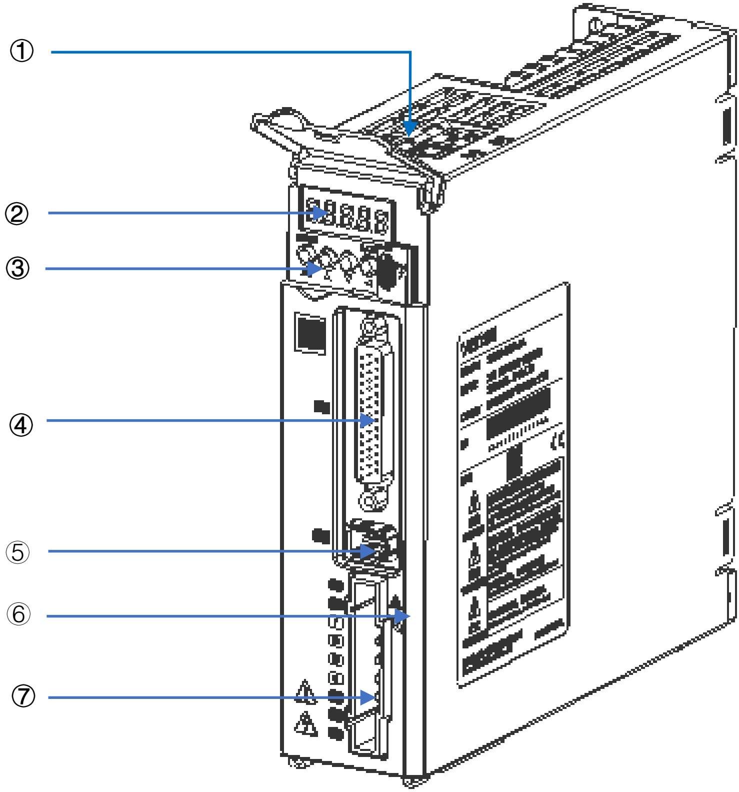


Figure 2.2 Drive components

Table 2-1 Description of Drive Components

Number	Part Name	Description
①	CN6A/6B	Internal parallel connection, RS485, CanOpen communication command connection
②	Monitors	5-bit 8-segment LED digital tube for displaying servo driver operation status and parameters
③	Button	For interaction with drive-related parameters
④	CN1 terminal	Command input and output signals
⑤	CN2 terminal	For connection to encoders
⑥	CHARGE	Used to indicate that the bus capacitor is in a charged state. When the indicator is on, there is still a charge inside the Servo Drive even if the main circuit power is OFF.
⑦	Power	L1, L2: external power input connection.

	terminals	P、N: DC busbar terminal for multi-machine common DC busbar; P、B2、B3: Regenerative braking resistor configuration port; U、V、W: Connect servo motor U, V, W phases.

2.1.3 Technical Specifications

Electrical specifications

Table 2-2 Input voltage and output current of driver corresponding specifications

Machine model	Rated input voltage (V)	Rated output current (A)	Maximum output current (A)
SD780-1R8A□A	Single Phase 220	1.8	6.3
SD780-3R3A□A	Single Phase 220	3.3	11.6
SD780-5R5A□A	Single Phase 220	5.5	16.5
SD780-1R8A□A-FS	Single Phase 220	1.8	6.3
SD780-3R3A□A-FS	Single Phase 220	3.3	11.6
SD780-5R5A□A-FS	Single Phase 220	5.5	16.5

Basic specifications

Table 2-3 Driver Specification Description

<table>
<tr><th colspan="3">Project</th><th>Specification</th></tr>
<tr><td colspan="3">Control method</td><td>IGBT PWM control, sine wave current drive mode</td></tr>
<tr><td colspan="3">Encoder feedback</td><td>Serial encoder: Absolute encoder</td></tr>
<tr><td rowspan="9">Environmental conditions</td><td colspan="2">Operating temperature</td><td>0℃～40℃ (40℃～50℃, for every 1℃ rise, the derate decreases by 2%)</td></tr>
<tr><td colspan="2">Storage temperature</td><td>-20℃～65℃</td></tr>
<tr><td colspan="2">Using humidity</td><td>95%RH or less (no freezing, condensation)</td></tr>
<tr><td colspan="2">Storage humidity</td><td>95%RH or less (no freezing, condensation)</td></tr>
<tr><td colspan="2">Vibration resistance</td><td>$4.9m/s^2$</td></tr>
<tr><td colspan="2">Impact strength</td><td>$19.6m/s^2$</td></tr>
<tr><td colspan="2">Protection level</td><td>IPX0</td></tr>
<tr><td colspan="2">Altitude</td><td>Less than 1000m (1000m~2000m, derate by 1% for every 100 meter)</td></tr>
<tr><td colspan="2">Other</td><td>No electrostatic interference, strong electric field, strong magnetic field, radiation, etc.</td></tr>
<tr><td rowspan="3">Speed Control Torque control</td><td colspan="2">Speed control range</td><td>1:5000 (the lower limit of the speed control range is the value at the rated torque load without stopping condition)</td></tr>
<tr><td rowspan="2">Speed volatility</td><td>Load fluctuation</td><td>Less than ±0.01% of rated speed (at load fluctuation: 0% to 100%)</td></tr>
<tr><td>Voltage fluctuations</td><td>0% of rated speed (at voltage fluctuation: ±10%)</td></tr>
</table>

		Temperature fluctuations	Less than ±0.1% of rated speed (at temperature fluctuation: 25℃±25℃)
	Torque control accuracy		±1% (reproducibility)
	Soft start time setting		0s～10s (acceleration and deceleration can be set separately)
Location Control	Feedforward compensation		0%～100%
	Command pulse	Command pulse pattern	Includes three types of commands: "pulse + direction", "CW + CCW pulse sequence", and "A and B phase orthogonal pulse".
		Input Form	Linear drive, open collector
		Maximum input frequency	Differential input: High speed up to 4Mpps. Open collector: 200Kpps max.
Communication function	485		Standard
	CAN		Optional
	USB		PC, standard, compliant with USB 2.0 specification (12Mbps)
Display Functions			CHARGE, 8-segment LED × 5 bits
Panel Operator Function			Push button switch×4pcs
Recycling process			Functions can be built-in/external
Protection function			Overcurrent, overvoltage, undervoltage, overload, regeneration fault, encoder disconnection, etc.
Auxiliary Functions			Gain adjustment, alarm recording, JOG operation, etc.
Encoder pulse divider output			Phase A, Phase B, Phase C: Linear drive output, number of divided pulses: 35 to 32767

2.1.4 Servo Drive Braking Resistor Specifications

Table 2.4 Servo Drive Braking Resistor Related Specifications

Drive Model	Braking Voltage (V)	Built-in resistors	External minimum resistance (Ω)	Maximum external resistance (Ω)
SD780-1R8A□A	380	None	40	200
SD780-3R3A□A	380	None	40	100
SD780-5R5A□A	380	50Ω 50W	25	70

2.1.5 Drive Mounting Dimensions

Figure 2.3 Schematic diagram of the drive profile

Table 2-5 Correspondence between drive form factor and mounting size

Structure	Dimension(mm)			Mounting dimensions (mm)				Mounting hole diameter
	W	H	D	W1	H1	A	B	-
SIZE A	50	170	170	20	160	7.5	5	2-M4

2.2 Introduction of servo motor

2.2.1 Servo motor naming

V7U	—	L	06	A	—	R40	30	—	D	1	L
①		②	③	④		⑤	⑥		⑦	⑧	⑨

①

Marking	Product Marking
V7U	V7U Series

②

Marking	Inertia class
L	Low inertia
M	Medium inertia
H	Large inertia

③

Marking	Flange size
40	40×40
60	60×60
80	80×80

④

Marking	Voltage Rating
A	220V

⑤

Marking	Power Rating
R05	0.05kW
R10	0.10kW
R20	0.20kW
R40	0.40kW
R75	0.75kW
1R0	1.0kW

⑥

Marking	Rated speed
15	1500rpm
30	3000rpm

⑦

Marking	Encoder type
D	23-bit multi-loop
Q	17-bit single-turn magnetic programming
R	17-bit multi-turn magnetic encoding

⑧

Marking	Gate type
1	No holding brake
2	With holding brake

⑨

Marking	Speed class
L	Low speed
H	High speed
BLANK	Normal speed

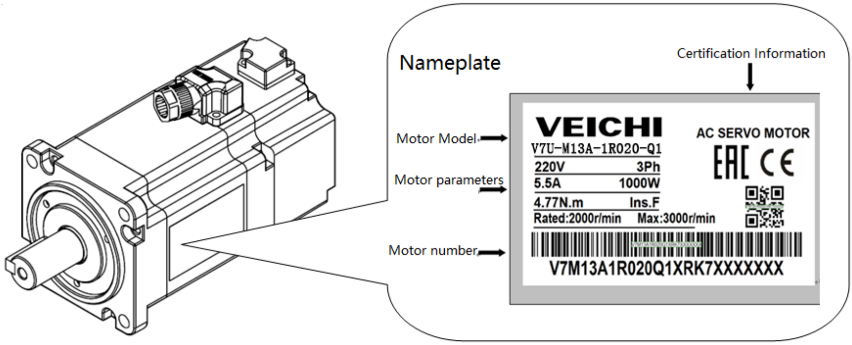


Figure 2.4 Motor model and nameplate information

2.2.2 Servo Motor Parts Description

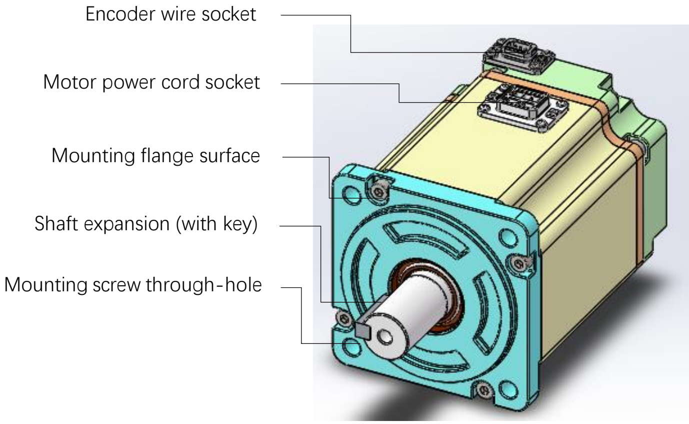


Figure 2.5 Motor without holding brake

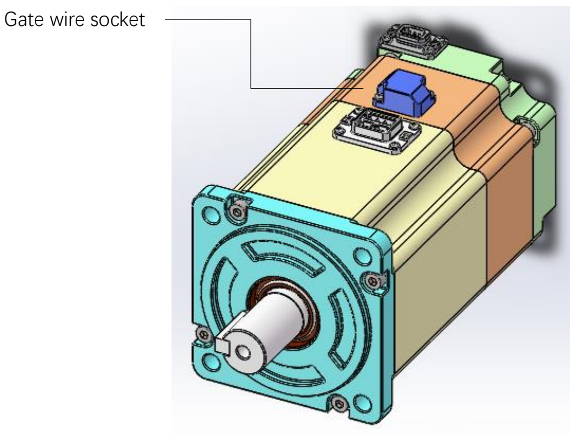


Figure 2.6 Motor with holding brake

2.2.3 Motor Technical Specifications

Specifications of Mechanical Characteristics of Motors

Table 2-6 Motor mechanical characteristics parameter specifications

Projects	Instructions
Work System	Continuous
Vibration Rating	49m/s2 (5G) or less when rotating, 24.5m/s2 (2.5G) or less when stopped
Insulation resistance	DC (DC) 500V, >10MΩ
Operating ambient temperature	0℃～40℃
Use of environmental humidity	20%～80% (no condensation)
Excitation method	Permanent magnet type
Installation method	Flange
Heat resistance grade	F grade
Insulation voltage	AC1500V 1min (200V class)

Motor Rating Specifications

Table 2-7 Motor parameter specifications

Motor Model	Rated power (W)	Rated torque (N•m)	Maximum torque (N•m)	Rated current (Arms)	Maximum current (Arms)
V7U-L04A-R0530-□1	50	0.16	0.48	1	3
V7U-L04A-R0530-□2	50	0.16	0.48	1	3
V7U-L04A-R1030-□1	100	0.32	0.96	1	3
V7U-L04A-R1030-□2	100	0.32	0.96	1	3
V7U-L06A-R4030-□1	400	1.27	3.81	2.6	7.8
V7U-L06A-R4030-□2					
V7U-M06A-R4030-□1					
V7U-M06A-R4030-□2					
V7U-L06A-R6030-□1	600	1.91	5.73	3.3	9.9
V7U-L06A-R6030-□2					
V7U-L08A-R7530-□1L	750	2.38	7.14	3.1	9.3
V7U-L08A-R7530-□2L					
V7U-M08A-R7530-□1L					
V7U-M08A-R7530-□2L					
V7U-L08A-R7530-□1	750	2.38	7.14	4.6	13.8
V7U-L08A-R7530-□2					
V7U-M08A-R7530-□1					
V7U-M08A-R7530-□2					

V7U-L08A-1R030-□1	1000	3.18	9.54	5	15
V7U-L08A-1R030-□2					
V7U-M08A-1R030-□1					
V7U-M08A-1R030-□2					

Motor Model	Rated speed (rpm)	Maximum speed (rpm)	Rotor inertia $(10^{-4}\ kg \cdot m^2)$	Voltage (V)
V7U-L04A-R0530-□1	3000	6000	0.027	220
V7U-L04A-R0530-□2			0.028	
V7U-L04A-R1030-□1		6000	0.051	
V7U-L04A-R1030-□2			0.052	
V7U-L06A-R4030-□1		6000	0.34	
V7U-L06A-R4030-□2			0.36	
V7U-M06A-R4030-□1		6000	0.67	
V7U-M06A-R4030-□2			0.69	
V7U-L06A-R6030-□1		5000	0.51	
V7U-L06A-R6030-□2			0.53	
V7U-L08A-R7530-□1L		4000	1.02	
V7U-L08A-R7530-□2L			1.13	
V7U-L08A-R7530-□1		6000	1.02	
V7U-L08A-R7530-□2			1.13	
V7U-M08A-R7530-□1L		4000	2.3	
V7U-M08A-R7530-□2L			2.41	
V7U-M08A-R7530-□1		6000	2.3	
V7U-M08A-R7530-□2			2.41	
V7U-L08A-1R030-□1		5000	1.34	
V7U-L08A-1R030-□2			1.45	
V7U-M08A-1R030-□1			2.62	
V7U-M08A-1R030-□2			2.73	

2.2.4 Motor Axial and Radial Allowable Load

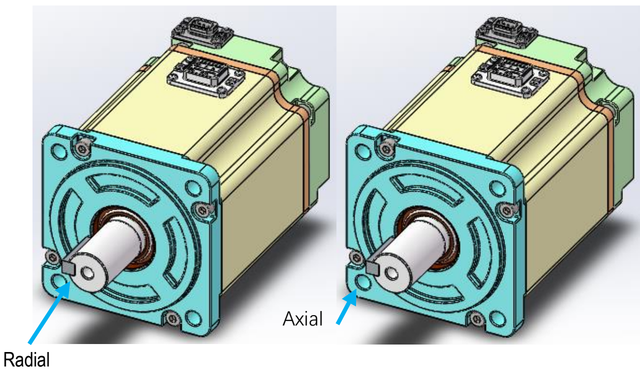


Figure 2.7 Schematic diagram of motor radial and axial loads

Table 2-8 Allowable motor axial and radial loads

Motor Model	Radial allowable load(N)	Axial allowable load (N)
V7U-L04A-R0530-□1	76	53
V7U-L04A-R0530-□2		
V7U-L04A-R1030-□1		
V7U-L04A-R1030-□2		
V7U-L06A-R4030-□1	248	76
V7U-L06A-R4030-□2		
V7U-M06A-R4030-□1		
V7U-M06A-R4030-□2		
V7U-L06A-R6030-□1		
V7U-L06A-R6030-□2		
V7U-L08A-R7530-□1L	389	143
V7U-L08A-R7530-□2L		
V7U-L08A-R7530-□1		
V7U-L08A-R7530-□2		
V7U-M08A-R7530-□1L		
V7U-M08A-R7530-□2L		
V7U-M08A-R7530-□1		
V7U-M08A-R7530-□2		
V7U-L08A-1R030-□1		
V7U-L08A-1R030-□2		
V7U-M08A-1R030-□1		
V7U-M08A-1R030-□2	389	143

2.2.5 Electrical Specifications of the Gate Motor

Table 2-9 Electrical specification parameters of the gate motor

Motor Model	Holding torque (N.m)	Supply voltage (V)±10%	Release time (ms)	Attracting time (ms)	Rotary clearance (°)
V7U-L04A-R0530-□2	0.38	24	20	50	0.5
V7U-L04A-R1030-□2					
V7U-L06A-R4030-□2	1.5	24	20	60	0.5
V7U-M06A-R4030-□2					
V7U-L06A-R6030-□2					
V7U-L08A-R7530-□2L	3.8	24	80	100	0.5
V7U-L08A-R7530-□2					
V7U-M08A-R7530-□2L					
V7U-M08A-R7530-□2					
V7U-L08A-1R030-□2					

V7U-M08A-1R030-□2						

2.2.6 Servo Motor Mounting Dimensions

Table 2-10 60 flange motor dimensions

Motor Model	L	LL	LR	S	QK	U	W
	Unit: millimeter (mm)						
V7U-L04A-R0530-□1	94	69	25	8	14	1.5	3
V7U-L04A-R0530-□2	120	95	25	8	14	1.5	3
V7U-L04A-R1030-□1	108	83	25	8	14	1.5	3
V7U-L04A-R1030-□2	134	109	25	8	14	1.5	3
V7U-L06A-R4030-□1	124.5	94.5	30	14	22.5	2.5	5
V7U-L06A-R4030-□2	155.5	125.5	30	14	22.5	2.5	5
V7U-M06A-R4030-□1	134.5	104.5	30	14	22.5	2.5	5
V7U-M06A-R4030-□2	165.5	135.5	30	14	22.5	2.5	5
V7U-L06A-R6030-□1	143.5	113.5	30	14	22.5	2.5	5
V7U-L06A-R6030-□2	174.5	144.5	30	14	22.5	2.5	5

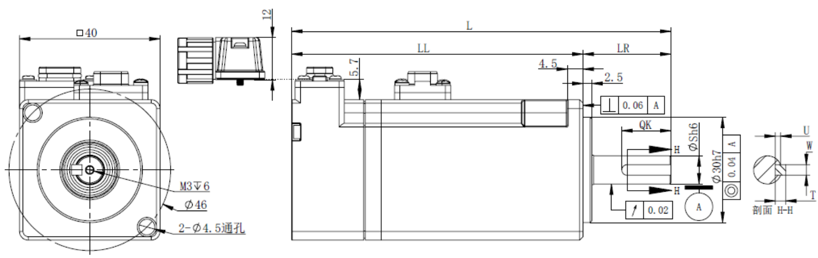
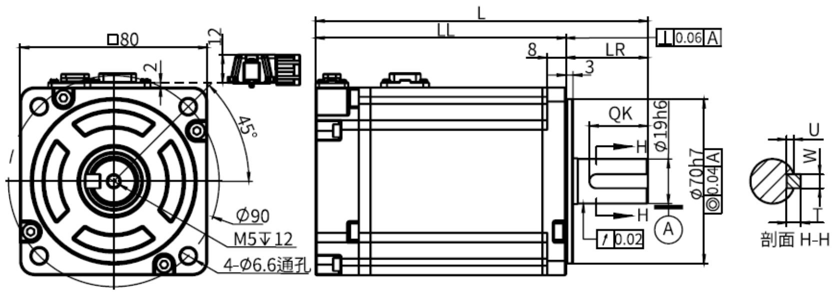


Table 2-11 80 flange motor dimensions

Motor Model	L	LL	LR	S	U	W	QK
	Unit: millimeter (mm)						
V7U-L08A-R7530-□1L	142	107	35	19	25	3	6
V7U-L08A-R7530-□2L	174	139	35	19	25	3	6
V7U-L08A-R7530-□1	142	107	35	19	25	3	6
V7U-L08A-R7530-□2	174	139	35	19	25	3	6
V7U-M08A-R7530-□1L	152	117	35	19	25	3	6
V7U-M08A-R7530-□2L	162	149	35	19	25	3	6
V7U-M08A-R7530-□1	152	117	35	19	25	3	6
V7U-M08A-R7530-□2	162	149	35	19	25	3	6
V7U-L08A-1R030-□1	156	121	35	19	25	3	6
V7U-L08A-1R030-□2	188	153	35	19	25	3	6

V7U-M08A-1R030-□1	166	131	35	19	25	3	6
V7U-M08A-1R030-□2	198	163	35	19	25	3	6



2.3 Matching cables and models

2.3.1 Motor power cable

VM 075 — L030 — 0 T L

① ② ③ ④ ⑤ ⑥

①

Marking	Product Series
VM	Power Cables

②

Marking	Wire diameter
075	$0.75mm^2$
150	$1.5mm^2$
250	$2.5mm^2$

③

Marking	Cable length
L030	3m
L050	5m
L100	10m
L150	15m
L200	20m
L250	25m
L300	30m

④

Marking	Applicable with motor
U	40 Flange
UB	40 Flange Brake
0	60/80Flange
0B	60/80Flange Brake

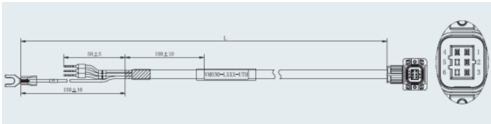
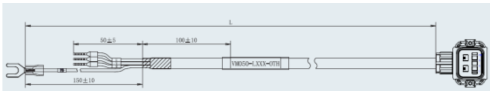
⑤

Marking	Connectors Type
T	Cold press type terminals

⑥

Marking	Cable Material
L	Standard Cable
H	Flexible Cable

Table 2-12 List of motor power cable

Power cable naming	Appearance diagram	Applicable models
VM030-□-UT□		40 flange motor
VM050-□-OT□		60/80 flange motor

2.3.2 Encoder cable

VE 04 — L030 — 2 S N L

① ② ③ ④ ⑤ ⑥ ⑦

①

Marking	Product Series
VE	Encoder cables

②

Marking	Wire diameter
04	4 core twisted shield
06	6 core twisted shield

③

Marking	Cable length
L030	3m
L050	5m
L100	10m
L150	15m
L200	20m
L250	25m
L300	30m

④

Marking	Applicable with motor
2	1394 Plug

⑤

Marking	Connectors Type
S	Hook type motor connector

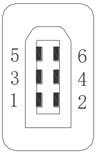
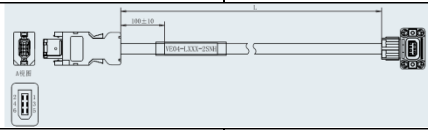
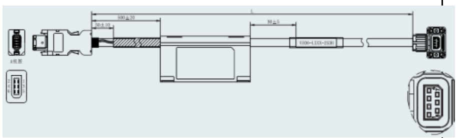
⑥

Marking	Battery
N	No Battery
D	With Battery

⑦

Marking	Cable Material
L	Standard Cable
H	Flexible Cable

Table 2-13 List of motor encoder cable

Encoder cable naming	Appearance diagram		
VE04-□-2AN□	 A-way view	A	B
			
		A	B
VE06-□-2AN□		A	B
			
		A	B

2.4 Servo System Configuration

Servo Drive		Servo Motor					Matching cables	
Model	Rated current (Arms)	Power (W)	Motor model	Torque (N-m)	Rated current (Arms)	Rated speed (rpm)	Motor power cable	Encoder cable
SD780-1R1A	1.6	50	V7U-L04A-R0530-□1	0.16	1	3000	VM030-L030-UTL(UL)	VE04-L030-2SNL(UL)
		50	V7U-L04A-R0530-□2				VM030-L030-UBTL(UL)	VE04-L030-2SNL(UL)
SD780-1R8A	1.8	100	V7U-L04A-R1030-□1	0.32	1		VM030-L030-UTL(UL)	VE04-L030-2SNL(UL)
			V7U-L04A-R1030-□2				VM030-L030-UBTL(UL)	VE04-L030-2SNL(UL)
SD780-3R3A□	3.3	400	V7U-L06A-R4030-□1	1.27	2.6		VM050-L030-0TL(UL)	VE04-L030-2SNL(UL)
			V7U-L06A-R4030-□2				VM050-L030-0BTL(UL)	VE04-L030-2SNL(UL)
		400	V7U-M06A-R4030-□1				VM050-L030-0TL(UL)	VE04-L030-2SNL(UL)
			V7U-M06A-R4030-□2				VM050-L030-0BTL(UL)	VE04-L030-2SNL(UL)
		600	V7U-L06A-R6030-□1	1.91	3.3		VM050-L030-0TL(UL)	VE04-L030-2SNL(UL)
			V7U-L06A-R6030-□2				VM050-L030-0BTL(UL)	VE04-L030-2SNL(UL)
		750	V7U-L08A-R7530-□1L	2.38	3.1		VM050-L030-0TL(UL)	VE04-L030-2SNL(UL)
			V7U-L08A-R7530-□2L				VM050-L030-0BTL(UL)	VE04-L030-2SNL(UL)
SD780-5R5A□	5.5	750	V7U-L08A-R7530-□1	2.38	4.6		VM050-L030-0TL(UL)	VE04-L030-2SNL(UL)
			V7U-L08A-R7530-□2				VM050-L030-0BTL(UL)	VE04-L030-2SNL(UL)

			V7U-M08A-R7530-□1L	2.38	3.1		VM050-L030-OTL(UL)	VE04-L030-2SNL(UL)
			V7U-M08A-R7530-□2L				VM050-L030-OBTL(UL)	VE04-L030-2SNL(UL)
			V7U-M08A-R7530-□1	2.38	4.6		VM050-L030-OTL(UL)	VE04-L030-2SNL(UL)
			V7U-M08A-R7530-□2				VM050-L030-OBTL(UL)	VE04-L030-2SNL(UL)
		1000	V7U-L08A-1R030-□1	3.18	5		VM050-L030-OTL(UL)	VE04-L030-2SNL(UL)
			V7U-L08A-1R030-□2				VM050-L030-OBTL(UL)	VE04-L030-2SNL(UL)
			V7U-M08A-1R030-□1				VM050-L030-OTL(UL)	VE04-L030-2SNL(UL)
			V7U-M08A-1R030-□2				VM050-L030-OBTL(UL)	VE04-L030-2SNL(UL)

Notes：

①: number of cable cores; ②: cable length; ③: with battery or not; ④: cable material

Chapter 3 Wiring and Installation

NOTE

3.1 Servo Driver Terminal Pins Distribution

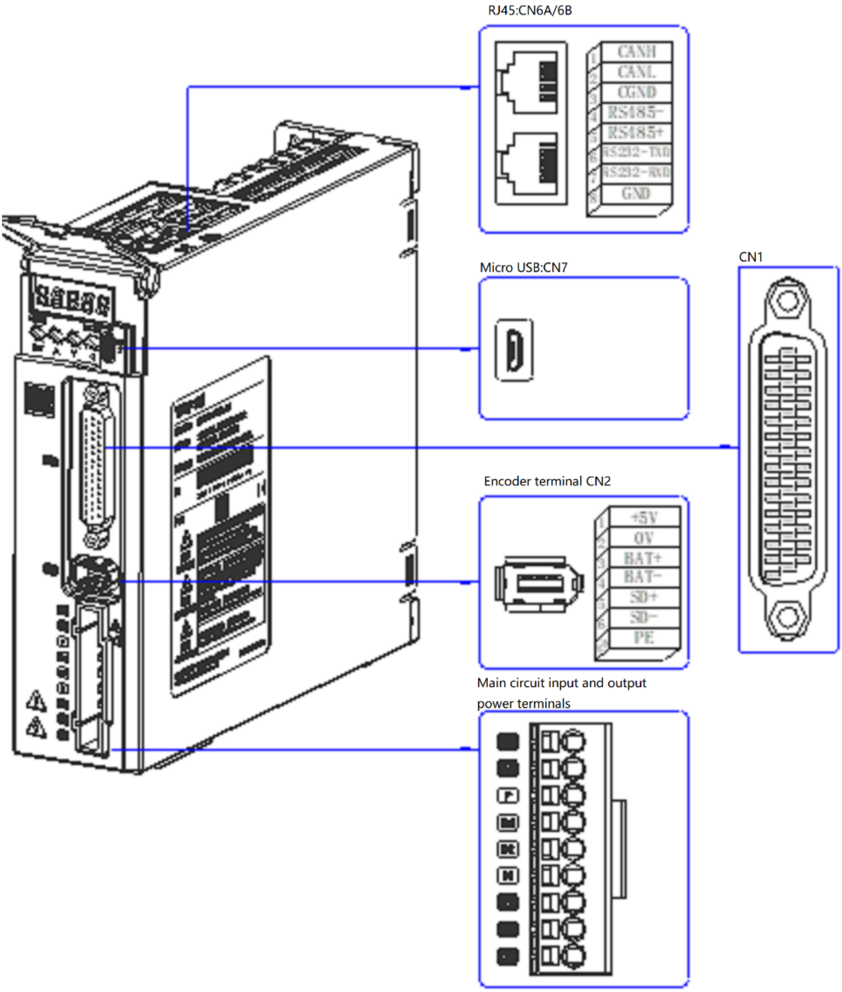


Figure 3.1 Driver terminal pinout diagram

3.1.1 Servo Driver Main Circuit Connection

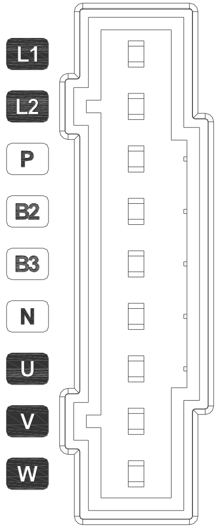


Figure 3.2 Servo driver main circuit terminal pins distribution diagram

Table 3-1 Servo driver main circuit terminal pin description

No.	Part Name	Description
1	L1, L2 (power input terminals)	Reference nameplate rated voltage level input control circuit power
2	P, N (servo busbar terminals)	DC bus terminal for multiple servo common DC bus
	P, B2 (external braking resistor connection terminal)	When an external braking resistor is required, connect it between P and B2
	B2, B3 (built-in braking resistor connection terminal)	When built-in braking resistor is needed, short B2 and B3
3	U, V, W (servo motor connection terminals)	Connect the U, V and W phases of the servo motor

3.1.2 Example of Braking Resistor Wiring

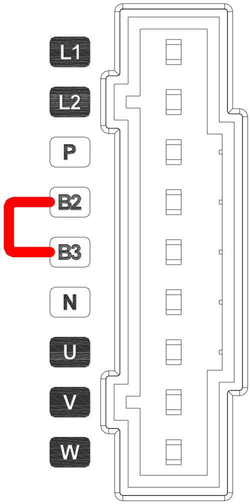


Figure 3.3 Schematic diagram of the connection of the built-in braking resistor

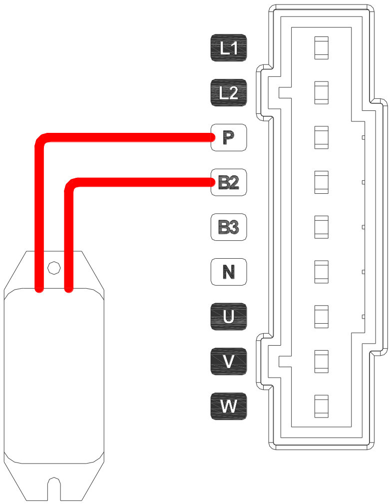


Figure 3.4 Connection diagram of external braking resistor

Table 3-2 Servo Drive Braking Resistor Related Specifications

Drive Model	Braking voltage (V)	Built-in resistors	External minimum resistance (Ω)	Maximum external resistance (Ω)
SD780-1R8A□A	380	No	40	200
SD780-3R3A□A	380	No	40	100
SD780-5R5A□A	380	50Ω 50W	25	70

3.1.3 Recommended type and specification of main circuit connection cable

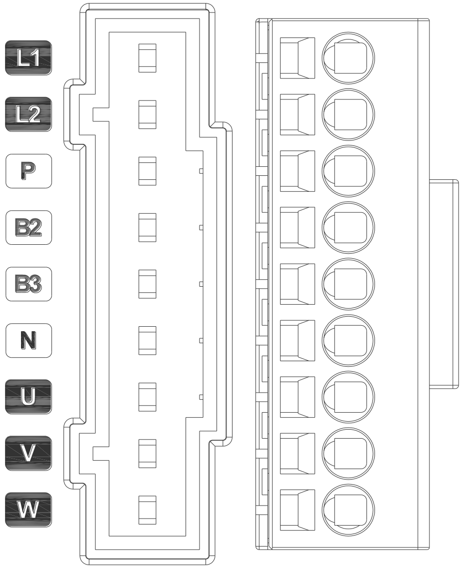


Figure 3.5 Schematic diagram of the main circuit terminal block of the drive

Table 3-3 Drive main circuit cable specifications

Input voltage	Drive model	Rated input current (A)	Recommended input power cable (L1, L2)		Rated output current (A)	Recommended output power cable (U, V, W)		Recommended grounding wire (PE)	
			mm^2	AWG	-	mm^2	AWG	mm^2	AWG
220V	SD780-1R8A□A	3	0.5	20	1.8	0.5	20	0.5	20
	SD780-3R3A□A	5.6	0.75	18	3.3	0.5	20	0.5	20
	SD780-5R5A□A	8.5	1.0	16	5.5	0.75	18	0.75	18

Note

- Single-phase inputs with only two wires, L1 and L2.
- The above cables are copper core cable, if the aluminum wire, the wire diameter to take the copper wire 1.5 times to 2 times.

3.1.4 Example of Power Wiring

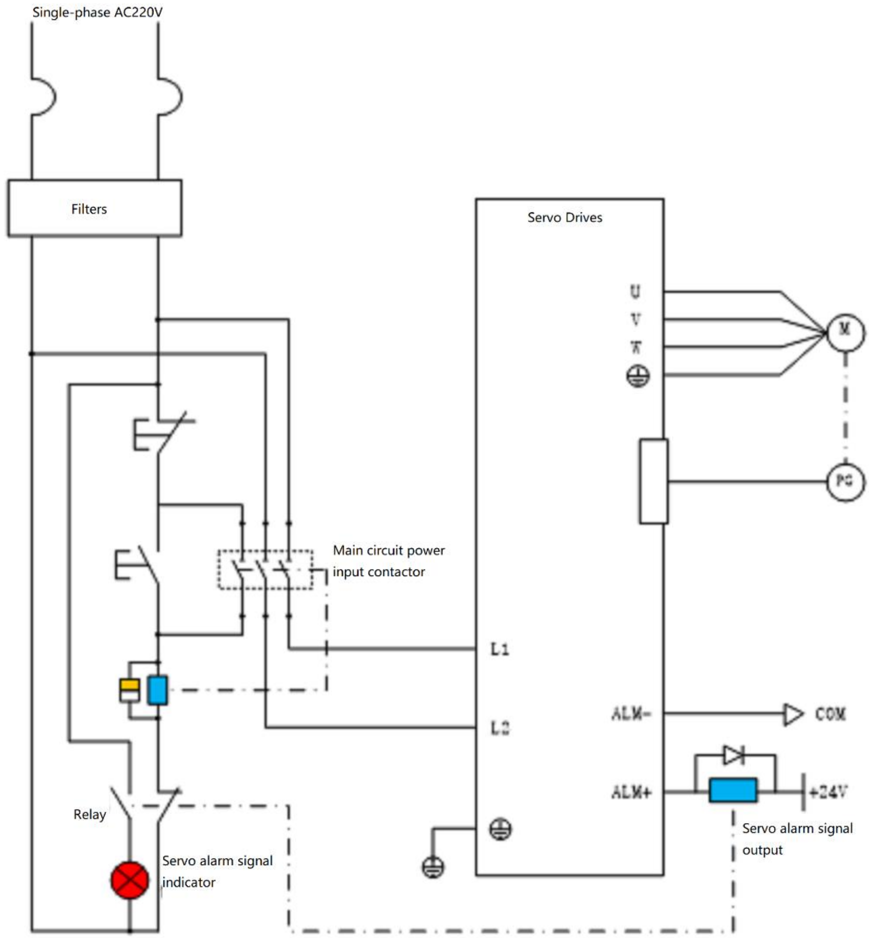


Figure 3.6 Single-phase 220V main circuit wiring

3.1.5 Main Circuit Wiring Considerations

● The input power line cannot be connected to the outputs U, V and W, otherwise it will cause damage to the servo driver.

● If the cable is bundled and used in a duct, etc., please consider the allowable current reduction rate as the heat dissipation conditions become worse.

● When the cabinet temperature is higher than the cable temperature limit value, please use the cable with larger temperature limit value, and cable wire is recommended to use Teflon wire; when in low temperature environment, please pay attention to the cable warming measures, general cable in the low temperature environment, the surface is easy to harden and break.

● Please ensure that the bending radius of the cable is more than 10 times the outer diameter of the cable itself, in order to prevent long-term bending from breaking the inner core of the cable.

● Please do not pass or bundle power and signal cables together from the same pipe, to avoid interference, the distance between them is more than 30cm.

● High voltage may remain inside the drive after the power is turned off. Please do not touch the power terminals within 5 minutes.

● Do not turn the power ON/OFF frequently. When repeated continuous ON/OFF power is required, keep it below 1 time/minute. The power supply part of the Servo Drive has capacitors, and a large charging current will flow when the power supply is ON. Frequent ON/OFF power supply will deteriorate the performance of the main circuit components inside the driver.

● Please use the ground wire with the same cross-sectional area as the main circuit cable. If the cross-sectional area of the main circuit wire is less than 1.6mm^2, please use 2.0mm^2 ground wire.

● Please connect the servo driver to the earth reliably.

● Do not power on with loose terminal block screws or loose cable wires, which may cause fire.

3.1.6 Main Circuit Peripheral Power Distribution Specifications

Table 3-4 Main circuit peripheral power distribution specification table

Main circuit power	Drive Model	Recommended Circuit Breakers	Recommended Contactors

		Current (A)	Schneider Models	Current (A)	Schneider Models
Single-phase 220V	SD780-1R8A□A	4	OSMC32N3C4	9	LC1 D09
	SD780-3R3A□A	6	OSMC32N3C6	9	LC1 D09
	SD780-5R5A□A	6	OSMC32N3C6	9	LC1 D09

3.1.7 Spring-type Connector Wiring Method

Spring-type connector type terminals are used for servo drives with 750W or lower power. The following is a detailed explanation of how to wire the spring-type terminals.

(1) Removing the Terminal Block from the Servo Drive

The terminal block must be removed from the Servo Drive before wiring. Direct wiring without removing the terminal block may cause damage to the Servo Drive.

(2) Wire Stripping

Peel off the outer skin of the wire used 8mm to 9mm.

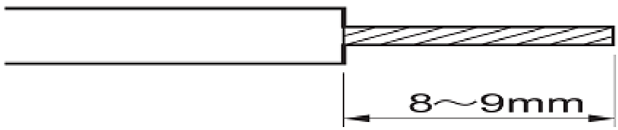
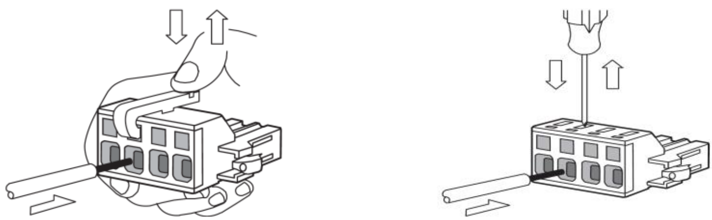


Figure 3.7 Cable stripping diagram

(3) Open the Wire Insertion Slot in the Terminal Block

There are two ways to open the wire insertion slot, as shown below.

- Pry open the slot with the control bar that comes with the servo driver (as shown in Figure 3.8, drawing a).
- Insert a "slotted" screwdriver into the terminal opening (end width 3.0mm to 3.5mm) and press firmly to open the slot (as shown in Figure b).



a. Pry open the slot with the matching control bar　　b. Use a screwdriver to open the slot by pressing

Figure 3.8 Pressed wire slot usage

(4) Insert the Wire into the Slot

Once the slot is open, the wire is inserted and then the slot is closed by releasing the pressure of the control bar or screwdriver.

(5) Reinstall the Terminal Block into the Servo Drive

After connecting all terminals, plug the terminals back into their original positions on the servo drive.

Cautions	
⚠	● Do not operate with electricity when wiring. ● Do not short-circuit adjacent cores when inserting cables. ● The stripped wire ends need to be twisted tightly to ensure that no core is exposed after inserting into the terminal.

3.2 Motor Power Cable

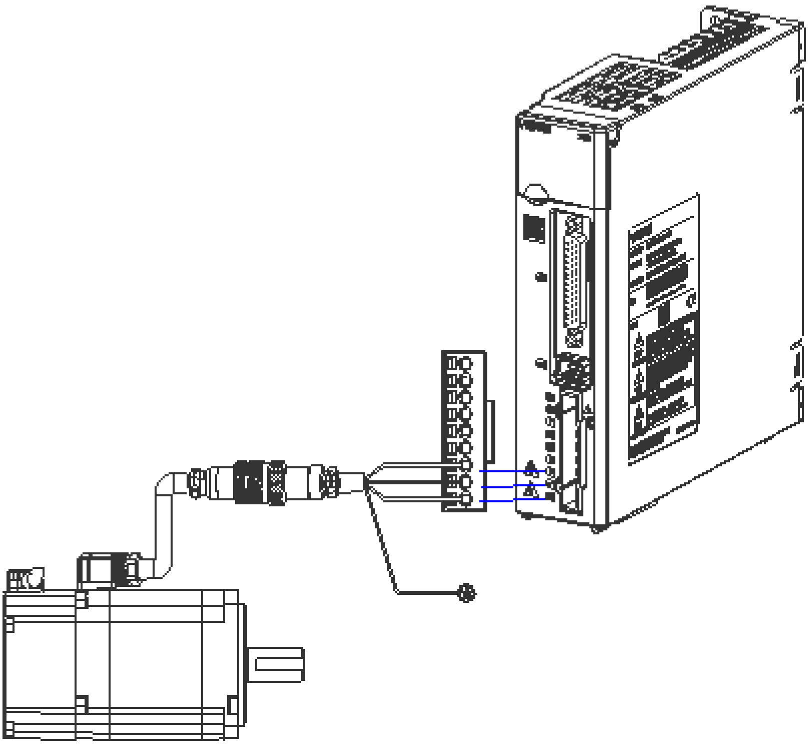
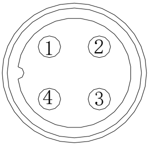


Figure 3.9 Servo driver output and motor connection

Table 3-5 Servo motor power cable definition

Terminal Distribution	Signal Definition	Terminal Pin Definition

	PE	1
	U	2
	V	3
	W	4

3.3 CN2 encoder connection cable

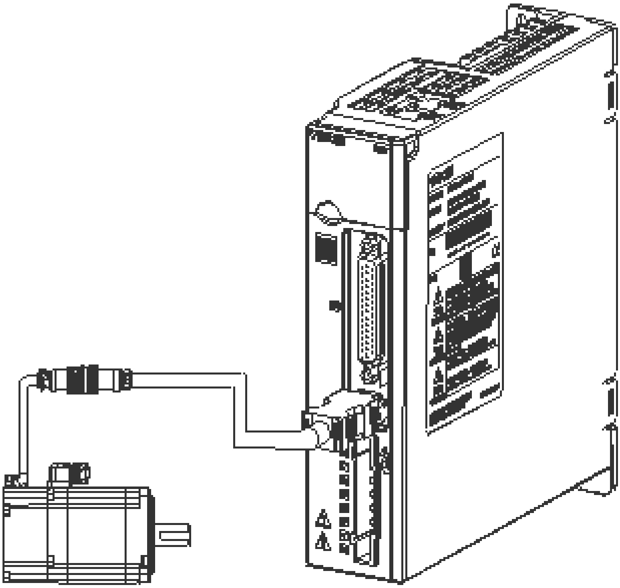
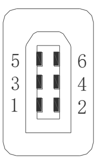
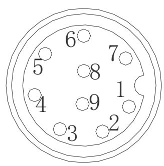
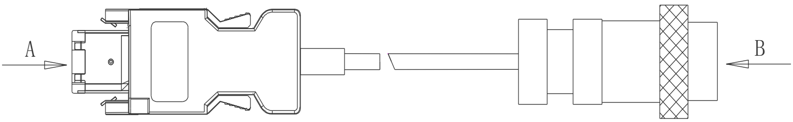


Figure 3.10 Schematic diagram of servo driver and encoder connection

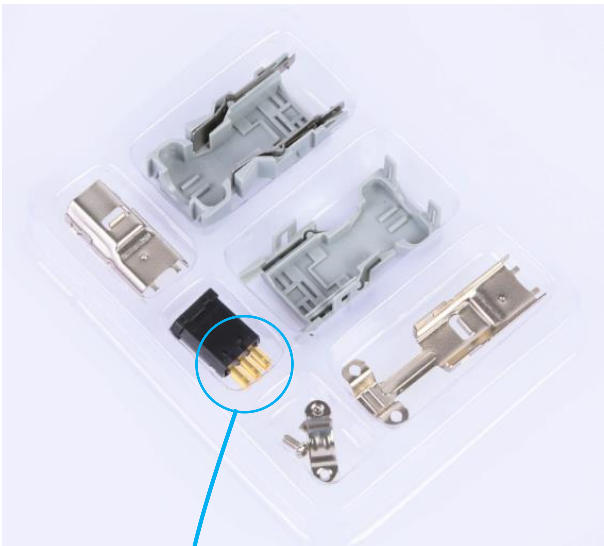
Table 3-6 CN2 encoder connection cable

Terminal distribution diagram	Signal definition	A-side pin number	B-side pin number	Terminal distribution diagram
	Encoder power supply +5V	1	1	
	Encoder power supply 0V	2	2	
	Absolute encoder battery BAT+	3	3	

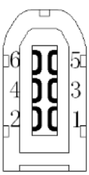
A-way view	Absolute encoder battery BAT-	4	4	B-way view
	Serial Data SD+	5	5	
	Serial Data SD-	6	6	
	PE (shielding layer)	Iron shell	7	



Accessory(optional)



1394 connector soldering pin definition



Attention	
	● When using multi-turn absolute encoders, please pay attention to the battery and serial data connection。 ● Please refer to the above diagram for pin definitions when soldering the encoder wiring by yourself.

3.4 CN6A and CN6B Communication Terminals

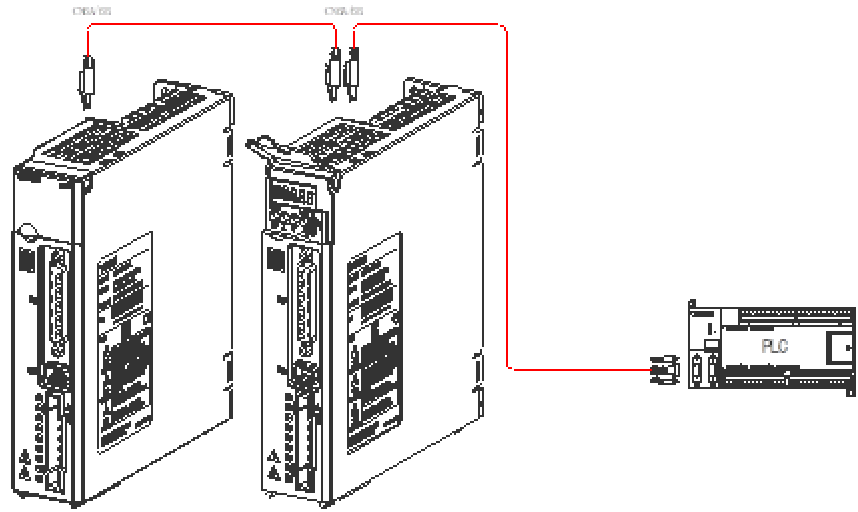


Figure 3.11 Communication wiring diagram

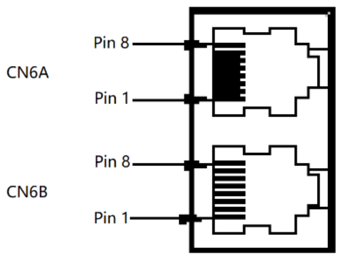


Figure 3.12 Communication port CN6 pin definition

Depending on the model, the definition of the port is different, so you need to confirm the model before using the definition of this interface.

For field identification bit S (standard type) or C (CANopen bus type), the pins of CN6 are defined as shown in Table 4-7

Table 3-7 CN6 interface definition

Pin number	Signal Name	Function	Pin number	Signal Name	Function
1	CANH	CAN data+	6	–	–
2	CANL	CAN data-	7	GND	–
3	CANG	CAN signal ground	8		–
4	485-(B-)	485 Data-	Housing	Shielding	Shielding
5	485+(A+)	485 Data-	–	–	–

Precautions for CAN communication

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

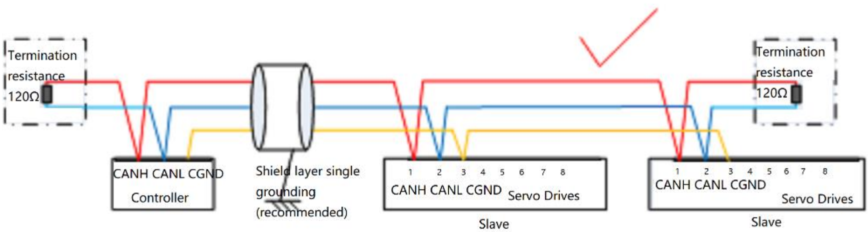


Figure 3.13 Correct CAN connection method

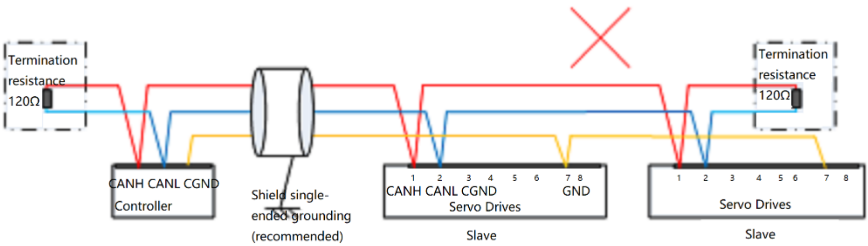


Figure 3.14 Wrong CAN connection method

Attention	
	● It is recommended that the shield is single-ended and grounded. ● 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 driver, otherwise the machine will be damaged!

Precautions for 485 communication

When using 485 communication, users should pay attention to the connection between the (GND) terminal of the upper unit and the GND terminal of the servo driver, as shown below:

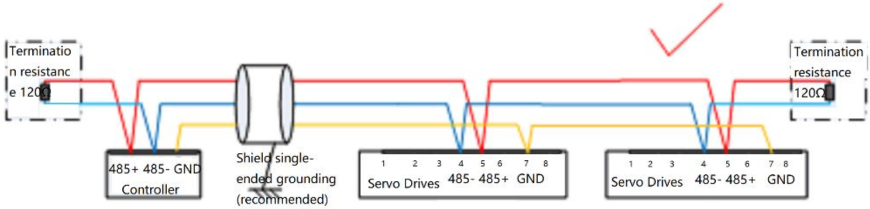


Figure 3.15 Correct 485 connection method

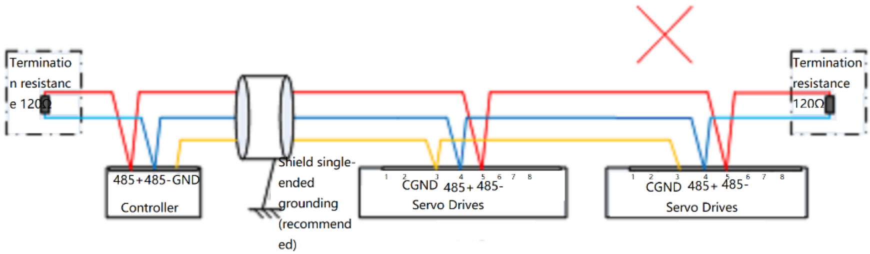


Figure 3.16 Wrong 485 connection method

Attention	
	● It is recommended that the shield is single-ended and grounded. ● 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 driver, otherwise the machine will be damaged!

3.5 Multifunctional CN1 terminal wiring

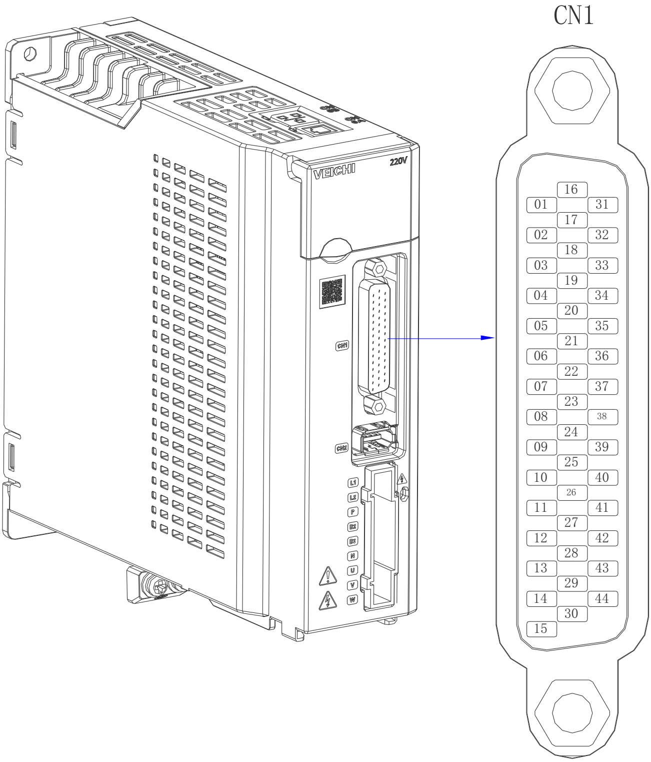


Figure 3.17 Pin 44 definition of multi-function CN1 terminal

Attention	
	● Recommend using 24AWG to 26AWG wire diameter cable

3.5.1 Position Command Input Signal

Table 3-8 Position command input signal description

Signal Name	Pin number	Function

Position command	PULSE+ PULSE- SIGN+ SING-	41 43 37 39	Low-speed pulse command input method. ①Differential drive input ②Open collector input	Input pulse pattern. ①Direction + pulse ②A and B phase quadrature ③CW/CCW pulse
	HPULSE+ HPULSE-	38 36	High-speed input pulse command	
	HSIG-+ HSIGN-	42 40	High-speed position command symbols	
	PULLHI	35	External power input interface for command pulses	
	GND	29	Signal Ground	

The upper unit measures the command pulse, i.e., the symbol output circuit, which can be selected from either the differential driver 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 pulse width

Pulse mode		Maximum frequency (PPS)	Minimum pulse width (μs)
Low speed	Differential	500k	1
	Collector open circuit	200k	2.5
High-speed differential		4M	0.125

Attention	
	● The upper unit output pulse width that is less than the minimum pulse width value will cause the driver to receive pulses incorrectly.

(1) Low-speed Pulse Input Command

① Differential Input Method

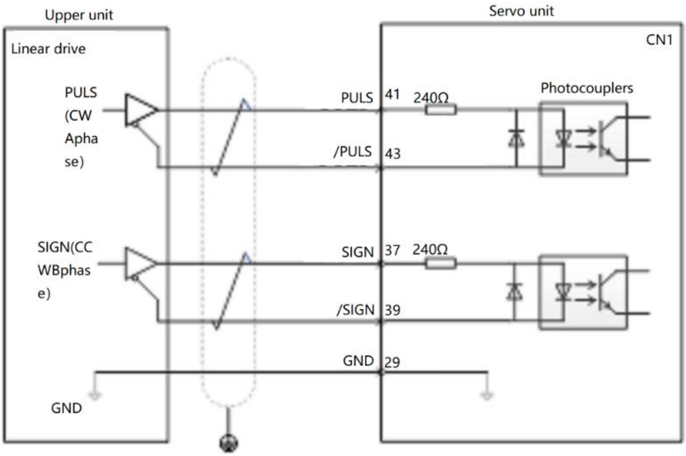
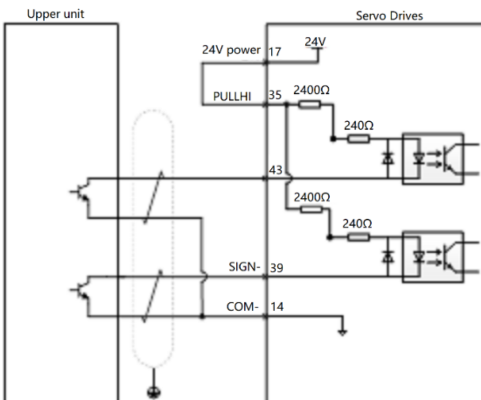


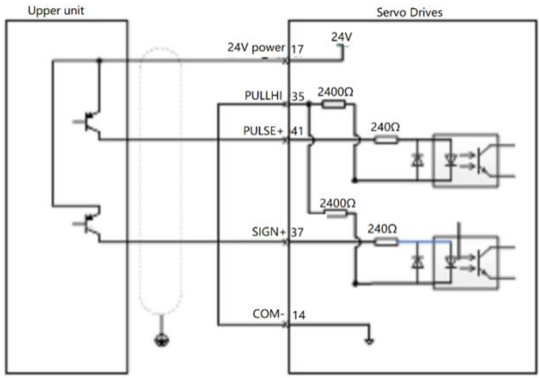
Figure 3.18 Example of connection of linear drive inputs

② Open collector input method

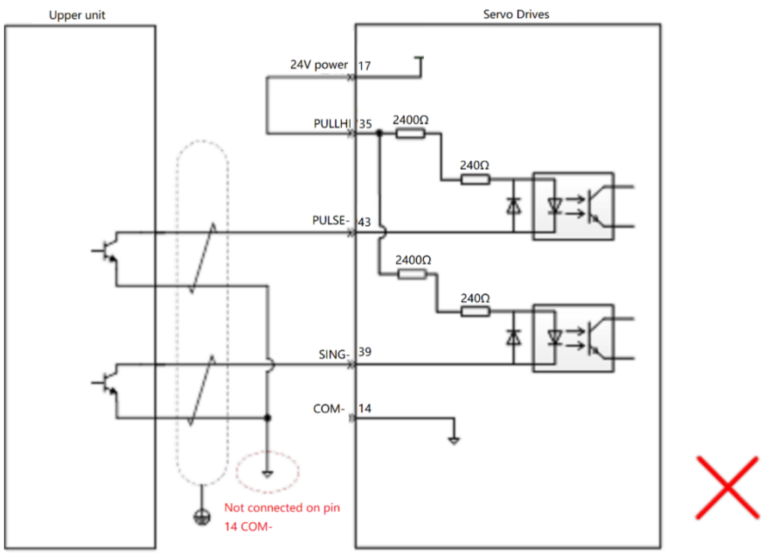
a. Use of Internal Power Supply

Table 3-10 Wiring method of open collector input for internal 24V supply

Drive Module Type	Wiring Diagram
NPN type (common cathode)	

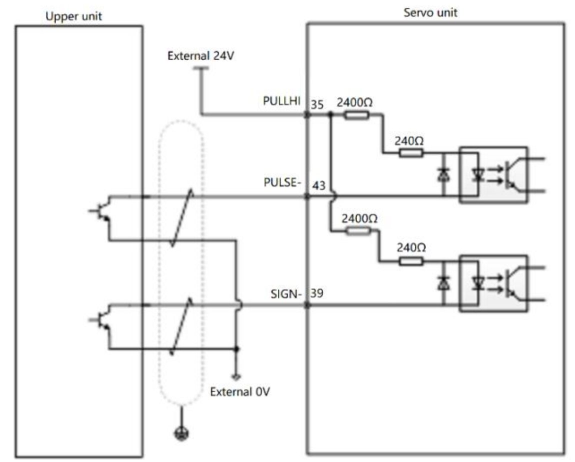
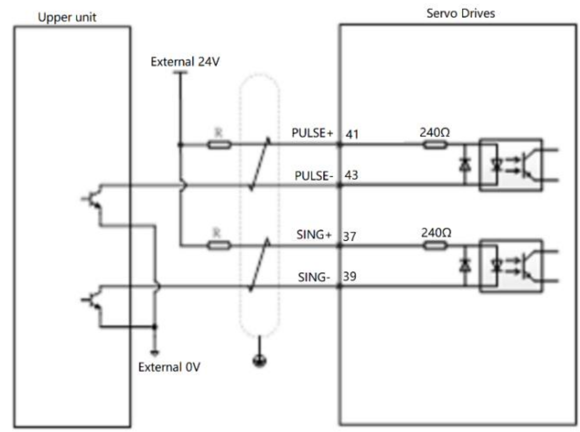
PNP type (common anode)	

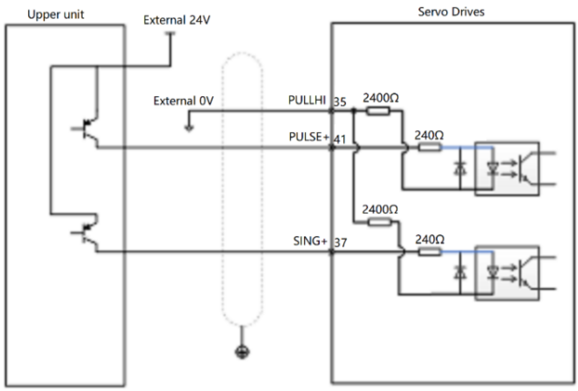
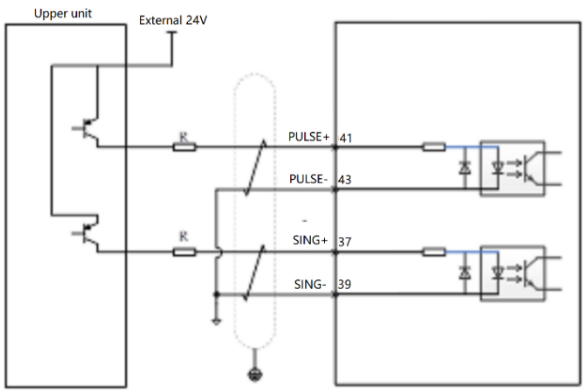
Wrong wiring example: not connected to pin 14 COM-, can not form a closed circuit!



b. Using External Voltage

Table 3-11 Open-collector input wiring method for external 24V supply

Drive Module Type	Current limiting resistor type	Wiring Diagram
NPN type (Common Cathode)	Internal resistance	
	External resistance	

<table>
<tr><td rowspan="2">PNP type (Common anode)</td><td>Internal resistance</td><td>
</td></tr>
<tr><td>External Resistors</td><td>
</td></tr>
</table>

The selection of resistance R should satisfy the formula:

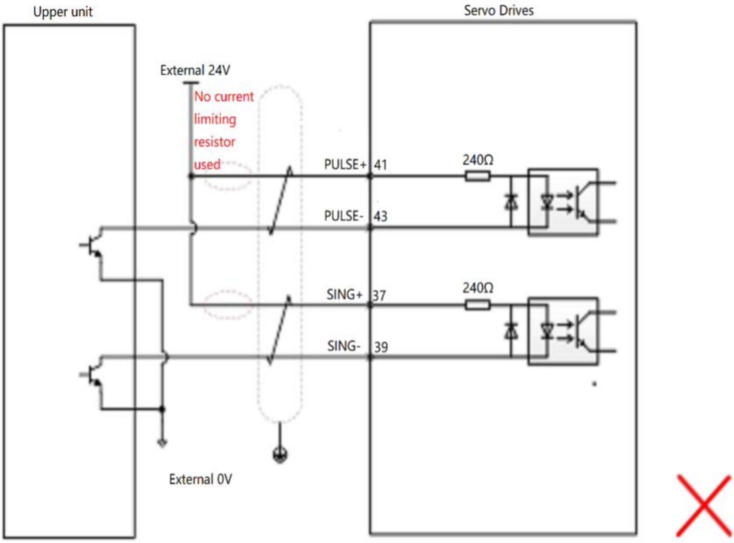
$$\frac{V_{cc}-1.5}{R+240}=10mA$$

Table 3-12 Recommended R1 resistance value

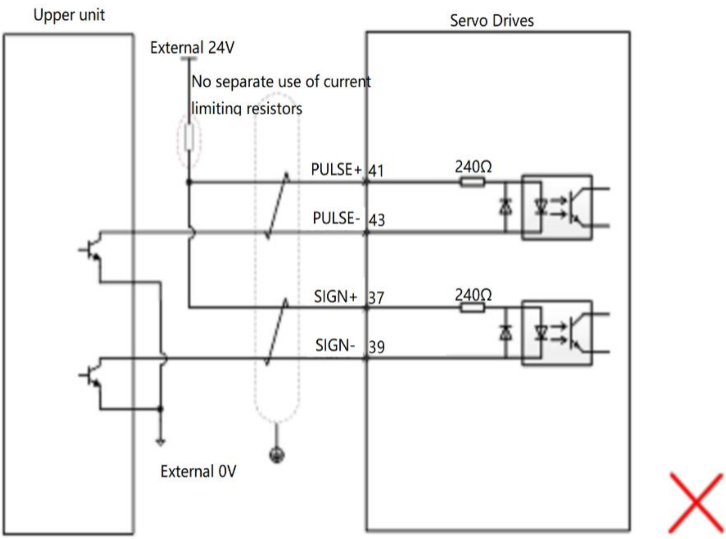
Vcc voltage	R resistance value	R Power
24V	2.4kΩ	0.5W
12V	1.5kΩ	0.5W

Example of Incorrect Wiring

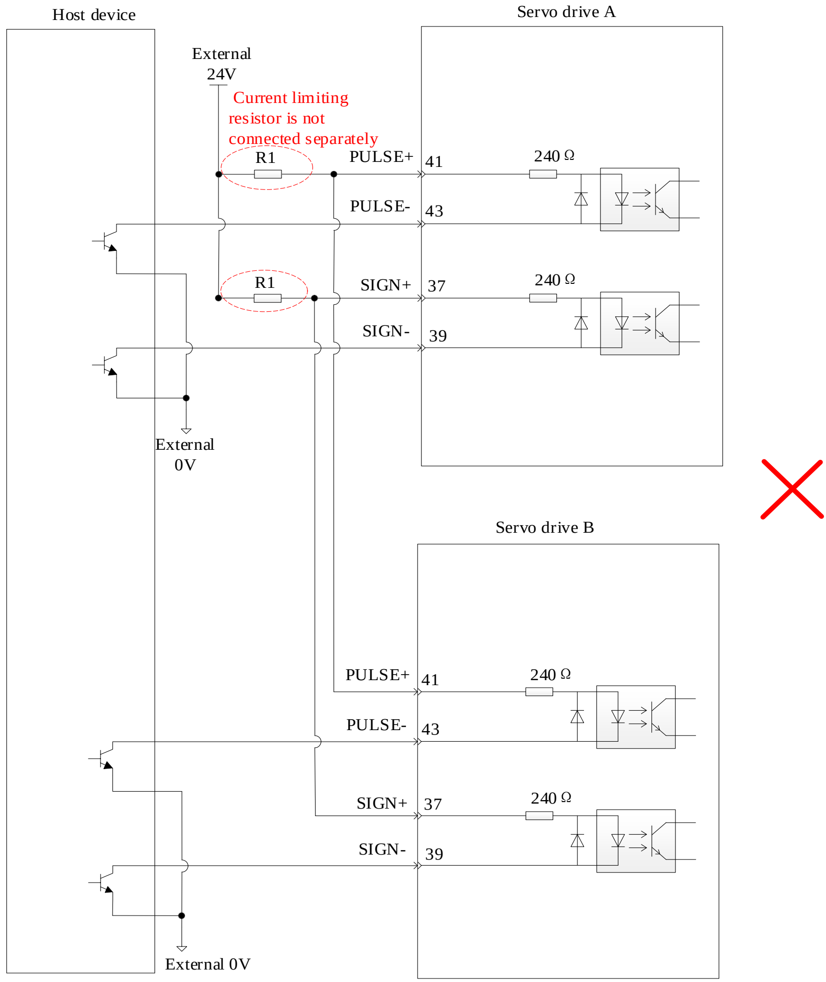
Error 1: Not connecting the current limiting resistor, resulting in port burnout

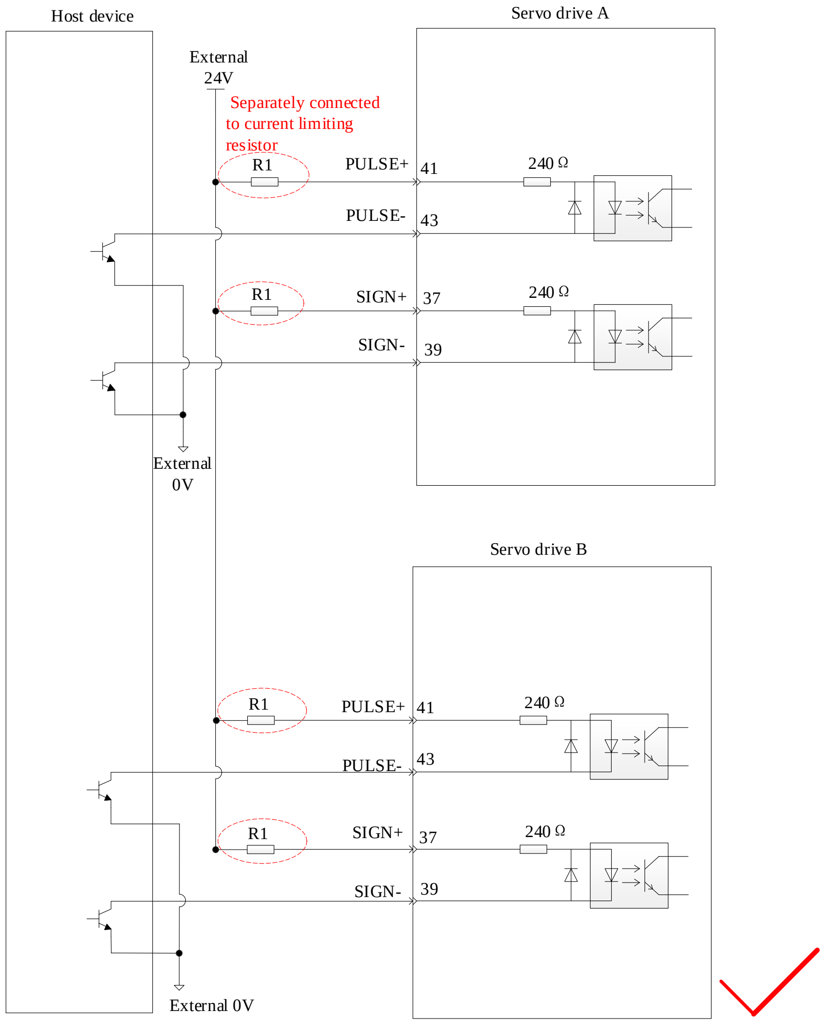


Error 2: Multiple ports share the same current-limiting resistor, resulting in incorrect pulse reception



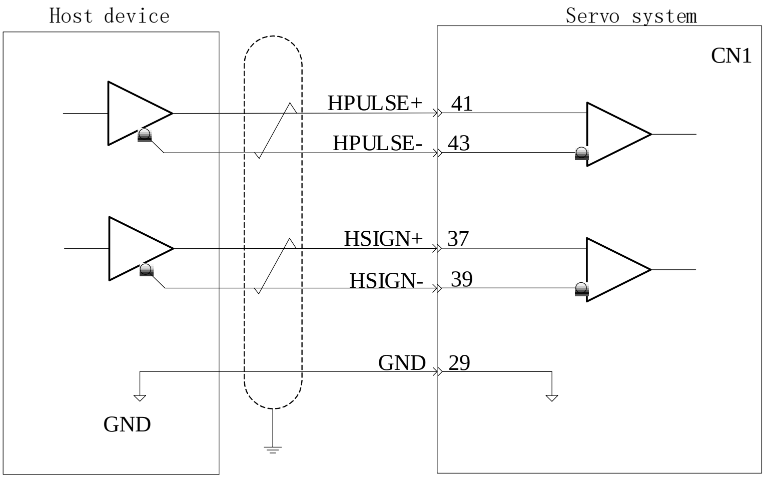
Error 5: Multiple ports share current-limiting resistors, resulting in incorrect pulse reception




Host device
Servo drive A
External
24V
Separately connected
to current limiting
resistor
R1
PULSE+
41
240 Ω
PULSE-
43
R1
SIGN+
37
240 Ω
SIGN-
39
External
0V
Servo drive B
R1
PULSE+
41
240 Ω
PULSE-
43
R1
SIGN+
37
240 Ω
SIGN-
39
External 0V

(2) High-speed Pulse Input Command

The output circuit for high-speed command pulses and +- symbols on the host computer side can only be output to the servo driver via the differential driver.



Note	
⚠	● Be sure that the differential input is a 5V system, otherwise the input pulse of the driver is unstable, which may result in the following situations: (i) pulse loss when inputting the command pulse; (ii) command reversal when inputting the command direction. ● Be sure to connect GND of the host computer to GND of the drive to reduce noise interference.

3.5.2 Digital Input and Output Signals

Table 3-13 X/Y Signal Description

Signal name		Default function symbol	Pin number	Default function description
Universal X terminal	X1	S-ON	9	Servo enable
	X2	P-OT	10	Positive overtravel switch
	X3	N-OT	34	Negative overtravel switch
	X4	INHIBIT	8	Pulse prohibition
	X5	ALM-RST	33	Fault reset
	X6	ORGS	32	Origin signal
	X7	TL-SEL	12	Torque limiting switching
	X8	-	30	Reserved

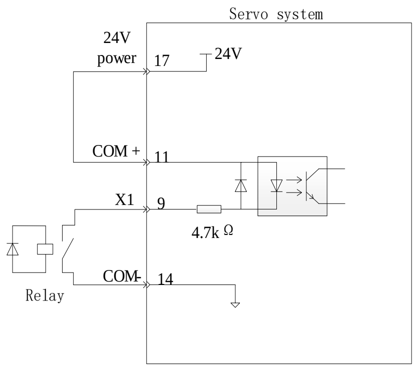
	COM+	Common end	11	X common terminal
Power supply	+24V		17	Internal 24V power supply, voltage range +20 V to +28V, maximum output current 200mA
	COM-		14	
Universal Y terminal	Y1+	RDY+	7	Servo ready
	Y1-	RDY-	6	
	Y2+	COIN+	5	Positioning complete
	Y2-	COIN-	4	
	Y3+	BK+	3	Holding brake output
	Y3-	BK-	2	
	Y4+	Alarm+	1	Fault output
	Y4-	Alarm-	26	
	Y5+	ORGC+	28	Home return completed
	Y5-	ORGC-	27	

3.5.2.1 Digital Input Circuit

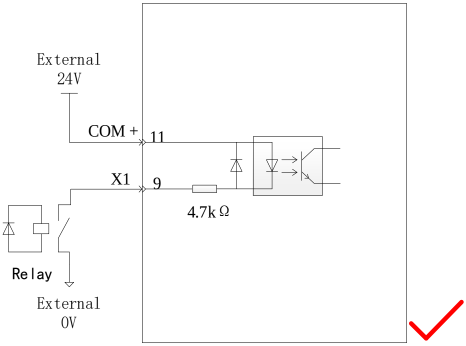
Using X1 as an example, the X1 to X8 interface circuits are identical.

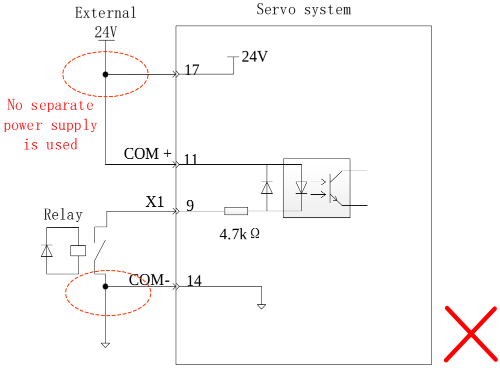
(1) Host Computer is Relay Output

① Use the servo driver internal 24V power supply wiring diagram as follows.



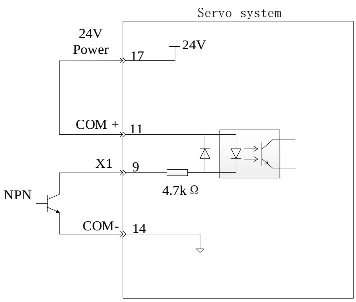
② The wiring diagram when using an external 24V power supply is as follows.

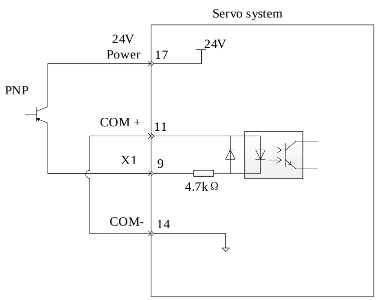




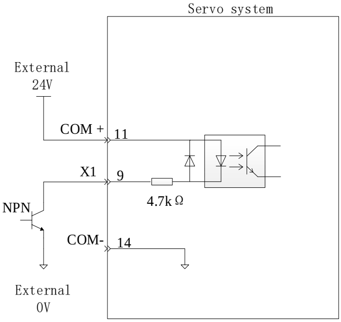
(2) Host computer is open collector output

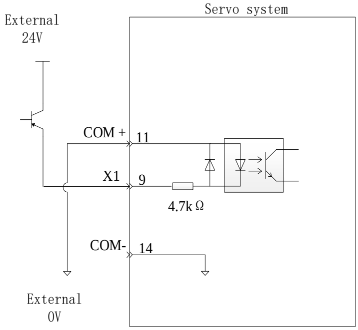
① Use the servo driver internal 24V power supply wiring diagram as follows.





② The wiring diagram when using an external 24V power supply is as follows.



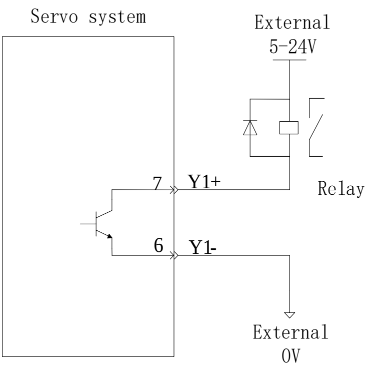


Note
● NPN and PNP input mixing is not supported

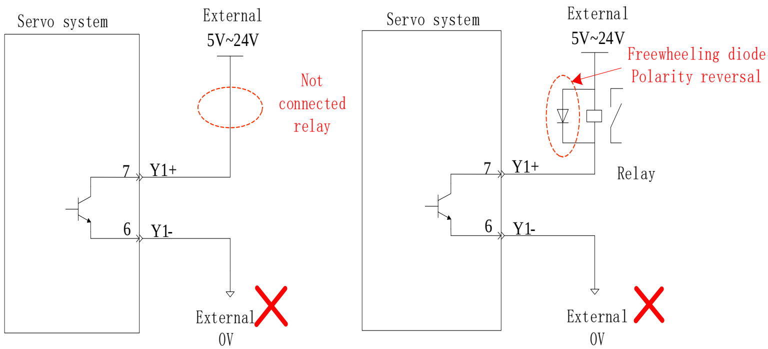
3.5.2.2 Digital Output Circuit

Take Y1 as an example to illustrate the circuit diagram for digital output, and the same circuit for Y1 to Y5 interface.

(1) Output Control Relay

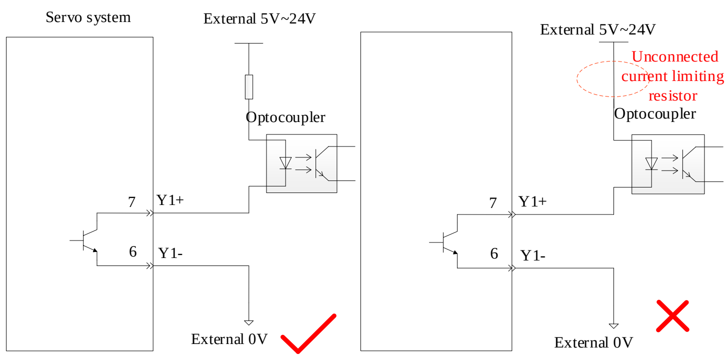


Example of Incorrect Wiring.



Note	
⚠	● When outputting a control relay, be sure to connect a current-continuing diode, otherwise the Y terminal connector may be damaged.

(2) Output Control Optocoupler Devices



The maximum allowable voltage and current capacity of the servo driver's internal optocoupler output circuit is as follows.

Voltage: DC30V (max.)

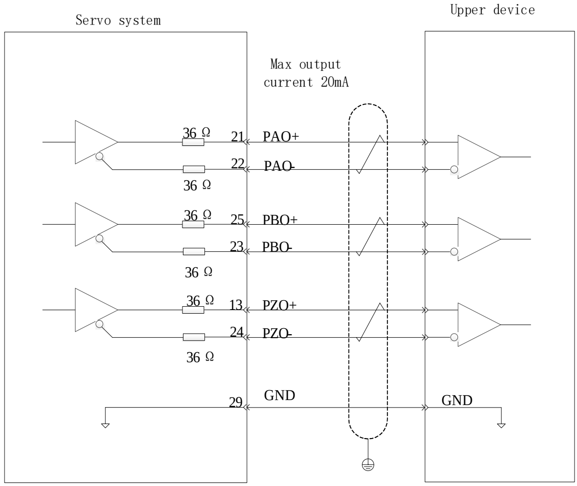
Current: DC50mA (max.)

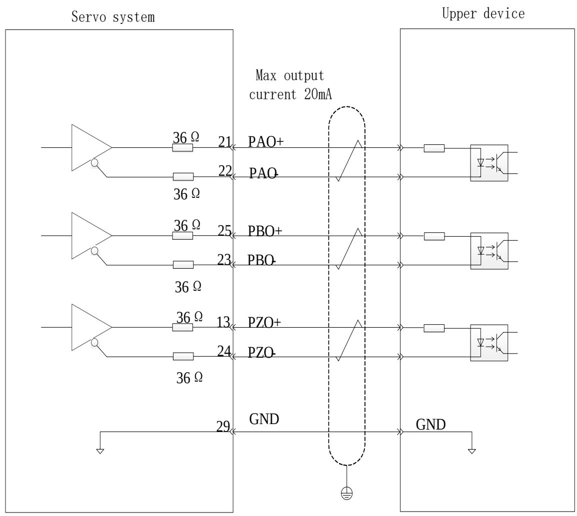
3.5. 3 Encoder Frequency Division Output Signal

Table 3-14 Encoder Frequency division Output Signal Specifications

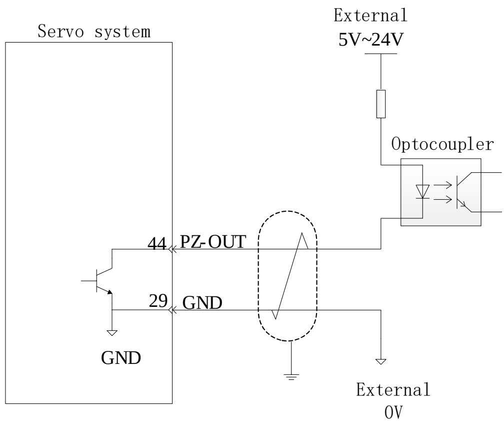
<table>
<tr><th>Signal name</th><th>Default function</th><th>Pin number</th><th colspan="2">Functionalities</th></tr>
<tr><td rowspan="8">Frequency division output universal signal</td><td>PAO+</td><td>21</td><td rowspan="2">A-phase frequency division output signal</td><td rowspan="4">The quadrature frequency division output signals of A and B</td></tr>
<tr><td>PAO-</td><td>22</td></tr>
<tr><td>PBO+</td><td>25</td><td rowspan="2">B-phase frequency division output signal</td></tr>
<tr><td>PBO-</td><td>23</td></tr>
<tr><td>PZO+</td><td>13</td><td rowspan="2">Z-phase frequency division output signal</td><td rowspan="2">Home pulse output signal</td></tr>
<tr><td>PZO-</td><td>24</td></tr>
<tr><td>PZ-OUT</td><td>44</td><td>Z-phase split output signal</td><td>Home pulse open collector output signal</td></tr>
<tr><td>GND</td><td>29</td><td colspan="2">Origin pulse open collector output signal ground</td></tr>
<tr><td rowspan="3">Power supply</td><td>+5V</td><td>15</td><td colspan="2" rowspan="2">Internal power supply 5V, maximum output current 200mA</td></tr>
<tr><td>GND</td><td>16</td></tr>
<tr><td>PE</td><td>casing</td><td colspan="2">-</td></tr>
</table>

The encoder divider output circuit outputs a differential signal through a differential driver. Normally, a feedback signal is provided when forming a position control system for the host computer. On the host computer side, use a differential or optocoupler receiving circuit with a maximum output circuit of 20mA.





The encoder Z-phase divider output circuit can be output by an open collector signal. Normally, the feedback signal is provided when forming a position control system for the host computer. On the host computer side, please use an optocoupler circuit, relay circuit to receive it.



Note	
	● Be sure to connect the GND of the 5V of the host computer to the GND of the drive and use a twisted shield to reduce noise interference.

The maximum allowable voltage and current capacity of the servo driver's internal optocoupler output circuit is as follows.

Voltage: DC30V (max.)

Current: DC50mA (max)

3.5.4 Braking Wiring

The wiring of the brake input signal has no polarity and requires the user to prepare 24 V voltage. An example of the standard connection between the brake signal BK and the brake power supply is shown below.

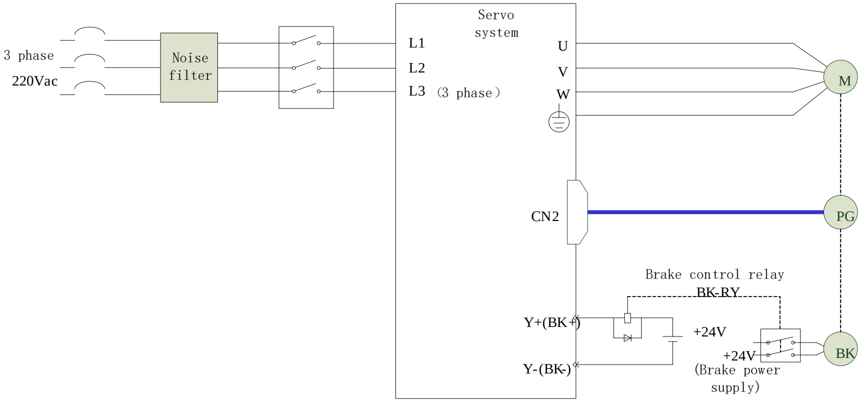


Figure 3.19 Wiring diagram for brake

Holding brake wiring considerations.

The length of the motor holding cable must take full account of the voltage drop caused by the cable resistance, and the braking operation must ensure that the input voltage is at least 21.6 V. The motor holding braking are shown in the table below.

Table 3-15 Table of parameters of brake

Motor model	Maintaining torque (N. m)	Supply voltage (V) ±10%	Release time (ms)	Attraction time (ms)	Rotary clearance (°)
VM7-L06A-R2030-□2	1.5	24	<20	<50	<0.5
VM7-L06A-R4030-□2					
VM7-L06A-R6030-□2					
VM7-L08A-R7530-□2L	4	24	<40	<60	<0.5
VM7-L08A-R7530-□2					
VM7-M08A-R7530-□2L					
VM7-M08A-R7530-□2					

Note

- The holding brake coil has no polarity
- Servo enable (S-ON) should be turned off after the servo motor is stopped.
- The brake may click when the motor with the built-in brake is running, but there is no functional effect.
- When the holding coil is energized (holding brake open state), flux leakage may occur at the shaft end, etc. Be careful when using instruments such as magnetic sensors near the motor.
- The brake mechanism is a non-energy-activated fixed special mechanism that cannot be used for dynamic braking purposes and is used only when the servo motor is held in a stopped state.

3.6 Anti-interference Countermeasures for Electrical Wiring

To suppress interference, take the following measures.

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

(2) Use thick wire ($2mm^2$ or more) for grounding wiring whenever possible.

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

② One point must be grounded. .

(3) Use a noise filter to prevent RF interference. When using in a residential environment or an environment with high 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 method can be used.

① Install the host computer as well as the noise filter as close to the servo drive as possible.

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

③ When wiring separate the strong current line from the weak current line and keep them more than 30cm apart. Do not put them into the same conduit or bundle them together.

④ Do not share the power supply with a welding machine, electrical discharge processing equipment, etc. When there is a high frequency generator nearby, install a noise filter on the input side of the power cord.

3.6.1 Example of Interference-Resistant Wiring and Grounding Treatment

The main circuit of the driver uses "high-speed switching elements", and depending on the peripheral wiring and grounding treatment of the servo driver, switching noise may affect the normal operation of the system. Therefore, proper grounding methods and wiring must be used, and noise filters must be added when necessary.

(1) Example of Interference-resistant Wiring

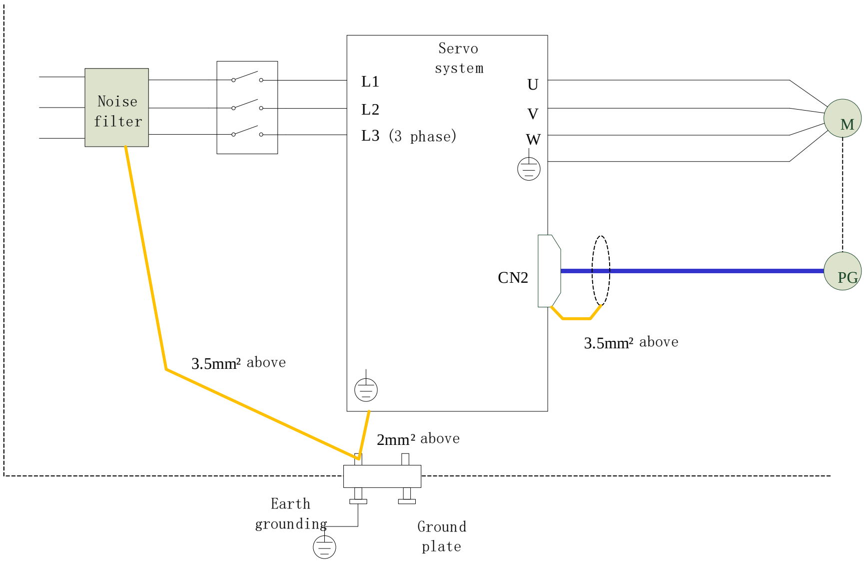


Figure 3.20 Example of interference-resistant wiring

Use thicker wire than 3.5 mm^2 (braided copper wire recommended) for the outer box connection for earthing, if possible.

When using the noise filter, observe the precautions described in "How to use the noise filter" below.

(2) Grounding Treatment

To avoid possible interference problems, ground as follows.

① Grounding of servo motor casing

Please connect the ground terminal of the servo motor to the ground terminal PE of the servo driver and ground the PE terminal reliably to reduce potential electromagnetic interference problems.

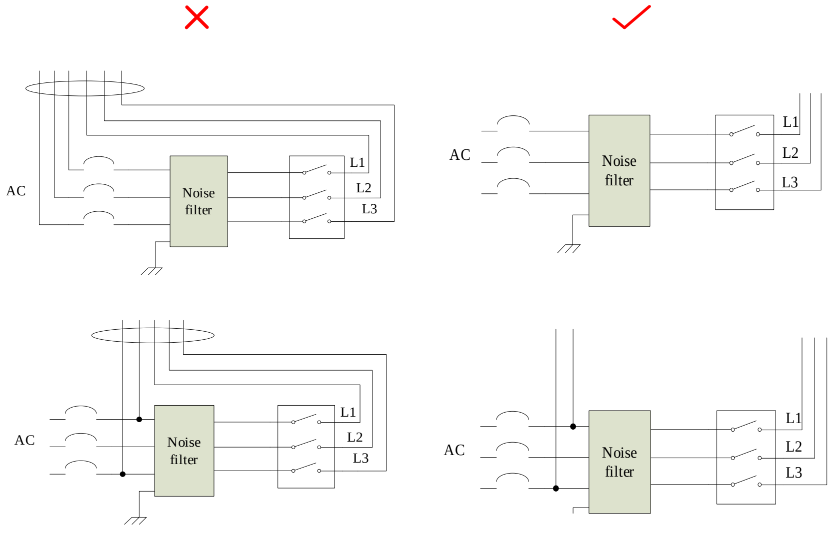
② Grounding of encoder cable shield

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

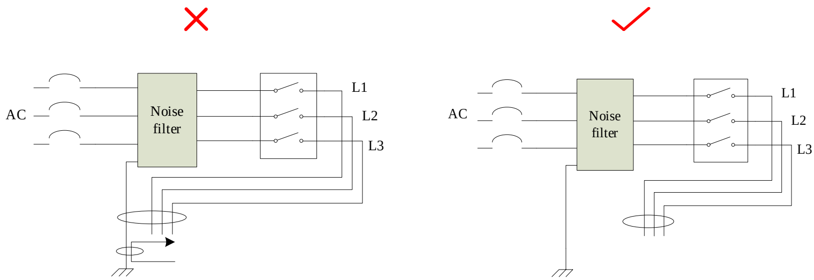
3.6.2 How to Use The Noise Filter

To prevent interference from the power supply line and weaken the influence of the Servo Drive on other sensitive equipment, select the appropriate noise filter at the power supply input according to the input current. Also, install noise filters at the power lines of peripheral devices as necessary. When installing and wiring the noise filter, observe the following precautions to avoid weakening the actual use of the filter.

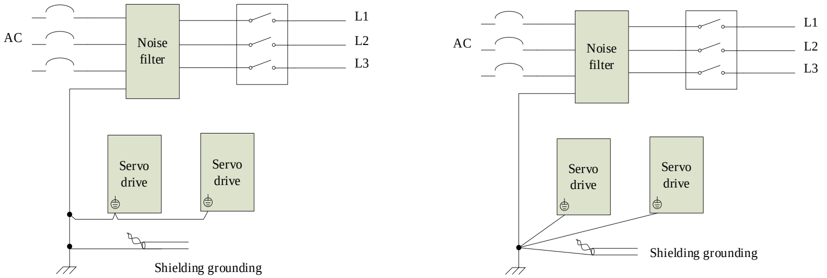
(1) Separate the noise filter input and output wiring, and do not group them in the same duct or bundle them together.



(2) Separate the noise filter ground wire from its output power line



(3) The noise filter should be grounded separately using a short thick wire as possible, do not share a ground wire with other grounded equipment.



(4) **Installation and control cabinet noise filter ground processing method:** When the noise filter and servo drive installed in the same control cabinet, it is recommended to fix the filter and servo drive on the same metal plate to ensure that the contact part is conductive and well lapped, and ground the metal plate.

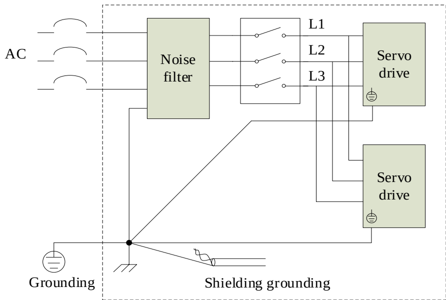


Figure 3.21 Schematic of noise filter ground handling

3.7 Precautions for the Use of the Cable.

(1) Do not bend the cable or put it under tension. The core diameter of the signal cable is only 0.2mm or 0.3mm, so it is easy to break.

(2) When the cable is to be moved, please use a flexible cable, as ordinary cable is easily damaged after a long period of bending. Small power motors with their own cables cannot be used for cable movement.

(3) When using cable protection chains, ensure that.

(i) The bending diameter of the cable is at least 10 times the outer diameter of the cable.

(ii)Do not secure or bundle wiring in the cable protection chain, but only at the two non-movable ends of the cable protection chain.

(iii) Do not tangle or twist the cable.

(iv) Ensuring that the duty cycle within the cable protection chain is below 60 per cent.

(vi) Do not mix cables with too different shapes to prevent thick wires from crushing thin wires; if you must mix cables, install a spacer in the middle of the cable.

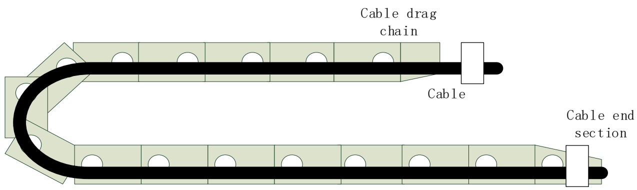


Figure 3.22 Schematic diagram of the cable protection chain

3.8 Typical Wiring

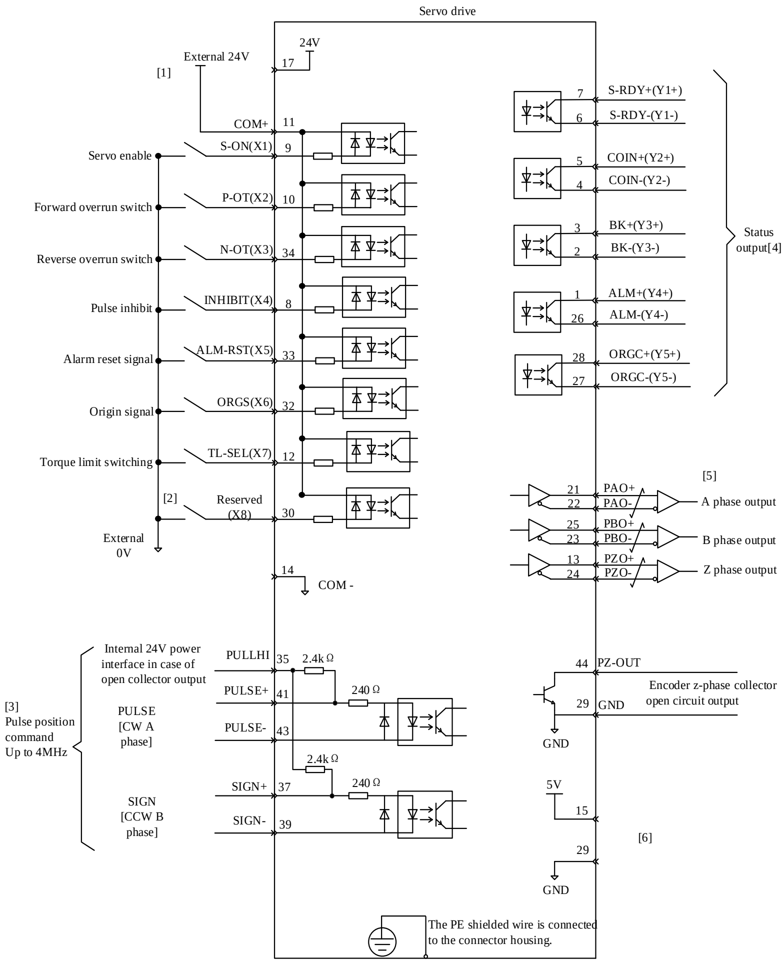


Figure 3.23 Typical wiring example for position control

[1] Example is external power supply wiring; if using internal 24V power supply, connect pin 17 (+24V) to pin 11, and the input terminal corresponding pin connect to pin 14 (COM-).
[2] X7 and X8 are high-speed input terminals, so select them according to the function.
[3] Please use twisted shielded wire for pulse port wiring, the shield must be connected to PE at both ends, and GND must be reliably connected to the signal ground of the host computer.
[4] Y output power supply is provided by user, power supply range 5V to 24V. maximum allowable voltage DC30V, maximum allowable current 50mA for Y port.
[5] Please use twisted shielded cable for the encoder frequency division output cable, the shield must be connected to PE at both ends, and GND must be reliably connected to the signal ground of the host computer.
[6] Internal +5V supply with 200mA maximum operating current

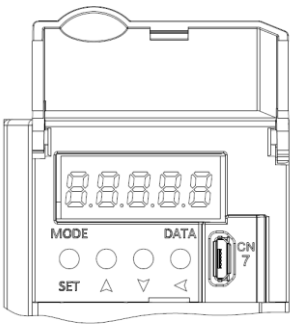
Chapter 4 Panel Operation

4.1 Name and Function of the Panel Operator Keys

The panel operator consists of a panel display section and panel operator keys.

The panel operator allows you to display the status, perform auxiliary functions, set parameters and monitor the action of the servo.

The names and functions of the panel operator keys are shown below.



Button number	Button name	Functionalities
①	MODE/SET button	Switching display Determining the seting
②	UP button	Increase the set value
③	DOWN button	Decrease the set value
④	DATA/SHIFT button	Display of set values Shift the digit one place to the left (digit blinking)

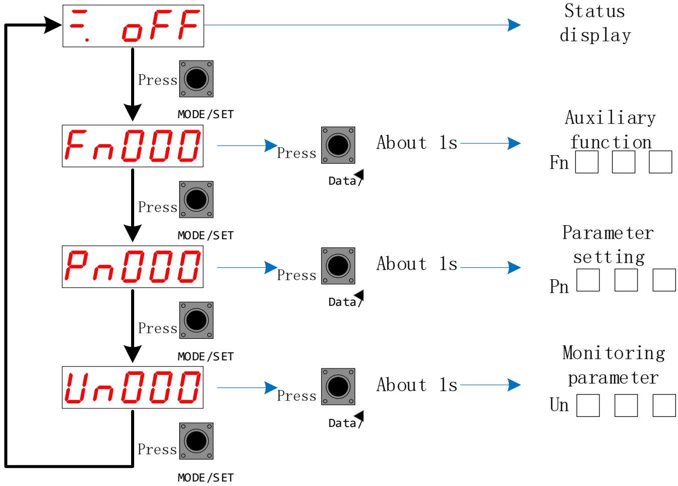
How do I get the servo alarm to reset?

The servo alarm is reset by pressing and holding the UP and DWON buttons simultaneously.

(Note) Before resetting the servo alarm, be sure to eliminate the cause of the alarm.

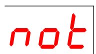
4.2 Function Switching

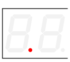
Press the MODE/SET button and the functions will be switched as follows. For how to operate each function, refer to the reference item.

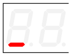
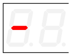
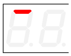
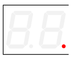
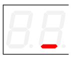
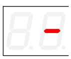
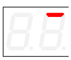
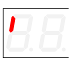
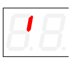
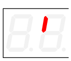


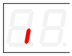
4.3 Status display

The status display is discriminated as shown below.

Abbreviated symbol	Meaning	Abbreviated symbol	Meaning
	**Servo ready.** Display servo ready		**Prohibit reversing drive state** Indicates that the input signal (N-OT) is open-circuit
	**Runtime** Display servo enable status		**Servo not ready** Servo is currently faulty or bus voltage is not established
	**Prohibit forward drive state** Indicates that the input signal (P-OT) is open-circuit		**Alarm Status** Flashing alarm number

Number	Showing	Meaning
1		**Control power ON display** Light on when the control power of the servo unit is ON. Light off when the control power of the servo unit is OFF.

2		**Servo ready display** The servo unit main circuit, encoder, etc. are normal, and the servo ON signal can be received.
3		**Servo enable flag** Light off when the servo is not enabled. Light on when the servo is enabled.
4		**Speed consistency (/V-CMP) display (when in speed control mode)** The light comes on when the difference between the servo motor speed and the commanded speed is within the specified value, and goes off when it exceeds the specified value. **Positioning completion (/COIN) display (at position control)** The light comes on when the deviation between the position command and the actual motor position is within the specified value, and light off when it exceeds the specified value.
5		**Power ready Display** Lights on when the main circuit power is ON and off when the main circuit power is OFF.
6		**Display in torque command input (at torque control)** The torque command in the input lights up when it is greater than the specified value and light off when it is less than the specified value. **Display in clear signal input (in case of position control)** light on when there is a clear signal input and light off when there is no input.
7		**Display in speed command input (at speed control)** The speed command in the input lights up when it is greater than the specified value and light off when it is less than the specified value. **Display in command pulse input (in position control mode)** Light on when there is a pulse command input and light off when there is no input.
8		**Rotation detection (/TGON) display** Light on when the rotation speed of the servo motor is higher than the specified value and light off when it is lower than the specified value.
9		**Location mode Display** The servo drive is currently running in position mode.
10		**Speed mode Display** The servo drive is currently running in speed mode.
11		**Torque mode display** The servo drive is currently running in torque mode.
12		**JOG or PJOG display** The servo drive runs in either JOG mode or PJOG mode.

13		Fully closed-loop operating status display Light of when the servo drive is operating in semi-closed loop mode. Light on when the servo drive is running in full closed-loop mode.
14		CN5 port 5V power supply Light off when the servo driver does not output 5V power. Light on when the servo driver outputs 5V power.

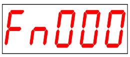
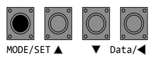
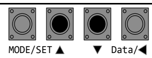
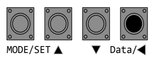
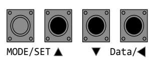
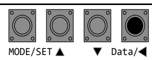
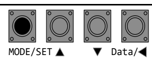
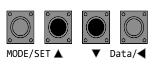
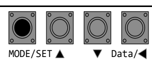
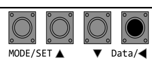
4.4 Operation of the Auxiliary Function (Fn□□□□)

The auxiliary function is used to perform functions related to the setting and adjustment of the servo unit.

Displayed on the panel operator as a number beginning with Fn.

For example, the display example is JOG operation

The following is an explanation of how to operate the auxiliary functions with point-and-click operation.

Steps	panel display	Buttons used	Operations
1			Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2			Adjust by pressing UP or DOWN until Fn005 is displayed.
3			Press the DATA/SHIFT key for about 1 second, then the display will be as shown on the left. Note: The Pn500 setting is used as the reference point for initial entry.
4			Adjust the desired tap speed by pressing UP, DOWN and DATA/SHIFT. Note: The maximum jog speed is 1200 rpm.
5			Press the MODE/SET key, then the display will be as shown on the left.
6			Press MODE/SET to enter the servo ON state
7			Press the UP key (forward rotation) or DOWN key (reverse rotation) and the servo motor rotates at the speed set in step 4 while the key is pressed.
8			Press MODE/SET to enter the servo OFF state
9			Press the DATA/SHIFT key for about 1 second to return to the Fn005 display

4.5 How to Write the Parameter (Pn□□□□□)

4.5.1 Method of Writing Parameters of the "Value Setting Type"

Parameter number
※ Indicates user privilege 2
☆ Indicates manufacturer's parameters

Function code effective time
○ Indicates immediate effect
■ Indicates re-powering is effective

Address for communication
★ Indicates 32-bit data
The address is expressed in hexadecimal

Pn204	Electronic Gear Numerator	■	Correspondence address: 0x0204 ★
Factory value: 4	Setting range: 1 to 1073741824	Unit: instruction unit	Control mode. P

Control mode using this parameter
P: Position control
S: Speed control
T: Torque control

4.5.2 Method of Writing Parameters for "Functionally Selective"

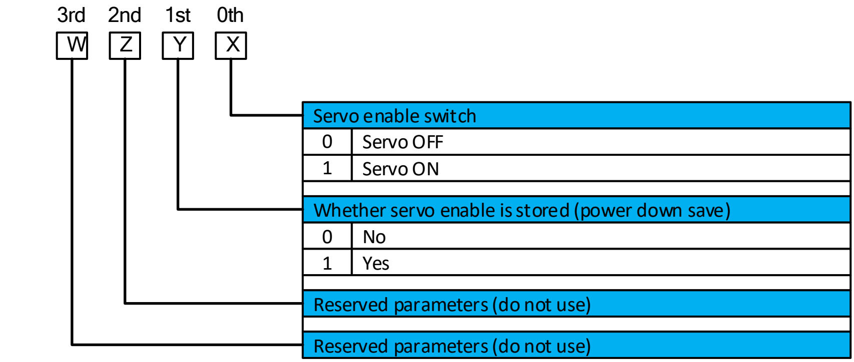
Parameter number
※ Indicates user privilege 2
☆ Indicates manufacturer's parameters

Function code effective time
○ Indicates immediate effect
■ Indicates re-powering is effective

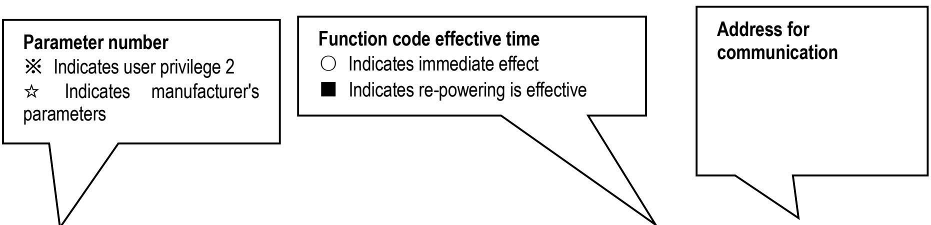
Address for communication
★ Indicates 32-bit data
The address is expressed in hexadecimal

Pn001	Function selection basic switch 1	○	Correspondence address: 0x0001
Factory value: 0x0000	Setting range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

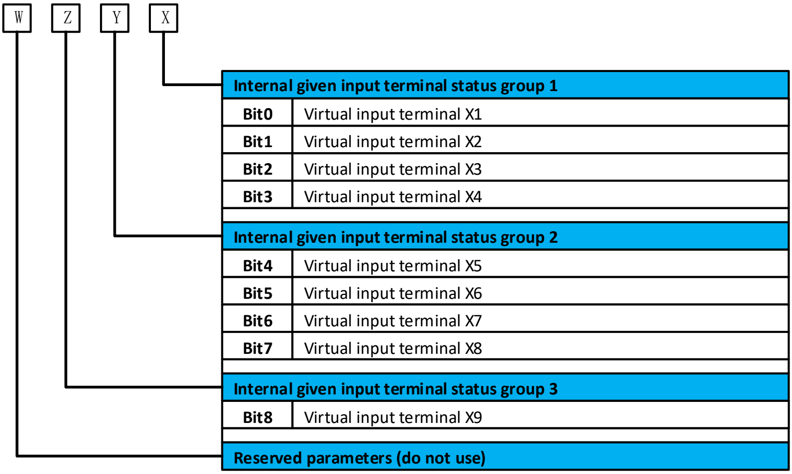
W/Z/Y/X indicates the setting value for each.
Pn001.X indicates the setting value of bits 0 - 3
Pn001.Y indicates the setting value of bits 4 - 7
Pn001.Z indicates the setting value of bits 7 - 11
Pn001.W indicates the setting value of



4.5.3 How to Write the Switching Parameters



Pn630	State of internal software given input terminal (X)	○	Correspondence address : 0x0630
Factory value: 0000	Setting range: 0000 to 03FF	Unit: N/A	Control mode. P S T



4.6 Method of Setting Parameter (Pn□□□□□)

4.6.1 Settings Below 5-digit

(1) Positive Number Setting with a Setting Range of Less than 5 Digits

The following describes the setting method when changing the setting value of the speed loop integral (Pn102) from 40.0 to 120.0.

Steps	Panel display	Buttons used	Operations
1	Pn 102	MODE/SET ▲ ▼ Data/◀	Press the MODE/SET key to enter the parameter setting status. If the function code parameter number is not displayed as "Pn102", adjust it by pressing UP or DOWN until "Pn102" is displayed.
2	0040.0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to display the current setting value of "Pn100".
3	0040.0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key to move the blinking digit to make the number "4" blink. (The number of blinking digits can be changed)
4	0 120.0	MODE/SET ▲ ▼ Data/◀	Press the UP key 8 times to adjust the setting to 120.0
5	donE (blinking)	MODE/SET ▲ ▼ Data/◀	When the MODE/SET button is pressed, "donE" will flash and the set value will change from 40.0 to 120.0.

6	0120.0	–	When the set value is valid, the screen as shown on the left is displayed.
7	Pn102	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to return to the "Pn102" display.

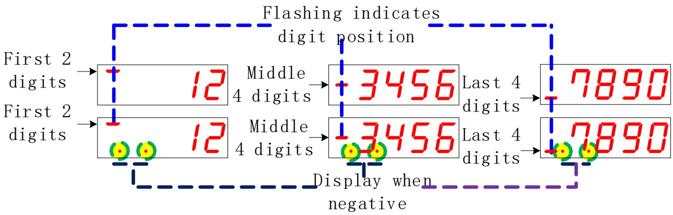
(2) Negative Number Setting with a Setting Range of Less than 5 Digits

The following describes how to set the internal speed command 0 (Pn304) when the setting value is changed from 100 to -800.

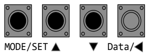
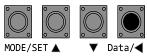
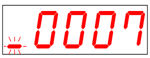
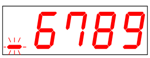
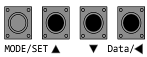
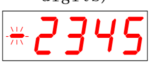
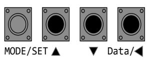
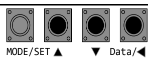
Steps	Panel display	Buttons used	Operations
1	Pn304	MODE/SET ▲ ▼ Data/◀	Press the MODE/SET key to enter the parameter setting status. If the function code parameter number is not displayed as "Pn304", adjust it by pressing UP or DOWN until "Pn304" is displayed.
2	00100	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to display the current setting value of "Pn304".
3	00100	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key to move the blinking digit to make the number "1" blink. (The number of blinking digits can be changed)
4	-0800	MODE/SET ▲ ▼ Data/◀	Press the DOWN key 9 times to adjust the setting to -800.
5	donE (blinking)	MODE/SET ▲ ▼ Data/◀	When the MODE/SET button is pressed, "donE" will flash and the setting value will change from 100 to -800.
6	-0800	–	When the set value is valid, the screen as shown on the left is displayed.
7	Pn304	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to return to the "Pn304" display.

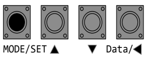
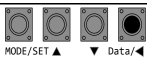
4.6.2 Settings Above 5 Digits

Since the panel operator can only display 5 digits, set values above 5 digits are displayed as follows.



Example: When the positioning completion signal (COIN) threshold (Pn262) is set to "0123456789", set it as follows.

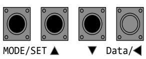
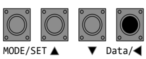
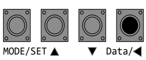
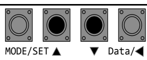
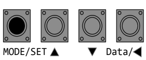
Steps	Panel display	Buttons used	Operations
1	 	 	Press the MODE/SET key to enter the parameter setting status. If the function code parameter number is not displayed as "Pn262", adjust it by pressing UP or DOWN until "Pn262" is displayed.
2	 	 	Press the DATA/SHIFT key for about 1 second to display the last 4 digits of the current setting value of "Pn262".
3	(before change of last 4 digits)  ↓ (after change of last 4 digits)  	 	Press the DATA/SHIFT key to move the blinking display digit (you can change the blinking display digit) and set the value of each digit.
4	(before the change of the middle 4 digits)  ↓ (after change of middle 4 digits)  	 	Continue to press DATA/SHIFT to display the middle 4 digits. Press the DATA/SHIFT key to move the blinking display digit (you can change the blinking display digit) and set the value of each digit.
5	(before the first 2	 	Continue to press DATA/SHIFT to display the middle 4 digits.

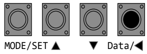
	positions were changed) 00 ↓ (after change of first 2 digits) 01		Press the DATA/SHIFT key to move the blinking display digit (you can change the blinking display digit) and set the value of each digit.
6	donE (blinking)		When the MODE/SET key is pressed, the value set by this operation is written to the servo unit, and "donE" will flash when the writing is successful, so that the set value changes from 7 to 123456789.
7	01		When the set value is successful, the screen shown on the left is displayed.
8	Pn262		Press the DATA/SHIFT key for about 1 second to return to the "Pn262" display.

4.6.3 Function Code Setting for Function Selection Type

The function selection type sets various functions by selecting from the functions assigned to each digit of the panel operator display number.

Example: Setting method when changing the control mode (Pn000.X) of function selection basic switch 0 (Pn000) from position mode to speed mode.

Steps	Panel display	Keys used	Operations
1	Pn000		Press the MODE/SET key to enter the parameter setting status. If the function code parameter number is not displayed as "Pn000", adjust it by pressing UP or DOWN until "Pn000" is displayed.
2	n.0001		Press the DATA/SHIFT key for about 1 second to display the current setting value of "Pn300".
3	n.0001		Press the DATA/SHIFT key to move the blinking display digit so that the number "1" is blinking. (The number of blinking digits can be changed)
4	n.0000		Press the DOWN key once to adjust the setting value to "n.0000".
5	donE (blinking)		When the MODE/SET button is pressed, "donE" will flash, and the set value will change from "n.0001" to "n.0000". (Change position control mode to speed

			control mode)
6		-	When the set value is valid, the screen as shown on the left is displayed.
7			Press the DATA/SHIFT key for about 1 second to return to the "Pn000" display.

Chapter 5 Commissioning and commissioning

5.1 Basic Settings

5.1.1 Pre-operation Checks

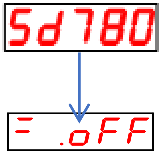
To ensure that the motor will operate safely and properly, check and confirm the following items beforehand. If you find any problems, please deal with them properly before operation.

Table 5-1 Checklist before power-up operation

No.	Elements
1	The power input terminals (L1 and L2) of the servo driver must be properly connected
2	The servo driver output terminals (U, V, W) and the servo motor power cable (U, V, W) must be in phase and correct.
3	The power input terminals (L1, L2) and output terminals (U, V, W) of the Servo Drive must not be connected incorrectly.
4	When using the drive's built-in regenerative resistor, the built-in regenerative resistor port (B2/B3) must be wired correctly. When using an external regenerative resistor, the external resistor connection port (P+/B2) must be wired correctly.
5	The DC bus terminals (P+/N) must not be connected backwards.
6	The control signal cable of the servo drive is wired correctly; external signal cables such as the holding brake and overtravel protection are reliably connected. The power supply to the brake is correct.
7	The servo driver and servo motor must be reliably grounded.
8	The cable is within the specified limits for wire diameter, force, etc.
9	There are no metal chips, wire heads and other foreign matters inside and outside the servo driver that will cause short circuit of signal line and power line
10	The external braking resistor is not placed on a combustible object.
11	The mounting of the servo motor, the shaft and the mechanical connection must be reliable.
12	The servo motor and the connected machinery must be in an operable state.

5.1.2 Turning on the Power

Turn on the input power, for the single-phase 220V power terminal is L1, L2. After turning on the input power, the bus voltage indicator lights up to show no abnormality, and the drive panel display shows "Sd780" - "Off" in turn, indicating that the servo drive is in the operational state, waiting for the host computer to give the servo enable signal.



When "nrd" (no ready) is displayed on the drive panel display, refer to "10.1 Troubleshooting and Warning Handling Before Operation" for related procedures.

5.1.3 Switching Inputs and Outputs

The input and output terminals of the Servo Drive can all be configured with function codes.
Input and output terminal signal sources, which are given in two ways.

① **External terminals are given.**

② **Virtual terminals are given.**

Virtual terminal assignment, i.e. the corresponding terminal signal state is assigned via communication or the keypad panel.

(1) Switching Input Operation Example: Configure terminal X1 as the enable signal.

Table 5-2 Switching Input Operation Procedure

Steps	Items	Operations
1	Power on	When the drive is powered up, "Off" is displayed on the panel.
2	Terminal Configuration	Set the X1 signal to "servo enable control signal", Pn601=0x0001. In other words, CN1-9 pins are selected as "servo enable control terminals" and the status is normally open (normal).
3	External terminal use	(a) Close the terminal switch and "On" is displayed on the drive panel, indicating that the servo is enabled. Disconnect the terminal switch and the drive panel displays "Off", the servo is ready and not enabled.
4	External terminal signal monitoring	The monitoring function code Un100.01 allows you to monitor the current input terminal X1 signal status.

(2) Example of Operation of Switching Output

Table 5-3 Operation Procedure for Switching Outputs

Steps	Items	Operations

1	Power on	When the drive is powered up, "Off" is displayed on the panel.
2	Terminal Configuration	Pn611=0x0001 (Y1 output signal is "servo ready"); at this time, Un006.bit0=1, Y1 terminal output low level. This means that CN1-7/6 pins are selected as "servo ready".
3	Output terminal monitoring	The Servo Drive outputs the corresponding signal status without being ready. E.g. drive is currently faulty, or bus voltage is not established, etc.
4	Output terminal signal monitoring	The monitoring function code Un101.01 allows you to monitor the current output terminal Y1 signal status.

(3) Example of Virtual Terminal Input and Output Operation

Table 5-4 Example of Virtual Terminal Input/Output Operation

Steps	Items	Operations
1	Power on	(a) The drive is powered up and "Off" is displayed on the panel.
2	Terminal Configuration	Setting Pn601=0x1001 configures terminal X1 as the servo enable control terminal and the terminal signal is given by Pn630.01, external terminal giving is invalid. Set Pn611=0x1001, i.e. the Y1 terminal output signal is controlled by function code Pn631.01.
3	Virtual terminal input given	Set Pn630.01=1, the servo driver panel shows "On", i.e. the driver is enabled. Set Pn630.01=0, the servo driver panel shows "Off", i.e. the driver is enabled to disconnect.
4	Virtual terminal output given	(a) Set Pn631.01 = 1, at which point Un101.01 = 1 and output terminal Y1 is low. Set Pn631.01=0, at this point Un101.01=0 and output terminal Y1 is high.

(4) Example of Forced Output from Output Terminal

In practice, you can use the auxiliary function "Forced output terminal signal (Fn300)" to force the corresponding output terminal (Y) to output accordingly.

5.1.4 JOG Test Run

JOG operation is an action function to check whether the servo motor can rotate normally by internal command without connecting to the host computer, and it can be used to judge whether the motor rotates with abnormal vibration or noise.

Point movements include.

- JOG mode (speed).
- Program JOG mode (location).

5.1.4.1 JOG Mode (speed)

JOG mode (speed) is the drive's internal operation speed mode, which performs the speed trajectory planning function according to the set parameters Pn500 and acceleration and deceleration times Pn310 and Pn311.

Related function codes.

Function code	Parameter name	Range	Default value	Unit
Pn500	JOG speed	0 to 1000	500	rpm
Pn310	Speed command trapezoidal acceleration time	0 to 10,000	200	ms
Pn311	Speed command trapezoidal deceleration time	0 to 10,000	200	ms

Related input terminals.

Setting	Symbol	Functional name	Instructions	Trigger method	Running mode
0x17	JOGP	Forward-pointing	When high, the motor rotates in the positive direction	Voltage level trigger	P S T
0x18	JOGN	Negative point movement	When high, the motor rotates in the negative direction	Voltage level trigger	P S T

(1) Panel Operation

The panel operation procedure for JOG mode is described in the example "JOG operation (Fn005))".

Note	
	● The motor is in the enable state and the panel tap operation is invalid.

(2) Host Computer Operation

Open the host computer commissioning software, enter the speed JOG interface, and then set the relevant parameters to complete the JOG operation.

When the JOG screen is closed and the JOG mode is exited, the previously set Pn500 JOG speed value is saved.

(3) Terminal JOG

By configuring the corresponding input terminals, you can perform the corresponding forward and reverse rotation pointing via the configured terminals.

Table 5-5 Terminal Pointing Example

Steps	Items	Operations
1	Power on	(a) The drive is powered up and "Off" is displayed on the panel.
2	Terminal Configuration	Pn605=0x0017 (forward JOG, active high). Pn606=0x0018 (reverse JOG, active high).
3	Trial run	When the servo is enabled, X5 or X6 is continuously given high to allow the servo to JOG, with the JOG speed determined by Pn500.

Note
● Terminal JOG is independent of the control mode, and the terminal JOG function can be performed in any mode. ● Terminal forward JOG and terminal reverse JOG cannot be active at the same time.

5.1.4.2 Program JOG (position)

The program JOG operation is a function that runs continuously through the pre-set operation mode, movement distance, movement speed, acceleration and deceleration time, waiting time, and number of movements.

Related function codes.

Function code	Parameter name	Range	Default value	unit
Pn502	Program JOG operation mode	0 to 5	0	-
Pn503	Program JOG move distance	1 to 1073741824	60,000	pulse
Pn505	Program JOG acceleration and deceleration time	2 to 10,000	100	ms
Pn506	Program JOG wait time	0 to 10,000	100	ms
Pn507	Number of program JOG moves	0 to 1000	1	times -
Pn508	Program JOG movement speed	1 to 10,000	500	rpm

Note
● Program JOG runs as position control with gear ratio and position command filtering in effect. ● To prevent accidents, it is recommended that the overtravel protection function be turned on during use. ● When Pn507 is set to 0, the program JOG keeps running in a loop.

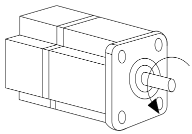
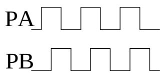
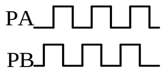
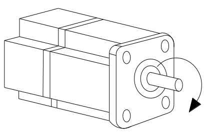
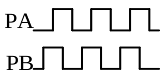
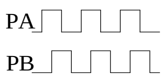
(1) For the panel operation of the program JOG, refer to "Program JOG Operation (Fn006)" for related operations.

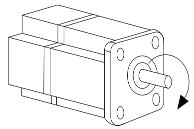
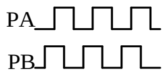
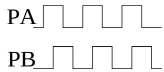
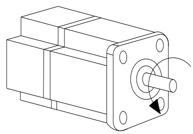
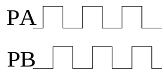
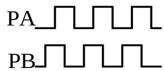
(2) The servo driver's host computer operation program JOG mode specific operation is shown in the host computer operation example.

5.1.5 Direction of Rotation and Frequency Division Output Setting

By setting "Rotation direction selection (Pn002)", the direction of rotation of the motor can be changed without changing the polarity of the input command.
Servo driver's frequency division output pulse is "A phase + B phase" quadrature pulse, from Pn070 to determine the number of pulses output per rotation (before quadruple frequency), such as Pn070 = 2500, then the driver output pulse per rotation is 2500 (before quadruple frequency).
By setting the output pulse polarity (Pn072.X), the phase overrun and lag relationship between the A-phase pulse and the B-phase pulse can be changed without changing the direction of motor rotation.

Table 5.6 Motor rotation direction and AB signal

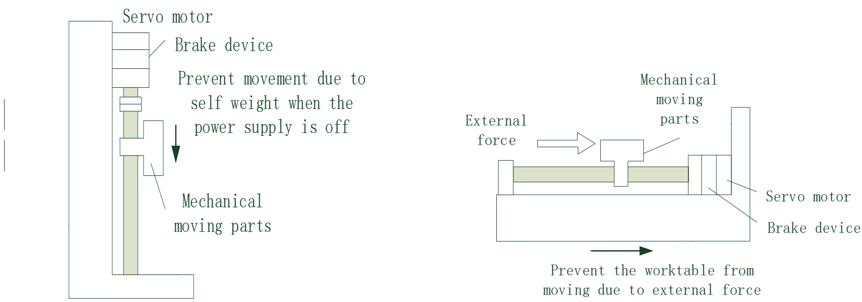
Function code Pn002	Command direction	Motor rotation direction	When Pn072.X=0, Encoder feedback output direction	When Pn072.X=1, Encoder feedback output direction
Pn002=0	Positive command	 Facing the shaft end, rotate counterclockwise (CCW)	 Phase A overruns phase B by 90°	 Phase A lags phase B by 90°
	Negative command	 Facing the shaft end, rotate clockwise (CW)	 Phase A lags phase B by 90°	 Phase A overruns phase B by 90°

Pn002=1	Positive command	 Facing the shaft end, rotate clockwise (CW)	 Phase A lags phase B by 90°	 Phase A overruns phase B by 90°
	Negative command	 Facing the shaft end, rotate counterclockwise (CCW)	 Phase A overruns phase B by 90°	 Phase A lags phase B by 90°

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

5.1.6 Holding Brake Setting

A holding brake is a mechanism that prevents the servo motor shaft from moving when the servo drive is in a non-operating state, and keeps the motor locked in position so that the moving part of the machinery does not move due to self-weight or external forces.



a. Hold brake motor for vertical axis b. Hold brake motor for horizontal axis

Figure 5.4 Schematic diagram of the use of the brake motor

Note

	● Non-polarity of the holding coil. ● Servo enable (S-ON) should be turned off after the servo motor is stopped. ● The brake may click when the motor with the built-in brake is running, but there is no functional effect. ● When the holding coil is energized (holding brake open state), flux leakage may occur at the shaft end, etc. Be careful when using instruments such as magnetic sensors near the motor. ● The brake mechanism is a non-energy-activated fixed special mechanism that cannot be used for dynamic braking purposes and is used only when the servo motor is held in a stopped state.

(1) Holding Signal (/BK) ON at Motor Start

When the servo motor starts, you can set the delay time (Pn00B) for the motor to release the holding brake as a way to control the time from when the servo receives the ON signal to when the motor actually enters the energized state.

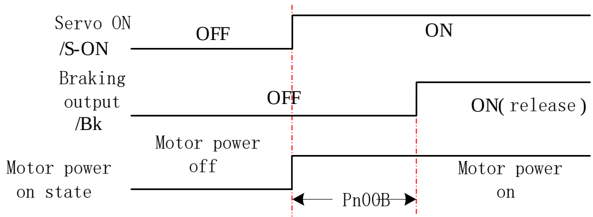


Fig. 5.5 Timing diagram of the motor start/ BK signal ON

(2) Holding Brake Signal (/BK) OFF Operation When the Motor Stops Locking

When the servo motor is stopped, the holding brake signal (/BK) and the servo enable signal (/S-ON) are turned off at the same time.The time from when the servo enable signal (/S-ON) is turned off to when the motor actually enters the non-energized state can be changed by setting Pn008.

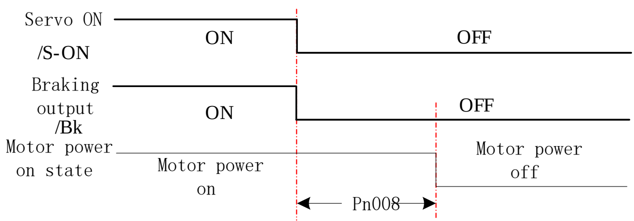


Figure 5.6 Timing diagram of motor stop lockout when/BK signal is OFF

(3) The Holding Signal (/BK) is Turned off When the Motor is running.

When an alarm occurs during servomotor rotation, the servomotor stops and the holding brake signal (/BK) is OFF. In this case, the holding brake signal (/BK) output time can be adjusted by setting the brake command output speed value (Pn010) and "Servo OFF - brake command wait time" (Pn009).

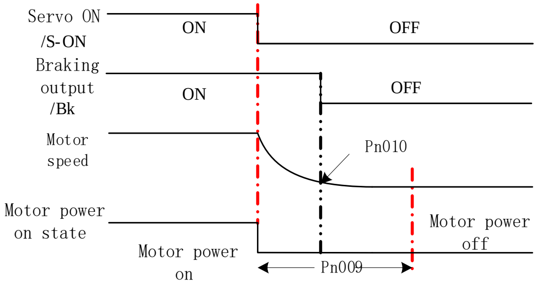


Figure 5.7 Timing diagram of the motor running with/BK signal OFF

Note	
⚠	● There may be slight differences in holding and release times depending on the brake model. ● Ensure that the input command is after the brake opening action time to ensure the accuracy of the command. ● When the motor is locked to prevent possible danger caused by motor action when the servo is OFF, the motor lock time (Pn008) can be set to ensure that the motor does not operate during the holding process.

5.1.7 Overtravel Settings

The overtravel prevention function of the servo unit is a safety function that forces the servo motor to stop by inputting a limit switch signal when the movable part of the machine exceeds the moveable area.

The overtravel signals include the prohibit forward side input (P-OT) signal and the prohibit reverse side input (N-OT) signal. The P-OT and N-OT signals are installed at a specific position of the mechanical load, and the mechanical load is stopped by the P-OT and N-OT signals when the mechanical load is out of the range of that specific position.

(1) Use of External Overtravel Signals

Switching signals using external limit switches.

Setting	Symbol	Functional name	Instructions	Trigger method	Running mode
0x02	P-OT	Prohibit forward drive	When the mechanical movement exceeds the moveable range, the overtravel prevention function is entered. ON-Disable forward drive	Voltage level trigger	P S T

			OFF-Allows forward drive		
0x03	N-OT	Prohibit reverse drive	When the mechanical movement exceeds the moveable range, the overtravel prevention function is entered. ON - Disable reverse drive OFF - Allows reverse drive	Voltage level trigger	P S T

To use the overtravel function, connect the input signal of the overtravel limit switch to the pre-assigned input terminal correctly. In the case of linear drive (screw), 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 "Multi-function CN1 terminal wiring".

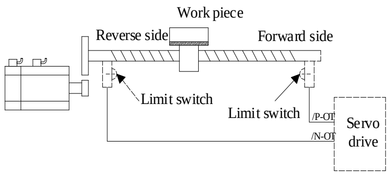


Figure 5.10 Diagram of external overtravel limit switch connection

When the forward limit switch signal of the servo unit is active, the servo will not allow forward rotation, only reverse rotation.

When the servo unit's negative limit switch signal is active, the servo will not allow reverse rotation, only forward rotation.

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

(2) Internal Soft Limit

The switch for the internal soft limit is Pn00D.W. The corresponding function can be switched on by setting the corresponding function code.

Related Function Code

Function code	Parameter name	Range	Default value	Unit
Pn00D.W	Absolute position limit switches	0 to 2	0	-

Pn030	Absolute value limit single-turn maximum	-2^{31} to $2^{31}-1$.	0	-
Pn032	Absolute value limit multi-turn maximum	-2^{15} to $2^{15}-1$.	32767	-
Pn033	Absolute value limit single-turn minimum	-2^{31} to $2^{31}-1$.	0	-
Pn035	Absolute value limit multi-turn minimum	-2^{15} to $2^{15}-1$.	-32768	-

When using the soft limit function, the absolute value limit value can be set manually, or by using the auxiliary function Fn305.

For setting by auxiliary function, see "Soft limit setting (Fn305)" for details.

Note	
⚠	● The motor encoder must be an absolute encoder (PnF00.W=1 and Pn00D.W=1) in order to use the soft limit function. ● The soft limit function only distinguishes the size according to the absolute value position of the motor encoder, and considers the larger position value as a positive limit and the smaller position value as a negative limit.

5.1.8 Overloads

Overloads include transient overloads, and continuous overloads.

(1) Detection time of overload warning (AL.910)

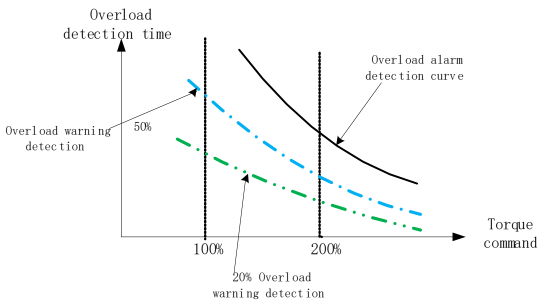


Figure 5.11 Overload warning detection time diagram

The factory overload warning detection time is 20% of the overload alarm detection time. The overload warning detection time can be changed by changing the overload warning value (Pn015). In addition, using it as an overload protection function corresponding to the system used increases 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 the overload alarm detection time (50%).

(2) Transient and Continuous Overloads

By using the "Motor overload detection base current derating setting (Pn016)" to detect the overload alarm, the detection time of the motor overload alarm can be shortened, and the detection time of the instantaneous overload alarm will be changed accordingly.

Motor base current after rating reduction equals motor current threshold for starting the calculation of the overload alarm (default is 1.15 times the motor) multiply motor overload detection base current derating setting(Pn016)

Example: With Pn016 set to 50% as shown in Figure 5.12, the overload alarm can be detected earlier because the motor overload is calculated from 50% of the base current.

When the value of Pn018 is changed, the overload warning detection time is changed accordingly because the overload warning detection current size is changed.

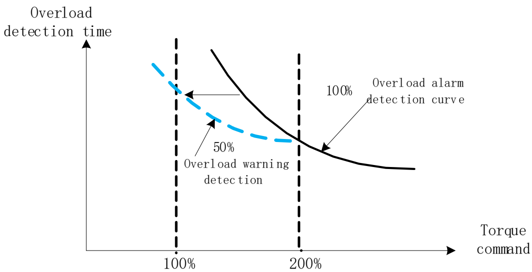


Figure 5.12 Motor overload alarm detection time diagram

An example graph of the overload curves for the drive and motor is shown in Figure 5.13. In the graph, the overload curve for the motor (the two curves against the bottom) has an overload starting point of 115% and a critical point of 180% for continuous and instantaneous overload; the overload curve for the drive (the two curves against the top) has a starting point of 115% and a critical point of 170%.

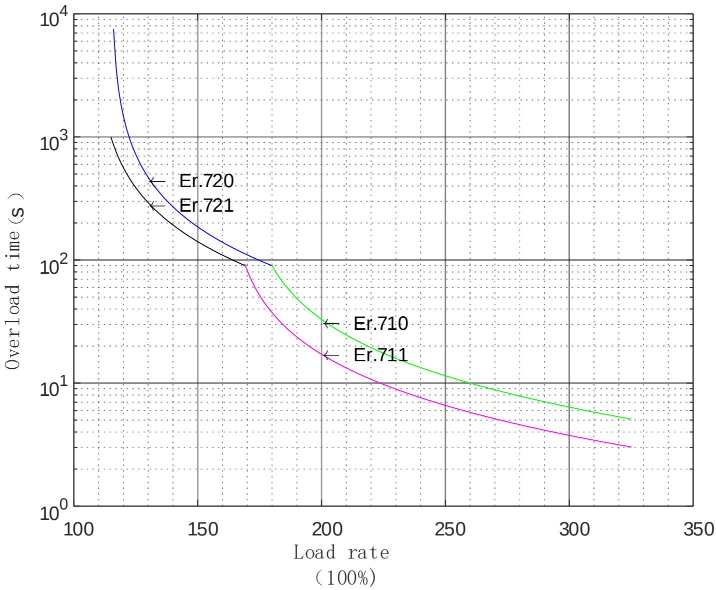


Figure 5.13 Example of Servo Drive and Servo Motor Overload Curve

Note	
⚠	● Different motors and drives have different overload curves.

5.1.9 Torque Limitation

(1) Torque Limiting Method

The output torque can be limited for the purpose of protecting the machine, etc. The limiting method is divided into internal limiting and external limiting, and the torque limiting can be set by the parameter Pn050.

Related Function Code

Function code	Parameter name	Range	Default value	Unit
Pn050	Torque limiting method selection	0 to 5	2	-
Pn051	Internal forward torque limitation	0 to 500	300	%
Pn052	Internal reversing torque limitation	0 to 500	300	%

Pn053	Emergency Stop Torque	0 to 800	800	%
Pn054	External torque limiting1	0 to 500	300	%
Pn054	External torque limiting2	0 to 500	300	%

Note

● If the set value exceeds the maximum torque of the servo motor used, the actual torque is also limited to the maximum torque of the servo motor. If the setting value is too small, insufficient torque may occur when the servo motor accelerates or decelerates, so set it according to the actual situation.

(2) Torque Limiting Output Signal (TLT)

When ON is output in torque limiting, it indicates that the motor output torque is in the limiting state. The current status of the motor torque limit can be confirmed by this signal.

Setting	Symbol	Functional name	Instructions	Trigger method	Running mode
0x05	TLT	Torque limitation	This signal is output ON when the output torque of the motor is within the set range. When the output torque of the click is outside the set range, this signal is output OFF.	level trigger	P S T

(3) Torque Limitation at Undervoltage

The undervoltage warning is detected when the main circuit DC voltage inside the servo unit is below the specified value due to a transient power failure or short time supply of the main circuit supply voltage; the output current can be optionally limited at this time, and the relevant parameters are shown in the table below.

Function code	Parameter name	Range	Default value	Unit
Pn045	Function selection in case of main circuit (DC) undervoltage	0: No undervoltage warning detected 1: Detect undervoltage warning 2: Detect undervoltage warning and simultaneous torque limiting via Pn041 and Pn042	0	-

Pn046	Torque limiting when main circuit voltage drops	0 to 100	50	%
Pn047	Torque limit release time when main circuit voltage drops	0 to 1000	100	ms

By combining this function with the instant stop hold time setting function, it is possible to avoid shutdown due to an alarm when the power supply voltage is insufficient and continue operation without power restoration operations.

Undervoltage warning, torque limit is applied inside 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 5.14. In Figure 5.14.

When the main circuit input supply voltage is AC200V, b = 200V and a = 280V

When the main circuit input supply voltage is AC400V, a = 560V and b = 400V.

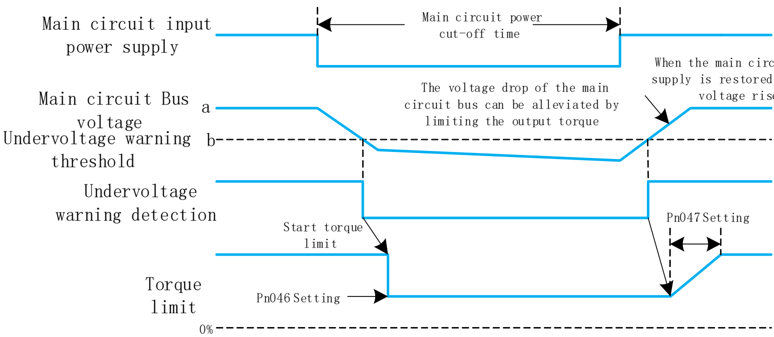


Figure 5.14 Undervoltage warning i.e. warning release timing diagram

5.1.10 Shutdown Mode

Related function codes.

Function code	Parameter Name	Range	Default value	Unit
Pn004	Stop method in case of Gr.1 type of alarm	0: Stopping the motor by DB (dynamic brake) 1: Stop the motor via DB, then disengage DB 2: Without DB, set the motor to free run	2	-
Pn005	Stop method in case of Gr.2 class alarm	0: Zero speed stop 1: DB stop or free running	0	-

		stop (same as Pn004)		
Pn007	Stopping method in case of overtravel (OT)	0: DB stop or free running stop (same as Pn004) 1: Use the value of Pn053 as the maximum deceleration torque to stop the motor, then enter servo lock state 2: Use the value of Pn053 as the maximum deceleration torque to stop the motor, then enter the free state	0	-

Note

● For the vertical axis, the workpiece may fall after entering overtravel because the brake signal (/BK) turns on (brake release). To prevent the workpiece from falling, set the "servo motor to enter the zero position fixed state after stopping (Pn007=1)".

● When an external force is applied, the motor will be blocked at the base after stopping when it enters overtravel, and the load shaft end may be pushed back by the external force. To prevent the servo motor from being pushed back by an external force, set the "servo motor to zero fixed state after stopping (Pn007=1)".

● When the servomotor is stopped or rotating at a very low speed, no braking force will be generated when the dynamic braking stop is selected, just as in the free-running state.

● The setting of the zero-speed stop method is valid only for position control and speed control.

5.1.11 Regenerative Brake Setting

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

Note

● When connecting an external regenerative braking resistor, be sure to set the appropriate values for Pn012 and Pn013, otherwise the regenerative overload alarm will not be detected properly and may cause damage to the external regenerative resistor.

● When selecting an external regenerative braking resistor, be sure to confirm that the capacity is appropriate, as this may result in injury or fire.

5.2 Location Model

Position control is the control of the position of the motor by position commands. The total number of position commands is used to determine the target position of the motor and the position command frequency determines the motor rotation speed. The position command can be given by external pulse input, internal position position command, etc. Through the internal encoder (the motor comes with an encoder), the servo drive can achieve fast and accurate control of the position and speed of the machinery.

Position control is mainly used where positioning control is required.

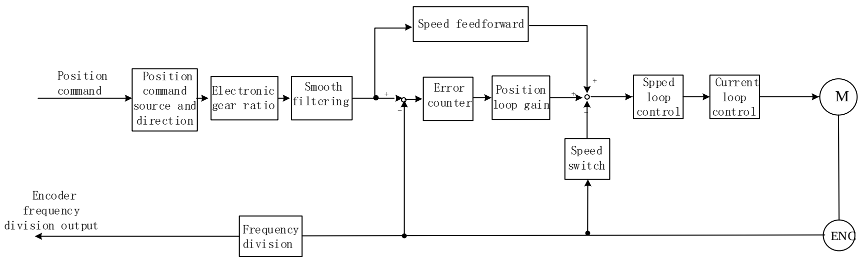
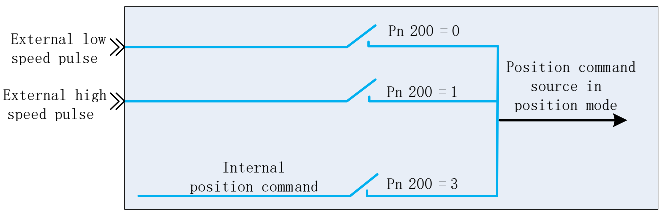


Figure 5.15 Position Control Block Diagram

5.2.1 Pulse Command Source Selection

For position control, the position command source is set by function code Pn200. Please set the corresponding parameters according to the actual situation.



Related Function Code

Function code	Parameter name	Range	Default value	Unit
Pn200.X	Pulse command source selection	0: External low-speed pulse sequence 1: External high-speed pulse sequence 2: Reserved 3: Internal position	0	-

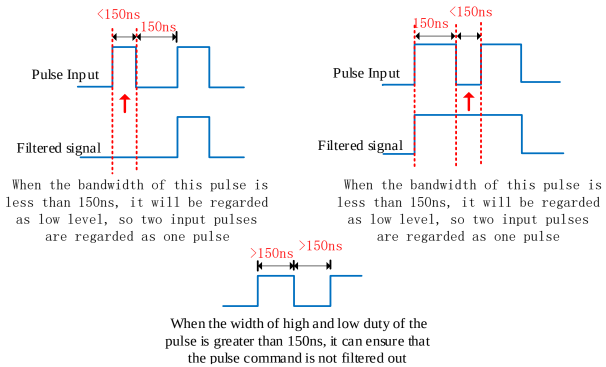
		command		

5.2.2 Pulse Command Filter Selection

Select the appropriate command pulse filter according to the frequency of the highest pulse during operation, which can be set by the parameter Pn202.Y. Improper selection may cause the servo unit to receive pulses abnormally.

When the pulse frequency is momentarily too high and the pulse width is less than the filter width setting, the pulse will be filtered out as noise. Therefore, the filter width setting must be less than the actual pulse width. It is recommended that the actual pulse width be 4 times or more than the filter width setting.

Example: A filter width duration of less than 150ns will be treated as an interference signal.



Related function code

Function code	Parameter name	Range	Default value	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	2	-

		8: Filter time Pn011 setting		
Pn011	External pulse signal filtering time customization	0 to 5000	400	12.5ns

5.2.3 Pulse Command Multiplier

The input multiplier of the position command pulse can be switched by the command pulse 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 **1x** to any set **n times** (max. 100 times). The multiplier is set by the command pulse input multiplier (Pn203).
Whether or not the multiplier has switched can be confirmed by commanding the pulse input multiplier switching output (PSELA) signal.

Related function code

Function code	Parameter name	Range	Default value	Unit
Pn271	External pulse command multiplier selection	0: Invalid 1: Mandatory validity 2: Whether the digital input terminal P-GAIN control is valid	0	-
Pn203	External pulse command multiplier	1 to 100	1	-

Related input terminal

Setting	Symbol	Function name	Instructions	Trigger method	Running mode
0x10	P-GAIN	Command pulse input multiplier switching	This signal is used to change the frequency of the command pulse input when in position mode. Inactive: switch to normal pulse input mode. Valid: Switches to the set multiplier.	level trigger	P

Related output terminal

Setting	Symbol	Function name	Instructions	Trigger method	Running mode
0x0A	PSELA	Command pulse input multiplier switching	PSELA is OFF when Pn200.X = 0. PSELA is ON when Pn200.X = 1.	Voltage level trigge	P

		output	Pn200.X = 2, PSELA = P-GAIN .	r	

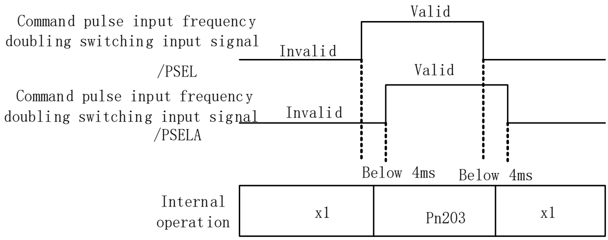


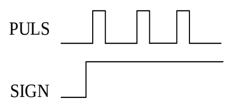
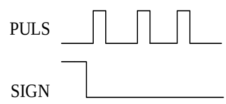
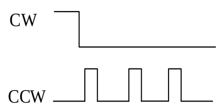
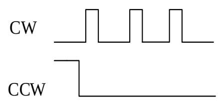
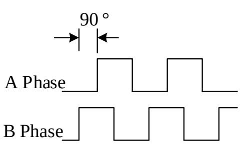
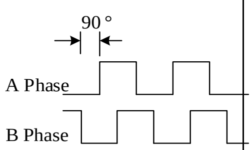
Figure 5.16 Input-output timing diagram requirements for command pulse input multiplier switching

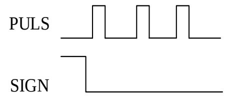
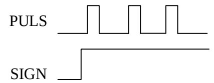
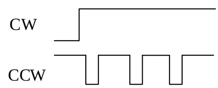
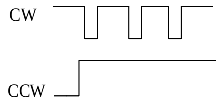
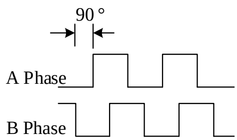
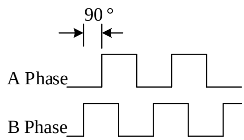
"The " command pulse input multiplier signal is a universal configurable switch input, see "Multi-function CN1 terminal wiring" for wiring details.

Note	
⚠	● When the input pulse frequency is too low and the Pn203 setting is too large, unstable speed may occur. ● Switch the command pulse multiplier when the position command pulse is 0. If you switch when the position command pulse is not 0, the servo motor may cause position deviation or position loss.

5.2.4 Pulse Input Form

Table 5-7 Descriptions related to the form of pulse input

Pn202.X setting	Pn201 setting	Command form	Forward command	Reversal command
0	0	Pulse + Direction		
0	1	CW+CCW		
0	4	Orthogonal coding 4x		

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

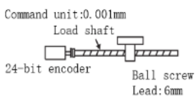
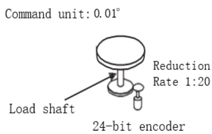
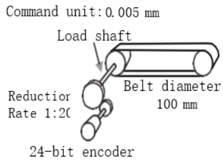
Select the pulse input form of the servo unit according to the pulse output form of the upper system.

5.2.5 Electronic Gear Ratios

For a machine reduction ratio of n/m on the motor shaft and load side (n revolutions of the load shaft for m revolutions of the motor), the set value of the electronic gear ratio can be got by the following equation.

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Pn204}}{\text{Pn206}} = \frac{\text{Encoder resolution}}{\text{One turn movement of load shaft (command unit)}} \times \frac{m}{n}$$

Table 5-8 Electronic Gear Ratio Setting Routine

Steps	Elements	Mechanical system components		
		Ball screw	Round table	Belt + Pulley
–	–			
1	Machine specifications	Ball screw lead: 6mm Reduction ratio: 1/1	Rotation angle of 1 turn: 360° Deceleration ratio: 1/20	Pulley diameter: 100mm (Pulley circumference: 314mm) Reduction ratio: 1/20
2	Encoders resolution	16777216 (24 bits)	16777216 (24 bits)	16777216 (24 bits)
3	Command unit	0.001mm	0.01°	0.005mm

4	Travel of 1 rotation 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	Parameters	Pn204: 16777216	Pn204: 16777216	Pn204: 16777216
		Pn206: 6000	Pn206: 1800	Pn206: 3140

Note
● 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 operation. ● When 0.001 ≤ electronic gear ratio (B/A) ≤ 64000, "Parameter abnormality (Er.040) alarm" will occur if this setting range is exceeded. ● After calculating the reduction ratio into the electronic gear ratio, if the range of the electronic gear ratio is exceeded, consider setting the pulse input multiplier.

5.2.6 Pulse Deviation Clearance

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

Related function code

Function code	Parameter name	Range	Default value	Unit
Pn272	Position deviation clear (CLR) signal status	0: Position deviation cleared at high level (H) 1: Position deviation cleared at rising edge 2: Position deviation cleared at low level (L) 3: Position deviation cleared at falling edge	0	-
Pn273	Position deviation clearing action	0: Servo OFF, Clear position deviation in case of fault	0	-

		1: No position deviation is cleared (cleared only by CLR signal) 2: Clear position deviation in case of failure		

Related input terminal

Setting	Symbol	Function name	Instructions	Trigger method	Running mode
0x11	CLR	Pulse deviation clearing	Clear the position pulse error amount, when this signal is valid, the position pulse error accumulated by the servo driver is cleared to zero.	Voltage level trigger	P

Note	
	● If the setting is set to the pulse deviation clear state, the servo lock function is disabled. In this case, the servo motor will rotate slightly due to the drift pulse in the speed loop. ● When the position mode is running, the servo motor stops running due to the travel limit, and the position deviation remains. Pay attention to the motor action safety when removing the travel limit.

Wiring for Pulse Deviation Clearance

The pulse deviation clear signal is a universal configurable switch input, see "Multi-function CN1 terminal wiring" for wiring details.

5.2.7 Command Pulse Disable

The command pulse disable (INHIBIT) function is a function that disables command pulse input counting during position control. When this function is active, the servo unit enters a state where command pulse input cannot be received.

(1) Configuration of command pulse prohibition

This signal is not configured in the factory default switch configuration, so you need to configure the pin number for this function(0x0D) by parameters Pn601 to Pn609.

Related input terminal

Setting	Symbol	Function name	Instructions	Trigger method	Running mode
0x0D	INHIBIT	Command pulse	This signal is used to control the drive from	Voltage	P S T

		disable	receiving further pulse commands. Valid: disables receiving pulse commands and stops counting. Invalid: allows the pulse command to be received and counted.	level trigge r	

(2) Wiring for Command Pulse Prohibition

The command pulse disable signal is a universal configurable switch input, see "Multi-function CN1 terminal wiring" for wiring details.

5.2.8 Positioning Proximity

In positioning proximity (NEAR) position control, the host computer can receive the positioning proximity signal before confirming the positioning completion signal to prepare for the sequence of actions after positioning completion. In this way, the time required for action at positioning completion can be shortened. This signal is usually used in pairs with the positioning completion signal, see "Positioning completion" for details on positioning completion signals.

(1) Configuration for Positioning Proximity

This signal is not configured in the factory default switch output configuration, so you need to configure the pin number for this function (0x08) by parameters Pn611 to Pn614.

Related output terminal

Setti ng	Symbol	Function name	Instructions	Trigge r method	Running mode
0x09	NERA	Command pulse disable	This signal is output ON when the current position deviation is within the position proximity signal threshold (Pn260). This signal is output OFF when the current position deviation is outside the position approach signal threshold (Pn260).	Voltag e level trigge r	P S T

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

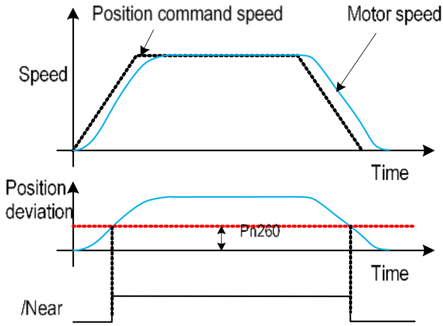


Figure 5.17 Schematic diagram of the positioning proximity signal output

(2) Wiring for positioning proximity

The positioning proximity signal is a universal configurable switch output, see "Multi-function CN1 terminal wiring" for wiring details.

5.2.9 Positioning completion

A signal indicating the completion of servo motor positioning (COIN) during position control.

(1) Positioning of the completed configuration

In the factory default switch output configuration this signal is configured as CN1 pin numbers 27 and 28 by default (Pn612=0x02), please check before use.

Positioning completion-related configuration

Fn No.	Parameter	Range	Default	Unit
Pn262	Positioning the completed range	0～1073741824	7	User unit
Pn200.W	Positioning completion signal (COIN) output timing	0: Output when the absolute value of position deviation is less than the positioning completion range (Pn262) 1: The absolute value of position deviation is less than the positioning completion range (Pn262) and the position command is filtered to 0 2: The absolute value of position deviation is less than the positioning completion range (Pn262) and the position command input is 0	0	

Associated output terminals

Value	Symbolic	Function	Instructions	Trigger	Mode
0x02	COIN	Positioning complete	This signal is output ON when the current position deviation is within the positioning completion signal threshold (Pn262). This signal is output OFF when the current position deviation is outside the positioning completion signal threshold (Pn262).	Galvanic trigger	P S T

In 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 setting value of Pn262, and the positioning completion signal is output for the upper unit to confirm that positioning has been completed. If the Pn262 setting is too large and the deviation is small in low-speed operation, the positioning completion signal may be output all the time. When this occurs, lower the Pn262 setting value.

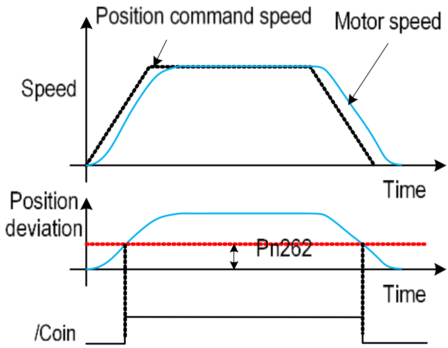


Figure 5.18 Schematic diagram of positioning completion signal output

(2) Wiring for positioning completion

The positioning completion signal is a universal configurable switch output, see "Multi-function CN1 terminal wiring" for wiring details.

5.2.10 Position command smoothing setting (position command filtering)

A function that filters the command pulse input to make the rotation of the servo motor smoother. This function is more effective in the following cases.

- When the commanded upper unit does not perform acceleration or deceleration
- When the command pulse frequency is extremely low
- When setting the position command smoothing function, the response of the system may be affected, so please use it wisely

Related Function Code

Fn No.	Parameter	Range	Default	Unit
Pn211	Position command low-pass filtering time constant	0 to 655	0	ms
Pn212	Position command sliding average filter time	0 to 1000	0	ms

The position command low-pass filter reduces mechanical shocks in the event of sudden changes in the frequency of the input pulse command.
The difference between the position command low-pass filtering time constant and the position command sliding average filtering time is shown below.

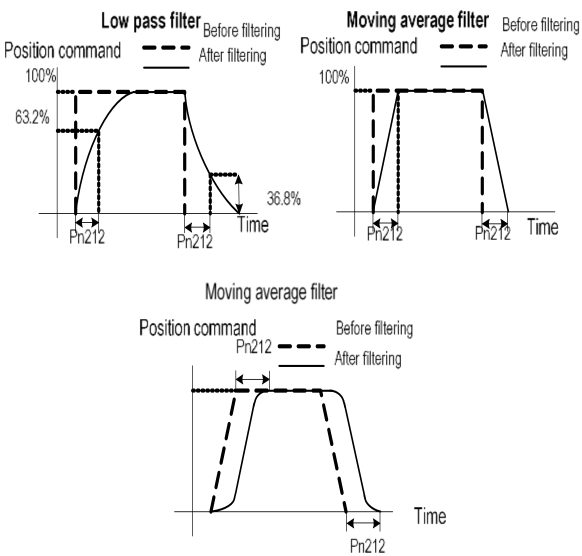


Figure 5.19 Filtering effect of several filters

5.2.11 Crossover output

The encoder divider pulse output is a 2-phase pulse (A-phase and B-phase) with 90° phase difference that outputs position information to the outside based on the current encoder position information inside the servo unit.

(1) Crossover pulse output parameter configuration

Fn No.	Parameter	Range	Default	Unit
Pn070	Number of encoder divider pulses	35 to 32767	2500	-
Pn071	Encoder divider pulse Z signal width	1 to 31	4	-
Pn072X	Motor-side encoder crossover output polarity	0: Positive polarity output 1: Negative polarity output	0	-

a) Number of frequency division pulses

The number of pulses per revolution from the encoder is processed inside the servo unit, divided into frequencies and output to the set value of Pn070.

The number of divided pulses output from the encoder should be set according to the system specifications of the machine and the upper unit.

Example.

For Pn070= 16 (16 pulses per revolution), an example of the output of the encoder divided pulse output A phase (PAO) signal and the encoder divided pulse output B phase (PBO) signal is shown in the figure below.

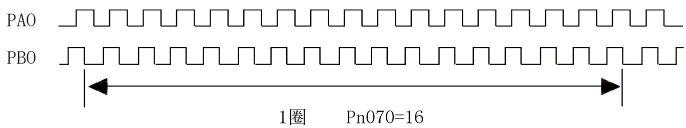


Figure 5.20 Timing diagram of pulse division output

b) Frequency division output Z pulse width

Z pulse is a pulse sent by the encoder following the motor shaft rotation for one week, which is used to determine the zero position or mark position. The servo driver provides Z pulse output width adjustable function, which is used to widen the Z signal of the encoder to meet the needs of different upper units, so that the user becomes more flexible in selecting upper motion control devices.

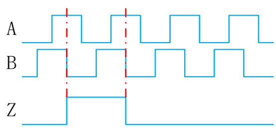


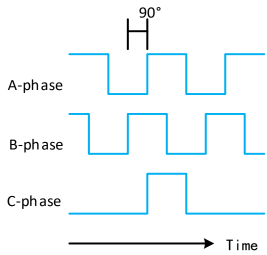
Figure 5.21 Timing diagram of pulse division output

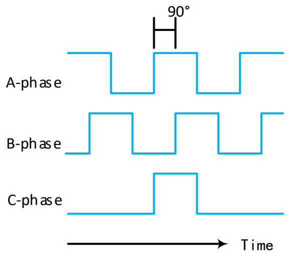
Example: As shown in Figure 5.21, set Pn071 to be set to 4 and the Z pulse width to be

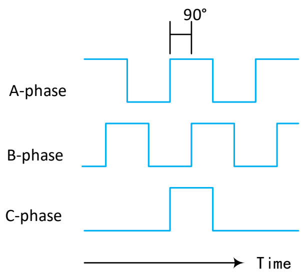
4 times the quadrature AB pulse width.

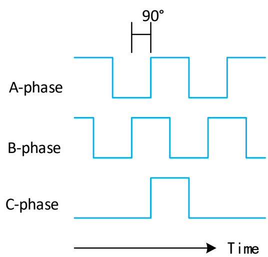
The user can perform Z pulse width widening processing in the range of 1 to 31.

c) Crossover output direction

<table>
<tr><th></th><th>Counterclockwise rotation (CCW)</th><th>Clockwise rotation (CW)</th></tr>
<tr><td>Pn002=0</td><td>

Phase A overtakes phase B</td><td>

Phase A lags behind phase B</td></tr>
<tr><td>Pn002=1</td><td>

Phase A lags behind phase B</td><td>

Phase A overtakes phase B</td></tr>
</table>

Figure 5.22 Effect of inverse pulse divider output pickup

The parameter Pn072 can be set to invert the AB-phase signal logic of the divided output pulse.

Precautions

● The phase polarity of the AB phase pulses output by the crossover is related to the direction of rotation of the motor, in addition to Pn072. When applying this function, adjust the direction of rotation of the motor (Pn002) first, and then determine whether the polarity of the divider output pulse needs to be reversed.

(2) Crossover pulse output wiring

See "Multi-function CN1 terminal wiring" for details of the crossover pulse output wiring.

5.2.12 Example of Position Control Operation

In position mode, there are two ways to receive pulses: one is a low-speed pulse interface and the other is a high-speed pulse interface.
The general open collector pulse command frequency is 200kHz maximum, and the low speed pulse interface is recommended; when the user uses higher frequency or specific linear output pulses, the linear differential input interface is recommended.
See "Multi-function CN1 terminal wiring" for details of low-speed pulse and high-speed pulse wiring.
The operation of the servo drive position control is described using the linear differential input as an example.
Example: PLC linear differential output pulses, pulse type is orthogonal AB, requires one rotation of the motor every 10,000 pulses, the operation steps are shown in Table 5-8.

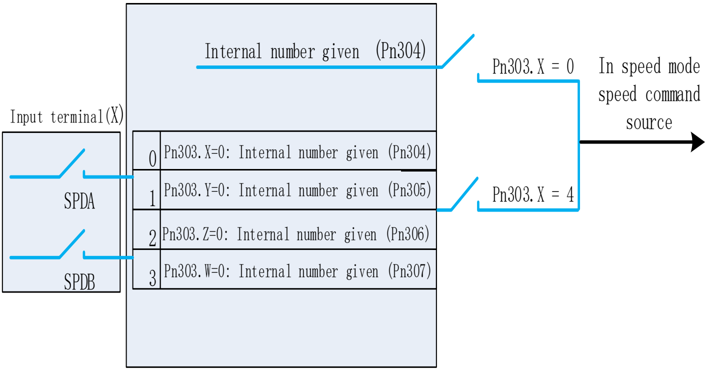
Table 5-8 Example of external encoder commissioning using 5V differential output

Steps	Item	Operations
1	Power on electric power	(a) The drive is powered up and "Off" is displayed on the panel.
2	Control mode selection	Pn000.X = 0 (control mode selected as position mode). Pn200 = 0 (the source of the pulse command is the CN1 terminal).
3	Selecting the pulse form	Pn201 = 0 ("Quadrature AB" pulse input method) Pn202.X=0 (pulse input is positive logic).
4	Setting the electronic gear ratio	Pn204 = 8388608 (23-bit encoder), Pn206 = 10000. (For every 10000 pulses received by the driver, the motor runs 1 revolution)
5	Sending pulses to the servo	The PLC sends pulses at a constant frequency, in a certain number of ways, and at certain intervals.
6	Check the received pulse frequency and pulse count	Monitoring function code Un007 to determine whether the received pulse speed matches the actual one sent. Monitor Un006 and check that the input pulse counter Un006 matches the actual number sent.

5.3 Speed (internal setting) mode

5.3.1 Summary of functions

The speed command source supported by this product is mainly set by internal registers. Internal register setting speed is a function that sets the motor speed in advance by the internal user parameters of the Servo Drive and selects it using an external input signal for speed control operation without having to configure a speed generator or pulse generator externally.



SPDB	SPDA	Command Source Selection
0	0	Pn303.X setting
0	1	Pn303.Y setting
1	0	Pn303.Z setting
1	1	Pn303.W setting

Figure 5.23 Block diagram of speed command source

5.3.2 Soft Start

The soft start function is a speed command that converts a step speed command into a smoother constant acceleration and deceleration. The acceleration time and deceleration time can be set, and this function is used when smooth speed control is desired during speed control.

Related function codes

Fn. No	Parameter	Range	Default	Unit
Pn310	Soft start acceleration time (ACC) during speed control mode	0 to 10,000	200	ms
Pn311	Soft start deceleration time (DEC) during speed control mode	0 to 10,000	200	ms

Pn30A is the time it takes for the motor to reach the maximum speed of the motor from a stop; Pn30B is the time it takes for the motor to reach the motor stop from the maximum speed. The actual acceleration and deceleration times are calculated by the following equation.

$$\text{Actual acceleration time} = \frac{\text{target speed}}{maximum\ speed} \times \text{soft start (acceleration time Pn310)}$$

$$\text{Actual deceleration time} = \frac{\text{target speed}}{\text{maximum speed}} \times \text{soft start(deceleration time Pn311)}$$

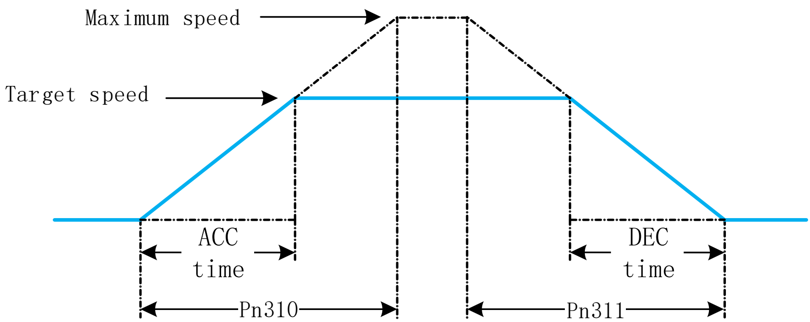


Figure 5.24 Soft start acceleration and deceleration time effect demonstration

5.3.3 Zero speed clamp function

The zero speed clamp function is a function that performs servo lock when the speed command is below the zero speed fixed speed threshold (Pn313) in the zero speed clamp (/ZCLAMP) ON state. In this case, a position loop is formed inside the servo unit and the speed command will be ignored. The servo motor is fixed within ± 1 pulse of the zero position fixed effective position, and returns to the zero position fixed position even if rotation occurs due to an external force.

(1) Configuration of zero-speed clamp

Related function codes

Fn. No	Parameter	Range	Default	Unit
Pn313	Zero speed fixed speed threshold	0 to 10,000	10	rpm

Related input terminals

Value	Symbolic	Function	Instructions	Trigger	Mode
0x0C	ZCLAMP	Zero speed clamp	When high, the speed command is below the speed value of Pn313 for servo lock.	galvanic trigger	S

Precautions

	● When the servo motor is fixed in the zero position, there is ±1 pulse jump, and even if rotation occurs due to external forces, it will return to the zero fixed position.

(2) Wiring for zero speed clamp

The zero fixed signal is a universal configurable switch input, see "Multi-function CN1 terminal wiring" for wiring details.

5.3.4 Rotation detection signal

The switching rotation detection signal (/TGON) is output when the motor speed is above the set value of function code Pn317 (rotation checkout value).

(1) Rotation detection signal configuration

Related parameters

Fn. NO	Parameter	Range	Default	Unit
Pn317	Rotation detection value	0 to 10,000	20	rpm

Associated output terminals

Value	Symbolic	Function	Instructions	Trigger	Mode
0x04	/TGON	Rotation signal	This signal is output when the motor running speed is lower than the rotation detection value.	Galvanic trigger	P S T

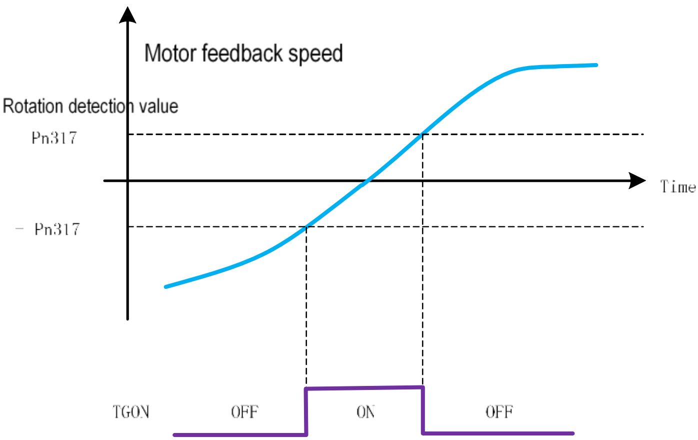


Figure 5.25 Schematic diagram of the rotation signal output

(2) Wiring of rotation detection signal

The rotation detection signal is a universal configurable switch output signal, see "Multi-function CN1 terminal wiring" for wiring details.

5.3.5 Consistent speed

The speed agreement signal (/V-CMP) is a signal output when the absolute value of the deviation between the actual feedback speed of the motor and the target command speed is within the set value of function code Pn320.

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

(1) Configuration of speed-consistent signals

Related function codes

Fn No.	Parameter	Range	Default	Unit
Pn320	Speed-consistent signal threshold	0 to 100	10	rpm

Associated output terminals.

Value	Symbolic	Function	Instructions	Trigger	Mode
0x03	/V-CMP	speed consistency	This signal is output when the deviation between the motor feedback speed and the given speed is lower than Pn320	galvanic trigger	P S T

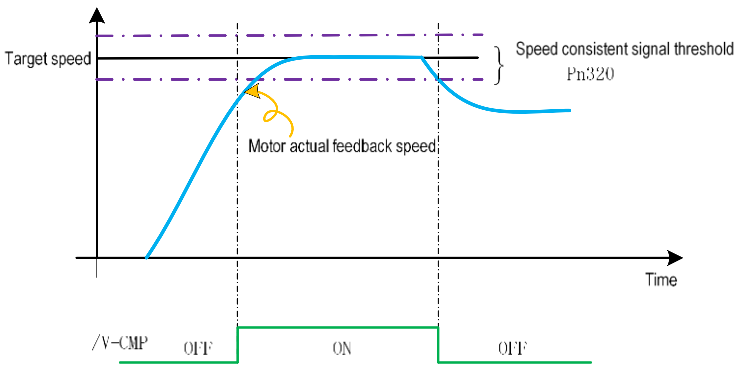


Figure 5.26 Schematic of the speed-consistent signal output

(2) Wiring of speed-consistent signals

The speed consistent signal is a universal configurable switch output signal, see "Multi-function CN1 terminal wiring" for wiring details.

5.3.6 Example of speed control operation

Example 1: The user sets the speed via the internal function code register.

Table 5-9 Example of digital given internal speed operation

Steps	Item	Operations
1	go on electric power	(a) The drive is powered up and "Off" is displayed on the panel.
2	Control mode selection	Pn000.X = 1 (control mode is speed mode). Pn300 = 0 (speed command source is Pn304).
3	Servo Enable	Pn001=0, enable servo
4	Speed adjustment	Set the value in function code Pn304 to adjust the motor speed. Pn304 = 100, motor running at 100 rpm in positive rotation. Pn304 = -100, motor running in reverse at -100 rpm. Pn304 = 0, the motor is stationary and locks the shaft.

Example 2: The user selects the desired target speed via the terminals.

Table 5-10 Example of mixed internal speed operation

Steps	Item	Operations
1	go on electric power	(a) The drive is powered up and "Off" is displayed on the panel.
2	Control mode selection	Pn000.X = 1 (control mode selected as speed mode). Pn300 = 4 (the source of the speed command is "internal digital mixing").
3	Terminal Assignment	Pn605.YX=0x08 (assign X5 to SPD-D) Pn606.YX=0x09 (assign X6 as SPD-A) Pn607.YX=0x0A (assign X7 as SPD-B)
4	Speed command source setting	Pn303.X=0 (speed command source internal speed Pn304 given) Pn303.Y=0 (speed command source internal speed Pn305 given) Pn303.Z=0 (speed command source internal speed Pn306 given) Pn303.W=1 (speed command source internal speed Pn307 given)
5	Multi-segment speed value setting	Set the desired target value in Pn304, Pn305, Pn306, Pn307
6	Servo Enable	Set internal enable Pn001.X=1

8	Switching	Adjustment of three speed switch quantities for speed selection. SPD-D regulates the direction of operation. The segment number for which SPD-A and SPD-B jointly control the internal speed.

5.4 Torque (internal setting) mode

5.4.1 Summary of functions

The internal setting torque is a function to perform torque control operation by means of four torque commands set in advance by the user parameters inside the Servo Drive and selected using external input signals, and is effective for torque control actions with an operating torque of up to four torques. It is not necessary to configure the torque generator externally.

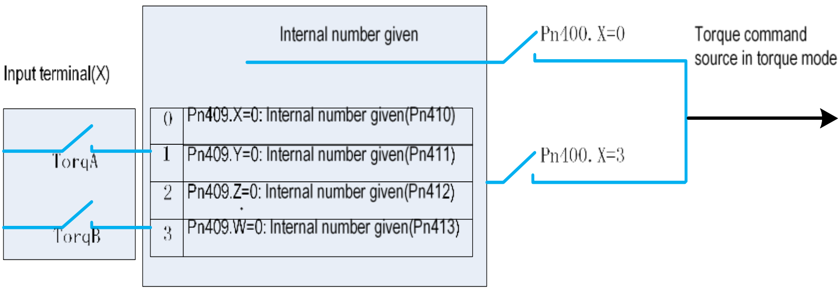


Figure 5.27 Block diagram of torque command source in torque mode

Related function code

Fn No.	Parameter	Range	Value	Unit
Pn400. X	Torque mode command source selection	0: Internal number given 1: Reservations 2: Reservations 3: Internal digital mixing given 4: External single trigger	0	-
Pn400. Y	Speed limiting source selection for torque control	0: Reserved 1: Reservations 2: Internal numbers given	2	-
Pn403	Direction of torque command	0: Same direction as torque command 1: Reverse with torque command	0	rpm
Pn404	Torque command first-order low-pass filtering time	0.00 to 655.35	0.00	ms
Pn409. X	Torque command source 1	0: Internal digital given (Pn410)	0	-

		1: Reservations 2: Reservations		
Pn409.Y	Torque command source 2	0: Internal number given (Pn411) 1: Reservations 2: Reservations	0	-
Pn409.Z	Torque command source 3	0: Internal number given (Pn412) 1: Reservations 2: Reservations	0	-
Pn409.W	Torque command source 4	0: Internal number given (Pn413) 1: Reservations 2: Reservations	0	-
Pn415	Internal speed limit value for torque control	0 to 10,000	0	rpm

Related input terminals

<table>
<tr><th>Value</th><th>Symbolic</th><th>Functional name</th><th>Instructions</th><th>Trigger</th><th>Mode</th></tr>
<tr><td>0x0F</td><td>TPR-D</td><td>Torque command direction switching during torque mode</td><td>This signal is used in the torque control mode to adjust the output direction of the torque command via this terminal.
(a) Invalid: in the same direction as the torque command.
Valid: reverse of torque command.</td><td>Galvanic trigger</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 selection</th></tr><tr><td>0</td><td>0</td><td>Pn409.X setting</td></tr><tr><td>0</td><td>1</td><td>Pn409.Y setting</td></tr><tr><td>1</td><td>0</td><td>Pn409.Z set</td></tr><tr><td>1</td><td>1</td><td>Pn409.W setting</td></tr></table></td><td rowspan="2">Galvanic trigger</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>

5.4.2 Speed limitation during torque control

Speed limit is a function that limits the speed of the servo motor to protect the machine. In torque control, the servo motor is controlled to output the commanded torque, but not the motor speed. Therefore, when a commanded torque greater than the machine side torque is input, the motor speed will increase significantly. In this case, it is necessary to limit the speed by this function.

Related function code

Fn. NO	Parameter	Range	Default	Unit
Pn415	Internal speed limit value for torque control	0 to 10,000	0	rpm

5.4.3 Torque single trigger

As shown in the figure below, when the drive receives the external start trigger signal, it first enters into the locking process, in which the drive is subject to two restrictions, one is the maximum torque limit, and the other is the maximum speed limit, when not accelerated to the maximum speed, the drive outputs at the set maximum torque, when the speed reaches the maximum value, the torque limit is carried out, and as the load gradually increases and is influenced by the resistance, the The motor speed gradually decreases, when the motor speed is low enough and lasts for a preset duration, this action ends and waits for the next start trigger signal.

Related input terminals

Value	Symbolic	Function	Instructions	Trigger	Mode
0x14	T-CTRG	Torque command trigger	(a) In the case of torque control, this signal is used to select the desired torque command. The corresponding trigger edge signal is configured via the function code Pn430.	high and low levels trig along	🄣

Configure the torque command trigger terminal (0x14) inside the function codes Pn601 to Pn609, and then control the single trigger function of torque according to the trigger method set by Pn430.

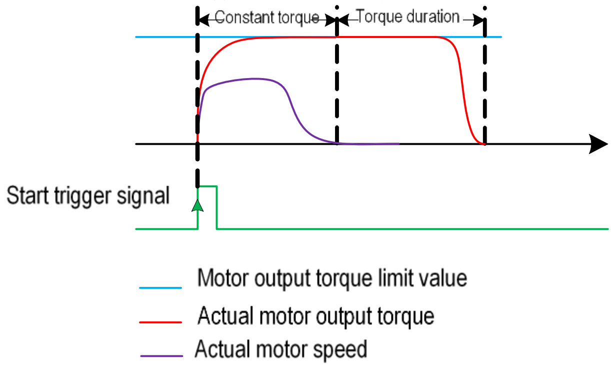


Figure 5.28 Schematic diagram of single torque trigger

Related function codes

Fn. NO	Parameter	Range	Default	Unit
Pn400.X	Torque mode command source	4: External single trigger given	0	-
Pn410	Internal torque command 1	-500.0 to 500.0	0	%

Pn415	Internal speed limit value during torque control	0 to 10,000	100	rpm
Pn430.	Torque command start method	0: Low level 1: Rising edge 2: Falling edge 3: High level	1	-
Pn431	Speed threshold after torque arrival	0 to 500	5	rpm
Pn432	Duration after torque arrival	0 to 500	120	ms

Example of a torque single trigger run:

Table 5-11 Torque Single Trigger Run Example

Steps	Item	Operations
1	Terminal assignment and wiring	Let Pn604=0x0014 (terminal X4 is the torque trigger terminal, and the trigger signal is given externally); connect the trigger input signal according to the wiring of the cis-control input circuit, CN1-40.
2	Control mode selection	Pn000.X = 2 (control mode selected as torque control). Pn400.X = 4 (selection of the torque source as single trigger mode). Pn400.Y=2 (speed limit is Pn415 when torque control is selected). Pn430.X=1 (select trigger mode as rising trigger).
3	Servo Enable	Pn410 = 10 (arrival torque of 50%). Pn415 = 200 (speed limit of 200 rpm for torque control). When servo is enabled, the servo motor does not move.
4	Terminal Trigger	To close and then break terminal X4, i.e. rising edge trigger torque operation. (a) Under no load, the speed rises to a limiting speed of 200 rpm and then runs at a constant speed with a motor torque of about 5% and remains constant. The load is then increased and when the load reaches 10%, the motor stops immediately and waits for the next trigger.

5.4.4 Example of torque control operation

Example 1:

Table 5-12 Example of Internal Torque Operation

Steps	Item	Operations
1	Control mode selection	Pn000.X = 2 (control mode selected as torque control). Pn400.X = 0 (the source of torque is selected as Pn410). Pn400.Y=2 (speed limit is Pn415 when torque control is selected).
2	Torque setting	Pn410=0, enable servo, servo motor does not move.
3	speed limit	Pn415 = 1000 (i.e., speed limit of 1000 rpm for torque control).
4	Servo Enable	Pn001.X=1.
5	Torque	Pn410=20, motor speed up to 1000rpm at no load.

	adjustment	

Example 2.

Table 5-13 Example of Internal Torque Mixing Operation

Steps	Item	Operations
1	Control mode selection	Pn000.X = 2 (control mode selected as torque control). Pn400.X = 3 (selection of the torque source as mixed given). Pn400.Y=2 (speed limit is Pn415 when torque control is selected).
2	Terminal Assignment	Pn605.YX=0x0F (assign X5 to TOR-D). Pn606.YX=0x12 (assign X6 to TOR-A). Pn607.YX=0x13 (assign X7 as TOR-B).
3	Torque command source setting	Pn409.X = 0 (torque command source internal torque Pn410 given). Pn409.Y=0 (torque command source internal torque Pn411 given). Pn409.Z = 0 (torque command source internal torque Pn412 given). Pn409.W=0 (torque command source internal torque Pn413 given).
4	Torque command setting	The relevant torque values are set for internal torque Pn410, Pn411, Pn412 and Pn413.
5	Speed limit setting	The speed limit value Pn415 is set for the torque mode.
6	Servo Enable	Pn001.X=1
7	Switching	Switching torque switch signals for corresponding control. TOR-D regulates the direction of operation. TOR-A and TOR-B control the command source for internal torque (Pn409.X to Pn409.W).

5.5 Hybrid control mode

5.5.1 Basic settings for hybrid control mode

The servo unit can switch between two combinations of various control methods for selection.

Related Function Code

Fn No.	Parameter	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

Value	Symbolic	Function	Instructions	Trigger	Mode
0x0B	C-SEL	Control mode switching	This signal is used for control mode switching selection	Level trigger	P S T
0x1A	C-SEL2	Control mode switching	This signal is used for control mode switching selection	Level trigger	P S T
0x1B	C-Ctrig	Control mode switching confirmation	This signal is used for confirmation of the control mode switching selection	Along trigger	P S T

In the hybrid control mode, the "C-SEL" input signal is used to switch between the control modes of speed mode, torque mode, and position mode.

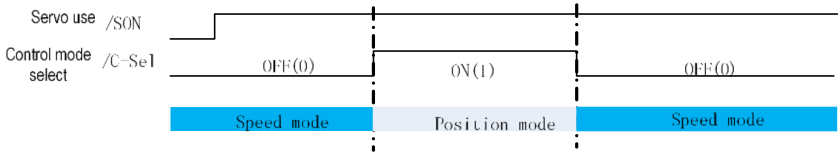
In the mixed operation mode, mode switching is controlled by the "control mode switching" terminal signal (C-SEL).

P000.X Set value	Control mode switching signal (C-SEL)	
	High level (H)	Low Level (L)
3	position mode	Speed mode Torque mode
4	position mode	Torque mode
5	Torque mode	Speed mode

Pn000.X Set value	Control mode switching signal		C-Trig	Control mode
	C-SEL	C-SEL2		
6	0	0	↑	Speed mode
	0	1		Position mode
	1	0		Torque mode

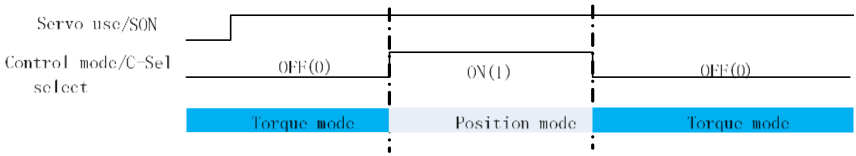
5.5.2 Speed/position control mode

After setting the control mode selection signal (/C-SEL), the user selects the corresponding control mode via the upper unit.



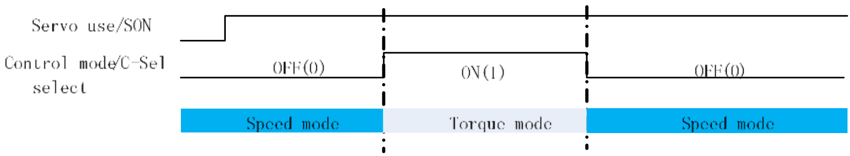
5.5.3 Torque/position control mode

After setting the control mode selection signal (/C-SEL), the user selects the corresponding control mode via the upper unit.



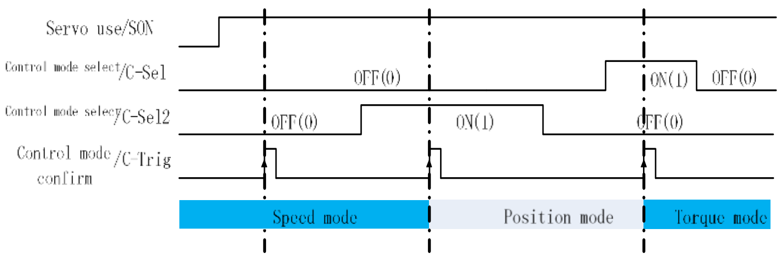
5.5.4 Speed/Torque Control Mode

After setting the control mode selection signal (/C-SEL), the user selects the corresponding control mode via the upper unit.



5.5.5 Speed/position/torque control mode

After setting the control mode selection signal (/C-SEL, /C-SEL2, /C-Ctrig), the user selects the corresponding control mode via the upper unit.



Precautions	
	● In Speed/Position/Torque mode (Pn000.X=6), after the drive is powered up, the drive is in speed mode until the rising edge signal of the control mode confirmation signal (C-Trig) is triggered.

5.6 Absolute encoders

When using a multi-turn absolute encoder, an absolute value checkout system can be constructed with the upper unit. The absolute value checkout system eliminates the need to perform home return operation each time the power is turned on.

Related function codes.

Fn No.	Parameter	Range	Default	Unit
Pn040	How to use the motor-side encoder	0 - Use absolute encoder as absolute encoder 1 - Using absolute encoders as incremental encoders	0	-
Pn041	Alarm/warning option for absolute encoder battery under-voltage	0-Sets low battery voltage to fault 1 - Set low battery voltage as a warning	0	-

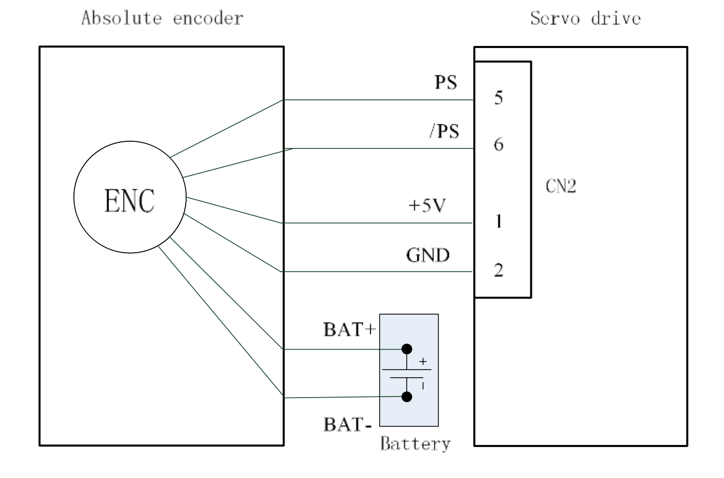
5.6.1 Connection of the absolute encoder

In order to save the position data of the absolute encoder, a battery unit needs to be installed.

When using an encoder cable with a battery box, install the battery into the battery box.

Table 5-29 Absolute Encoder Cable Connection Methods

Absolute encoder wiring	Connection schematic

Use of encoder cable with battery compartment	

5.6.2 Absolute encoder data reading

There are two ways of reading the absolute value of a multi-turn encoder via a PLC.

① Communication reading.

② DI/DO terminal reading.

(1) Communication to read the absolute value of multi-turn encoder

Related Function Code

Monitoring	Parameter	Range	Unit	Address
Un010	Absolute encoder single-turn value	0 to 2^{24}	Encoder units	0xE010
Un011	Absolute encoder multi-turn values	-3276 to 32767	rev	0xE011
Un603	Absolute encoder pulses (low 32 bits)	Uint32	Encoder units	0xE603
Un605	Absolute encoder pulses (high 32 bits)	Int32	Encoder units	0xE605

(2) Input and output terminals read the absolute value of the multi-turn encoder

The user can read the absolute position of the drive through the timing logic of the drive's input terminal (X) and output terminal (Y) without communication from the host computer. The format of the data to be read is as follows.

Bit63 to Bit48	Bit47 to Bit32	Bit31 to Bit16	Bit15 to Bit0

Word_4	Word_3	Word_2	Word_1
calibration value (Check Sum)	Number of encoder turns	Number of pulses in one revolution of the encoder. 24-bit encoder: 0 to 16777216 23-bit encoder: 0 to 8388608 20-bit encoder: 0 to 1048576 17-bit encoder: 0 to 131072	

Description.

① To prevent data errors, the number of turns of the encoder and the number of pulses in one turn are calibrated with the following calibration formula.

Check Sum=((((Word_1 + 0xA700) XOR (Word_2)) + 0x605A) XOR (Word_3) + 0x5A06)

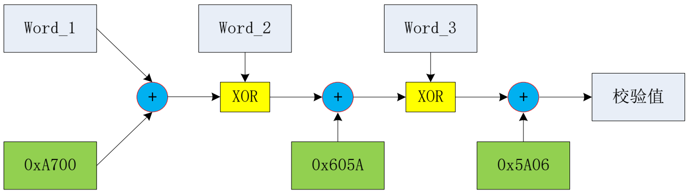


Figure 5.45 Schematic diagram of the checksum operation

② 0xA700, 0x605A, 0x5A06 are all in hexadecimal.

③ This algorithm does not carry a plus or minus sign.

④ XOR is the symbol for the iso-or operation.

Absolute position values can be read using DI/DO, and the timing sequence for reading the relevant data is shown below.

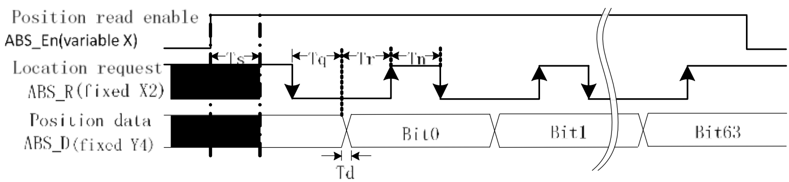


Figure 5.46 Timing diagram for reading absolute position using DI/DO

The following table illustrates the delay in reading the absolute position using DI/DO.

	Ts	Tq	Tr	Tn	Td
Minimum (Min)	2ms	2ms	2ms	1ms	62.5us
Max	Pn073+2ms				–

Description of the timing when using DI/DO to read absolute positions.

① When starting to read the absolute position using DI/DO, the upper unit turns the position reading enable (ABS_En, 0x07) signal on.

② After the delay time of Ts delay to confirm the level, X4/Y4 is switched from the original DI/DO function to ABS_R and ABS_D functions. If the X4 signal is a high level signal before switching, when the original function switches ABS_R function, its original function will continue to keep high level state in the driver. [**Before and after turning on the position reading enable (ABS_En) signal, users need to pay special attention to its function switching, and it is recommended that users set X4 and Y4 to 0, i.e. do not use X4 and Y4 to multiplex with other functions.**]

③ When X4 is set high at ABS_En and after Ts time delay, X4 is switched to ABS_R. If the upper computer sets this signal low, the drive enters the data request preparation phase.

④ After time Td has elapsed, the driver has prepared and placed the data on ABS_D and the upper unit can read it after Tr time has elapsed. After the reading is complete, the ABS_R signal is set high, then after time Tn, the ABS_R signal is set low, and so on until all bits of data have been read.

⑤ When ABS_En is set low before the upper unit has read all 64-bit data, this data is finished, and when it is necessary to continue transferring absolute value position information, it is necessary to start again from step 1.

For example, the encoder is a 24-bit absolute encoder, when the absolute position single turn number is 1234 turns, the pulse data in one turn is 16777200, and the corresponding data sent is

Bit63 to Bit48	Bit47 to Bit32	Bit31 to Bit16	Bit15 to Bit0
Word_4	Word_3	Word_2	Word_1
Calibration value	Number of encoder turns	Number of pulses in one revolution of the encoder	
0x5CC1	0x04D2	0x00FF	0xFFF0

The encoder is a 24-bit absolute encoder, when the absolute position single turn number is -1234 turns, the pulse data in one turn is 16777200, the corresponding sent data is

Bit63 to Bit48	Bit47 to Bit32	Bit31 to Bit16	Bit15 to Bit0
Word_4	Word_3	Word_2	Word_1
Calibration value	Number of encoder turns	Number of pulses in one revolution of the encoder	
	0xFB21	0x00FF	0xFFF0

5.6.3 Replacing the battery

If the battery voltage is below approx. 2.7 V, "Encoder battery alarm (Er.830)" or "Absolute encoder battery abnormality warning (A.930)" will be displayed. When Er.830 or AL.930 appears, you can first check if the battery is loose; if not, the battery is under-voltage and the encoder battery needs to be replaced.

Table 5-30 Procedure for Replacing the Absolute Encoder Battery

Steps	Item	Operations
1	Power on electric power	Turn on the control power of the servo driver only
2	Battery replacement	**Battery installation 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 **Battery installation on top of the upper unit**: Remove the old battery → Install the new battery
3	Elimination of faults or alarms	**Warning AL.930 displayed on the drive panel**: wait about 5s after replacing the battery and the warning will be removed automatically. The **drive panel displays fault Er.830**: Replace the battery and reapply power to eliminate the fault.
4	Confirm complete elimination of the fault	After the drive is re-powered, there is no fault display on the drive panel, indicating a successful battery replacement.

Precautions	
	● When replacing the battery, do so with the drive powered up and the encoder connected properly, otherwise the absolute encoder data will be lost. The operation to clear the encoder multi-turn value can be performed with the auxiliary function Fn008, see "7.9 Setting the absolute encoder"; it can also be operated in the "Control Panel" on the VCSD.exe software of the host computer.

5.7 Maximum number of revolutions

5.7.1 Overview

When controlling the position of a rotating body such as a rotary table, the number of revolutions will always exceed the upper limit of the absolute value encoder after a certain period of time because it can only rotate in one direction.
For example, suppose the turntable in the figure below is a machine that can only move in one direction.

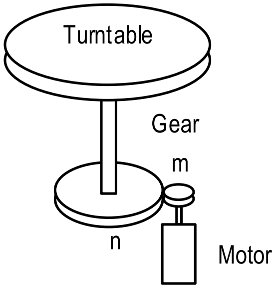
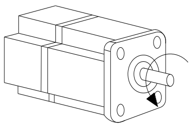
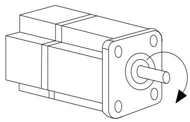


Figure 5.47 Typical mechanical device

After the number of turns already rotated, the absolute value multi-turn position information will overflow.
For this, the corresponding position control requires the use of absolute multi-turn upper limits for the corresponding restriction process.

Explanation of terms

Forward	Reverse
 Facing the shaft end, the motor rotates counterclockwise (CCW)	 Facing the shaft end, the motor rotates clockwise (CW)

5.7.2 Related principles

The general multi-turn absolute encoder shows a count range of [-32768, +32767], as shown below: When the motor is in positive rotation and running for a long time, the number of rotations of the encoder changes to a maximum value of +32767; when the rotation continues, then the data overflows. When the power is reapplied after the overflow, the multi-turn value is no longer appropriate for the absolute coordinate system.

For example: in a transmission system with transmission ratio n:m=1:5 (i.e., the motor rotates 5 turns and the turntable rotates 1 turn), when the multi-turn value of the absolute position coordinate zero position is 0 and the single turn value is 0, the encoder multi-turn data will overflow after the turntable rotates about 6554 turns, theoretically the motor rotates 32770 turns and the turntable rotates 6554 turns, at this time the motor multi-turn data overflows 3 turns and the encoder multi-turn At this time, the motor multi-turn data overflowed by 3 turns, the encoder multi-turn feedback value becomes -32766, at this time, the upper computer system operation, then the zero point position of the rotary table has been offset.

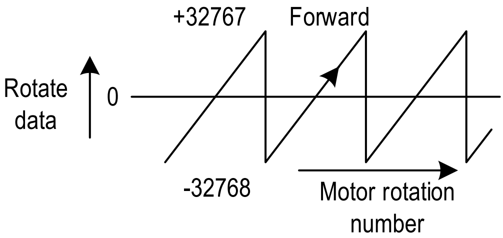


Figure 5.48 Encoder positive revolution overflow

When the upper limit of the number of revolutions is used, it is possible to keep the number of revolutions of the motor and the number of revolutions of the turntable from trailing in the relationship of the integer ratio.
Still using the above example, for a drive system with a ratio of n:m = 1:5 (i.e., 5 revolutions of the motor and 1 revolution of the rotary table), the table coordinates are no longer affected by the encoder multi-turn overflow when the upper limit of revolutions is set to 5.

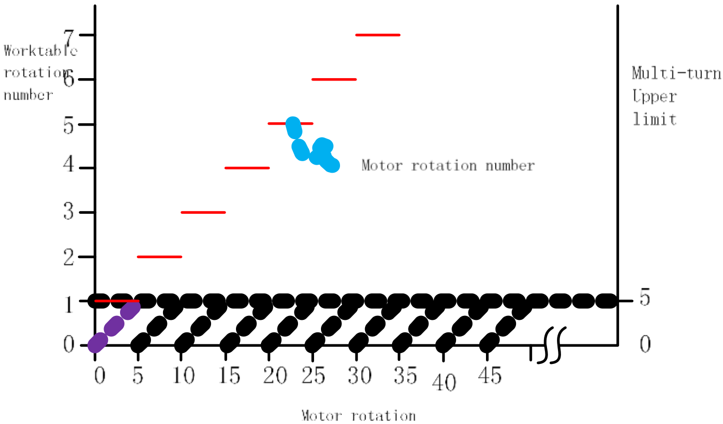
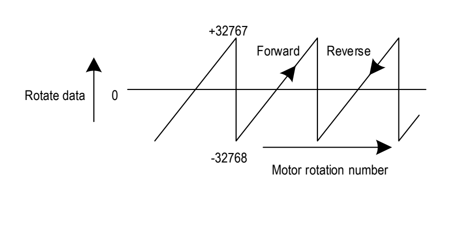
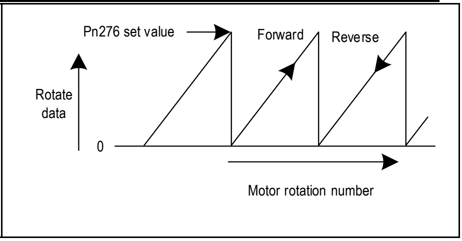


Figure 5.49 Table-motor rotation relationship at multi-turn limit

Correspondingly, the encoder multi-turn values (Un011), when the rotation turns are off and on are

Pn276 is 0	Pn276 is not 0

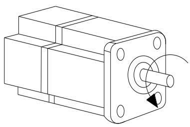




5.7.3 Related function codes

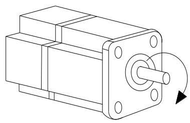
Fn No.	Parameter	Range	Default	Unit
Pn276	Upper limit of the number of revolutions	0 to 30,000	0	pen in
Pn277.X	Direction selection when the upper limit of rotation turns on	0: Motor running direction is CCW (counterclockwise) direction 1: Motor running direction is CW (clockwise) direction	0	-

The direction selection when the upper limit of rotation turns on is mainly to set the initial multi-turn zero position value. It is set according to the actual direction of motor operation and is based on the following.



Facing the shaft end, the motor rotates counterclockwise (CCW)

Pn277.X=0



Facing the shaft end, the motor rotates clockwise (CW)

Pn277.X=1

5.7.4 Steps for use

Step 1: Set the correct upper limit for the number of rotations (Pn276) according to the actual machine conditions.
Step 2: Set the direction selection (Pn277.X) when the upper limit of rotational turns is turned on.
Step 3: Use the auxiliary function Fn006 or the upper unit to clear the multi-turn value of the absolute encoder.

Precautions

	● This function is only valid when using absolute encoders. ● Set the direction of rotation of the motor correctly, and make sure that the actual direction of motor operation is the same as the direction set for the motor, otherwise the ER.840 alarm will be generated.

Chapter 6 Adjustment

6.1 Pre-adjustment considerations

6.1.1 Adjustment type

Tuning is a function that optimizes responsiveness by adjusting the servo gain of the servo unit.

The servo gain is set by a combination of several parameters (velocity loop gain, position loop gain, filter, friction compensation, rotational inertia ratio, etc.), which affect each other, so the setting must take into account the balance between the individual parameter settings.

The factory setting of the servo gain is a stable setting. Please use various adjustment functions to further improve the responsiveness according to the state of the user's machinery.

Adjustment types include adjustment-free function, inertia recognition, gain adjustment, filter adjustment, friction compensation, A-type vibration suppression control, low frequency vibration suppression, Easy FFT, etc.

6.1.2 Safety precautions during adjustment

When making adjustments, the servo unit protection function shown below should be set to a more appropriate value.

(1) Overtravel setting

For details on overtravel settings, refer to "5.1.7 Overtravel Settings".

(2) Torque limitation

The torque limiting function is a function that calculates the torque required for machine operation and limits the output torque so that it does not exceed that value. It can reduce the shock in case of a malfunction such as a disturbance or collision of the machine. If the torque is set lower than the value required for operation, overshoot or vibration may occur. See "5.1.12 Torque Limiting" for details.

(3) Position deviation threshold

The excessive position deviation alarm is an effective protection function when using the servo unit for position control. If the motor movement does not match the command, an abnormal condition can be detected and the motor can be stopped by setting an appropriate alarm value for excessive position deviation.

The position deviation is the difference between the position command value and the actual position, as detailed in function codes Pn264 and Pn266.

The position deviation can be expressed as the following equation for the position loop gain (Pn101) versus motor speed.

$$\text{Position deviation "Instruction unit"} = \frac{\text{Motor speed(rpm)}}{60} \times \frac{\text{Encoder resolution}}{Pn101} \times \frac{Pn206}{Pn204}$$

When the acceleration or deceleration of the position command exceeds the tracking capability of the motor, the following hysteresis will become larger, and thus the position deviation will not satisfy the above relationship. Please reduce the acceleration and deceleration of the position command to the value that the motor can track, or increase the value of the excessive position deviation alarm.

(4) Excessive position deviation alarm value at servo ON

If the servo is set to ON when the position deviation is accumulated, the motor will return to the original position in order to make the position deviation "0", which may cause danger. To avoid this, set an alarm value for excessive position deviation when the servo is ON to limit the movement.

(5) Vibration detection function

Please set the appropriate value for the vibration detection function via "Online vibration monitoring (Fn402)".

6.2 Adjustment-free function

6.2.1 Introduction to the adjustment-free function

The adjustment-free function is a function that allows stable response to be obtained by automatic adjustment regardless of the type of machinery and load fluctuations.

Related function codes.

Fn No.	Parameter	Range	Default	Unit
Pn175.X	Adjustment-free switch	0: Adjustment-free function is disabled 1: Adjustment-free function is effective	1	-
Pn175.Y	Speed control method in adjustment-free	0: for speed control 1: For speed control and use of the upper unit as position control	0	-
Pn175.Z	Adjustment-free rigidity value	0 to 9	0	-
Pn175.W	Adjustment-free load inertia	0: Small load inertia 1: Inertia of the load 2: High load inertia	0	-

The adjustment-free rigidity values correspond to the following bandwidths.

Value of adjustment-free rigidity (Pn175.Z)	Description
0	Response: Low
1	
2	
3	
4	
5	
6	
7	
8	
9	Response: High

6.2.2 Parameters when the adjustment-free function becomes ineffective

With the adjustment-free function active (Pn175.X=1), the following parameters become invalid.

Item	Function	Fn NO.
Gain (electronics)	Moment of inertia (mechanics)	Pn100
	2nd speed loop gain	Pn105
	2nd velocity loop integration time	Pn106
	2nd position loop gain	Pn107
	2nd torque command filtering time	Pn108
Smart Applications	Friction compensation function	Pn150.W
	Type A vibration suppression option	Pn140.X
Two sets of parameter selection switches	Gain Switching	Pn110.X

6.2.3 Adjustment-free function operation procedure

Steps	Description
1	Adjustment-free function on Pn175.X=1.
2	Adjustment-free value setting Pn175.Z To improve responsiveness, adjust the value of Pn175.Z to be

larger. To suppress vibration, adjust the value of Pn175.Z to a smaller value.

Value of adjustment-free rigidity (Pn175.Z)	Description
0	Response: Low
1	
2	
3	
4	
5	
6	
7	
8	
9	Response: High

Precautions	
	● The adjustment-free control function is valid for position control and speed control, but not for torque control. ● The motor may vibrate when used in excess of the allowable load inertia of the motor. In this case, turn down the no-adjustment load value (Pn175.W). ● During operation, perform this function in a state where an emergency stop is always possible to ensure safety.

6.3 Intelligent settings

6.3.1 Summary of intelligent settings

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

The Smart Set function is enabled in two ways.

- Activation by panel operation (intelligent adjustment with and without command input).
- Start of the host computer commissioning software.

(1) Advanced auto tuning without command input type

The following items will be adjusted when the no command input type advanced automatic adjustment function is on.

- Rotational inertia ratio
- Gain adjustment (speed loop gain, position loop gain, etc.)
- Filter adjustment (torque command filter, notch filter)
- Friction compensation
- Type A vibration suppression control
- Vibration suppression

(2) Command input type advanced auto tuning

When the intelligent adjustment function with command input is on, the following items will be adjusted.

- Gain adjustment (speed loop gain, position loop gain, etc.)
- Filter adjustment (torque command filter, notch filter)
- Friction compensation
- Type A vibration suppression control
- Vibration suppression

Precautions	
	● There is commanded intelligent setting to start adjustment with the current speed loop gain (Pn101) as the reference. If vibration occurs at the beginning of the adjustment, correct adjustment will not be possible. In this case, reduce the speed loop gain (Pn101) until the vibration is small, and then make the adjustment again.

6.3.2 Smart setting operation procedure

(1) Pre-implementation recognition matters

Be sure to check the following settings before executing the smart setting. If the settings are not set correctly, the function will not be executed during operation.

- No overtravel has occurred.
- Non-torque control.
- Gain switching selector switch for manual gain switching (Pn110.X = 0) and for gain 1.
- No alarms or warnings have occurred.
- The adjustment-free control function is disabled (Pn175.X = 0).

Precautions

	● When the speed control state performs no-command intelligent setting, it will automatically switch to position control to perform adjustment. Return to speed control when adjustment is complete. ● Intelligent setting with command cannot be executed in the torque control state. ● The command pulse input multiplier switching function becomes disabled during the execution of the setting only.

(2) Examples of adjustments that could not be performed or failed

Intelligent settings will not be executed properly in the following cases.

- Motor is in position control during power-on (in servo ON) (when there is commanded intelligent setting)
- When the mechanical system can only operate in one direction
- Narrower range of motion, when under 0.5 turns
- When the rotational inertia varies within the set operating range
- When the dynamic friction of the machinery is high
- When the rigidity of the machine is low and vibration occurs during positioning movements
- When speed feedforward is input
- Smaller positioning completion signal threshold (Pn262)

Precautions	
	● If the no command intelligent adjustment of variable inertia load fails, please change the adjustment mode and use the one-touch adjustment or adjustment-free function. ● For smart adjustment, set "Electronic gear ratio (Pn204/Pn206)" and "Positioning completion range (Pn262)", set to the value for the test run, otherwise the adjustment may fail or the adjustment result may not match the result of the test run.

6.4 One-touch tuning

One-touch tuning is a method of inputting a speed command or position command from the upper unit and manually making adjustments while running. By adjusting one or two values with the bandwidth setting, the relevant servo gain setting is automatically adjusted.

The one-touch tuner makes adjustments to the following items.

- Gain adjustment (velocity loop gain, position loop gain, etc.).
- Filter adjustment (torque command filter, notch filter).
- Friction compensation.
- Type A vibration suppression control.

If you cannot obtain satisfactory response characteristics by intelligent setting, use one-touch tuning. If you want to further fine-tune the gain of each servo after the one-touch tuning, refer to "Manual tuning function" to perform manual tuning.

If the setting is not correct, "NO-OP" will be displayed in the operation and the function cannot be executed. Before performing the bandwidth setting, be sure to check the following settings.

- Adjustment-free function selected as disabled (Pn175.X=0)
- When tuning is performed via speed control, the tuning mode is set to 0 or 1

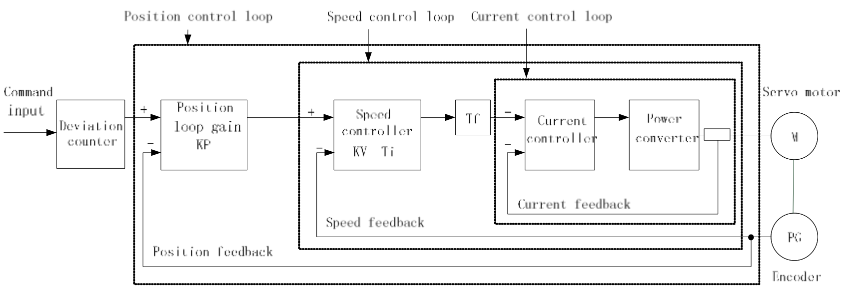
One-touch tuning is turned on by:

- Keypad panel "One-touch tuning (Fn303)".
- "One-touch tuning" of the host computer.

Precautions	
	● Set the rotational inertia ratio (Pn100) correctly before performing one-touch tuning.

6.5 Function adjustment

To adjust the servo gain, adjust the relevant gain parameters of the Servo Drive one by one based on an understanding of the Servo Drive's composition and characteristics. In most cases, if there is a large change in one parameter, the other gain parameters must be adjusted again. To confirm the response characteristics, prepare the relevant monitoring waveforms with the relevant debugging tool.



The Servo Drive consists of a position, velocity, and current loop, and the more inward the loop, the more the response characteristics need to be improved. Failure to observe this principle may result in poor responsiveness or vibration.

Since the current loop ensures adequate responsiveness, the customer does not have to make adjustments to the relevant parameters.

By manually adjusting the servo gain of the set servo unit, the response characteristics of the servo unit can be improved. For example, in position control, the positioning time can be shortened.

Please use manual adjustment in the following situations.

- When automatic adjustments cannot be successfully carried out.
- When there is a greater need to increase the servo gain than the result of automatic adjustment.
- When the customer wants to determine the servo gain to inertia ratio by himself/herself.

Precautions	
	● It is recommended that tuning be performed from the factory-set state of each parameter of the Servo Drive gain. ● Vibration may occur when adjusting the Servo Drive gain. It is recommended to turn on the alarm parameter setting for detecting vibration to be active (Pn185.X=1).

6.5.1 Gain adjustment

Example of adjustment steps

Steps	Description
1	Adjust the torque command filter time parameter (Pn104) and set it to no vibration.
2	Increase the speed loop gain (Pn101) as much as possible to the extent that the machinery does not vibrate, while decreasing the speed loop integration time parameter (Pn102).
3	Repeat steps 1 and 2 to reduce the already changed value by 10% to 20% amplitude.
4	For position control, the position loop gain (Pn103) is increased to the extent that the machinery does not vibrate.

Precautions	
	● When adjusting the Servo Drive gain, if one parameter is changed, the other parameters need to be readjusted as well. Please do not make a large change to a parameter alone. Please use the amplitude of about 5% as a general standard to fine-tune each servo gain parameter.

● For the procedure to change the servo parameters, observe the following.

When response needs to be improved.

① Reduction of the torque command filter time parameter (Pn104).
② Increasing the velocity loop gain (Pn101).
(iii) Decrease the velocity loop integration time parameter (Pn102).
④ Increase the position loop gain (Pn103).

When reducing the response, prevent vibration and overshoot when.

① Increasing the torque command filter time parameter (Pn104).
(ii) Reduce the speed loop gain (Pn101).
(iii) Increase the velocity loop integration time parameter (Pn102).
④ Reduce the position loop gain (Pn103).

(1) Position ring 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 will increase and the time required for positioning will be reduced. In general, the position loop gain cannot be increased beyond the inherent vibration number of the mechanical system. Therefore, to set the position loop gain to a larger value, you need to increase the machine rigidity and increase the inherent vibration number of the machine.

Fn No.	Parameter	Range	Default	Unit
Pn103	Position loop proportional gain	1.0 to 2000.0	40.0	1/s

Precautions

● The position loop proportional gain (Pn103) must not be set too large during motor operation, otherwise an overcurrent alarm may occur when the machinery is running at high speed. In this case, fault detection of excessive position deviation will become more difficult, and as a criterion for the setting value, refer to the following conditions.

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

where.

F_c: Maximum frequency of position command pulses (pulse/s).

K_p: Position loop gain (1/s).

1.2 to 2.0: Safety factor (protection against frequent excessive position deviations).

● When using the position command filter, the transition bias will increase depending on the filter time parameter. The setting value should take into account the stacking of the filter signal.

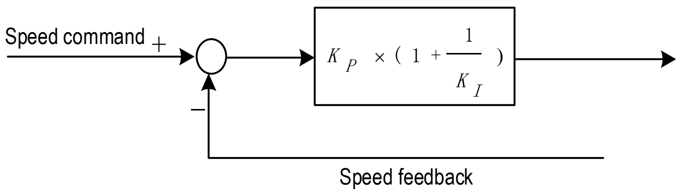
(2) Adjustment of speed loop proportional gain and speed loop integration time parameter

The velocity loop proportional gain (Kp) is the parameter that determines the responsiveness of the velocity loop. Since a low responsiveness of the velocity loop becomes a delay element of the outer position loop, overshoot or vibration of the velocity command can occur. For this reason, the higher the setting value, the more stable the servo system and the better the responsiveness, within the range that the mechanical system does not vibrate.

Fn No.	Parameter	Range	Default	Unit
Pn101	Speed loop proportional gain	1.0 to 2000.0	40.0	Hz

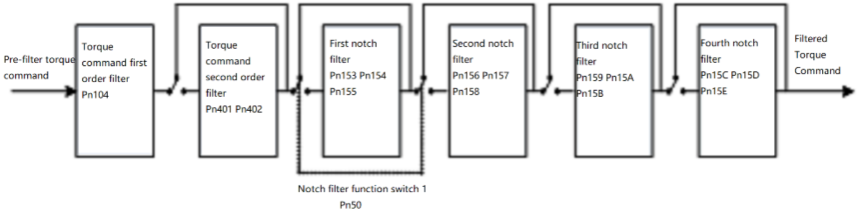
In order to respond to even small inputs, the velocity loop contains an integral element. Since this integral element is a delay element for the servo system, when the time parameter is set too large, overshoot occurs or the positioning time is prolonged, making the responsiveness worse.

Fn No.	Parameter	Range	Default	Unit
Pn102	Velocity loop integration time constant	0.15 to 512	20.0	ms



(3) Torque command filte

The torque command filter is serially configured with a primary delay filter, a secondary delay filter and a Notch filter, each playing its own role



Precautions	
⚠	● Torque command second-order filters are not valid at Pn401 = 5000 Hz and are valid at Pn401 < 5000 Hz. ● The 3rd notch filter is not valid at Pn159=5000Hz and is valid at Pn159<5000Hz. ● The 4th notch filter is not effective at Pn15C = 5000 Hz and is effective at Pn15C < 5000 Hz.

Low-pass filter

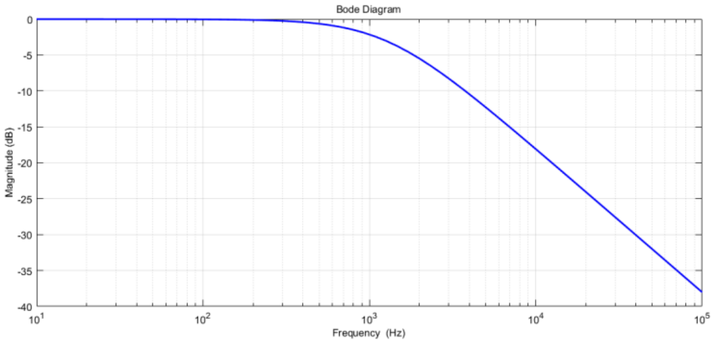
If mechanical vibration may be caused by the Servo Drive, it is possible to eliminate the vibration by parameterizing the torque command filtering time.
The smaller the value the more responsive control is possible, but subject to mechanical conditions.

Fn No.	Parameter	Range	Default	Unit
Pn104	Torque command filter time constant	0.00 to 655.35	1.00	ms
Pn401	Torque command second-order low-pass filter cutoff frequency	100 to 5000	5000	Hz
Pn402	Torque command second-order low-pass filter Q	0.50 to 1.00	1.00	ms

Precautions	
⚠	● Torque command second-order filters are not valid at Pn401 = 5000 Hz and are valid at Pn401 < 5000 Hz. ● The 3rd notch filter is not valid at Pn159=5000Hz and is valid at Pn159<5000Hz. ● The 4th notch filter is not effective at Pn15C = 5000 Hz and is effective at Pn15C < 5000 Hz.

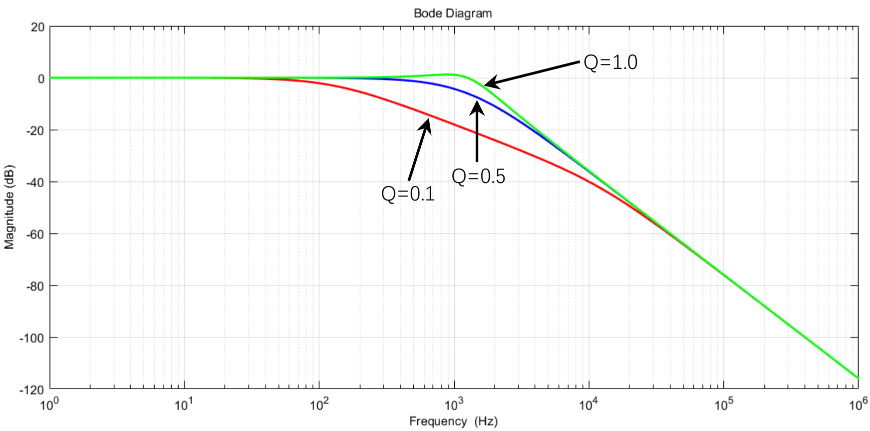
Example 1: For the torque command filter time Pn104 = 5ms, the cut-off frequency of the corresponding low-pass filter is 1256Hz, and the corresponding amplitude-frequency

characteristics of the filter are shown below: at 1256Hz, the amplitude decays -3DB.



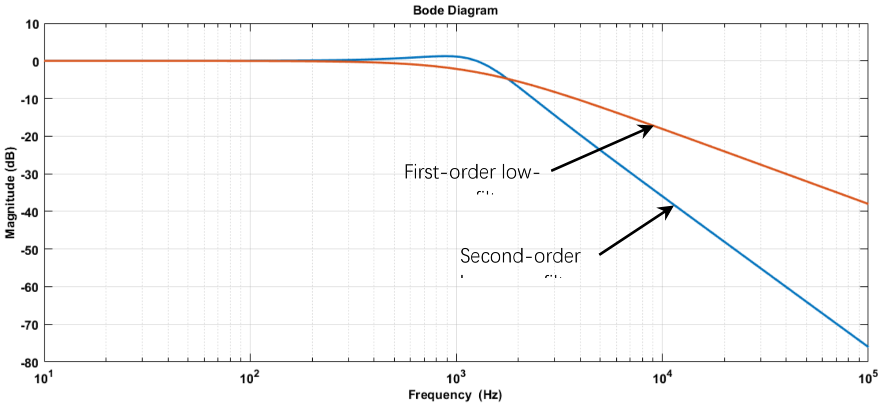
Precautions	
⚠	● The above low-pass filter frequency characteristics are obtained from theoretical model calculations and simulations, and there are some differences with the actual characteristics.

Example 2: The decay in amplitude diminishes as the Q value gradually increases for the cutoff frequency Pn402 = 1256 Hz of the torque command 2nd order filter.



Precautions	
⚠	● The above filter frequency characteristics are obtained from theoretical model calculations and simulations, and there are some differences with the actual characteristics.

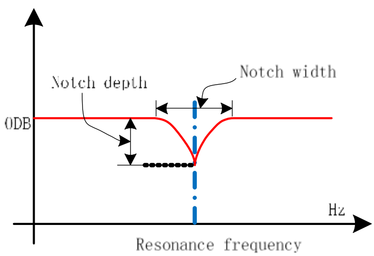
Example 3: The cut-off frequency of the torque command 1st order low-pass filter is 1256 Hz and the cut-off frequency of the torque command 2nd order filter is Pn402 = 1256 Hz with Q = 1.0 The filter frequency characteristics are shown below.

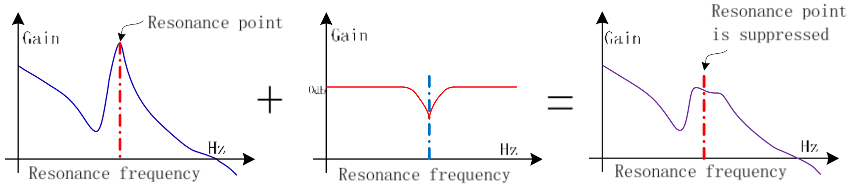


Precautions	
	● The above filter frequency characteristics are obtained from theoretical model calculations and simulations, and there are some differences with the actual characteristics.

Notch filter

A notch filter is a filter used to remove a specific vibration frequency component caused by resonance of a ball screw shaft, etc. The gain curve is shown in the figure below, and the specific frequency (hereinafter called the trap frequency) has a notch shape. This feature enables the elimination or reduction of frequency components near the trap frequency. The notch filter is set by three parameters: the notch filter frequency, the notch filter Q value, and the notch filter depth.





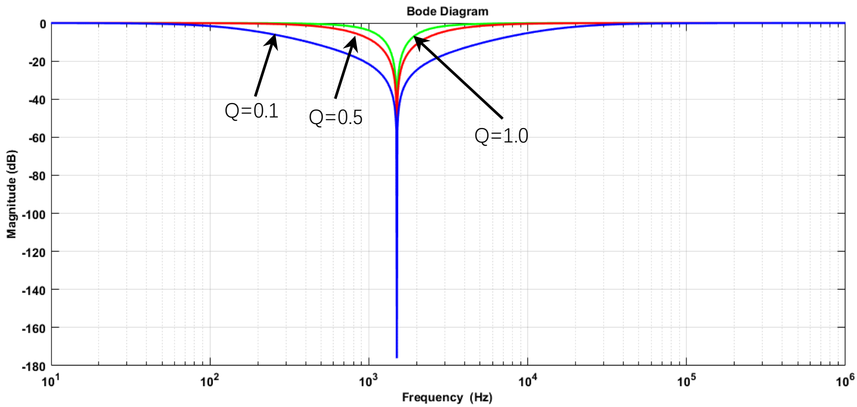
The notch filter Q and the notch filter depth D are described below.

Notch filter Q

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

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

Example: notch filter center frequency 1500Hz, trap depth D = 0, in the notch filter depth value (D) at different setting values amplitude attenuation effect graph.



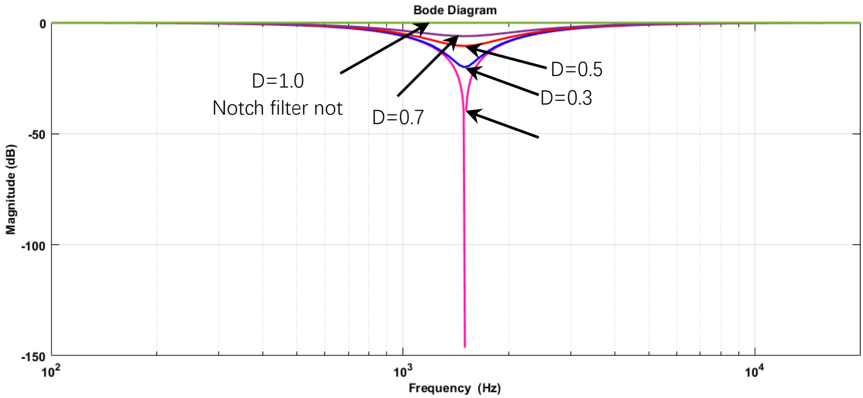
Precautions	
	● The above notch filter frequency characteristics are obtained from theoretical model calculations and simulations, and there are some differences with the actual characteristics.

Notch filter depth

The notch filter depth is the depth of depression (amplitude) that varies depending on the trap depth setting at a certain defined notch center frequency, depending on the notch filter depth (D).

The smaller the notch filter depth value (D), the deeper the depression, the better the vibration suppression control effect, but too small will increase the vibration.

Example: notch filter center trap frequency 1500Hz, notch filter width Q = 0.7, in the notch filter depth value (D) at different setting values amplitude attenuation effect graph.



Precautions	
	● The above notch filter frequency characteristics are obtained from theoretical model calculations and simulations, and there are some differences with the actual characteristics.

Related function code

Fn No.	Parameter	Range	Default	Unit
Pn153	Notch filter 1 frequency	50 to 5000	5000	Hz
Pn154	Notch filter 1Q value	0.50 to 10.00	7.00	–
Pn155	Notch filter 1 depth	0.000 to 1.000	0.00	–
Pn156	Notch filter 2 frequency	50 to 5000	5000	Hz
Pn157	Notch filter 2Q value	0.50 to 10.00	7.00	–
Pn158	Notch filter 2 depth	0.000 to 1.000	0.00	–
Pn159	Notch filter 3 frequency	50 to 5000	5000	Hz
Pn15A	Notch filter 3Q value	0.50 to 10.00	7.00	–

Pn15B	Notch filter 3 depth	0.000 to 1.000	0.00	-
Pn15C	Notch filter 4 frequency	50 to 5000	5000	Hz
Pn15D	Notch filter 4Q value	0.50 to 10.00	7.00	-
Pn15E	Notch filter 4 depth	0.000 to 1.000	0.00	-

6.5.2 Gain switching

The gain switching function includes "Manual Gain Switching" which uses an external input signal and "Auto Gain Switching" which switches automatically.
By using the gain switching function, you can increase gain and shorten positioning time during positioning, and decrease gain and suppress vibration when the motor is stopped.

Fn No.	Parameter	Range	Default	Unit
Pn110.X	Gain Toggle Selector Switch	0: Manual switching 1: Automatic switching	0	-
Pn110.Y	Position control gain auto switching condition	0: Positioning completion signal ON 1: Positioning completion signal OFF 2: Positioning proximity signal ON 3: Positioning proximity 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 to 65535	0	ms
Pn113	Gain switching transition time 2	0 to 65535	0	ms
Pn114	Gain switching wait time 1	0 to 65535	0	ms
Pn115	Gain switching wait time 2	0 to 65535	0	ms

Switched gain combinations

Parameter	Gain 1	Gain 2
Speed loop proportional gain	Pn101	Pn105
Velocity loop integration time	Pn102	Pn106

constant		
Position loop proportional gain	Pn103	Pn107
Torque command filtering time	Pn104	Pn108
Model tracking control gain	Pn241	Pn246
Model tracking control gain attenuation coefficient	Pn242	Pn247

Precautions	
	● The gain switching of Model Tracking Control Gain and Model Tracking Control Attenuation Coefficient is only available for "Manual Gain Switching". ● The gain switching of model tracking control gain and model tracking control attenuation coefficient is only effective when the drive is not commanded and the motor is stopped.

Gain switching method.

- Manual switching.
- Automatic switching.

For manual switching, you need to configure external input signal to control gain switching, and for automatic switching, you need to set the switching conditions and judge whether to switch according to the conditions.

(1) Manual switching

Related input signals

Value	Symbolic	Function	Instructions	Trigger	Mode
0x0E	/G-SEL	Gain Switching	This signal is used to switch the selection of the two gain bands for the speed and position modes. Invalid: switch to gain 1. Valid: switch to gain 2.	Level trigger	P S T

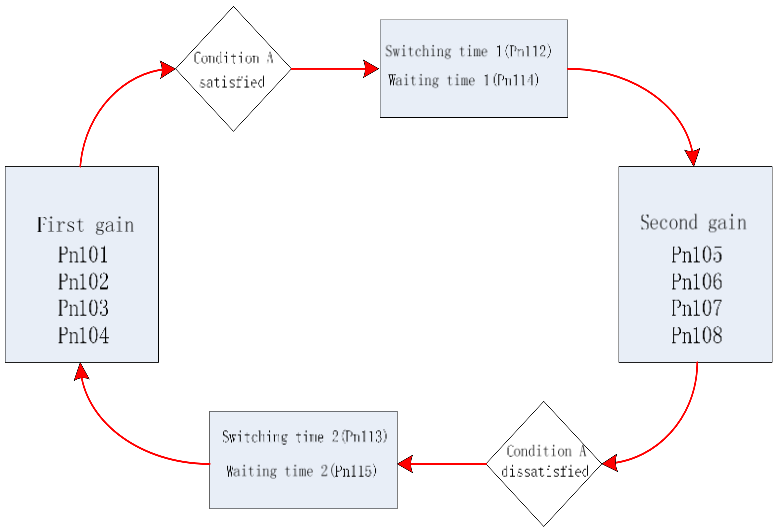
(2) Automatic switching

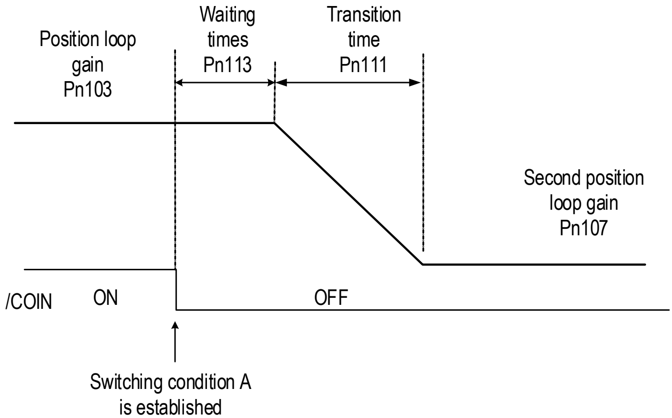
The "Auto switching gain" is only valid for position control, and the switching condition is executed by the following settings.

Parameters	Toggle condition	Switching gain	Switching wait time	Switching time
Pn110.Y setting	Condition A	Gain 1 → Gain 2	Waiting time 1	Switching

corresponds to switching condition A	holds		(Pn114)	transition time 1 (Pn112)
	Condition A does not hold	Gain 2 → Gain 1	Waiting time 2 (Pn115)	Switching transition time 2 (Pn113)

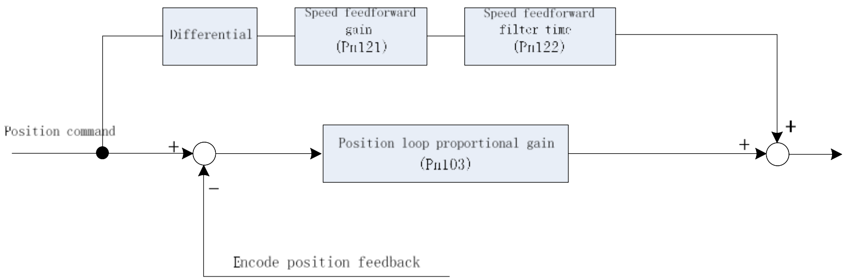
Example: In the automatic gain switching mode with the position completion signal (/COIN) ON, assume that the gain is switched from the position loop gain Pn103 to the second position loop gain Pn107. The /COIN signal of the switching condition is ON, and after waiting for the waiting time Pn114 from the time when the switching condition is established, the gain is changed linearly from Pn103 to Pn107 during the switching time Pn112.





6.5.3 Speed feedforward

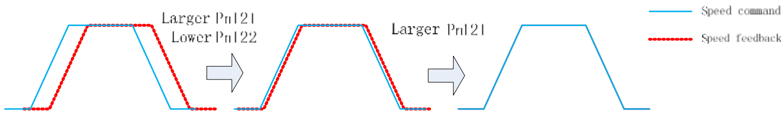
Speed feedforward is a function that performs feedforward compensation to reduce positioning time during position control.



Related function codes.

Fn No.	Parameter	Range	Default	Unit
Pn121	Speed feedforward gain	0 to 100	0	%
Pn122	Speed feed-forward filtering time	0 to 64.00	0.00	ms

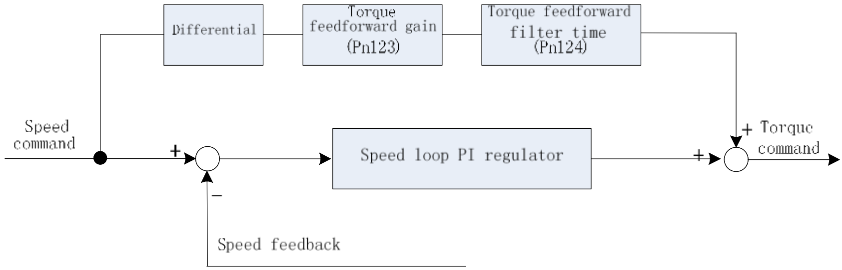
When the speed feedforward gain is turned on, an increase in the value of the speed feedforward gain improves the amount of speed following error when the speed control command changes smoothly; if the speed control command does not change smoothly, a decrease in the value of the gain reduces the operating vibration phenomenon of the mechanism. When the speed feedforward gain Pn121 is close to 100%, the more complete the precompensation is, the smaller the dynamic tracking error becomes.



Precautions	
	● The speed feedforward gain setting is too large and may cause the unit to vibrate, so set the value to 80% or less. ● When the speed feed forward gain Pn121 is set to 0%, the speed feed forward function is disabled.

6.5.4 Torque feedforward

Position control mode, using internal torque feedforward, can improve the torque command response and reduce the position deviation at fixed acceleration and deceleration; speed control mode, using torque feedforward, can improve the torque command response and reduce the speed deviation at fixed speed.



Related function codes.

Fn No.	Parameter	Range	Default	Unit
Pn123	Torque feedforward gain	0 to 100	0	%
Pn124	Torque feed-forward filtering time	0 to 64.00	0.00	ms

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

6.5.4 PI/P switching

PI-P control can be switched when the control mode is speed control or position control, and in mixed control mode, it is only effective when switching to speed mode and position mode. PI-P switching can be switched with the manual PI-P control signal (/P-CON) via the switching signal, and becomes P control when the /P-CON signal is set to ON. The conditions for automatic switching can also be selected with the parametric speed loop PI-P switching condition selection switch Pn10B.

(1) Manual PI-P control

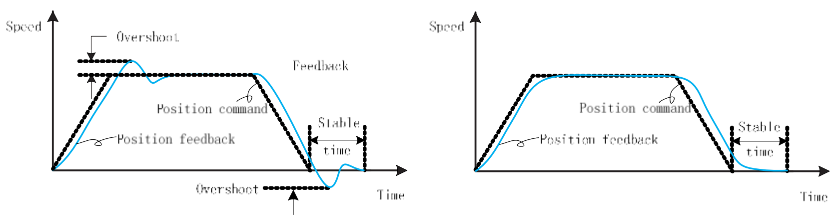
a) Configuration of manual PI-P control

Related input signals

Value	Symbolic	Function	Instructions	Trigger	Mode
0x05	P-CON	Speed loop PI<->P switch over	This signal is used to switch the PI (proportional/integral) regulator of the drive speed loop with the P (proportional) regulator. Invalid: becomes a PI controller (proportional/integral). Valid: becomes P controller (proportional).	Level trigger	P S T

(2) Automatic switching

Automatic PI-P switching is performed by setting the switching conditions via Pn131 and setting the switching condition values via Pn10C to Pn10F. By setting the switching conditions and condition values appropriately, overshoot during acceleration and deceleration can be suppressed and the stabilization time can be shortened.



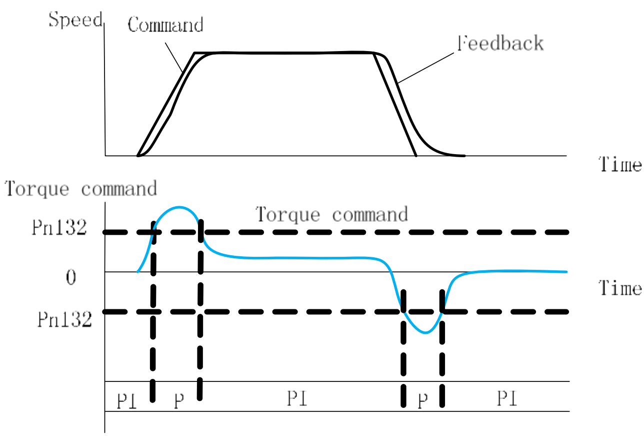
Unswitched PI adjustment effect Automatic switching PI-P condition effect

Fn No.	Parameter	Range	Default	Unit

Pn130.X	Speed loop PI-P switching condition selector switch	0: Conditional on internal torque command 1: Conditional on speed command 2: Conditioned on acceleration 3: Conditioned on position deviation pulses 4: No mode switch function	0	-
Pn132	Speed loop PI-P switching condition (torque command)	0 to 800	200	%
Pn133	Speed loop PI-P switching condition (speed command)	0 to 10,000	0	rpm
Pn134	Velocity loop PI-P switching condition (acceleration)	0 to 30,000	0	rpm/s
Pn135	Speed loop PI-P switching condition (position deviation)	0 to 10,000	0	command unit

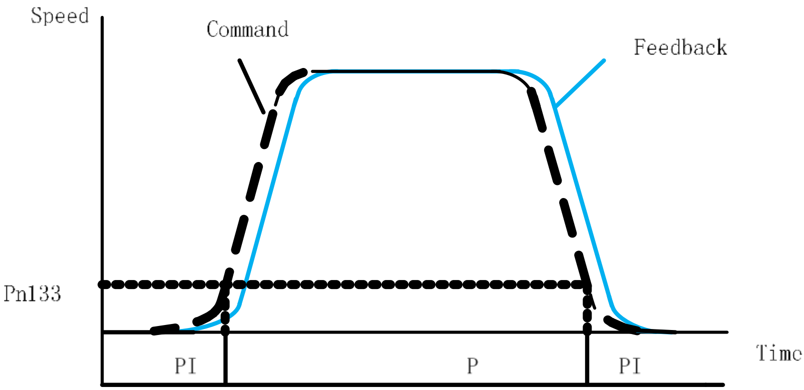
Switching commissioning of the mode switch as torque command

When the switching condition of the mode switch is used as the torque command (default), the torque command exceeds the torque set in Pn132 and the speed loop will switch to P control, see Figure 6.8. The factory torque command value is set to 200%.



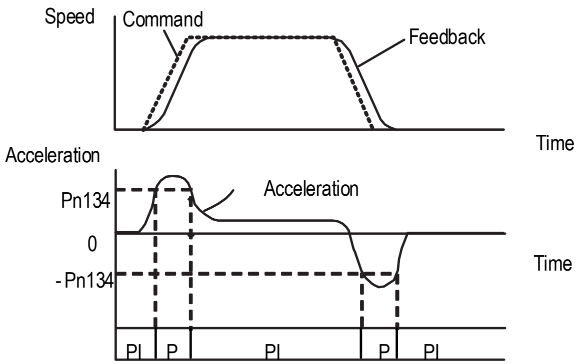
Mode switch switching condition as speed command

When the switching condition of the mode switch is used as the speed command, the speed loop will switch to P control when the speed command exceeds the speed set in Pn133.



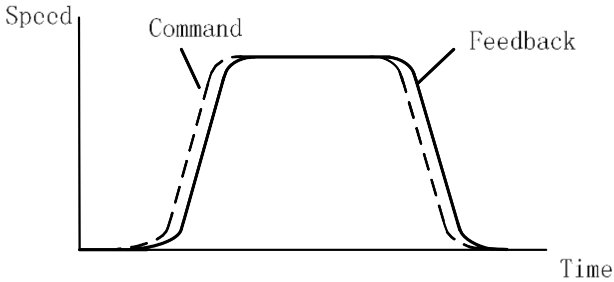
Mode switch switching condition as acceleration command

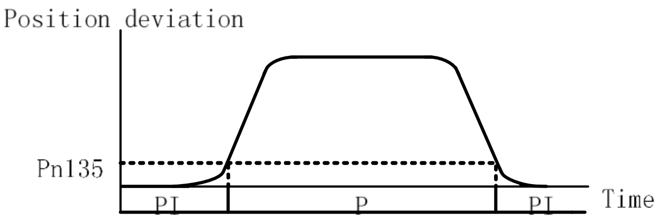
When the switching condition of the mode switch is acceleration, the speed loop will switch to P control when the speed command exceeds the acceleration set in Pn134.



Switching condition of the mode switch as position deviation

If the position deviation exceeds the value set in Pn135 when the switching condition of the mode switch is position deviation, the speed loop will switch to P control. It should be noted that this setting is only valid for position control.





6.5.5 Friction compensation

The friction compensation function is a function that compensates for viscous friction variations and fixed load variations.

The friction compensation function automatically adjusts the auxiliary functions with.

- Intelligent adjustment without command input (Fn201).
- Intelligent adjustment with command input (Fn202).
- One-touch tuning (Fn303).

The following description addresses the manual adjustment of the friction compensation parameters.

(1) Related function codes

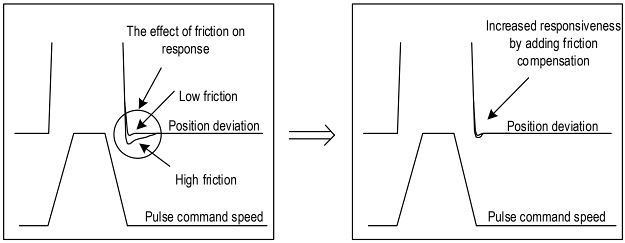
Fn No.	Parameter	Range	Default	Unit
Pn150.W	Friction compensation function enabled	0: No friction compensation function is used 1: Use the friction compensation function	1	-
Pn161	Friction compensation gain	10 to 1000	100	%
Pn162	2nd friction compensation gain	10 to 1000	100	%

Pn163	Friction compensation factor	0 to 100	0	%
Pn164	Friction compensation frequency correction	1.0 to 1000.0	0	Hz
Pn165	Friction compensation gain correction	0 to 1000	100	%

Precautions	
	● When using the friction compensation function, set the rotational inertia ratio (Pn100) as correctly as possible. If the rotational inertia ratio is set incorrectly, vibration may be caused.

(2) Friction compensation function operation procedure

Steps	Item	Operations
1	Related parameter settings	Pn161 = 100 (friction compensation gain of 100%). Pn162 = 100 (2nd friction compensation gain is 100%) Pn163 = 0 (friction compensation factor of 0, no compensation). Pn164 = 0 (friction compensation frequency corrected to 0 Hz). Pn165 = 100 (friction compensation gain corrected to 100%). Note: Make sure Pn164 and Pn165 are always at the factory settings.
2	Friction compensation factor adjustment	Pn163: Friction compensation factor During the operation of the equipment, the position deviation is monitored dynamically and in time by means of the upper computer software oscilloscope. At the same time, the size of the friction compensation coefficient (Pn163) is gradually changed to check whether the change in the friction compensation coefficient (Pn163) has improved the actual position deviation.
3	Friction compensation gain adjustment	Pn161: Friction compensation gain If adjusting the friction compensation coefficient (Pn163) is not effective, adjust the friction compensation gain (Pn161), and after adjusting the friction compensation gain (Pn161), return to step 2 for adjustment of the compensation coefficient (Pn163). Repeat steps 2 and 3.
4	Comparison of adjustment effects	The following diagram shows the effect before and after the adjustment.

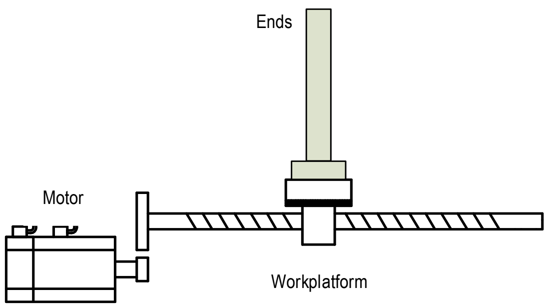
<table>
<tr><td></td><td></td><td>

Before friction compensation
After friction compensation</td></tr>
</table>

Precautions	
	● The higher the setting of the friction compensation gain (Pn161), the better the responsiveness to external disturbances, but too large a setting Vibrations are easily generated. ● The higher the setting value of friction compensation coefficient (Pn63), the better the effect, but too high a setting value is prone to vibration. Recommended users are set at 90% or less.

6.5.6 Low frequency vibration suppression

If the system is not sufficiently rigid during servo system operation, the mechanical drive end will continue to oscillate even after the motor body has come to a near standstill at the end of the positioning command, and the low frequency vibration suppression function is used to slow down the oscillation of the mechanical drive end.
The low frequency vibration suppression range is 1.0 Hz to 100.0 Hz.
The following description addresses the manual adjustment of the friction compensation parameters.

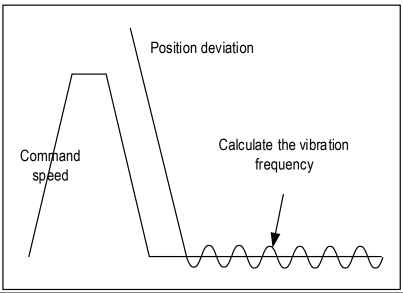


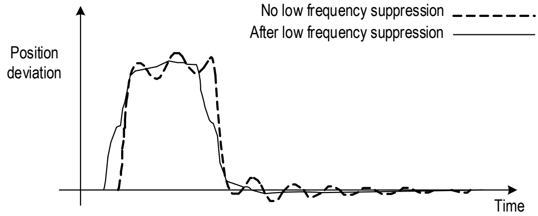
Related function codes

Fn No.	Parameter	Range	Default	Unit
Pn232	Low frequency vibration detection sensitivity (Positioning completion signal threshold)	0.1 to 300.0	40.0	%
Pn233	Low frequency vibration suppression 1 frequency A	1.0 to 250.0	50.0	0.1Hz
Pn234	Low Frequency Vibration Suppression 1 Frequency B	1.0 to 250.0	70.0	0.1Hz
Pn235	Low Frequency Vibration Suppression 2 Frequency	1.0 to 200.0	80.0	0.1Hz
Pn236	Low frequency vibration suppression 2 complement	10 to 1000	100	%

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

Friction compensation function operation procedure

Steps	Item	Operations
1	Detection of vibration frequency	The real-time position deviation values are monitored using the upper digital oscilloscope, and the corresponding frequencies are acquired for the position deviations acquired by the monitoring. 
2	Parameter Settings	Pn235: low frequency vibration suppression 2 frequency (Pn235) Set the vibration frequency obtained in step 1 to Pn235.
3	Comparison of adjustment	After the suppression frequency set in step 2, check whether the suppression effect is as expected, and fine-tune the corresponding suppression frequency near the set suppression

	effects	frequency until the desired effect is achieved. 

Chapter 7 Auxiliary functions

7.1 List of Auxiliary Functions

The auxiliary functions are displayed as numbers beginning with Fn for servo motor trial operation, adjustment, information inquiry and other related functions.

Fn No.	Function description	Reference
Fn000	Historical fault information search	7.2
Fn001	Clear alarm records •	7.3
Fn002	Software Reset (Soft ReSet)	7.4
Fn003	User parameters restored to defaults	7.5
Fn005	JOG operation	7.6
Fn006	Program JOG operation	7.7
Fn007	Motor parameter writing	7.8
Fn008	Setting (initialization) of the absolute encoder and	7.9
Fn010	Disable parameter writing	7.10
Fn011	Display of motor model information	7.11
Fn012	Display software version information (MCU and FPGA)	7.12
Fn01E	Display of Servo Drive model information	7.13
Fn080	Motor pole position identification	7.14
Fn200	Turningless function	7.15
Fn201	No command input type advanced adjustment	7.16
Fn202	Advanced adjustment with command input type	7.17
Fn203	Trouble clearing	7.18
Fn204	Type A vibration suppression control function	7.19
Fn300	Forced output of terminal signals	7.20
Fn301	Position command counter cleared	7.21
Fn302	Zeroing of the encoder feedback position counter	7.22
Fn303	One-touch tuning function	7.23
Fn304	Home return zero setting	7.24
Fn305	Soft limit setting	7.25
Fn400	Encoder over-temperature alarm threshold setting	7.26
Fn401	Easy FFT	7.27
Fn402	Online monitoring of vibrations	7.28

7.2 Historical fault information search (Fn000)

The Servo Drive has a fault traceability display that can retroactively display up to ten alarms that have been generated.

The traceability contains.

① The code when alarms.

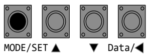
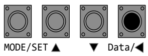
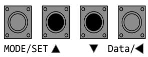
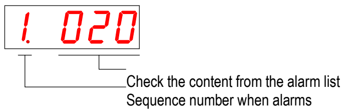
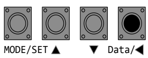
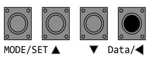
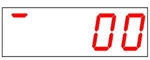
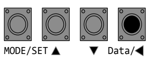
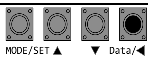
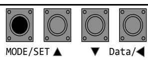
② The time when alarms.

The time when an alarm occurs is measured in 100ms units for the duration of time after the control power is turned on. If it is operated 24 hours a day, 365 days a year, it can be measured continuously for about 13 years.

Example of time display when alarms.

When 72000 is displayed, 72000 x 100 [ms] = 7200 [s] = 120 [min] = 2 [h].

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1			Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2			Pressing the DATA/SHIFT key for about 1 second displays the latest alert, as shown on the left picture.
3			Each press of the DOWN key displays an old alarm backwards; each press of the UP key displays a new alarm backwards. The larger the number in the left end digit, the older the alarm displayed. 
4			Pressing the DATA/SHIFT key displays the last 4 digits of the time when the fault occurred
5			Pressing the DATA/SHIFT key displays the middle 4 digits of the time when the fault occurred
6			Pressing the DATA/SHIFT key displays the first 2 digits of the time when the fault occurred
7			Pressing the DATA/SHIFT key returns to the display of the alarm number
8			Press MODE/SET to return to the Fn000 display

CAUTION

- When the same alarm occurs consecutively, it is not saved if the interval between the occurrence of alarms is less than one hour, otherwise it will be saved.
- When no alarms, "□." is displayed on the panel operator. ----".
- Alarm logging can be cleared by "Clear Alarm Logging (Fn001)". Even if you perform an alarm reset or Disconnecting the main circuit power to the servo unit also does not clear the alarm log.

7.3 Clearing alarm records (Fn001)

This function is used to clear the alarm record of the Servo Drive. Alarm records generated by the Servo Drive Unit cannot be cleared even if an alarm reset is performed or the main circuit power to the Servo Unit is disconnected. Only use this auxiliary function to clear the relevant records.

The basic setup procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn001	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn001 is displayed.
3	trCL0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second, then the display will be as shown on the left.
4	trCL2	MODE/SET ▲ ▼ Data/◀	Press the Up key to set the current display value to "trCL2".
	donE (blinking)	MODE/SET ▲ ▼ Data/◀	Press the MODE key to clear the fault record, and when the fault record is cleared, "donE" flashes and returns to the display on the left. When the display is not "trCL2", press the "MODE" key, then the display will show "no-op", which means the writing operation is prohibited.
5	trCL2	—	After displaying donE, the status display of "trCL2" is returned.
6	Fn001	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to return to the Fn006 display.

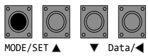
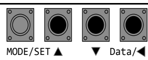
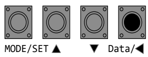
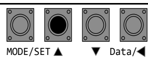
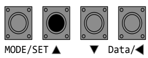
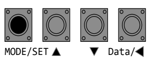
CAUTION

● Before clearing the alarm message, make sure that the parameter write ban function (Fn010) is not set to "Prohibit writing".

7.4 Software reset (Fn002)

The Servo Drive can be reset from within by software. This is used when some parameters need to be turned back on after changing the parameter settings. It is also possible to make the setting effective without turning on the power again.

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn002		Adjust by pressing the "UP" or "DOWN" key until Fn002 is displayed.
3	rSt0		Press the "DATA/SHIFT" key for about 1 second and the display will appear as shown on the left picture.
4	rSt2		Press the "UP" button until the display shows the figure on the left picture.
5	rSt2		When "rst2" is displayed, press the "MODE" key and the drive enters the reset and reboot state. Pressing the "MODE" key while other states are displayed will cause the drive to display the "no-op" disable operation flag.
6	.oFF		Press the "MODE/SET" key and the drive will perform a software reset, after the reset is complete, the display will be as shown on the left picture.

CAUTION

● This function must be operated from the state of servo OFF.

● This function is not related to other devices and can reset the servo driver with the same effect as the processing when the power is turned on. The servo driver will output the ALM signal, and other output signals may be changed forcibly.

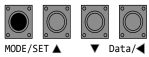
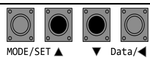
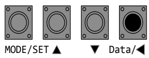
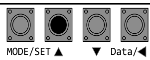
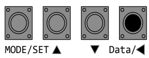
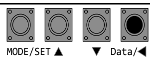
● The parameter disable function (Fn010) is not set to "Prohibit Writing".

7.5 User parameter reset (Fn003)

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

CAUTION
● Parameter set value initialization must be executed in the servo OFF state, and cannot be executed in the servo ON state. ● In order for the setting to take effect, the power of the servo unit must be turned on after operation.

The basic setup procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn003		Adjust by pressing UP or DOWN until Fn003 is displayed.
3	P.Int0		Press the DATA/SHIFT key for about 1 second, then the display will be as shown on the left picture.
4	P.Int2		Press and hold the UP key until "P.Int2" is displayed.
5	donE (blinking)		Press MODE/SET to restore the user parameters to their defaults. After setting is complete, donE flashes for about 1 second. When the "MODE" key is pressed while "P.Int2" is not displayed, the "no-op" prohibition sign is displayed.
6	P.Int2	—	When donE is displayed, the status display of "P.Int2" is returned.
7	Fn003		Press the DATA/SHIFT key for about 1 second to return to the display of Fn003.

CAUTION
● After the initialization of the parameter setting is completed, the power of the servo unit needs to be turned on again.

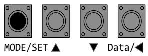
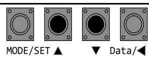
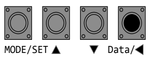
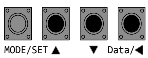
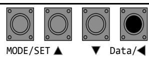
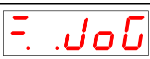
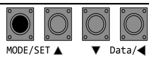
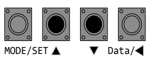
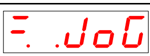
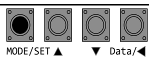
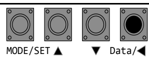
7.6 JOG runs (Fn005)

JOG operation is a function to confirm the servo motor action by speed control without connecting to the upper unit.

Related Function Code

Pn500	Jogging speed (JOG)		○	Address: 0x0500
Default: 200	Setting range: 0～10000	Unit: 1rpm		Mode: $\boxed{P}$ $\boxed{S}$ $\boxed{T}$

The basic setup procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn005		Adjust by pressing UP or DOWN until Fn005 is displayed.
3	0200		Press the DATA/SHIFT key for about 1 second, then the display will be as shown on the left. Note: The Pn500 is used as the reference point for initial entry.
4	0085		Adjust the desired tap speed by pressing UP, DOWN and DATA/SHIFT. Note: The maximum speed jogging value is 1200 rpm.
5			Press the MODE/SET key, then the display will be as shown on the left.
6			Press MODE/SET to enter the servo ON state
7			Press the UP key (forward rotation) or DOWN key (reverse rotation) and the servo motor rotates at the speed set in step 4 while the key is pressed.
8			Press MODE/SET to enter the servo OFF state
9	Fn005		Press the DATA/SHIFT key for about 1 second to return to the Fn005 display

CAUTION

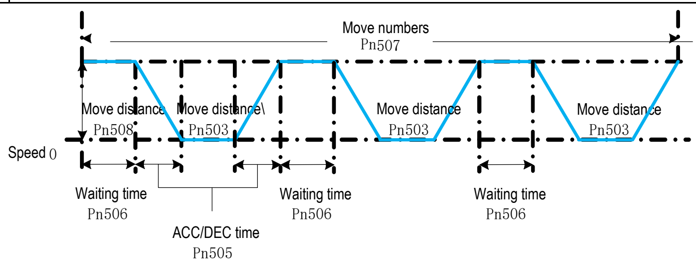
	● Please set the appropriate JOG speed value. ● Make sure that the JOG move is within the mechanical operation range. ● The parameter disable function (Fn010) is not set to "No Write". ● The main circuit power should be turned on. ● No alarm occurs. ● The servo is OFF.

7.7 Program JOG Run (Fn006)

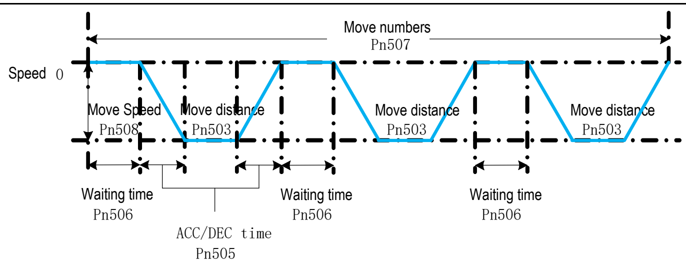
Program JOG operation is a function that continuously operates by pre-set operation mode (Pn502), travel distance (Pn503), acceleration and deceleration time (Pn505), wait time (Pn506), move numbers (Pn507), and travel speed (Pn508). This function is the same as JOG operation (Fn002), and the setting does not require connection to the upper unit, so it can confirm the move of the servo motor and perform a simple positioning action.

(1) Program JOG operation mode

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

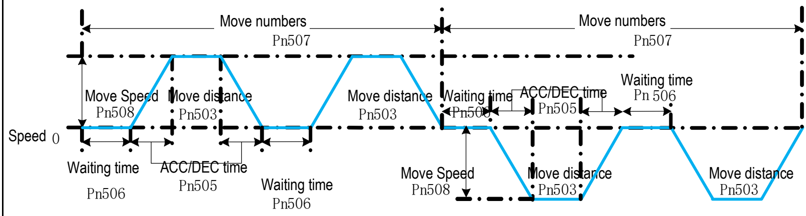
<table>
<tr><td>Pn502=0</td><td colspan="2">(Waiting time Pn506 → Forward move Pn503) × Move numbers Pn507</td></tr>
<tr><td>Speed Schematic</td><td>

Note: Set Pn507 (Move numbers) to "0" for an unlimited number of runs.</td></tr>
</table>

<table>
<tr><td>Pn502=1</td><td colspan="2">(Waiting time Pn506 →Forward move Pn503) × Move numbers Pn507</td></tr>
<tr><td>Speed Schematic</td><td>

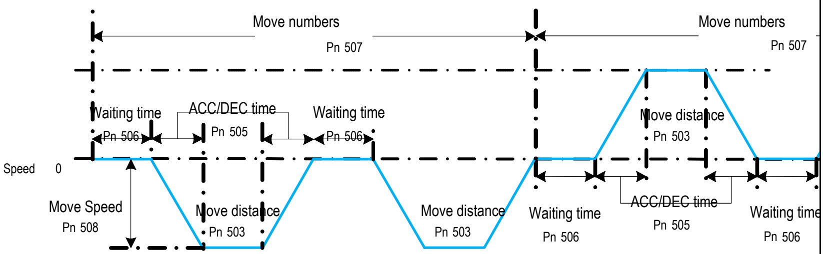
Note: Set Pn507 (Move numbers) to "0" for an unlimited number of runs.</td></tr>
</table>

<table>
<tr><td>Pn502=2</td><td>(Waiting time Pn506→Forward move Pn503→Waiting time Pn506→Forward move Pn503) × Move numbers Pn507
(Wait time Pn506→Reverse move Pn503→Wait time Pn506→Reverse move Pn503) × Move numbers Pn507</td></tr>
<tr><td>Speed Schematic</td><td>Note: Set Pn536 (Move numbers) to "0" for an unlimited number of runs.



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

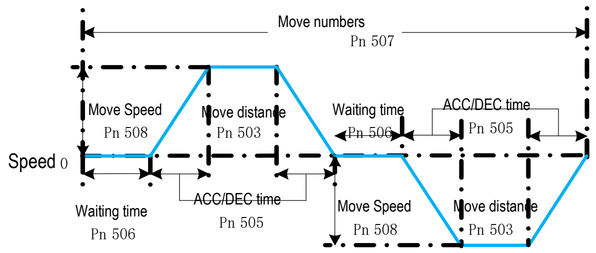
<table>
<tr><td>Pn502=3</td><td>(Waiting time Pn506→Reverse move Pn503→Waiting time Pn506→Reverse move Pn503) × Move numbers Pn507
(Waiting time Pn506→Forward move Pn503→Waiting time Pn506→Forward move Pn503) × Move numbers Pn507</td></tr>
<tr><td>Speed Schematic</td><td>



Note: Set Pn507 (move numbers) to "0" for an unlimited number of runs.</td></tr>
</table>

Pn502=4	(Waiting time Pn506 → Forward move Pn503 → Waiting time Pn506 → Reverse move Pn503) × Moves number Pn507

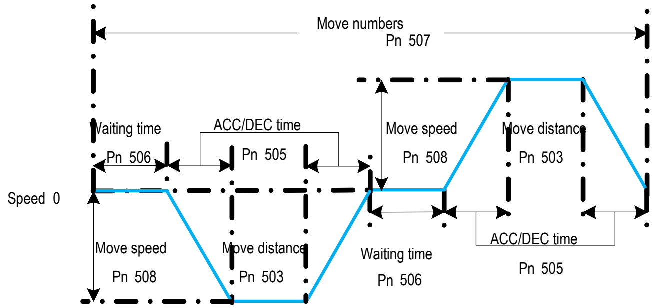
Speed Schematic



Note: Set Pn507 (move numbers) to "0" for an unlimited number of runs.

Pn502=5	(Waiting time Pn506 → Reverse move Pn503 → Waiting time Pn506 → Forward move Pn503) × Move numbers Pn507

Speed Schematic



Note: Set Pn507 (move numbers) to "0" for an unlimited number of runs.

Related function codes.

Pn502	Program JOG operation method		○	Address: 0x0502
Default: 0	Setting range: 0 to 5	Unit: N/A		Mode: P S T

3rd 2nd 1st 0th

W Z Y X

X: Program JOG operation method

0	(Waiting time Pn506→Forward move distance Pn503) × Move numbers Pn507
1	(Waiting time Pn506→Reverse move distance Pn503) × Move numbers Pn507
2	(Waiting time Pn506→Forward move distance Pn503) × Move numbers Pn507 (Waiting time Pn506→Reverse move distance Pn503) × Move numbers Pn507
3	(Waiting time Pn506→Revere move distance Pn503) × Move numbers Pn507 (Waiting time Pn506→Forward move distance Pn503) × Move numbers Pn507
4	(Waiting time Pn506→Forward move distance Pn503→(Waiting time Pn506 → reverse move distance Pn503) × Move numbers Pn507
5	(Waiting time Pn506→Reverse move distance Pn503→(Waiting time Pn506 →Forward move distance Pn503) × Move numbers Pn507

Y: Reserved (No change)

Z: Reserved (No change)

W: Reserved (No change)

Pn503	Program JOG move distance			Address: 0x0503
Default: 60,000	Setting range: 1 to 1073741824	Unit: 1 command unit		Mode: P S T
Pn505	Program JOG acceleration and deceleration time			Address: 0x0505
Default: 100	Setting range: 2 to 10000	Unit: 1ms		Mode: P S T
Pn506	Program JOG wait time			Address: 0x0506
Default: 100	Setting range: 0 ~ 10000	Unit: 1ms		Mode: P S T
Pn507	Number of program JOG moves			Address: 0x0507
Default: 1	Setting range: 0 to 1000	Unit: 1 time		Mode: P S T

Pn508	Program JOG move speed		Address: 0x0508
Default: 500	Setting range: 1 to 10000	Unit: 1rpm	Mode: P S T

CAUTION

● If the program JOG operation mode is set to modes 2 and 3, and the number of program JOG moves is 0, the drive generates an Error warning.

The basic setup procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn006	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn004 is displayed.
3	P.JOG	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second, then the display will be as shown on the left.
4	P.JOG	MODE/SET ▲ ▼ Data/◀	Press the MODE/SET button to enter the servo ON state.
5	P.JOG	MODE/SET ▲ ▼ Data/◀	If the UP or DOWN key is pressed in the direction of the initial action that matches the operation mode, the action starts after the set waiting time. Note: If the MODE/SET key is pressed during operation, the servo OFF state is entered and the motor stops running. If the DATA/SHIFT key is pressed for about 1 second during operation, it returns to step 2.
6	P.JOG	MODE/SET ▲ ▼ Data/◀	If the program JOG has finished running, the blinking display shows "End" and returns to the left display.
7	Fn006	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to return to the display of Fn004.

CAUTION

	● Please set the appropriate JOG speed value. ● Make sure that the JOG move is within the mechanical operation range. ● The parameter disable function (Fn010) is not set to "disable writing". ● When overtravel occurs during operation, the corresponding overtravel protection action is performed. ● When setting the travel distance and travel speed, the operating range of the machine used and the safe travel speed must be considered. ● Although the program JOG operation is position control, it is not possible to input pulse commands to the servo unit. ● The position command filtering function can be executed during program JOG operation.

7.8 Motor parameter writing (Fn007)

The motor parameter write function is used to write motor-related parameters to the serial encoder EEPROM.

The basic setup (initialization) steps are shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn007	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn007 is displayed.
3	EEPr0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second, and "EEPr0" is displayed.
4	EEPr2	MODE/SET ▲ ▼ Data/◀	Press the "UP" button twice to adjust to "EEPr2".
5	donE (blinking)	MODE/SET ▲ ▼ Data/◀	Press the "MODE" key to write the motor data to the encoder EEProm, when the display is not "Eepr2", press the "MODE" key, the display will be When the display is not "Eepr2", press "MODE", the display will be "no-op", which means the writing operation is prohibited. After the parameter is written successfully, the panel will display "donE" and flash for about 1 second.
6	EEPr2	-	When donE is displayed, the status display of "EEPr2" is returned.
7	Fn007	MODE/SET ▲ ▼ Data/◀	Pressing the DATA/SHIFT key returns the display to Fn007.

CAUTION

	● The parameter disable function (Fn010) is not set to "Prohibit writing". ● Do not operate the machine while the relevant parameter is written to the encoder. Accidental mechanical moves may occur, resulting in personal accidents or mechanical damage. ● Random setting of relevant parameters may cause damage to the machine.

7.9 Setting of the absolute encoder (Fn008)

The absolute encoder must be set (initialized):

- When the machine is initially started.
- When the "Encoder backup alarm (ER.810)" occurs.
- When the serial data of the absolute encoder's rotation is to be initialized.

The basic setup (initialization) steps are shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn008	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn008 is displayed.
3	PGCL0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second, then PGCL1 is displayed.
4	PGCL2	MODE/SET ▲ ▼ Data/◀	Press and hold the UP button until "PGCL2" is displayed.
5	donE (blinking)	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to start setting (initializing) the absolute encoder. After setting is complete, donE flashes for about 1 second.
6	PGCL2	-	After displaying donE, the display of "PGCL2" is returned.
7	Fn008	MODE/SET ▲ ▼ Data/◀	Pressing the DATA/SHIFT key returns the display to Fn008.

CAUTION	
	● After setting the absolute value encoder, the rotation data is the value in the range of - 2 revolutions to + 2 revolutions. Due to mechanical system, the reference position of the upper device will change. Please determine the reference position of the upper device according to the set position. ● If the machine is operated without positioning the upper device, unexpected mechanical action may occur, resulting in personal accidents, Or mechanical damage, please operate the machine carefully.

	● Parameter prohibition function (fn010) cannot be set to "write prohibition"; ● Please perform basic setting (initialization) in servo off state. ● "Encoder backup alarm (ER. 810)" cannot be input through the alarm reset (/ alm-rst) of the servo unit. For signal contact, be sure to set (initialize) through fn008. ● When the alarm (ER. 8 □□) monitored inside the encoder occurs, do not use the method of cutting off the power supply to release the alarm.

7.10 Prohibition of parameter changes (Fn010)

This auxiliary function is mainly used to inadvertently change parameters and to restrict the functions that perform the auxiliary function.

When the user sets "Prohibit parameter change", the following restrictions apply when changing parameters and performing auxiliary functions.

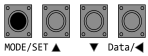
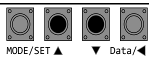
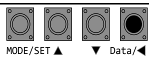
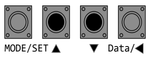
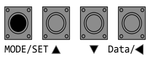
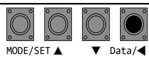
(1) Parameters: Cannot be changed. If the user changes the function code parameter, "No-OP" is displayed flashing and the menu returns to the previous level.

(2) Auxiliary function: Part of the function cannot be executed. If the user tries to perform the following auxiliary functions, "No-OP" is displayed flashing and returns.

Fn No.	Function description	Prohibit Writing
Fn000	Display of fault logs	Yes
Fn001	Clear alarm records	No
Fn002	Software Reset (Soft ReSet)	No
Fn003	User parameters restored to defaults	No
Fn005	JOG runs	No
Fn006	Program JOG runs	No
Fn007	Motor parameter writing	No
Fn008	Setting (initialization) of the absolute	No
Fn010	Disable parameter writing	Yes
Fn011	Display of motor model information	Yes
Fn012	Display software version (MCU and FPGA)	Yes
Fn01E	Display of Servo Drive model information	Yes
Fn080	Motor pole position identification	No
Fn200	TurningLess function	No
Fn201	No command input type advanced adjustment	No
Fn202	Advanced adjustment with command input type	No
Fn204	Type A vibration suppression control	No
Fn203	Alarm clearing	No
Fn205	Low frequency vibration suppression function	No

Fn300	Forced output of terminal signals	No
Fn301	Position command counter cleared	No
Fn302	Zeroing of the encoder feedback position	No
Fn303	One-touch tuning	No
Fn304	Home return zero setting	No
Fn305	Soft limit setting	No
Fn401	Easy FFT	No
Fn402	Online monitoring of vibrations	No

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn010		Adjust by pressing UP or DOWN until Fn010 is displayed.
3	P.0000		Press the DATA/SHIFT key for about 1 second, then the display will be as shown
4	P.0001		Press the UP/DOWN key to set the corresponding value. P.0000: Allow parameter change [factory default] P.0001: Prohibition of parameter changes
5	P.0001		Press the MODE/SET button to confirm the setting. After successful setting, "DonE" will flash as shown on the left picture after the display. Note: If a value other than "P.0000" or "P.0001" is set, "Error" is displayed.
6	Fn010		Press the "DATA/SHIFT" key to return to the "Fn010" display.

7.11 Display of motor model information (Fn011)

This auxiliary function is used to display the motor model information, which includes the motor code, power rating, current rating (peak), and maximum current (peak).

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn011	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn011 is displayed.
3	u.0220	MODE/SET ▲ ▼ Data/◀	Pressing the DATA/SHIFT key for about 1 second displays the servo motor voltage code. No. / Type V.0220 / AC220V V.0380 / AC 380V
4	P.0020	MODE/SET ▲ ▼ Data/◀	Pressing the MODE/SET key displays the servo motor capacity. P.0020 Servo motor capacity (Value ×10W) The example indicates 200W.
5	A.0031	MODE/SET ▲ ▼ Data/◀	Pressing the MODE/SET key displays the rated current (peak) of the servo motor. A.0031 Servo motor rated current (Value ×0.1A) The example indicates 3.1A.
6	E.0024	MODE/SET ▲ ▼ Data/◀	Pressing MODE/SET displays the servo motor's encoder type and resolution. E.0024 Encoder type: No. / Types 0 / Incremental 1 / Multi-turn absolute 2 / Single-turn absolute Encoder resolution: No. / Resolution 0 / Line 2500 17 / 17 bits 20 / 20 bits

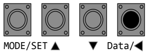
			− | − | | 23 | 23 bits − | − | | 24 | 24 bits
7	Fn011	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key to return to the "Fn011" display.

7.12 Display of software version (Fn012)

This auxiliary function is used to display the functions of the software version of the Servo Drive.

The procedure is shown below.

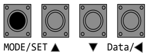
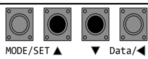
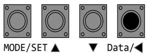
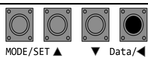
Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn012	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn012 is displayed.
3	A.3101	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to display the software version of the MCU. "A. □□□□". A.3101 Software version code MCU code The example indicates that the MCU software version is 3101.
4	F.3001	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to display the software version of the FPGA, "F. □□□□". F.3001 Software version code FPGA code The example indicates that the FPGA software version is 3001.

<table>
<tr><td>5</td><td>Fn012</td><td></td><td>Press the "DATA/SHIFT" key to return to the "Fn012" display.</td></tr>
</table>

7.13 Displaying Servo Drive model information (Fn01E)

This auxiliary function is used to display the servo drive model information, query the drive rated current, maximum current according to the corresponding code.

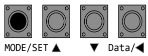
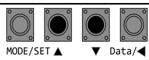
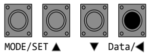
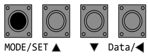
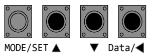
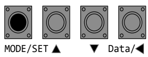
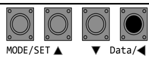
The procedure is shown below.

<table>
<tr><th>Steps</th><th>Panel display</th><th>Keys used</th><th>Operations</th></tr>
<tr><td>1</td><td>Fn000</td><td></td><td>Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.</td></tr>
<tr><td>2</td><td>Fn01E</td><td></td><td>Adjust by pressing the "UP" or "DOWN" key until Fn01E is displayed.</td></tr>
<tr><td>3</td><td>L033A</td><td></td><td>Press the "DATA/SHIFT" key for about 1 second to display the servo drive code, which corresponds to the following table.
<table>
<tr><th>Code</th><th>Rated current</th><th>Rated voltage</th></tr>
<tr><td>L011A</td><td>1.1A</td><td>220V</td></tr>
<tr><td>L018A</td><td>1.8A</td><td>220V</td></tr>
<tr><td>L033A</td><td>3.3A</td><td>220V</td></tr>
<tr><td>L055A</td><td>5.5A</td><td>220V</td></tr>
</table></td></tr>
<tr><td>4</td><td>Fn01E</td><td></td><td>Press the "DATA/SHIFT" key for about 1 second to return to the Fn01E state.</td></tr>
</table>

7.14 Motor pole position identification (Fn080)

This auxiliary function is used to enable the identification of the initial motor zero position.

The procedure is shown below.

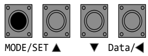
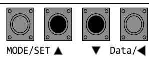
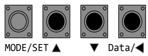
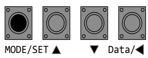
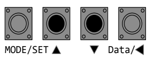
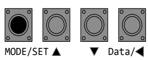
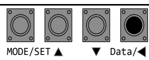
Steps	Panel display	Keys used	Operations
1	Fn000		Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn080		Adjust by pressing the "UP" or "DOWN" key until Fn080 is displayed.
3	.P-dt		Press the "DATA/SHIFT" key for about 1 second and the pole identification symbol is displayed as shown on the left.
4	040.0		Press the "MODE/SET" key to display the current level for pole recognition, the initial default value is "40.0" in 0.1%.
5	045.0		Press the "UP", "DOWN" and "DATA/SHIFT" keys to adjust the desired current, which can be adjusted from 20.0% to 120.0%.
6	.P-dt (blinking)		Press the "MODE/SET" key to start the pole position and encoder recognition. During the recognition process, the digital tube is alternately on and off. **Note: During recognition, the current recognition can be stopped by pressing the "MODE/SET" key.**
7	.P-dt	-	After the magnetic pole position recognition is completed, the display will be as shown on the left and the servo motor will become OFF.
8	Fn080		Press the "DATA/SHIFT" key for about 1 second to return to the Fn080 status.

CAUTION	
⚠	● The parameter disable function (Fn010) cannot be set to "disable writing".

7.15 Adjustment-free function (Fn200)

The adjustment-free function is a function that allows the drive to obtain a more stable response by automatic adjustment when the mechanical type or load fluctuates.

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn200		Adjust by pressing the "UP" or "DOWN" key until Fn200 is displayed.
3	d 1		Press the "DATA/SHIFT" key for about 1 second and the pole identification symbol is displayed as shown on the left. The "UP" and "DOWN" keys are used to select the appropriate value according to the current load inertia. **Notes.** Change the setting to "d2" if overshoot occurs in the response waveform, or when used on a permissible load inertia. When a high frequency sound occurs, change the setting to "d0".
4	L 4		Press the "MODE/SET" key to display the rigidity value setting screen without adjustment.
5	L 3		Press "UP" or "DOWN" to select the rigidity value. The higher the number, the higher the gain and the higher the response **Notes.** If the stiffness value is too high, vibration may occur, so reduce the stiffness value. When a high frequency sound occurs, press the "DATA/SHIFT" button to automatically adjust the frequency of the notch filter to the vibration frequency.
6	L 3		Press the "MODE/SET" key, the display will change to "DonE" and flash for about 2 seconds, then "L 3" will be displayed. The setting is saved in the servo unit.
7	Fn200		Press the "DATA/SHIFT" key for about 1 second to return to the Fn200 state.

CAUTION	
	● parameter prohibition function (fn010) cannot be set to "write prohibition"; ● after the servo driver is installed on the machine, when the adjustment free function is effective, it will send a signal when the initial servo is on. An instant sound, which is the sound when setting the notch filter, is not a fault. After power on again, when the servo is on,No more sound. ● when the motor is used in excess of the allowable load moment of inertia of the motor, the motor may produce vibration. At this point, lower the tuning Value or set mode = 2.

7.16 Intelligent adjustment without command input (Fn201)

The command input type intelligent adjustment function is a function that automatically adjusts the servo drive according to the mechanical characteristics when automatic operation (forward and reverse reciprocating motion) is executed within the set range. The Drive can perform intelligent adjustment without connecting to the upper unit.

The specifications for the smart adjustment operation are as follows.

● Maximum speed: Motor rated speed $\times\frac{2}{3}$

● Acceleration torque: Motor rated torque (approx. 100%, acceleration torque may fluctuate depending on rotational inertia ratio, mechanical friction, external disturbances, etc.).

● Travel distance: Can be set arbitrarily. The factory setting is equivalent to 3 revolutions of the motor

When the Smart Adjustment function is on, the following items will be adjusted.

● Rotational inertia ratio

● 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

(1) Pre-implementation recognition matters

Be sure to check the settings before performing intelligent adjustment. If the settings are not correct, "NO-OP" will be displayed and the function cannot be performed.

● The parameter prohibition function (Fn010) is not set to "Writing prohibition"

● Main circuit power ON

● No overtravel occurred

● Servo is OFF

● Non-torque control

● Gain switching switch is manual gain switching
● Gain 1 was selected
● No alarms or warnings occur
● Hard-wired base blocking function (HWBB) is disabled
● Set "presumed inertia" in the state where the no-adjustment function is active, or set the no-adjustment function to be disabled

(2) Examples of adjustments that cannot be performed

In the following cases, the intelligent adjustment will not be executed properly, so please adjust it by the command input type advanced auto-tuning adjustment or one-touch tuner.
● When the mechanical system can only operate in one direction
● Narrower range of motion, when under 0.5 turns

(3) Examples of adjustments that cannot be made smoothly

In the following cases, if the intelligent adjustment cannot be made smoothly, please adjust the machine by the command input type advanced auto-tuning adjustment or one key adjustment.
● When an adequate range of motion is not available
● When the rotational inertia varies within the set operating range
● When the dynamic friction of the machinery is high
● When mechanical rigidity is low and vibration occurs during positioning moves
● When using the location credit function
    ● When P (proportional) control (When "presumption of inertia" is set, the mode switch function becomes inactive during the presumption of inertia and becomes PI control, and the mode switch function becomes active again after the presumption of inertia is completed)
● When speed feedforward and torque feedforward are input
● Smaller positioning completion thresholds

When fine tuning the overshoot amount without changing the positioning completion threshold (Pn262), the overshoot checkout value (Pn192) is used. Since the factory setting of Pn192 is 100%, the redundant maximum is adjusted to the same overshoot amount as the preposition completion threshold. If it is changed to 0%, adjustment can be made when overshoot occurs within the positioning completion width. However, the positioning time may be extended after changing this value.

(4) Setting of relevant parameters before adjustment

①Moving distance

Pn702	Advanced adjustment of the moveable range	○	Address: 0x0702

Default: 3.0	Display range: 0.5 to 10.0	Unit: 0.1 turn	Mode: P S T

②Inertia recognition initial value

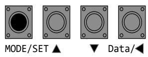
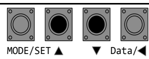
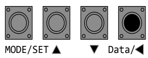
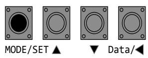
Pn705	Initial value of inertia discrimination		○	Address: 0x0705
Default: 300	Display range: 0 to 20000	Unit: 1%		Mode: P S T

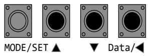
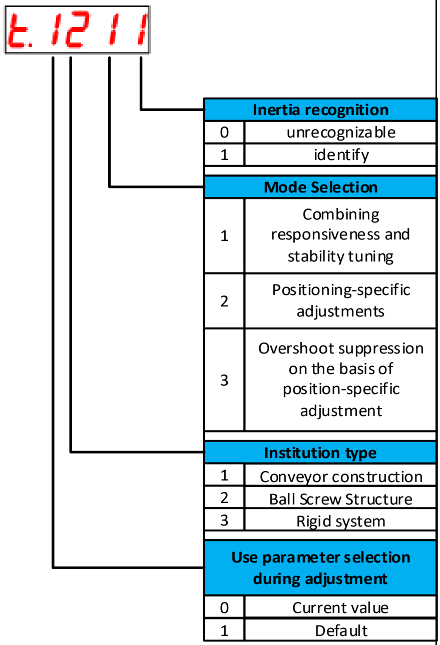
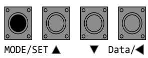
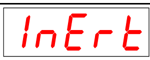
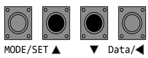
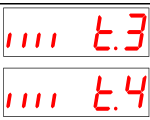
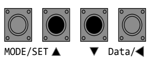
③ Inertia discrimination vibration detection threshold

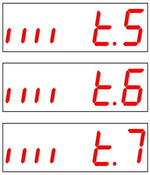
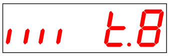
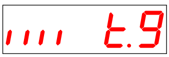
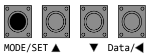
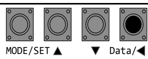
Pn706	Vibration detection threshold in inertia discrimination		○	Address: 0x0706
Default: 300	Display range: 0 to 5000	Unit: 1rpm		Mode: P S T

(5) Operation steps

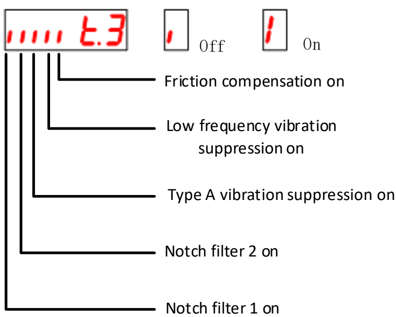
The procedure is shown below.

Steps	Panel display	Keys used	Operations
1			Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2			Adjust by pressing "UP" or "DOWN" until Fn201 is displayed.
3			Press the "DATA/SHIFT" key for about 1 second, and the command-type intelligent adjustment function symbol is displayed as shown on the left picture.
4			Press the "MODE/SET" key to enter the interface for setting parameters related to the advanced adjustment function.

<table>
<tr><td>5</td><td></td><td>
</td><td>The "UP", "DOWN" and "Data/Shift" keys are used to adjust the corresponding selector switches.

</td></tr>
<tr><td>6</td><td></td><td>
</td><td>Press the "MODE/SET" key to enter the inertia recognition interface, as shown in the figure on the left. The drive enters the ON state and the motor locks the shaft.</td></tr>
<tr><td>7</td><td>
(blinking)</td><td>
</td><td>Inertia recognition is started by pressing the "UP" button.</td></tr>
<tr><td>8</td><td></td><td>-</td><td>After the normal recognition of the completed inertia, the corresponding inertia value will be displayed.
The inertia ratio identified in the example is 120%.
Note: If you wish to terminate the subsequent action, press the "DATA/SHIFT" key for about 1 second to return to the Fn201 state.</td></tr>
<tr><td>9</td><td></td><td>
</td><td>The parameter adjustment is started by pressing the "UP" key.
After entering the parameter rectification, the display screen is shown</td></tr>
</table>

			on the left picture. The corresponding numeric codes are shown below. "t.3": vibration detection in progress "t.4": most applicable in gain search "t.5": filter configuration in progress "t.6": most applicable in gain search "t.7": model tracking control adjustment in progress
10			After completing the advanced adjustment in step 9, the "End" symbol will flash, and after about two seconds of display, the symbol "t.8" will be displayed as shown on the left. Press the "DATA/SHIFT" key for about 1 second to return to the Fn201 state.
11			When you are satisfied with the result in step 10 above, press the "MODE/SET" button, then the corresponding tuning result will be updated and saved in Eeprom, and after successful saving, "Done" will be displayed on the blinking screen, and after about two seconds, the symbol "t.9" will be displayed as shown on the left. After about two seconds, the symbol "t.9" is displayed as shown on the left picture.
12			Press the "DATA/SHIFT" key for about 1 second to return to the Fn201 state.

Note: During the process of making adjustments, the corresponding function on or off flag bits are shown below.



7.17 Command input type intelligent adjustment (Fn202)

The command input type intelligent adjustment function is a function that automatically adjusts the servo drive according to the mechanical characteristics while the drive is receiving commands from the host computer to operate.

CAUTION	
	● Command input type intelligent adjustment starts with the currently set speed loop gain (Pn102) as the reference. Therefore, if an abnormality such as vibration occurs at the start of adjustment, correct adjustment will not be possible. In such a case, reduce the speed loop gain (Pn102) until the vibration disappears, and then perform the adjustment. ● The command input type intelligent adjustment may vibrate or overshoot during automatic adjustment. To ensure safety, perform this function in a state where an emergency stop can be made at any time.

There are instructions for the intelligent adjustment function.

The intelligent tuning with command input is a function that automatically tunes the operating commands from the upper unit so that the relevant parameters are eventually tuned to best suit the operating condition of the equipment. If the rotational inertia of the load is known to the user, this function can be performed without the uncommanded intelligent tuning function (Fn201).

When the Smart Adjustment function is on, the following items will be adjusted.

- Gain adjustment (speed loop gain, position loop gain, etc.)
- Filter adjustment (torque command filter, notch filter)
- Friction compensation
- Type A vibration suppression control
- Vibration suppression

(1) Pre-implementation recognition matters

Be sure to check the settings before performing intelligent adjustment. If the settings are not correct, "NO-OP" will be displayed and the function cannot be performed.

- The parameter prohibition function (Fn010) is not set to "Writing prohibition"
- Main circuit power ON
- No overtravel occurred
- Servo is OFF
- Non-torque control
- Gain switching switch is manual gain switching
- Gain 1 was selected
- No alarms or warnings occur
- Hard-wired base blocking function (HWBB) is disabled
- Ineffective adjustment-free function

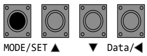
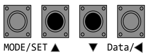
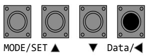
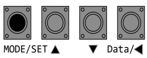
(2) Examples of adjustments that cannot be performed

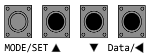
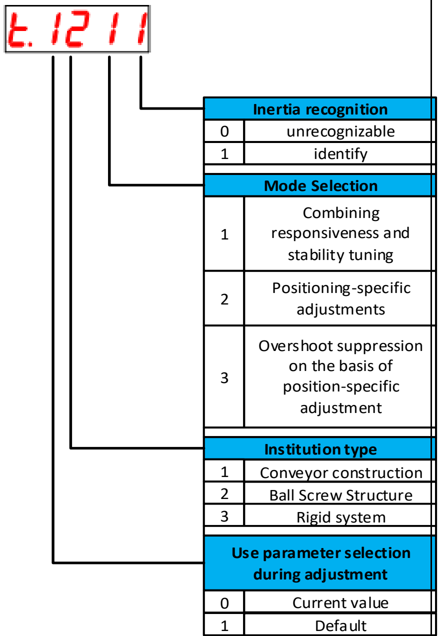
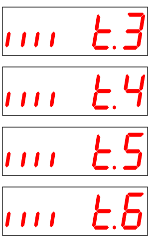
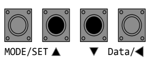
In the following cases, the intelligent adjustment cannot be performed properly, so please adjust it by the command input type intelligent fixed adjustment or one-touch adjustment.

● A narrow range of activity, when below the set value of the positioning completion threshold.
● Moving at a low speed, below the set value of the speed rotation detection value.
● When the stopping time is 10 ms or less.
● When the rigidity of the machinery is low and vibrations occur during positioning.
● When using the location credit function.
● When using the mode switch.

(3) Operation steps

The procedure is shown below.

Step s	Panel display	Keys used	Operations
1			Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2			Adjust by pressing the "UP" or "DOWN" key until Fn202 is displayed.
3			Press the "DATA/SHIFT" key for about 1 second, and the command-type intelligent adjustment function symbol is displayed as shown on the left picture.
4			Press the "MODE/SET" key to enter the interface for setting parameters related to the advanced adjustment function.

5			The "UP", "DOWN" and "Data/Shift" keys are used to adjust the corresponding selector switches.  Note: In the commanded type adjustment function, the inertia recognition switch cannot be modified.
6			Press the "MODE/SET" key to go to the inertia recognition screen, which is displayed as shown in the figure on the left. The inertia ratio in the example is 120%. Note: If you wish to terminate the subsequent action, press the "DATA/SHIFT" key for about 1 second to return to the Fn201 state.
7			The parameter adjustment is started by pressing the "UP" key. After entering the parameter rectification, the display screen is shown on the left. The corresponding numeric codes are shown below. "t.3": vibration detection in progress "t.4": most applicable in gain search "t.5": filter configuration in progress

	t.7		"t.6": most applicable in gain search "t.7": model tracking control adjustment in progress
8	t.8		After completing the advanced adjustment in step 7, the "End" symbol will flash, and after about two seconds of display, the symbol "t.8" will be displayed as shown on the left picture.
9	t.9	MODE/SET ▲ ▼ Data/◀	When you are satisfied with the result in step 8 above, press the "MODE/SET" button, then the corresponding tuning result will be updated and saved in Eeprom, and after successful saving, "Done" will be displayed with a flashing light. After about two seconds, the symbol "t.9" is displayed as shown on the left picture.
10	Fn202	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to return to the Fn202 state.

7.18 Alarm reset (Fn203)

This auxiliary function is used to clear drive faults.

Fault reset is only valid for resettable faults.

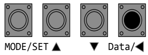
(1) Pre-implementation recognition matters

- The parameter prohibition function (Fn010) is not set to "Writing prohibition".

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn203	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn203 is displayed.
3	A.rSt0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to display the symbol as shown on the left.
4	A.rSt2	MODE/SET ▲ ▼ Data/◀	Press the "UP" key until "A.rst2" is displayed as shown on the left.
5	donE (blinking)	MODE/SET ▲ ▼ Data/◀	Press the MODE/SET key and the drive will clear the relevant alarm, after clearing is complete, while "donE" is displayed flashing for about 1 second. Pressing Mode when the screen other than "A.rst2" is displayed shows "no-op", which means that writing is prohibited.

6		-	After displaying "donE", the display of "A.rst2" is returned.
7			Press the "DATA/SHIFT" key to return to the "Fn203" display.

7.19 Type A vibration suppression control function (Fn204)

The Type A vibration suppression control function is used to further improve the vibration suppression effect after adjustment by single parameter tuning.

The A-type vibration suppression control function effectively suppresses the continuous vibration of about 100Hz to 1000Hz that occurs during the process of increasing the control gain.

This function will be set automatically by smart tuning or command input type smart tuning, so there is little need to use it. Please use it only when further fine tuning is required and when readjustment is necessary due to vibration detection failure.

CAUTION	
	● After executing this function, the relevant parameters will be set automatically. Therefore, the response performance may change significantly before and after executing this function, so for safety reasons, execute this function in a state where you can stop it at any time in an emergency. ● Before executing the A-type vibration suppression control function, set the rotation inertia ratio correctly by intelligent tuning, etc. Otherwise, normal control may not be possible and vibration may occur. ● The vibration frequency range that can be detected using the A-type vibration suppression control function is 100 Hz to 1000 Hz. Vibration frequencies outside the detection range cannot be detected, so set the notch filter by turning on single-parameter tuning or use the vibration suppression function. ● Increasing the damping gain of the A-type vibration suppressor can improve the vibration suppression effect, but a large damping gain alone may increase vibration. While determining the damping effect, gradually increase the damping gain setting by 10% in the range of 0% to 200%. If the damping gain reaches 200% and the vibration suppression effect is still not achieved, terminate the setting and reduce the control gain by one-touch tuning, etc.

(1) Pre-implementation recognition matters

Before performing the A-type vibration suppression control function, be sure to check the following settings, because if they are not set correctly, "NO-OP" will be displayed in the operation and the function cannot be performed.

● The parameter prohibition function (Fn010) is not set to "Prohibit writing".

● Invalidation of the exemption option.

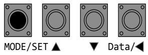
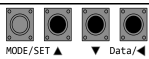
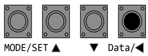
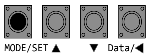
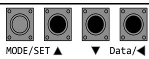
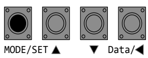
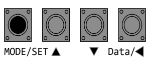
● Non-torque control.

● The parameter is not set to "Prohibit writing".

(2) Operation steps

The user can execute this function if vibration is generated by the input action while operating with the keyboard, or if he wants to make further fine adjustments after using the A-type vibration suppression control function.

The procedure to be followed when the vibration frequency is not known is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn204		Adjust by pressing the "UP" or "DOWN" key until Fn204 is displayed.
3	A-tYP		Press the "DATA/SHIFT" key for about 1 second to display the A-Type suppression control symbol "A-Typ".
4	t 0		Press the "MODE/SET" key, the keypad digital tube displays the adjustment mode selection.
5	t 1		When the display is not "t0", use the "UP" and "DOWN" keys to adjust it to "t0".
6	F----- (blinking)		When "t0" is displayed, press the "MODE/SET" key to enter the frequency search phase. If no vibration frequency is searched for more than 8 seconds, the value step "4" is automatically exited. If vibration is detected but not detected, reduce the vibration detection sensitivity setting. If you reduce the vibration detection sensitivity setting, the detection sensitivity will increase, but if the sensitivity value is too small, vibration may not be detected correctly.
7	F0600		When the vibration frequency is searched automatically, it is displayed as shown on the left. Indicates that the resonant frequency is 600Hz.
8	L 000		Press the "MODE/SET" button to enter the damping gain setting interface, as shown in the figure on the left.

9	L 080	MODE/SET ▲ ▼ Data/◀	Press the "UP", "DOWN" and "DATA/SHIFT" keys to adjust the current vibration suppression damping value. While checking the damping effect, gradually increase the damping gain setting by 10% in the range of 0% to 200%. If the damping gain reaches 200% and the damping effect is still not obtained, terminate the setting and reduce the control gain by single parameter adjustment.
10	Fn204	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to exit.

The frequency of vibration is known and the procedure to be followed when fine adjustment is required is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn204	MODE/SET ▲ ▼ Data/◀	Adjust by pressing the "UP" or "DOWN" key until Fn204 is displayed.
3	A-tyP	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to display the A-Type suppression control symbol "A-Typ".
4	t 0	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" key, the keypad digital tube displays the adjustment mode selection.
5	t 1	MODE/SET ▲ ▼ Data/◀	When the display is not "t1", adjust it to "t1" by using the "UP" and "DOWN" keys.
6	F0600		Displays the currently set vibration frequency.
7	F0365	MODE/SET ▲ ▼ Data/◀	Press the "UP", "DOWN" and "DATA/SHIFT" keys to adjust the current vibration frequency.
8	L 000	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" button to enter the damping gain setting interface, as shown in the figure on the left.
9	L 080	MODE/SET ▲ ▼ Data/◀	Press the "UP", "DOWN" and "DATA/SHIFT" keys to adjust the current vibration suppression damping value. While checking the damping effect, gradually increase the damping gain setting in 10% steps from 0% to 200%. If the damping gain reaches 200% and the damping effect is not obtained, terminate the setting and reduce the control gain by single parameter adjustment.

10	Fn204	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to exit.

7.20 Forced output terminal signal (Fn300)

In the process of commissioning the drive and the upper computer, the output terminal (Y) of the servo drive is required to force the output signal for the upper computer to debug, which can be achieved by this auxiliary function

(1) Pre-implementation recognition matters

The following confirmations shall be achieved when enforcing the output.

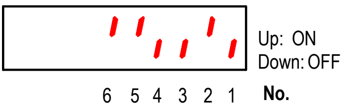
- The parameter prohibition function (Fn010) is not set to " Prohibit writing ".
- Servo is OFF

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn300	MODE/SET ▲ ▼ Data/◀	Adjust by pressing the "UP" or "DOWN" key until Fn300 is displayed.
3	doFor	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to display the forced output symbol "doFor".
4		MODE/SET ▲ ▼ Data/◀	Press the "Mode" key to enter the forced output state. By default, all output terminals are in "oFF" state. The display symbol is shown on the left picture.
5		MODE/SET ▲ ▼ Data/◀	Press the "Up" key, the corresponding output terminal is "on". Press the "Down" button, the corresponding output terminal will be "oFF".
6	Fn300	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to return to the "Fn300" display.

Note: The status of the digital tube corresponding to the output signal is shown below.



Display LED number	CN1 input pin number	Signal Name
1	CN1-6/7	Y 1
2	CN1-4/5	Y 2

3	CN1-2/3	Y 3
4	CN1-1/26	Y 4
5	CN1-27/28	Y 5

7.21 Position command counter clear (Fn301)

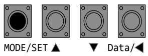
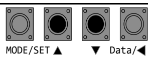
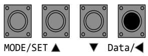
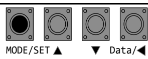
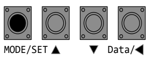
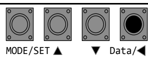
This auxiliary function is used by the host computer to give the value of the pulse counter, i.e. to clear the value of the monitoring function code Un006.

(1) Pre-implementation recognition matters

● The parameter prohibition function (Fn010) is not set to " Prohibit writing".

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn301		Adjust by pressing UP or DOWN until Fn301 is displayed.
3	P.CLr0		Press the DATA/SHIFT key for about 1 second to display the symbol as shown on the left picture.
4	P.CLr2		Press the "UP" key until "P.CLr2" is displayed as shown on the left picture.
5	donE (blinking)		Press the MODE/SET key and the drive will clear the relevant variables, after clearing is complete, while "donE" flashes for about 1 second. Pressing Mode when the screen other than "P.CLr2" is displayed shows "no-op", which means that writing is prohibited.
6	P.CLr2	-	After "donE" is displayed, the display of "P.CLr2" is returned.
7	Fn301		Press the "DATA/SHIFT" key to return to the "Fn301" display.

7.22 Zeroing the encoder position feedback counter (Fn302)

This auxiliary function is used to clear the value of the encoder feedback counter, i.e. to clear the value of the monitoring function codes Un007, Un008 and Un00F for zero processing.

(1) Pre-implementation recognition matters

● The parameter prohibition function (Fn010) is not set to " Prohibit writing".

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn302	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Fn302 is displayed.
3	E.CLr0	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to display the symbol as shown on the left picture.
4	E.CLr2	MODE/SET ▲ ▼ Data/◀	Press the "UP" key until "E.CLr2" is displayed as shown on the left.
5	donE (blinking)	MODE/SET ▲ ▼ Data/◀	Press the MODE/SET key and the drive will clear the relevant variables, after clearing is complete, while "donE" flashes for about 1 second. Pressing Mode when the screen other than "E.CLr2" is displayed shows "no-op", which means that writing is prohibited.
6	E.CLr2	-	After "donE" is displayed, return to the display of "E.CLr2" .
7	Fn302	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key to return to the "Fn302" display.

7.23 One-touch tuning (Fn303)

One-touch tuning is a method of inputting a speed command or position command from the upper unit and manually making adjustments while running. By adjusting one or two values with the one-touch tuner, the relevant servo gain setting is automatically adjusted.

The one-touch tuner function makes adjustments to the following items.

- Gain adjustment (speed loop gain, position loop gain, etc.).
- Filter adjustment (torque command filter, notch filter).
- Friction compensation.
- Type A vibration suppression control.

The one-touch tuning procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.

2	Fn303	MODE/SET ▲ ▼ Data/◀	Adjust by pressing the "UP" or "DOWN" key until Fn303 is displayed.
3	t 20	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to enter the setting interface related to one-touch tuning, which is displayed as shown in the figure on the left picture.
4	t 20 ↑ ↓ t 21	MODE/SET ▲ ▼ Data/◀	The "UP", "DOWN" and "Data/Shift" keys are used to adjust the corresponding selector switches. t 20 **Tuning set strength** 0 — Focus on stability 1 — Focus on responsive **Rigid type** 1 — Belt drive 2 — Ball screw drive 3 — Direct connection of rigid body without reducer and transmission mechanism
5	L0040	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" key to display the one-touch gain data as shown on the left picture.
6	L0085	MODE/SET ▲ ▼ Data/◀	When the value of the parameter gain is changed by the UP or DOWN key, the actual servo gain (Pn101, Pn102, Pn103, Pn104) is changed at the same time. This function is used by the user to judge the response effect, and the tuning is ended when the effect is satisfactory.
7	L0085	MODE/SET ▲ ▼ Data/◀	Press the "MODE/SET" button to store the four calculated gains in the parameters. After normal tuning, "donE" will flash and return to the display on the left. Note: When you finish without saving the calculated gain, go to the next step.
8	Fn303	MODE/SET ▲ ▼ Data/◀	Press the "DATA/SHIFT" key for about 1 second to return to the Fn203 state.

CAUTION

	● When satisfactory response characteristics cannot be obtained by intelligent tuning or command input type intelligent tuning, use single parameter tuning. ● Vibration or overshoot may occur during adjustment. To ensure safety, perform in a state where an emergency stop is always possible this feature. ● If you want to further fine-tune each servo gain after single-parameter tuning, perform manual tuning. ● Depending on the selected adjustment mode, the one-touch tuning operation proceeds as follows. ①When Tuning Mode = 0 or 1, the model tracking control is "disabled" and adjustments other than for positioning purposes are made. ②When Tuning Mode = 2 or 3, the model tracking control is "active" and positioning-specific adjustments are made.

7.24 Zero setting for origin return (Fn304)

This auxiliary function is used to store the current multi-turn absolute position information to function codes Pn296 and Pn297.

(1) Pre-implementation recognition matters

● The parameter disable function (Fn010) is not set to "disable writing".

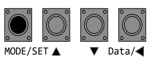
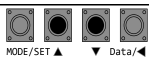
(2) Related function codes

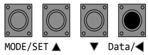
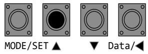
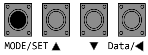
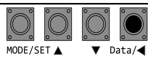
Pn296	Absolute position zero multi-turn value	○	Address: 0x0296
Default: 0	Setting range: -32768 to 32767	Unit: rev	Mode. P

Pn297	Absolute position zero turn value	○	Address: 0x0297 ★
Default: 0	Setting range: 0 ～ 16777216	Unit: Encoder unit	Mode. P

(3) Operation steps

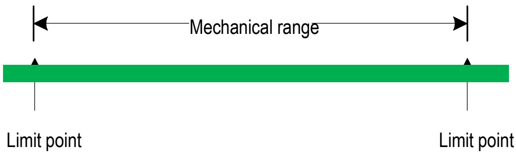
The procedure is shown below.

Steps	Panel display	Keys used	Operations
1			Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2			Adjust by pressing UP or DOWN until Fn304 is displayed.

3	orG.S0		Press the DATA/SHIFT key for about 1 second to display the symbol as shown on the left picture.
4	orG.S2		Press the "UP" button until "orG.S2" is displayed as shown on the left picture.
5	donE (blinking)		Press the MODE/SET key, the drive will store the encoder related information, after successful storage, at the same time "donE" flashing display for about 1 second. Pressing Mode when the screen other than "orG.S2" is displayed shows "no-op", which means that writing is prohibited.
6	orG.S2	-	After the display of donE, the display of "orG.S2" is returned.
7	Fn304		Press the "DATA/SHIFT" key to return to the "Fn304" display.

7.25 Soft limit setting (Fn305)

Soft limit setting means that the left and right limit positions are limited by the internal single and multi-turn values of the absolute encoder in the absence of an external limit switch.



CAUTION	
⚠	● Please set the appropriate speed value. ● Please ensure that it is within the operating range of the machinery. ● Make sure the soft limit switch function is not turned on (Pn00A.W = 0).

(1) Precautions for basic settings (initialization)

To perform the soft limit setting operation, the following must be verified.

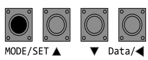
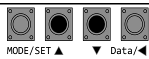
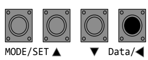
- The parameter prohibit writing function (Fn010) is not set to "prohibit writing".
- Main circuit power ON.
- No alarms have occurred.
- Servo is OFF.
- The encoder is a multi-turn absolute encoder.

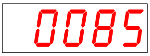
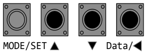
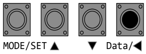
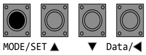
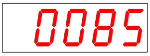
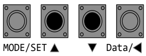
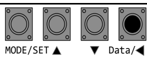
(2) Related function codes

Pn030	Absolute position limit single-turn maximum (internal soft limit)	○	Address: 0x0030 ★
Default: 0	Setting range: -2^{31} to $2^{31}-1$	Unit: instruction unit	Mode: P S T
Pn032	Absolute position limiting multi-turn maximum (internal soft limit)	○	Address: 0x0032
Default: 32767	Setting range: -32768 to 32767	Unit: instruction unit	Mode: P S T
Pn033	Absolute position limit min (internal soft limit)	○	Address: 0x0033 ★
Default: 0	Setting range: -2^{31} to $2^{31}-1$	Unit: instruction unit	Mode: P S T
Pn035	Absolute position limiting multi-turn minimum (internal soft limit)	○	Address: 0x0035
Default:-32768	Setting range: -32768 to 32767	Unit: instruction unit	Mode: P S T
Pn500	Jogging speed (JOG)	○	Address: 0x0500
Default: 200	Setting range: 0～10000	Unit: 1rpm	Mode: P S T

(3) Operation steps

The basic setup procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn305		Adjust by pressing UP or DOWN until Fn305 is displayed.
3	0200		Press the DATA/SHIFT key for about 1 second, then the display will be as shown on the left. Note: The Pn500 is used as the reference point for initial entry.

4			Adjust the desired tap speed by pressing UP, DOWN and DATA/SHIFT. Note: The maximum speed value is 1200rpm.
5			Press the MODE/SET key, then the display will be as shown on the left, and enter the positive limit point setting status. Adjust the corresponding load to the positive limit point with the "UP" or "DOWN" key.
6			Press the MODE/SET key to set the current positive limit point. Also enter the negative limit point state. Adjust the corresponding load to the positive limit point with the "UP" or "DOWN" key.
7			Press the MODE/SET key to set the current negative limit point. Also exit the corresponding limit point setting state.
8			Press the DATA/SHIFT key for about 1 second to return to the Fn305 display.

7.26 Encoder over-temperature alarm threshold setting (Fn400)

This auxiliary function is only used to set the Tamagawa encoder.

(1) Pre-implementation recognition matters

- The parameter disable function (Fn010) is not set to "disable writing".
- The driver is not enabled.
- The motor-mounted encoder manufacturer is Tamagawa, i.e. PnF15.X=2, and the encoder model number is TS5700N8401 or TS5700N8501.

PnF15☆	Rotary Motor Types & Encoder Manufacturers	●	Address: 0x0F15
Default: 0000	Setting range: 0x0000~0xFFFF	Unit: N/A	Mode. P S T

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

0th digit (X): Encoder manufacturers

Encoder manufacturers	
0	No distinction between manufacturers
1	NK
2	DMC
3	RY

1st digit (Y): Rotary motor types

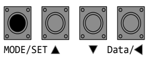
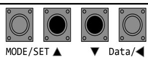
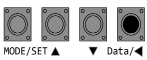
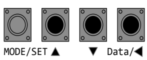
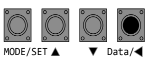
Rotary motor types	
0	Surface Mounted (SPM)
1	Inline (IPM)

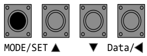
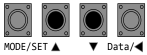
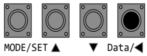
2nd digit (Z): Reserved parameters (do not use)

3rd digit (W): Reserved parameters (do not use)

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Fn000 is displayed.
2	Fn400		Adjust by pressing UP or DOWN until Fn400 is displayed.
3	t. 090		Press the DATA/SHIFT key for about 1 second, then the display will read as shown on the left, which indicates that the current encoder over-temperature detection point temperature is 90° C. Note: The current encoder over-temperature is used as the reference point for initial entry.
4	t. 090		Press the MODE/SET key, then the display will be as shown on the left to enter the encoder over-temperature detection point temperature threshold setting state.
5	t. 100		The "UP", "DOWN" and "SHIFT" keys are used to adjust the corresponding values. Note: The maximum value is set to 130° C. When set to 0, the over-temperature detection function is turned off.

6	donE (blinking)		Press MODE/SET and the set temperature value will be written to the Eeprom of the encoder, while "donE" flashes for about 1 second.
7	t. 100		When "donE" is displayed, the display returns to the status shown on the left picture.
8	Fn400		Press the DATA/SHIFT key for about 1 second to return to the Fn400 display.

7.27 EasyFFT (Fn401)

The EasyFFT function transmits the periodic waveform command from the servo driver to the servo motor, allowing the servo motor to rotate slightly several times within a certain period of time, causing the machine to vibrate. The servo driver detects the resonant frequency based on the vibration generated by the machine, and then sets the corresponding notch filter based on the detected resonant frequency. The notch filter can effectively remove high frequency vibrations and noise.

If vibration is generated with a loud sound (abnormal sound) during operation, perform this function after servo OFF.

CAUTION	
	● When this function is executed, the servo motor will rotate slightly. Do not touch the servo motor or the unit during execution. Failure to do so may cause personal injury. ● This function must be used in a state where the gain is low such as the initial stage of servo adjustment. If the Easy FFT function is executed after a higher gain is set, the machinery may vibrate due to the mechanical characteristics and gain balance.

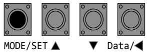
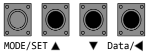
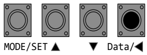
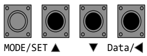
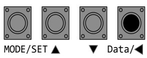
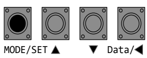
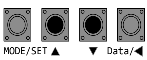
(1) Pre-implementation recognition matters

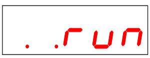
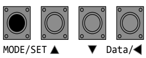
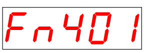
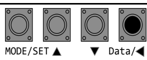
Before performing the A-type vibration suppression control function, be sure to check the following settings, because if they are not set correctly, "NO-OP" will be displayed in the operation and the function cannot be performed.

- The parameter prohibit function (Fn010) is not set to "Prohibit writing".
- Main circuit power ON.
- No alarms have occurred.
- No over-travel has occurred.
- No instructions are entered from outside.
- The servo is OFF.

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn401		Adjust by pressing the "UP" or "DOWN" key until Fn401 is displayed.
3	In 15 (amplitude setting)		Press the "DATA/SHIFT" key for about 1 second, and the display will be as shown on the left to enter the command amplitude setting mode.
4	In 20		The command amplitude is adjusted by pressing the "UP" or "DOWN" key. The command amplitude can be set in the range of 1 to 800 When setting Easy FFT for the first time, it is recommended that you do not change the command amplitude setting, but start from the initial setting of "15". If you increase the command amplitude, the detection accuracy will increase, but the vibration and noise generated by the machine will become larger in a short period of time. When changing the command amplitude, gradually increase the vibration amplitude and adjust it while observing. The set command amplitude is saved in the Pn723.
5	F.		Press the "DATA/SHIFT" key for about 1 second, and the display will be as shown on the left to enter the operation ready state.
6	. .run		Press the "MODE/SET" key to turn the servo ON. If you want to turn the servo OFF at this time, press the "MODE/SET" button and return to step 5.
7	E_FFt		Press the "UP" or "DOWN" key while the servo is ON, and the servo motor repeatedly turns forward and reverse several times at a maximum of 1/4 turn. The running time is 2 seconds. The display on the left flashes during operation. (Note) When the action is terminated during operation, press the "MODE/SET" key to return to step 5.

			The motor moves slightly while making a sound, for safety reasons, do not approach the operating range of the machine.
8			When the checkout process is completed normally, the "E_FFt" display stops flashing and the detected resonant frequency is displayed. If the detection fails, "F----" is displayed. To set the detection result, you must proceed to step 9. (Note) Even if the detection ends normally, if the running time exceeds 2 seconds, the detection accuracy may not be sufficient, and the detection accuracy may be improved if the command amplitude is increased to slightly more than "15" and then executed again. However, if the command amplitude is increased, the vibration and noise generated by the machine will become larger in a short period of time. When changing the command amplitude, gradually increase the amplitude value and observe the situation while making the change.
9			Press "MODE/SET" to automatically set the resonant frequency for detection. When the notch filter is set normally, "donE" flashes and the display returns to the left. After the 1st band notch filter frequency has been set, the 2nd band notch filter frequency (Pn156) is automatically set in Pn150.X = 1. Press the "MODE/SET" key once more to return to step 5. (Note) The notch filter frequency cannot be set in Pn150.X and Pn150.Z if the band 1 and band 2 notch filter frequencies have already been set. Not using the notch filter frequency detected by this function is to set Pn150.X = 0 (notch filter is invalid).
10			Press the "DATA/SHIFT" key for about 1 second to exit.

7.28 On-line vibration monitoring (Fn402)

When vibration occurs during operation of the equipment, if this function is executed in the servo ON state, the notch filter or torque command filter is set according to that vibration frequency, and sometimes the vibration is eliminated.

When online, the vibration frequency of the noise generated by mechanical resonance, etc. is detected, and for that frequency, the effective torque command filter or notch filter frequency is automatically selected, and the relevant parameters are automatically set.

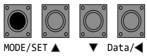
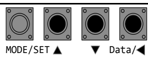
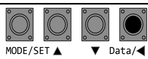
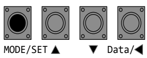
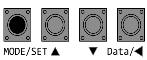
(1) Pre-implementation recognition matters

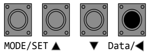
When performing online vibration monitoring, the following checks are performed.

- The parameter prohibit function (Fn010) is not set to "Prohibit writing".
- Servo is ON
- No over-travel occurred
- The correct inertia ratio is set

(2) Operation steps

The procedure is shown below.

Steps	Panel display	Keys used	Operations
1	Fn000		Press the "MODE/SET" key to select the auxiliary function. Adjust by pressing the "UP" and "DOWN" keys until Fn000 is displayed.
2	Fn402		Adjust by pressing the "UP" or "DOWN" key until Fn207 is displayed.
3	F		Press the "DATA/SHIFT" key for about 1 second and "F" is displayed.
4	F (blinking)		Press the "MODE/SET" key, "F" will start flashing and the frequency detection will start automatically.
5	F. 1000		"F" stops flashing and the frequency checkout ends. If the detection is normal, the result of the detection is displayed. The vibration frequency displayed is the frequency at the maximum peak. To use this detection frequency, you must go to step 6. If the value confirms the vibration frequency without setting the detection result, press the DATA/SHIFT key for about 1 second to return to step 2. If the frequency detection fails (more than 8 seconds), "F----" is displayed. When the checkout processing bit ends normally, "no_op" is displayed.
6	donE (blinking)		By pressing the "MODE/SET" key, the optimal notch filter frequency or torque command filter time constant for the frequency is set automatically. When set

			normally, the flashing display shows "donE".
7			Press the "DATA/SHIFT" key for about 1 second to return to the "Fn402" display.

Chapter-8 Monitoring parameters

8.1 List of monitoring displays

The monitor display function is numbered starting with Un and is used to realize the function of displaying the status of the input and output signals of the Servo Drive and related information.

Un No.	Description	Unit	Data type ①	Address
Un000	Motor feedback speed	rpm	int16	0xE000
Un001	Speed command	rpm	int16	0xE001
Un002	Internal torque command	%	int16	0xE002
Un004	Rotation angle (angle from the origin of the magnetic pole [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 counter 1	command unit	int32	0xE007
Un008	Motor encoder feedback pulse counter 2	encoder units	int32	0xE008
Un009	Position deviation (valid only for position control)	user units	int32	0xE009
Un00A	Cumulative load rate (value relative to rated torque at 100%, displaying valid values for 10s cycles)	%	uint16	0xE00A
Un00B	Regenerative load factor (value at 100% of the regenerative power that can be processed, showing the regenerative power consumption for a 10s cycle)	%	uint16	0xE00B
Un00D	Effective gain monitoring (1: first gain; 2: second gain)	-	uint16	0xE00D

Un00E	Total drive power-up time ②	0.1s	uint32	0xE00E
Un00F	CN5 port input signal monitoring	-	uint16	0xE00F
Un010	Absolute encoder single-turn value	Encoder units	uint32	0xE011
Un011	Absolute encoder multi-turn values	rev	int16	0xE010
Un017	Encoder Z signal output number	-	int32	0xE017
Un018	Encoder Z signal one-way output number	-	int32	0xE018
Un02A	Internal control status 1	-	uint16	0xE02A
Un02B	Internal control status (input terminal) 2	-	uint16	0xE02B
Un02C	Internal control status (input terminal) 3	-	uint16	0xE02C
Un02D	Internal control status (output terminals) 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 main version	-	uint16	0xE035
Un036	FPGA main version	-	uint16	0xE036
Un037	MCU subversion	-	uint16	0xE037
Un038	FPGA subversion	-	uint16	0xE038
Un087	Serial encoder communication exception counter	times	uint16	0xE087
Un089	module temperature	0.1° C	uint16	0xE089
Un100	Input signal monitoring	-	uint16	0xE100
Un101	Output signal monitoring	-	uint16	0xE101
Un105	Position Rectification Time	0.1ms	uint16	0xE105
Un106	Position overshoot amount	command unit	uint16	0xE106

Un10B	KTY type temperature sensor detection value	1° C	uint16	0xE10B
Un10D	Internal chip temperature (ambient temperature)	0.1° C	uint16	0xE10D
Un140	DC bus voltage	1V	uint16	0xE140
Un141	Current detection value (RMS)	0.1 A	uint16	0xE141
Un142	Cumulative load rate (value relative to rated torque at 100%, displaying valid values for 2ms cycles)	0.1%	uint16	0xE142
Un143	Regenerative load accumulation value	0.1%	uint16	0xE143
Un144	DB load accumulation value	%	uint16	0xE144
Un203	Set abnormal parameter function code (Er.040)	-	uint16	0xE203
Un212	System time monitoring A(Avg)	0.1us	uint16	0xE212
Un213	System time monitoring A(Max)	0.1us	uint16	0xE213
Un214	System time monitoring B(Avg)	0.1us	uint16	0xE214
Un215	System time monitoring B(Max)	0.1us	uint16	0xE215
Un216	System time monitoring C(Avg)	0.1us	uint16	0xE216
Un217	System time monitoring C(Max)	0.1us	uint16	0xE217
Un218	System time monitoring R(Avg)	0.01ms	uint16	0xE218
Un219	System time monitoring R(Max)	0.01ms	uint16	0xE219
Un300	Current Pr position execution path number	-	uint16	0xE300
Un511	Zero value of U-phase current	-	int16	0xE511
Un512	Zero value of V-phase current	-	int16	0xE512
Un513	Hardware version code	-	int16	0xE513
Un603	Absolute encoder pulse [low 32 bits]	Encoder units	uint32	0xE603
Un605	Absolute encoder pulses [high 32 bits]	Encoder units	uint32	0xE605
Un607	Mechanical absolute position [low 32 bits]	Encoder units	uint32	0xE607

Un609	Mechanical absolute position [high 32 bits]	Encoder units	uint32	0xE609
Un800	Current fault or warning code	-	uint16	0xE800
Un801	Code when alarm	-	uint16	0xE801
Un802	Timestamp when alarm	100ms	uint32	0xE802
Un803	Actual motor speed when alarm	rpm	int16	0xE803
Un804	Speed command when alarm	rpm	int16	0xE804
Un805	Internal torque command when alarm	%	int16	0xE805
Un806	Input command pulse speed when alarm	rpm	int16	0xE806
Un807	Deviation counter when alarm (position deviation)	pulse	int32	0xE807
Un808	Main circuit bus voltage when alarm	V	uint16	0xE808
Un809	RMS value of the current feedback when alarm	A	int16	0xE809
Un80A	Cumulative load rate when alarm [2ms]	%	uint16	0xE80A
Un80B	Regenerative load rate when alarm [2ms]	%	uint16	0xE80B
Un80C	Power consumption of DB resistor when alarm [2ms]	%	uint16	0xE80C
Un80D	Maximum cumulative load rate when alarm	%	uint16	0xE80D
Un80E	Rotational inertia rate when alarm	%	uint16	0xE80E
Un80F	Number of serial encoder communication exceptions when alarm	-	uint16	0xE80F
Un810	Internal signal monitoring when alarm	-	uint32	0xE810
Un814	Internal input signal monitoring when alarm	-	uint32	0xE814
Un818	Internal output signal monitoring when alarm	-	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 record 0 occurrence time	0.1s	uint32	0xE830
Un832	Alarm record 1 occurrence time	0.1s	uint32	0xE832
Un834	Alarm record 2 occurrence time	0.1s	uint32	0xE834
Un836	Alarm record 3 occurrence time	0.1s	uint32	0xE836
Un838	Alarm record 4 occurrence time	0.1s	uint32	0xE838
Un83A	Alarm record 5 occurrence time	0.1s	uint32	0xE83A
Un83C	Alarm record 6 occurrence time	0.1s	uint32	0xE83C
Un83E	Alarm record 7 occurrence time	0.1s	uint32	0xE83E
Un840	Alarm record 8 occurrence time	0.1s	uint32	0xE840
Un842	Alarm record 9 occurrence time	0.1s	uint32	0xE842

Notes:

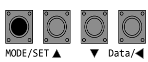
① In the table above, the data type definitions are described as follows.

Data type	Explanation
int16	Signed words (16-bit)
uint16	Unsigned word (16 bits)
int32	Signed double word (32-bit)
uint32	Unsigned double word (32-bit)

② The monitoring function code Un00E may actually have a deviation of ±1 hour.

8.2 16-bit length data reading method

The Un000 is used as an example to illustrate how to read the 16-bit data decimal display.

Steps	Panel display	Keys used	Operations
1			Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Un000 is displayed.

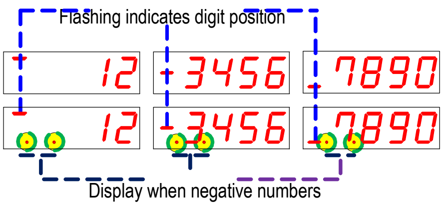
2	Un000	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Un000 is displayed.
3	1200	MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second, then the motor speed is displayed. The graph on the left indicates that the current speed is 1200 rpm.
4	- 1200	—	The graph on the left indicates that the current speed is -1200rpm.
5	Un000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to return to the display on the left.

8.3 32-bit length data reading method

The Un008 is used as an example to illustrate how to read 32-bit data decimal display.

Steps	Panel display	Keys used	Operations
1	Un000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Un000 is displayed.
2	Un008	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Un008 is displayed.
3	_7890 (last 4 digits)	MODE/SET ▲ ▼ Data/◀	If you press the DATA/SHIFT key for about 1 second, the last 4 digits of the data are displayed.
4	-3456 (middle 4)	MODE/SET ▲ ▼ Data/◀	Pressing the DATA/SHIFT key displays the middle 4 digits of the data.
5	‾ 12 (first 2 places)	MODE/SET ▲ ▼ Data/◀	Pressing the DATA/SHIFT key displays the first 2 digits of the data **Note:** After displaying the first 2 digits, press the DATA/SHIFT key once more to resume displaying the last 4 digits.
6	Un008	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to return to the display on the left.

The display reads as follows.



Note: 32-bit signed numbers are displayed in the range -2147483648 to 2147483647. Out of this range, the following is displayed.

Decreasing by 1 from -2147483648 shows 2147483647, and so on.

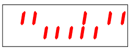
Increasing 1 from 2147483647 shows -2147483648, and so on.

8.4 Input signal (X) status monitoring

The input signal in the CN1 terminal can be viewed with "Input signal (X) status monitoring (Un100)". The display procedure, display judgment method and display example are as follows.

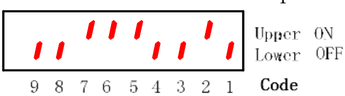
8.4.1 Display steps

The procedure for displaying the input signal (SI) is shown below.

Steps	Panel Display	Keys used	Operations
1	Un000	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Un000 is displayed.
2	Un 100	MODE/SET ▲ ▼ Data/◀	Adjust by pressing UP or DOWN until Un100 is displayed.
3		MODE/SET ▲ ▼ Data/◀	Press the DATA/SHIFT key for about 1 second to display the symbol as shown on the left picture
4	Un 100	MODE/SET ▲ ▼ Data/◀	Press MODE/SET to return to the display on the left. picture

8.4.2 Judgment methods for display

The assigned input signal is indicated by the lighted status of the drive's panel operator's digital tube.



When the input signal is OFF, the lower SEG (LED) lights up.
When the input signal is ON, the upper SEG (LED) lights up.

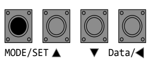
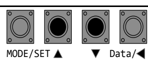
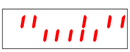
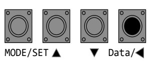
Display LED number	CN1 input pin number	Signal Name
1	CN1-9	X1
2	CN1-10	X2
s3	CN1-34	X3
4	CN1-8	X4
5	CN1-33	X5
6	CN1-32	X6
7	CN1-12	X7
8	CN1-30	X8
9	-	-

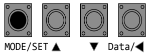
8.5 Output signal (Y) status monitoring

The output signal in the CN1 terminal can be viewed with "Output signal (Y) status monitoring (Un101)". The display procedure, display judgment method and display example are as follows.

8.5.1 Display steps

The procedure for displaying the output signal (Y) is shown below.

Steps	Panel display	Keys used	Operations
1			Press MODE/SET to select the auxiliary function. Adjust by pressing UP or DOWN until Un000 is displayed.
2			Adjust by pressing UP or DOWN until Un101 is displayed.
3			Press the DATA/SHIFT key for about 1 second to display the symbol as shown on the left picture

4			Press MODE/SET to return to the display on the left. picture

8.5.2 Judgment methods for display

The assigned output signal is indicated by the lighted status of the drive's panel operator's digital tube.

When the output signal is OFF, the lower SEG (LED) lights up.
When the output signal is ON, the upper SEG (LED) lights up.

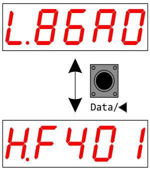
Display LED number	CN1 input pin number	Signal Name
1	CN1-6/7	Y1
2	CN1-4/5	Y2
3	CN1-2/3	Y3
4	CN1-1/26	Y4
5	CN1-27/28	Y5

8.6 Absolute encoder position information display

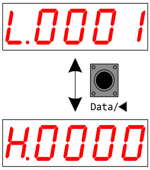
In the case of absolute encoders, when the corresponding position information is read, when the monitoring function code shows a multi-turn value Un011 is 500, a single-turn value Un010 is 100000 and an encoder is 24 bits, the amount of pulses converted to encoder units is

$$EncFbk = 500 \times 2^{24} + 100000 = 8388708000 \text{ [Decimal]}$$
$$= 0x00000001F40186A0 \text{ [Hexadecimal]}$$

Then Un603 is shown as:



Un605 is shown as.

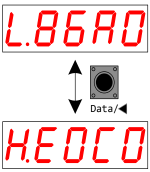


When using an absolute encoder, when the monitoring function code shows a multi-turn value Un011 is -500, a single-turn value Un010 is 100000 and the encoder is 24 bits, the amount of pulses converted to encoder units is

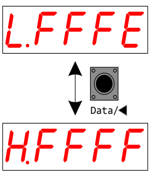
EncFbk = -500 x 224 + 100000 = -8388508000 [Decimal]

= 0xFFFFFFFE0C0186A0 [Hexadecimal]

Then Un603 is shown as.



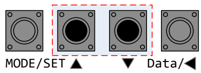
Un605 is shown as.



8.7 Clearable monitoring function code

This drive supports a function where some of the monitoring function codes can be cleared for practical use.

Clear method: Press "UP" + "DOWN" keys on the keyboard panel at the same time.



Clearable monitoring function codes.

Un number	Show Description
Un006	Input command pulse counter
Un007	Motor encoder feedback pulse counter 1
Un008	Motor encoder feedback pulse counter 2
Un017	Encoder Z signal output number
Un018	Encoder Z signal one-way output number

s

8.8 Detailed description of some monitoring function codes

Un00B	Regenerative load factor (value at 100% of the regenerative power that can be processed, showing the regenerative power consumption for a 10s cycle)	Unit: 1%	Communication address: 0xE00B
Parameter Description	This function code is used to record the accumulated value of heat generated by regenerative braking after the servo drive's main loop voltage is greater than the regenerative braking threshold, and it only records the current regenerative load rate for the last 10S clocks. Note: The regenerative load accumulation value monitored by the monitoring function code Un143 is the accumulation value for the entire process (including heat accumulation and heat dissipation).		

Un00E	Total drive power-up time	Unit: 0.1s	Communication address: 0xE00E
Parameter Description	This function code is used to record the total time that the servo drive has been running after the main circuit voltage has been established. The function code is 32 bits and the panel display is decimal data.		

Caution	
	● When multiple successive power-ups and power-downs of the drive occur in a short period of time, there may be a maximum of 1 hour deviation in the total power-up time record. ● The drive total power-up time timing starts when the drive main circuit voltage is established.

Un017	Encoder Z signal output number	Unit: -	Communication Address: 0xE017
Parameter Description	This function code is used to record the number of servo drive encoder Z signal outputs. The recording method is absolute number (actual number of outputs). Note: Auto-zero when re-powered or press the "UP" + "DOWN" keys on the keypad at the same time to clear.		

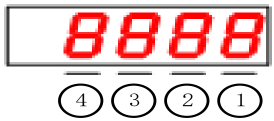
Un018	Encoder Z signal one-way output number	Unit: -	Communication Address: 0xE018
Parameter Description	This function code is used to record the number of servo drive encoder Z signal outputs. The recording method is relative number (associated with direction).		

Caution
● Auto-zero when re-powered or press the "UP" + "DOWN" keys on the keypad at the same time to clear. ●The Z signal is only counted cumulatively by the function code Pn074.X = 1.

Un02A	Internal signal status 1	Unit: N/A	Communication address: 0xE02A

Parameter Description

This function is used to monitor the status of critical signals inside the drive



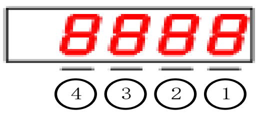
① Internal signal status 00	
Bit0	Main circuit voltage establishment
Bit1	Encoder initialization complete
Bit2	Servo ON request
Bit3	Dynamic brake signal
② Internal signal status 01	
Bit4	Motor rotation direction
Bit5	Speed loop control method
Bit6	Speed command rotation signal (speed mode)
Bit7	Maximum torque reached
③ Internal signal status 02	
Bit8	Fully closed-loop/semi-closed-loop state
Bit9	CN5 port +5V power output status
Bit10	Mode key status
Bit11	Up key status
④ Internal signal status 03	
Bit12	Down key status
Bit13	Set key status
Bit14	Reserved
Bit15	Reserved

Caution	
	● Bit6 – Speed command rotation signal. In speed mode, Bit6 is 1 when the speed command value is greater than the threshold value set by Pn314, otherwise it’s 0.

Un02B	Internal signal status (input terminal) 2	Unit: N/A	Communication address: 0xE02B

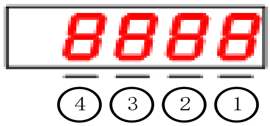
Parameter Description

This function is used to monitor the status of critical signals inside the drive



①	Internal signal status 10	
	Bit0	Servo Enable
	Bit1	Positive limit
	Bit2	Negative limit
	Bit3	Alarm reset
②	Internal signal status 11	
	Bit4	Speed loop PI-P switching
	Bit5	Torque limiting selection
	Bit6	Absolute location information request
	Bit7	Speed direction
③	Internal signal status 12	
	Bit8	Internal speed option A
	Bit9	Internal speed option B
	Bit10	Control mode selection
	Bit11	Zero speed clamp
④	Internal signal status 13	
	Bit12	Pulse Prohibition
	Bit13	Gain Switching
	Bit14	Torque direction selection
	Bit15	Pulse command multiplier

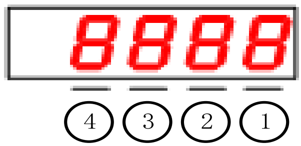
Un02C	Internal signal status (input terminal) 3	Unit: N/A	Communication address: 0xE02C
Parameter Description	This function is used to monitor the status of critical signals inside the drive.		



1	Internal signal status 20	
	Bit0	Pulse deviation clearing
	Bit1	Torque selection A
	Bit2	Torque selection B
	Bit3	Torque triggering
2	Internal signal status 21	
	Bit4	Reserved
	Bit5	Fully closed loop/semi closed loop switching options
	Bit6	Forward JOG
	Bit7	Negative JOG
3	Internal signal status 22	
	Bit8	Internal built-in trigger
	Bit9	Internal position 0
	Bit10	Internal location 1
	Bit11	Internal position 2
4	Internal signal status 23	
	Bit12	Internal position 3
	Bit13	Home return enable
	Bit14	Mechanical home signal
	Bit15	Reserved

Un02D	Internal signal status (output	Unit: N/A	Communication

	terminal) 4		address: 0xE02D
Parameter Description	This function is used to monitor the status of critical signals inside the drive		



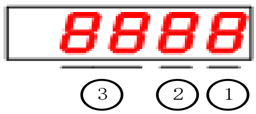
1	Internal signal status 30	
	Bit0	Servo ready.
	Bit1	Positioning complete
	Bit2	Speed consistency
	Bit3	Motor rotation
2	Internal signal status 31	
	Bit4	Torque limiting in
	Bit5	Speed limiting in
	Bit6	Brake holding signal
	Bit7	Warning signal
3	Internal signal status 32	
	Bit8	Location close to
	Bit9	Command pulse input multiplier switching
	Bit10	Fault signal
	Bit11	Target torque reached
4	Internal signal status 33	
	Bit12	Home return completed
	Bit13	Reserved
	Bit14	Reserved
	Bit15	Reserved

Un02E	Can Status	Unit: N/A	Address

			Communication to: 0xE02E

Parameter Description

This function is used for Can working status.



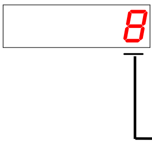
① Can status bit	
Bit0	Error warning flag (0: OFF; 1: ON)
Bit1	Error passive flag (0: OFF; 1: ON)
Bit2	Bus off flag (0: OFF; 1: ON)
Bit3	Reserved
② Can bus last fault code	
0	No error
1	Filler error
2	Formatting error
3	Confirmation error
4	Bit-hidden error
5	Bit-obvious error
6	CRC error
7	Set by software 1
③ Can Receive Error Register	
0 to 255	The implementation part of the Can protocol fault isolation mechanism, this counter is incremented by 1 if an error occurs during reception. After each successful reception, this counter is decremented by 1 and reset to 120 if its value is greater than 128. when the counter exceeds 127, the CAN controller enters the error passive state.

Un02F	Can Command Word	Unit: N/A	Communication address: 0xE02F

Parameter Description	This function is used to monitor the network commands sent by the producer to the current drive.

Command Word	Instructions
01h	Run command (all networks are working)
02h	Stop command (only NMT works in the whole network)
80h	Pre-run command (only SDO, heartbeat, NMT work)
81h	Reset node command
82h	Reset communication command

Un030	Drive operating status	Unit: N/A	Address Communication to: 0xE030
Parameter Description	This function code is used to record the current operating status of the servo drive, so that it is easy for the upper computer and other devices to read the current working status of the drive through communication. When the drive is running in different working states, different data is displayed to indicate the current state the drive is in, specifically.		



Current operating status of the drive	
0	The servo drive is currently OFF
1	The servo drive is currently ON
2	The servo drive is currently in warning operation
3	The servo drive is currently in a fault alarm state

Un031	CanOpen Operational Status	Unit: N/A	Communication address: 0xE031

Parameter Description	This function is used to monitor the current message activation status of CanOpen.

CanOpen running state 1	
Bit0	SDO telegrams (0: off; 1: active)
Bit1	PDO telegrams (0: off; 1: active)
Bit2	Consumer heartbeat (0: off; 1: active)
Bit3	Producer heartbeat (0: off; 1: active)
CanOpen running state 2	
Bit4	Emergency telegrams (0: off; 1: active)
Bit5	Synchronized frames (0: off; 1: active)
Bit6	Reserved
Bit7	Reserved
Reserved	
Reserved	

Un142	Regenerative load accumulation value	Unit: 0.1%	Communication address: 0xE00A
Parameter Description	This function code is used to record that the servo drive has accumulated the regenerative load and the accumulated value is the heat generated and dissipated during the whole process. The drive generates an ER.920 warning when the monitored value of the Un142 is greater than 50.0%. The drive generates an ER.320 fault when the monitored value of the Un142 is greater than 100.0%. **Note:** Regenerative braking is turned off after a regenerative overload fault is generated.		

Chapter-9 Parameter Description

9.1 Basic parameters (Pn0xx)

Pn000	Function selection basic switch 0	■	Communication address: 0x0000
Factory value: 0x0000	Setting range: 0x0000~0x0217	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

X (0th): 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	Reserved (please do not use)

Y (1st): Reservedd parameters (Do not use)

Z (2nd): Drive Model Selection

0	Standard pulse type
1	CanOpen type
2	EtherCAT type

W (3rd): Motor type

0	Rotating motors
1	Reserved
2	Virtual motors

Parameter Description

Control mode selection: Used to set the command signal source of the drive. Position mode selects the command source by function code Pn200; speed mode selects the command source by function code Pn300; torque mode selects the command source by function code Pn400.

Drive model selection: The software automatically detects whether the hardware is an EtherCAT model, if yes, it automatically switches to EtherCAT model, some standard pulse type functions are not available, if there are special circumstances, the automatic detection function can be turned off, please consult the manufacturer.

Pn001	Function selection basic switch 1	○	Communication address: 0x0001
Factory value: 0x0000	Setting range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

X (0th): Servo enable switch

0	Servo OFF
1	Servo ON

Y (1st): Whether servo enable is stored (power down save)

0	No storage
1	Storage

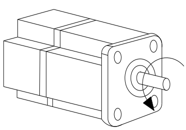
Z (2nd): Reserved parameters (do not use)

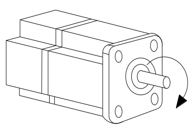
W (3rd): Reserved parameters (do not use)

Pn002	Motor rotation direction selection	■	Communication address: 0x0002
Factory value: 0x0000	Setting range: 0x0000~0x0001	Unit: N/A	Control mode. P S T

For setting the use of the absolute encoder with battery.

Setting value	Instructions	Note
0	Forward rotation in CCW direction (counterclockwise)	-
1	With CW direction as forward direction (clockwise)	-





Facing the shaft end, the motor rotates counterclockwise (CCW) Facing the shaft end, the motor rotates clockwise (CW)

Pn003	Monitoring display when power is turned on	■	Communication address: 0x0003
Factory value: 0FFF	Setting range: 0x0000~0x0FFF	Unit: N/A	Control mode. P S T
Parameter Description	It is used to set the Un number, and the data of the corresponding set Un number is displayed on the panel operator when the power is turned on. Note: When set to 0x0FFF, the system status (Off, ndy, On, etc.) is displayed when the power is turned on.		

Pn004	Stop method in case of servo OFF and Gr.1 alarm	■	Communication address: 0x0004
Factory value: 0x0002	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P S T

Used to set how drive will stop when OFF and when a Type 1 fault alarm is generated.

Setting value	Instructions	Note
0	Stopping the motor by means of DB (dynamic brake)	[Model-related]
1	Stop the motor via DB, then disengage DB	[Model-related]
2	No DB, set motor to free run	[Default]

Pn005	Stop method on Gr.2 alarm	■	Communication address: 0x0005
Factory value: 0x0000	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P S T

Used to set how to stop the drive when it generates a Type 2 fault alarm.

Setting value	Instructions	Note
0	Zero speed stop	-
1	DB stop or free run stop (same stop method as Pn004)	[Model-related]

Pn006	Function selection basic switch 6	■	Communication Address: 0x0006
Factory value: 0x1001	Setting range: 0x0000 to 0x4121	Unit: N/A	Control mode. P S T

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

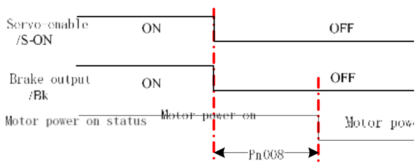
Overtravel (OT) warning detection option (0th, X)	
0	Non-detection of overtravel warnings
1	Detect Overtravel Warning
Reserved parameters (do not use) (1st, Y)	
Warning detection options (2nd, Z)	
0	Detection warning
1	Non-detection warning (except A.971)
Cooling fan control (for drives with fans) (3rd, W)	
0	When servo is enabled, fan runs when temperature exceeds 45°C, stops when it is less than 42°C The fan stops immediately when the servo is OFF
1	Fan runs immediately when servo is enabled When the servo is OFF, the fan runs when the temperature exceeds 45°C, and stops when it is less than 42°C
2	When servo is enabled, the fan runs immediately; when servo is OFF, the fan stops immediately
3	Forced closure
4	Forced open

Pn007	Stop method in case of drive overtravel (OT)	■	Communication Address: 0x0007
Factory value: 0x0001	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P S T

Used to set how to stop the drive when it generates an overtravel.

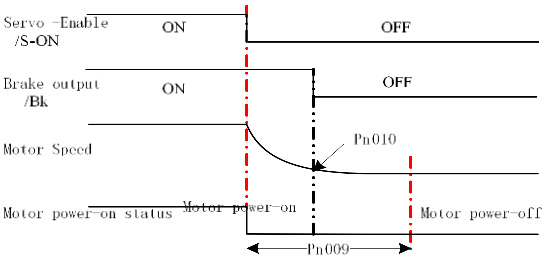
Setting value	Instructions	Note
0	DB stop or free run stop (same stop method as Pn004)	[Model-related]
1	Use the value of Pn053 as the maximum deceleration torque to stop the motor, then enter servo lock	-
2	Use the value of Pn053 as the maximum deceleration torque to stop the motor, and then enter the free state	

Caution	
	● For the vertical axis, the workpiece may fall after entering overtravel due to the holding brake (/BK) signal being turned on (holding brake released). To prevent the workpiece from falling, set the "servo motor to enter the zero position fixed state after stopping (Pn007=1)". ● When an external force is applied, the motor will be blocked at the base after stopping when it enters overtravel, and the load shaft end may be pushed back by the external force. To prevent the servo motor from being pushed back by an external force, set the "servo motor to zero fixed state after stopping (Pn007=1)".

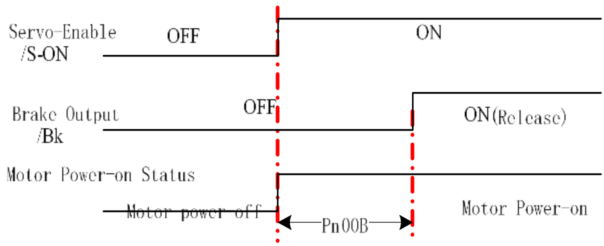
Pn008	Brake command - Motor output delay time when servo is OFF	○	Communication address: 0x0008
Factory value: 0	Setting range: 0 to 2000	Unit: ms	Control mode. P S T
Parameter Description	When the servo motor is stopped, the brake (/BK) signal and the servo ON (/S-ON) signal are turned off at the same time. By setting this function code, the time from when the servo ON (/S-ON) signal is turned off to when the motor actually enters the non-energized state can be changed. When used for vertical axes, the self-weight or external force of the mechanical moving part may cause slight mechanical movement. By setting this function code, the motor can be energized for an extended period of time after the brake is applied to eliminate slight mechanical movement.  Note: When an alarm occurs, independent of this setting, the servo motor		

	immediately enters a non-energized state, at which time the machine may sometimes move before the brake acts due to the self-weight of the mechanical moving part or external forces, etc.

Pn009	Servo OFF-Brake command wait time	○	Communication address: 0x0009
Factory value: 50	Setting range: 0 to 2000	Unit: ms	Control mode. P S T

Pn00A	Motor speed setting when the electromagnetic brake is released	○	Communication address: 0x000A
Factory value: 100	Setting range: 0～10000	Unit: rpm	Control mode. P S T
Parameter Description	When an alarm 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 the servo OFF-brake command wait time. The brake will act when either of the following conditions holds. When the motor enters a non-energized state, the motor speed is lower than the motor speed setting when the electromagnetic brake hold is released. When the motor enters the non-energized state, after the servo OFF - brake command wait time.  		

Caution	
⚠	● When the stop method for alarm occurrence is zero-speed stop, the system outputs the brake signal (/BK) by means of function code Pn007 after stopping the motor by means of the zero-speed command. ● Even if a value exceeding the maximum speed of the servo motor used is set in Pn009, it will be limited to the maximum speed of the servo motor.

Pn00B	Brake command – Hold brake release delay time at servo ON	○	Communication address: 0x000B
Factory value: 10	Setting range: 0 to 2000	Unit: ms	Control mode. P S T
Parameter Description	When the servo motor is started, the delay time (Pn007) for the motor to release the holding brake can be set to control the time from when the servo receives the ON signal to when the motor actually enters the energized state. When used for vertical axis, the self-weight of the mechanical moving part or external force may cause slight movement of the machine, and by setting this function code, the holding brake can be released after the motor enable state. 		

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

Pn00D	Function selection basic switch D	■	Communication address: 0x000D
Factory value: 0x0000	Setting range: 0x0000 to 0x2111	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

X	AC/DC power input selection
0	AC power input: AC power input from terminals L1, L2, L3
1	DC power input: DC power input from between "+" and "-"

Y	Unit input selection for three-phase input specification servo units (model-related)
0	Use with three-phase power input
1	Use three-phase input specifications with single-phase power input

Z	Speed detection method selection
0	Speed detection method 1
1	Speed detection method 2 (motor speed will become smooth)

W	Absolute position limit switches (soft limit switches)
0	Absolute position soft limit invalid
1	Absolute position soft limit active, set by function codes Pn030 and Pn032
2	Absolute position soft limit valid, set via object

Caution

● Absolute soft limit switches can only be opened if both of the following are active.

1. The motor encoder is an absolute encoder (PnF00.W = 1).
2. Use the absolute encoder normally (Pn040 = 1).

● The external input terminal limit switch is always active regardless of whether the absolute value limit switch is on or off (in case it has been configured).

Pn00E	Function selection basic switch E	■	Communication address: 0x000E
Factory value: 0x4000	Setting range: 0x0000~0x0111	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

Absolute encoder multi-turn overflow fault (ER.C21)	
0	Un-shield
1	Shield

Driver and motor voltage match detection switch	
0	Turn on
1	Close

Virtual Motor Encoder Types	
0	Incremental
1	Absolute

Virtual Motor Encoder Bits	
0	16-bit
1	17 places
2	20 places
3	23 places
4	24-bit

Caution

● The absolute encoder multi-turn count overflow monitoring function is only active when both of the following conditions are in effect.

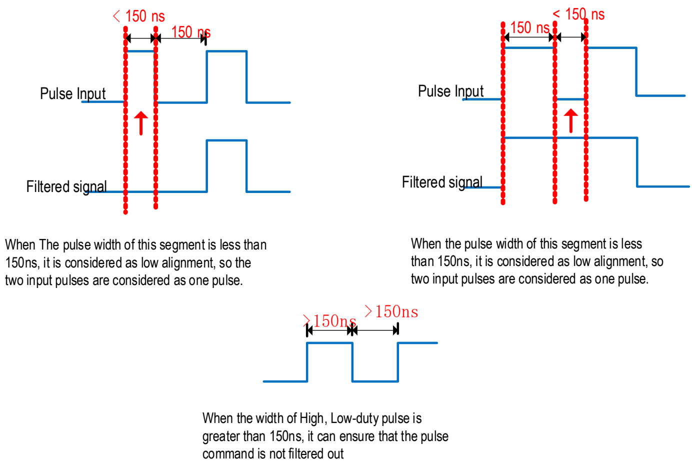
1. The motor encoder is an absolute encoder (PnF00.W = 1).
2. Use the absolute encoder normally (Pn040 =1).

● The range of the absolute encoder multi-turn count is [-32768, 32767], beyond which an ER.C21 fault is generated.

● The absolute value multi-turn overflow fault detection will turn itself off when the rotation turn limit function (Pn276 not 0) is turned on.

● The driver and motor voltage matching detection switch, in actual use, after the detection switch is "off", the 380V servo driver can drive the 220V motor, at this time, you need to consider whether the driver current

	is within the actual demand range and other factors; 220V driver can drive the 380V motor, at this time, you need to Consider the maximum speed of the motor and other factors.

<table>
<tr><td colspan="1">Pn011</td><td colspan="2">External pulse signal filtering time customization</td><td>■</td><td>Communication address: 0x0011</td></tr>
<tr><td>Factory value: 400</td><td colspan="2">Setting range: 0~5000</td><td>Unit: 12.5ns</td><td>Control mode. P</td></tr>
<tr><td>Parameter Description</td><td colspan="4">Used to set the filtering time for external pulse command signals.
When the user sets Pn011 = 12 (12 × 12.5ns = 150ns), a filter width duration of less than 150ns will be treated as an interference signal.

Calculation method: the maximum pulse frequency sent by the user's upper unit mount is f kHz, then.
$$Pn011 = \frac{40000}{f} + 1$$
Note: The custom time is calculated based on when the hardware filter is</td></tr>
</table>

	turned off, and the custom time is adjusted according to the actual working conditions after the hardware filter is actually turned on.

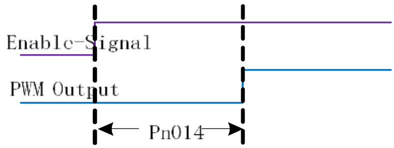
Pn012	External regenerative resistor power		■	Communication address: 0x0012
Factory value: 0	Setting range: 0 to 65535		Unit: 10W	Control mode. P S T
Parameter Description	When an external regenerative resistor is connected, the regenerative resistor power is set to a value that matches the connected external regenerative resistor. Note: The setting value varies depending on the cooling of the external regenerative resistor. When an alarm occurs and the regenerative resistor temperature is not high at that time, the corresponding power value can be set large; conversely, set a smaller value. When **self-cooling method** (natural convection cooling): Set to a value of 20% or less of the regenerative resistance power (W). When **forced air cooling method**: Set to a value of 50% or less of the regeneration resistance power (W). For example, if the power of the self-cooling external regenerative resistor is 100W, 100W x 20% = 20W, Pn012 should be set to "2" (setting unit: 10W)			

Caution	
	● For drives with built-in regenerative braking resistors as standard, when set to 0, the drive is protected against the built-in resistors. ● If the setting value is improper, the drive may display the ER.320 alarm.

Pn013	External regenerative resistor resistance value		○	Communication address: 0x0013
Factory value: 0	Setting range: 0 to 65535		Unit: 1Ω	Control mode. P S T
Parameter Description	When an external regenerative resistor is connected, the regenerative resistor resistance value is set to a value that matches the connected external regenerative resistor.			

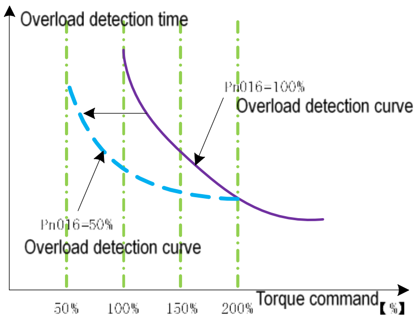
Caution

⚠	The minimum regenerative resistance value allowed to be connected to each power section varies, see "Setting regenerative resistance" for details, otherwise the internal components of the servo unit may be damaged.

Pn014	Servo drive power-on enable delay time	○	Communication address: 0x0014
Factory value: 0	Setting range: 0~6000	Unit: ms	Control mode. P S T
Parameter Description	Used to enable the drive immediately after power-up enable, and then enable it after a set time delay after the bus voltage has been established. 		

Pn015	Motor overload warning value	○	Communication address: 0x0015
Factory value: 50	Setting range: 1 to 100	Unit: %	Control mode. P S T

Pn016	Motor overload detection base current derating setting	○	Communication address: 0x0016
Factory value: 100	Setting range: 10 to 100	Unit: %	Control mode. P S T
Parameter Description	Overload (continuous maximum) faults (ER.720) can be detected in advance to prevent overloading the motor and causing it to burn out. By detecting the overload alarm using the "base current after rating reduction" in the following equation, the overload fault detection time can be reduced. Note that the detection value of the overload (instantaneous maximum) alarm (ER.710) cannot be changed. Motor base current after rating reduction = Motor base current × Motor overload detection base current derating setting **Terminology Description:** Motor base current: motor current threshold to start calculating overload		

	alarms Motor overload detection base current derating setting value: the rated reduction rate of the motor base current. For example, if Pn018 is set to 50%, the motor overload is calculated from 50% of the base current, so the overload alarm can be detected early. When the value of Pn018 is changed, the overload alarm detection time will be changed, and the overload alarm detection time will be changed accordingly. 

Pn017	Servo unit overload detection current derating percentage at single-phase power input	○	Communication address: 0x0017
Factory value: 50	Setting range: 10 to 100	Unit: %	Control mode. P S T

Pn030	Absolute position limit single-turn maximum (internal soft limit)	○	Communication address: 0x0030 ★
Factory value: 0	Setting range: -2^{31} to $2^{31}-1$	Unit: Encoder unit	Control mode. P S T

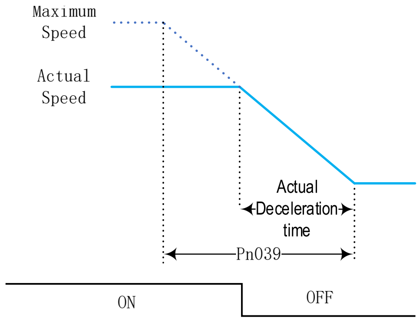
Pn032	Absolute position limiting multi-turn maximum (internal soft limit)	○	Communication address: 0x0032
Factory value: 32767	Setting range: -32768 to 32767	Unit: circle	Control mode. P S T
Parameter	The internal position feedback of the drive compares with the set limit value and immediately alarms and performs the relevant operation when the		

Description	limit value is exceeded. The function code Pn000A.3 switch allows the user to make the relevant selection. Notes. ● When (Pn030 × number of pulses in one revolution + Pn032) is less than (Pn035 × number of pulses in one revolution + Pn033), the absolute position limit minimum and maximum values are interchanged. ● Only for absolute encoder type motors.

Pn033	Absolute position limit minimum value (internal soft limit)	○	Communication address: 0x0033 ★
Factory value: 0	Setting range: -2^{31} to $2^{31}-1$	Unit: Encoder unit	Control mode. P S T

Pn035	Absolute position limiting multi-turn minimum value (internal soft limit)	○	Communication address: 0x0035
Factory value: -32768	Setting range: -32768 to 32767	Unit: circle	Control mode. P S T
Parameter Description	The internal position feedback of the drive compares with the set limit value and immediately alarms and performs the relevant operation when the limit value is exceeded. The function code Pn000A.3 switch allows the user to make the relevant selection. Notes. ● When (Pn030 × number of pulses in one revolution + Pn032) is less than (Pn035 × number of pulses in one revolution + Pn033), the absolute position limit minimum and maximum values are interchanged. ● Only for absolute encoder type motors.		

Pn036	Absolute position-limited hysteresis loop	○	Communication address: 0x0036
Factory value: 200	Setting range: 0 to 30000	Unit: Encoder unit	Control mode. P S T
Parameter Description	When using the soft limit function, the soft limit unit is an encoder unit, and when the soft limit state is entered, the soft limit state may be entered and exited frequently. Setting the corresponding hysteresis loop value according to the actual situation can effectively circumvent the frequent entering-exiting soft limit state.		

Pn039	Deceleration stop time at servo OFF (DEC)	○	Communication address: 0x0039
Factory value: 0	Setting range: 0～10000	Unit: 1ms	Control mode. P S T
Parameter Description	$$\text{Actual deceleration time} = \frac{Target\ speed}{Maximum\ speed} \times \text{Deceleration time Pn039}$$ 		

Caution	
	● When Pn039 is set to 0, the deceleration stop function is disabled when the servo is OFF. ● The servo OFF stop function is valid only for the external input terminal and the internal Pn001_X. It is not valid for other enabling methods. ● Valid for position mode, speed mode, and torque mode.

Pn040	How to use the absolute encoder	○	Communication address: 0x0040
Factory value: 0x0001	Setting range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

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

X: How to use the standard pulse type servo absolute encoder	
0	Normal use of absolute encoders
1	Use of absolute encoders as incremental encoders

Y: Use of EtherCAT bus type servo absolute encoders	
0	Normal use of absolute encoders
1	Use of absolute encoders as incremental encoders

Z: Reserved parameters (do not use)

W: Reserved parameters (do not use)

Caution
● Normal use of the absolute encoder requires an externally equipped battery, otherwise the drive generates a battery undervoltage warning or fault alarm.

Pn041	Absolute encoder alarm/alarm selection in case of battery undervoltage	■	Communication address: 0x0041
Factory value: 0x0000	Setting range: 0x0000~0x0001	Unit: N/A	Control mode. P S T

For setting the use of the absolute encoder with battery.

Setting value	Instructions	Note
0	Set battery undervoltage to alarm (Er.830)	-
1	Setting battery undervoltage as a warning (AL.930)	-

● Alarm Er.830: The drive checks for proper encoder backup battery within 8 seconds of power-up, and no longer checks for proper encoder backup battery voltage after 8 seconds.

● Warning AL.930: The drive dynamically checks the encoder backup battery voltage as soon as it is powered up and generates a corresponding warning when it falls below the alert value, the warning disappears automatically when it rises above the alert value.

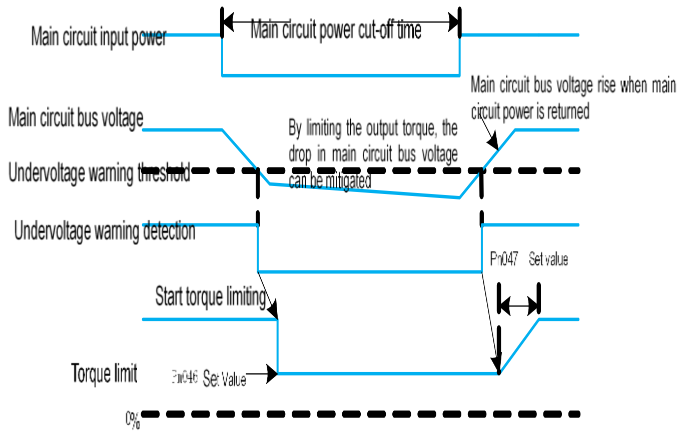
Pn045	Function selection in case of main circuit (DC) undervoltage	■	Communication address: 0x0045
Factory value: 0x0000	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P S T

Used to set the torque limiting threshold for the drive output.

Setting value	Instructions	Note
0	Non-detection of undervoltage warning	-
1	Detect undervoltage warning	-
2	Detects undervoltage warnings and simultaneously performs torque limiting via Pn046 and Pn047	-

Pn046	Torque limiting during main circuit descent	○	Communication address: 0x0046
Factory value: 50	Setting range: 0 to 100	Unit: 1%	Control mode. P S T
Parameter Description	Percentage relative to the rated torque of the motor.		

Pn047	Torque limit release time when main circuit is down	○	Communication address: 0x0047
Factory value: 100	Setting range: 0~1000	Unit: 1ms	Control mode. P S T
Parameter Description	Torque limiting is performed inside the Servo Drive according to the undervoltage warning. When the undervoltage warning is released, the torque limiting value is controlled according to the set time.		



Pn050	Torque limiting method selection	■	Communication address: 0x0050
Factory value: 0x0002	Setting range: 0x0000~0x0116	Unit: N/A	Control mode. P S T

Used to set the torque limiting threshold for the drive output.

Setting value	Instructions	Note
0	Reserved	-
1	Reserved	-
2	Internal forward and reverse rotation limits	-
3	Internal forward rotation limit and internal reverse rotation limit	-
4	External terminal limit selection	-
5	Limit after pulse command is 0 and positioning is complete	-

Description of torque limiting method selection

Pn0050	Positive Rotation	Reverse Rotation	Instructions

<table>
<tr><td colspan="2">0</td><td colspan="2">Reserved</td><td>-</td></tr>
<tr><td colspan="2">1</td><td colspan="2">Reserved</td><td>-</td></tr>
<tr><td colspan="2">2</td><td colspan="2">Pn051</td><td>Limit the maximum torque value for forward and reverse rotation by setting the value with function code Pn051</td></tr>
<tr><td colspan="2">3</td><td>Pn051</td><td>Pn0052</td><td>Set the maximum torque value for forward rotation via function code Pn051.
Set the maximum torque value for reverse via function code Pn052.</td></tr>
<tr><td rowspan="2">4</td><td>OFF</td><td colspan="2">Pn054</td><td rowspan="2">The torque limit value is selected via an external terminal.
When TL-SEL is low (OFF), function code Pn054 sets the value to limit the maximum torque value for forward and reverse rotation.

When TL-SEL is high (ON), function code Pn055 sets the value to limit the maximum torque value for forward and reverse rotation.</td></tr>
<tr><td>ON</td><td colspan="2">Pn055</td></tr>
<tr><td rowspan="2">5</td><td>OFF</td><td colspan="2">Pn051</td><td rowspan="2">(i) When the external pulse command is 0 (after filtering); (ii) Positioning is complete.

When either of the two conditions does not hold, the maximum torque values for forward and reverse rotation are limited by function code Pn051.

When both conditions hold, the maximum torque value for forward and reverse rotation is limited by function Pn052.</td></tr>
<tr><td>ON</td><td colspan="2">Pn052</td></tr>
</table>

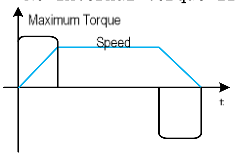
Caution
● The torque limiting method is only valid for the non-torque mode. Torque limiting in torque mode is only available through: 1. function code Pn051 for forward torque limiting and reverse torque limiting. 2. External torque limiting, switch to external torque limiting Pn051 via external X terminal.

Pn051	Internal forward torque limitation	○	Communication address: 0x0051
Factory value: Model determination	Setting range: 0 to 500	Unit: 1%	Control mode. P S T

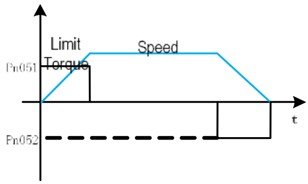
Pn052	Internal reverse torque limitation	○	Communication address:

			0x0052
Factory value: Model determination	Setting range: 0 to 500	Unit: 1%	Control mode. P S T
Parameter Description	The output torque can be limited for the purpose of protecting the machine, etc. Internal torque limiting is a limiting method in which the maximum output torque is always limited by a parameter. Note: (1) The setting unit is a percentage relative to the rated torque of the motor. (2) When the torque limit setting is too small, insufficient torque may occur when the servo motor is accelerating or decelerating.		

No internal torque limitation



With internal torque limitation



Pn053	Emergency stop torque	○	Communication address: 0x0053
Factory value: 800	Setting range: 0 to 800	Unit: 1%	Control mode. P S T
Parameter Description	Maximum torque display for emergency stop in specific situations, for emergency stop in case of overtravel.		

Pn054	External torque limiting1	○	Communication address: 0x0054
Factory value: 100	Setting range: 0 to 500	Unit: 1%	Control mode. P S T

Pn055	External torque limiting2	○	Communication address: 0x0055
Factory value:	Setting range: 0 to 500	Unit: 1%	Control mode. P S T

100			

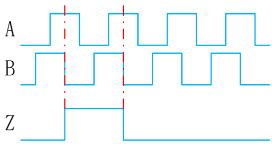
Pn056	Stall speed detection torque threshold	○	Communication address: 0x0056
Factory value: 100	Setting range: 0 to 255	Unit: 1%	Control mode. P S T
Parameter Description	When the current torque is greater than the Pn056 set threshold and the speed is greater than the Pn057 set threshold, the stall speed detection function is on. Note: (i) This torque threshold is relative to the maximum torque; (ii) When Pn056 is set to 0, the stall speed detection function is turned off.		

Pn057	Speed thresholds for stall speed detection	○	Communication address: 0x0057
Factory value: 20	Setting range: 0 to 200	Unit: 1%	Control mode. P S T
Parameter Description	When the current torque is greater than the Pn056 set threshold and the speed is greater than the Pn057 set threshold, the stall speed detection function is on. Note: This speed value is relative to the maximum overspeed threshold.		

Pn059	KTY type temperature sensing alarm thresholds	○	Communication address: 0x0059
Factory value: 0	Setting range: 0 to 180	Unit: 1° C	Control mode. P S T
Parameter Description	It is used for over-temperature protection processing of motors equipped with KTY-type sensors. When the motor temperature is greater than this set threshold, a corresponding over-temperature alarm (ER.42A) is generated. Note: 1. When set to 0, the over-temperature monitoring function is invalid. 2. Valid only for motors equipped with KTY type temperature sensors.		

Pn070	Number of encoder divider pulses	○	Communication address: 0x0070
Factory value: 2500	Setting range: 35 to 32767	Unit: NA	Control mode. P S T

Parameter Description	The function code is used to set the number of encoder divider pulses, which is the value before 4x frequency.

Pn071	Encoder divider pulse Z signal width	■	Communication address: 0x0071
Factory value: 4	Setting range: 1 to 31	Unit: N/A	Control mode. P S T
Parameter Description	Z pulse is a pulse sent by the encoder following the motor shaft rotation for one week, which is used to determine the zero position or mark position. The servo driver provides Z pulse output width adjustable function, which is used to widen the Z signal of the encoder to meet the needs of different upper units, so that the user becomes more flexible in selecting upper motion control devices. Example: Set Pn071 set to 4, which means the Z pulse width is 4 times the quadrature AB pulse width. The user can widen the Z pulse width in the range of 1 to 31.  Note: This function is only valid when Pn072.Y=0 (encoder output OA/OB/OZ source is the motor encoder signal).		

Pn072	Frequency division output pin signal setting	■	Communication address: 0x0072
Factory value: 0x0010	Setting range: 0x0000~0x0013	Unit: N/A	Control mode. P S T

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

X (0th): OA/OB/OC output source selection in CN1 terminal

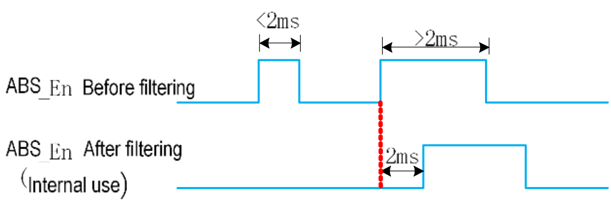
0	Positive polarity output (forward direction)
1	Negative polarity output (reverse)

Y (1st): Motor-side encoder crossover output polarity

0	Source is motor-side encoder frequency division output
1	Use of absolute encoders as incremental encoders
2	The source is the high-speed pulse instruction in CN1
3	The source is a fully closed-loop encoder signal with optical scale

Z (2nd): Reserved parameters (do not use)

W (3rd): Reserved parameters (do not use)

Pn073	Absolute encoder data request signal (ABS_En) filtering time	○	Communication address: 0x0073
Factory value: 0	Setting range: 0 to 32	Unit: ms	Control mode. P S T
Parameter Description	This filtering time is used to filter the ABS_En signal given by the user. Example: When Pn073 is set for 2ms, ABS_En signal less than 2ms will be filtered out, and at the same time, ABS_En signal will have a 2ms delay. 		

Caution	
⚠	● When set to 0, the absolute encoder data request function is turned off

Pn074	Encoder Z signal single-turn output control switch	○	Communication address: 0x0074

Factory value: 0xFF50	Setting range: 0x0100~0xFFF1	Unit: N/A	Control mode. P S T

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

Encoder Z signal output method	
0	Normal output
1	Anti-shake output

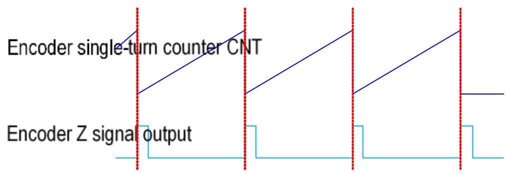
Encoder Z signal anti-shake width	
0 ... F	Single-turn Z-signal anti-shake width in 100 encoder units.

Encoder Z signal single-turn output width	
01 ... FF	Single-turn Z signal output width in 10us.

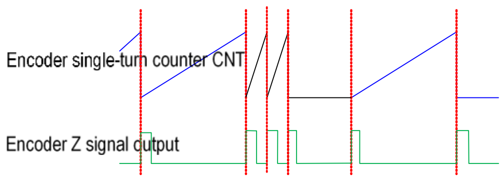
Parameter Description

This function code is used for the function setting where the upper computer needs to calculate the number of revolutions of the motor by the Z signal of the encoder.

For example, as shown below, for each revolution of the motor, the encoder Z signal is output when the encoder single-turn counter is 0.



And in actual use, there may be a motor zero speed lock with a single-turn position calculator at position 0. The encoder frequently outputs the Z signal, causing the upper computer pulse count to be abnormal.



Note: This function is only valid when Pn007.Z=0 (encoder output OA/OB/OZ source is the motor encoder signal).

Pn076	Serial encoder single-turn resolution usage	■	Communication address: 0x0076
Factory value: 0x0020	Setting range: 0x0000~0x0051	Unit: N/A	Control mode. P S T

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

0th (X): Encoder single-turn resolution adjustment switch

0	Non-adjustment
1	Adjustment

1st (Y): Single-turn resolution setting

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

2nd (Z): Reserved parameters (do not use)

3rd (W): Reserved parameters (do not use)

Caution

- Valid only for serial encoders.
- If the adjustment of the single-turn resolution is lower than the actual encoder resolution, the actual encoder resolution is used as the reference.

Pn07F	Serial encoder multi-turn and fault clearing	○	Communication Address: 0x007F
Factory value: 0x0000	Setting range: 0x0000~0xFFFF	Unit: N/A	Control mode. P S T

Parameter Description	This function code is used for multiple turns of the serial encoder and for battery fault clearing. The function code is executed by writing 1 to this function code. The effect is the same as the auxiliary function Fn008, which is used for the user to implement the absolute encoder multi-turn clearing via RS485, etc.

Caution	
	● Valid only for absolute serial encoders. ● Function code Pn07F is not saved when power is lost and is automatically cleared when execution is complete. ● Execution in the drive enable state is prohibited.

Pn080	Local communication address (485 & CanOpen)		○	Communication address: 0x0080
Factory value: 1	Setting range: 0 to 255	Unit: N/A		Control mode. P S T
Parameter Description	This function code is used to set the drive axis address. 0: Broadcast address, the upper computer can write to all drives through the broadcast address, the drive receives the frame of the broadcast address to operate accordingly, but does not respond. 1 to 255: When multiple Servo Drives are networked, each Drive can only have a unique address; otherwise, communication will be abnormal or impossible. Note: For CanOpen models, the maximum allowed value for this communication address is 63.			

Pn081	Local communication format		■	Communication address: 0x0081
Factory value: 0x0502	Setting range: 0x0000~0x0655	Unit: N/A		Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

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

Y: 485 communication verification method	
0	No parity, 8 bits data, 1 stop bit (N-8-1)
1	Even parity, 8 bits of data, 1 stop bit (N-8-1)
2	Odd parity, 8 bits 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)

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

W: Reserved parameters (do not use)

Caution

● The baud rate and communication verification method of the servo driver must be the same as those of the host computer, otherwise communication is not possible.

Pn085	Whether the communication write function code is stored in Eeprom	○	Communication address: 0x0085
Factory value: 0x0000	Setting range: 0x0000~0x0111	Unit: N/A	Control mode. P S T

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

X: 485 communication	
0	No storage
1	Storage

Y: CanOpen Newsletter	
0	No storage
1	storage

Z: Reserved parameters (please do not change)

W: Reserved parameters (please do not change)

Parameter Description	If the changed parameters do not require power-down storage, please set the corresponding function to not store, otherwise, a long time to change the function code data in large quantities and store it into the Eeprom will cause the Eeprom to be damaged and the drive will generate an Er.021 fault.

Pn087	485 communication register address mapping switch	○	Communication address: 0x0087
Factory value: 0x0000	Setting range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

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

X: 1# Register address mapping switch	
0	Close
1	Turn on

Y: 2# Register address mapping switch	
0	Close
1	Turn on

Z: Reserved parameters (do not use)

W: Reserved parameters (do not use)

Pn088	1# register mapping source address	○	Communication Address:

			0x0088
Factory value: 0x0000	Setting range: 0x0000 to 0x1FFF	Unit: N/A	Control mode. P S T

Pn089	1# register mapping destination address	○	Communication address: 0x0089
Factory value: 0x0000	Setting range: 0x0000 to 0x1FFF	Unit: N/A	Control mode. P S T

Pn08A	2# register mapping source address	○	Communication Address: 0x008A
Factory value: 0x0000	Setting range: 0x0000 to 0x1FFF	Unit: N/A	Control mode. P S T

Pn08B	2# register mapping destination address	○	Address Communication to: 0x008B
Factory value: 0x0000	Setting range: 0x0000 to 0x1FFF	Unit: N/A	Control mode. P S T

9.2 Gain parameters(Pn1xx)

Pn100	Rotational inertia ratio (J)	○	Communication address: 0x0100
Factory value: 100	Setting range: 0～20000	Unit: 1%	Control mode. P S T
Parameter Description	Set the total inertia to motor rotor inertia ratio. $$\text{Pn100} = \frac{\text{Load inertia} + \text{Motor rotor inertia}}{\textit{Motor rotor inertia}} \times 100\%$$		

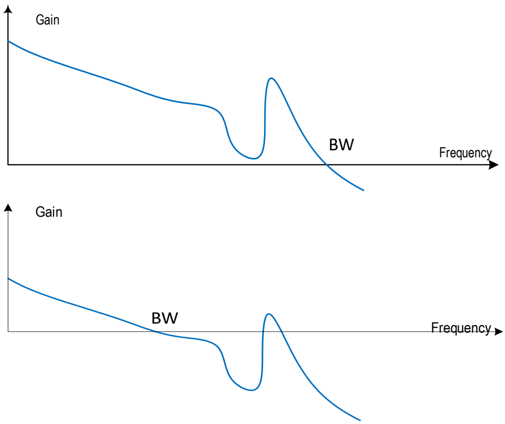
Pn101	Speed loop proportional gain (ASR_KP)	○	Communication address: 0x0101
Factory value:	Setting range: 1.0 to 2000.0	Unit: Hz	Control mode. P S T

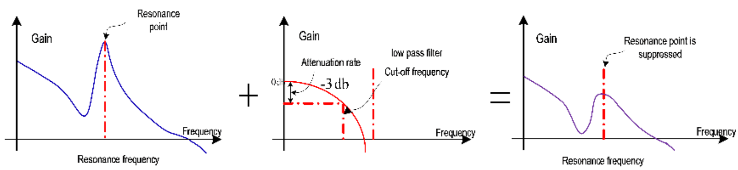
40.0			
Parameter Description	Sets the gain of the speed regulator (ASR_KP), which determines the responsiveness of the speed control loop. The larger the ASR_KP value setting, the higher the speed loop response frequency and the better the followability for speed commands. By increasing the setting value of the speed loop gain, the response characteristics of the servo system can be improved. However, when the ASR_KP setting is too large, it is easy to cause vibration.		

Pn102	Speed loop integration time constant (ASR_Ki)	○	Communication address: 0x0102
Factory value: 20.00	Setting range: 0.15 to 512.00	Unit: ms	Control mode. P S T
Parameter Description	Sets the integration time of the speed regulator (ASR_Ki), which determines the responsiveness of the speed control loop. The smaller the ASR_Ki value setting, the higher the speed loop response frequency and the better the follow-through for speed commands. By reducing the setting value of the velocity loop integration time, the response characteristics of the servo system can be improved. However, when the ASR_Ki setting is too small, vibration is easily caused.		

Pn103	Position loop proportional gain (APR_KP)	○	Communication to: 0x0103
Factory value: 40.0	Setting range: 1.0 to 2000.0	Unit: 1/s	Control mode. P S T
Parameter Description	Sets the gain of the position regulator (APR_KP), which determines the responsiveness of the position control system. The larger the APR_KP value, the higher the position response frequency, the better the followability for position commands, the smaller the amount of position deviation, and the shorter the positioning adjustment time. However, when the APR_KP value is set too large, it is easy to cause vibration.		

Pn104	Torque command filter time constant	○	Communication address: 0x0104
Factory value: 1.00	Setting range: 0.00 to 655.35	Unit: ms	Control mode. P S T

<table>
<tr>
<td>Parameter Description</td>
<td>
Sets the resonance rejection low-pass filtering time constant. When the constant is set to 0, the low-pass filtering function is turned off. When the resonance phenomenon occurs in the mechanical structure, it is possible that the drive control system is too rigid or the corresponding bandwidth is too fast. By using this parameter with the resonance suppression notch filter parameter, the resonance of the control system can be suppressed without changing the control parameters.


As the torque command filter time parameter is gradually adjusted from 0 to a larger one, the corresponding BW point will become smaller and smaller. Of course the problem of resonant frequency generation will be solved, but the bandwidth and phase boundaries of the system response will be reduced at the same time.


As the low-pass filter is cranked up from 0, the co-channel band becomes smaller and smaller. Although the problem of resonance generation is solved, the system response bandwidth and phase boundaries are also reduced and the system becomes more unstable.
Recommended.
Adjustment values for the stability control range. $Pn104[ms] = \frac{1000}{2\pi \times Pn102[Hz] \times 4}$
Adjustment values for the limit control range. $Pn104[ms] = \frac{1000}{2\pi \times Pn102[Hz] \times 1}$
</td>
</tr>
</table>

Pn105	2nd speed loop proportional gain	○	Communication address: 0x0105
Factory value: 40.0	Setting range: 1.0 to 2000.0	Unit: Hz	Control mode. P S T

Pn106	2nd speed loop integration time constant	○	Communication address: 0x0106
Factory value: 20.0	Setting range: 0.15 to 512.00	Unit: ms	Control mode. P S T

Pn107	2nd position loop proportional gain	○	Communication to: 0x0107
Factory value: 40.0	Setting range: 1.0 to 2000.0	Unit: 1/s	Control mode. P S T

Pn108	2nd torque command filter time constant	○	Communication address: 0x0108
Factory value: 1.00	Setting range: 0.00 to 655.35	Unit: 1ms	Control mode. P S T

Pn110	Automatic gain switching class application switch	■	Communication address: 0x0110
Factory value: 0x0000	Setting range: 0x0000~0x0051	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

X (0th):

Gain Toggle Selector Switch	
0	Manual gain switching, manual gain switching by external input signal (G-SEL)
1	Automatic switching mode Automatic switching from gain 1 to gain 2 when switching condition A holds Automatic switching from gain 2 to gain 1 when switching condition A does not hold

Y (1st):

Switching condition A	
0	Positioning completion signal (/COIN) ON
1	Positioning completion signal (/COIN) OFF
2	Positioning proximity signal (/NEAR) ON
3	Positioning proximity signal (/NEAR) OFF
4	Position command filter output equals 0 and command input OFF
5	Position command pulse input ON

Z (2nd): Reserved parameters (please do not change)

W (3rd): Reserved parameters (please do not change)

Pn112	Gain switching time1	○	Communication address: 0x0112
Factory value: 0	Setting range: 0 to 65535	Unit:	Control mode. P S T

		ms	

Pn113	Gain switching time2	○	Communication address: 0x0113
Factory value: 0	Setting range: 0 to 65535	Unit: ms	Control mode. P S T

Pn114	Gain switching wait time 1	○	Communication address: 0x0114
Factory value: 0	Setting range: 0 to 65535	Unit: ms	Control mode. P S T

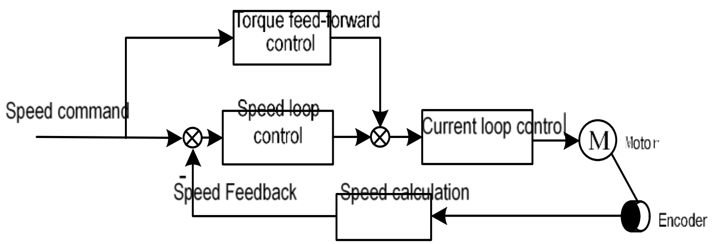
Pn115	Gain switching wait time 2	○	Communication address: 0x0115
Factory value: 0	Setting range: 0 to 65535	Unit: ms	Control mode. P S T

Pn120	Position integration time constant	○	Communication address: 0x0120
Factory value: 0.0	Setting range: 0.0 to 5000.0	Unit: ms	Control mode. P
Parameter Description	The integration function of the position ring at position integration is generally valid for use with electronic cams, electronic shafts, etc. Note: The position ring integral is invalid when set to 0.		

Pn121	Speed feedforward gain	○	Communication address: 0x0121
Factory value: 0	Setting range: 0 to 100	Unit: 1%	Control mode. P
Parameter Description	Speed feedforward is a function to shorten the positioning time, and this function is effective when the Servo Drive is performing position control. The speed feedforward is a command generated by differentiating the position command from the upper unit. When the position control command changes smoothly, the gain value is increased to improve the amount of position following error. If the position control command is not smooth, decreasing the position feedforward gain value will reduce the mechanism's operating		

	vibration phenomenon. Feedforward gain: reduces phase backward error.

Pn122	Speed feed-forward filtering time	○	Communication address: 0x0122
Factory value: 0.00	Setting range: 0.00 to 64.00	Unit: ms	Control mode. P

Pn123	Torque feedforward gain	○	Communication address: 0x0123
Factory value: 0	Setting range: 0 to 500	Unit: %	Control mode. P S
Parameter Description	Torque feedforward is only valid for position control and speed control.  		

Pn124	Torque feed-forward filtering time	○	Communication address: 0x0124
Factory value: 2.00	Setting range: 0.00 to 64.00	Unit: ms	Control mode. P S

Pn125 ★	Speed feedback low-pass filtering time constant	○	Communication address: 0x0125
Factory value: 0.00	Setting range: 0.00 to 655.35	Unit: ms	Control mode. P S T
Parameter	Set a first-order low-pass filter for the speed feedback of the speed loop.		

Description	The rotational speed contains resonance and high frequency disturbance signals, and noise can be eliminated by this parameter. Setting this value will make the feedback speed smoother and the vibration reduced. If a larger value is entered, it will become a delay element and reduce the corresponding performance, causing the loop response to slow down.

Pn130	Speed loop P/PI control switch	■	Communication address: 0x0130
Factory value: 0x0000	Setting range: 0x0000~0x0114	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

X (0th): 485 communication

0	Conditioned on internal torque command (Correlation value setting function code: Pn132)
1	Conditioned on speed command (relevant value setting function code: Pn133)
2	Conditioned on acceleration (Correlation value setting function code: Pn134)
3	Conditioned on position deviation (Correlation value setting function code: Pn135)
4	No mode switch function

Y (1st): Control method of speed loop

0	PI control
1	I-P control

Z (2nd): Reserved parameters (please do not change)

W (3rd): Reserved parameters (please do not change)

Pn132	Speed loop P/PI switching condition (torque command)	○	Communication address: 0x010C
Factory value: 200	Setting range: 0 to 800	Unit: 1%	Control mode. P S T

Pn133	Speed loop P/PI switching condition (speed command)		○	Communication address: 0x010D
Factory value: 0	Setting range: 0～10000	Unit: 1rpm		Control mode. P S T

Pn134	Speed loop P/PI switching condition (acceleration)		○	Communication address: 0x010E
Factory value: 0	Setting range: 0 to 30000	Unit: 1rpm/s		Control mode. P S T

Pn135	Speed loop P/PI switching condition (position deviation)		○	Communication address: 0x010F
Factory value: 0	Setting range: 0 ～ 10000	Unit: 1 command unit		Control mode. P S T

Pn140	Type A vibration suppression control switch		○	Communication address: 0x0140
Factory value: 0x0010	Setting range: 0x0000~0x0011	Unit: N/A		Control mode. P S

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

X (0th): Type A vibration suppression control switch selection

0	No use of Type A vibration suppression control
1	Use of Type A vibration suppression control

Y (1st): Type A vibration suppression control adjustment options

0	Automatic adjustment of type A vibration suppression control without using auxiliary functions
1	Automatic adjustment of A-type vibration suppression control using auxiliary functions

Z (2nd): Reserved parameters (do not use)

W (3rd): Reserved parameters (do not use)

Pn141	Type A Suppression Gain Compensation	○	Communication address: 0x0141
Factory value: 100	Setting range: 1 to 1000	Unit: %	Control mode. P S T

Pn142	A-type vibration suppression frequency	○	Communication address: 0x0142
Factory value: 100.0	Setting range: 1.0 to 2000.0	Unit: Hz	Control mode. P S T

Pn143	Type A vibration damping gain	○	Communication address: 0x0143
Factory value: 0	Setting range: 0 to 300	Unit: %	Control mode. P S T

Pn144	Type A vibration suppression filter constant 1 compensation	○	Communication address: 0x0144
Factory value: 0	Setting range: -10.00 to 10.00	Unit: ms	Control mode. P S T

Pn145	Type A vibration suppression filter constant 2 compensation	○	Communication address: 0x0145
Factory value: 0	Setting range: -10.00 to 10.00	Unit: ms	Control mode. P S T

Pn150	Notch filter function switch 1	○	Communication address: 0x0150
Factory value: 0x0001	Setting range: 0x0000~0x1101	Unit: N/A	Control mode. P S T

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

X	Selection of notch filter 1
0	Segment 1 notch filter is not valid
1	Segment 1 notch filter effective

Y	Reserved parameters (please do not change)

Z	Selection of notch filter 2
0	Segment 2 notch filter is ineffective
1	Segment 2 notch filter effective

W	Friction compensation function
0	No friction compensation function
1	Using the friction compensation function

Pn151	Notch filter function switch 2	○	Communication address: 0x0151
Factory value: 0x0101	Setting range: 0x0000~0x0101	Unit: N/A	Control mode. P S T

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

X	Notch filter 1 adjustment selection
0	Segment 1 notch filter is not automatically adjusted by the auxiliary function
1	Segment 1 notch filter automatically adjusted by auxiliary function

Y	Reserved parameters (please do not change)

Z	Selection of notch filter 2
0	Segment 2 notch filter is not automatically adjusted by the auxiliary function
1	Segment 2 notch filter automatically adjusted by auxiliary function

W	Reserved parameters (please do not change)

Pn152	Automatic trap resonance detection sensitivity	○	Communication address: 0x0152
Factory value: 100	Setting range: 1 to 200	Unit: %	Control mode. P S T

Pn153	Frequency of notch filter 1	○	Communication address: 0x0153
Factory value: 5000	Setting range: 50 to 5000	Unit: Hz	Control mode. P S T

Pn154	Q value of notch filter 1	○	Communication address: 0x0154
Factory value: 0.70	Setting range: 0.50 to 10.00	Unit: N/A	Control mode. P S T

Pn155	Depth of notch filter 1	○	Communication address: 0x0155
Factory value: 0.000	Setting range: 0.000 to 1.000	Unit: N/A	Control mode. P S T

Pn156	Frequency of notch filter 2	○	Communication address: 0x0156
Factory value: 5000	Setting range: 50 to 5000	Unit: Hz	Control mode. P S T

Pn157	Q value of the notch filter 2	○	Communication address: 0x0157
Factory value: 0.70	Setting range: 0.50 to 10.00	Unit: N/A	Control mode. P S T

Pn158	Depth of notch filter 2	○	Communication to: 0x0158
Factory value: 0.000	Setting range: 0.000 to 1.000	Unit: N/A	Control mode. P S T

Pn159	Frequency of the notch filter 3	○	Communication address: 0x0159
Factory value: 5000	Setting range: 50 to 5000	Unit: Hz	Control mode. P S T
Parameter Description: Sets the center frequency of the notch filter. When the frequency of the notch filter is set to 5000, the notch filter is invalid.			

Pn15A	Q value of the notch filter 3	○	Communication Address: 0x015A
Factory value: 0.70	Setting range: 0.50 to 10.00	Unit: N/A	Control mode. P S T

Pn15B	The depth of the notch filter 3	○	Communication to: 0x015B
Factory value: 0.000	Setting range: 0.000 to 1.000	Unit: N/A	Control mode. P S T

Pn15C	The frequency of the notch filter 4	○	Communication Add: 0x015C
Factory value: 5000	Setting range: 50 to 5000	Unit: Hz	Control mode. P S T
Parameter Description Sets the center frequency of the notch filter. When the frequency of the notch filter is set to 5000, the notch filter is invalid.			

Pn15D	Q value of the notch filter 4	○	Communication Add:

			0x015D
Factory value: 0.70	Setting range: 0.50 to 10.00	Unit: N/A	Control mode. P S T

Pn15E	The depth of the notch filter 4	○	Communication Add: 0x015E
Factory value: 0.000	Setting range: 0.000 to 1.000	Unit: N/A	Control mode. P S T

Pn161	Friction compensation gain	○	Communication address: 0x0161
Factory value: 100	Setting range: 10 to 1000	Unit: %	Control mode. P S

Pn162	2nd friction compensation gain	○	Communication address: 0x0162
Factory value: 100	Setting range: 10 to 1000	Unit: %	Control mode. P S

Pn163	Friction compensation coefficient	○	Communication Add: 0x0163
Factory value: 0	Setting range: 0 to 100	Unit: %	Control mode. P S

Pn164	Friction compensation frequency correction	○	Communication Add: 0x0164
Factory value: 0.0	Setting range: 0.0 to 1000.0	Unit: Hz	Control mode. P S

Pn165	Friction compensation gain correction	○	Communication Add:

			0x0165
Factory value: 100	Setting range: 0~1000	Unit: %	Control mode. P S

Pn175	Adjustment-free switch		○	Communication Add: 0x0175
Factory value: 0x1400	Setting range: 0x0000~0x2911	Unit: N/A		Control mode. P

3rd 2nd 1st 0th

W Z Y X

Adjustment-free option (0th: X)	
0	Adjustment-free invalid
1	M Adjustment-free valid

Speed control method in adjustment-free (1st: Y)	
0	Used for speed control
1	For speed control and use of the upper unit as position control

Adjustment-free rigidity value (2nd: Z)		
0	Rigidity value 0	Response: Low
1	Rigidity value 1	
2	Rigidity value 2	
3	Rigidity value 3	
4	Rigidity value 4	
5	Rigidity value 5	
6	Rigidity value 6	
7	Rigidity value 7	
8	Rigidity value 8	
9	Rigidity value 9	Response: High

Adjustment-free load inertia (3rd: W)	
0	Low load inertia
1	ITnertia of the load
2	High load inertia

Pn17A	Adjustment-free of disturbance compensation gain		○	Communication Add: 0x017A
Factory value: 600.0	Setting range: 0: 0 to 6553.5	Unit: Hz		Control mode. P S

Pn17B	Adjustment-free of inertia correction	○	Communication Add:

	coefficient		0x017B
Factory value: 100	Setting range: 0 to 100	Unit: %	Control mode. P S

Pn17C	Adjustment-free torque filtering time coefficient	○	Communication add: 0x017C
Factory value: 0.10	Setting range: 0:00 to 655.35	Unit: ms	Control mode. P S

Pn17D	Adjustment-free speed feedback filtering low-pass filtering time	○	Communication address: 0x017D
Factory value: 0.10	Setting range: 0:00 to 655.35	Unit: ms	Control mode. P S

Pn185	Motor abnormal vibration detection	○	Communication address: 0x0185
Factory value: 0x0000	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P

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

X:

Motor abnormal vibration detection switch	
0	Non-detectable vibration
1	Warning after detection of abnormal vibrations (Er.911)
2	Fault issued after detection of abnormal vibration (Er.520)

Y: Reserved parameters (please do not change)

Z: Reserved parameters (please do not change)

W: Reserved parameters (please do not change)

Pn186	Motor abnormal vibration detection sensitivity	○	Communication address: 0x0186
Factory value: 100	Setting range: 50 to 500	Unit: %	Control mode. P S T

Pn187	Motor abnormal vibration detection value	○	Communication address: 0x0187
Factory value: 50	Setting range: 0 to 5000	Unit: rpm	Control mode. P S T
Parameter Description	Set the threshold value for vibration detection, vibration detection value = Pn186 x 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 detection sensitivity (relative positioning completion) during advanced tuning	○	Communication address: 0x0192
Factory value: 100	Setting range: 0 to 100	Unit: %	Control mode. P S T

Pn193	Exploring maximum gain during advanced tuning	○	Communication address: 0x0193
Factory value: 300.0	Setting range: 1.0 to 400.0	Unit: Hz	Control mode. P S T

9.3 Position parameters (Pn2xx)

Pn200	Position command source selection	■	Communication address: 0x0200
Factory value: 0x0020	Setting range: 0x0000~0x0084	Unit: N/A	Control mode. P

3rd 2nd 1st 0th

W Z Y X

X (0th):

External pulse command logic	
0	External low-speed pulse sequence
1	External high-speed pulse sequence
2	Reserved
3	Internal position given
4	Reserved

Y (1st):

External pulse command filtering time (software filtering)	
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 Pn011 setting

Z (2nd): Reserved parameters (please do not change)

W (3rd): Reserved parameters (please do not change)

Caution

● The maximum pulse frequency for low-speed pulses is 500 kHz, and pulse filters 1 to 5 are effective.

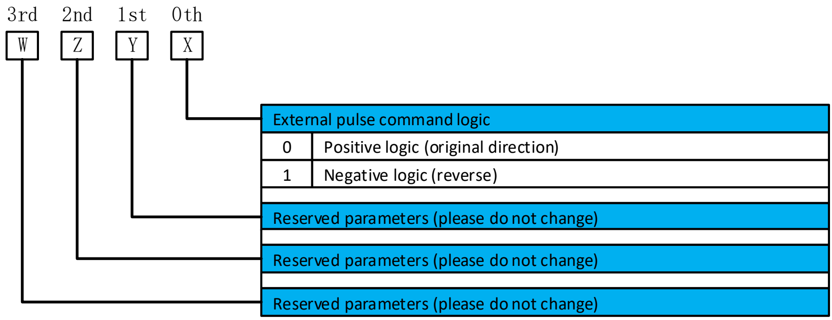
Pn201	External pulse input type	■	Communication address: 0x0201
Factory value:	Setting range:	Unit: N/A	Control mode. P

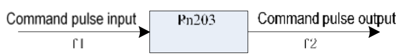
0x0000	0x0000~0x0002		

In position mode, the type of pulse used to set the drive.

Setting value	Instructions	Note
0	Pulse + Direction	-
1	Forward and Reverse Pulse Columns (CW+CCW)	-
2 to 3	Reserved	
4	90° phase difference quadrature pulse AB (4x frequency)	-

Pn202	External pulse command logic	■	Communication address: 0x0202
Factory value: 0x0020	Setting range: 0x0000~0x0001	Unit: N/A	Control mode. P

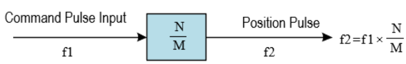


Pn203	External pulse command multiplier	○	Communication address: 0x0203
Factory value: 1	Setting range: 1 to 100	Unit: x 1	Control mode. P
Parameter Description	Used to process the corresponding multiplier for external pulse commands, which can be switched via the digital input terminal X (P-GAIN). It can be switched to 1x to any set N times (max. 100 times). 		

	Note: This multiplier is only valid for external pulse commands, not for internal program JOG, Smart Adjust, etc.

Pn204	Electron gear numerator (N)	○	Communication address: 0x0204 ★
Factory value: 1	Setting range: 0 to 1073741824	Unit: N/A	Control mode. P
Parameter Description	Used to set the numerator value of the electronic gear ratio.		

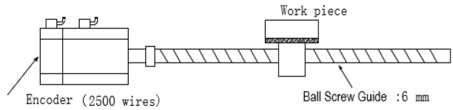
Caution	
	● When this function code is set to 0, the drive automatically sets the electronic gear numerator internally with the resolution of the encoder. **For example.** When the serial encoder resolution is 17 bits and set to 0, the drive sets itself internally to N = 131072. When the serial encoder resolution is 24 bits and set to 0, the drive internally sets itself N = 16777216. When the serial encoder resolution is 23 bits and set to 0, the drive internally sets itself to N=8388608.

Pn206	Electronic gear denominator (M)	○	Communication address: 0x0206 ★
Factory value: 1	Setting range: 1 to 1073741824	Unit: NA	Control mode. P
Parameter Description	The e-gear function is to provide easy change of travel ratio. Usually a large e-gear ratio will cause a step change in the position command, which can be improved by smoothing it out with an S-curve or low-pass filter. For example, when the electronic gear ratio is equal to 1, the motor encoder enters at 10,000 ppr per week, and 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 the user should set the electronic gear ratio reasonably.  The reduction ratio of the motor shaft and load side of the machine is $\frac{A}{B}$ (load rotates A while motor rotates B) the electronic gear ratio can be		

set by the following equation.

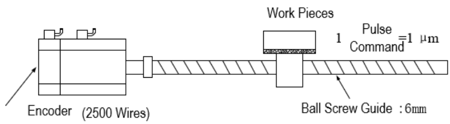
- Electronic gear ratio$\frac{N}{M} = \frac{\textit{Electronic gear molecule}}{\textit{Electronic gear denominator}} = \frac{\text{Pn204}}{\text{Pn206}} = \frac{\textit{Motor Encoder Resolution}}{\text{One revolution of load shaft movement (command unit)}} \times \frac{B}{A}$

For **example, the** servo motor encoder resolution is 10000p/rev, the ball screw lead is 6mm, and the workpiece moves 10mm when the command is input to the upper computer to output the number of pulses.



No electronic gear ratio used

Because the servo motor rotates one week when the screw moves 6mm, when moving 10mm, the servo motor needs to rotate 10 ÷ 6 = 1.6666 turns, then it needs 1.6666 × 2500 × 4 = 16666 pulses, and the command is input to the upper computer to output 16666 pulses.

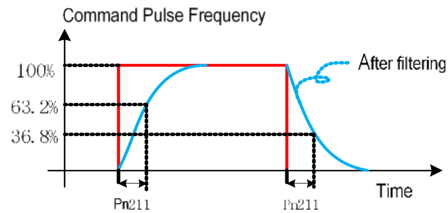


Use of electronic gear ratios

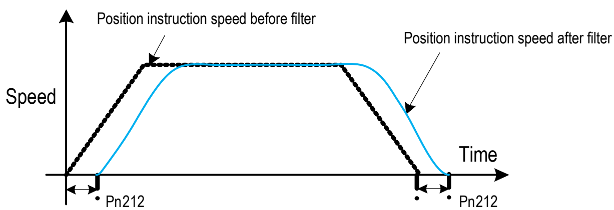
Because 1 pulse is set to 1μm when the servo motor rotates and moves the workpiece 10mm (10000μm), one pulse is equivalent to 1μm, then 10000 ÷ 1 = 10000 is needed and 10000 pulses are output by the upper computer.

Caution

- It is recommended that the user make electronic gear ratio changes after the motor has been stopped or at low speeds, otherwise large vibrations may be caused. If vibration occurs during switching, use position smoothing related parameters to mitigate the vibration.
- For control using internal multi-segment positions, when the Servo Drive is executing a segment of position positioning operation, a change in the electronic gear ratio during this period does not immediately act on the current position until after the current position segment is completed, and is not effective when the next position segment is executed.
- When an external pulse command is used, the electronic gear ratio change is immediately applied to the input pulse.
- The setting range of the electronic gear ratio is. $0.001 \leq \text{Electronic gear ratio}\left(\frac{N}{M}\right) \leq 64000$, the ER.d04 fault alarm occurs when this setting range is exceeded.

<table>
<tr><td>Pn211</td><td>Position command low-pass filtering time constant</td><td>○</td><td>Communication address: 0x0211</td></tr>
<tr><td>Factory value: 0.0</td><td>Setting range: 0.0 to 655.0</td><td>Unit: ms</td><td>Control mode. P</td></tr>
<tr><td>Parameter Description</td><td colspan="3">Position command low-pass filtering, mainly to provide buffering against too rapid changes in the input pulse command signal.
Note: This low-pass filter is invalid when set to 0.


Generally used for.
● No acceleration or deceleration function in the upper unit.
● Comparatively large electronic gears.
● Lower frequency of pulse commands.
● The motor operates with stepping steps, unstable phenomena, and other occasions.</td></tr>
</table>

<table>
<tr><td>Pn212</td><td>Position command sliding average filtering</td><td>O</td><td>Communication address: 0x0212</td></tr>
<tr><td>Factory value: 0.0</td><td>Setting range: 0.0 to 1000.0</td><td>Unit: ms</td><td>Control mode. P</td></tr>
<tr><td>Parameter Description</td><td colspan="3">Smoothing is applied to position commands. The smoothing effect occurs at the beginning and end of the step command, but causes a delay in the position command.

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

Cautions
● When set to 0, the position command linear filtering function is turned off.

Pn220	Gap compensation function switch	■	Communication address: 0x0220
Factory value: 0x0000	Setting range: 0x0000~0x0011	Unit: N/A	Control mode. P

3rd 2nd 1st 0th

W Z Y X

X (0th):

Gap compensation function switch	
0	Close
1	Turn on

Y (1st):

Direction of backlash compensation	
0	Positive compensation
1	Reverse compensation

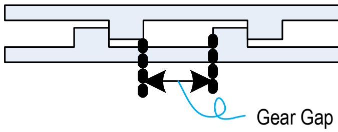
Z (2nd): Reserved parameters (do not use)

W (3rd): Reserved parameters (do not use)

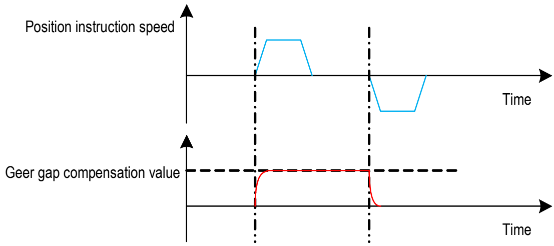
Parameter Description

For ball screw and other similar transmission mechanism, there will be repetitive errors due to long time wear, when the gap can be used to make up

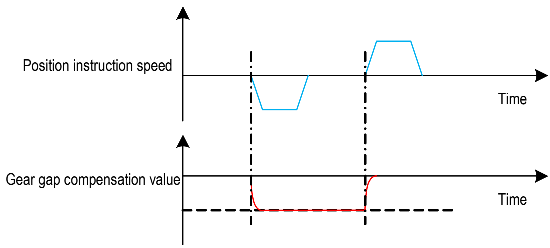
The compensation can reduce the errors arising from the design of the mechanism.



Pn220.Y=0 (forward compensation)



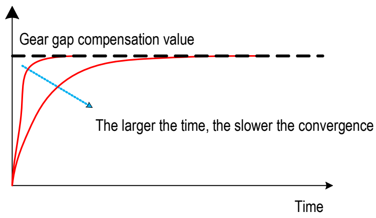
Pn220.Y=1 (negative compensation)



Pn221	Tooth gap compensation amount		O	Communication address: 0x0221 ★
Factory value: 0.0	Setting range: -5000.0 to 5000.0	Unit: 0.1 command unit		Control mode: P

Pn223	Gap compensation filtering time constant	O	Communication address: 0x0223

Factory value: 10.00	Setting range: 0.00 to 100.00	Unit: ms	Control mode. P
Parameter Description	In the case of fixed point start/stop, the gear gap compensation value shows an exponential relationship with time, which is used to determine the rate of convergence of this compensation curve.		



Pn232	Low frequency vibration detection sensitivity (relative to positioning completion signal threshold)	O	Communication address: 0x0232
Factory value: 40.0	Setting range: 0.1 to 300.0	Unit: %	Control mode. P
Parameter Description	Set the threshold value for low frequency vibration detection, vibration detection value = Pn232 x Pn262. the smaller the setting, the easier it is to detect vibration.		

Pn233	Low frequency vibration suppression 1 frequency A	O	Communication address: 0x0233
Factory value: 50.0	Setting range: 1.0 ~ 250.0	Unit: Hz	Control mode. P

Pn234	Low Frequency Vibration Suppression 1 Frequency B	O	Communication address: 0x0234
Factory value: 70.0	Setting range: 1.0 ~ 250.0	Unit: Hz	Control mode. P

Pn235	Low Frequency Vibration Suppression 2 Frequency		O	Communication address: 0x0235
Factory value: 200.0	Setting range: 1.0 ~ 200.0	Unit: Hz		Control mode. P
Parameter Description	Used to set the suppression center frequency for low frequency vibration. This function is turned on when this function code is not 200.0Hz. When this function is turned on, the response of the drive will be decreased. After the model tracking function is turned on (Pn240.X=1), this function can be turned on by function code Pn240.Y=2.			

Pn236	Low frequency vibration suppression 2 gain		O	Communication address: 0x0236
Factory value: 100	Setting range: 10 ~ 1000	Unit: %		Control mode. P
Parameter Description	Used to set the suppression gain of low frequency vibration. The smaller the setting of this function code, the more obvious it is to suppress the vibration, too small may lead to too long positioning time.			

Pn240	MFC Function Switch		O	Communication address: 0x0240
Factory value: 0x0100	Setting range: 0x0000~0x1121	Unit: N/A		Control mode. P S T

Pn241	Model tracking control gain		O	Communication address: 0x0241
Factory value: 50.0	Setting range: 1.0 ~ 2000.0	Unit: 1/s		Control mode. P

Pn242	Model Tracking Control Gain Correction		O	Communication address: 0x0242
Factory value: 100.0	Setting range: 50.0 ~ 200.0	Unit: %		Control mode. P

Pn243	Model tracking control speed feedforward compensation	○	Communication address: 0x0243
Factory value: 100.0	Setting range: 0.0 ~ 1000.0	Unit: %	Control mode. P

Pn244	Model tracking control bias (forward direction)	○	Communication address: 0x0244
Factory value: 100.0	Setting range: 0.0 ~ 1000.0	Unit: %	Control mode. P

Pn245	Model tracking control bias (reverse direction)	○	Communication address: 0x0245
Factory value: 100.0	Setting range: 0.0 ~ 1000.0	Unit: %	Control mode. P

Pn246	Model 2 tracking control gain	○	Communication address: 0x0246
Factory value: 50.0	Setting range: 1.0 ~ 2000.0	Unit: 1/s	Control mode. P

Pn247	Model 2 Tracking Control Gain Correction	○	Communication address: 0x0247
Factory value: 100.0	Setting range: 50.0 ~ 200.0	Unit: %	Control mode. P

Pn248*	Control type selector switch	■	Communication address: 0x0248
Factory value: 0x0011	Setting range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

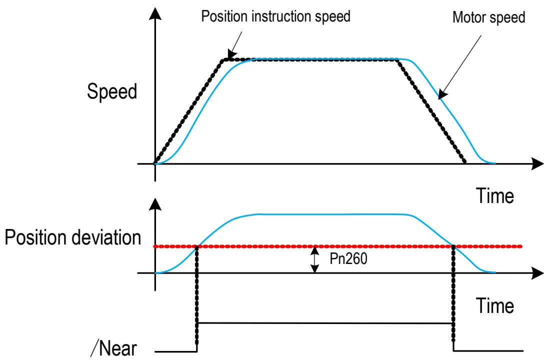
W Z Y X

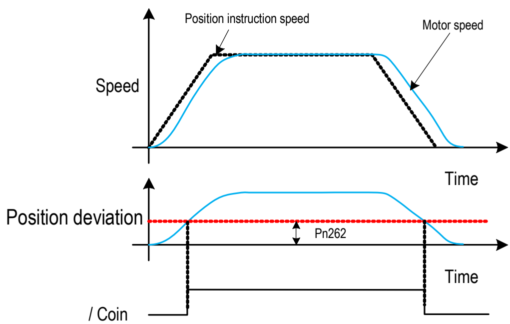
MFC control type selection	
0	Control with Type I MFC
1	Controlled with Type II MFC

Type of adjustment exemption	
0	Use Type I debugging-free
1	Use Type II debugging-free

Reserved parameters (please do not change)

Reserved parameters (please do not change)

Pn260	Position Proximity Signal (/Near) Threshold		O	Communication address: 0x0260 ★
Factory value: 1073741824	Setting range: 1 ~ 1073741824	Unit: instruction unit		Control mode. P
Parameter Description	The signal is output when the difference between the number of command pulses of the upper unit and the amount of servo motor movement (position deviation) is lower than the Pn260 setting. In position control, the upper unit can receive the positioning approach signal before confirming the positioning completion signal to prepare for the sequence of movements after  positioning completion or to perform other operations. Note: Normally, please set a value greater than the positioning completion width (Pn262).			

<table>
<tr><td>Pn262</td><td colspan="2">Positioning completion signal (/COIN) threshold</td><td>O</td><td>Communication address: 0x0262</td></tr>
<tr><td>Factory value: 7</td><td>Setting range: 0 ~ 1073741824</td><td colspan="2">Unit: instruction unit</td><td>Control mode. P</td></tr>
<tr><td>Parameter Description</td><td colspan="4">The signal is output when the difference between the number of command pulses of the upper unit and the servo motor movement (position deviation) is lower than the Pn262 setting.


Notes.
The parameter has no effect on the final positioning accuracy.
If the set value is too large and the deviation is small in low-speed operation, a constant-time positioning completion signal (/Coin) may be output, and when a constant-time positioning signal is output, the positioning completion threshold is reduced until the signal is no longer output.</td></tr>
</table>

<table>
<tr><td>Pn264</td><td colspan="2">Position deviation too large fault threshold</td><td>O</td><td>Communication address: 0x0264 ★</td></tr>
<tr><td>Factory value: 5242880</td><td>Setting range: 1 ~ 1073741824</td><td colspan="2">Unit: instruction unit</td><td>Control mode. P</td></tr>
<tr><td>Parameter Description</td><td colspan="4">A position deviation fault is generated when the deviation between the position command and the actual feedback during motor operation exceeds this threshold.
The position deviation during normal operation varies according to the settings of action speed, gain, feedforward, etc. Therefore, in actual use, it is set by the following formula.</td></tr>
</table>

	$\text{Pn264}=\frac{F_c}{K_p}\times(1.2\sim2.0)$ where. F_c: Maximum frequency of position command pulses (pulse/s). K_p: Position loop gain (1/s). 1.2 to 2.0: Safety factor (protection against frequent excessive position deviations)

Pn266	Excessive Position Deviation Warning Threshold	O	Communication address: 0x0266
Factory value: 100	Setting range: 10 ~ 100	Unit: %	Control mode. P
Parameter Description	This parameter sets the excessive position deviation warning threshold, when the current position deviation value $>\frac{\text{Pn264}\times\text{Pn266}}{100}$ When the current position deviation value is >, the drive generates a position deviation too large warning.		

Pn267	Maximum threshold for fault with excessive position deviation at servo ON	O	Communication address: 0x0267 ★
Factory value: 5242880	Setting range: 1 ~ 1073741823	Unit: instruction unit	Control mode. P
Parameter Description	When the position deviation exceeds this function code value at the moment of servo ON during motor action, the drive will generate a servo ON position deviation too large fault.		

Pn269	Warning threshold for excessive position deviation at servo ON	O	Communication address: 0x0269
Factory value: 100	Setting range: 10 ~ 100	Unit: %	Control mode. P
Parameter Description	When the position deviation exceeds this function code value at the moment of servo ON during motor action, the drive will generate a servo ON position deviation too large fault.		

Pn270	Speed limit value at servo ON	O	Communication address: 0x0270
Factory value:	Setting range: 0~10000	Unit: rpm	Control mode. P

1000			

Pn271	External pulse command multiplier selection	■	Communication address: 0x0271
Factory value: 0x0000	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P

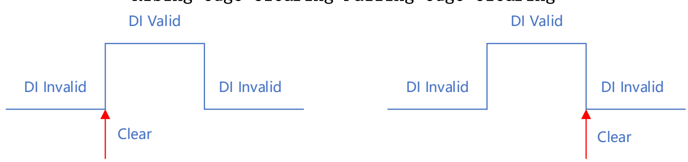
Pn272	External terminal clear (CLR) position deviation signal method	■	Communication address: 0x0272
Factory value: 0x0000	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P

In position mode, used to set how the position deviation generated by the drive is cleared.

setpoint	instructions	note
0	Position deviation cleared at high level (H)	-
1	Clear position deviation at rising edge	-
2	Position deviation cleared at low level (L)	-
3	Clearing position deviations on falling edge	-

Position deviation clear (CLR) signal status.

Rising edge clearing Falling edge clearing



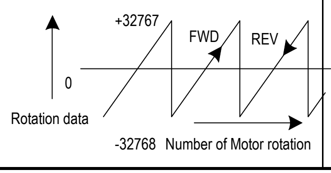
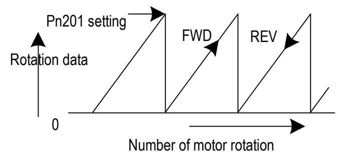
Pn274	Positioning Completion Signal (/Coin) Output	■	Communication

	Timing		address: 0x0274
Factory value: 0x0000	Setting range: 0x0000~0x0002	Unit: N/A	Control mode. P

In the position mode, it is used to set the timing of the positioning completion signal output.

setpoint	instructions	note
0	Output if the absolute value of the position deviation is less than the positioning completion range (Pn262)	–
1	Position deviation absolute value is less than the positioning completion range (Pn262) and the position command is filtered to 0	–
2	The absolute value of the position deviation is less than the positioning completion range (Pn262) and the position command input is 0	–

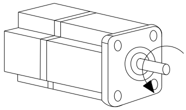
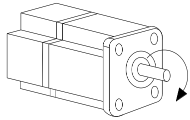
Pn276	Upper limit of the number of rotations	○	Communication address: 0x0276
Factory value: 0	Setting range: 0 ~ 30000	Unit: number of turns	Control mode. P S T
Parameter Description	The upper limit of the number of rotations can be used to control the position of a rotary body such as a rotary table. In order to keep the number of rotations of the motor to the number of rotations of the turntable as an integer ratio and to avoid fractions, the upper limit of the number of rotations is used.		

Pn201 is 0	Pn201 is not 0
	

Cautions	
⚠	●Setting of the upper limit of the number of rotations, valid only when using absolute encoders. ● When Pn201 = 0, the upper limit setting for the number of rotation turns is invalid.

Pn277	Direction selection when the upper limit of rotation turns on	■	Communication address: 0x0277
Factory value: 0x0000	Setting range: 0x0000 ~ 0x0001	Unit: N/A	Control mode. S
Parameter Description.	The direction selection when the rotation lap limit is turned on means that when the user needs to turn on the rotation lap limit function, the direction of rotation of the motor is determined according to the user's rotary table when it is actually running rotation. The setting is made according to the actual situation.		

Set value	Instructions	Note
0	Motor runs in CCW (counterclockwise) direction	–
1	The motor runs in CW (clockwise) direction	–

	 Facing the shaft end, the motor rotates counterclockwise (CCW) Pn277 = 0	 Facing the shaft end, the motor rotates clockwise (CW) Pn277 = 1

Cautions	
	● When the motor rotation direction (Pn277) is set incorrectly, an abnormal absolute position is caused, resulting in an ER.840 fault alarm.

Pn290	Home return mode setting	○	Communication address: 0x0290
Factory value: 0.100	Setting range: 0x0000~0x23A4	Unit: N/A	Control mode. P S T

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

X (0th): Home Return Enable Control

0	Turn off the home return function
1	Enabling home return function by DI terminal signal
2	Home return is initiated immediately after power-up, and the drive is enabled when home return is complete
3	Immediate origin return
4	With the current position as the origin

Y (1st): Home return model

0	Positive return to zero, deceleration point, home point are home switch
1	Zero return anyway, deceleration point, home point are home switch
2	Forward return to zero, deceleration point and home point are motor Z signal
3	Zero return anyway, deceleration point and home point are motor Z signal
4	Forward zero return, deceleration point is home switch, home point is motor Z signal
5	Reverse zero return, deceleration point is home switch, home point is motor Z signal
6	Positive return to zero, deceleration point, home point for positive overtravel switch
7	Reverse zero return, deceleration point, home point for reverse overtravel switch
8	Forward return to zero, deceleration point and home point are motor Z signal
9	Zero return anyway, deceleration point and home point are motor Z signal
A	Absolute position back to zero

Z (2nd): Home return terminal trigger mode method selection

0	Low level trigger, high level stop
1	Rising edge triggering
2	Falling edge triggering
3	High level trigger, low level stop

W (3rd): Home return timeout time units

0	1ms
1	10ms
2	100ms

Pn291	Origin return to high speed	O	Communication address: 0x0291

Factory value: 100.0	Setting range: 0.0 ~ 3000.0	Unit: rpm	Control mode. P
Parameter Description	The origin return process should first find the reference point (deceleration point) and determine the range of the origin. The speed of finding the reference point should not be too slow, too slow may report an origin return timeout fault.		

Pn292	Home returns low speed	O	Communication address: 0x0292
Factory value: 10.0	Setting range: 0.0 ~ 1000.0	Unit: rpm	Control mode. P
Parameter Description	Home return overload in the first to determine the range of the home point, then slow down the operation, in the vicinity of the home point to pinpoint the home point, and finally lock the home point is located. Finding the zero speed should not be too fast, too fast may not find the home point or find the home point error is large.		

Pn293	Home return acceleration / deceleration time	O	Communication address: 0x0293
Factory value: 3000	Setting range: 0 ~ 3000	Unit: ms	Control mode. P
Parameter Description	Home return acceleration time, which is the time required for the motor to accelerate from 0 rpm to 3000 rpm. Home return deceleration time, which is the time it takes for the motor to decelerate from 3000rpm to 0rpm.		

Pn294	Zero Offset Position	O	Communication address: 0x0294 ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: instruction unit	Control mode. P
Parameter Description	The zero offset position means that the motor needs to travel a further distance after finding the origin, and this distance is the zero offset position of the motor, i.e. the absolute motor position coordinates.		

Pn296	Absolute position zero multi-turn value	O	Communication

			address: 0x0296
Factory value: 0	Setting range: -32768 ~ 32767	Unit: rev	Control mode. P S T

Pn297	Absolute position zero single-turn value	○	Communication address: 0x0297 ★
Factory value: 0	Setting range: 0 ~ 2147483647	Unit: Encoder unit	Control mode. P S T
Parameter Description	The multi-turn value and single-turn value of the absolute position zero point together indicate the target absolute position of the motor, which is used for setting the target position of the motor when the servo selects the absolute position back to zero, i.e. the multi-turn value and single-turn value of the motor are equal to or similar to the set value at the final stop.		

Pn299	Home return timeout setting	○	Communication address: 0x0299
Factory value: 10000	Setting range: 0 ~ 65535	Unit: ms	Control mode. P S T
Parameter Settings	Used to set the maximum search home signal time. If this function code is set too small or if the home signal is not searched for within the time set by this function code, the drive will generate a home return timeout fault ER.8A1. Note: When set to 0, this function is turned off.		

9.4 Speed parameters (Pn3xx)

Pn300	Speed command source selection	■	Communication address: 0x0300
Factory value: 0000	Setting range: 0x0000~0x0005	Unit: N/A	Control mode. S

In speed mode, it is used to select the speed command source.

<table>
<tr><th>Setting value</th><th>Instructions</th><th>Note</th></tr>
<tr><td>0</td><td>Internal digital given</td><td>Given by function code Pn304</td></tr>
<tr><td>1</td><td>Reserve</td><td>-</td></tr>
<tr><td>2</td><td>Reserve</td><td>-</td></tr>
<tr><td>3</td><td>Reserve</td><td>-</td></tr>
<tr><td>4</td><td>Internal digital mixing gives</td><td><table>
<tr><th>SPDB</th><th>SPDA</th><th>Command Source Selection</th></tr>
<tr><td>0</td><td>0</td><td>Pn303.X setting</td></tr>
<tr><td>0</td><td>1</td><td>Pn303.Y setting</td></tr>
<tr><td>1</td><td>0</td><td>Pn303.Z setting</td></tr>
<tr><td>1</td><td>1</td><td>Pn303.W setting</td></tr>
</table></td></tr>
<tr><td>5</td><td>Reserve</td><td>-</td></tr>
</table>

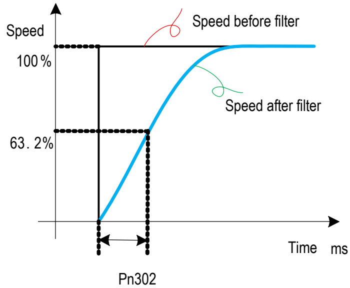
Pn301	Speed command direction	O	Communication address: 0x0301
Factory value: 0x0000	Setting range: 0x0000~0x0001	Unit: N/A	Control mode. S

Setting value	Instructions	Note
0	Same direction as current speed command	-
1	Reverse with current speed command	-

Note: ① Function code Pn301 and external terminal speed direction (SPD-D) are valid for both the analog speed command and the internal register speed command.

② The logic for combining function code Pn301 with the external terminal speed direction (SPD-D) is as follows (using the CCW direction as a forward reference).

Pn302	Speed command low-pass filtering	O	Communication address: 0x0302
Factory value: 0.40	Setting range: 0.00 ~ 655.35	Unit: ms	Control mode. S

Parameter Description	Applying 1 low-pass filter to the speed command input makes the speed command smooth. Note: Valid for both internal digital analog and external analog. 

Pn303	Speed control switch 1	■	Communication address: 0x0303
Factory value: 0x0000	Setting range: 0x0000~0x2222	Unit: N/A	Control mode. S

3rd 2nd 1st 0th

W Z Y X

Speed command source 1	
0	Internal digital give (Pn304)

Speed command source 2	
0	Internal digital give (Pn305)

Speed command source 3	
0	Internal digital give (Pn306)

Speed command source 4	
0	Internal digital give (Pn307)

Pn304	Internal speed 0	O	Communication address: 0x0304
Factory value: 100	Setting range: -10000 ～ 10000	Unit: 1rpm	Control mode. S

Pn305	Internal speed 1	O	Communication address: 0x0305
Factory value: 200	Setting range: -10000 ～ 10000	Unit: 1rpm	Control mode. S
Factory value: 300	Setting range: -10000 ～ 10000	Unit: 1rpm	Control mode. S

Pn307	Internal speed 3	O	Communication address: 0x0307
Factory value: 400	Setting range: -10000 ～ 10000	Unit: 1rpm	Control mode. S

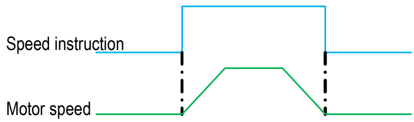
Pn308	Internal speed command units	O	Communication address: 0x0308
Factory value: 0x0000	Setting range: 0x0000~0x0001	Unit: N/A	Control mode. S

Setting value	Instructions	Note
0	1rpm	-
1	0.1rpm	-

Cautions
● The internal speed command unit is valid only for internal speed commands Pn304 ~ Pn307.

Pn310	Soft start acceleration time (ACC) during speed control mode	O	Communication address: 0x0310
Factory value: 200	Setting range: 0～10000	Unit: 1ms	Control mode. S

<table>
<tr><td>Pn311</td><td colspan="3">Soft start deceleration time (DEC) during speed control mode</td><td>○</td><td>Correspondence to: 0x0311</td></tr>
<tr><td colspan="2">Factory value: 200</td><td>Setting range: 0～10000</td><td colspan="2">Unit: 1ms</td><td>Control mode. S</td></tr>
<tr><td>Parameter Description</td><td colspan="5">
The soft start function means that the step speed command is converted into a smoother constant acceleration and deceleration speed command, and the acceleration time and deceleration time can be set.



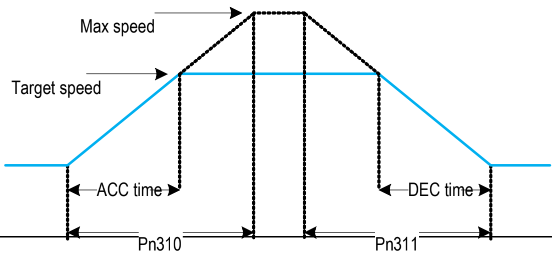
Pn310: The time it takes for the motor to reach the maximum speed of the motor from the stop state.

Pn311: The time it takes for the motor to reach motor stop from maximum speed.

The actual acceleration and deceleration times are calculated by the following equation.

$$\text{Real ACC time} = \frac{\text{Target speed}}{\text{Maximum speed}} \times \text{softstart (ACC time Pn310)}$$

$$\text{Actual DEC time} = \frac{\text{Target speed}}{\text{Maximum speed}} \times \text{softstart (DEC time Pn311)}$$

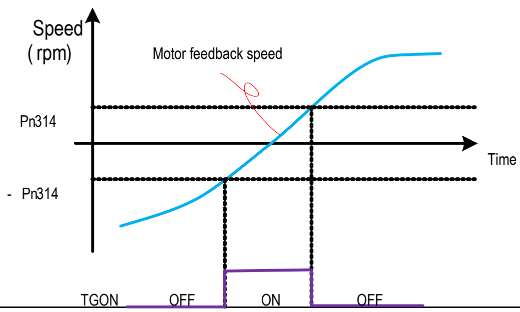


</td></tr>
</table>

<table>
<tr><td>Pn313</td><td colspan="3">Zero fixed speed threshold</td><td>○</td><td>Communication address: 0x0313</td></tr>
<tr><td colspan="2">Factory value: 10</td><td>Setting range: 0～10000</td><td colspan="2">Unit: rpm</td><td>Control mode. S</td></tr>
<tr><td>Parameter Description</td><td colspan="5">The zero fix function is a function that performs servo lock when the input voltage of the speed command is lower than the speed set by the zero fix speed threshold when the zero fix signal (/ZCLAMP) is ON. In this case, a position loop is formed inside the servo unit, and the speed command is ignored. For systems in which the upper unit does not construct a position loop for speed control.</td></tr>
</table>

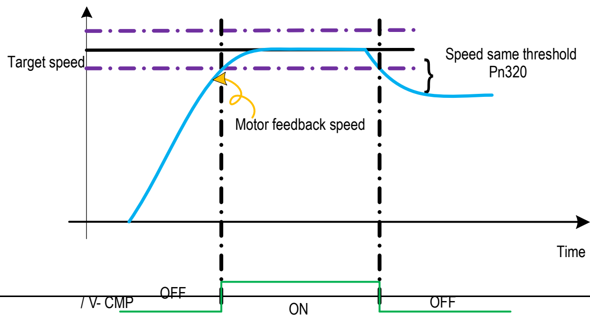
Cautions
● When the servo motor is fixed in the zero position, there is ±1 pulse jump, and even if rotation occurs due to external forces, it will return to the zero fixed position.

Pn314	Zero fixed compensation for maximum speed	O	Communication address: 0x0314
Factory value: 1000	Setting range: 50 ~ 10000	Unit: rpm	Control mode. S
Parameter Description	When the servo motor is fixed in the zero position, the external force occurs the rotation and also returns to the zero fixed position, limiting the maximum speed of the return.		

Pn317	Rotation detection value	O	Communication address: 0x0317
Factory value: 20	Setting range: 1 ~ 10000	Unit: rpm	Control mode. P S T
Parameter Description	Used 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, the corresponding motor rotation signal TGON outputs the corresponding signal. 		

Pn318	Maximum operating speed	O	Communication address: 0x0318

Factory value: 10000	Setting range: 0～10000	Unit: rpm	Control mode. P S
Parameter Description	Set the maximum operating speed of the servo motor. When this limit is greater than the maximum motor speed, the maximum motor speed is used as the maximum operating speed.		

Pn320	Speed-consistent signal threshold		O	Communication address: 0x0320
Factory value: 10	Setting range: 0 to 100	Unit: rpm		Control mode. P S T
Parameter Description	Sets 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 indicates that the user speed is reached and the output of the /V-CMP signal assigned to the output terminal is output high (ON). **For example**, Pn320=50rpm, target speed is 2000rpm, and motor speed is output in the range of 1950rpm ~ 2050rpm /V-CMP signal. 			

9.5 Torque parameters (Pn4xx)

Pn400	Torque control switch 1	■	Communication address: 0x0400
Factory value: 0x0020	Setting range: 0x0000~0x0045	Unit: N/A	Control mode. T

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

X: Torque mode command source selection

0	Internal digital given	Function code Pn410 given
1	Reserve	–
2	Reserve	–
3	Internal digital mixing gives	see table below
4	Single trigger mode	
5	Reserve	Reserve

TorqB	TorqA	Command Source Selection
0	0	Pn409.X setting
0	1	Pn409.Y setting
1	0	Pn409.Z setting
1	1	Pn409.W setting

Y: Speed limiting source selection for torque control

0	Reserve	–
1	Reserve	–
2	Internal numeric feed mode 1	Function code Pn415 given
3	DI terminal selection given	OFF: Pn415; ON: Pn416
4	Internal numeric feed mode 2	Positive command: Pn415; Reverse: Pn416

Z: Reserved parameters (please do not change)

W: Reserved parameters (please do not change)

Pn401	Torque command second-order low-pass filter cutoff frequency	O	Correspondence to: 0x0401
Factory value: 5000	Setting range: 100 ~ 5000	Unit: Hz	Control mode. T
Parameter Description	When set to 5000, the filter is invalid		

Pn402	Torque command second-order low-pass filter Q		○	Communication address: 0x0402
Factory value: 0.50	Setting range: 0.50 ~ 1.00	Unit: N/A		Control mode. T

Pn403	Direction of torque command		○	Communication address: 0x0403
Factory value: 0x0000	Setting range: 0x0000~0x0001	Unit: N/A		Control mode. T

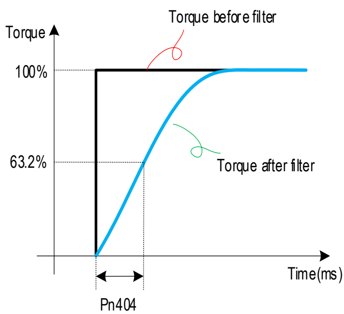
Setting value	Instructions	Note
0	Same direction with torque command	-
1	Reverse with torque command	-

Cautions

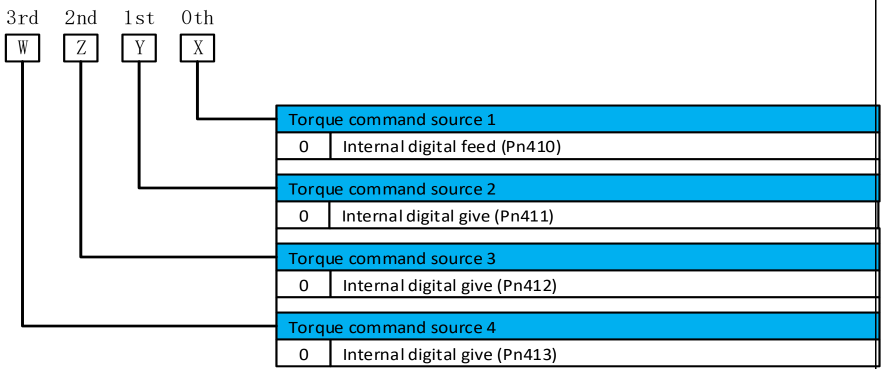
- Function code Pn403 with external terminal torque command direction (TPR-D) is valid for the internal register torque command.
- The logic for combining function code Pn403 with the external terminal torque command direction (TPR-D) is as follows (using the CCW direction as a positive reference).

Given Torque command	External terminals TPR-D	Pn403.X	Reality direction of instruction
Positive instruction	OFF	0	positive instruction
		1	anti-directive
	ON	0	anti-directive
		1	positive instruction
Negative instruction	OFF	0	anti-directive
		1	positive instruction
	ON	0	positive instruction

			1	anti-directive

Pn404	Torque command filtering time		O	Communication address: 0x0404
Factory value: 0.00	Setting range: 0.00 ~ 655.35	Unit: ms		Control mode. T
Parameter Description	Applying a first-order low-pass filter to the torque command input makes the torque command smooth. 			

Pn409	Torque control switch 3		O	Communication address: 0x0409
Factory value: 0x0000	Setting range: 0x0000~0x2222	Unit: N/A		Control mode. T



Pn410	Internal torque command 1 setting value		O	Communication address: 0x0410
Factory value: 0.0	Setting range: -500.0 ~ 500.0	Unit: %		Control mode. T

Pn411	Internal torque command 2 setting value		O	Correspondence to: 0x0411
Factory value: 0.0	Setting range: -500.0 ~ 500.0	Unit: %		Control mode. T

Pn412	Internal torque command 3 setting value		O	Correspondence to: 0x0412
Factory value: 0.0	Setting range: -500.0 ~ 500.0	Unit: %		Control mode. T

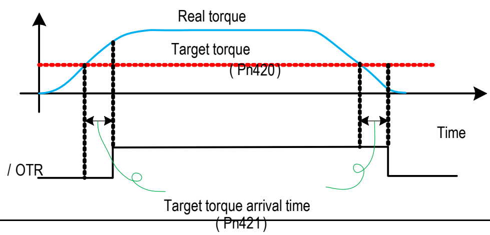
Pn413	Internal torque command 4 setting value	O	Correspondence

			to: 0x0413
Factory value: 0.0	Setting range: -500.0 ~ 500.0	Unit: %	Control mode. T

Pn415	Internal speed limit value during torque control1		O	Communication address: 0x0415
Factory value: 1000	Setting range: 0～10000	Unit: rpm		Control mode. T

Pn416	Internal speed limit value during torque control2		O	Communication address: 0x0416
Factory value: 1000	Setting range: 0～10000	Unit: rpm		Control mode. T

Pn420	Target torque reaches set value		O	Communication address: 0x0420
Factory value: 100.0	Setting range: 0.0 ~ 500.0	Unit: %		Control mode. P S T

Pn421	Target torque arrival time window		O	Correspondence to: 0x0421
Factory value: 5	Setting range: 0~1000	Unit: ms		Control mode. P S T
Parameter Description	When the torque output by 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 switch 2		O	Communication address: 0x0430
Factory value: 0x0001	Setting range: 0x0000~0x0013	Unit: N/A		Control mode. T

3rd 2nd 1st 0th

W Z Y X

0th (X): Single torque command trigger method

0	Low level
1	Rising edge
2	High level
3	Edge of drop

1st (Y): Control priority in torque mode

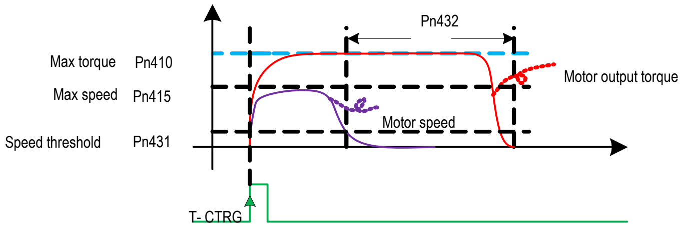
0	Speed priority
1	Torque priority

2nd (Z): Reserved parameters (please do not change)

3rd (W): Reserved parameters (please do not change)

Pn431	Speed threshold reached by a single trigger moment		O	Communication address: 0x0431
Factory value: 20	Setting range: 0 ~ 500	Unit: rpm		Control mode. T

Pn432	Duration after arrival of single trigger torque		O	Communication address: 0x0432
Factory value: 30	Setting range: 0 ~ 500	Unit: ms		Control mode. T

Parameter Description	When the actual value of the current torque reaches the set torque while the motor speed is less than the threshold value set by function code Pn431, the output torque of the motor becomes 0 after continuing for the time set by function code Pn432. Note: This function is only available when Pn430.X=1 or Pn430.X=3. 

9.6 Auxiliary parameters (Pn5xx)

Pn500	Jogging speed (JOG)	O	Communication address: 0x0500
Factory value: 200	Setting range: 0 ~ 2000	Unit: rpm	Control mode. P S T

Pn502	Program JOG operation method	O	Communication address: 0x0502
Factory value: 0x0000	Setting range: 0x0000~0x0005	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

0th (X)	Program JOG operation method
0	(Waiting time Pn535 → forward movement Pn531) × number of moves Pn536
1	(Waiting time Pn535 → reverse movement Pn531) × number of moves Pn536
2	(Waiting time Pn535 → forward movement Pn531) × number of moves Pn536 (Waiting time Pn535 → reverse movement Pn531) × number of moves Pn536
3	(Waiting time Pn535 → reverse movement Pn531) × number of moves Pn536 (Waiting time Pn535 →forward movement Pn531) × number of moves Pn536
4	(Waiting time Pn535→ forward movement Pn531→ (Waiting time Pn535 → reverse movement Pn531) × number of moves Pn536
5	(Waiting time Pn535→ reverse movement Pn531→ (Waiting time Pn535 → forward movement Pn531) × number of moves Pn536

1st (Y): Reserved parameters (please do not change)

2nd (Z): Reserved parameters (please do not change)

3rd (W): Reserved parameters (please do not change)

Cautions
Pn502.X=0, 2, 4, when the panel operation is enabled, it needs to press the "UP" key to start the PJOG. Pn502.X=1, 3, 5, when the panel operation is enabled, it needs to press the "Down" key to start the PJOG.

Pn503	Program JOG movement distance		O	Communication address: 0x0503 ★
Factory value: 60,000	Setting range: 1 ~ 1073741824	Unit: instruction unit		Control mode. P S T

Pn505	Program JOG acceleration and deceleration time	O	Communication

			address: 0x0505
Factory value: 100	Setting range: 2 ~ 10000	Unit: ms	Control mode. P S T

Pn506	Program JOG waiting time	O	Communication address: 0x0506
Factory value: 100	Setting range: 0～10000	Unit: ms	Control mode. P S T

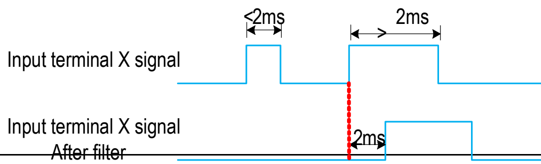
Pn507	Number of program JOG movement	O	Communication address: 0x0507
Factory value: 1	Setting range: 0~1000	Unit: times	Control mode. P S T
Parameter Description	Used to set the number of cycle periods during program JOG.		

Cautions
● When Pn502 is set to 2 or 3 while Pn507 is set to 0, the program JOG function is disabled. ● When Pn507 = 0, there is no limit to the number of program JOG movement.

Pn508	Program JOG movement speed	O	Communication address: 0x0508
Factory value: 500	Setting range: 1 ~ 10000	Unit: rpm	Control mode. P S T

9.7 Terminal parameters(Pn6xx)

Pn600	Switching input terminal X Filtering time	O	Communication address: 0x0600
Factory value: 2	Setting range: 0 ~ 3000	Unit: ms	Control mode. P S T

Parameter Description	Used to set the X terminal signal filtering time for external inputs to the drive. **Example**: When Pn600 sets the filtering time to 2ms, signals less than 2ms are filtered out. 

Cautions	
	● The switching input terminal X filter time is valid for all X1 to X9. ● The input terminal X status bit for monitoring function code Un100 monitoring is the filtered status.

Pn601	Input terminal X1 configuration [CN1-9]	O	Communication address: 0x0601
Factory value: 0x0001	Setting range: 0x0000~0x112F	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

1st–0th (Y X):

Function assignment value	
00	Invalid
01 … 2F	See "Schedule 1 Input Terminal Function Definitions".

2nd (Z):

Input terminal contact properties	
0	Normally open
1	Normally closed

3rd (W):

Input terminal signal source	
0	External hardware terminal X1
1	Internal software status bit given by Pn630.Bit0

Pn602	Input terminal X2 configuration [CN1-10]	O	Communication address: 0x0602

Factory value: 0x0002	Setting range: 0x0000~0x112F	Unit: N/A	Control mode: P S T

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

Y X: Function assignment value

Function assignment value	
00	Invalid
01 … 2F	See "Schedule 1 Input Terminal Function Definitions".

Z: Input terminal contact properties

Input terminal contact properties	
0	Normally open
1	Normally closed

W: Input terminal signal source

Input terminal signal source	
0	External hardware terminal X2
1	Internal software status bit given by Pn630.Bit1

Pn603	Input terminal X3 configuration [CN1-34]	O	Communication address: 0x0603
Factory value: 0x0003	Setting range: 0x0000~0x112F	Unit: N/A	Control mode: P S T

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

Y X: Function assignment value

Function assignment value	
00	Invalid
01 … 2F	See "Schedule 1 Input Terminal Function Definitions".

Z: Input terminal contact properties

Input terminal contact properties	
0	Normally open
1	Normally closed

W: Input terminal signal source

Input terminal signal source	
0	External hardware terminal X3
1	Internal software status bit given by Pn630.Bit2

Pn604	Input terminal X4 configuration [CN1-8]	O	Communication address: 0x0604
Factory value: 0x0005	Setting range: 0x0000~0x112F	Unit: N/A	Control mode. P S T

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

(1st and 0th: Y X)

Function assignment value	
00	Invalid
01	See "Schedule 1 Input Terminal Function Definitions".
...	
2F	

(2nd: Z)

Input terminal contact properties	
0	Normally open
1	Normally closed

(3rd: W)

Input terminal signal source	
0	External hardware terminal X4
1	1Internal software status bit given by Pn630.Bit3

Pn605	Input terminal X5 configuration [CN1-33]	O	Communication address: 0x0605
Factory value: 0x0004	Setting range: 0x0000~0x112F	Unit: N/A	Control mode. P S T

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

Function assignment value	
00	Invalid
01	See "Schedule 1 Input Terminal Function Definitions".
...	
2F	

Input terminal contact properties	
0	Normally open
1	Normally closed

Input terminal signal source	
0	External hardware terminal X5
1	Internal software status bits given by Pn630.Bit4

Pn606	Input terminal X6 configuration [CN1-32]		O	Communication address: 0x0606
Factory value: 0x0006	Setting range: 0x0000~0x112F	Unit: N/A		Control mode. P S T

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

Function assignment value	
00	Invalid
01	See "Schedule 1 Input Terminal Function Definitions".
...	
2F	

Input terminal contact properties	
0	Normally open
1	Normally closed

Input terminal signal source	
0	External hardware terminal X6
1	Internal software status bit given by Pn630.Bit5

Pn607	Input terminal X7 configuration [CN1-12]	O	Communication address: 0x0607

Factory value: 0x0007	Setting range: 0x0000 ~ 0x112F	Unit: N/A	Control mode. P S T

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

Y X:

Function assignment value	
00	Invalid
01 … 2F	See "Schedule 1 Input Terminal Function Definitions".

Z:

Input terminal contact properties	
0	Normally open
1	Normally closed

W:

Input terminal signal source	
0	External hardware terminal X7
1	Internal software status bits given by Pn630.Bit6

Pn608	Input terminal X8 configuration [CN1-30]	O	Communication address: 0x0608
Factory value: 0x0000	Setting range: 0x0000~0x112F	Unit: N/A	Control mode. P S T

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

Y X:

Function assignment value	
00	Invalid
01 … 2F	See "Schedule 1 Input Terminal Function Definitions".

Z:

Input terminal contact properties	
0	Normally open
1	Normally closed

W:

Input terminal signal source	
0	External hardware terminal X8
1	Internal software status bits given by Pn630.Bit7

Pn611	Output terminal Y1 configuration [CN1-6/7]	O	Communication address: 0x0611
Factory value: 0x0001	Setting range: 0x0000~0x110F	Unit: N/A	Control mode. P S T

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

Function assignment value	
00	See "Schedule 2 Output Terminal Function Definitions".
...	
0F	

Output terminal contact properties	
0	Normally open
1	Normally closed

Output terminal signal source	
0	Function Code Pn610 Distribution Signal Control
1	Function code Pn631.Bit0 bit control

Pn612	Output terminal Y2 configuration [CN1-4/5]	O	Communication address: 0x0612
Factory value: 0x0002	Setting range: 0x0000~0x110F	Unit: N/A	Control mode. P S T

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

Function assignment value	
00	See "Schedule 2 Output Terminal Function Definitions".
...	
0F	

Output terminal contact properties	
0	Normally open
1	Normally closed

Output terminal signal source	
0	Function Code Pn610 Distribution Signal Control
1	Function code Pn631.Bit1 bit control

Pn613	Output terminal Y3 configuration [CN1-2/3]	O	Communication address: 0x0613
Factory value: 0x0007	Setting range: 0x0000~0x110F	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

Y X (1st, 0th):

Function assignment value	
00	See "Schedule 2 Output Terminal Function Definitions".
...	
0F	

Z (2nd):

Output terminal contact properties	
0	Normally open
1	Normally closed

W (3rd):

Output terminal signal source	
0	Function code Pn613 Distribution signal control
1	Function code Pn631.Bit2 bit control

Pn614	Output terminal Y4 configuration [CN1-1/26]	O	Communication address: 0x0614
Factory value:	Setting range:	Unit: N/A	Control mode. P S T

0x000B	0x0000~0x110F		

3rd 2nd 1st 0th

W Z Y X

Function assignment value	
00	See "Schedule 2 Output Terminal Function Definitions".
...	
0F	

Output terminal contact properties	
0	Normally open
1	Normally closed

Output terminal signal source	
0	Function code Pn614 Distribution signal control
1	Function code Pn631.Bit3 bit control

Pn615	Output terminal Y5 configuration [CN1-27/28]	O	Communication address: 0x0615
Factory value: 0x0000	Setting range: 0x0000~0x110F	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

Function assignment value	
00	See "Schedule 2 Output Terminal Function Definitions".
...	
0F	

Output terminal contact properties	
0	Normally open
1	Normally closed

Output terminal signal source	
0	Function code Pn614 Distribution signal control
1	Function code Pn631.Bit3 bit control

Pn630	Internal software gives the state of the input	O	Communication

	terminal (X)		address: 0x0630
Factory value: 0x0000	Setting range: 0x0000~0x03FF	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

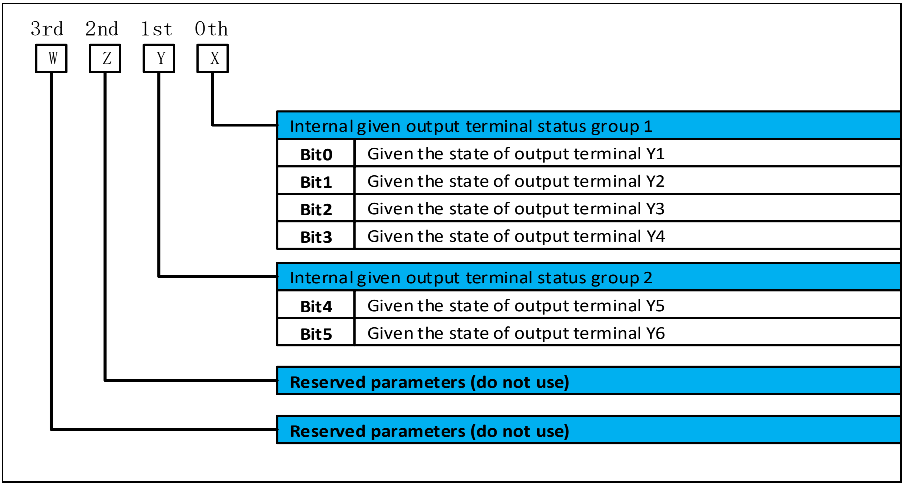
Internal given input terminal status group 1	
Bit0	Virtual input terminal X1
Bit1	Virtual input terminal X2
Bit2	Virtual input terminal X3
Bit3	Virtual input terminal X4

Internal given input terminal status group 2	
Bit4	Virtual input terminal X5
Bit5	Virtual input terminal X6
Bit6	Virtual input terminal X7
Bit7	Virtual input terminal X8

Internal given input terminal status group 3	
Bit8	Virtual input terminal X9

Reserved parameters (do not use)

Pn631	Internal software gives the output terminal (Y) status	O	Communication address: 0x0631
Factory value: 0x0000	Setting range: 0x0000~0x003F	Unit: N/A	Control mode. P S T



9.8 Extended parameters(Pn7xx)

Pn702	Advanced adjustment of the moveable range		O	Communication address: 0x0702
Factory value: 3.0	Display range: 0.5 ~ 10.0	Unit: circle		Control mode. P S T

Pn705	Initial value of inertia identification		O	Communication address: 0x0705
Factory value: 300	Display range: 0～20000	Unit: %		Control mode. P S T

Pn706	Vibration detection threshold in inertia identification		O	Communication address: 0x0706
Factory value: 250	Display range: 0 ~ 5000	Unit: rpm		Control mode. P S T

Pn720*	EasyFFT Sweep Start Frequency		O	Communication address: 0x0720
Factory value:	Display range: 1 ~ 5000	Unit: Hz		Control mode. P

400			S T

Pn721*	EasyFFT End-of-Sweep Frequency	O	Correspondence to: 0x0721
Factory value: 4000	Display range: 50 ~ 5000	Unit: Hz	Control mode. P S T

Pn722*	EasyFFT detects the lower limit of resonance frequency	O	Communication address: 0x0722
Factory value: 500	Display range: 50 ~ 5000	Unit: Hz	Control mode. P S T

Pn723*	EasyFFT Scan Torque Command Amplitude	O	Communication address: 0x0723
Factory value: 15	Display range: 1 ~ 800	Unit: %	Control mode. P S T
Parameter Description	Used to set the amplitude value of the EasyFFT Scan Torque command.		

Pn740※	Speed pulsation compensation function	○	Communication address: 0x0740
Factory value: 0x0000	Display range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

Speed pulsation compensation function switch (0th, X)	
0	No speed pulsation compensation function is used
1	Using the speed pulsation compensation function

Valid conditions for speed pulsation compensation (1st, Y)	
0	Speed instruction
1	Motor speed

2nd (Z): Reserved parameters (do not use)

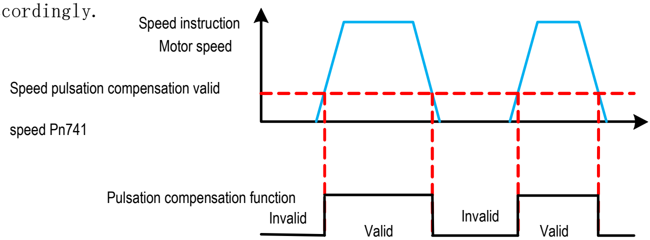
3rd (W): Reserved parameters (do not use)

Parameter Description	Used to turn the speed pulsation compensation function on and off.

Pn741*	Speed pulsation compensation effective speed	■	Communication address: 0x0741
Factory value: 0	Setting range: 0~10000	Unit: rpm	Control mode. P S T

Parameter Description

When the speed pulsation compensation function is effective, the pulsation compensation value is compensated to reduce pulsation even when the speed command is 0 or the motor speed is 0. In order to prevent this phenomenon, the effective speed of speed pulsation compensation needs to be set accordingly.



Pn742*	Speed pulsation compensation gain	■	Communication

			address: 0x0742
Factory value: 80	Setting range: 0 ~ 100	Unit: %	Control mode. P S T

Pn743*	Speed pulsation compensation component 1 frequency	■	Communication address: 0x0743
Factory value: 0	Setting range: 0 ~ 100	Unit: N/A	Control mode. P S T

Pn744*	Speed pulsation compensation 1st component amplitude value (correspond to maximum current)	■	Communication address: 0x0744
Factory value: 0.0	Setting range: -10.0% ~ 10.0%	Unit: %	Control mode. P S T

Pn745*	Speed pulsation compensation component 1 phase	■	Communication address: 0x0745
Factory value: 0	Setting range: 0 ~ 360	Unit: ° (deg)	Control mode. P S T

Pn746*	Speed pulsation compensation 2nd component frequency	■	Communication address: 0x0746
Factory value: 0	Setting range: 0 ~ 100	Unit: N/A	Control mode. P S T

Pn747*	Speed pulsation compensation 2nd component amplitude value (correspond to maximum current)	■	Communication address: 0x0747
Factory value: 0.0	Setting range: -10.0% to 10.0%	Unit: %	Control mode. P S T

Pn748*	Speed pulsation compensation 2nd component phase	■	Communication address: 0x0748

Factory value: 0	Setting range: 0 ~ 360	Unit: ° (deg)	Control mode. P S T

Pn749*	Speed pulsation compensation 3rd component frequency	■	Communication address: 0x0749
Factory value: 0	Setting range: 0 ~ 100	Unit: N/A	Control mode. P S T

Pn74A*	Speed pulsation compensation 3rd component amplitude value (correspond to maximum current)	■	Communication address: 0x074A
Factory value: 0.0	Setting range: -10.0% to 10.0%	Unit: %	Control mode. P S T

Pn74B*	Speed pulsation compensation component 3 phase	■	Correspondence to: 0x074B
Factory value: 0	Setting range: 0 ~ 360	Unit: ° (deg)	Control mode. P S T

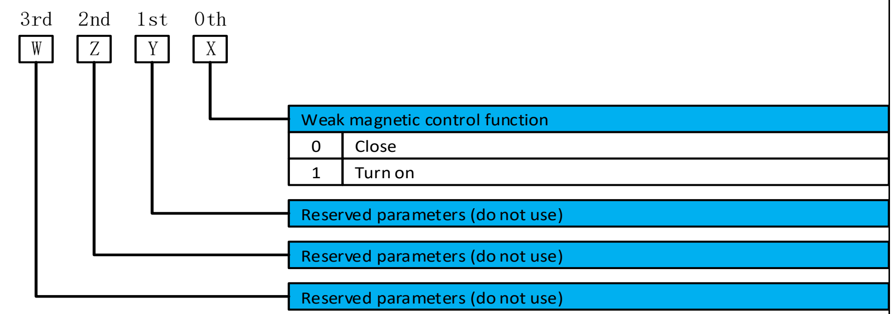
Pn74C※	Speed pulsation compensation 4th component frequency	■	Correspondence to: 0x074C
Factory value: 0	Setting range: 0 ~ 100	Unit: N/A	Control mode. P S T

Pn74D*	Speed pulsation compensation component 4 amplitude value (correspond to maximum current)	■	Correspondence to: 0x074D
Factory value: 0.0	Setting range: -10.0% ~ 10.0%	Unit: %	Control mode. P S T

Pn74E*	Speed pulsation compensation component 4 phase	■	Communication

			address: 0x074E
Factory value: 0	Setting range: 0 ~ 360	Unit: ° (deg)	Control mode. P S T

Pn755	Weak magnetic control function switch	O	Communication address: 0x0755
Factory value: 0x0001	Display range: 0x0000~0x0001	Unit: N/A	Control mode. P S T



Pn756	Weak magnetic control loop proportional gain	O	Correspondence to: 0x0756
Factory value: 30	Setting range: 10 ~ 1000	Unit: Hz	Control mode. P S T

Pn757	Integration time constants for weak magnetic control loops	O	Communication address: 0x0757
Factory value: 16	Setting range: 10 ~ 1000	Unit: us	Control mode. P S T

Pn758	Weak magnetic control loop integral upper limit value	O	Communication address: 0x0758
Factory value:	Setting range: 0 ~ 200	Unit: %	Control mode. P

100			S T

Pn759	Weak magnetic control voltage threshold	O	Communication address: 0x0759
Factory value: 115	Setting range: 50 ~ 150	Unit: %	Control mode. P S T

Pn75A	Maximum weak magnetic current during weak magnetic control	O	Communication address: 0x075A
Factory value: 95	Setting range: 50 ~ 150	Unit: %	Control mode. P S T
Pn75B	Main circuit voltage filtering time during weak magnetic control	O	Communication address: 0x075B
Factory value: 2.0	Setting range: 1.0 ~ 10.0	Unit: ms	Control mode. P S T
Parameter Description	The sliding average filtering times for the DC voltages used for the weak magnetic calculations were subjected to the associated averaging process.		

Pn77F	External input power failure detection function switch	O	Communication address: 0x077F
Factory value: 0x0000	Display range: 0x0000~0x0011	Unit: N/A	Control mode. P S T

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

External input power failure detection function switch	
0	Close
1	Turn on

External input power down detection time	
0	Detected regardless of servo ON and OFF
1	Detected only when servo is ON

Alarm method when external input power failure is detected	
0	Generate Er.F10 fault alarm
1	Generate AL.910 warning alarm

Reserved parameters (do not use)

Parameter Description	This function code is used for the drive's power-down detection function for external input power, and can be enabled for some applications with specific needs, such as vertical axis applications.

Pn780	External input power-down detection signal filtering time		O	Communication address: 0x0780
Factory value: 2	Setting range: 0~1000	Unit: ms		Control mode. P S T

Pn781*	Drive bus over-voltage point		O	Communication address: 0x0781
Factory value: Model determination	Setting range: 0~1000	Unit: V		Control mode. P S T
Parameter Description	Set the bus voltage overvoltage point threshold, when the bus voltage is greater than this value will report an overvoltage fault. For 220V (S2/T2) models, the default value of the driver overvoltage point: **400V**, with a setting range of **360V to 410V**. For 380V (T3) models, the drive overvoltage point default value: **760V**, with a setting range of **660V to 800V**. **Note:** Do not change the parameters yourself without the manufacturer's permission, as this may cause irrecoverable damage to the machine!			

Pn782*	Drive regenerative braking point	■	Communication address: 0x0782
Factory value: Model determination	Setting range: 0~1000	Unit: V	Control mode. P S T
Parameter Description	Set the bus regeneration voltage braking time threshold to release the capacitor charge to make the bus voltage drop. For 220V (S2/T2) models, the default value of the driver relief point: 370V, the setting range is 350V to 400V; For 380V (T3) models, the default value for the drive relief point: 680V, with a setting range of 660V to 760V.		

Pn783*	Regenerative closure hysteresis loop width	■	Communication address: 0x0783
Factory value: 10	Setting range: 0 ~ 50	Unit: V	Control mode. P S T
Parameter Description	In order to avoid frequent access to the bus relief, the number of frequent accesses to regenerative braking can be effectively reduced by this function code. The value cannot be set too large, too large can easily cause large fluctuations in the DC bus.		

Pn784*	Drive bus undervoltage point	■	Communication address: 0x0784
Factory value: Model determination	Setting range: 160 ~ 500	Unit: V	Control mode. P S T
Parameter Description	Set the bus voltage undervoltage point threshold, when the bus voltage is less than this value will report an undervoltage fault. For 220V (S2/T2) models, the default value for drive undervoltage fault: 180V, with a setting range of 160V to 220V. For 380V (T3) models, the drive undervoltage fault default: 380V, with a setting range of 370V to 500V.		

Pn785*	Driver bus undervoltage detection filtering time constant		○	Communication address: 0x0785
Factory value: 10	Setting range: 0 ~ 65535	Unit: ms		Control mode. P S T

Pn786*	Drive bus undervoltage warning value		○	Communication address: 0x0785
Factory value: Model determination	Setting range: 160 ~ 500	Unit: V		Control mode. P S T
Parameter Description	Set the bus voltage undervoltage point threshold, when the bus voltage is less than this value will report undervoltage warning. For 220V (S2/T2) models, the default value for the drive undervoltage warning: 180V. For 380V (T3) models, the drive undervoltage warning defaults to: 380V.			

Pn788	Motor maximum speed fine adjustment		○	Communication address: 0x0788
Factory value: 0	Setting range: 0 ~ 2	Unit: 100rpm		Control mode. P S T

Pn790*	Motor code setting		■	Communication address: 0x0790
Factory value: Model determination	Setting range: 0x0000~0xFFFF	Unit: N/A		Control mode. P S T

Parameter Description	Used to set the type of motor the drive is configured for, the specific code setting is based on the value indicated in the motor nameplate mark. The motor code setting is only available 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 function code Pn791 set value 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 performs serial communication processing based on the encoder set by function code Pn791.

Pn791*	Encoder control switch	■	Communication address: 0x0791
Factory value: Model determination	Setting range: 0x0000~0x0007	Unit: N/A	Control mode. P S T

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

X (0th): Encoder type

0	Non-Wire Saving Incremental Encoder (2500 lines)
1	Line saving incremental encoder (2500 lines)
2	Tamagawa 17-bit absolute encoder
3	Tamagawa 23-bit absolute encoder
4	Nikon 20-bit single-turn encoder
5	Nikon 20-bit multiturn encoder
6	Nikon 24-bit single-turn encoder
7	Nikon 24-bit multiturn encoder
8	Serial incremental encoder (10000 lines)

Y (1st): Reserved parameters (do not use)

Z (2nd): Reserved parameters (do not use)

W (3rd): Reserved parameters (do not use)

Parameter Description	Used to set the encoder type.

Cautions
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 for Pn790 is an incremental encoder motor in the motor bank, the type of encoder is set automatically and function code Pn791 is invalid. ● Pn790 has the highest priority. The drive automatically determines the type of encoder after the value in Pn790.

Pn792*	Motor zero pole position		■	Communication address: 0x0792
Factory value: Model determination	Display range: -360 ~ 360	Unit: °		Control mode. P S T
Parameter	Used to display the motor zero pole reference position. The auxiliary			

Description	function Fn080 updates this function code value when recognition is complete, and is dedicated to serial encoders.

Pn793*	Position sensor resolution	■	Communication address: 0x0793 ★
Factory value: 10000	Setting range: 1 ~ 2^{31}	Unit: N/A	Control mode. P S T
Parameter Description	Used to set the custom motor parameter encoder resolution, for incremental encoders, the setting value is the value after 4x frequency. **Example:** If the incremental encoder is 2500 lines, the value of the position sensor resolution is 10000.		

Pn795*	Incremental encoder control switches	■	Communication address: 0x0795
Factory value: 0x0000	Setting range: 0x0000~0x0111	Unit: N/A	Control mode. P

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

0th (X): How to use the angle value corresponding to Hall signal WVU

0	Use internal factory setting values
1	Use external Pn796 to Pn79B setting values

1st (Y): How to use the encoder Z signal latch value

0	Use internal factory setting values
1	Use external Pn79C to set the value

2nd (Z): How to use incremental encoder resolution

0	Use internal factory setting values
1	Use external Pn793 to set the value

3rd (W): Reserved parameters (do not use)

Pn796*	Angle value when incremental encoder Hall signal WVU is 1 (001)	■	Communication address: 0x0796
Factory value: 240.0	Setting range: 0.0 ~ 359.9	Unit.	Control mode. P S T

Pn797*	Angle value when incremental encoder Hall signal WVU is 2 (010)	■	Communication address: 0x0797
Factory value: 0.0	Setting range: 0.0 ~ 359.9	Unit: °	Control mode. P S T

Pn798*	Angle value when incremental encoder Hall signal WVU is 3 (011)	■	Communication address: 0x0798
Factory value: 300.0	Setting range: 0.0 ~ 359.9	Unit: °	Control mode. P S T

Pn799*	Angle value when incremental encoder Hall signal WVU is 4 (100)	■	Communication address: 0x0799
Factory value: 120.0	Setting range: 0.0 to 359.9	Unit: °	Control mode. P S T

Pn79A*	Angle value when incremental encoder Hall signal WVU is 5 (101)	■	Communication address: 0x079A
Factory value: 180.0	Setting range: 0.0 ~ 359.9	Unit: °	Control mode. P S T

Pn79B*	Angle value when incremental encoder Hall signal WVU is 6 (110)	■	Communication address: 0x079B
Factory value: 60.0	Setting range: 0.0 ~ 359.9	Unit: °	Control mode. P S T

Pn79C*	Incremental encoder Z signal corresponding to angle value	O	Communication address: 0x079C
Factory value: 330.0	Setting range: 0.0 ~ 359.9	Unit: °	Control mode. P S T

Pn79E	Reserved	○	Communication address: 0x079E
Factory value: 0000	Setting range: 00000 ~ 65535	Unit: N/A	Control mode. P S T

Pn79F	User password	○	Communication address: 0x079F
Factory value: 0x0000	Setting range: 0x0000~0xFFFF	Unit: N/A	Control mode. P S T

9.9 Motion control parameters(Pn8xx)

Pn800	Internal position command setting	■	Communication address: 0x0800
Factory value: 0x0000	Setting range: 0x0000 ～ 0x0000	Unit: N/A	Control mode. P

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

X: Internal position command source

0	Internal multi-segment position (Pr command)
1	Reserved

Y: Reserved parameters (do not use)

Z: Reserved parameters (do not use)

W: Reserved parameters (do not use)

Pn802	Internal multi-stage position (speed) operation mode	○	Communication address: 0x0802
Factory value: 0x0000	Setting range: 0x0000~0x1113	Unit: N/A	Control mode. P

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

X: Internal position operation mode	
0	Single-segment operation (input terminal X or communication)
1	Single run end stop
2	Operation in a cycle
3	Sequential operation

Y: Residual path handling in multi-segment operation mode	
0	Continue running the unfinished path
1	Restart from path 1

Z: Whether the single-segment operation mode is updated immediately	
0	Non-immediate updates
1	Communication commands are executed as soon as they are given

W: Absolute position starting point selection	
0	The motor position after the origin return is used as the starting point for the absolute position
1	The absolute zero point (Pn296, Pn297) is used as the starting point for the absolute position

Parameter Description	When Pn802.Z=0, the DI terminal or the communication given Pr instruction is first stored in the buffer, and the current instruction is executed and then the instruction given by the previous communication is taken out from the buffer. When Pn802.Z=1, the communication command is executed immediately after it is given.

Pn803	Multi-segment position (speed) endpoint path	O	Communication address: 0x0803
Factory value: 1	Setting range: 1 ~ 15	Unit: N/A	Control mode: P

Pn804	Sequential run start path	O	Communication address: 0x0804
Factory value: 1	Setting range: 0 ~ 15	Unit: N/A	Control mode: P

Parameter Description	1) Round 1 of the sequential runs starts at Pr1 and runs to the path pointed to by Pn803. 2) Pn804 = 0 or Pn804 > Pn803, the sequence will be stopped after 1 round. 3) For Pn804 ≤ Pn803, the cycle runs after round 1 and the starting segment number of the cycle run is Pn804. 4) Enable signal CTRG is high level active.

Pn806	Pr command communication parameters (single segment operation)		O	Communication address: 0x0806
Factory value: 10000	Setting range: 0 ~ 65535	Unit: N/A		Control mode. P
Parameter Description	① DI terminal switching mode is valid, input 1 ~ 15 can trigger the corresponding Pr path, input 1000 can force the end of the current operation mode. ② In position mode, enter 0 to trigger home return, and enter 1000 to force the end of home return.			

Pn810	PR path 1 control word L		O	Communication address: 0x0810
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A		Control mode. P

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

X (0th):

PR Type (TYPE)	
0	Positioning control
1	Fixed speed control

Y (1st):

Type of positioning control	
0	Positioning control as incremental position
1	Positioning control as absolute position
2	Positioning control as relative position

Z (2nd):

Fixed speed control unit	
0	Speed units are 0.1 rpm
1	Speed in PPS

W (3rd): Reserved parameters (do not use)

Pn811	PR path 1 control word H	O	Communication address: 0x0811
Factory value: 0x0000	Setting range: 0x0000 ~ 0x7777	Unit: N/A	Control mode. P

3rd W — 2nd Z — 1st Y — 0th X

0th (X):

Acceleration time (ACC)	
0	Select "Acceleration time" function code Pn890 ~ Pn89F
...	
7	

1st (Y):

Deceleration time(DEC)	
0	Select "Deceleration time" function code Pn890 ~ Pn89F
...	
7	

2nd (Z):

Internal target speed	
0	Select "Internal target speed setting" function code Pn8B0 ~ Pn8BF
...	
7	

3rd (W):

Delay time (pause time)	
0	Select "Delay time after position arrival" function code Pn8A0 ~ Pn8AF
...	
7	

Pn812	PR1 information	O	Communication address: 0x0812 ★
Factory value: 0	Setting range: -2^{31}~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn814	PR2 control word L	O	Communication address: 0x0814
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn815	PR2 control word H	O	Communication

			address: 0x0815
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn816	PR2 information	O	Communication address: 0x0816 ★
Factory value: 0	Setting range: $-2^{31}\sim 2^{31}-1$	Unit: N/A	Control mode. P

Pn818	PR3 control word L	O	Communication address: 0x0818
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn819	PR3 control word H	O	Communication address: 0x0819
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn81A	PR3 information	O	Correspondence to: 0x081A ★
Factory value: 0	Setting range: $-2^{31}\sim 2^{31}-1$	Unit: N/A	Control mode. P

Pn81C	PR4 control word L	O	Correspondence to: 0x081C
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn81D	PR4 control word H	O	Communication

			address: 0x081D
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn81E	PR4 information	O	Communication address: 0x081E ★
Factory value: 0	Setting range: -2^{31} to $2^{31}-1$	Unit: N/A	Control mode. P

Pn820	PR5 control word L	O	Communication address: 0x0820
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn821	PR5 control word H	O	Communication address: 0x0821
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn822	PR5 information	O	Communication address: 0x0822 ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn824	PR6 control word L	O	Communication address: 0x0824
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn825	PR6 control word H	O	Communication address: 0x0825

Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode: P

Pn826	PR6 information	O	Communication address: 0x0826 ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode: P

Pn828	PR7 control word L	O	Communication address: 0x0828
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode: P

Pn829	PR7 control word H	O	Communication address: 0x0829
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode: P

Pn82A	PR7 information	O	Communication address: 0x082A ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode: P

Pn82C	PR8 control word L	O	Communication address: 0x082C
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode: P

Pn82D	PR8 control word H	O	Communication address: 0x082D
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode: P

Pn82E	PR8 information	O	Communication address: 0x082E ★
Factory value: 0	Setting range: $-2^{31} \sim 2^{31}-1$	Unit: N/A	Control mode. P

Pn830	PR9 control word L	O	Communication address: 0x0830
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn831	PR9 control word H	O	Communication address: 0x0831
Factory value: 0x0000	Setting range: 0x0000 ~ 0x7777	Unit: N/A	Control mode. P

Pn832	PR9 information	O	Communication address: 0x0832 ★
Factory value: 0	Setting range: $-2^{31} \sim 2^{31}-1$	Unit: N/A	Control mode. P

Pn834	PR10 control word L	O	Communication address: 0x0834
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn835	PR10 control word H	O	Communication address: 0x0835
Factory value:	Setting range:	Unit: N/A	Control mode. P

0x0000	0x0000~0x7777		

Pn836	PR10 information	O	Communication address: 0x0836 ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn838	PR11 control word L	O	Communication address: 0x0838
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn839	PR11 control word H	O	Communication address: 0x0839
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn83A	PR11 information	O	Communication address: 0x083A ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn83C	PR12 control word L	O	Correspondence to: 0x083C
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn83D	PR12 control word H	O	Correspondence to: 0x083D
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn83E	PR12 information	O	Communication address: 0x083E ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn840	PR13 control word L	O	Communication address: 0x0840
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn841	PR13 control word H	O	Communication address: 0x0841
Factory value: 0x0000	Setting range: 0x0000~0x7777	Unit: N/A	Control mode. P

Pn842	PR13 information	O	Communication address: 0x0842 ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn844	PR14 control word L	O	Communication address: 0x0844
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn845	PR14 control word H	O	Communication address: 0x0845
Factory value:	Setting range:	Unit: N/A	Control mode. P

0x0000	0x0000~0x7777		

Pn846	PR14 information	O	Communication address: 0x0846 ★
Factory value: 0	Setting range: -2^{31} ~ $2^{31}-1$	Unit: N/A	Control mode. P

Pn848	PR15 control word L	O	Communication address: 0x0848
Factory value: 0x0000	Setting range: 0x0000~0x0121	Unit: N/A	Control mode. P

Pn849	PR15 control word H	O	Communication address: 0x0849
Factory value: 0x0000	Setting range: 0x0000 ~ 0x7777	Unit: N/A	Control mode. P

Pn890	Acceleration and deceleration time (No. #0)	O	Communication address: 0x0890
Factory value: 30	Display range: 0 ~ 65500	Unit: ms	Control mode. P
Parameter Description	PR mode acceleration and deceleration time setting, indicating acceleration from 0rpm to 3000rpm time, same below.		

Pn891	Acceleration and deceleration time (No. #1)	O	Communication address: 0x0891
Factory value: 50	Display range: 0 ~ 65500	Unit: ms	Control mode. P

Pn892	Acceleration and deceleration time (No. #2)	O	Communication address: 0x0892
Factory value:	Display range: 0 ~ 65500	Unit: ms	Control mode. P

200			

Pn893	Acceleration and deceleration time (No. #3)	O	Communication address: 0x0893
Factory value: 300	Display range: 0 ~ 65500	Unit: ms	Control mode. P

Pn894	Acceleration and deceleration time (No. #4)	O	Communication address: 0x0894
Factory value: 500	Display range: 0 ~ 65500	Unit: ms	Control mode. P

Pn895	Acceleration and deceleration time (No. #5)	O	Communication address: 0x0895
Factory value: 600	Display range: 0 ~ 65500	Unit: ms	Control mode. P

Pn896	Acceleration and deceleration time (No. #6)	O	Communication address: 0x0896
Factory value: 800	Display range: 0 ~ 65500	Unit: ms	Control mode. P

Pn897	Acceleration and deceleration time (No. #7)	O	Communication address: 0x0897
Factory value: 900	Display range: 0 ~ 65500	Unit: ms	Control mode. P

Pn898	Delay time after position arrival (number #0)	O	Communication address: 0x0898
Factory value: 0	Display range: 0～60000	Unit: ms	Control mode. P

Parameter Description	Delay time after PR mode completion, same below.

Pn899	Delay time after position arrival (number #1)		O	Communication address: 0x0899
Factory value: 100	Display range: 0~60000	Unit: ms		Control mode. P

Pn89A	Delay time after position arrival (number #2)		O	Communication address: 0x089A
Factory value: 200	Display range: 0~60000	Unit: ms		Control mode. P

Pn89B	Delay time after position arrival (number #3)		O	Communication address: 0x089B
Factory value: 400	Display range: 0~60000	Unit: ms		Control mode. P

Pn89C	Delay time after position arrival (number #4)		O	Communication address: 0x089C
Factory value: 500	Display range: 0~60000	Unit: ms		Control mode. P

Pn89D	Delay time after position arrival (number #5)		O	Communication address: 0x089D
Factory value: 800	Display range: 0~60000	Unit: ms		Control mode. P

Pn89E	Delay time after position arrival (No. #6)	O	Communication address: 0x089E

Factory value: 1000	Display range: 0～60000	Unit: ms	Control mode. P

Pn89F	Delay time after position arrival (number #7)	O	Communication address: 0x089F
Factory value: 1500	Display range: 0～60000	Unit: ms	Control mode. P

Pn8A0	Internal target speed setting (No. #0)	O	Communication address: 0x08A0
Factory value: 20.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P
Parameter Description	PR mode target speed setting, same below.		

Pn8A2	Internal target speed setting (No. #2)	O	Communication address: 0x08A2
Factory value: 100.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P

Pn8A3	Internal target speed setting (No. #3)	O	Communication address: 0x08A3
Factory value: 200.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P

Pn8A4	Internal target speed setting (No. #4)	O	Communication address: 0x08A4
Factory value: 300.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P

Pn8A5	Internal target speed setting (No. #5)	O	Communication

			address: 0x08A5
Factory value: 500.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P

Pn8A6	Internal target speed setting (No. #6)	O	Communication address: 0x08A6
Factory value: 600.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P

Pn8A7	Internal target speed setting (No. #7)	O	Communication address: 0x08A7
Factory value: 800.0	Display range: 0.0 ~ 6000.0	Unit: rpm	Control mode. P

9.10 Communication address(PnExx)

PnE00☆	Servo Model selection	■	Communication address: 0x0E00
Default value: model determined	Display range : 0x0000 ~ 0xFFFF	Unit: N/A	Control mode: P S T

Communication address Explanation:

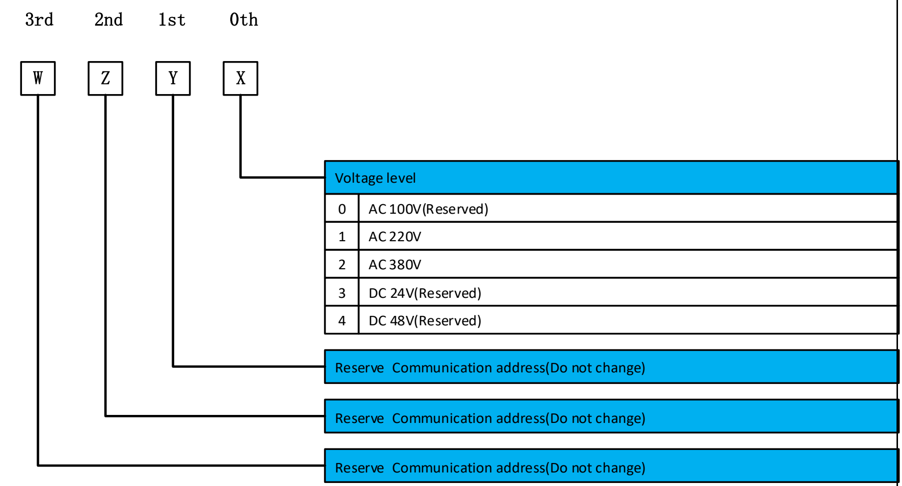
Set up Servo models, After Set up is completed, it needs to be powered on again to take effect。

Set value	Servo Code	Remark
0x011A	SD700P-1R1A	Rated current 1.1A, Main circuit power supply specifications: Single phase 220V
0x018A	SD700P-1R8A	Rated current 1.8A, Main circuit power supply specifications: Single phase 220V
0x033A 0002	SD700P-3R3A	Rated current 3.3A, Main circuit power supply specifications: Single phase 220V
0x055A	SD700P-5R5A	Rated current 5.5A, Main circuit power supply specifications: Single phase 220V

PnE01☆	Servo Power	■	Communication address: 0x0E01

Default value: model determined	Set range: 0～65535	Unit: W	Control mode: P S T

PnE02☆	Voltage level	■	Communication address: 0x0E02
Default value: model determined	Set range: 0x0000～0x0004	Unit: N/A	Control mode: P S T

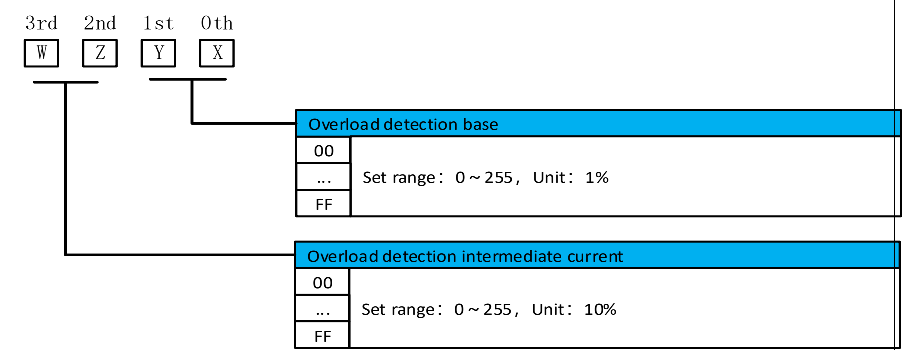


PnE03☆	Servo Rated current (Peak)	■	Communication address: 0x0E03
Default value: model determined	Set range: 0.0～6553.5	Unit: A	Control mode: P S T

PnE04☆	Servo Maximum current (Peak)	■	Communication address: 0x0E04
Default value: model determined	Set range: 0.0～6553.5	Unit: A	Control mode: P S T

PnE05☆	Module overheating detection threshold	○	Communication address：0x0E05
Default value: model determined	Set range：60.0～100.0	Unit：℃	Control mode：P S T
Communication address Explanation	Used to set up the temperature detection alarm threshold of the module. When the temperature value of the module is greater than this threshold, will issue a module overheating fault。		

PnE06☆	Overload detection current	■	Communication address：0x0E06
Default value: model determined	Set range：0x0000～0xFFFF	Unit：N/A	Control mode：P S T



PnE07☆	Overload detection time	■	Communication address：0x0E07
Default value: model determined	Set range：0x0000～0xFFFF	Unit：N/A	Control mode：P S T

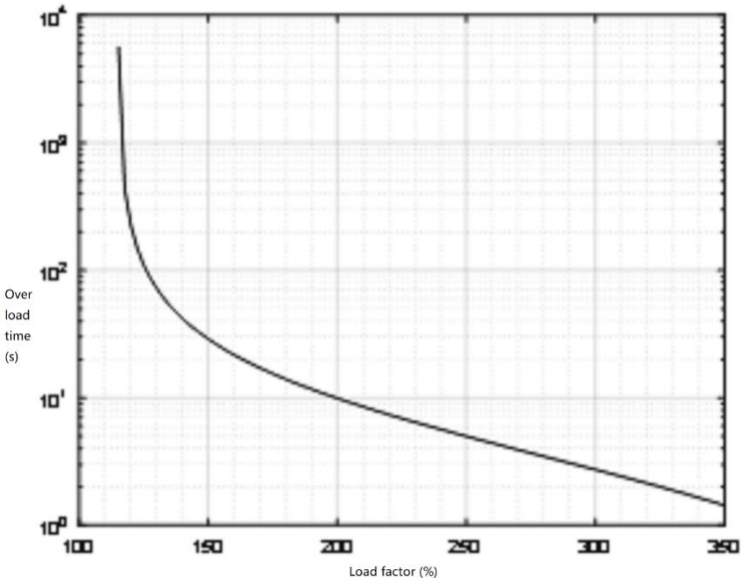
3rd	2nd	1st	0th
W	Z	Y	X

Intermediate time of overload detection (1st, 0th: Y X)

00	Set range0～255， Unit1s
...	
FF	

Maximum overload detection time (3rd, 2nd: W Z)

00	Set range0～255， Unit1s
...	
FF	

Communication address Explanation	Used to set ’s overload protection time。 

PnE08☆	Overload detection time fine-tuning	■	Communication address: 0x0E08
Default value: model determined	Set range: 0x0000～0xFFFF	Unit: N/A	Control mode: P S T

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

overload detection intermediate time fine-tuning (Y X)

00	Set range0～255, Unit: 1%
...	
FF	

Maximum overload detection time fine-tuning (W Z)

00	Set range0～255, Unit: 1%
...	
FF	

PnE09☆	Motor Overload detection time fine-tuning	■	Communication address: 0x0E09
Default value: model determined	Set range: 0x0000～0xFFFF	Unit: N/A	Control mode: P S T

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

Motor overload detection intermediate time fine-tuning (Y X)

00	Set range0～255, Unit: 1%
...	
FF	

Motor Maximum overload detection time fine-tuning (W Z)

00	Set range0～255, Unit: 1%
...	
FF	

S

PnE0A☆	Low 8 bits (L): Reserve Communication address High 8 bits (H): Motor overspeed threshold fine-tuning	■	Communication address: 0x0E0A
Default value: model determined	Set range: 0x0000～0xFFFF	Unit: N/A	Control mode: P S T

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

YX: Reserve Communication address(Do not use)

00	Reserve Communication address
...	
FF	

WZ: Motor overspeed point threshold adjustment

00	Set range0～255, The fine tuning of the overspeed point is calculated as follows: $\frac{PnF06.YX \times PnE0A.WZ}{100 \times 100}$
...	
FF	

PnE0B☆	Built-in regenerative braking resistor resistance	○	Communication address: 0x0E0B
Default value: model determined	Set range: 0～65535	Unit: Ω	Control mode: P S T

PnE0C☆	Built-in regenerative resistance capacity	○	Communication address: 0x0E0C
Default value: model determined	Set range: 0.0～6553.5	Unit: %	Control mode: P S T

PnE0D☆	Built-in dynamic brake (DB) resistance value	○	Communication address: 0x0E0B
Default value: model determined	Set range: 0～65535	Unit: mΩ	Control mode: P S T

PnE0E☆	Built-in dynamic braking (DB) resistance capacity	○	Communication

			address: 0x0E0C
Default value: model determined	Set range: 0.0～6553.5	Unit: %	Control mode: P S T

PnE10☆	P-N voltage detection level (the maximum voltage that can be detected by the hardware)	○	Communication address: 0x0E10
Default value: model determined	Set range: 0～1000	Unit: V	Control mode: P S T
Communication address Explanation	Set up The calibration value of bus voltage detection. The value is adjusted based on the hardware part. For 220V (S2/T2) models, Set up is 500V; For 380V (T3) models, set up is 940V. Note: Without the permission of the manufacturer, please do not change the Communication address yourself, otherwise it may cause irreversible damage to the !		

PnE11☆	P-N voltage detection low-pass filter time constant	○	Communication address: 0x0E11
Default: 0	Set range: 0～10000	Unit: us	Control mode: P S T

PnE12☆	P-N voltage detection and zero adjustment	○	Communication address: 0x0E12
Default : Factory setting	Set range: -50～50	Unit: V	Control mode: P S T

PnE13☆	P-N voltage detection gain fine tuning	○	Communication address: 0x0E13
Default: 0	Set range: -127～127	Unit: N/A	Control mode: P S T
Communication address Explanati	Set up Set the linearity of bus voltage detection to make relevant adjustments:: $U_{dc} \times \frac{256+PnE13}{256}$		

on	Note: Without the permission of the manufacturer, please do not change the Communication address by yourself, otherwise it may cause irreversible damage to the !

PnE14☆	Main circuit detection filter selection switch		■	Communication address: 0x0E14
Default: 0x0055	Set range: 0x0000～0x7777	Unit: N/A		Control mode: P S T

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

X (0th): Main circuit voltage detection abnormal detection filter

0	Set range0～7, Unit: 250us
...	
7	

Y (1st): Overvoltage alarm detection filter

0	Set range0～7, Unit: 250us
...	
7	

Z (2nd): Regenerative braking start filter

0	Set range0～7, Unit: 250us
...	
7	

W (3rd): Filter time at the end of regenerative braking

0	Set range0～7, Unit: 250us
...	
7	

PnE15☆	Alarm muting switch 1		○	Communication address: 0x0E15
Default: 0x0000	Set range: 0x0000～0x003F	Unit: N/A		Control mode: P

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

0th (X): System switch A

Bit0	Reserve
Bit1	Check the switch within 4 times of the capacity ratio of the motor and the (0: monitoring; 1: not monitoring)
Bit2	Motor and overload monitoring(0: monitoring; 1: not monitoring)
Bit3	Serial Code Device Over-Temperature Monitoring Er.860(0: monitoring; 1: not monitoring)

1st (Y): System switch B

Bit0	Operation mode detection switch supported by 【EtherCAT】((0: off; 1: on)
Bit1	FPGA backup program running detection switch(0: off; 1: on)
Bit2	Non-standard CanOpen life protection automatic switch(0: off; 1: on)
Bit3	Reserved

2nd (Z): Reserve Communication address(Do not use)

Bit0	FPGA backup program running detection switch(0: off; 1: on)
Bit1	MicroChip ESC Manual selection (0: 9253; 1: 9252)
Bit2	MicroChip ESC options(0: automatic; 1: manual)
Bit3	Reserved

3rd (W): Reserve Communication address(Do not use)

PnE17☆	Single tube fail-safe time & single tube bootstrap charging time	■	Communication address：0x0E17
Default value: model determined	Set range：0x0000～0xFFFF	Unit：N/A	Control mode：P S T

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

1st–0th (YX): Rated speed

Set range： 0～255
Unit： 1ms
Incremental encoder

3rd–2nd (WZ): Maximum overload detection time fine-tuning

Set range： 0～255
Unit： 1ms
Incremental encoder

PnE1C☆	System switch 2	○	Communication address：0x0E1C
Default：0x0003	Set range：0x0000～0xFFFF	Unit：N/A	Control mode：P

3rd 2nd 1st 0th

W Z Y X

System switch 2A	
Bit0	Regenerative braking protection function switch((0: off; 1: on)
Bit1	Phase compensation switch(0: off; 1: on)
Bit2	DB brake protection function switc(0: off; 1: on)
Bit3	ESC manufacture selection(0 : MicroChip ; 1 : BeckOff)

System switch 2B	
Bit0	Incremental encoder AB signal(Er.C91) Anomaly detection switch(0: off; 1: on)
Bit1	Incremental encoder Z signal(Er.C92) Anomaly detection switch(0: off; 1: on)
Bit2	FPGA to ARM monitoring(Error) Detection switch(0: off; 1: on)
Bit3	EtherCat Automatic model detection switch (0: off; 1: on)

System switch 2C	
Bit0	ACR work method (0: Method 1; 1: Method 2)
Bit1	Current feedback mode selection (0: Method 0; 1: Method 1)
Bit2	Silent mode switch ((0: off; 1: on)
Bit3	Single-tube bootstrap charging manual switch (0: off; 1: on)

System switch 2D	
Bit0	Single-tube bootstrap mode switch (0: off; 1: on)
Bit1	Current sampling chip manual (0： C796/NSI1306； 1： AM1305)
Bit2	Power level detection switch (0: off; 1: on)
Bit3	Single-tube model current sampling chip automatic identification switch(0: off; 1: on)

PnE1D☆	System switch 3	○	Communication address: 0x0E1D
Default: 0000	Set range: 0x0000～0x0001	Unit: N/A	Control mode: P

3rd 2nd 1st 0th

W Z Y X

X: System switch 3A

0	Function code Allow writing
1	Function code Communication address Write prohibited

Y: Reserve Communication address(Do not change)

Z: Reserve Communication address(Do not change)

W: Reserve Communication address(Do not change)

PnE1E☆	Permitted number of consecutive failures of serial communication	■	Communication address: 0x0E1E
Default value: model determined	Set range: 0x0000～0x00FF	Unit: N/A	Control mode: P S T

3rd 2nd 1st 0th

W Z Y X

YX: Permitted number of consecutive failures of serial

00 ... FF	Set range0～255, Unit: Times

WZ: Reserve Communication address(Do not use)

Communication address Explanation	When the number of consecutive communication failures between the set r and the serial encoder is greater than the set value, an Er.C90 fault alarm will be generated.

PnE1F☆	Silent mode filter time constant	○	Communication

			address：0x0E1F
Default value: model determined	Set range：1～65535	Unit：us	Control mode：P S T

PnE20☆	Current loop gain(D axis)	○	Communication address：0x0E20
Default value: model determined	Set range：100～10000	Unit：Hz	Control mode：P S T

PnE21☆	Current loop gain(Q axis)	○	Communication address：0x0E21
Default value: model determined	Set range：100～10000	Unit：Hz	Control mode：P S T

PnE22☆	Current loop integral time constant(D axis)	○	Communication address：0x0E22
Default value: model determined	Set range：0～65535	Unit：us	Control mode：P S T

PnE23☆	Current loop integral time constant(Q axis)	○	Communication address：0x0E23
Default value: model determined	Set range：0～65535	Unit：us	Control mode：P S T

PnE24☆	Current loop integral limit value(D axis)	○	Communication address：0x0E24
Default：10430	Set range：0～65535	Unit：N/A	Control mode：P S T

PnE25☆	Current loop integral limit value(Q axis)	○	Communication

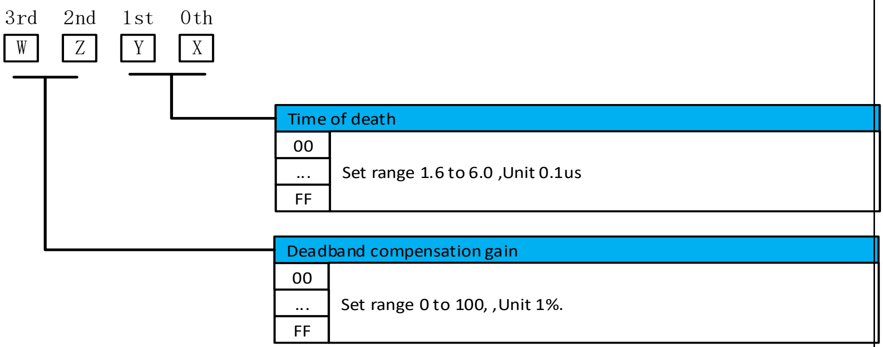
			address: 0x0E25
Default: 10430	Set range: 0～65535	Unit: N/A	Control mode: P S T

PnE28☆	Current detection gain 1	○	Communication address: 0x0E28
Default value: type determination	Set range: 0 to 16384	Unit: N/A	Control mode. P S T
Communication address Description	Set the hardware current detection factor for . $$PnE28=\frac{\text{Current detection resistance (m}\Omega\text{)} \times \text{driver maximum current PnE15 (peak, 0.1A)}}{\text{Analog to digital conversion chip full scale voltage (320mV)}}\times 8192$$ Note: Do not change the communication address without the manufacturer's permission, as this may cause irrecoverable damage to the		

PnE29☆	Voltage compensation gain	○	Communication address: 0x0E29
Default value: 115	Set range: 0 to 300	Units: %.	Control mode. P S T
Communication address Description	Set the gain value for the compensation voltage value.		

PnE2A☆	Carrier frequency	○	Communication address: 0x0E2A
Default value: type determination	Set range: 2000 to 16000	Unit: HZ	Control mode. P S T
Communication address Description	Setting the carrier (PWM) frequency of the servo		

PnE2B☆	Deadband compensation gain|Deadband time	■	Communication address: 0x0E2B
Default value: type determination	Set range: 0x0000 to 0xFF32	Unit: N/A	Control mode. P S T



PnE2C☆	Current forecast gain	■	Communication address: 0x0E2C
Default value: type determination	Set range: 0.00 to 100.00	Unit: N/A	Control mode. P S T

PnE2D☆	Current detection gain 2	○	Communication address: 0x0E2D
Default value: type determination	Set range: 0 to 16384	Unit: N/A	Control mode. P S T

PnE30☆	Maximum value allowed for overvoltage setting	○	Communication address: 0x0E30
Default value: type	Set range: 100 to 1000	Unit: V	Control mode. P S T

determination			
Communication address Description	Setting the maximum permissible overvoltage of the servo		

PnE31☆	Permissible minimum values for overvoltage settings	○	Communication address: 0x0E31
Default value: type determination	Set range: 100 to 1000	Unit: V	Control mode. P S T
Communication address Description	Setting the minimum permissible overvoltage of the servo		

PnE32☆	overcurrent protection filtering time	○	Communication address: 0x0E32
Default value: type determination	Set range: 0x0000 to 0xFFFF	Unit: NA	Control mode. P S T

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

1st, 0th (Y X): overcurrent protection filtering time

00 ... FF	Set range 0 to 255, units: 1.6us

3rd, 2nd (W Z): External hardware overcurrent signal filtering time

00 ... FF	Set range 0 to 255, unit: 1us

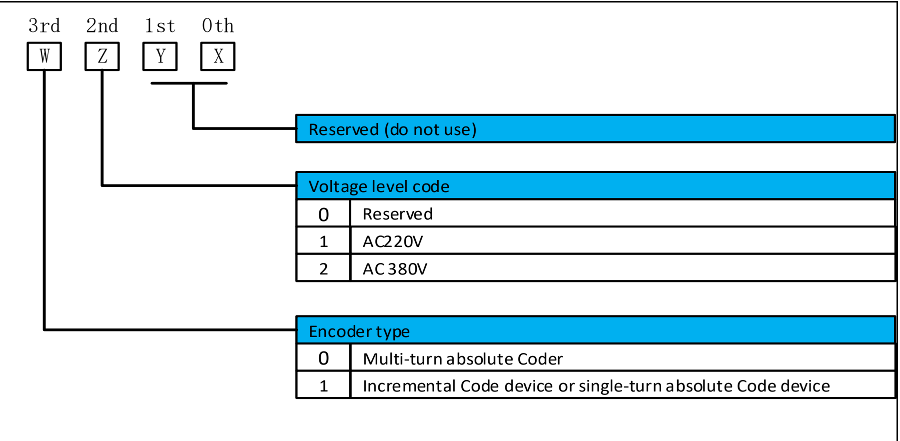
PnE33☆	overcurrent protection thresholds		○	Communication address: 0x0E33
Default value: type determination	Set range: 0.0 to 6553.5	Unit: A		Control mode. P S T
Communication address Description	Set ’s hardware overcurrent thresholds, which vary from model to model, and do not change the parameters yourself without the manufacturer’s permission, as this may cause irrecoverable damage to the !			

PnE35☆	PWM frequency permissible upper limit		○	Communication address: 0x0E34
Default value: type determination	Set range: 3000 to 16000	Unit: Hz		Control mode. P S T
Communication address Description	Setting the upper frequency of the servo PWM			

PnEA8☆	2nd speed feedback filter time constant		○	Communication address: 0x0EA8
Default value: type determination	Set range: 0.02 to 655.35	Unit: ms		Control mode. P S T

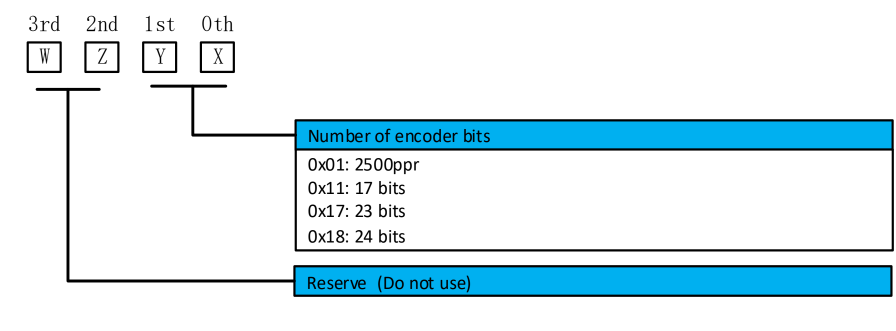
9.11 Motors Parameters (PnFxx)

PnF00☆	Encoder type and motor voltage level code		●	Communication address: 0x0F00
Default value: type determination	Set range: 0x0000 to 0x22FF	Unit: N/A		Control mode. P S T



PnF02☆	Motor Power		●	Communication address: 0x0F02
Default value: type determination	Set range: 0 to 65535	Unit: W		Control mode. P S T

PnF03☆	Number of encoder bits (resolution)		■	Communication address: 0x0F03
Default value: type determination	Set range: 0x0000 to 0x00FF	Unit: N/A		Control mode. P S T



PnF05☆	Maximum speed & rated speed	■	Communication address: 0x0F05
Default value: type determination	Set range: 0x0000 to 0xFFFF	Unit: N/A	Control mode. P S T

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

Rated speed

Set range: 0 to 255
Unit: 100rpm
Incremental encoders

Maximum speed

Set range: 0 to 255
Unit: 100rpm
Incremental encoders

PnF06☆	Number of motor poles & overspeed detection thresholds	■	Communication address: 0x0F06
Default value: type determination	Set range: 0x0000 to 0xFF32	Unit: N/A	Control mode. P S T

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

Overspeed detection thresholds

Set range: 0x00 to 0x32
Units: %.
Incremental encoders

Number of motor poles

06	6-pole motors (3 pairs of poles)
08	8-pole motor (4 pairs of poles)
0A	10-pole motors (5 pairs of poles)

PnF07☆	Rated torque		●	Communication address: 0x0F07
Default value: type determination	Set range: 0.00 to 655.35	Unit: Nm		Control mode. P S T

PnF08☆	Maximum torque		●	Communication address: 0x0F08
Default value: type determination	Set range: 0 to 65535	Units: %.		Control mode. P S T

PnF09☆	Motor rated current (peak)		●	Communication address: 0x0F09
Default value: type determination	Set range: 0.0 to 6553.5	Unit: A		Control mode. P S T

PnF0A☆	Maximum instantaneous motor current (peak).		●	Communication address: 0x0F0A
Default value: type determination	Set range: 0.0 to 6553.5	Unit: A		Control mode. P S T

PnF0B☆	Counter-electromotive force (rms)		●	Communication address: 0x0F0B
Default value: type determination	Set range: 0.0 to 6553.5	Unit: mV /rpm		Control mode. P S T

PnF0C☆	Motor rotor inertia	●	Communication

			address: 0x0F0C
Default value: type determination	Set range: 0 to 65535	Unit: 10^{-6}kgm ^{2}	Control mode. P S T

PF0D☆	Motor stator resistance (line resistance R)	●	Communication address: 0x0F0D
Default value: type determination	Set range: 0.000 to 65.535	Unit: Ω	Control mode. P S T

PF0E☆	Motor inductance (wire inductance)	●	Communication address: 0x0F0E
Default value: type determination	Set range: 0.00 to 655.35	Unit: mH	Control mode. P S T

PnF0F☆	Motor overload detection base current	●	Communication address: 0x0F0F
Default value: type determination	Set range: 0 to 65535	Units: %.	Control mode. P S T

PnF10☆	Intermediate current for motor overload detection	●	Communication address: 0x0F10
Default value: type determination	Set range: 0 to 65535	Units: %.	Control mode. P S T

PnF11☆	Duration of intermediate current for motor overload detection	●	Communication address: 0x0F11

Default value: type determination	Set range: 0 to 65535	Unit: 10S	Control mode. P S T

PnF12☆	Motor overload detection Maximum current	●	Communication address: 0x0F12
Default value: type determination	Set range: 0 to 65535	Units: %.	Control mode. P S T

PnF13☆	Motor overload detection Maximum current duration	●	Communication address: 0x0F13
Default value: type determination	Set range: 0 to 65535	Unit: S	Control mode. P S T

PnF15☆	Rotary motor types & encoder manufacturers	●	Communication address: 0x0F15
Default value: 0000	Set range: 0x0000 to 0xFFFF	Unit: N/A	Control mode. P S T

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

X:

Encoder manufacturers	
0	No distinction between manufacturers
1	NK
2	DMC
3	RY

Y:

Rotary motor types	
0	Surface Mounted (SPM)
1	Inline (IPM)

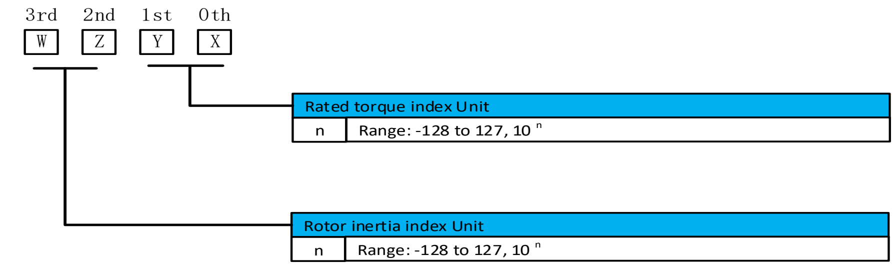
Z: Reserved parameters (do not use)

W: Reserved parameters (do not use)

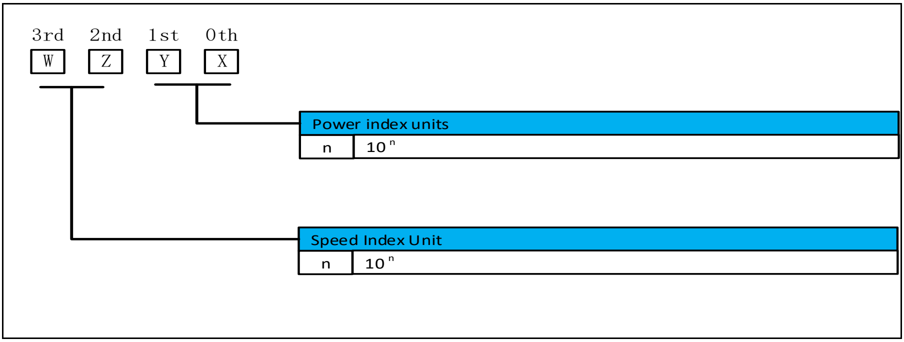
PF16☆	Convex pole motor inductance Lq	●	Communication address: 0x0F16
Default value: type determination	Set range: 0.00 to 655.35	Unit: mH	Control mode. P S T

PF17☆	Convex pole motor inductance Ld	●	Communication address: 0x0F17
Default value: type determination	Set range: 0.00 to 655.35	Unit: mH	Control mode. P S T

PnF18☆	Rotor inertia index Unit|Torque rating index Unit	●	Communication address: 0x0F18
Default value: type determination	Set range: 0x0000 to 0xFFFF	Unit: N/A	Control mode. P S T



PnF19☆	Speed index Unit|Power index Unit	●	Communication address: 0x0F19
Default value: type determination	Set range: 0x0000 to 0xFFFF	Unit: N/A	Control mode. P S T



PnF1B☆	Motor pole starting position value	●	Communication address: 0x0F1B
Default value: type determination	Set range: 360 to 360	Unit: degrees	Control mode. P S T

PnF1E☆	Associated flag bit (FLAG)	●	Communication address: 0x0110
Default value: type determination	Set range: 0x0000 to 0xFFFF	Unit: N/A	Control mode. P S T

3rd 2nd 1st 0th

W Z Y X

X → Flag bit switch 1

0th place	Reserved
Bit1	Reserved
Bit2	Speed feedback second filter on ((0: off; 1: on)
Bit3	Reserved

Y → Flag bit switch 2

Bit 4	Reserved
Bit 5	Reserved
Bit 6	Reserved
Bit 7	Reserved

Z → Reserved (please do not change)

W → Reserved (please do not change)

Chapter 10 Troubleshooting

10.1 Pre-operation fault and warning handling

10.1.1 Unable to enable

cannot be enabled via external input terminal X1 and the panel keeps displaying the following "nrd" status:.

Figure 10.1 Panel status display ("ndy" status)

In fact, after enabling via external input terminal X1, the panel should show the following "On" status:.

Fig. 10.2 Panel status display ("On" status)

The steps to check are as follows

1) No display of panel status (panel digital tube does not light up)

Faulty control power supply. Measure the ac voltage between l1 and l2 to see if it meets the appropriate specification.

2) Mains voltage failure

For single phase 220VServo measures the AC voltage between L1 and L2, the mains DC bus voltage amplitude (voltage between P ⊕/ -) is greater than the undervoltage point 170V (default) and is stable for 250ms time, then the bus voltage is established and the mains circuit power is ready and the corresponding flag bit is displayed (bright), as shown in Figure 10-3.

Figure 10.3 Main circuit ready flag bit

In the case of an invalid main circuit ready flag bit (flag bit is in the "not lit" state), the main circuit voltage needs to be monitored accordingly via the Un140.

AC220V : The normal monitoring value for the Un140 is 310V;.

When the actual monitoring of the Un140 value deviates significantly from the normal value mentioned above, it is necessary to measure and compare the P ⊕/- interval voltage and to investigate problems with the wiring, the grid power supply, etc.

(3) Ready state

In the case of normal status of the above two states, while is free of faults and warnings, the Servo Ready flag bit is shown in Figure 10.4 below. In case of faults or warnings in the panel, refer to "10.2 Handling faults and warnings during operation" for the relevant processing.

Figure 10.4 Servo ready flag bit

4) Servo enable

Check whether the Pn6 group function code parameters is set up Servo enable signal (input terminal X function 1: S-ON). If it is set up, check that the corresponding terminal logic is valid; if it is not, set up and make the terminal logic valid. If the Servo enable signal has been set up and the corresponding terminal logic is valid, but the panel still displays "OFF", check that this X terminal is wired correctly, refer to "Chapter 3 Wiring and Installation".

10.1.2 Operating exceptions in position mode

After troubleshooting the above 10.1.1 Unable to enable problem, the Servo panel displays "On" when the following phenomenon appears for the corresponding problem.

Table 10-1 Fault phenomenon and analysis when servo display "on" 1

Failure phenomena	Reasons	Confirmation method
Servo motor axis in free running condition	Motor power cable not connected	◆ Check that the motor side and side power cables U, V and W are well connected.

The upper unit sends a position command and the Servo motor does not rotate.	The pulse command counter (Un006) is 0.	◆ Check if the control mode is position control mode (Pn000.X=0). ◆ The pulse port is incorrectly wired. Determine the power connection according to the interface requirements when Pn200.XSet up is 0 or 1. Whether the road meets the relevant specifications. ◆ Wrong type of pulse Check that the external pulse type set by Pn201 is related to the upper unit Whether the position commands sent are consistent. ◆ No position command entered Check if the pulse command disable function is used. Use an oscilloscope to see if there is a pulse input (high or low pulse) to the pulse interface.
Upper unit sends position command, Servo motor reverses	The pulse command counter (Un006) counts the opposite of actual.	◆ Check the command logic of the external pulse Pn202ParametersSet up with the actual Whether the input pulses correspond, if they do not, adjust the logic direction corresponding to Pn202.
Normal operation	Positioning does not turn, producing non-conforming position deviations.	◆ Confirmation of the upper unit position command sending counter, Servo bit Set the command counter, the motor feedback pulse counter and the mechanical stop position. See "Steps for checking the cause of faults in mis-positioning during normal operation".

Checking method for the cause of failure of inaccurate positioning during normal operation

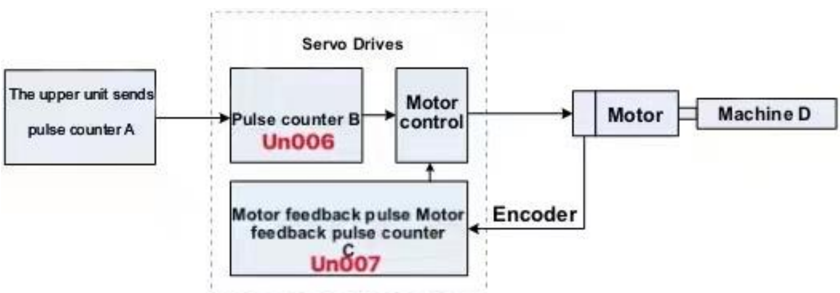


Fig. 10.5 Block diagram of the position control principle

The main causes of misalignment are.

(1) The number of pulses A sent by the upper unit is not the same as 's pulse counter B (Un006), caused by.

◆ Incorrect input position command count due to noise in the wiring of the upper unit command output device (PLC, motion controller, etc.) and Servo . The following checks can be carried out to deal with this:

A、 Check that the pulse input terminals are twisted shielded.

B、 Check if it is the open collector input method in the low speed pulse input, if so change to differential input.

C、 Check if it is a low speed pulse input, if so, turn on the pulse command hardware filter (Pn200.Y).

D、 Depending on the maximum pulse frequency, the appropriate software filter time for the pulse command is selected (Pn200.Y).

E、 Be sure to wire the pulse input terminals separately from l1c, l2c, l1, l2 and l3.

◆ The pulse command filtering time (Pn004.Z) on the servo r side is not set correctly, resulting in a loss of the normal pulse signal or abnormalities. If so, select the appropriate pulse command software filter time based on the maximum pulse frequency.

◆ Ifduring normal operation of the motor, the signal output to the from the upper computer command output device (PLC, motion controller, etc.) is interrupted, check whether there is an open pulse command forbidden to receive or a pulse deviation clear signal on the side.

◆ Whether the motor encounters a forward/reverse overtravel limit switch during operation.

(2) 's pulse counter B (Un006) and motor feedback pulse counter C (Un007) are not the same, caused by

◆ If the motor is equipped with an incremental Coder, it is possible that the motor Coder is affected by noise and the Coder feedback signal counts incorrectly.

◆ If the motor is equipped with an incremental Code device, the pulse reception count may be abnormal due to poor wiring contact caused by the cable not being tightened at both ends.

◆ Check whether a fault or failure of the enable signal has occurred during operation, resulting in the command not being fully executed.

If, despite checking that the signal counts in (1) and (2) above are normal, there is still an inaccurate positioning, then.

◆ Check that there is no relative slippage in the connection between the motor and the load, and if there is, deal with it accordingly.

If, despite checking all of the above, there is still misalignment, then.

◆ Check that the electronic gear ratio setting in is reasonable and correct.

If, despite checking all of the above, there is still misalignment, then.

◆ Machining tolerances exist for mechanical loads, try using a fully closed loop.

10.1.3 Operating exceptions in speed mode

After troubleshooting the above 10.1.1 Unable to enable problem, the Servo panel displays "On" when the following phenomenon appears for the corresponding problem.

Table 10-2 Fault phenomenon and analysis when servo display "on" 2

Failure phenomena	Reasons	Confirmation method
Servo motor axis in free running condition	Motor power cable not connected	◆ Check that the motor side and side power cables U, V and W are well connected.
Servo motor does not rotate or rotates incorrectly when speed command is entered	Speed command is 0	◆ Wrong control mode selection. Check if the control mode is speed mode (Pn000.X=1) ◆ Wrong speed command source selection. Check that the Pn300 is set correctly. ◆ No speed command entered or speed command abnormal 1. Select internal digital timing (Pn300 = 0), check Pn304 setting Is the placement correct? 2、Optional internal digital mixer (Pn300=4), check Pn300 ~ Is the Pn303S setting reasonable, in addition, the X input terminal SPD- needs to be checked. A. Is the SPD-B signal normal?
Input speed command, Servo motor rotation	Speed command is negative	◆ Select internal digital timing (Pn300 = 0), check Pn304 Set whether it is less than 0. ◆ Select the internal digital mixing feed (Pn300=4) and check Whether the setting of Pn300 to Pn303S is less than 0. ◆ Check that the X input terminal SPD-D direction signal is normal.

10.1.4 Abnormal operation in torque mode

After troubleshooting the above 10.1.1 Unable to enable problem, the Servo panel displays "On" when the following phenomenon appears for the corresponding problem.

Table 10-3 Fault phenomenon and analysis when servo display "on" 3

Failure phenomena	Reasons	Confirmation method
Servo motor axis	Motor power	◆ Check that the motor side and side power cables U, V and W are well connected.

in free running condition	cable not connected	
Input torque command, servo motor does not rotate	Torque command is 0	Wrong control mode selection. Check if the control mode is torque mode (Pn000.X=2) ◆ The torque command source is incorrectly selected. Check that the Pn400 is set correctly. ◆ Torque command not entered 1. Select the internal digital timing (Pn400.X = 0) and check that Pn410 is set correctly. 2. Select the internal digital mix to give (Pn400.Y=3), check whether the settings of Pn410 to Pn413 are reasonable, in addition, you need to check whether the X input terminals Tor-A and Tor-B signals are normal.
	Speed limit is 0	◆ Speed limit in torque mode is 0 1. Select the internal digital timing (Pn400.Y=2) and check that Pn415 is set correctly.
Input torque command, servo motor reverses	Torque command is negative	◆ Select the internal digital timing (Pn400.X=0) and check that the Pn410 setting is less than 0. ◆ Select the internal digital mixing feed (Pn400.Y=3), check whether Pn410 to Pn413 are set Less than 0. ◆ Check that the X input terminal direction signal is normal.

10.2 Fault and warning handling during operation

10.2.1 Classification of faults and warnings

Servo faults and warnings are divided into two categories: Category 1 (simply called Gr.1) and Category 2 (simply called Gr.2)

Stopping method in case of failure.

Gr.1: The stopping method in the event of a fault depends on Pn004. the factory setting is free stop.

Gr.2: The method of stopping in the event of a fault depends on Pn005. the factory setting is zero speed stop with zero speed command.

Is the fault resettable?

Yes: can be de-activated by a fault reset.

No: the fault cannot be lifted by a fault reset.

"Can be lifted by fault reset" means that the user can stop the panel fault display by "resetting the signal". Specific operation method:

Method 1: Press the "Up" + "Down" keys on the keyboard panel at the same time.

Method 2: Fault reset release via auxiliary function Fn303

Method 3: Use the di input terminal x to clear.

Associated fault clearing terminal function no.

Set value: 0x04			
Symbols	Fault reset	Trigger	Control

		method	mode
ALM-RST	This signal is used to clear a fault alarm that has occurred in . Valid: alarm cleared. Invalid: Alarm clearing is prohibited.	High and low levels	P S T

Cautions	
	For some of the troubles that can be removed, the relevant settings must be changed to remove the cause of the fault. Only then can it be reset. ● For some non-removable faults, it is necessary to reproduce the upper control power (l1c, l2c) in order to clear it, at the upper power. Before you can do this, or before you can enable it, you need to investigate the cause of the relevant fault.

10.2.2 Fault and warning logs

The servo is equipped with a fault and warning logging function that allows the logging of the last ten fault and warning names, the time when the fault and warning occurred, as well as the current fault and warning names, the current warning and the status information when the warning occurred (time stamp, actual motor speed, speed command, internal torque command, input command pulse speed, position deviation, main circuit bus voltage, current feedback RMS, cumulative load factor, regenerative load factor, DB resistor power consumption, maximum cumulative load factor, rotational inertia ratio, number of serial Coder communication exceptions, internal signal monitoring, input signal X monitoring and output signal Y monitoring).

Fault and warning logs are viewed by

Method 1: View via the auxiliary function Fn000.

Method 2: By monitoring function codes Un800 to Un842

10.2.3 Fault and warning outputs

The Servo can output the current fault or warning signal flag.

Relevant output signals.

Set value: 0x08			
Symbols	Warning Signals	Trigger method	Control mode
Warning	When this signal is on, a warning signal is output.	High and low levels	P S T

Set value: 0x0B			
Symbols	Fault signals	Trigger method	Control mode
Alerts	When this signal is on, a fault signal is output	High and low levels	P S T

10.2.4 Historical fault queries

Historical fault information can be queried by the user via the auxiliary function Fn000 or obtained by monitoring the parameters, where the smaller the value of the record number, the more recent the alarm has occurred.

Table 10-4 Function codes for historical fault information queries

Login	Show Explanation	Unit	Data type	Communication address
Un820	Alarm log 0	-	uint16	0xE820
Un821	Alarm log 1	-	uint16	0xE821
Un822	Alarm log 2	-	uint16	0xE822
Un823	Alarm log 3	-	uint16	0xE823
Un824	Alarm log 4	-	uint16	0xE824
Un825	Alarm log 5	-	uint16	0xE825
Un826	Alarm log 6	-	uint16	0xE826
Un827	Alarm log 7	-	uint16	0xE827
Un828	Alarm log 8	-	uint16	0xE828
Un829	Alarm log 9	-	uint16	0xE829
Un830	Alarm log 0 time of occurrence	0.1s	uint32	0xE830
Un832	Alarm log 1 time of occurrence	0.1s	uint32	0xE832
Un834	Alarm log 2 time of occurrence	0.1s	uint32	0xE834
Un836	Alarm log 3 time of occurrence	0.1s	uint32	0xE836
Un838	Alarm log 4 time of occurrence	0.1s	uint32	0xE838
Un83A	Alarm log 5 time of occurrence	0.1s	uint32	0xE83A
Un83C	Alarm log 6 time of occurrence	0.1s	uint32	0xE83C
Un83E	Alarm log 7 time of occurrence	0.1s	uint32	0xE83E

ÄÄÄÄÄ	Alarm log8 time of occurrence	0.1s	uint32	0xE840
Un842	Alarm log 9 time of occurrence	0.1s	uint32	0xE842

Cautions	
	● For recurring fault messages, when the current fault is the same as the previous fault message and in the 30s If it occurs within the time, the current fault information is not recorded.

10.2.5 Current fault information search

The user can monitor the parameters or the upper computer for information relating to the occurrence of faults, such as speed, voltage and current, to facilitate practical troubleshooting.

Table 10-5 Current fault information query monitoring function codes

Login	Show Explanation	Unit	Data type	Communication address
Uniform 800	Current fault or warning codes	-	uint16	0xE800
Un801	Code when the alarm occurs	-	uint16	0xE801
Un802	Timestamp of when the alarm occurred	100ms	uint32	0xE802
Un803	Actual motor speed at the time of the alarm	Rpm	int16	0xE803
Un804	Speed command when an alarm occurs	Rpm	int16	0xE804
Un805	Internal torque command when an alarm occurs	%	int16	0xE805
Un806	Input command pulse speed at the time of the alarm	Rpm	int16	0xE806
Un807	Deviation counter (amount of position deviation) at the time of the alarm	Pulses	int32	0xE807
Un808	Main circuit bus voltage at the time of the alarm	V	uint16	0xE808
Un809	RMS value of the current feedback at the time of the alarm	%	int16	0xE809

Un80A	Cumulative load factor at the time of the alarm [2ms].	%	uint16	0xE80A
ÄÄÄÄÄ	Regenerative load factor when an alarm occurs [2ms].	%	uint16	0xE80B
Un80C	DB resistor consumes power when an alarm occurs [2ms].	%	uint16	0xE80C
Spacecraft (Un80D)	Maximum cumulative load factor at the time of the alarm	%	uint16	0xE80D
Un80E	Rotational inertia ratio at the time of the alarm	%	uint16	0xE80E
Un80F	Number of serial Code device communication exceptions at the time of the alarm	-	uint16	0xE80F
Un810	Internal signal monitoring in the event of an alarm	-	uint32	0xE810
Un814	Internal input signal monitoring in the event of an alarm	-	uint32	0xE814
Un818	Internal output signal monitoring in the event of an alarm	-	uint32	0xE818

10.2.6 List of faults

Table 10-6 List of fault messages

Fault Code	Fault name	Fault Classification	Can a fault reset
ER.020	User function code Parameters and checksum exception	Gr.1	No
ER.021	Function code parameters formatting exception	Gr.1	No
ER.022	Factory function code parameters formatting exception	Gr.1	No
ER.023	MCU and FPGA communication exception	Gr.1	No
ER.030	FPGA backup program running	Gr.1	No
ER.040	Function code parameters setting exception	Gr.1	No
ER.042	Address combination exception	Gr.1	No

ER.050	and motor voltage do not match or differ in power by a factor of 4 or more	Gr.1	Yes
ER. 051	Power level setting Exception	Gr.1	No
ER.0b0	ServoON command invalid	Gr.2	Yes
ER.100	Overcurrent (software)	Gr.1	No
ER.102	Single tube fail-safe	Gr.1	No
ER.320	Regenerative overload	Gr.1	Yes
ER.400	Overvoltage	Gr.1	Yes
ER.410	Undervoltage	Gr.2	Yes
ER.42A	KTY type temperature sensor overtemperature	Gr.1	Yes
ER.450	Digital input terminal X function assignment repeat	Gr.2	Yes
ER.451	Digital output terminal Y function assignment repeat	Gr.2	Yes
ER.452	Abnormal distribution of analogue signal ai in torque mode	Gr.2	Yes
ER.520	Vibration faults	Gr.2	Yes
ER.521	Vibration during free adjustment	Gr.2	Yes
ER.710	instant overload	Gr.2	Yes
ER.711	Instantaneous motor overload	Gr.2	Yes
ER.720	continuous overload	Gr.2	Yes
ER.721	Continuous motor overload	Gr.2	Yes
ER.730	DB Overload	Gr.2	Yes
ER.7A0	overtemperature	Gr.2	Yes
ER.810	Multi-turn data exceptions in absolute encoders	Gr.1	Yes
ER.820	Data verification exceptions in absolute encoders	Gr.1	No
ER.830	Battery undervoltage for absolute Encoder	Gr.1	Yes
ER.840	Multi-turn upper limit restriction direction anomaly	Gr.1	No
ER.860	Excessive temperature in absolute encoders	Gr.1	No
ER.890	Motor Code does not exist	Gr.1	No
ER.8A1	Home return timeout	Gr.2	No
ER. B31	Abnormal U-phase detection circuit	Gr.1	No
ER. B32	Abnormal V-phase detection circuit	Gr.1	No
ER. B33	STO input protection	Gr.2	Yes
ER. bf0	System operation exception 1	Gr.1	No

ER. bf1	System operation exception 2	Gr.1	No
ER. bf2	MCU data write exception to FPGA	Gr.1	No
ER. bf3	Abnormal pulse command source selection	Gr.1	No
ER. BF4	overcurrent (hardware)	Gr.1	No
ER. C10	stall detection	Gr.1	No
ER. C21	Absolute Coder multi-turn count overflow	Gr.1	No
ER. C80	Incremental encoder frequency division setting abnormal	Gr.1	No
ER. C90	Serial encoder disconnection	Gr.1	No
ER. C91	Abnormal encoder acceleration	Gr.1	No
ER. C92	Incremental encoder Z signal loss	Gr.1	No
ER. C95	Incremental encoder Hall signal anomaly	Gr.1	No
ER. d00	Excessive position deviation	Gr.1	Yes
ER.d01	Excessive position deviation at ServoON	Gr.1	Yes
ER. D02	Excessive position deviation due to speed limitation during ServoON	Gr.1	Yes
ER.d03	Excessive mixing deviation (excessive deviation between motor feedback position and optical scale)	Gr.2	Yes
ER. d04	Electronic gear ratio setting Overrun	Gr.1	Yes
ER.E03	Zero return setting Exception (CanOpen & EtherCAT mode)	Gr1	No
ER.E05	Operating modes not supported by	Gr1	No
ER.E20	Can master station dropout (lifetime factor)	Gr1	Yes
ER.E21	Can master station drop out (consumer time)	Gr1	Yes
ER. F10	External input power failure	Gr2	Yes
Up...	ARM chip enters program upgrade	×	No
Error	ARM chip anomalies	×	No

10.2.7 List of warnings

Table 10-7 List of warning messages

Warning Code	Warning Name	Warning
ER.900	Excessive position deviation	The accumulated position deviation exceeds the $\left(\frac{Pn264 \times Pn266}{100}\right)$ the set value.
ER.901	Excessive position	The accumulated position deviation at ServoON

	deviation at ServoON	exceeds the $\left(\frac{Pn269 \times Pn270}{100}\right)$ The set value.
ER. 910	Motor or overload	Display before the Servomotor or Servo is about to reach an overload (ER. 710 or ER. 720) fault. If operation continues, an ER. 710 or ER. 720 fault alarm may occur.
ER. 911	Motor vibration warning	Servo detects abnormal vibrations in the motor during operation. The threshold value for detecting abnormal vibrations is the same as the ER. 520 fault detection value. It can be switched off or on by means of function code Pn185.
ER. 920	Regeneration overload warning	Display before the Servo is about to reach a regenerative overload (ER. 320) fault. If operation continues, an ER. 320 fault may occur.
ER. 921	Dynamic Brake (DB) overload warning	Display before the Servo is about to reach a dynamic brake overload (ER. 730) fault. If operation continues, an ER. 730 fault may occur.
ER. 930	Battery undervoltage for absolute Encoder	The servo detects a warning indication of low battery voltage in the absolute encoder
ER. 931	Abnormal external terminal jog signal	For external terminal jog (Jogp/Jogn), both positive and negative jog signals are given. For normal use, the positive or negative jog signal is given separately.
ER. 940	ServoON signal anomaly (Enabled when bus voltage is not established).	When the DC bus voltage has not yet been established, the enable signal (SON) is given via the input terminals or the internal register. For normal use, wait until the bus voltage has been established before assigning the corresponding enable signal.
ER. 941	Function code re-powered to take effect	The function code needs to be re-powered to take effect.
ER. 950	Single tube self-lifting anomaly	When enabled, the motor speed is greater than the Rated speed.
ER. 955	External power failure	External power failure
ER. 971	Undervoltage warning	Warning indication that the Servo 's current main circuit bus voltage is below the Pn786 setting and that an undervoltage (ER. 410) fault may occur if operation continues.
ER. 9A0	Positive overtravel warning	The servo detects an overtravel signal (P-OT) during operation.
ER. 9A1	Negative overtravel warning	The servo detects an overtravel signal (N-OT) during operation.

ER. 9A2	ServoON speed limit in progress	The servo is speed limited when the speed exceeds the function code Pn270 setting at the moment of ON or at the moment of limit withdrawal, so please set this value appropriately for safety in practice.

10.2.8 Causes of unusual alarms and how to deal with them

Error code	ER. 020	User function code Parameters and checksum exception
Reason	The unit internally checks the function code (user Parameters group) and the function code Parameters and checksum failure occurs when the checksum fails.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Instantaneous dips in control supply voltage.	◆ Measure the supply voltage.	Set the power supply voltage within the specified range and carry out the initialization of the parameters setting value (Fn005).
2. Instant power off during parameter writing	◆ Verify that the parameters is in the stored procedure A momentary power failure occurred in the	After initialising the parameters setting value (Fn005), reset the function code parameters.
3. Parameterss are written frequently.	◆ Check if the upper unit is frequent Perform a parameters change operation.	It is possible that the Servo is faulty. Replace the Servo and change the Parameters writing method.
4. ac power, grounding and static noise that can cause data storage malfunctions.	◆ After initializing the parameters setting value After resetting the function code parameters, it remains. Frequent.	Take measures to prevent noise disturbance.
5. Servo unit failure	◆ Reset function after multiple initialisation The energy code parameters is followed by a corresponding fault.	It is possible that the Servo is faulty. Replace the Servo .

Error code	ER. 021	Function code parameters formatting exception
Reason	The total number of function codes has changed and usually appears after updating the software. Software version number update. ’s Power level code is not set.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Updated software.	◆ Check if the software is updated	Reset the model (PnE00).
2. Power level code is not set.	◆ Check if the function code PnE00 is 0	Reset the model (PnE00).
3. Servo unit failure.	◆ After resetting the function code parameters after multiple initializations and the corresponding fault.	Possible Servo failure. Replace Servo

Error code	ER. 022	Factory function code parameters and checksum exception
Reason	The unit internally checks the function code (manufacturer's parameters group) and a function code parameters and checksum failure will occur if the checksum fails.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Instantaneous dips in control supply voltage.	◆ Measure the supply voltage.	Set the supply voltage within the specified range and reset the manufacturer's parameters.
2. Instant power off during parameter writing.	◆ Verify that the parameters has not been momentarily powered down during storage.	Reset the default set.
3. Parameterses are written frequently.	◆ Check if the parameters change operation is frequently performed by the upper unit.	It is possible that the Servo is faulty. Replace the Servo and change the Parameters writing method.
4. ac power, grounding and static noise that can cause data storage malfunctions.	◆ After initializing the parameters setting value and resetting the function code parameters, it remains the parameters. Frequent.	Take measures to prevent noise disturbance.
5. Servo unit failure	◆ After resetting the function code	It is possible that the Servo is faulty.

	parameters after multiple initializations and the corresponding fault.	Replace the Servo .

Error code	ER. 023	MCU and FPGA communication exception
Reason	During the initialization process, the MCBU writes relevant data to a specific address of the FPGA and then reads the relevant data from the specific address to verify the normal status of the address bus, data bus and relevant signals between the MCBU and the FPGA.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Servo unit failure.	◆ The Servo has failed when the power is turned on several times and the fault is still reported.	Replace

Error code	ER. 030	FPGA using backup code
Reason	The FPGA uses a backup code.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Was there a firmware update to the FPGA before this alarm was generated?	Check if the fpga firmware has been upgradedoperation.	If you have, re-update the relevant firmware.
2. This alarm is generated at power up	◆ Possible external interference at start-up Causes program loading exceptions	Re-power.

Error code	ER. 040	Parameters setting exception
Reason	The function code ParametersSet value exceeds its specified range.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Outside the Set range of parameterses.	◆ Confirm the setting of the changed parameter Scope.	The abnormal function code address is determined by monitoring the function code Un203 so that the changed parameters is a value within a Set range.

Error code	ER. 042	Address combination exception
Reason	Communication address combination exception.	

Treatment.

Reasons	Confirmation method	Handling measures
1. The speed at which the program JOG runs is not within the specified range due to a change in the electronic gear ratio or the servo motor encoder resolution.	◆ Check if the detection condition formula is valid. $Pn508 \times \frac{\text{Encoder resolution}}{\text{[illegible]}} \geq \frac{Pn204}{\text{[illegible]}}$	Decrease the value of the electronic gear ratio.
2. The speed at which the program JOG is running is not within the specified range due to a change in the program JOG movement speed (Pn508).		Increase the value of the program JOG movement speed (Pn508).
3. Due to changes in the electronic gear ratio or the servo motor encoder resolution, the advanced adjustment does not move at the required speed range.		Decrease the value of the electronic gear ratio.

Error code	ER. 050	Wrong combination of motor capacities
Reason	The capacity of the motor and do not match.	

Treatment.

Reasons	Confirmation method	Handling measures
1. The capacity of the servo unit does not match the capacity of the servo motor.	◆ Confirmed as $\frac{1}{4} \leq \frac{\text{Motor capacity}}{\text{[illegible]}} \leq 4$	Matching the Servo to the capacity of the Servo motor.
2. Abnormal servo motor parameters.	◆ Check whether the parameters of the motor corresponds to the actual one	Set the motor parameters correctly.
3. Servo Parameters exception.	◆ Check that Servo 's parameter is Does it correspond to the actual specification parameter.	Sets the servo specification parameters.

Error code	ER. 050	Power level setting Exception
Reason	Set up's power level does not match the actual hardware	

Treatment.

Reasons	Confirmation method	Handling measures
1. Check that the setting value of PnE00 corresponds to the model	◆ Check the setting of PnE00	Correctly set the program specification parameters

Error code	ER. 0b0	ServoON command invalid
Reason	When using certain auxiliary functions, Servo is also enabled by means of them.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Internal enable (Pn001.X = 1).	◆ Check if the auxiliary function is used, while internally enabling	Invalidate the internal enable setting.
2. External enable signal (s-on) is active.	◆ Check if the auxiliary function is used while the external terminal is enabled	Set the external X terminal S-ON signal to inactive.

Error code	ER. 100	Servo overcurrent (software)
Error code	ER. bf4	Servo overcurrent (hardware)
Reason	The output current of the exceeds the set threshold.	

Treatment.

Reasons	Confirmation method	Handling measures
1. Short circuit in motor cable U, V, W.	◆ Check whether the motor power cable U, V, W is short-circuited, and whether the connector wire has burrs	Connect the motor cables correctly.
2. Grounding of motor cables U, V and W.	◆ Check the insulation resistance between the motor power cable U, V, W and the motor wire. Measure the insulation resistance between the U, V and W ends of the and the ground wire (PE) for megohm (MΩ) level values	Replace the motor with a new one if the insulation is poor.
3. Motor burnout.	◆ Check that the resistance between the wires of the motor is balanced.	If it is not balanced, the motor needs to be replaced.
4. Poor contact with the motor power cable.	◆ Check whether the connector terminals of U, V and W of the motor connection are off	If loose and dislodged, tighten.
5、The gain setting is not reasonable and vibration occurs during motor operation.	◆ Check the motor in the starting and running of process, whether the motor has vibration or strange noise..	Make gain adjustments.
6. The braking resistor is too small or short-circuited.	◆ If using built-in braking resistor, confirm that the measurement is reliably connected between B2/B3 with wires, and if so, measure the resistance value between P/B3. ◆ If external braking resistor is used, make sure the resistance value of external braking resistor between P /B2 is measured.	If the resistance value is infinity "∞", the brake resistor is internally disconnected:. If using an internal braking resistor, adjust to use an external braking resistor and remove the wire between B2/B3, the resistor resistance and power supply can be selected to match the internal braking resistor. If an external braking resistor is used, replace it with a new one and reconnect it between P ⊕/B2.
7. Wrong encoder wiring, loose plug.	◆ Check if you use our standard Encoder cable, with or without loose connectors.	Resolder, plug in, or replace the encoder cable.

	◆ 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.	
8. Servo failure.	◆ The main circuit power was reconnected several times, but the fault was still reported.	Replace .

Error code	ER. 102	Single tube fail-safe
Reason	single tube voltage anomaly	

Treatment.

Reasons	Confirmation method	Handling measures
1. Output out of phase, blocked rotation	◆ Check if has output out of phase. ◆ Check that the motor is not blocked.	Check that the load does not exceed the actual permissible load range of the motor.

Error code	ER. 320	Regenerative overload
Reason	The heat accumulation of the regenerative braking resistor exceeds the fault threshold.	

Treatment.

Reasons	Confirmation method	Handling measures
1. The supply voltage is outside the specification range.	◆ Measure the supply voltage.	Set the supply voltage within the specification range.
2. External regeneration resistor value or Insufficient capacity of the regenerative resistor, or In a state of continuous regeneration.	◆ Confirm operating conditions or capacity.	Change of regeneration resistance value, regeneration resistance capacity.
3. The set capacity is less than the capacity of the actual external regeneration resistor.	◆ Confirm the connection and capacity value of regeneration resistor	Calibration of the capacity value of the regeneration resistor.
4. The external regeneration resistor has too large a resistance.	◆ Check that the regeneration resistance value is correct.	Correctly set the resistance and capacity of the regenerative resistor.
5. Subject to external drag regeneration state.	◆ Verify that the operation is not affected by external dragging influence	Correctly set up the system including servo and mechanical operating conditions, using a common DC busbar.
6. The large load inertia causes regenerative energy in deceleration, resulting in higher DC bus voltage and insufficient energy absorption by the regenerative resistor.	◆ Check the deceleration time of the motor during the deceleration process. ◆ Check the regeneration resistor load factor. ◆ Check the regeneration warning display.	Increase motor and capacity and slow down the deceleration time. External regeneration resistor.
7. Motor rotation	◆ Check the deceleration time	Supplied with motor,

speed is too high to absorb regenerative energy within the specified deceleration time	of the motor during the deceleration process. ◆ Check the regeneration resistor load factor. ◆ Check the regeneration warning display.	capacity, slowing down deceleration time. External regeneration resistor.
8. Servo failure.	◆The main circuit power was reconnected several times, but the fault was still reported.	Replace .

Error code	ER. 400	Overvoltage
Reason	The dc bus voltage between p ⊕/- exceeds the fault value:. AC220V Drivers : normal value 310V, fault value 400V. AC380V Drivers: normal value 540V, fault value 800V.	

Treatment.

Reasons	Confirmation method	Handling measures
1. The main circuit input voltage is too high.	◆ Check the input power specifications. Measure the main circuit side (L1, L2, L3) input voltages for compliance with the following specifications. AC220V Drivers Valid values: 220V - 240V Allowable deviation: ±10% (196V-264V) AC380V Drivers	Refer to the specifications on the left and replace or adjust the input power supply.

	Valid values: 380V-440V Allowable deviation: ±10% (342V-484V)	
2. Power supply in unstable condition state, or were affected by lightning strikes.	◆ Monitor the input power for lightning strikes and measure if the input power is stable and meets the above specifications.	After connecting the surge suppressor, switch on the control power and mains power and replace the Servo if a fault still occurs.
3. Failure of the built-in braking resistor.	If the built-in brake resistor is used, confirm whether B2/B3 is connected reliably with wires, if so, measure the resistance value between P/B3	If the resistance value is infinity "∞", the brake resistor is internally disconnected:. If using an internal braking resistor, adjust to use an external braking resistor and remove the wire between B2/B3, the resistor resistance and power supply can be selected to match the internal braking resistor.
4. External braking resistor failure.	◆ If an external braking resistor is used, measure resistance value between P /B2.	If the resistance value is infinity "∞", the braking resistor is disconnected. If an external braking resistor is used, replace it with a new one and reconnect it between P ⊕/B2.
5. The resistance value of external braking resistor is too large, and the maximum energy cannot be completely absorbed.	◆ Measure the resistance value between P /B2 and compare it with the recommended value.	Replace the external braking resistor with an advance value and reconnect it between P ⊕/B2.
6. The maximum	◆Confirm the deceleration time	Ensure that the main

braking energy exceeds the absorbable value when the motor is running with a sharp deceleration condition.	in operation, measure the DC bus voltage between P/N, and confirm whether the voltage exceeds the fault value during the deceleration section	circuit input voltage is within ’s specification and increase the deceleration time where this is allowed.
7. The measured value of bus voltage has a large deviation.	◆Measure if the DC bus voltage value between P/N matches the value of Un140.	Ask our technical support.
8. In the above allowable inertia ratio state Run under.	◆ Verify that the rotational inertia ratio is operating within the allowable rotational inertia ratio.	Extend the deceleration time or reduce the load.
9. Servo failure.	◆ After reapplying power to the main circuit after several power failures, the fault is still reported.	Replace .

Reason	The dc bus voltage between p ⊕/- is below the fault value:. AC220V Drivers: normal value 310V, fault value 180V;. AC380V Drivers: normal value 540V, fault value 380V.

Treatment.

Reasons	Confirmation method	Handling measures
1. The main circuit power supply is unstable or a momentary power failure occurs.	◆ Check the input power specifications and measure the input voltage on the side of the main circuit (L1, L2, L3) for compliance with the following specifications. AC220V Valid values: 220V - 240V Allowable deviation: ±10% (196V-264V) AC380V Valid values: 380V-440V Allowable deviation: ±10% (342V-484V)	Refer to the specifications on the left and replace or adjust the input power supply.
2. The supply voltage drops during operation.	◆ Detect the power supply voltage on the input side of the and check whether the main circuit supply power is excessive, resulting in insufficient power supply capacity and voltage drop.	Replace or adjust the input power supply.
3. The power supply is out of phase and , which should be fed with three-phase power to run,	◆ Check that the main circuit wiring is correct and reliable.	Replace the cable and connect the main circuit power cable correctly to. Three phase: L1, L2,

is actually fed with single-phase power.		L3 Single phase: L1, L2
4. Large deviations in measured busbar voltage values.	◆ Measure that the DC bus voltage value between P /N⊕ corresponds to the value of Un140.	Ask our technical support.
5. Servo failure.	◆ The fault is still reported when the main circuit power is turned back on after repeated power down.	Replacement of SVO .

Error code	ER. 42A	KTY type temperature sensor overtemperature
Reason	The KTY type temperature sensor detects a temperature value greater than the set overtemperature threshold (Pn055).	

Treatment.

Reasons	Confirmation method	Handling measures
1. The overtemperature threshold is set too small.	◆ Check that the value set for function code Pn055 is not too small.	Reasonable setting of overtemperature thresholds.
2. Abnormal motor cooling fan.	◆ Check that the cooling fan of the motor is running properly. ◆ Check the motor cooling duct for obstruction.	(b) If the motor cooling fan is abnormal, exclude the corresponding abnormality. Clear the air duct obstruction.
3. Motor load working conditions exceed the selection.	◆ Check if the motor has been operating above the rated torque operating conditions for a long time.	Reasonable choice type.
4. Servo failure.	◆ The fault is still reported when the main circuit power is turned back on after repeated power down.	Replace .

Error code	ER. 450	Digital input terminal X function assignment repeat
Reason	The same function is assigned to different digital inputs x or the assigned function is abnormal	

Treatment.

Reasons	Confirmation method	Handling measures
1. The same function is assigned to different input terminals x.	◆ Check that function codes Pn601. YX – Pn609. YX are set to the same function number.	Readjust input terminal X, which has been assigned the same function number, to assign a different function number, then reset the fault to take effect.
2. The function number setting of input terminal X is abnormal.	◆ Check if the set function number exists.	Correct the non-existent function number that was set.

Error code	ER. 451	Digital output terminal Y function assignment repeat
Reason	The same function is assigned to a different digital output terminal Y or the assigned function number is abnormal	

Treatment.

Reasons	Confirmation method	Handling measures
1. The same function is assigned to different output terminals y.	◆ Check if the function code Pn611. YX – Pn614. YX is set to the same function number.	Readjust output terminal Y, which has been assigned the same function number, to assign a different function number, and then reset the fault to take effect.
2. Function number Set up exception for output terminal Y.	◆ Check if the set function number exists.	Correct the non-existent function number that was set.

Error code	ER. 452	Abnormal distribution of analogue signal ai in torque mode
Reason	In torque mode, the same analogue signal is assigned to both the torque command source and the speed limit command source in torque mode.	

Treatment.

Reasons	Confirmation method	Handling measures
The same analogue signal is assigned to both the torque command and the speed limit command in torque mode.	◆ Check that the analogue input signal 1 is used as a torque command and also as a source for speed limitation in torque mode. ◆ Check that the analogue input signal AI2 is used as a torque command and also as a source for speed limitation in torque mode.	Correct setting of the torque command source and the speed limit command source in torque mode. If the same analogue command is required as the source of the torque command and the source of the speed limit command in torque mode, the corresponding masking is carried out via Pn009.Y.

Chapter 11 Communication

11.1 485 communication

The servo drive's master computer communication uses a standard Modbus protocol based on the 485 interface.
Modbus is a serial, asynchronous communication protocol and a common language for its application to PLCs or other controllers. This protocol defines a message structure that a controller can recognize as being in use, regardless of the network over which they are transmitted. The Modbus protocol does not require a dedicated interface; the typical physical interface is RS485.

11.1.1 Modbus communication protocol

(1) Transmission mode

The transmission modes are divided into ASCII transmission mode and RTU mode.
This product supports RTU mode only. The characters sent in RTU mode are expressed as hexadecimal numbers. For example, if you send 30H, you can directly input 30H into the packet.

(2) Baud rate

Setting range: 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps.

(3) Data frame format

The data frame format for RTU mode is as follows.

Table 11-1 RTU Data Frame Format

Start bit position	address	command	data	CRC check	Stop bit
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 (Word), up to 16 words in a row.
For example, 2 words are read continuously from the start address E003H of servo drive with the station number 01H. The command message and response message are as follows.

Table 11-2 0x03 Command Format

Command message (master)		Response message (slave)	
Address	01H	Address	01H
Command	03H	Command	03H
Start data address	E0H (high byte)	Number of data (in byte)	04H
	03H (low byte)		

Number of date (in word)	00H	Start data address 0004H low 16 bits	3AH
	02H		9AH
CRC check (low)	03H	Start data address 0004H high 16 bits	00H
CRC check (high)	CBH		05H
–	–	CRC check (low)	16H
–	–	CRC check (high)	C7H

(5) 06H command code writes 1 word

Function: Write 1 word.

Example: Write 1000 (03E8H) to address 0A00H of servo drive with station number 01H.

Table 11-3 0x06 Command to Write a Word

Command message (master)		Response message (slave)	
Address	01H	Address	01H
Command	06H	Command	06H
Start data address	0AH	Start data address	0AH
	00H		00H
Data content	03H	Data content	03H
	E8H		E8H
CRC check code	8AH	CRC check code	8AH
	ACH		ACH

(6) 10H command code writes 2N words

Function: Write N words (Word), N ⩾ 2.

For example, write 100 to the address 0100H of servo drive with slave address 0100H and 400 to the address 0101H of servo drive with slave address 01H

Table 11-4 0x06 Command to write 2N words

Command message (master)		Response message (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 number	04H	CRC check code	40H
Data content 1st word high byte	00H		34H
Data content 1st word low byte	64H	–	–
Data content 2nd word high byte	01H	–	–
Data content 2nd word low byte	90H	–	–
CRC check code	BEH	–	–
	1CH		–

(7) RTU mode check code calculation

RTU mode uses CRC (Cyclical Redundancy Check) to detect error values.

The calculation of the CRC detection value is illustrated in the following steps.
Step 1: Preset a 16-bit register with the content of FFFFH, called 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 three until step three has been performed eight times before going to step five.
Step 5: Repeat steps 2 to 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.
Note: After calculating the CRC error value, the low bit of CRC must be filled at first in the command message, and then the high bit of CRC is filled.
For example, 2 words (word) are read from address 0004H of servo driver 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 11-5 CRC Check Code Calculation

Command Meaning	Command content
Address	01H
Command	03H
Start data address	00H (high byte)
	04H (low byte)
Number of data (in word)	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.

11.1.2 Communication-related settings

(1) Related function codes

Function code	Name	Setting range	Default
Pn080	Local communication address	1 to 255	1

Pn081.	RS485 communication baud rate	0: 4800bps 1: 9600bps 2: 19200bps 3: 38400bps 4: 57600bps 5: 115200bps	2
Pn081.Y	RS485 communication check method	0: no parity, 8 bits of data, 1 stop bit (N, 8, 1) 1: Even parity, 8 bits of data, 1 stop bit (E, 8, 1) 2: Odd parity, 8 bits of 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 (E, 8, 2) 5: Odd parity, 8-bit data, 2 stop bits (O, 8, 2)	0

(2) 485 bus structure

The Servo Drive uses RS485 for 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.

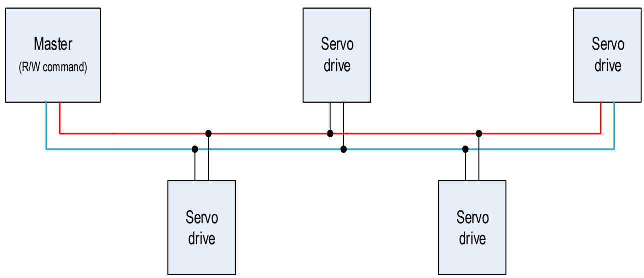


Figure 11.1 Connection of the 485 communication bus

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.

(3) Grounding and termination

Terminal resistors of 120Ω are to be used for the termination 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.

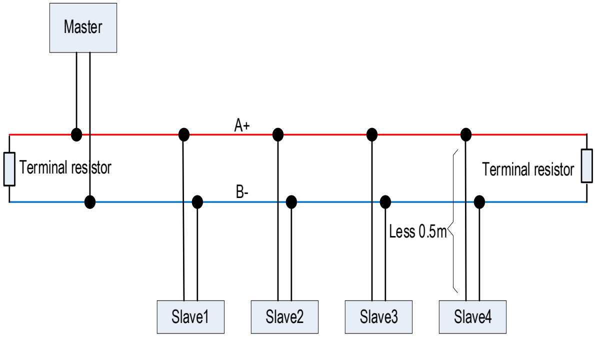


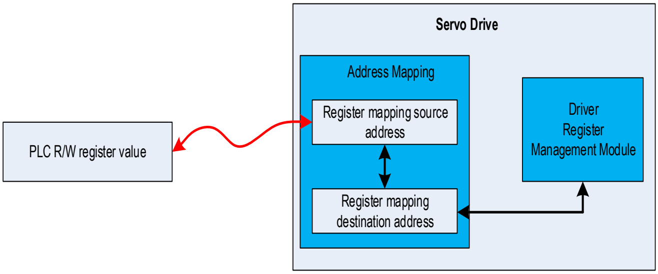
Figure 11.2 Connection diagram for the terminal resistor

Recommended: terminal resistor resistance of 120Ω.

Attention	
	● The user writes the function code parameters of the driver through the Modbus communication protocol. Due to the limitation of the erasable times of the data storage chip EEPROM, the user cannot write and store the parameters to EEPROM frequently, otherwise the maloperation of 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 it is expected that the data is only written to ram and not stored in EEPROM, the corresponding address is 0x1300.

11.1.3 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

Function code	Name	Setting range	Default
Pn087.X	485 communication register address mapping switch	0 to 1	0
Pn087.Y		0 to 1	0
Pn088	1# register mapping source address	0x000 to 0x1FFF	0x000
Pn089	1# register mapping destination address	0x000 to 0x1FFF	0x000
Pn08A	2# register mapping source address	0x000 to 0x1FFF	0x000
Pn08B	2# register mapping destination address	0x000 to 0x1FFF	0x000

For example, without changing the PLC program, by using the register address mapping function, an existing PLC program achieves mapping of this address to the address in this product by writing the speed command value to address 0x0A00.

Steps	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)

Attention	
	● The register address mapping function is valid only for 485 communication, and has no effect on USB communication.

11.2 Canopen communication

11.2.1 Canopen performance parameters

Table 11-6 Description of CAN Performance Parameters

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
Maximum number of stations	63
CAN frame length	0 to 8
Application layer CAN frame type	standard frame
Terminal resistor	120Ω
Supported sub-protocols	CiA-301: Canopen Application Layer and Communication Protocol
Supported Services	NMT: Network Management SDO: Service Data Object PDO: Process Data Object SYNC: Synchronization Generator
PDO Transmission Type	Time event trigger, synchronous trigger
PDO data supported	4 RPDO, 4 TPDO
SDO transmission method	Accelerated SDO transmission
Supported servo operation mode	Profile position mode Profile speed mode Profile Torque Mode Home position return mode Interpolation mode

The Canopen communication function of the Servo Drive supports the following different baud rates. The communication distance is dependent on the baud rate and the communication cable.

Table 11-7 Supported Baud Rate Descriptions

Data transmission rate	Bus cable length
1 Mbit/s	25
500kbit/s	100
250kbit/s	250
125kbit/s	500
50kbit/s	1000
25kbit/s	2500

Table 11-8 CAN communication transmission distance, rate, and node relationship

No.	Transmission distance	Speed	Node number	Wire diameter
①	25m	1Mbps	64	0.205mm ^{2}

②	95m	500Kbps	64	0.34mm ^{2}
③	560m	100Kbps	64	0.5 mm ^{2}
④	1100m	50Kbps	64	0.75mm ^{2}

11.2.2 Network parameter configuration

11.2.2.1 Communication object identifiers

The Communication Object Identifier (COB-ID) specifies the priority of the object during communication and the identification of the communication object. the COB-ID corresponds to the 11-bit frame ID in CAN. the 11-bit COB-ID consists of two parts, divided into the object function code and the 7-bit node address, as shown in Table 11-9.

Table 11-9 Description of COB-ID Composition

10	9	8	7	6	5	4	3	2	1	0
Function Code				Node ID						

Each of Canopen's communication objects has a default COB-ID that can be read and partially modified through SDO. The list of objects is shown in Table 11-10 below.

Table 11-10 Object COB-ID

communication object	Function Code	Node address	COB-ID	Corresponding object index
Network management	0000b	0	0h	-
Synchronized objects	0001b	0	80h	1005h, 1006h
Emergency message	0001b	0 to 127	80h+Node_ID	1014h
TPDO1	0011b	0 to 127	180h+Node_ID	1800h
RPDO1	0100b	0 to 127	200h+Node_ID	1400h
TPDO2	0101b	0 to 127	280h+Node_ID	1801h
RPDO2	0110b	0 to 127	300h+Node_ID	1401h
TPDO3	0111b	0 to 127	380h+Node_ID	1802h
RPDO3	1000b	0 to 127	400h+Node_ID	1402h
TPDO4	1001b	0 to 127	480h+Node_ID	1803h
RPDO4	1010b	0 to 127	500h+Node_ID	1403h
T_SDO	1011b	0 to 127	580h+Node_ID	1200h
R_SDO	1100b	0 to 127	600h+Node_ID	1200h
NMT error	1110b	0 to 127	700h+Node_ID	1016h, 1017h

For example,

The COB_ID of R_SDO of slave 2 is 600h+2h=602h

11.2.2.2 System parameter settings

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 11-11 Table of System Setting Function Codes

Function code	Name	Setting range	Setting value
Pn000.Z	Drive Model Selection	0: Standard pulse type 1: Canopen type 2: EtherCAT type	1
Pn080	Can Node_ID	1 to 127	1 (default)
Pn081.Z	Can communication baud rate	0: 20kbit/s 1: 50 kbit/s 2: 100 kbit/s 3: 125 kbit/s 4: 250 kbit/s 5: 500 kbit/s 6: 1 Mbit/s	4 (default)

11.2.2.3 NMT services

The Network Management System (NMT) is responsible for initializing, starting the network and stopping it, which belongs to a master-slave system. There is one and only one Network Management System (NMT) master in the entire Canopen network that can configure the Canopen network, including itself. The Network Management System (NMT) message format is shown in Table 11-12.

Table 11-12 NMT Message Format

COB_ID	RTR	Data (bytes)	
		0	1
0x000	0	command word	Node_ID

The COB_ID of the NMT message is fixed to "0x000".

The data area consists of two bytes, the first of which is a command word indicating the control function of the frame, as shown in Table 11-13.

Table 11-13 NMT Message Commands

Command word	Description
01h	Run command (all networks are working)
02h	Stop command (only NMT works in the whole network)
80h	Pre-run command (only SDO, heartbeat, NMT work)
81h	Reset node command
82h	Reset communication command

The second byte is the node address of Canopen. When it is "0", it is a broadcast message, which is valid for all slave devices in the network.

Table 11-14 Status Table

	Initialize	Pre-run	Run	Stop
PDO			○	
SDO		○	○	
SYNC		○	○	
EMCY		○	○	
Boot-Up	○			
NMT		○	○	○

Note: ○ indicates valid

For **example, to** turn on the drive's SDO operation (drive node address is 1), a command word of 80 can be sent.

Frame format	Cob_ID	RTU	0	1	2	3	4	5	6	7
data frame	00	0	80	01	–	–	–	–	–	–

11.2.2.4 NMT error control

NMT error control is mainly used to detect whether the devices in the network are online and the state they are in, including node protection/life protection and heartbeat. In practice, life protection and heartbeat are not allowed to be used at the same time, and the time for node protection/life protection and heartbeat should not be set too short to avoid increasing the network load.

(1) Node/life protection

Node protection is where the NMT master periodically queries the NMT slave status via remote frames; lifetime protection is where the slave indirectly monitors the master's status via the interval of remote frames received for monitoring 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 node protection remote frame interval under normal circumstances(Unit: ms), and the product of 100Ch and 100Dh determines the final time for master queries. Under normal circumstances, node protection is all possible. Lifetime protection is activated when both node 100Ch and 100Dh are not 0 and a node protection request frame is received.

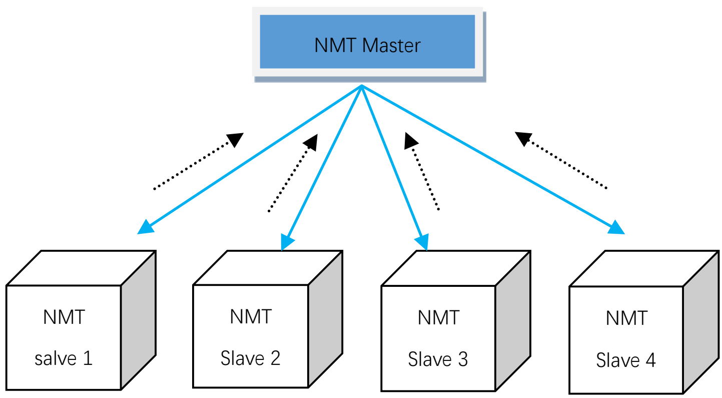


Figure 11-3 Link Diagram

The NMT master sends a node protection remote frame every period of 100Ch time, and the slave must answer, otherwise the slave is considered dropped; if the slave does not receive a node protection remote frame within 100Ch × 100Dh time, the master is considered dropped.

The NMT master sends remote frames in the format shown in Table 11-15.

Table 11-15 Node Protection Remote Frame Messages

COB_ID	RTR
0x700 + Node_ID	1

The answer messages returned by the NMT from the node are shown in Table 11-16.

Table 11-16 Node Protection Answer Messages

COB_ID	RTR	Data
0x700 + Node_ID	0	status word

The data segment is a one-byte status word with the data format shown in Table 11-17.

Table 11-17 Data Segment Correspondence Description

Data bit	Description
bit7	Must alternate "0" and "1" each time
bit6～0	4: Stop state 5: Operational status 127: Pre-operation status

(2) Heartbeat

The heartbeat model uses a producer-consumer model.

The Canopen device may send heartbeat messages according to the period set by the producer heartbeat interval object 1017h (Unit:ms). A node in the CAN network with consumer heartbeat function monitors this producer according to the consumer time set by object 1016h and it 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 interval 1017h, the node heartbeat function activates and starts generating heartbeat messages. After configuring a valid Sub index for consumer heartbeat 1016h, monitoring starts upon receiving a frame of heartbeat from the corresponding node.

The master sends a heartbeat messages at its producer time, and the slave monitoring the master considers the master dropped if it does not receive the heartbeat messages within the object 1016 Sub index time. Object 1016h sub index time ≥ master producer time × 2, otherwise it causes the slave to mistakenly consider the master as dropped.

Each object of the slave sends a heartbeat message at 1017h time, and the master that monitors the slave and does not receive the heartbeat message within the consumer time is considered to have dropped the slave.

The format of the heartbeat message is shown in Table 11-18.

Table 11-18 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 11-19 Data Segment Correspondence Description

Data bit	Description
bit7	Fixed to "0"
bit6 to bit0	4: Stop state 5: Operational status 127: Pre-operation status

11.2.3 Service Data Objects (SDO)

The Service Data Object (SDO) is linked to the object dictionary through object indexes and sub-indexes, through which the SDO can read the object contents in the object dictionary or modify the object data if allowed.

11.2.3.1 SDO transmission method

The SDO transmission method follows the client-server mode, i.e. the Ask and Answer method, which is similar to the freedom in serial communication. SDO is initiated by the SDO client in the CAN bus network and answered by the SDO server. The data exchange between SDO requires at least two CAN messages and the two CAN messages do not have the same CAN identifier. The transmission is as shown in the following figure.

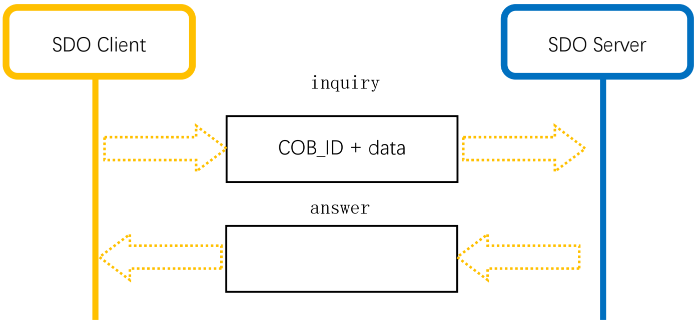


Figure 11-4 SDO client reading-writing the object dictionary in the SDO server

11.2.3.2 SDO transmission format

SDO transmission is divided into object data transmission of no more than 4 bytes and higher than 4 bytes. Accelerated SDO transmission mode shall be adopted when it is not higher than 4 bytes, and segmented transmission or block transmission mode shall be adopted when it is higher than 4 bytes. Sd780 series drives only support accelerated SDO transmission. The SDO communication message is basically composed of COBID + command code + index + Sub index + data. The data segment adopts the "small-end mode", i.e., the low bit is in the front and the high bit is in the back. The format of SDO transmission message is shown in table 11-20.

Table 11-20 SDO Transmission Messages

COB-ID	0	1	2	3	4	5	6	7
600h+Node_ID	command code	index		Sub index	data area			
580h+Node_ID		index		Sub index	data area			

For example,

The data area needs to send or receive data as 32-bit 0x11223344, which is arranged as 44 33 22 11 when sending or receiving.

(1) SDO accelerated write transmission message

For reading and writingienot higher than 4 bytes, accelerated SDO transmission is used.

The transmission messages vary according to the inconsistency of the read/write method and data length. The format of the accelerated SDO write message is shown in Table 11-21.

Table 11-21 Explanation of Accelerated SDO Message Format

<table>
<tr><th></th><th>COB-ID</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><td rowspan="3">client side
→</td><td rowspan="3">600h+Node_ID</td><td>23H</td><td rowspan="3" colspan="2">index</td><td rowspan="3">Sub index</td><td colspan="4">data</td></tr>
<tr><td>2BH</td><td colspan="2">data</td><td>–</td><td>–</td></tr>
<tr><td>2FH</td><td>data</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">server
←</td><td rowspan="2">580h+Node_ID</td><td>60H</td><td rowspan="2" colspan="2">index</td><td rowspan="2">Sub index</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>80H</td><td colspan="4">Abort Code</td></tr>
</table>

Note: 1. "–" means data is available but not considered, and it is recommended to write 0 when writing data.

2、The servo driver currently supports the following command words.

Table 11-22 SDO Write Command Words

Command word	Description
2Fh	Write 1 byte
2Bh	Write 2 bytes
23h	Write 4 bytes

Example 1: If the slave Node_ID is 1 and the SDO is used to write the object 100Dh(00), which is 8 bits, and the data 64h is written to this object, the data command is sent.

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	601	2F	0D	10	00	64	–	–	–

If the parameter is written successfully, the returned data frame is

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	581	60	0D	10	00	–	–	–	–

Example 2: If the slave Node_ID is 1, and the factory parameter Pn500 [2003h (01)] is written with SDO, which is 16 bits, and the data 64h is written to this object, the data command is sent as.

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	601	2B	05	20	01	64	00	–	–

If the parameter is written successfully, the returned data frame is

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	581	60	05	20	01	–	–	–	–

(2) SDO accelerated read transmission messages

The SDO read data operation is accelerated when the object message is not higher than 4 bytes. The format of the accelerated SDO read message is shown in Table 11-23.

Table 11-23 Explanation of Accelerated SDO Message Format

<table>
<tr><th></th><th>COB-ID</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><td>client side
→</td><td>600h+Node_ID</td><td>40</td><td colspan="2">index</td><td>Sub index</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="4">server
←</td><td rowspan="4">580h+Node_ID</td><td>43H</td><td colspan="2" rowspan="4">index</td><td rowspan="4">Sub index</td><td colspan="4">data</td></tr>
<tr><td>4BH</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">Abort Code</td></tr>
</table>

Example 1: Slave Node_ID is 1. Read object 100Dh(00) with SDO and send the following command.

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	601	40	0D	10	–	–	–	–	–

The data frame returned under normal conditions is.

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	581	4F	0D	10	00	00	–	–	–

Example 2: Slave Node_ID is 1. Read factory parameter P204 [2002h (05)] with SDO and send the following command.

Frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	601	40	02	20	05	–	–	–	–

If the drive electronic gear ratio is 16777216:10000, i.e., Pn204 = 16777216, the data frame returned under normal conditions is

frame format	Cob_ID	0	1	2	3	4	5	6	7
data frame	581	4B	02	20	05	00	00	00	01

11.2.4 Process Data Objects (PDO)

The Process Data Object (PDO) is used to transfer real-time data and is the dominant data transfer method in Canopen. The transfer of PDO is fast because it does not require an answer and the length of the PDO must not exceed 8 bytes.

The mapping configuration process for PDO is as follows.

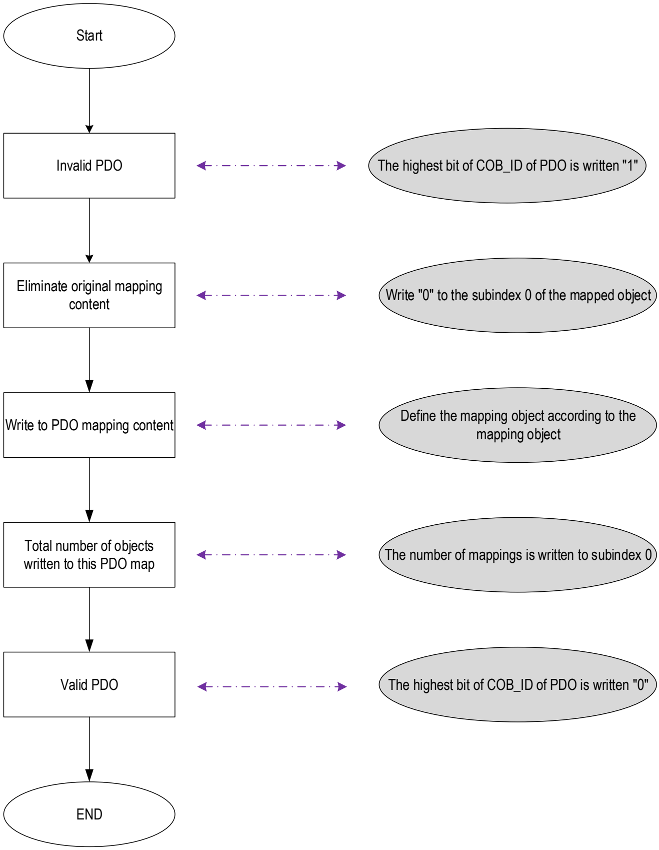


Figure 11-5 PDO Mapping Configuration Flow

(1) Transmission method of PDO

PDO uses a mode of producer / customer, 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 transmitter PDO (TxPDo) and a receiver PDO (RxPDO) with the transmission mode defined in the PDO communication parameter index. The mode of transmission is shown below.

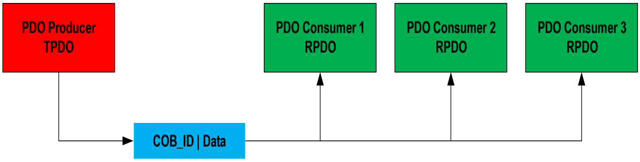


Figure 11-6 PDO transmission method

(2) PDO objects

The PDO can be divided into Receiver PDO (RPDO) and Transmitter PDO (TPDO). The transmission method and content of PDO is determined by both of the communication parameters and the mapping parameters. This servo drive is designed with 4 RPDO and 4 TPDO to implement the data transmission of PDO, and the list of related objects is shown in Table 11-24.

Table 11-24 List of PDO Objects

Name		COB_ID	Communication object	Mapping object
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 parameters

The COB_ID of the PDO contains control bits and identification data to determine the bus priority of this PDO. The 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.

MSB LSB

31	30 0
0: Activation 1: Close	1400h to 1403h + Node_ID 1800h~1803h + Node_ID

For example, for a station with Node_ID 1, the COB_ID of RPD01 is "80000201h" in the invalid state, and writing "00000201h" to this COB_ID will activate RPD01.

(4) Transmission type of PDO

The transmission type of the PDO is located on sub-index 02 of the communication parameters (RPDO: 1400h to 1403h; TPDO: 1800h to 1803h).

Table 11-25 Classification of PDO Transmission Types

Communication type value	Synchronous		Asynchronous
	cycle	acyclic	
0		○	
1 to 240	○	-	-
241-253	--		
254/255	-	-	○

When the transmission type of the TPDO is 0, the TPDO is sent if the mapped data changes and a synchronization frame is received.

When the transmission type of the TPDO is 1 to 240, the TPDO is sent when the corresponding number of synchronization frames is received.

When the transmission type of the TPDO is 254 or 255, the TPDO is sent when the mapped data changes or the event timer arrives.

When the output type of the RPDO is 0 to 240, update the latest data of that RPDO to the application whenever a synchronization frame is received.

When the transmission type of RPDO is 254 or 255, the received data is updated directly to the application.

(5) Prohibition of time

The prohibition time is set for the TPDO and is stored on sub-index 03 of the communication parameter (1800h to 1803h) to prevent the CAN network from being continuously occupied by a PDO with a lower priority. The time unit of this parameter is 125us, and after setting the value, the transmission interval of the same TPDO must not be smaller than the time corresponding to this parameter.
For example, if the prohibition time of TPDO1 is 16, the minimum transmission interval of TPDO1 is 2ms.

Attention
● The prohibition time should not be too small, otherwise the bus may be overloaded when the data keeps changing. Please set the prohibition time reasonably.

(6) Event Timer

For TPDO with asynchronous transmission (transmission type 254 or 255), an event timer is defined, which is located on sub-index 05 of the communication parameters (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 parameters

All PDO transmission data must be mapped to the corresponding index area through the object dictionary. When mapping, the index, Sub index and mapped object lengths need to be configured in the appropriate format. The length of each PDO data cannot exceed 8 bytes and can map one or more objects at the same time. The index 0 records the number of objects specifically mapped by this PDO, and the sub-indexes 1 to 4 are the mapping contents. The mapping parameters are defined as follows.

Table 11-26 PDO Mapping Parameter Content Definitions

<table>
<tr><th>Bits</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 rowspan="4">Definition</td><td colspan="3" rowspan="4">index</td><td colspan="3" rowspan="4">Sub index</td><td colspan="2">Object Length</td><td>Bit length</td></tr>
<tr><td colspan="2">08h</td><td>8-bit</td></tr>
<tr><td colspan="2">10h</td><td>16-bit</td></tr>
<tr><td colspan="2">20h</td><td>32-bit</td></tr>
</table>

For example,

RPDO1 mapping object 6040h.

PDO1	0	1	2	3	4	5	6	7
value	0x11	0x22	0x33	0x44	0x55	0x66	0x77	0x88

RPDO1

Index	Sub index	Definition	Value	Read and Write Properties	Data Size
0x1600	0	Number of valid maps	1	R/W	Uint8
0x1600	1	Mapped objects1	0x60400010	R/W	Uint32
0x1600	2	Mapped objects2		R/W	Uint32
0x1600	3	Mapped objects3		R/W	Uint32
0x1600	4	Mapped objects4		R/W	Uint32
0x6040	0	Control word	0x2211	R/W	Uint16 (2bytes)

Figure 11-7 RPDO1 Mapping

TPDO1 mapping object 6041h.

PDO1	0	1	2	3	4	5	6	7
value	0xBB	0xAA	0x33	0x44	0x55	0x66	0x77	0x88

TPDO1

Index	Sub index	Definition	Value	Read and Write Properties	Data size
0x1A00	0	Number of valid maps	1	R/W	Uint8
0x1A00	1	Mapping objects1	0x60410010	R/W	Uint32
0x1A00	2	Mapping objects2		R/W	Uint32
0x1A00	3	Mapping objects3		R/W	Uint32
0x1A00	4	Mapping objects4		R/W	Uint32
0x6041	0	Control word	0xAABB	R/W	Uint16 (2bytes)

Figure 11-8 TPDO1 Mapping

11.2.5 Synchronous objects (SYNC)

The Servo Drive is not only a synchronous consumer, but also a synchronous producer. The objects that support synchronization-related objects are the synchronization object COB_ID (1005h) and the synchronization cycle period (1006h), respectively.
The second highest bit of the synchronization object COB_ID (1005h) determines whether the synchronization generator is activated.

MSB LSB

31	30	29 0
0	0: Closed 1: Activation	0x80

Similar to PDO transmission, the output of synchronization objects follows a producer-consumer model. In a Canopen network, only one station sends a synchronization object (SYNC).The one sending the synchronization object (SYNC) is the producer, and the one receiving the synchronization object (SYNC) is the consumer, and the transmission framework is shown in Figure 11-10.

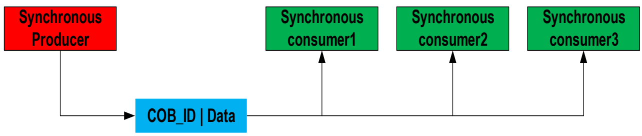


Figure 11-9 Synchronous Transmission Method

The method of synchronous implementation in Canopen is to use PDO to send the control data to each slave, and each slave that receives a control command from the master only saves the command temporarily, and the master sends out a synchronous object (SYNC) broadcast message only after all the slave commands have been sent. After receiving the synchronous object (SYNC) messages, all the slaves that support synchronous transmission mode will simultaneously execute the previously received control commands.
The transmission of synchronous PDO is closely linked to synchronous frames and its specific application is shown below.

Table 11-27 PDO Trigger Methods

Communication type value	Synchronous		Asynchronous
	cycle	acyclic	
0		○	
1 to 240	○	-	-
241-253	--		
254 to 255	-	-	○

When the transmission type of the TPDO is 0, the TPDO is sent if the mapped data is changed and a synchronization frame is received.
When the transmission type of the TPDO is 1 to 240, the TPDO is sent when the corresponding

number of synchronization frames is received.

When the transmission type of the TPDO is 254 or 255, the TPDO is sent when the mapped data changes or the event timer arrives.

When the output type of the RPDO is 0 to 240, the latest data from that RPDO is updated to the application whenever a synchronization frame is received.

When the transmission type of RPDO is 254 or 255, the received data is updated directly to the application.

11.2.6 Emergency Object Service (EMCY)

When a Canopen node fails, the node sends an emergency message frame according to the table transformation mechanism. The emergency message follows the producer-consumer model, where other nodes in the CAN network can choose to handle the failure after the node failure is sent. This Servo Drive only acts as an emergency message producer and does not process other node emergency messages.

When a node fails, the driver updates the error register (1001h) and the predefined error field (1003h), regardless of whether an emergency message is activated or not.

When an emergency message is used, it needs to be activated accordingly.

MSB LSB

31	30 0
0: Activation 1: Close	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	Reserved	auxiliary byte			

Note: The error register is always the same as 1001h.

(1) When an abnormality occurs in communication, the error code remains the same as required by the DS301, and the auxiliary byte is zero in the event of a communication abnormality.

(2) When an abnormality specified by the user occurs, the error code is 0xFF00 and the auxiliary byte displays the user-specified error code.

For **example**, turn on contact 1 (Pn080=1) emergency messages.

(1) Node pre-operation (valid for turning on SDO operation)

frame format	Cob_ID	0	1
data frame	00	80	01

Note: The frames are remote frames.

(2) The object of activating the emergency message is 1014h, where Bit31 is used to activate/deactivate the emergency message, according to which the data sent by the master 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: The frames are data frames.

(3) Check if the drive has an active emergency messages by monitoring function code Un031 (communication address 0xE031).

11.2.7 Control mode

11.2.7.1 Profile position mode (pp)

When in profile position mode, the master sends the required target position (absolute or relative), speed, acceleration and deceleration of the position curve, and other related object dictionaries to the servo drive, which generates the target curve command based on the received related data and commands.

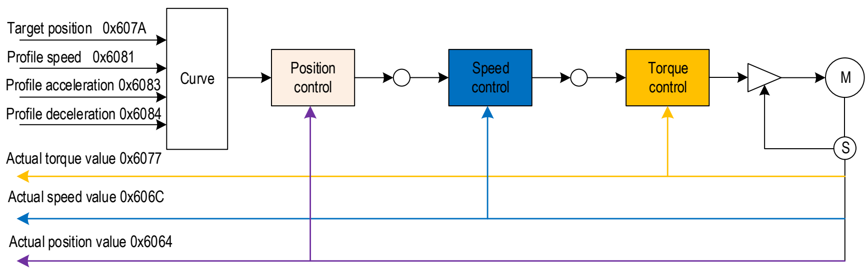


Figure 11.10 Block diagram of profile position mode control

Dictionary of related objects.

Control word 6040h		
Bit	Name	Description
0	Servo Ready (Switch On)	0: invalid; 1: valid
1	Turn on main circuit power (Enable Voltage)	0: invalid; 1: valid
2	Quick Stop	0: valid; 1: invalid
3	Servo operation (Enable Operation)	0: invalid; 1: valid
4	New Set-Point	Rising edge triggers a new target position
5	Change Set Immediately	0: not immediately updated; 1: immediately updated
6	Absolute position command / Relative position command (Abs/Rel)	0: The target position is an absolute position command 1: The 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	Target Position Update (Set Point Acknowledge)	0: Target position can be updated 1: Target position cannot be updated
13	Following error	0: No excessive position deviation fault 1: Excessive position deviation fault occurs
15	Home Return Complete (Home Find)	0: Home return not completed 1: Home return complete

Index	Sub index	Name	Read Write	Data type	Unit	Setting range
0x603F	00	error code	RO	UINT16	–	0 to 65535
0x6040	00	control word	RW	UINT16	–	0 to 65535
0x6041	00	status word	RO	UINT16	–	0 to 65535
0x6060	00	operating mode	RW	INT8	–	0 to 10
0x6061	00	Mode Display	RO	INT8	–	0 to 10
0x6062	00	position command	RO	DINT32	command unit	–
0x6063	00	Position Feedback	RO	INT32	Encoder units	–
0x6064	00	Position Feedback	RO	INT32	command unit	–
0x606C	00	Actual speed feedback	RO	INT32	Command unit/s	–
0x607A	00	Target position	RW	INT32	command unit	-2^{31} to $(2^{31}-1)$
0x6081	00	Profile speed	RW	UINT32	Command unit/s	0 to $(2^{32}-1)$
0x6083	00	acceleration	RW	UINT32	Command unit/s^2	0 to $(2^{32}-1)$

0x6084	00	deceleration	RW	UINT32	Command unit/s^2	0 to (2^{32}-1)

Before using profile position mode, set the drive to position mode (Pn000.X = 0) and select the position command source as Canopen given (Pn200 = 3). The profile position mode operation setup procedure is shown in the following table.

Item	Steps	Parameter input	Status word display (6041h)
Servo Enable	0	0	0x0240
	1	6040h = 0x06	0x0621
	2	6040h = 0x07	0x0633
	3	6040h = 0x0F	0x0637
Control mode switching	4	6060h = 1	0x0637
Profile position parameter assignment	5	607Ah = 10000	0x0637
	6	6081h = 1000	0x0637
	7	6083h = 200	0x0637
	8	6084h = 200	0x0637
Absolute/relative position selection	9	6040h Bit6 set to 1 (relative position)	0x0637
Position command trigger	10	6040h Bit4 set to 1 (rising edge)	0x1237
Positioning complete	11	6041h Bit10 set to 1	0x0637
Trigger bit cleared for next use	12	6040h Bit4 cleared	0x0637

When running the profile position mode, there are two ways to update the Commands, namely immediate and non-immediate updates. The specific process of implementing these two ways is described below.

(1) Relative position command, immediate update

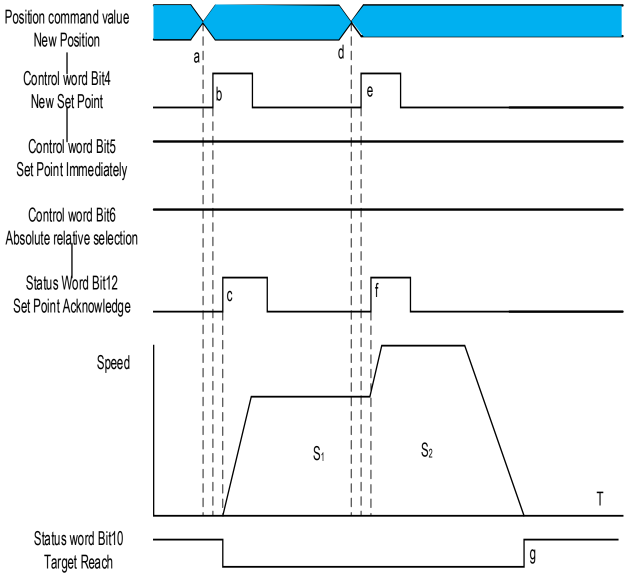


Figure 11.11 Timing sequence diagram for immediate update mode of relative position command value

The timing sequence diagram shown in Figure 11.11 corresponds to the operational steps shown in the following table.

Steps	Item	Operations
1	Position command assignment	Assign a value to 607Ah (given the target position).
2	Position command trigger	6040h. Bit5=1 (given an immediate update position command). Bit6=1 (selected as relative position). Bit4=1 (rising edge triggered operation).
3	New position command received	Bit4 of 6040h is detected as rising edge → planning position curve → Bit10 of 6041h = 0 (positioning not completed), Bit12 = 1.
4	Second segment position command assignment	Assign a new position command value to 607Ah if the first position command does not run to completion.
5	New position command trigger	Give Bit4 of 6040h a rising edge to trigger new position command execution
6	Servo drive receives new position command	Bit5 of 6040h is detected high → Immediately plan the next section of position command value from the current speed

		The pulse values that are not executed in the first position command are accumulated in the second position command execution
7	Status word display	After the 2nd position command is executed, the status word bit10 positioning completion flag is set to 1

(2) Relative position command, not immediate update

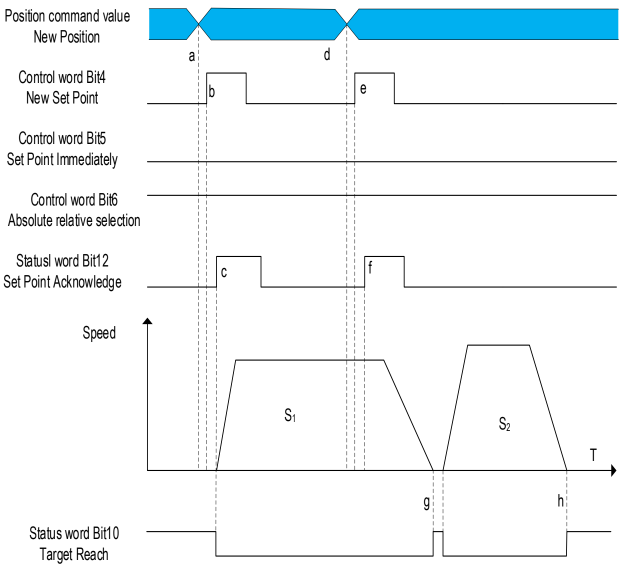


Figure 11.12 Timing sequence diagram for **non-immediate update** mode of relative position command value

The timing sequence diagram shown in Figure 11.12 corresponds to the operational steps shown in the following table.

Steps	Item	Operations
1	Position command assignment	Assign a value to 607Ah (given the target position).
2	Position command trigger	6040h. Bit5=0 (position command not immediately updated). Bit6=1 (selected as relative position). Bit4=1 (rising edge triggered operation).

3	New position command received	Bit4 of 6040h is detected as rising edge → planning position curve → Bit10 of 6041h = 0 (positioning not completed), Bit12 = 1.
4	Second segment position command assignment	The first segment position command S1 is assigned a new position command value to 607Ah without running to completion.
5	New position command trigger	Give the rising edge of Bit4 of 6040h to trigger the new position command execution.
6	Servo drive receives new position command	Determine that the control word Bit5 is 0. Do not update the position command immediately. Wait for the completion of the 1st position command before executing.
7	Position command update	S1 positioning completion is detected → 2nd segment position command S2 is planned.
8	Status word display	After the completion of S2, Bit10 = 1 (positioning complete) and Bit12 = 0 (new position command allowed) for 6041h.

11.2.7.2 Profile speed mode (pv)

In profile speed mode, the master transmits the required target speed, acceleration time, and deceleration time to the servo drive, which performs speed and torque regulation.

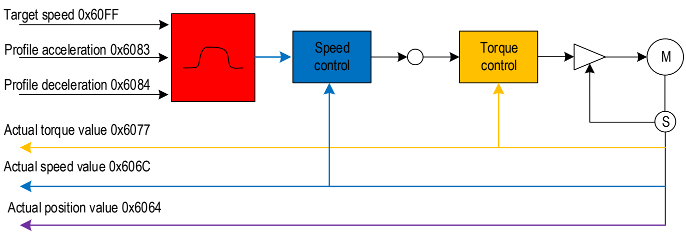


Figure 11.13 Block diagram of profile speed mode control

Dictionary of related objects.

Index	Sub	Name	Read	Data	Unit	Setting
0x603F	00	error code	RO	UINT16	-	0 to 65535
0x6040	00	control word	RW	UINT16	-	0 to 65535
0x6041	00	status word	RO	UINT16	-	0 to 65535
0x6060	00	operating mode	RW	INT8	-	0 to 10
0x6061	00	Mode Display	RO	INT8	-	0 to 10
0x606C	00	Actual speed feedback	RO	INT32	Command unit/s	-

0x607F	00	Maximum profile speed	RW	UINT32	0.1rpm	0 to (2^{32}– 1)
0x6083	00	acceleration	RW	UINT32	Command unit/s^2	0 to (2^{32}– 1)
0x6084	00	deceleration	RW	UINT32	Command unit/s^2	0 to (2^{32}– 1)
0x60FF	00	Target speed	RW	INT32	Command unit/s	-2 ^{31}to (2^{31}– 1)

Note: The speed limit value is determined by the smaller value of 0x607F and the maximum motor speed.

Before using the profile speed mode, set the drive to speed mode (Pn000.X = 1) and select the speed command source as Canopen given (Pn300 = 5). The operation procedure for the profile speed mode is shown in the following table.

Item	Steps	Parameter input	Status word display (6041h)
Profile speed parameter assignment	1	6083h = 200	0x0240
	2	6084h = 200	0x0240
	3	60FFh = 10000	0x0240
Control mode selection	4	6060h = 3	0x0240
Servo Enable	6	6040h = 0x06	0x0221
	7	6040h = 0x07	0x0233
	8	6040h = 0x0F	0x0637

The speed command is updated immediately in profile speed mode, and its timing sequence diagram is shown in Figure 11.14.

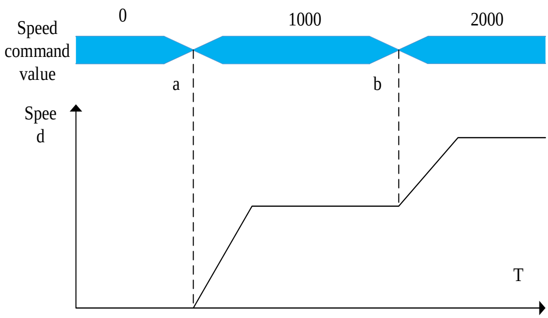


Figure 11.14 Timing sequence diagram for profile speed mode operation

The timing sequence diagram shown in Figure 11.13 corresponds to the operational steps shown below.

Steps	Item	Operations
1	Speed command giving	After the speed command is given, the servo controls motor to run at the set speed
2	Speed command change	After the speed command changes, the servo controls motor to change speed from the current speed to the set speed.

11.2.7.3 Profile torque mode (pt)

In profile torque mode, the master sends the target torque command 6071h, torque ramp constant 6087h to the servo drive and the torque regulator is executed internally by the servo drive. When the speed reaches the maximum speed limit (drive internal parameter Pn316), it will enter into the speed regulation process.

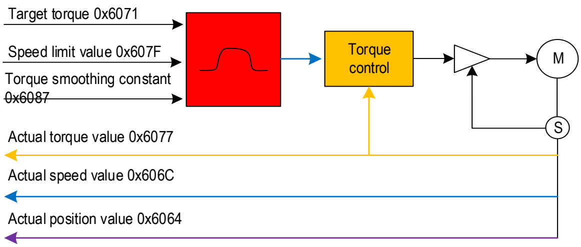


Figure 11.15 Timing sequence diagram for profile torque mode operation

Dictionary of related objects

Index	Sub index	Name	Read Write	Data type	Unit	Setting range
0x603F	0x00	error code	RO	UINT16	–	0 to 65535
0x6040	0x00	control word	RW	UINT16	–	0 to 65535
0x6041	0x00	status word	RO	UINT16	–	0 to 65535
0x6060	0x00	operating mode	RW	INT8	–	0 to 10
0x6061	0x00	Mode Display	RO	INT8	–	0 to 10
0x606C	0x00	Actual speed feedback	RO	INT32	Command unit/s	–
0x6071	0x00	Target torque	RW	INT16	0.1%	-3000 to 3000
0x6072	0x00	Maximum torque	RW	UINT16	0.1%	0 to 3000
0x6074	0x00	Torque command	RO	INT16	0.1%	–
0x6077	0x00	Actual torque	RO	UINT16	1%	–
0x6087	0x00	Torque ramp time	RW	UINT32	ms	0 to $(2^{32}-1)$

Before using the profile torque mode, set the drive to position mode (Pn000.X=2) and select the position command source as Canopen given (Pn400.X=5). The following table shows the operating procedure for the profile speed mode.

Item	steps	Parameter input	Status word display (6041h)
Servo Enable	0	0	0x8240
	1	6040h = 0x06	0x8221
	2	6040h = 0x07	0x8233
	3	6040h = 0x0F	0x8237
Control mode switching	4	6060h = 4	0x8237
Profile torque parameter assignment	5	6087h = 100	0x8237
	6	6071h = 500	0x8237

11.2.7.4 Home position return mode (hm)

The home position return mode is used to find the mechanical home and locate the position relationship of the mechanical home to the mechanical zero point.

Mechanical home position: a fixed position on the machine that corresponds to a defined home signal switch.

Mechanical Home = Mechanical Zero + 607C (Home Offset)

Mechanical zero point: the absolute 0 position mechanically.

After the servo drive has finished returning to the home point, the motor will stop at the mechanical home point and the position relationship of the mechanical home point to the mechanical zero point will be adjusted by setting the value of the object dictionary 0x607C.

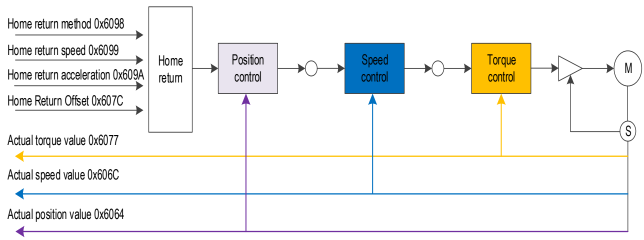


Figure 11.16 Home position return mode control block diagram

Dictionary of related objects

Index	Sub index	Name	Read Write Types	Data type	unit	Setting range
0x603F	00	error code	RO	UINT16	-	0 to 65535
0x6040	00	control word	RW	UINT16	-	0 to 65535
0x6041	00	status word	RO	UINT16	-	0 to 65535
0x6060	00	operating mode	RW	INT8	-	0 to 10
0x6061	00	Mode Display	RO	INT8	-	0 to 10
0x6064	00	Physical position feedback	RO	INT32	command unit	-
0x606C	00	Actual speed	RO	INT32	Command	-

		feedback			unit/s	
0x6067	00	Position reaches threshold	RO	UINT32	User units	-
0x6098	00	Home return method	RW	INT8	-	1 to 35
0x6099	01	Search for deceleration point at high speed	RW	UINT32	0.1rpm	0 to 65535
	02	Search home at low speed	RW	UINT32	0.1rpm	1 to 500
0x609A	00	Acceleration and deceleration time	RW	UINT32	ms	0 to (2^{32}–1)

The steps to turn on the return to zero mode are shown below.

Item	Steps	Parameter input	Status word display (6041h)
Servo Enable	0	0	0x8240
	1	6040h = 0x06	0x8221
	2	6040h = 0x07	0x8233
	3	6040h = 0x0F	0x8237
Control mode switching	4	6060h = 6	0x8637
Assignment of origin regression parameters	5	609Ah = 1000	0x8637
	6	6099_01h =1000	0x8637
	7	6099_02h = 100	0x8637
	8	6098=1	0x8637
Triggering a return to home position	9	6040bit4 set 1	0x1237
Find the home position	10	-	0x8637

11.2.7.5 Interpolation mode (ip)

In interpolated position mode, the host computer sends a position value (corresponding to the object dictionary [60C1h]) every synchronization cycle, which takes the value of the object dictionary 60C1h as the absolute position. For example, if the value of 60C1 is 0 at the beginning, the current point is the absolute position starting point. The servo driver receives the interpolated position value in the first cycle and starts planning 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 execution unit for execution, while starting to plan a new position curve.

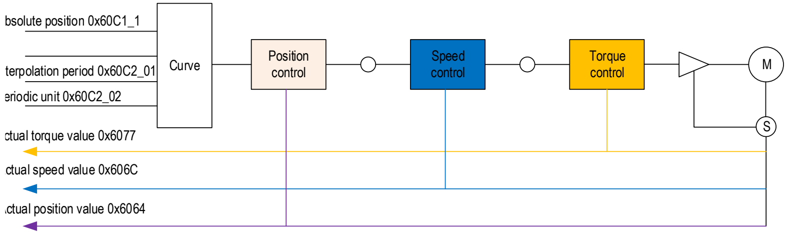


Figure 11.17 Block diagram of interpolation mode control

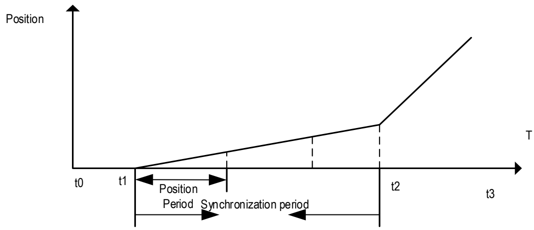


Figure 11.18 Schematic diagram of interpolation position

As shown in Figure 11.18, at moment t0, the master computer sends an interpolated position command value, and the servo drive plans the motion trajectory POS0 based on the received interpolated position value. moment t1 sends the motion trajectory POS0 to the execution unit, and at the same time plans the motion trajectory POS1 based on the new interpolated position value. moment t2 executes the motion trajectory POS1 again, and at the same time plans the motion trajectory POS2 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.

Dictionary of related objects

Index	Sub index	Name	Read Write	Data type	Unit	Range	Default
6039	00	error code	RO	UINT16	-	UINT16	0
6040	00	control word	RW	UINT16	-	UINT16	0
6041	00	status word	RO	UINT16	-	UINT16	0
6060	00	operating mode	RW	UINT8	-	UINT8	0
6061	00	Operation mode display	RO	UINT8	-	UINT8	0
6064	00	Actual position value	RO	INT32	command unit	INT32	0
6065	00	Position Deviation Excess Threshold	RW	UINT32	command unit	UINT32	3840000

6067	00	Position reaches threshold	RW	UINT32	command unit	UINT32	100
6068	00	Position arrival time	RW	UINT16	ms	UINT16	0
607A	00	Target position value	RW	INT32	command unit	INT32	0
607D	01	Software limit min.	RW	INT32	command unit	INT32	-2^31
	02	Software limit maximum	RW	INT32	command unit	INT32	2^31
60C1	01	Interpolation position absolute position value	RW	INT32	command unit	INT32	0
60C2	01	Interpolation period value	RW	UINT8	-	UINT8	1
	02	Interpolation cycle unit	RW	INT8	-	INT8	-3

The interpolation command values are generated through the master computer planning, and each synchronization cycle the master computer plans the interpolation command values and sends them to the servo drive to control the motor operation through the PDO. Before using the interpolation mode, set the drive to position mode (Pn000.X=0) and select the position command source as Canopen given (Pn200=3). The interpolation mode operation is shown in the following table.

Item	Steps	Parameter input	Status word display
Servo Enable	0	0	0x8240
	1	6040h = 0x06	0x8221
	2	6040h = 0x07	0x8233
	3	6040h = 0x0F	0x8237
Interpolation cycle assignment	4	60C2_01 = 200 (or 0xC8)	0x8237
	5	60C2_02 = -3 (or 0xFD)	0x8237
Control mode selection	6	6060h = 7	0x8637
Interpolation Enable	7	Control word bit4 set to 1	0x8637
Interpolation position assignment	8	60C1 = 10000 (motor goes through 10,000 pulses at constant speed in 200ms)	0x9237
Positioning complete	9	-	0x8637

11.2.8 Object Dictionary

11.2.8.1 Description of Object Properties

Explanation of Terms

"Index": specifies the position of each object in the object dictionary, expressed in hexadecimal (h).

"Data type": see Table 11-28 for details.

Table 11-28 Description of Data types

Data type	Numerical range	Data length	DS301 value
Int8	-128 to 127	1 byte	2
Uint8	0 to 255	1 byte	5
Int16	-32768 to +32767	2 bytes	3
Uint16	0 to 65535	2 bytes	6
Int32	-2147483648 to +2147483647	4 bytes	4
Uint32	0～4294967295	4 bytes	7
String	ASCII	-	9

"Read/Write Type": see Table 11-29 for details.

Table 11-29 Description of Read and Write Types

Read/Write Type	Description
RW	Read and Write
WO	Write only
RO	Read-only
CONST	Constant, read-only

"Object structure": see Table 11-30 for details.

Table 11-30 Description of Object structure

Object structure	Description	DS301 value
VAR	Single simple value containing the Data types in Table 3-1	7
ARR	Data blocks with the same type	8
REC	Has different types of data blocks	9

11.2.8.2 List of 1000h cluster objects

Index	Sub index	Name	Objects structure	Data types	Read Write types	Mapping option (Y/N)
1000h	-	Equipment Type	VAR	Uint32	RO	N
1001h	-	error register	VAR	Uint8	RO	N
1003h	-	Predefined error fields	ARR	Uint32	RW	N

	1～4h	error field	-	Uint32	RW	N
1005h	-	Synchronous message COB-ID	VAR	Uint32	RW	N
1006h	-	Synchronous cycle time	VAR	Uint32	RW	N
100Ch	-	Node guarding time	VAR	Uint16	RW	N
100Dh	-	life time factor	VAR	Uint8	RW	N
1010h	-	Save parameters	ARR	Uint32	RW	N
	1h	Save all object parameters	-	Uint32	RW	N
1011h	-	Restore default parameters	ARR	Uint32	RW	N
	1h	Save all object parameters	-	Uint32	RW	N
1014h	-	Emergency message COB-ID	VAR	Uint32	RO	N
1016h	-	Consumer Heartbeat Time	ARR	-	-	-
	0h	Support for maximum Sub indexes	-	Uint8	RO	N
	1h	Consumer Heartbeat Time	-	Uint32	RW	N
	2h	Consumer Heartbeat Time	-	Uint32	RW	N
	3h	Consumer Heartbeat Time	-	Uint32	RW	N
	4h	Consumer Heartbeat Time	-	Uint32	RW	N
1017h	-	Producer heartbeat time	VAR	Uint16	RW	N
1018h	-	Device Object Description	REC	-	-	-
	0h	Support for maximum Sub indexes	-	Uint8	RO	N
	1h	Manufacturer ID	-	Uint32	RO	N
	2h	Device Code	-	Uint32	RO	N
	3h	Device revision number	-	Uint32	RO	N
1029h	-	Misbehavior Object	ARR	-	-	-

	0_h	Support for maximum Sub indexes	-	Uint8	RO	N
	1_h	communication error	-	Uint8	RW	N
1200h	-	SDO Server Parameters	REC	-	-	-
	0_h	Support for maximum Sub indexes	-	Uint8	RO	N
	1_h	Client to server COB-ID	-	Uint32	RO	N
	2_h	Server to client COB-ID	-	Uint32	RO	N
1400h	-	RPDO1 mapping parameters	REC	-	-	-
	0_h	RPDO1 maximum Sub index	-	Uint8	RO	N
	1_h	RPDO1COB-ID	-	Uint32	RW	N
	2_h	Type of transmission for RPDO1	-	Uint8	RW	N
	3_h	Prohibited time (not supported)	-	Uint16	RW	N
	4_h	Reserved	-	Uint8	RW	N
	5_h	Event timer (not supported)	-	Uint16	RW	N
1401h	-	RPDO2 mapping parameters	REC	-	-	-
	0_h	RPDO2 maximum Sub index	-	Uint8	RO	N
	1_h	RPDO2COB-ID	-	Uint32	RW	N
	2_h	Types of RPDO2 transmission	-	Uint8	RW	N
	3_h	Prohibited time (not supported)	-	Uint16	RW	N
	4_h	Reserved	-	Uint8	RW	N
	5_h	Event timer (not supported)	-	Uint16	RW	N
1402h	-	RPDO3 mapping parameters	REC	-	-	-
	0_h	RPDO3 maximum Sub index	-	Uint8	RO	N
	1_h	RPDO3COB-ID	-	Uint32	RW	N

	2_h	Types of RPDO3 transmission	-	Uint8	RW	N
	3_h	Prohibited time (not supported)	-	Uint16	RW	N
	4_h	Reserved	-	Uint8	RW	N
	5_h	Event timer (not supported)	-	Uint16	RW	N
1403h	-	RPDO4 mapping parameters	REC	-	-	-
	0_h	RPDO4 maximum Sub index	-	Uint8	RO	N
	1_h	RPDO4COB-ID	-	Uint32	RW	N
	2_h	Type of transmission of RPDO4	-	Uint8	RW	N
	3_h	Prohibited time (not supported)	-	Uint16	RW	N
	4_h	Reserved	-	Uint8	RW	N
	5_h	Event timer (not supported)	-	Uint16	RW	N
1600h	-	RPDO1 mapping parameters	REC	-	-	-
	0_h	Number of valid mappings for RPDO1	-	Uint8	RW	N
	1_h	RPDO1 mapping object 1	-	Uint32	RW	N
	2_h	RPDO1 mapping object 2	-	Uint32	RW	N
	3_h	RPDO1 mapping object 3	-	Uint32	RW	N
	4_h	RPDO1 mapping object 4	-	Uint32	RW	N
1601h	-	RPDO2 mapping parameters	REC	-	-	-
	0_h	Number of valid mappings for RPDO2	-	Uint8	RW	N
	1_h	RPDO2 mapping object 1	-	Uint32	RW	N
	2_h	RPDO2 mapping object 2	-	Uint32	RW	N
	3_h	RPDO2 mapping object 3	-	Uint32	RW	N

	4h	RPDO2 mapping object 4	-	Uint32	RW	N
1602h	-	RPDO3 mapping parameters	REC	-	-	-
	0h	Number of valid mappings for RPDO3	-	Uint8	RW	N
	1h	RPDO3 mapping object 1	-	Uint32	RW	N
	2h	RPDO3 mapping object 2	-	Uint32	RW	N
	3h	RPDO3 mapping object 3	-	Uint32	RW	N
	4h	RPDO3 mapping object 4	-	Uint32	RW	N
1603h	-	RPDO4 mapping parameters	REC	-	-	-
	0h	Number of valid mappings for RPDO4	-	Uint8	RW	N
	1h	RPDO4 mapping object 1	-	Uint32	RW	N
	2h	RPDO4 mapping object 2	-	Uint32	RW	N
	3h	RPDO4 mapping object 3	-	Uint32	RW	N
	4h	RPDO4 mapping object 4	-	Uint32	RW	N
1800h	-	TPDO1 parameters	REC	-	-	-
	0h	TPDO1 maximum Sub index	-	Uint8	RO	N
	1h	TPDO1COB-ID	-	Uint32	RW	N
	2h	TPDO1 transmission type	-	Uint8	RW	N
	3h	Prohibition time	-	Uint16	RW	N
	4h	**Reserved**	-	Uint8	RW	N
	5h	event timer	-	Uint16	RW	N
1801h	-	TPDO2 parameters	REC	-	-	-
	0h	TPDO2 maximum Sub index	-	Uint8	RO	N

	1h	TPDO2COB-ID	–	Uint32	RW	N
	2h	TPDO2 transmission type	–	Uint8	RW	N
	3h	Prohibition time	–	Uint16	RW	N
	4h	**Reserved**	–	Uint8	RW	N
	5h	event timer	–	Uint16	RW	N
1802h	–	TPDO3 Parameters	REC	–	–	–
	0h	TPDO3 maximum Sub index	–	Uint8	RO	N
	1h	TPDO3COB-ID	–	Uint32	RW	N
	2h	TPDO3 Transmission Type	–	Uint8	RW	N
	3h	Prohibition time	–	Uint16	RW	N
	4h	**Reserved**	–	Uint8	RW	N
	5h	event timer	–	Uint16	RW	N
1803h	–	TPDO4 parameters	REC	–	–	–
	0h	TPDO1 maximum Sub index	–	Uint8	RO	N
	1h	TPDO4COB-ID	–	Uint32	RW	N
	2h	TPDO4 transmission type	–	Uint8	RW	N
	3h	Prohibition time	–	Uint16	RW	N
	4h	**Reserved**	–	Uint8	RW	N
	5h	event timer	–	Uint16	RW	N
1A00h	–	TPDO1 mapping parameters	REC	–	–	–
	0h	Number of valid mappings for TPDO1	–	Uint8	RW	N
	1h	TPDO1 Mapping Object 1	–	Uint32	RW	N
	2h	TPDO1 Mapping Object 2	–	Uint32	RW	N
	3h	TPDO1 Mapping Object 3	–	Uint32	RW	N

	4_h	TPDO1 mapping object 4	–	Uint32	RW	N
1A01h	–	TPDO4 Mapping Parameters	REC	–	–	–
	0_h	Number of valid mappings for TPDO2	–	Uint8	RW	N
	1_h	TPDO2 Mapping Object 1	–	Uint32	RW	N
	2_h	TPDO2 Mapping Object 2	–	Uint32	RW	N
	3_h	TPDO2 Mapping Object 3	–	Uint32	RW	N
	4_h	TPDO2 mapping object 4	–	Uint32	RW	N
1A02h	–	TPDO3 Mapping Parameters	REC	–	–	–
	0_h	Number of valid mappings for TPDO3	–	Uint8	RW	N
	1_h	TPDO3 Mapping Object 1	–	Uint32	RW	N
	2_h	TPDO3 Mapping Object 2	–	Uint32	RW	N
	3_h	TPDO3 Mapping Object 3	–	Uint32	RW	N
	4_h	TPDO3 mapping object 4	–	Uint32	RW	N
1A03h	–	TPDO4 Mapping Parameters	REC	–	–	–
	0_h	Number of valid mappings for TPDO4	–	Uint8	RW	N
	1_h	TPDO4 Mapping Object 1	–	Uint32	RW	N
	2_h	TPDO4 Mapping Object 2	–	Uint32	RW	N
	3_h	TPDO4 Mapping Object 3	–	Uint32	RW	N
	4_h	TPDO4 Mapping Object 4	–	Uint32	RW	N

11.2.8.3 List of 6000h cluster objects

The Canopen6000h group object dictionary assignment is shown in the following table.

Index	Sub index	Name	Access rights	Mapping option	Data type	Unit	Range	Default
6039	00	error code	RO	Y	UINT16	-	UINT16	-
6040	00	control word	RW	Y	UINT16	-	UINT16	0
6041	00	status word	RO	Y	UINT16	-	UINT16	-
6060	00	operating mode	RW	Y	UINT8	-	UINT8	0
6061	00	Operation mode display	RO	Y	UINT8	-	UINT8	-
6062	00	Position command value	RO	Y	INT32	command unit	INT32	-
6064	00	Actual position value	RO	Y	INT32	command unit	INT32	-
6065	00	Position Deviation Excess Threshold	RW	Y	UINT32	command unit	UINT32	3840000
6067	00	Position reaches threshold	RW	Y	UINT32	command unit	UINT32	100
6068	00	Position arrival time	RW	Y	UINT16	ms	UINT16	0
606B	00	Speed command value	RO	Y	INT16	0.1rpm	INT16	-
606C	00	Actual speed feedback value	RO	Y	INT16	0.1rpm	INT16	-
606D	00	Speed reaches threshold	RW	Y	UINT16	0.1rpm	UINT16	10
606E	00	speed arrival time window	RW	Y	UINT16	ms	UINT16	0

606F	00	Zero Speed Threshold	RW	Y	UINT16	0.1rpm	UINT16	10
6070	00	Zero-speed time window	RW	Y	UINT16	ms	UINT16	0
6071	00	Target torque value	RW	Y	INT16	0.1%	INT16	0
6074	00	Torque command value	RO	Y	INT16	0.1%	INT16	-
6075	00	Rated current value	RO	Y	UINT32	mA	UINT32	-
6076	00	Rated torque value	RO	Y	UINT32	mNm	UINT32	-
6077	00	Actual current value	RO	Y	INT16	0.1%	INT16	-
6078	00	Actual torque value	RO	Y	INT16	0.1%	INT16	-
607A	00	Target position value	RW	Y	INT32	command unit	INT32	0
607C	00	Home return bias	RW	Y	INT32	command unit	INT32	0
607D	01	Software limit min.	RW	Y	INT32	command unit	INT32	-2^31
	02	Software limit maximum	RW	Y	INT32	command unit	INT32	2^31
607F	00	Maximum speed limit	RW	Y	UINT32	0.1rpm	UINT32	50,000
6080	00	Maximum motor speed	RO	Y	UINT32	rpm	UINT32	-
6081	00	Profile position target speed value	RW	Y	UINT32	0.1rpm	UINT32	10000
6083	00	acceleration time	RW	Y	UINT16	ms	UINT16	200
6084	00	Deceleration time	RW	Y	UINT16	ms	UINT16	200
6087	00	Torque smoothing time	RW	Y	UINT16	ms	UINT16	200

6093	01	Electronic gear numerator (not supported at this time)	RW	Y	UINT32	–	UINT32	1
	02	Electronic gear denominator (not supported at this time)	RW	Y	UINT32	–	UINT32	1
6098	00	Home return method	RW	Y	UINT8	–	UINT8	0
6099	01	Home return to high speed	RW	Y	UINT16	0.1rpm	UINT16	1000
	02	Home return to low speed	RW	Y	UINT16	0.1rpm	UINT16	100
609A	00	Home return plus deceleration time	RW	Y	UINT16	ms	UINT16	200
60C1	01	Interpolation position absolute position value	RW	Y	INT32	command unit	INT32	0
60C2	01	Interpolation period value	RW	Y	UINT8	–	UINT8	1
	02	Interpolation cycle unit	RW	Y	INT8	–	INT8	-3
60F4	00	User position deviation	RO	Y	INT32	command unit	INT32	–
60FC	00	Motor position command	RO	Y	INT32	Encoder units	INT32	–
60FD	00	Digital input status	RO	Y	UINT16	–	UINT16	
60FE	00	Number of digital outputs	RO	N	UINT8	–	1	1

	01	Digital output status	RO	Y	UINT16	–	UINT16	0
60FF	00	Profile speed target speed value	RW	Y	INT16	0.1rpm	INT16	0
6502	00	Servo drive support operation mode	RO	Y	UINT16	–	UINT16	0

11.2.8.4 Detailed descriptions of 1000h objects

Object 1000h					
Index	1000 h				
Name	Device Type				
Object structure	VAR	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RO	Default	–
Function description	The Device Type parameter is used to describe the device sub-protocol or application specification used.				

<table>
<tr><th colspan="6">Object 1001h</th></tr>
<tr><td>Index</td><td colspan="5">1001 h</td></tr>
<tr><td>Name</td><td colspan="5">Error Register</td></tr>
<tr><td>Object structure</td><td>VAR</td><td>Data type</td><td>Uint8</td><td>Data range</td><td>Uint8</td></tr>
<tr><td>Mapping option</td><td>NO</td><td>accessibility</td><td>RO</td><td>Default</td><td>0x0</td></tr>
<tr><td>Function description</td><td colspan="5">Include error type information by bit, as in the following table.
<table>
<tr><th>bit</th><th>description</th><th>bit</th><th>description</th></tr>
<tr><td>0</td><td>common</td><td>4</td><td>communications</td></tr>
<tr><td>1</td><td>current</td><td>5</td><td>Sub- protocols</td></tr>
<tr><td>2</td><td>currents</td><td>6</td><td>Reserved</td></tr>
<tr><td>3</td><td>temperature</td><td>7</td><td>Manufacturer Definition</td></tr>
</table>
When an error occurs, the corresponding bit of the error is "1" and bit 0 must be "1" whenever there is an error.</td></tr>
</table>

Object 1003h	
index	1003 h
Name	Pro-defined Error Field

Object structure	ARR	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RO	Default	-

Sub index	00 h				
Name	Number of Errors				
Object structure	-	Data type	Uint32	Data range	0 to 4
Mapping option	NO	accessibility	RW	Default	0
Function description	Only 0 can be written, at which point all error records are cleared				

Sub index	1 to 4 h				
Name	Standard Error Field				
Object structure	-	Data type	Uint8	Data range	Uint8
Mapping option	NO	accessibility	RW	Default	-
Function description	When the Sub index is 0, it is not readable; when there is an error, the error is stored in the following format.				

MSB 31 … 16	LSB 15 … 0
Manufacturer Error Code	Standard Error Code

Object 1005h					
index	1005 h				
Name	Synchronization Message COB-ID (COB-ID SYNC Message)				
Object structure	VAR	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	0x80
Function description	Only 0x80h and 0x40000080h can be written. (a) When 0x00000080h is written, the synchronization generator does not operate. Activates the sync generator when 0x40000080h is written. The sync cycle period 1006h must be configured to be non-zero before activating the sync generator.				

Object 1006h	
index	1006 h
Name	Synchronization Cycle Period (Communication Cycle Period)

Object structure	VAR	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	0
Function description	The cycle time in 125us for the synchronous generator.				

Object 100Ch					
index	100C h				
Name	Node Guard Time (Guard Time)				
Object structure	VAR	Data type	Uint16	Data range	Uint16
Mapping option	NO	accessibility	RW	Default	0
Function description	For synchronous generators only, unit: ms. Used with lifetime factor for node protection.				

Object 100Dh					
index	100D h				
Name	Life Time Factor (LTF)				
Object structure	VAR	Data type	Uint8	Data range	Uint8
Mapping option	NO	accessibility	RW	Default	0
Function description	Must be greater than 1 when used.				

Object 1010h					
index	1010 h				
Name	Store Parameters				
Object structure	ARR	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	-

<table>
<tr>
<td>Function description</td>
<td>
Store parameter is to save the current value of the parameter to EEPROM, and the next time the EEPROM is loaded (re-power, reset node or reset communication), the value saved this time will be loaded.
When you need to save the parameter, you need to write "save" according to the ASCII code in addition to specifying the Sub index of the save area, and no other value can be saved 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 Sub index read return value indicates the way in which the Sub index holds its parameters. Return value format and meaning as follows.
MSB LSB
<table>
<tr><th>31 2</th><th>1</th><th>0</th></tr>
<tr><td>Reserved</td><td>0/1</td><td>0/1</td></tr>
</table>
<table>
<tr><th>value</th><th>description</th></tr>
<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>Automatically saves parameters only, does not receive commands to save parameters</td></tr>
<tr><td>3</td><td>The parameters can be saved automatically, or the number can be saved on command.</td></tr>
</table>
</td>
</tr>
</table>

Object 1011h					
index	1011 h				
Name	Restore Default Parameters				
Object structure	ARR	Data type	Uint32	Data range	-
Mapping option	NO	accessibility	RW	Default	

Function description

Restoring the default parameters is restoring the default parameters to the EEPROM and does not take effect immediately. The next time the EEPROM is loaded (power-on, node reset or reset communication), the Defaults (factory settings) will be loaded.

When you need to restore the default parameters, you need to write "load" according to the ASCII code in addition to specifying the sub-index corresponding to the recovery area; writing other values will not restore the Defaults successfully.

The correspondence of the writes is as follows.

MSB LS

ASCII	d	a	o	l
hexadecimal	64h	61h	6Fh	6C

The corresponding Sub index read return value indicates the way the Sub index holds its parameters. Return format and meaning.

MSB LB

31 1	0
Reserved	0/1

value	description
0	The device cannot restore the default parameters
1	The device can restore the default parameters

Object 1014h					
index	1014 h				
Name	Emergency Message COB-ID (COB-ID Emergency Message)				
Object structure	VAR	**Data type**	Uint32	**Data range**	Uint32
Mapping option	NO	**accessibility**	RW	**Default**	0x80+Node_ID
Function description	Bit31 of 0 indicates that the Emergency (EMCY) function is on (the servo will wait to send EMCY commands); Bit31 of 1 indicates that the Emergency (EMCY) function is off (the servo will not send EMCY commands).				

MSB LSB

31	30 to 11	10～0
0/1	00000000000000000000000	11-bits verification COB-ID

When an emergency message takes effect, its COB-ID must be consistent with this object.

Object 1016h	
index	1016 h
Name	Consumer Heartbeat Time (CHT)

<table>
<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 option</td><td>NO</td><td>accessibi lity</td><td>RW</td><td>Default</td><td></td></tr>
<tr><td>Function description</td><td colspan="5">The parameters include the address of the node to be monitored and the actual consumer time, and this time must be greater than the heartbeat producer time (unit: 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><td>31 24</td><td>23 16</td><td>15 0</td></tr><tr><td>Reservation (0)</td><td>Be watched address</td><td>Monitoring time</td></tr></table>The corresponding Sub index read return value indicates the way in which the Sub index restores the default parameters.</td></tr>
</table>

Sub index	00 h				
Name	Number of items (number entries)				
Object structure	-	Data type	Uint8	Data range	1
Mapping option	NO	accessibility	RO	Default	1
Function description	Only 0 can be written, at which point all error records are cleared.				

Sub index	01 h				
Name	Consumer Heartbeat Time (CHT)				
Object structure	-	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibi lity	RW	Default	0
Function description	Holds 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 option	NO	accessibi lity	RW	Default	
Function description	Units (ms) The producer hartbeat time defines the cycle time of the heartbeat.				

Object 1018h					
index	1018h				
Name	Device Object Description (Producer Heartbeat Time)				
Object structure	REC	Data type	Uint16	Data range	-
Mapping option	NO	accessibility	RO	Default	

Sub index	00 h				
Name	Number of projects				
Object structure	-	Data type	Uint8	Data range	3
Can you map	NO	accessibility	RO	Default	3

Sub index	01 h				
Name	Vendor ID (Vendor-ID)				
Object structure	-	Data type	Uint32	Data range	-
Mapping option	NO	accessibility	RO	Default	0x3B9
Function description	A unique number assigned by the CiA organization.				

Sub index	02 h				
Name	Product Code				
Object structure	-	Data type	Uint32	Data range	-
Mapping option	NO	accessibility	RO	Default	-
Function description	The equipment code corresponds to the product family and product model of the electronic tag, and the correspondence is as follows.				

31 16	15 0
Product Line	Product Model
MSB	LSB

Sub index	03 h				
Name	Equipment Revision Number				
Object structure	-	Data type	Uint32	Data range	-
Mapping option	NO	accessibility	RO	Default	-
Function description	Corresponding to the software version number 100Ah, the meaning is as follows.				

	31 16	15 0
	Main Revised Version	revised version
	MSB	LSB

Object 1029h					
index	1029 h				
Name	Error Behavior object (Error Behavior)				
Object structure	ARR	Data type	Uint8	Data range	Uint8
Mapping option	NO	accessibi lity	RW	Factory Settings	-
Function description	The state control to which the NMT for Canopen communication needs to automatically shift when different categories of errors occur. According to different values, the NMT shifts to different states.				

value	description
0	Turns to the pre-operation state when it is currently the operation state.
1	Keep the current state unchanged.
2	Go to stop.
other than it	Reserved.

Sub index	00 h				
Name	Largest Sub-index Supported				
Object structure	-	Data type	Uint8	Data range	1
Mapping option	NO	accessibility	RO	Default	1

Sub index	01 h				
Name	Communication Error				
Object structure	-	Data type	Uint8	Data range	-
Mapping option	NO	accessibi lity	RW	Default	0
Function description	Included communication errors include: NMT error control timeouts, PDO length errors, bus detachment, etc.				

Object 1200h					
index	1200 h				
Name	SDO Server Parameter				
Object structure	REC	Data type	-	Data range	-

<table>
<tr><td>Mapping option</td><td>NO</td><td>accessibility</td><td>RO</td><td>Default</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><td>31</td><td>30 to 11</td><td>100</td></tr><tr><td>0/1</td><td>000000000000000000000000</td><td>11-bits verification COB-ID</td></tr></table></td></tr>
</table>

Sub index	00 h				
Name	Number of projects				
Object structure	-	Data type	Uint8	Data range	2
Mapping option	NO	accessibility	RO	Default	2

Sub index	01 h				
Name	Client to Server COB-ID (COB-ID Client → Server(rx))				
Object structure	-	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RO	Default	0x600+Node_ID

Sub index	02 h				
Name	Server to Client COB-ID (COB-ID Server → Client(tx))				
Object structure	-	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RO	Default	0x580+Node_ID

Object 1400: RPDO1 Communication Parameter (RPDO Communication Parameter) Object 1402: RPDO2 Communication Parameter Object 1403: RPDO3 Communication Parameter (RPDO Communication Parameter) Object 1404: RPDO4 Communication Parameter					
index	1400 h to 1403 h				
Name	RPDO message COB-ID				
Object structure	REC	Data type	-	Data range	-
Mapping option	NO	accessibility	RW	Default	-

Sub index	00 h	

Name	Largest Sub-index Supported				
Object structure	-	Data type	Uint8	Data range	0 to 2
Mapping option	NO	accessibility	RO	Default	2

Sub index	01 h				
Name	COB-ID Used by RPDO (COB-ID Used by RPDO)				
Object structure	-	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	See functional description
Function description	Only the highest bit can be changed. A "0" indicates that the PDO is valid, and a "1" indicates that the PDO is invalid. MSB LB 31 | 30 to 11 | 10~0 0/1 | 00000000000000000000000 | 11-bits verification COB-ID The Default are as follows (Node_ID defaults to 1). 1400h: 0x80000200 + Node_ID 1401h: 0x80000300 + Node_ID 1402h: 0x80000400 + Node_ID 1403h: 0x80000500 + Node_ID				

Sub index	02 h				
Name	Reception type of RPDO (Reception type)				
Object structure	-	Data type	Uint8	Data range	Uint8
Mapping option	NO	accessibility	RW	Default	0
Function description	This value can only be modified if the PDO is invalid. Different values represent different PDO transfer types, as in the following table. value | description 0 | Synchronous acyclic 1 to 240 | synchronous cycle 254, 255 | Asynchronous acyclic				

Object 1600: RPDO1 Mapping Parameter Object 1601: RPDO2 Mapping Parameter Object 1602: RPDO3 Mapping Parameter Object 1603: RPDO4 Mapping Parameter	
index	1600 h to 1603 h
Name	RPDO Mapping Parameter (RPDO Mapping Parameter)

Object structure	REC	Data type	–	Data range	–
Mapping option	NO	accessibility	RW	Default	–
Function description	This object may only be modified in the PDO invalid state. The total bit length of the mapped object must not exceed 64 bits, and only per-byte mapping is supported, not per-bit mapping.				

Sub index	00_h				
Name	Number of valid mapping objects for PDO (Number of Mapped Application Objects in PDO)				
Object structure	–	Data type	Uint8	Data range	0 to 4
Mapping option	NO	accessibility	RW	Default	–
Function description	Writing 0 invalidates other Sub index mapping objects.				

Sub index	1_h to 4_h				
Name	RPDO Mapping for the nth Application Object to be Mapped				
Object structure	–	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	–
Function description	The mapped object content index and Sub index must exist in the object dictionary list, have the attributes in a writable state, and be mappable. The corresponding sub-indexes are written in the following format. MSB LSB				

31 16	15 8	7 0
index	Sub index	Object Length

RPDO default mapping content.

(1) RPDO1 (1600_h)

Sub index	value	description
0	1	Mapping 1 object
1	0x60400010	command word

(2) RPDO2 (1601_h)

word index	value	description
0	2	Mapping 2 objects
1	0x60410010	control word
2	0x60600008	Operation mode selection

(3) RPDO3 (1602_h)

word index	value	description

0	2	Mapping 2 objects
1	0x60410010	control word
2	0x607A0020	Target position (position command)

(4) RPDO4(1603 h)

Sub index	value	description
0	2	Mapping 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 1803 h: TPDO4 Communication Parameter					
index	1800 h– 1803 h				
Name	TPDO Communication Parameter				
Object structure	REC	Data type	–	Data range	–
Mapping option	NO	accessibility	RW	Default	–

Sub index	00 h				
Name	Largest Sub-index Supported				
Object structure	–	Data type	Uint8	Data range	0 to 4
Mapping option	NO	accessibility	RO	Default	5

Sub index	01 h				
Name	COB-ID Used by TPDO (COB-ID Used by TPDO)				
Object structure	–	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	See functional description
Function description	Only the highest bit can be changed; a "0" indicates that the TPDO is valid, and a "1" indicates that the PDO is invalid. MSB LSB 31 | 30 to 11 | 10~0 0/1 | 00000000000000000000000 | 11-bits verification COB-ID The Default are as follows (Node_ID defaults to 1). 1800h: 0x80000180 + Node_ID 1801h: 0x80000280 + Node_ID 1802h: 0x80000380 + Node_ID 1803h: 0x80000480 + Node_ID				

Sub index	02 h				
Name	Transmission type of TPDO(Transmission type)				
Object structure	-	Data type	Uint8	Data range	Uint8
Mapping option	NO	accessibility	RW	Default	255
Function description	This value can only be modified if the PDO is invalid. Different values represent different PDO transfer types, as in the following table. value / description: 0 — Synchronous, acyclic 1 to 240 — synchronous cycle 255 — Asynchronous, Periodic				

Sub index	03 h				
Name	Inhibit Time				
Object structure	-	Data type	Uint16	Data range	Uint16
Mapping option	NO	accessibility	RW	Default	8
Function description	This object can only be modified if the PDO is invalid. The unit is 125us. Note: The ban time is invalid when set to 0.				

Sub index	04 h				
Name	Reserved				
Object structure	-	Data type	Uint8	Data range	Uint8
Mapping option	NO	accessibility	RW	Default	0

Sub index	05 h				
Name	Event Timer				
Object structure	-	Data type	Uint16	Data range	Uint16
Mapping option	NO	accessibility	RW	Default	2
Function description	This object can only be modified if the PDO is invalid. The unit is 1ms. Note: When set to 0, the time timer is invalid.				

Object 1A00: TPDO1 Mapping Parameter (TPDO1 Mapping Parameter)

Object 1A01: TPD02 Mapping Parameter (TPD02 Mapping Parameter) Object 1A02: TPD03 Mapping Parameter (TPD03 Mapping Parameter) Object 1A03: TPD03 Mapping Parameter (TPD04 Mapping Parameter)					
index	1A00$_h$ to 1A03$_h$				
Name	TPDO Mapping Parameter				
Object structure	REC	Data type	-	Data range	-
Mapping option	NO	accessibility	RW	Default	-
Function description	This object can be modified only when the PDO state is invalid. The total bit length of the mapped object must not exceed 64 bits, and only per-byte mapping is supported, not per-bit mapping.				
Sub index	00 $_h$				
Name	Number of valid mapping objects for PDO (Number of Mapped Application Objects in PDO)				
Object structure	-	Data type	Uint8	Data range	0 to 4
Mapping option	NO	accessibility	RW	Default	-
Function description	When writing 0, the Sub index mapping object is invalid.				
Sub index	1 $_h$to 4 $_h$				
Name	TPDO Mapping for the nth Application Object to be Mapped				
Object structure	-	Data type	Uint32	Data range	Uint32
Mapping option	NO	accessibility	RW	Default	-
Function description	The mapped object content index and Sub indexes must exist in the object dictionary list, have the attributes in a writable state, and be mappable. Write the corresponding mapping object in the following format. MSB LSB				

31 16	15 8	7 0
index	Sub index	Object Length

TPDO default mapping content.

(1) TPDO1 (1A00 $_h$)

word index	value	description
0	1	Mapping 1 object
1	0x60410010	status word

(2) TPDO2(1A01 $_h$)

word index	value	description
0	2	Mapping 2 objects
1	0x60410010	status word
2	0x60610008	Current operating mode

(3) TPDO3(1A02 h)

word index	value	description
0	2	Mapping 2 objects
1	0x60410010	status word
2	0x60640020	Current position

(4) TPDO4(1A03 h)

word index	value	description
0	2	Mapping 2 objects
1	0x60410010	status word
2	0x606C0020	Current speed

11.2.8.5 Detailed descriptions of 6000h objects

Object 603Fh					
index	603F h				
Name	Error Code				
Object structure	VAR	Data type	UINT16	Data range	UINT16
Mapping option	Y	accessibility	RO	Default	0-
Parameter Description	Record the current fault information of the servo drive				

Object 6040h					
index	6040 h				
Name	Control Word				
Object structure	VAR	Data type	UINT16	Data range	UINT16
Mapping option	Y	accessibility	RW	Default	0

Parameter Description

Bit	value	function
0	0x0001	Servo Ready: 0 – not ready; 1 – ready.
1	0x0002	Turn on main circuit power: 0 – not turned on; 1 – turned on.
2	0x0004	Quick Stop: 0 – Quick Stop is valid; 1 – Quick Stop is not valid.
3	0x0008	Servo enable: 0 – not enabled; 1 – enabled.
4	0x0010	Rising edge triggers new position; high level triggers return home/interpolation mode.
5	0x0020	Immediate update in position mode: 0 – invalid; 1 – valid.
6	0x0040	Absolute/relative position selection: 0 – absolute position; 1 – relative position.
7	0x0080	Fault Reset.
8	0x0100	Reserved.
9	0x0200	Reserved.
10	0x0400	Reserved.
11	0x0800	Reserved.
12	0x1000	Reserved.
13	0x2000	Reserved.
14	0x4000	Reserved.
15	0x8000	Reserved.

Bit4 is a multiplexed bit for different control modes: position mode indicates a new position command trigger (rising edge trigger); home return mode indicates home return on (active at high level); interpolation mode indicates interpolation mode enable (active at high level).

Bit5 is the position mode function bit: when set high, the running position Command is interrupted immediately after the new position Command is triggered.

Bit6 is the function bit in position control mode: 0 – absolute position command; 1 – relative position command.

Bit7 is the common bit for all control modes: rising edge indicates the fault reset function.

Bit8 is a bit common to all control modes: the rising edge indicates a pause in the operation of the position, speed, home, interpolation and other modes being performed.

Object 6041h					
index	6041 h				
Name	Status Word				
Object structure	VAR	Data type	UINT16	Data range	UINT16

Mapping option	Y	accessibility	RO	Default	0

Parameter Description

Bit	value	function
0	0x0001	Servo ready.
1	0x0002	Waiting to turn on servo enable
2	0x0004	Servo operation
3	0x0008	faults
4	0x0010	Turn on main circuit power: 0 - not turned on; 1 - turned on.
5	0x0020	quick stop
6	0x0004	Power on to allow operation
7	0x0080	warning
8	0x0100	Manufacturer customization (reserved)
9	0x0200	Remote control: 0 - non-Canopen mode; 1 - Canopen remote control mode
10	0x0400	Target arrival: 0 - not arrived; 1: target position or speed arrived
11	0x0800	Software internal position overrun: 0 - within valid range; 1 - position command or feedback exceeds software internal position limit.
12	0x1000	Position mode: 0 - Allow receiving position command; 1 - Do not allow receiving position command.
		Speed mode: 0 - non-zero speed; 1 - zero speed.
		Return to zero mode: 0 - not completed; 1 - return to zero is completed.
		Interpolation mode: 0 - Interpolation mode is not active; 1 - Interpolation mode is active.
13	0x2000	Home return failure flag: 0 - no error occurred in return to zero; 1 - error occurred in return to zero
14	0x4000	Manufacturer customization (reserved)
15	0x8000	0-Home return is not completed; 1-Home return is completed (the position bit when the reference point is found).

Bit4 is the general purpose bit. Set high to indicate servo drive power up. The control state is initialized with this position 1.
Bit 7 is a general purpose bit. This bit is automatically set when an alarm exists in the servo drive.
Bit8 is the general purpose bit. The change bit is set if the servo drive has motion.

	Bit 9 is the general purpose bit. the change bit is automatically set when the CAN function is enabled. The control state machine initializes this position bit. Bit10 Position speed dedicated bit. In position mode, this position bit when the servo positioning is completed; in speed mode, this position bit when the servo speed reaches the set speed. Bit11 General purpose bit. This position bit is used when the servo run position value exceeds the set position limit value. Bit12 position, speed, interpolation mode with. In position mode, bit12=0 means the drive is allowed to receive new position fingers, bit12=1 means the drive is not allowed to receive new position fingers; in speed mode, bit12=1 means the current motor running speed reaches 0 speed; in interpolation mode, bit12=1 means the interpolation mode is activated; in home return mode, 0 means the home return is not completed; 1 means the home return is completed. Bit13 is a position, home point dedicated bit. In position mode, this position bit when the position deviation value exceeds the set threshold; in origin mode, the home return fails this position bit. Bit15 is the all modes common bit. The servo drive all performs home return and has completed home return; this bit is set when the reference point for home return is found.

Object 6060h					
index	6060 h				
Name	Modes of Operation				
Object structure	VAR	Data type	UINT8	Data range	UINT8
Mapping option	Y	accessibility	RW	Default	0
Parameter Description					

Setting	Control mode setting
1	Profile position mode
2	Profile speed mode
4	Profile Torque Mode
6	Home return model
7	Interpolation position mode
other	undefined

Object 6061h					
index	6060 h				
Name	Modes of Operation Display				
Object structure	VAR	Data type	UINT8	Data range	UINT8

Mapping option	Y	accessibility	RO	Default	0
Parameter Description					

displayed value	Control mode display
1	Profile position mode
3	Profile speed mode
4	Profile Torque Mode
6	Home return model
7	Interpolation position mode
other	undefined

Object 6062h					
index	6062 h				
Name	Position Demand Value				
Object structure	VAR	Data type	INT32	Data range	INT32
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Position command value in command units				

Object 6064h					
index	6064 h				
Name	User Position Feedback (Position Actual Value)				
Object structure	VAR	Data type	INT32	Data range	INT32
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Position feedback value in command units				

Object 6065h					
index	6065 h				
Name	User Position Deviation Excess Threshold (Following Error Window)				
Object structure	VAR	Data type	UINT32	Data range	UINT32
Mapping option	Y	accessibility	RW	Default	60,000
Parameter Description	Position deviation value threshold during motor operation, in command units. If the position deviation exceeds this value, the servo will alarm that the position deviation is too large.				

Object 6067h

index	6067 h				
Name	Position Reach Threshold (Position Window)				
Object structure	VAR	Data type	UINT32	Data range	UINT32
Mapping option	Y	accessibility	RW	Default	100
Parameter Description	The position command deviation value is less than the position arrival threshold and lasts for a period of time, the position arrival signal is set to 1. Unit: command unit				

Object 6068h					
index	6068 h				
Name	Position Window Time				
Object structure	VAR	Data type	UINT16	Data range	UINT16
Mapping option	Y	accessibility	RW	Default	0
Parameter Description	Position arrival time (unit: ms). When the position command deviation is within the position command deviation threshold, and after position window time, it indicates that motor positioning is complete.				

Object 606Bh					
index	606B h				
Name	User Actual Speed Demand Value				
Object structure	VAR	Data type	INT16	Data range	INT16
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Motor running speed command value unit: 0.1rpm.				

Object 606Ch					
index	606C h				
Name	Speed Actual Value				
Object structure	VAR	Data type	INT16	Data range	INT16
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Actual motor running speed value in 0.1rpm.				

Object 606Dh					
index	606D h				
Name	Speed Window				
Object structure	VAR	Data type	UINT16	Data range	UINT16
Mapping option	Y	accessibi lity	RW	Default	100
Parameter Description	The speed deviation is located within the speed arrival threshold and continues for a period of time before the speed arrival signal is set to 1, unit: 0.1 rpm.				

Object 606Eh					
index	606E h				
Name	Speed Window Time				
Object structure	VAR	Data type	UINT16	Data range	UINT16
Mapping option	Y	accessibi lity	RW	Default	0
Parameter Description	The speed deviation value lies within the speed threshold, the run time reaches the time window value, and the speed arrival signal is set to 1. Unit ms.				

Object 606Fh					
index	606F h				
Name	Speed Threshold				
Object structure	VAR	Data type	UINT16	Data range	0 to 2000
Mapping option	Y	accessibi lity	RW	Default	10
Parameter Description	When the speed is close to 0 speed, the 0 speed arrival signal is set to 1 when the speed is within the 0 speed threshold for a period of time. unit 0.1rpm.				

Object 6070h					
index	6070 h				
Name	Speed Threshold Time				
Object structure	VAR	Data type	UINT16	Data range	UINT16
Mapping option	Y	accessibi lity	RW	Default	0
Parameter Description	0 Speed arrival time window value in ms.				

Object 6071h	
index	6071 h

Name	Target torque				
Object structure	VAR	Data type	INT16	Data range	-5000 to 5000
Mapping option	Y	accessibility	RW	Default	0
Parameter Description	For profile torque mode only, reflecting the torque command (unit: 0.1%).				

Object 6074h					
index	6074 h				
Name	Torque demand value				
Object structure	VAR	Data type	INT16	Data range	-5000 to 5000
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Output value for profile torque mode only, torque limiting condition (unit: 0.1%).				

Object 6075h					
index	6075 h				
Name	Motor rated current (Motor rated current)				
Object structure	VAR	Data type	UINT32	Data range	UINT32
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Rated current (in mA) on the motor nameplate. All parameter values related to current are associated with this parameter.				

Object 6076h					
index	6076 h				
Name	Motor rated torque (Motor rated torque)				
Object structure	VAR	Data type	UINT32	Data range	UINT32
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Rated torque (in mNm) on the motor nameplate. All torque related parameter values are related to this parameter.				

Object 6077h.					
index	6077 h				
Name	Motor actual torque				
Object structure	VAR	Data type	INT16	Data range	INT16
Mapping option	Y	accessibility	RO	Default	0

Parameter Description	Reacts to the instantaneous torque output size of the servo motor (unit: 0.1%).

Object 6078h					
index	6078 h				
Name	Current actual value				
Object structure	VAR	Data type	INT16	Data range	INT16
Mapping option	Y	accessibility	RO	Default	0
Parameter Description	Reacts to the instantaneous current output magnitude of the servo motor (unit: 0.1%).				

Object 607Ah					
index	607A h				
Name	Target Position				
Object structure	VAR	Data type	INT32	Data range	INT32
Mapping option	Y	accessibility	RW	Default	0
Parameter Description	Sets the servo target position in Profile position mode (unit: command unit). When bit 6 of control word 6040h is 0, 607Ah is the target absolute position of the current segment; when bit 6 of control word 6040h is 1, 607Ah is the target incremental displacement of the current segment.				

Object 607Ch					
Index	607Ch				
Name	Home Offset				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RW	Default	0
Description	The position offset value of zero point to home position after home position return, Unit: Command unit				

Object 607Dh					
Index	607Dh				
Name	Software Absolute Position Limit (Software Position Limit)				
Structure	ARR	Data Type	INT32	Range	INT32

Sub-index	0				
Name	Numbers of Object in dictionary (Number of Entry)				
Structure	ARR	Data Type	UINT8	Range	2

Mapping Option	N	Accessibility	RO	Default	2

Sub-index	1				
Name	Min Software Absolute Position Limit (Min Software Position Limit)				
Structure	VAR	Data Type	INT32	Range	INT32
Mapping Option	Y	Accessibility	RW	Default	-2^{31}
Description	The minimum position value in position operation that is defined by software, Unit: Command unit				

Sub-index	2				
Name	Max Software Absolute Position Limit (Max Software Position Limit)				
Structure	VAR	Data Type	INT32	Range	INT32
Mapping Option	Y	Accessibility	RW	Default	$2^{31}-1$
Description	The max position value in position operation that is defined by software, Unit: Command unit				

Object 607Fh					
Index	$607F_h$				
Name	Max Profile Velocity				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RW	Default	50000
Description	Set the maximum running speed. (Unit: 0.1rpm)				

Object 6080h					
Index	6080_h				
Name	Max Motor Speed				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	Maximum speed limit
Description	Max motor speed, referring to sevro motor manual. (Unit: rpm)				

Object 6081h					
Index	6081_h				
Name	Profile Velocity				
Structure	VAR	Data Type	UINT32	Range	UINT32
Mapping option	Y	Accessibility	RW	Default	10000

Description	The given speed in profile position mode. Unit: 0.1 RPM

Object 6083h					
Index	607Fh				
Name	Profile Acceleration Time (Profile Acceleration)				
Structure	VAR	Data Type	UINT16	Range	UINT16
Mapping Option	Y	Accessibility	RW	Default	200
Description	In profile position mode, the acceleration time from 0rpm to the maximum speed. (Unit: ms)				

Object 6084h					
Index	6084h				
Name	Profile deceleration time (Profile Deceleration)				
Structure	VAR	Data Type	UINT16	Range	UINT16
Mapping Option	Y	Accessibility	RW	Default	200
Description	In profile position mode, the decelerationtime from the maximum speed to 0rpm. (Unit: ms)				

Object 6098h					
Index	6098h				
Name	Homing method				
Structure	VAR	Data Type	INT8	Range	0～35
Mapping Option	Y	Accessibility	RW	Default	0
Description	Definition of Home position return method				

Value	Description
1	Homing when reach reverse limit switch or receive the Z pule singal
2	Homing when reach forward limit switch or receive the Z pule singal
3，4	Homing when reachfoward home position switch or receive the Z pule singal
5，6	Homing when reach reverse home position switch or receive the Z pule singal
7～14	Homing when reach home position switch or receive the Z pule singal
15～16	Reserved
17～30	Homing is not correlated with Z pulse signal
31～32	Reserved
33～34	Homing is not correlated with Z pulse signal
35	Reset at current position

●The ER.E03 alarm is generated when the data is not set according to the above rules.

Object 6099h					
Index	6099h				
Name	Homing Speeds				
Structure	ARR	Data Type	UINT16	Range	UINT16
Mapping Option	Y	Accessibility	RW	Default	–

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	UINT8	Range	2
Mapping Option	Y	Accessibility	RO	Default	2

Sub-index	1				
Name	Search speed of deceleration point signal (Speed During Search for Switch)				
Structure	VAR	Data Type	UINT16	Range	UINT16
Mapping Option	Y	Accessibility	RW	Default	1000
Description	Return to home position in high speed. Unit: 0.1rpm				

Sub-index	2				
Name	Search speed of home position signal (Speed During Search for Zero)				
Structure	VAR	Data Type	UINT16	Range	1～500
Mapping Option	Y	Accessibility	RW	Default	100
Description	Return to home position in low speed. Unit: 0.1rpm				

Object 609Ah					
Index	609Ah				
Name	Home Position Return Acceleration Time (Homing Acceleration)				
Structure	VAR	Data Type	UINT16	Range	UINT16
Mapping Option	Y	Accessibility	RW	Default	1000
Description	During home position return process, the acceleration time from 0rpm to the 3000ms. (Unit: ms)				

Object 60C1h

Index	$60C1_h$				
Name	Interpolation data record				
Structure	ARR	Data Type	INT32	Range	INT32
Mapping Option	Y	Accessibility	RW	Default	0
Description	Command parameter setting of the interpolation mode.				

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	UINT8	Range	3
Mapping Option	N	Accessibility	RO	Default	3

Sub-index	1				
Name	Absolute Position Command (Position Command)				
Structure	VAR	Data Type	INT32	Range	INT32
Mapping Option	Y	Accessibility	RW	Default	0
Description	Absolute position command value in interpolation mode. Unit: Command unit				

Object 60C2h					
Index	$60C2_h$				
Name	Interpolation Time Period				
Structure	ARR	Data Type	UINT8	Range	UITN8
Mapping Option	Y	Accessibility	RW	Default	0

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	UINT8	Range	2
Mapping Option	N	Accessibility	RO	Default	2
Description	The number of sub-indexes in the object dictionary of interpolation period				

Sub-index	1				
Name	Interpolation period time constant (Interpolation Time Units)				
Structure	VAR	Data Type	UINT8	Range	UINT8
Mapping Option	Y	Accessibility	RW	Default	1
Description	Interpolation period time, unit is given by 60C2 02.				

	Eg: when 60C2_02=-3, 60C2_01=1, it indicates that the current interpolation period is 1ms. Note: The interpolation period must be the same as the synchronization period.

Sub-index	2				
Name	Interpolation period time unit (Interpolation Time Index)				
Structure	VAR	Data Type	INT8	Range	INT8
Mapping Option	Y	Accessibility	RW	Default	-3
Description	Set the unit of interpolation period. When set "-3", the unit of interpolation period is1 ms. When set "-4", the unit of interpolation period is 0.1ms. When set "-2", the unit of interpolation period is 10ms.				

Object 60F4h					
Index	60F4h				
Name	User Position Deviation (Following Error Actual Value)				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Real-time position deviation (unit: customized).				

Object 60FCh					
Index	60FCh				
Name	Motor position command (Position Demand Value*)				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Motor real time position command (electronic gear units: increments) User position command (6062h)× electronic gear ratio = motor position command (60FCh)				
Object 60FDh					
Index	60FDh				
Name	Digital Input				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Indicating the DI terminal logic of the drive. "0" indicates invalid, and "1" indicates valid				

31～16	15～4	3	2	1	0

	Factory defined	Resevered	Null	Null	Forward overrange switch	Reverse overrange switch

Object 60FEh					
Index	60FE_h				
Name	Digital Output				
Structure	ARR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	0

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	Uint8	Range	1
Mapping Option	N	Accessibility	RO	Default	1

Sub-index	1				
Name	Physical Outputs				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Indicating the DI terminal logic of the drive. “0” indicates invalid, and “1” indicates valid				

31～16	15～1	0
Factory defined	Resevered	Break output signal

Object 60FFh: Target Velocity					
Index	60FF_h				
Name	Digital input				
Structure	VAR	Data Type	INT16	Range	INT16
Mapping Option	Y	Accessibility	RW	Default	0
Description	The parameter that is used to adjust the speed in profile velocity mode. (Unit:0.1rpm)				

Object 6502h: Supported Drive Modes					
Index	6502_h				
Name	Mode options supported by the driver				
Structure	VAR	Data Type	UINT16	Range	UINT16
Mapping Option	Y	Accessibility	RO	Default	1B_h

<table>
<tr><td>Description</td><td>Servo mode options supported by the driver. 0 indicates unsupported and 1 indicates supported
<table>
<tr><th>Code</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>Porfile 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>Home position return mode</td><td>1</td></tr>
<tr><td>6</td><td>Interpolation position mode</td><td>1</td></tr>
<tr><td>7～15</td><td>Rsv</td><td>0</td></tr>
</table>
</td></tr>
</table>

11.2.9 Canopen Transmission Abort Code

Code	Description
0x05040001	Invalid commands (SDO only supports 0x40, 0x2F, 0x2B, 0x23 commands)
0x06010002	Attempt to write a read-only object
0x06020000	The object in the object dictionary does not exist
0x06040041	Object cannot map to PDO
0x06040042	The number and length of mapped objects exceed the PDO length
0x06070010	Written length does not match (written length inconsistent with object dictionary definition)
0x06070012	Data types do not match and service parameter lengths do not match
0x06090011	Sub-index does not exist
0x06090031	The written parameter value is too large
0x06090032	The write parameter value is too small

11.3.6.3 1000h Group Object Details

Object 1000h					
Index	1000_h				
Name	Device Type				
Structure	VAR	Data Type	Uint32	Range	–
Mapping Option	NO	Accessibility	RO	Default	0x00020192
Description	The device type parameter describes the device subprotocol or application specification used.				

BIT	Name	Description
0～15	Device subprotocol	402(0x192): Device subprotocol
16～23	Type	02: Sevro driver
25～31	Mode	Factory defined

Object 1001h					
Index	1001_h				
Name	Error Register				
Structure	VAR	Data Type	Uint8	Range	–
Mapping Option	NO	Accessibility	RO	Default	0x0
Description	The definition of each bit, shown as follows:				

Bit	Definition	Bit	Definition
0	General	4	Communication
1	Current	5	Subprotocol
2	Voltage	6	Reserved
3	Temperature	7	Factory defined

When an error occurs, the value of corresponding bit will be "1", and Bit 0 must be "1" whenever there is an error.

Object 1008h					
Index	1008h				
Name	Manufacturer Device Name				
Structure	REC	Data Type	Uint8	Range	–
Mapping Option	NO	Accessibility	RO	Default	Servo Device

Object 100Ah					
Index	100Ah				
Name	Software Version				
Structure	REC	Data Type	Uint8	Range	–
Mapping Option	NO	Accessibility	RO	Default	Based on drive model

Object 1018h					
Index	1018h				
Name	Identity Object				
Structure	REC	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	

Sub-index	00h				
Name	Nnumber of entries				
Structure	-	Data Type	Uint8	Range	4
Mapping Option	NO	Accessibility	RO	Default	4

Sub-index	01h				
Name	Vendor-ID				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	0x850104
Description	A unique number assigned by the ETG.				

Sub-index	02h				
Name	Product Code				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	-
Description	The device code corresponds to the product series and model of the e-label as follows: 31~16 / 15~0 Product Series / Product Model MSB / LSB				

31~16	15~0
Product Series	Product Model
MSB	LSB

Sub-index	03h				
Name	Revision Number				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	-
Description	This parameter corresponds to the software version number 100Ah:				

MSB	LSB
31~16	15~0
Primary Version	Secondary Version

Object 1600 Object 1601 Object 1602 Object 1603					
Index	1600_h～1603_h				
Name	RPDO Mapping Parameter				
Structure	REC	Data Type	–	Range	–
Mapping Option	NO	Accessibility	RW	Default	–
Description	You can only modify this object if the PDO is invalid. The total bit length of a mapped object cannot exceed 32 bytes. Only byte mapping is supported, but not bitwise mapping is supported.				

Sub-index	00_h				
Name	Number of Mapped Application Objects in PDO				
Structure	–	Data Type	Uint8	Range	0～4
Mapping Option	NO	Accessibility	RW	Default	–
Description	When set "0", other Sub-index's mapped objects is invalid.				

Sub-index	1_h～8_h				
Name	PDO Mapping for the nth Application Object to be Mapped				
Structure	–	Data Type	Uint32	Range	Uint32
Mapping Option	NO	Accessibility	RW	Default	–
Description	The index and subindex of the mapped object content must exist in the object dictionary list, The properties shall be writable and mappable. Write the corresponding sub-index in the following format				

MSB		LSB
31~16	15~8	7~0
Index	Sub-index	Length of object

RPDO Default Mapping Content:

(1) RPDO1 (1600_h)

Sub-index	Value	Description
0	1	Map 1 object
1	0x60400010	Control word

(2) RPDO2 (1601_h)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Control word
2	0x60600008	Operation 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(1603h)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Control word
2	0x60FF0020	Target speed (speed command)

Object 1A00 Object 1A01 Object 1A02 Object 1A03					
Index	1A00h～1A03h				
Name	TPDO Mapping Parameter				
Structure	REC	Data Type	–	Range	–
Mapping Option	NO	Accessibility	RW	Default	–
Description	You can only modify this object if the PDO is invalid. The total bit length of a mapped object cannot exceed 32 bytes. The mapped object supports byte mapping only but not bitwise mapping.				
Sub-index	00h				
Name	Number of Mapped Application Objects in PDO				
Structure	–	Data Type	Uint8	Range	0～4
Mapping Option	NO	Accessibility	RW	Default	–
Description	When set “0”, the mapped object of the subindex is invalid.				

Sub-index	1h～8h				
Name	TPRO Mapped object (PDO Mapping for the nth Application Object to be Mapped)				
Structure	–	Data Type	Uint32	Range	Uint32
Mapping Option	NO	Accessibility	RW	Default	–
Description	The Index and sub-index of the mapped object must be in the object dictionary list. The properties shall be writable and mappable. Write the corresponding mapped object in the following format:				

31~16	15~ 8	7~ 0
Index	Sub-index	Length of object

TPDO default mapping content:

(1)TPDO1(1A00h)

Sub-index	Value	Description

0	1	Map 1 object
1	0x60410010	Status word

(2) TPDO2 ($1A01_h$)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Status word
2	0x60610008	Current running mode

(3) TPDO3 ($1A02_h$)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Status word
2	0x60640020	Current position

(4) TPDO4 ($1A03_h$)

Sub-index	Value	Description
0	2	Map 2 objects
1	0x60410010	Status word
2	0x606C0020	Current velocity

Object 1C12h: Sync Manager 2 RPDO Assignment					
Index	1C12h				
Name	Sync Manager 2 RPDO Assignment				
Structure	ARR	Data Type	Uint16	Range	–
Mapping Option	NO	Accessibility	RW	Default	1

Sub-index	00_h				
Name	Max Sub-index of Sync Manager 2 RPDO Assignment				
Structure	–	Data Type	Uint8	Range	0～1
Mapping Option	NO	Accessibility	RW	Default	1

Sub-index	01_h				
Name	Index of RPDO Assignment Object				
Structure	–	Data Type	Uint16	Range	0～65535
Mapping Option	YES	Accessibility	RW	Default	0x1601
Description	Set the RPDO assignment Index: 1. Must be configured in the stand by state 2. Use TwinCAT software to select the RPDO assignment directly, otherwise follow the steps below: a. 1C12-00h Write value 0				

	b. 1C12-01h writes the pre-used RPDOx (1600h to 1603h) and configures the RPDOx mapped object (e.g. 1600h) c.1C12-00h write value 1

Object 1C13h: Sync Manager 2 TPDO Assignment					
Index	1C13h				
Name	Sync Manager 2 TPDO Assignment				
Structure	ARR	Data Type	Uint16	Range	–
Mapping Option	NO	Accessibility	RW	Default	1

Sub-index	00h				
Name	Max Sub-index of Sync Manager 2 TPDO Assignment				
Structure	–	Data Type	Uint8	Range	0～1
Mapping Option	NO	Accessibility	RW	Default	1

Sub-index	01h				
Name	Index of TPDO Object				
Structure	Uint16	Data Type		Range	0～65535
Mapping Option	YES	Accessibility	RW	Default	0x1A01
Description	Set the TPDO assignment Index: 1. Must be configured in the stand by state 2.Use TwinCAT software to select the TPDO assignment directly, otherwise follow the steps below: a.1C13-00h write the value 0 b. 1C13-01h writes the pre-used TPDOx (1A00h to 1A03h) and configures the RPDOx mapped object (e.g. 1A00h) c.1C13-00h write value 1				

Object 1C32h: Sync Manager 2 output Paramater					
Index	1C32h				
Name	Sync Manager 2 output Paramater				
Structure	REC	Data Type	–	Range	–
Mapping Option	NO	Accessibility	RO	Default	–

Sub-index	00h				
Name	Max Sub-index Sync Manager 2 output Paramater				
Structure	–	Data Type	Uint8	Range	–
Mapping Option	NO	Accessibility	RO	Default	32

Sub-index	01h				
Name	Sync Type				
Structure	–	Data Type	Uint16	Range	–
Mapping Option	NO	Accessibility	RO	Default	32
Description	0x0002 indicates that the synchronization type of SM2 is distributed clock synchronization 0 mode.				

Sub-index	02h				
Name	Cycle time (ns)				
Structure	–	Data Type	Uint32	Range	–
Mapping Option	NO	Accessibility	RO	Default	0
Description	Indicates the period of SYNC0.				

Sub-index	04h				
Name	Sync Tpye Supported				
Structure	–	Data Type	Uint16	Range	–
Mapping Option	NO	Accessibility	RO	Default	4
Description	Indicates the distribution clock type. 0x0004 indicates the distribution clock synchronization 0 mode.				

Sub-index	05h				
Name	Min Period time(ns)				
Structure	–	Data Type	Uint32	Range	–
Mapping Option	NO	Accessibility	RO	Default	125000
Description	Indicates the minimum synchronization period supported by the slave				

Sub-index	06h				
Name	Calculation and Copy Time (ns)				
Structure	–	Data Type	Uint32	Range	–
Mapping Option	NO	Accessibility	RO	Default	–

Sub-index	08h				
Name	Get cycle time				
Structure	–	Data Type	Uint16	Range	–
Mapping Option	NO	Accessibility	RW	Default	–

Sub-index	09_h				
Name	Delay time (ns)				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	$0A_h$				
Name	SYNC0 Cycle time				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RW	Default	-
Description	In distribution clock mode, the value of ESC register 09A0h is set				

Sub-index	$0B_h$				
Name	Number of lost sync events				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	$0C_h$				
Name	Cycle over count				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	-
Description	Due to too small setting period				

Sub-index	20_h				
Name	Synchronization error				
Structure	-	Data Type	BOOL	Range	-
Mapping Option	NO	Accessibility	RO	Default	-
Description	TURE: Sync is active and no error occurred. False: Sync is not active or no sync error occurred.				

Object 1C33h: Sync Manager 2 input Parameter					
Index	1C33h				
Name	Sync Manager 2 input Parameter				
Structure	REC	Data Type	-	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	00_h	

Name	Max Sub-index of Sync Manager 2 input Parameter				
Structure	-	Data Type	Uint8	Range	-
Mapping Option	NO	Accessibility	RO	Default	32

Sub-index	01_h				
Name	Synchronization Type				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	32
Description	0x0002 indicates that the synchronization type of SM2 is distribution clock synchronization 0 mode.				

Sub-index	02_h				
Name	Cycle time (ns)				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	0
Description	Indicates the period of SYNC0.				

Sub-index	04_h				
Name	Supported Sync Types				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	4
Description	Indicates the distribution clock type. 0x0004 indicates the distribution clock synchronization 0 mode.				

Sub-index	05_h				
Name	Minimum period time (ns)				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	125000
Description	Indicates the minimum synchronization period supported by the slave.				

Sub-index	06_h				
Name	Calculate and copy time (ns)				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	08_h	

Name	Get cycle time				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RW	Default	-
Sub-index	09h				
Name	Delay time (ns)				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	0Ah				
Name	SYNC0 Cycle time				
Structure	-	Data Type	Uint32	Range	-
Mapping Option	NO	Accessibility	RW	Default	-
Description	Same value as 1C32-0Ah				

Sub-index	0Bh				
Name	Number of lost sync events				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	0Ch				
Name	Cycle over count				
Structure	-	Data Type	Uint16	Range	-
Mapping Option	NO	Accessibility	RO	Default	-

Sub-index	20h				
Name	Synchronization error				
Structure	-	Data Type	BOOL	Range	-
Mapping Option	NO	Accessibility	RO	Default	-
Description	TURE: Sync is active and no error occurred. False: Sync is not active or no sync error occurred.				

11.3.6.4 6000h Parameter Group Object Details

Character Descriptions

Character	Description
HM	Home position return mode

CSP	Periodic synchronous position mode
PP	Profile position mode
CSV	Periodic synchronous velocity mode
PV	Profile velocity mode
CST	Periodic ProfileTorque Mode
PT	Profile torque mode

Object 603Fh			HM	CSP	PP	CSV	PV	CST	PT
Index	603Fh								
Name	Error Code								
Structure	VAR	Data Type	Uint16	Range	Uint16				
Mapping Option	Y	Accessibility	RO	Default	-				
Description	The fault code is the error that occurred on the last operation. Check the fault list for details.								

Object 6040h			HM	CSP	PP	CSV	PV	CST	PT
Index	6040h								
Name	Control Word								
Structure	VAR	Data Type	Uint16	Range	Uint16				
Mapping Option	Y	Accessibility	RW	Default	0				

<table>
<tr><td rowspan="14">Description</td><td colspan="3">Bit definition of the control word:</td></tr>
<tr><th>Bit</th><th>Definition</th><th>Description</th></tr>
<tr><td>0</td><td>Servo ready</td><td>0 – invalid; 1 – valid.</td></tr>
<tr><td>1</td><td>Turn on main circuit power</td><td>0 – invalid; 1 – valid.</td></tr>
<tr><td>2</td><td>Quick stop</td><td>0 – invalid; 1 – valid.</td></tr>
<tr><td>3</td><td>Servo running</td><td>0 – invalid; 1 – valid.</td></tr>
<tr><td>4～6</td><td>Mode-related</td><td>
<table>
<tr><th rowspan="2">Bit</th><th colspan="4">Operation 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 trigger</td><td>Reserved</td><td>Reserved</td><td>Home position return ON</td></tr>
<tr><td>5</td><td>0:Non-immediate update
1:Update Now</td><td>Reserved</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>6</td><td>0:Absolute position
1:Relative position</td><td>Reserved</td><td>Reserved</td><td>Reserved</td></tr>
</table>
</td></tr>
<tr><td>7</td><td>Fault Reset</td><td>bit7 rising edge valid.
bit7 is held at 1. All other control commands are invalid.</td></tr>
<tr><td>8</td><td>Pause</td><td>Temporarily unsupported.</td></tr>
<tr><td>9～10</td><td>NA</td><td>Reserved</td></tr>
<tr><td>11～15</td><td>Factory defined</td><td>Reserved</td></tr>
</table>

<table>
<tr><th>Object 6041h</th><th colspan="3"></th><th>HM</th><th>CSP</th><th>PP</th><th>CSV</th><th>PV</th><th>CST</th><th>PT</th></tr>
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<tr><td>Name</td><td colspan="10">Status Word</td></tr>
<tr><td>Structure</td><td>VAR</td><td>Data Type</td><td colspan="2">Uint16</td><td colspan="2">Range</td><td colspan="4">Uint16</td></tr>
</table>

Mapping Option	Y	Accessibility	RO	Default	0

Description

Indicate servo state:

Bit	Name	Definition
0	Servo ready	1:Valid; 0:Invalid
1	Waiting to turn on servo enable	1:Valid; 0:Invalid
2	Servo running	1:Valid; 0:Invalid
3	Fault	0:no fault;1:with fault
4	Turn on main circuit power	
5	Quick stop	-
6	Power on to allow operation	-
7	Warning	Reserved
8	Factory defined	
9	Remote control	0 - Non-Canopen mode. 1-Canopen remote control mode.
10	Target arrival	Speed mode: 0:Target speed is not reached. 1:Target speed is reached. Position mode: 0:Target position is not reached. 1:Target position is reached.
11	Software internal position overrun	0-Position command or feedback does not reach the software internal position limit. 1-Position command or feedback reaches the internal software position limit.
12	Zero speed signal	Speed mode: 0:Non-zero speed. 1:Zero speed. Position mode: 0:Allow to receive new position. 1:Do not allow to receive new position. Home position return mode: 0:Home position return not completed.

			1:Home position return has been completed.
	13	Home position return error	Home position return failure flag: 0:No error occurred in home position return 1:Home position return error occurred (Home position return mode, home position return timeout)
	14	NA	Reserved
	15	Home position return completed	0-Home position return is not performed or not completed. 1-Home position return has been completed and the reference point has been found.

Index	6060_h				
Name	Modes of Operation				
Structure	VAR	Data Type	Int8	Range	Int8
Mapping Option	Y	Accessibility	RW	Default	8
Description	Set the servo operation mode:				

Value	Description
0	Reserved
1	Profile position mode (pp)
3	Profile velocity mode (pv)
4	Profile torque mode (pt)
6	Home position return mode (hm)
8	Periodic synchronous position mode (csp)
9	Cyclic synchronous velocity mode (csv)
10	Periodic synchronous torque mode (cst)

Object 6061h			HM	CSP	PP	CSV	PV	CST	PT
Index	6061_h								
Name	Modes of Operation Display								
Structure	VAR	Data Type	Int8	Range		Int8			
Mapping Option	Y	Accessibility	RO	Default		0			

Description	Displays the servo operation mode, reflecting the actual servo operation mode, in the same format content as the 6060h.

Object 6062h						HM	CSP	PP
Index	6062h							
Name	Position Demand Value							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	Indicates real-time position commands (unit: user unit).							

Object 6063h		HM	CSP	PP	CSV	PV	CST	PT
Index	6063h							
Name	Position Actual Value							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	Indicates real-time motor absolute position feedback (unit: encoder unit).							

Object 6064h		HM	CSP	PP	CSV	PV	CST	PT
Index	6064h							
Name	Position Actual Value							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	Indicates real-time absolute motor position feedback (unit: user unit). User position feedback 6064h x gear ratio (6091h) = motor position feedback 6063h.							

Object 6065h						HM	CSP	PP
Index	6065h							
Name	Position Deviation Excess Threshold (Following Error Window)							
Structure	VAR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RW	Default	3840000			

Description	Set the value of position deviation excessive threshold (user unit). When 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 perform excessive position deviation monitoring.

Object 6067h						HM	CSP	PP
Index	6067h							
Name	Position Arrival Threshold (Position Window)							
Structure	VAR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RW	Default	100			
Description	Set the threshold value for position arrival (unit: user unit). If the difference between the user position command 6062h and the actual user position feedback 6064h is within ±6067h, and when the time reaches 6068h, the position is considered to be arrived, and bit10=1 of status word 6041h in profile position mode.							

Object 6068h						HM	CSP	PP
Index	6068h							
Name	Position arrival time window (Position Window Time)							
Structure	VAR	Data Type	Uint16	Range	Uint16			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the time window (unit: 2ms) for determining the validity of the position arrival. When the difference between the user position command 6062h and the actual user position feedback 6064h is within ±6067h, and when the time reaches 6068h, the position is considered to have arrived, and the status word 6041h bit10=1 in the profile position mode.							

Object 606Bh		HM	CSP	PP	CSV	PV	CST	PT
Index	606Bh							
Name	User actual speed command (Velocity Demand Value)							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RO	Default	-			
Description	Indicates the actual speed command of the user (unit: 1rpm). It indicates the speed command corresponding to the output of the position regulator in position mode. It indicates the input command of the speed regulator in speed mode.							

Object 606Ch		HM	CSP	PP	CSV	PV	CST	PT
Index	606Ch							
Name	User Actual Velocity Feedback (Velocity Actual Value)							
Structure	VAR	Data Type	Int32	Range	-2^{31}～ $(2^{31}-1)$			
Mapping Option	Y	Accessibility	RO	Default	-			
Description	Indicates the actual user speed feedback value (unit: user unit/s).							
Object 606Dh					CSV	PV	CST	PT
Index	606Dh							
Name	Velocity Arrival Threshold (Velocity Window)							
Structure	VAR	Data Type	UInt16	Range	0～3000			
Mapping Option	Y	Accessibility	RW	Default	10			
Description	Set the threshold value for speed arrival (unit: 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 bit10 of status word 6041h is 1 in the profile speed mode. Conversely, bit10 of status word 6061h is 0.							

Object 606Eh					CSV	PV	CST	PT
Index	606Eh							
Name	Velocity Arrival Window Time (Velocity Window Time)							
Structure	VAR	Data Type	UInt16	Range	UInt16			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the time window (unit: 2ms) for determining the validity of speed arrival. If 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 have arrived, and bit 10 of status word 6041h is 1 in the profile speed mode. Conversely, bit 10 of status word 6061h is 0.							

Object 606Fh					CSV	PV	CST	PT
Index	606Fh							
Name	Zero Velocity Threshold (Velocity Threshold)							

Structure	VAR	Data Type	UInt16	Range	0～2000
Mapping Option	Y	Accessibility	RW	Default	10
Description	Set the threshold value (unit: 1rpm) used to determine whether the user speed is 0. If the user speed feedback 606Ch is within ±606Fh and the time reaches 6070h setting value, it means that the user speed is 0. At this time, the status word 6041h bit12=1; if either of the two conditions is not satisfied, it is considered that the user speed is not 0, at this time, the status word 6041h bit12=0.				

Object 6070h					CSV	PV	CST	PT
Index	6070_h							
Name	Zero Velocity Threshold Time							
Structure	VAR	Data Type	UInt16	Range	UInt16			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the time window used to determine whether the user speed is 0 (unit: 2ms). If the user speed feedback 606Ch is within ±606Fh, and the time reaches 6070h setting value, it means that the user speed is 0. At this time the bit12 of status word 6041h is 1; if either of the two conditions is not satisfied, it is considered that the user speed is not 0, at this time the bit12 of status word 6041h is 0.							

Object 6071h							CST	PT
Index	6071_h							
Name	Target torque							
Structure	VAR	Data Type	Int16	Range	-5000～5000			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	For commanding target values (unit: 0.1%) in profile torque mode and cycle synchronous torque mode.							

Object 6072h		HM	CSP	PP	CSV	PV	CST	PT
Index	6072_h							
Name	Maximum torque limit							
Structure	VAR	Data Type	Uint16	Range	-5000～5000			
Mapping Option	Y	Accessibility	RW	Default	3000			

Description	Set the maximum output torque value of the servo drive (unit: 0.1%).

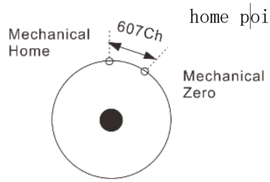
Object 6074h		HM	CSP	PP	CSV	PV	CST	PT
Index	6074_h							
Name	Torque demand value							
Structure	VAR	Data Type	Uint16	Range	-5000～5000			
Mapping Option	Y	Accessibility	RO	Default	-			
Description	Displays the current torque command (unit: 0.1%).							

Object 6076h		HM	CSP	PP	CSV	PV	CST	PT
Index	6076_h							
Name	Motor rated torque							
Structure	VAR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	The rated torque (unit: mNm) on the motor nameplate. All torque related parameter values are related to this parameter.							

Object 6077h		HM	CSP	PP	CSV	PV	CST	PT
Index	6077_h							
Name	Motor actual torque							
Structure	VAR	Data Type	Int16	Range	Int16			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	Indicates the instantaneous torque output value of the servo motor (unit: 0.1%).							

Object 607Ah							CSP	PP
Index	$607A_h$							
Name	Target Position							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the servo target position in profile position mode (unit: user unit).							

	When bit 6 of control word 6040h is 0, 607Ah is the absolute target position of the current segment. When bit6 of control word 6040h is 1, 607Ah is the target incremental displacement of the current segment.

Object 607Ch					
Index	607Ch				
Name	Home Offset				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RW	Default	0
Description	In the position control mode, the physical position that mechanical zero point deviates from the motor origin (unit: user unit). Mechanical home position = mechanical zero point+ 607Ch (home position offset). When set to 0, the home point is not offset.  				

Object 607Dh					
Index	607Dh				
Name	Software Position Limit				
Structure	VAR	Data Type	Int32	Range	-
Mapping Option	Y	Accessibility	RW	Default	0
Description	Set the minimum and maximum value of the software absolute position limit. Minimum absolute position limit = (607D-1h) Maximum absolute position limit = (607D-2h) Software absolute position limit setting: 1.When both (607D-1h) and (607D-2h) are set to default value, the software limit does not take effect. 2.When the minimum absolute position limit (607D-1h) is greater than the maximum absolute position limit (607D-2h), the internal software will adjust its value automatically. 3.When the position command or position feedback reaches the software limit value, the servo will run in position mode with the position limit as the target position and stop when it reaches the position limit, and prompt the overtravel warning. Input reverse command can make motor out of the position overtravel state.				

	4. Absolute position limit relative to the motor feedback position 6064h (user units).

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	Uint8	Range	2
Mapping Option	Y	Accessibility	RO	Default	2

Sub-index	1				
Name	Min Position Limit				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RW	Default	-231

Sub-index	2				
Name	Max Position Limit				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RW	Default	231-1

Object 607Eh			CSP	PP	CSV	PV	CST	PT
Index	$607E_h$							
Name	Command Polarity							
Structure	VAR	Data Type	Uint8	Range	Int8			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the polarity of position command, speed command and torque command.							

MSB LSB

7	6	5	4 0
Position command polarity	Position command polarity	Position command polarity	NA

	Bit7 = 1, indicating that the motor will reverse the running direction if position command x (-1) in standard position mode. In profile position mode and cycle synchronous position mode, the position command and target position are reversed. Bit6 = 1, indicating that the motor will reverse the running direction if the speed command (60FFh) × (-1) in speed mode. Bit5 = 1, indicating that the torque command × (-1) in torque mode.

Object 607Eh			CSP	PP	CSV	PV	CST	PT
Index	607F$_h$							
Name	Max Profile Velocity							
Structure	VAR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RW	Default	838860800			
Description	Set the maximum user operation speed (unit: user unit/s). The set value takes effect when the slave speed command is changed. $Max\ Profile\ Speed(\text{rpm}) = \frac{607\text{Fh} \times \frac{6091\text{h}-1}{6091\text{h}-2}}{\text{encoder resolution}} \times 60$ Note:In various modes, the maximum operating speed is limited by the function code Pn318 in addition to the 607Fh limit. The smallest of the two is taken for the limit.							

Object 6080h		HM	CSP	PP	CSV	PV	CST	PT
Index	6080$_h$							
Name	Max Motor Speed							
Structure	VAR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RO	Default	Maximum speed limit			
Description	The maximum permissible operating speed of the motor, which can be obtained from the instruction manual of the servo motor (unit: rpm).							

Object 6081h								PP
Index	6081$_h$							
Name	Position Profile Speed (Profile Velocity)							
Structure	VAR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RW	Default	10000			
Description	The running speed (in PUU/s) of the uniform section reached after the							

	completion of the acceleration section in the profile position mode. $$\text{Motor Speed(rpm)} = \frac{6081h \times \frac{6091h-1}{6091h-2}}{Encoder\ Resolution} \times 60$$

Object 6083h								PP	PV
Index	6083h								
Name	Profile Acceleration Time (Profile Acceleration)								
Structure	VAR	Data Type	Uint32	Range	Uint32				
Mapping Option	Y	Accessibility	RW	Default	100				
Description	Sets the acceleration during the profile position mode and profile velocity mode. Unit: Command unit/S^2. In position profile mode, the change is effective before this segment command is triggered; after this segment command is triggered, it is effective when the current segment is finished running. In velocity profile 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	6084h								
Name	Profile Deceleration Time (Profile Deceleration)								
Structure	VAR	Data Type	Uint32	Range	Uint32				
Mapping Option	Y	Accessibility	RW	Default	200				
Description	Sets the deceleration in the profile position mode and the profile speed mode. Unit: Command unit/S^2. In position profile mode, the change is effective before this segment command is triggered; after this segment command is triggered, it is effective when the current segment is finished running. In speed profile mode, it is effective immediately. When the parameter is set to 0, it is forced to 1 internally by the software.								

Object 6086h					
Index	6086h				
Name	Type of Motor Operation Curve				
Structure	VAR	Data Type	Int16	Range	Int16

Mapping Option	Y	Accessibility	RW	Default	-
Description	Curve type of motor position command or speed command. 0 - linear				

Object 6087h								PT
Index	6087h							
Name	Torque Slope Time (Torque Slope)							
Structure	VAR	Data Type	Uint32	Range	0~65535			
Mapping Option	Y	Accessibility	RW	Default	1000			
Description	Sets the torque command acceleration in profile torque mode, which indicates the torque command increment per second (0.1%/s). The parameter will be forced to convert to 1 when set to 0.							

Object 6091h		HM	CSP	PP	CSV	PV	CST	PT
Index	6091h							
Name	Gear Ratio							
Structure	ARR	Data Type	Uint32	Range	Uint32			
Mapping Option	Y	Accessibility	RW	Default	-			
Description	The position factor is used to establish the proportional relationship between the user-specified load displacement and the motor displacement: Motor displacement (motor units) = load displacement (user units) × position factor The position factor is set in relation to the mechanical reduction ratio, the parameters related to the mechanical dimensions and the motor resolution. The calculation method is as follows: $\text{Position Factor} = \frac{\text{Motor resolution} \times \text{Gear Ratio}}{\text{Load feeds}}$							

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	Uint8	Range	2
Mapping Option	Y	Accessibility	RO	Default	2

Sub-index	1				
Name	Motor Resolutions				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RW	Default	1

Sub-index	2				
Name	Shaft Resolutions				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RW	Default	0

Object 6091h								HM
Index	6098h							
Name	Homing method							
Structure	VAR	Data Type	Int8	Range	0～35			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Select the home position return method:							

Value	Description
1	Homing when reach reverse limit switch or receive the Z pulse singal
2	Homing when reach forward limit switch or receive the Z pulse singal
3，4	Homing when reach forward home switch or receive the Z pulse singal
5，6	Homing when reach reverse home switch or receive the Z pulse singal
7～14	Homing when reach home switch or receive the Z pulse singal
15～16	Reserved
17～30	Homing is not correlated with Z pulse signal
31～32	Reserved
33～34	Homing is not correlated with Z pulse signal
35	Reset at current position

●The ER.E03 alarm is generated when the data is not set according to the above rules.

Object 6091h								HM

Index	6099h				
Name	Homing Speeds				
Structure	ARR	Data Type	Uint8	Range	Uint32
Mapping Option	Y	Accessibility	RW	Default	-
Description	Thess two speed value settings included in the Home position return mode: 6099-1h search for the deceleration point signal speed (command unit/s). 6099-2h search for home signal speed (command unit/s).				

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	Uint8	Range	2
Mapping Option	Y	Accessibility	RO	Default	2

Sub-index	1				
Name	Search Speed of Deceleration Point Signal (Speed During Search fro Switch)				
Structure	VAR	Data Type	Uint32	Range	0～2^{32}-1
Mapping Option	Y	Accessibility	RW	Default	27962027
Description	This Sub-index is used to set the speed of searching for the deceleration point signal. This speed can be set to a higher value to prevent the home position return time from being too long and causing a home position return timeout fault.				

Sub-index	2				
Name	Search Speed of Origin Signal (Speed During Search for Zero)				
Structure	VAR	Data Type	Uint32	Range	1～500
Mapping Option	Y	Accessibility	RW	Default	5592405

Cautions	
!	● When returning to home position, the slave station will decelerate after finding the deceleration point. ● During deceleration, the slave station shields the change of home signal, and to avoid hitting 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 speed of returning, etc.

Object 609Ah					
Index	609Ah				
Name	Homing Acceleration Speed (Home Acceleration)				
Structure	ARR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RW	Default	100
Description	Sets the acceleration in home position return mode. The object dictionary units are defined as position command increments per second and are forced to convert to 1 when the parameter is set to 0.				

Object 60B0h								CSP
Index	60B0h							
Name	Position offset							
Structure	VAR	Data Type	Int32	Range	int32			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the servo position instruction offset in the cycle synchronous position mode. (Unit: command unit) Servo target position = 607Ah + 60B0h							

Object 60B1h								CSV
Index	60B1h							
Name	Velocity offset							
Structure	VAR	Data Type	Int32	Range	int32			
Mapping Option	Y	Accessibility	RW	Default	0			
Description	Set the servo speed command offset in the cycle synchronous speed mode. (Unit: command unit/s) Servo target speed = 60FFh+60B1h							

Object 60B2h								CST
Index	60B2h							
Name	Torque offset							
Structure	VAR	Data Type	Int32	Range	int32			

Mapping Option	Y	Accessibility	RW	Default	0
Description	Sets the servo torque command offset in the cyclic synchronous torque mode. (Unit:0.1%) Servo target torque = 6071h + 60B2h				

Object 60B8h					
Index	60B8h				
Name	Touch Probe Function				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RW	Default	0
Description	The probe function is the position latching function, which can latch the position information when the external DI signal or motor Z signal changes. This servo supports two probe functions, which can latch 4 position information. Probe 1 can select X5 as the probe signal and Probe 2 can select X6 as the probe signal. The functions of Probe 1 and Probe 2:				

Bit	Description	Range
0	Probe 1 enable	0---Non-Enablment 1---Enablement
1	Probe 1 trigger mode	0 -- Single Trigger 1 -- Continuous triggering
2	Probe 1 trigger signal selection	0---DI44 input signal 1---Z signal
3	NA	-
4	Probe 1 rising edge, falling edge selection	0---falling edge latching 1---Rising edge latching
5-7	NA	-
8	Probe 2 enable	0---Non-Enablment 1---Enablement
9	Probe 2 trigger mode	0 -- Single Trigger 1 -- Continuous triggering
10	Probe 2 trigger signal selection	0---DI44 input signal 1---Z signal
11	NA	-
12	Probe 2 rising edge, falling edge selection	0---Falling edge latching 1---Rising edge

		latching
13-15	NA	

<table>
<tr><td>Index</td><td>60B9h</td><td colspan="4"></td></tr>
<tr><td>Name</td><td colspan="5">探针状态(Touch Probe Status)</td></tr>
<tr><td>Structure</td><td>VAR</td><td>Data Type</td><td>Uint16</td><td>Range</td><td>Uint16</td></tr>
<tr><td>Mapping Option</td><td>Y</td><td>Accessibility</td><td>RO</td><td>Default</td><td>0</td></tr>
<tr><td>Description</td><td colspan="5">Read the status of Probe 1 and Probe 2
<table>
<tr><th>Bit</th><th>Description</th><th>Note</th></tr>
<tr><td>0</td><td>0 --- Probe 1 not enabled
1 - Probe 1 enabled</td><td></td></tr>
<tr><td>1</td><td>0-Probe 1 rising edge latch not executed
1-Probe 1 rising edge latch executed</td><td></td></tr>
<tr><td>2</td><td>0-Probe 1 falling edge latch not executed
1-Probe 1 falling edge latch executed</td><td></td></tr>
<tr><td>3～5</td><td>NA</td><td></td></tr>
<tr><td>6</td><td>0-DI44 input signal
1-Z signal</td><td></td></tr>
<tr><td>7</td><td>0-DI44 is low level
1-DI44 is high level</td><td></td></tr>
<tr><td>8</td><td>0-Probe 2 not enabled
1-Probe 2 enabled</td><td></td></tr>
<tr><td>9</td><td>0-Probe 2 rising edge latch not executed
1-Probe 2 rising edge latch is executed</td><td></td></tr>
<tr><td>10</td><td>0-Probe 2 falling edge latch not executed
1-Probe 2 falling edge latch executed</td><td></td></tr>
<tr><td>11～13</td><td>NA</td><td></td></tr>
<tr><td>14</td><td>0-DI45 input signal
1-Z signal</td><td></td></tr>
<tr><td>15</td><td>0-DI45 is low level
1-DI45 is high level</td><td></td></tr>
</table>
</td></tr>
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<table>
<tr><td colspan="3">Object 60BAh</td></tr>
<tr><td>Index</td><td>60BAh</td><td></td></tr>
<tr><td>Name</td><td colspan="2">Probe 1 Rising Edge Position Feedback (Touch Probe Pos1 Pos Value)</td></tr>
</table>

Structure	VAR	Data Type	Int32	Range	int32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Displays the moment of the rising edge of the Probe 1 signal, position feedback (command unit).				

Object 60BBh					
Index	60BBh				
Name	Probe 1 Descending Edge Position Feedback (Touch Probe Pos1 Neg Value)				
Structure	VAR	Data Type	Int32	Range	int32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Displays the falling edge of the Probe 1 signal with position feedback (command unit).				

Object 60BCh					
Index	60BCh				
Name	Probe 2 Rising Edge Position Feedback (Touch Probe Pos2 Pos Value)				
Structure	VAR	Data Type	Int32	Range	int32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Displays the rising edge of the Probe 1 signal, position feedback (command unit).				

Object 60BDh					
Index	60BDh				
Name	Probe 2 Descending Edge Position Feedback				
Structure	VAR	Data Type	Int32	Range	int32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Displays the falling edge of the Probe 2 signal with position feedback (command unit).				

Object 60E0h		HM	CSP	PP	CSV	PV	CST	PT
Index	60E0h							
Name	Forward torque limit (Positive Torque Limit)							
Structure	VAR	Data Type	Uint16	Range	Uint16			
Mapping Option	Y	Accessibility	RW	Default	3000			
Description	Limits the maximum value of forward / positive torque (unit: 0.1%).							

Object 60E1h			HM	CSP	PP	CSV	PV	CST
Index	60E1h							
Name	Reverse torque limit (Negtive Torque Limit)							
Structure	VAR	Data Type	Uint16	Range	Uint16			
Mapping Option	Y	Accessibility	RW	Default	3000			
Description	Limits the maximum value of reverse / negative torque (unit: 0.1%).							

Object 60F4h						HM	CSP	PP
Index	60F4h							
Name	User Position Deviation (Following Error Actual Value)							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	Real-time position deviation (unit: user unit).							

Object 60FCh						HM	CSP	PP
Index	60FCh							
Name	Motor position command (Position Demand Value*)							
Structure	VAR	Data Type	Int32	Range	Int32			
Mapping Option	Y	Accessibility	RO	Default	0			
Description	Motor real-time position command (unit before electronic gear: increments) User position command (6062h) × position factor (6091h) = motor position command (60FCh)							

Object 60FDh					
Index	60FDh				
Name	Digital Input				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	0

Description	Indicates the current DI terminal logic of the drive, 0 means invalid, 1 means valid Each of them represents the DI signal as follows: MSB LSB

31～16	15～4	3	2	1	0
Factory defined	Reserved	N/A	N/A	Forward overtravel switch	Reverse overtravel switch

Object 60FEh					
Index	60FEh				
Name	Digital Output				
Structure	ARR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	0

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	Uint8	Range	1
Mapping Option	N	Accessibility	RO	Default	1

Sub-index	0				
Name	Number of Sub-index (Number of Entries)				
Structure	VAR	Data Type	Uint8	Range	1
Mapping Option	N	Accessibility	RO	Default	1

Sub-index	1				
Name	Physical Outputs				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	Y	Accessibility	RO	Default	0
Description	Reflects the current DO terminal logic of the drive, 0 means invalid, 1 means valid The DO signals indicated by each of them are as follows: MSB LSB				

31～16	15～1	0
Factory defined	Reserved	Output Brake

Object 60FFh							CSV	PV

Index	$60FF_h$				
Name	Target Velocity				
Structure	VAR	Data Type	Int32	Range	Int32
Mapping Option	Y	Accessibility	RW	Default	0
Description	User speed command (unit: user unit/s).				

Object 6502h					
Index	6502_h				
Name	Supported Drive Modes				
Structure	VAR	Data Type	Uint32	Range	Uint32
Mapping Option	N	Accessibility	RO	Default	$6D_h$
Description	The servo operation mode supported by the drive, 0 means not supported, 1 means supported.				

Bit	Description	Value
0	Profile position mode	1
1	N/A	0
2	Profile speed mode	1
3	Profile Torque Mode	1
4	N/A	0
5	Home position return mode	1
6	Interpolation position mode	0
7	Cyclic synchronous position mode (csp)	1
8	Cyclic synchronous velocity mode (csv)	1
9	Cyclic synchronous torque mode (cst)	1
10～31	Factory Defined	Reserved

11.3 Canopen Object Group 2000h Description

2000h group object dictionary is a mapping of the drive’s internal parameters.

The object dictionaries 2000h to 2006h correspond to the parameter groups from Pn0xx to Pn6xx, respectively; 2010h to 2018h correspond to the monitoring parameters from Un0xx to Un8xx. 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	Data Type	Read/Write Option	Mapping Option
2000h	-	Pn0xx Basic Control Parameter Group	-	-	-
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn000:Function selection basic switch 0	Uint16	RW	N
	02h	Pn001:Function selection basic switch 1	Uint16	RW	N
	03h	Pn002:Motor rotation direction selection	Uint16	RW	N
	…	...	…	RW	N
	82h	Pn081:Local communication format	Uint16	RW	N
	83h	Pn082:EtherCat station alias	Uint16	RW	N
2001h	-	Pn1xx Gain Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn100:Rotational inertia ratio	Uint16	RW	N
	02h	Pn101:Speed loop proportional gain	Uint16	RW	N
	…	...	…	RW	N
	94h	Pn193:Maximum gain in advanced tuning process	Uint16	RW	N
2002h	-	Pn2xx Position Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn200:Position command source selection	Uint16	RW	N
	02h	Pn201:External pulse input type	Uint16	RW	N
	03h	Pn202:Position control function	Uint16	RW	N

		switch 1			
	04h	Pn203:External pulse command multiplier	Uint16	RW	N
	…	…	…	RW	N
	98h	Pn297:Absolute zero single-turn value setting	Uint16	RW	N
	9Ah	Pn299:Home position return timeout time	Uint16	RW	N
2003h	-	Pn3xx Speed Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn300: Speed command source selection	Int16	RW	N
	02h	Pn301: Speed command direction	Int16	RW	N
	…	…	…	RW	N
	21h	Pn320: Speed Consistent Signal Range	Uint16	RW	N
2004h	-	Pn4xx Speed Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn400: Torque control switch 1	Uint16	RW	N
	02h	Pn401: Torque command 2nd order low-pass filter cut-off frequency	Uint16	RW	N
	…	…	…	RW	N
	31h	Pn430: Torque control switch 2	Uint16	RW	N
2005h	-	Pn5xx Speed Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn500: JOG speed	Uint16	RW	N
	02h	Pn502: JOG operation method	Uint16	RW	N
	…	…	…	RW	N
	09h	Pn508: Program JOG moving speed	Uint16	RW	N
2006h	-	Pn6xx Speed Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Pn600: Filtering time of digital input terminal X	Uint16	RW	N
	02h	Pn601: Digital input terminal X1 configuration	Uint16	RW	N
	…	…	…	RW	N
	31h	Pn630: Internal software given the status of input terminal (X)	Uint16	RW	N
2010h	-	Un0xx Monitoring Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Un000: Motor feedback speed	Int16	RO	N

	02h	Un001: Command speed	Int16	RO	N
	…	…	…	RO	N
	38h	Un038: Canopen version (sub version number)	Uint16	RO	N
	39h	Un039: EtherCAT version (sub version number)	Uint16	RO	N
2011h	-	Un1xx Monitoring Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	05h	Un104: Serial encoder communication abnormal counter	Uint16	RO	N
	06h	Un105: Position rectification time	Uint16	RO	N
	…	…	…	RO	N
	54h	Un153: Analog channel 2 voltage (bias, gain, zero correction)	Uint16	RO	N
2012h	-	Un2xx Monitoring Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	04h	Un203: Set abnormal parameter function code number (Er040)	Uint16	RO	N
	13h	Un212: System monitoring average time A	Uint16	RO	N
	…	…	…	RO	N
	1Ah	Un219: System monitoring Max time R	Uint16	RO	N
2015h	-	Un5xx Monitoring Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	12h	Un512: U-phase current zero point value	Uint16	RO	N
	13h	Un513: V-phase current zero point value	Uint16	RO	N
2016h	-	Un6xx: Monitoring Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	04h	Un603: Absolute encoder pulses (low 32 bits)	Uint32	RO	N
	06h	Un605: Absolute encoder pulses (high 32bits)	Uint32	RO	N
2018h	-	Un8xx Monitoring Parameters	-	-	N
	00h	Support max sub-index	Uint8	RO	N
	01h	Un800: Current fault or warning code	Uint16	RO	N
	02h	Un801: The code when the alarm occurs	Uint16	RO	N
	…	…	…	RO	N
	43h	Un842: Alarm record 9 occurrence time	Uint16	RO	N

Cautions
The last two digits of the function code correspond to the Sub-index. The function code is a hexadecimal number, and the Sub-index is also a hexadecimal number. **Example**:When reading or writing function code Pn299, the corresponding object dictionary is 2002_9Ah.

11.4 Canopen Fault Code Definition

Code	Definition	Address	Auxiliary Code
Er.020	User Function Parameter and verfification anomaly	0x6000	0x00000020
Er.021	Function code parameter formatting anomaly	0x6001	0x00000021
Er.022	Factory parameter and verification anomaly	0x6002	0x00000022
Er.023	MCU and FPGA communication anomaly	0x6003	0x00000023
Er.030	FPGA using backup program	0x6004	0x00000030
Er.040	Function code parameter setting anomaly	0x6005	0x00000040
Er.042	Parameter combination anomaly	0x6007	0x00000042
Er.050	Drive and motor voltage inconsistency or power difference of more than 4 times	0x6009	0x00000050
Er.0B0	Servo ON command is invalid	0x600D	0x000000B0
Er.100	Drive over current (software)	0x600E	0x00000100
Er.101	Drive overcurrent (hardware)	0x600F	0x00000101
Er.320	Regenerative overload	0x6010	0x00000320
Er.400	Over-voltage	0x6012	0x00000400
Er.410	Under-voltage	0x6013	0x00000410
Er.42A	KTY type temperature sensor over temperature	0x6014	0x0000042A
Er.450	Input terminal X function assignment repeat	0x6015	0x00000450
Er.451	Output terminal X function assignment repeat	0x6016	0x00000451
Er.452	Assignment anomaly of analog signal AI in torque mode	0x6017	0x00000452
Er.520	Vibration fault	0x6018	0x00000520

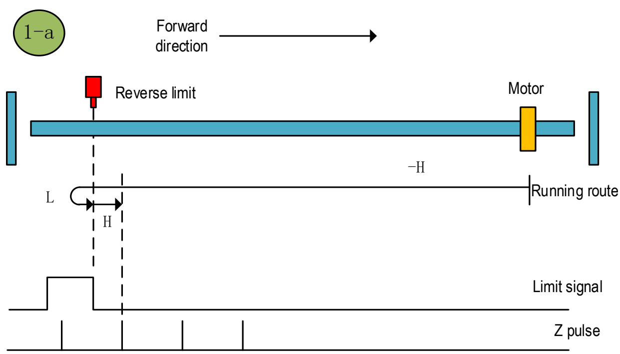
Er.521	Vibration occurs during auto-tuning	0x6019	0x00000521
Er.710	Drive instantaneous overload	0x601A	0x00000710
Er.711	Motor instantaneous overload	0x601B	0x00000711
Er.720	Drive continuous overload	0x601C	0x00000720
Er.721	Motor continuous overload	0x601D	0x00000721
Er.730	DB overload	0x601E	0x00000730
Er.7A0	Drive over temperature	0x6020	0x000007A0
Er.810	Multi-turn data abnormality in absolute encoder	0x6023	0x00000810
Er.820	Data verification abnormality in absolute encoder	0x6024	0x00000820
Er.830	Absolute encoder battery anomaly	0x6025	0x00000830
Er.840	Directional anomaly at the upper limit of encoder turns	0x6026	0x00000830
Er.860	High temperature in the absolute encoder	0x6028	0x00000860
Er.890	Motor code does not exist	0x6029	0x00000890
Er.8A1	Home position return timeout	0x602C	0x000008A1
Er.B31	U-phase detection circuit abnormal	0x6034	0x00000B31
Er.B32	V-phase detection circuit abnormal	0x6035	0x00000B32
Er.B33	STO input protection	0x6036	0x00000B33
Er.BF0	System operation anomaly	0x6039	0x00000BF0
Er.BF2	MCU data writing to FPGA anomaly	0x603B	0x00000BF2
Er.BF3	Pulse command source selection anomaly	0x603C	0x00000BF3
Er.C10	Over speed out of control dectected	0x603E	0x00000C10
Er.C21	Absolute encoder multi-turn overflow	0x6040	0x00000C21
Er.C80	Incremental encoder dividing frequency setting anomaly	0x6047	0x00000C80
Er.C90	Encoder wiring break	0x6048	0x00000C90
Er.C91	Encoder acceleration anomaly	0x6049	0x00000C91
Er.C92	Incremental encoder Z signal lost	0x604A	0x00000C92
Er.C95	Abnormal encoder UVW signal	0x604B	0x00000C95

Er.D00	Excessive position deviation	0x6050	0x00000D00
Er.D01	Excessive position deviation at servo ON	0x6051	0x00000D01
Er.D02	Excessive position deviation due to speed limit at servo ON	0x6052	0x00000D02
Er.D03	Excessive mixing deviation (excessive deviation between motor feedback position and optical scale)	0x6053	0x00000D03
Er.D04	Electronic gear ratio setting exceeds the limit	0x6054	0x00000D04
Er.E03	Abnormal home position return mode	0x6058	0x00000E03
Er.E05	Operation mode not supported by the drive	0x605A	0x00000E05
Er.E20	CAN master dropout (life factor)	0x6064	0x00000E20
Er.E21	CAN master dropout (consumer time)	0x6065	0x00000E21

11.5 Home Position Return Method Description

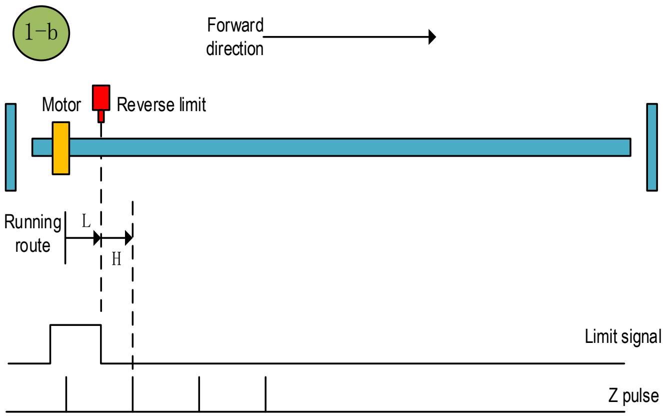
Home position return method 1(6098 00h = 1)

a: Start the home position return → search for the reverse limit at high speed reverse direction→ encounter the rising edge of reverse limit → decelerate to 0 → search for the falling edge of reverse limit at low speed forward direction → search for Z pulse in forward direction



a. Decelerate to search for Z in forward direction after encountering the reverse limit rising edge

b. Start the home position return→reverse limit valid→Search for the falling edge of reverse limit at low speed forward direction→ search for Z pulse in forward direction



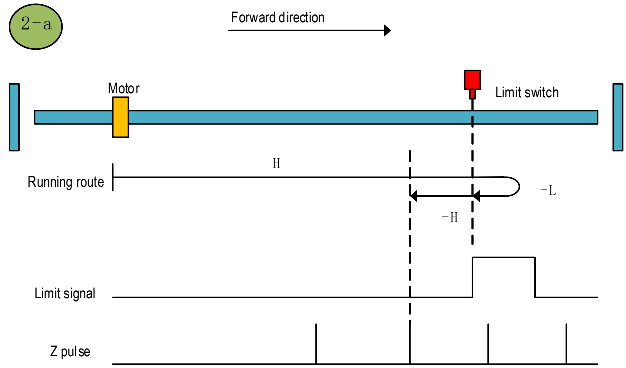
b. Start from reverse limit and find Z in forward direction

Fig.11.35 Home position return method 1

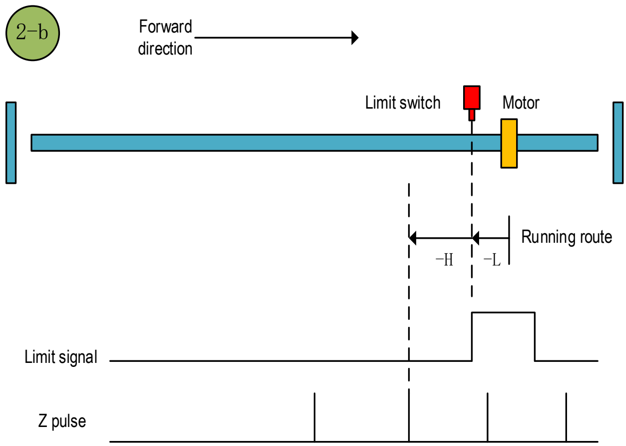
Home position return method 2 (6098 00h = 2)

a. Start the home position return → search for the forward limit at high speed forward direction → encounter the forward limit rising edge → decelerate to 0 → search for the falling edge of forward limit at low speed reverse direction→ search for Z pulse in reverse direction

b. Start the home position return →forward limit valid→search for the falling edge of forward limit at low speed reverse direction→search for Z pulse in reverse direction



a. Decelerate to search for Z in reverse direction after encountering the forward limit rising edge

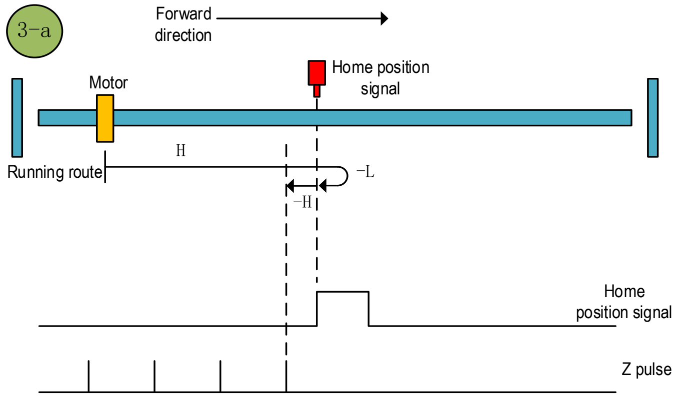


b. Start from forward limit and find Z in reverse direction

Fig.11.36 Home position return method 2

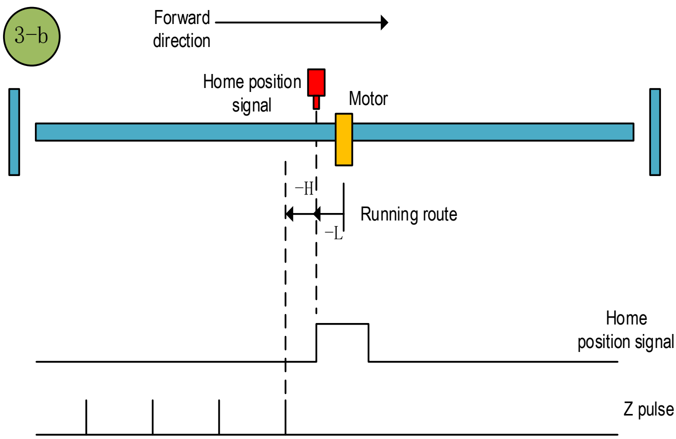
Home position return 3(6098 00h = 3)

a. Start the home position return →home position signal is OFF→search for the rising edge of home position signal at high speed forward direction→decelerate to 0→search for the falling edge of home position signal at low speed reverse direction→search for Z pulse in reverse direction



a. Search for the rising edge of home position signal in forward direction, and then decelerate to find Z in reverse direction

b. Start the home position return →Home position signal ON→Search for the falling edge of home position at low speed reverse direction→search for Z pulse in reverse direction

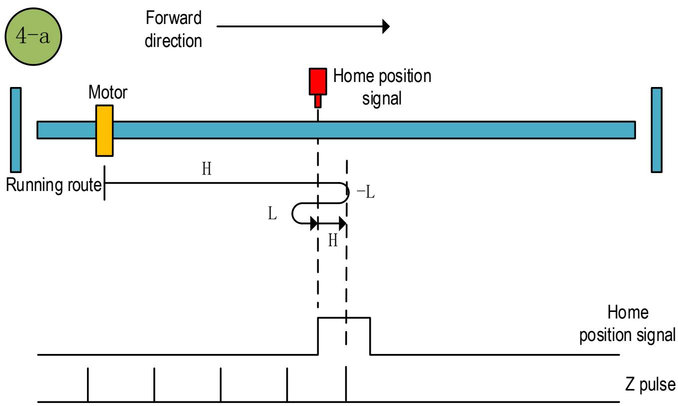


b. Start from home position signal and find Z in reverse direction

Fig.11.37 Home position return method 3

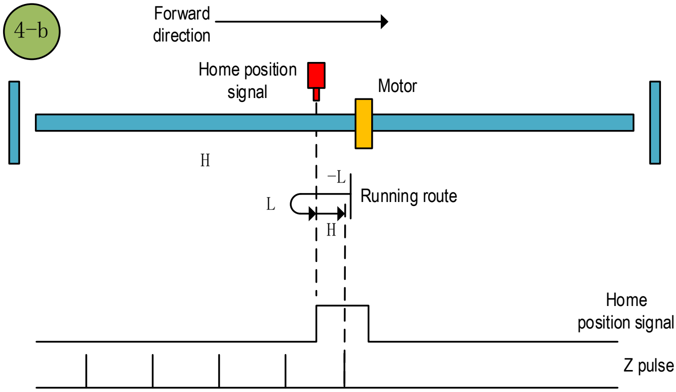
Home position return method 4(6098 00h = 4)

a. Start the home position return →home position signal OFF→search for the rising edge of home position at high speed forward direction →decelerate to 0→search for the falling edge of home position at low speed reverse direction →search for Z pulse in forward direction



a. Search for the home position signal in forward direction, and then decelerate to find Z in forward direction

b. Start the home position return →home position signal ON→ search for the falling edge of home position at low speed reverse direction →search for the rising edge of home position at high speed forward direction →search for Z pulse in forward direction

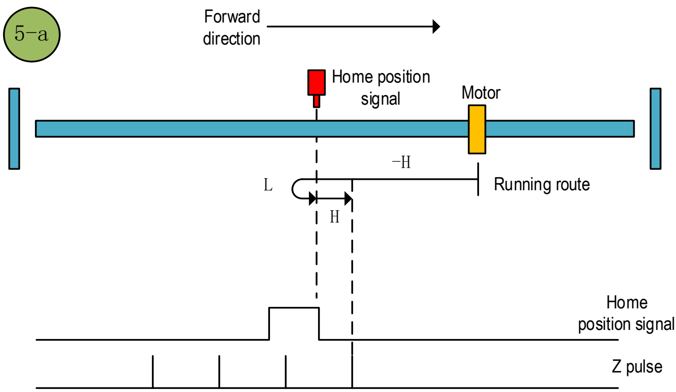


b. Start from home position signal, and find Z in forward direction

Fig. 11.38 Home position return method 4

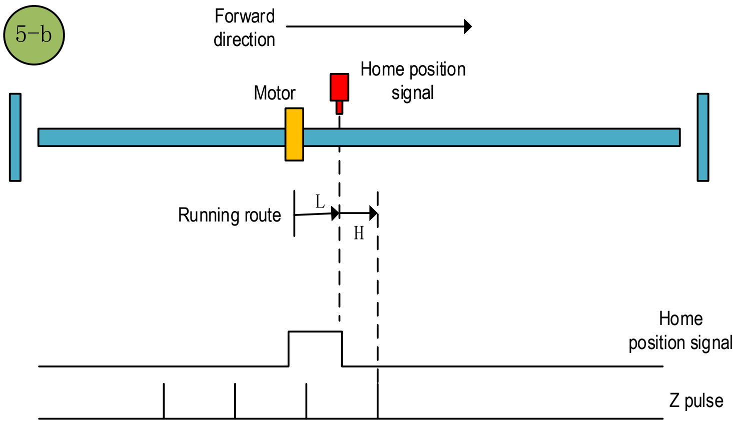
Home position return method 5 (6098 00h = 5)

a. Start the home position return →home position signal OFF→ search for the rising edge of home position at high speed reverse direction →decelerate to 0→ search for the falling edge of home position at low speed forward direction →search for Z pulse in forward direction



a. Search for the rising edge of home position signal in reverse direction, and then decelerate to find Z in forward direction

b. Start the home position return →home position signal ON→ search for the falling edge of home position at low speed forward direction →search for Z pulse in forward direction

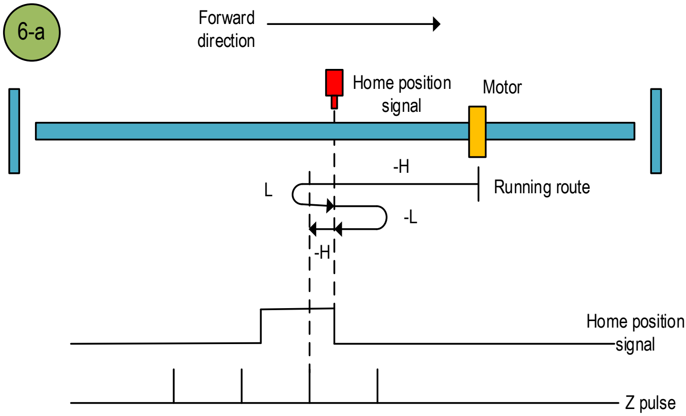


b. Start from home position signal, and then find Z in forward direction

Fig.11.39 Home position return method 5

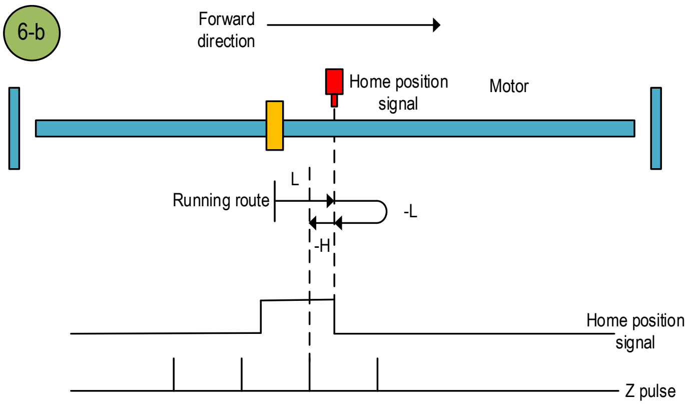
Home position return method 6(6098 00h = 6)

a. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



a. Search for the rising edge of home position signal in reverse direction, and then decelerate to find Z in reverse direction

b. Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed forward direction →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction

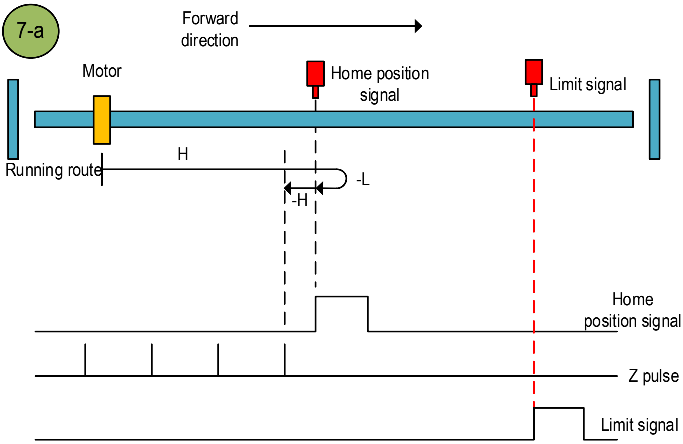


b. Start from home position signal and find Z in forward direction

Fig.11.40 Home position return method 6

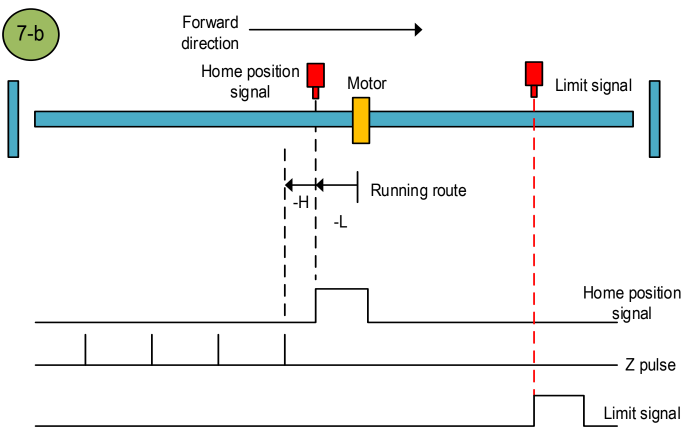
Home position return method 7(6098 00h = 7)

a. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction

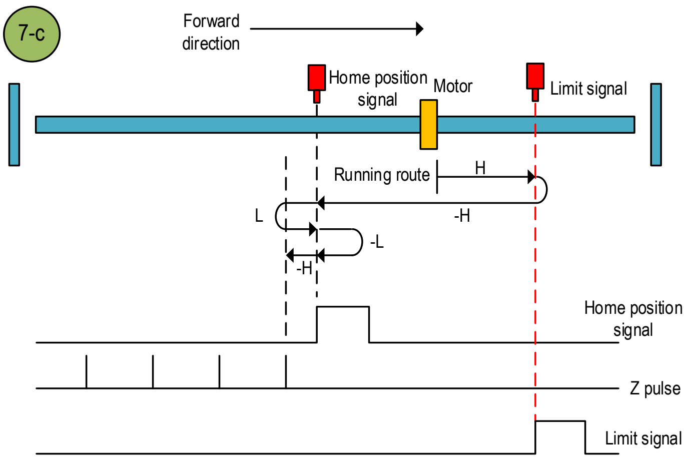


a. Search for the home position signal in forward direction, and then deceleration (not encounter the limit) to find Z in reverse direction

b. Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



b. Start from home position signal and then find Z in reverse direction c.Start the home position return →Home position OFF →Search for the rising edge of home position at high speed forward direction →Touch the forward limit →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Search for the falling edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction

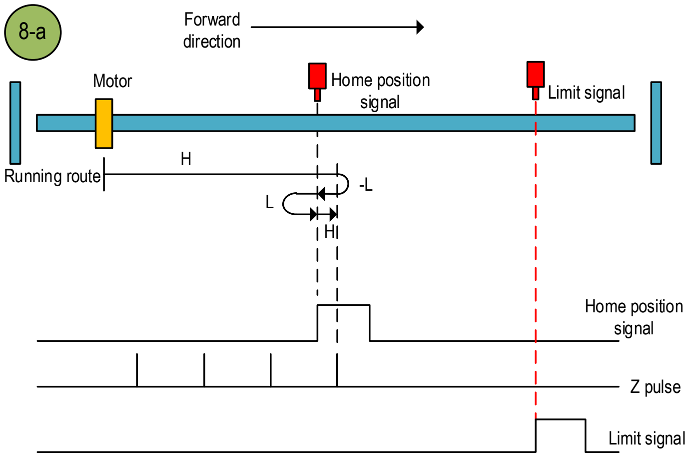


c.Forward running and encounter the forward limit, search for the falling edge of home position signal in reverse direction, and then decelerate to find Z in reverse direction

Fig.11.41 Home position return method 7

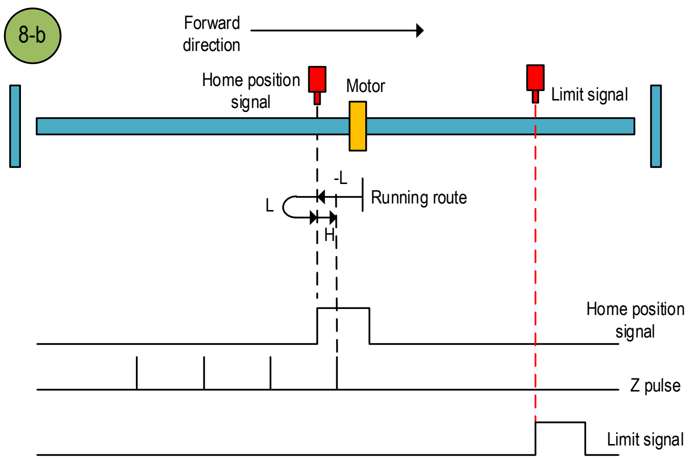
Home position return method 8(6098 00h = 8)

a. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Search for the rising edge of home position at low speed forward direction →Search for the Z pulse in forward direction



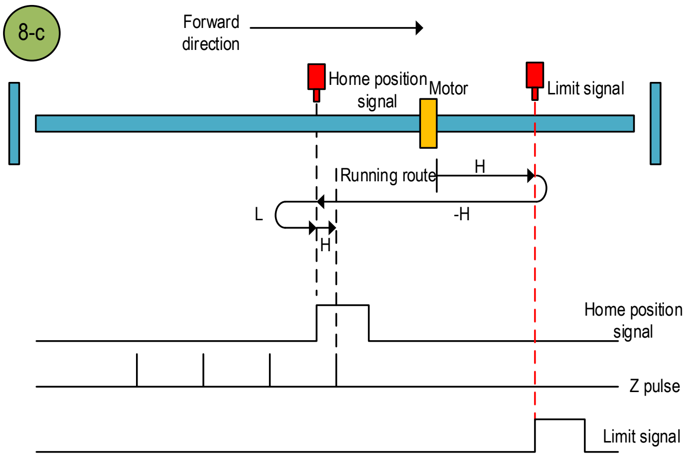
a. Search for rising edge of home position signal in forward direction, and then decelerate (not encounter the limit) to find Z in forward direction

b. Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed reverse direction →Search for the rising edge of home position at low speed forward direction →Search for the Z pulse in forward direction



b. Start from home position signal and then find Z in forward direction

c. Start the home position return →Home position OFF →Search for the rising edge of home position at high speed forward direction →Touch the forward limit →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Search for the Z pulse in forward direction

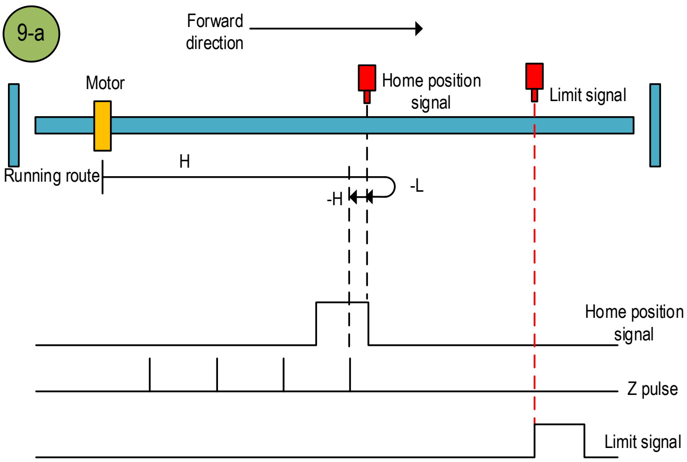


c. Forward running and encounter the forward limit, search for the falling edge of home position signal in reverse direction, and then decelerate to find Z in forward direction

Fig. 11.42 Home position return method 8

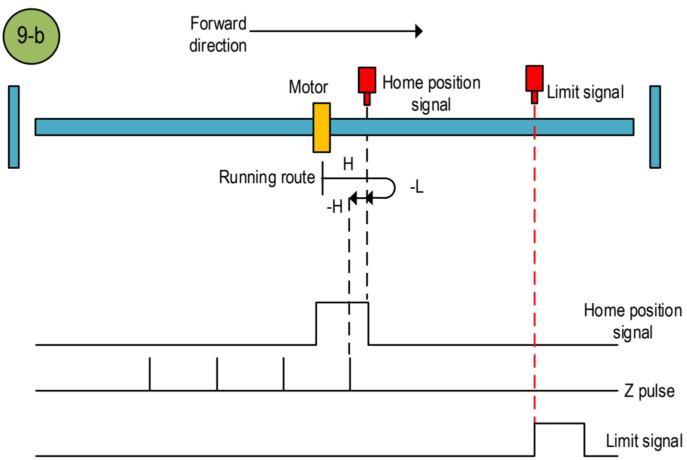
Home position return method 9(6098 00h = 9)

a. Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction

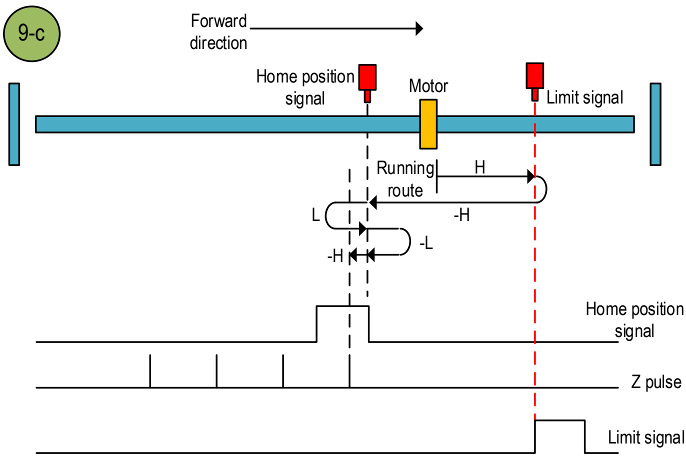


a. Search for falling edge of home position signal in forward direction, and then decelerate (not encounter the limit) to find Z in reverse direction

b. Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



b.Start from home position signal and then find Z in reverse directionc.Start the home position return →Home position OFF →Search for the falling edge of home position at high speed forward direction→Touch the forward limit →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction

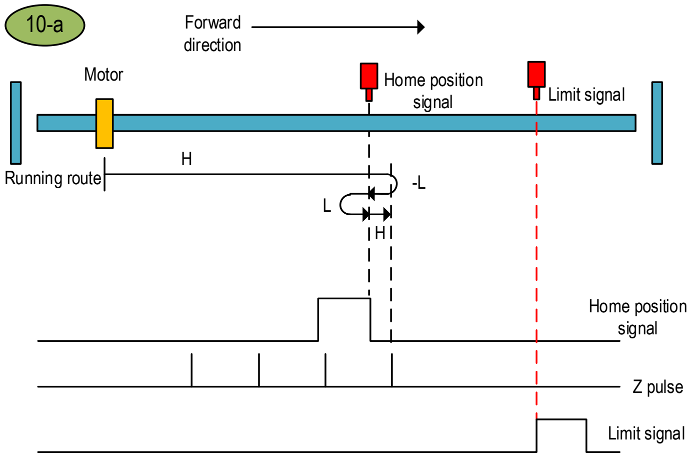


c. Forward running and encounter the forward limit, search for the rising edge of home position signal in reverse direction, and then decelerate to find Z in reverse direction

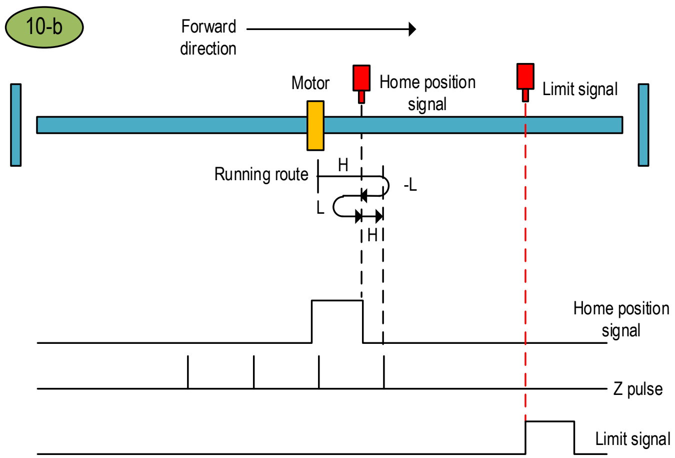
Fig. 11.43 Home position return method 9

Home position return method 10(6098 00h = 10)

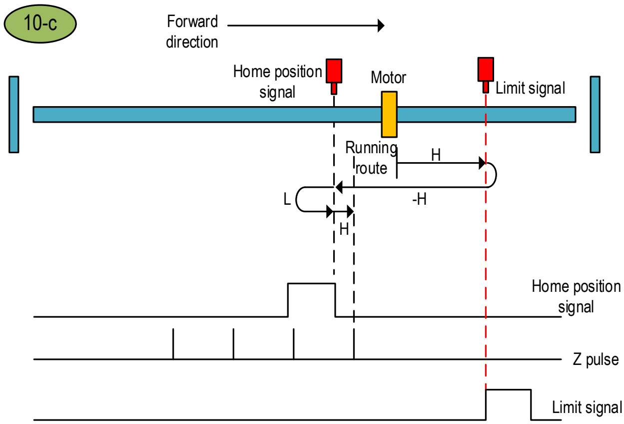
a. Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Search for the falling edge of home position at low speed forward direction →Search for the Z pulse in forward direction



a. Search for falling edge of home position signal in forward direction, and then decelerate (not encounter the limit) to find Z in forward directionb. Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Search for the falling edge of home position at low speed forward direction →Search for the Z pulse in forward direction



b. Start from home position signal and then find Z in forward directionc. Start the home position return →Home position OFF →Search for the falling edge of home position at high speed forward direction→Touch the forward limit →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Search for the Z pulse in forward direction

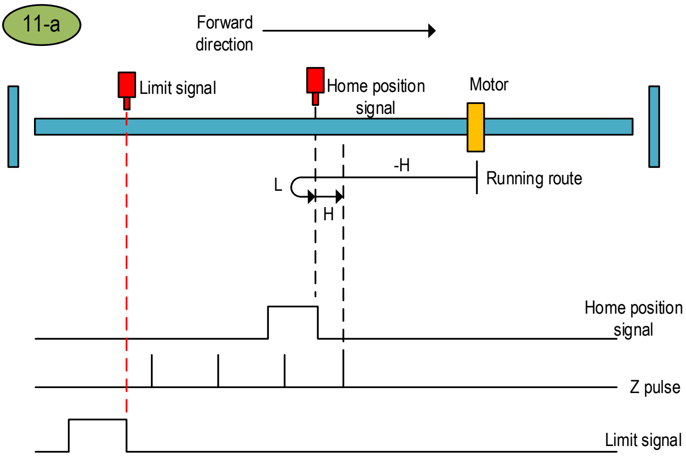


c. Forward running and encounter the forward limit, search for the rising edge of home position signal in reverse direction, and then decelerate to find Z in forward direction

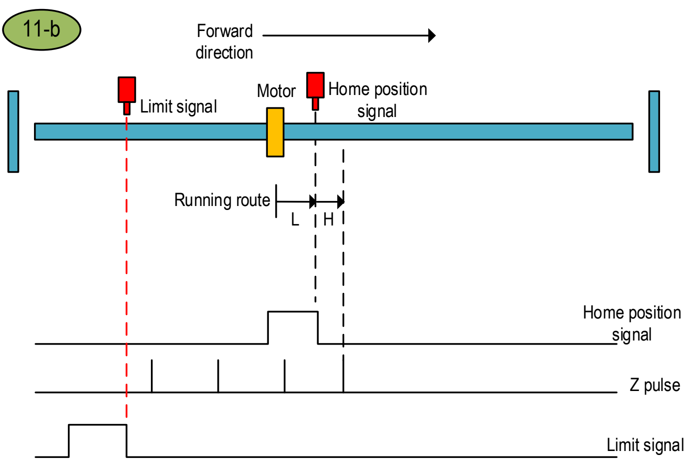
Fig.11.44 Home position return method 10

Home position return method 11(6098 00h = 11)

a. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Search for the Z pulse in forward direction



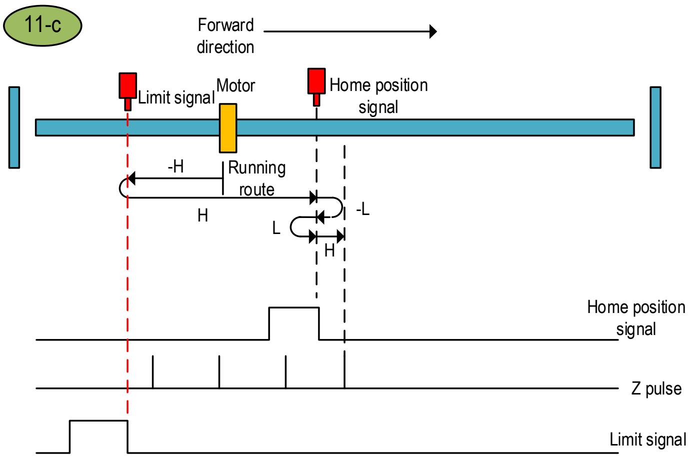
a. Search for rising edge of home position signal in reverse direction, and then decelerate (not encounter the limit) to find Z in forward directionb. Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed forward direction →Search for the Z pulse in forward direction



b. Start from home position signal and then find Z in forward direction

c. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Touch the reverse limit →Search for the falling edge of home position at high speed forward direction →Decelerate to 0

→Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in forward direction

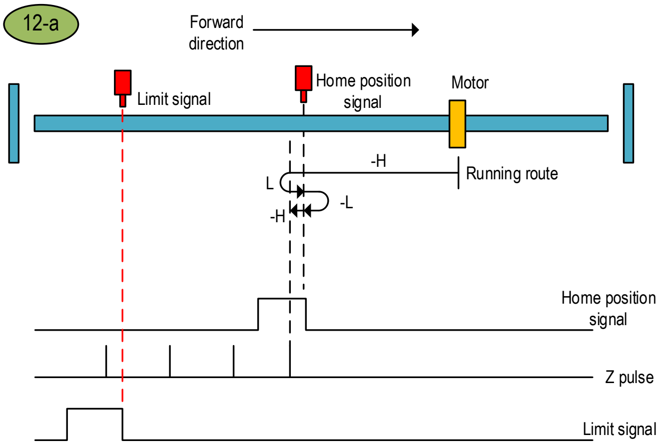


c. Reverse running and encounter the reverse limit, search for the falling edge of home position signal in reverse direction, and then decelerate to find Z in forward direction

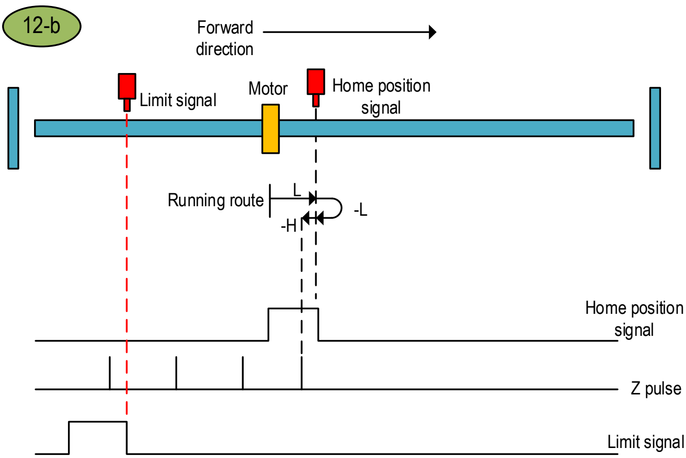
Fig. 11.45 Home position return method 11

Home position return method 12(6098 00h = 12)

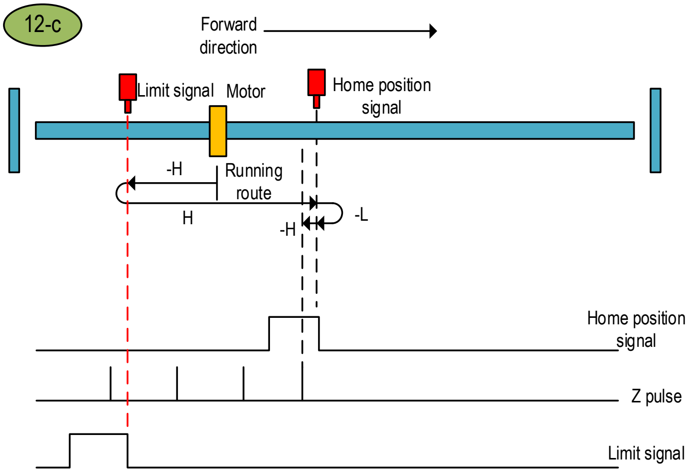
a. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



a. Search for rising edge of home position signal in reverse direction, and then decelerate (not encounter the limit) to find Z in reverse directionb. Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed forward direction →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



b. Start from home position signal and then find Z in reverse directionc. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Touch the reverse limit →Search for the falling edge of home position at high speed forward direction →Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction

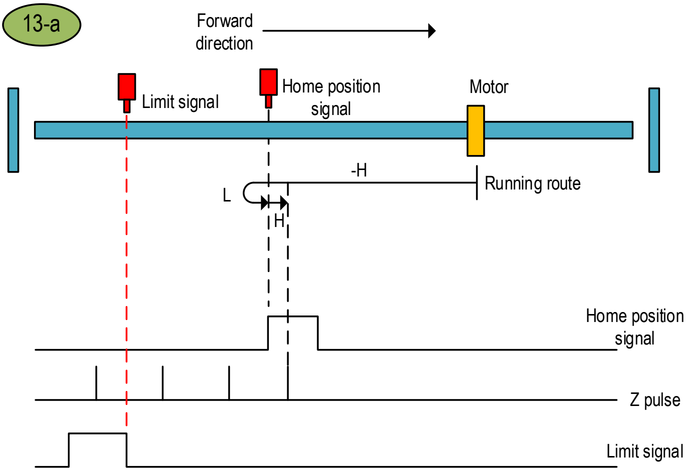


c. Reverse running and encounter the reverse limit, search for the falling edge of home position signal in reverse direction, and then decelerate to find Z in reverse direction

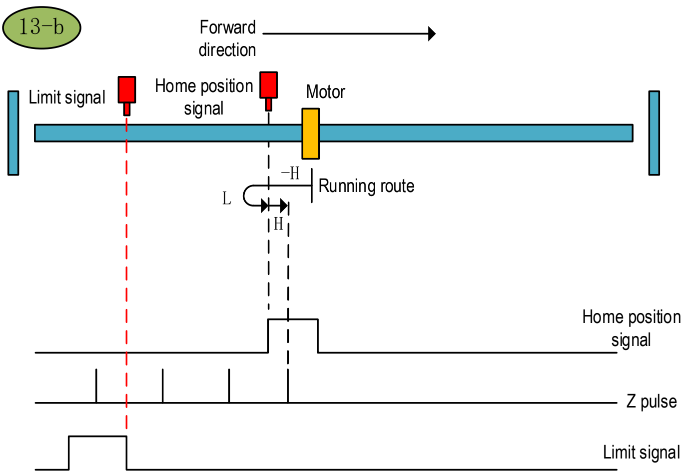
Fig. 11.46 Home position return method 12

Home position return method 13(6098 00h = 13)

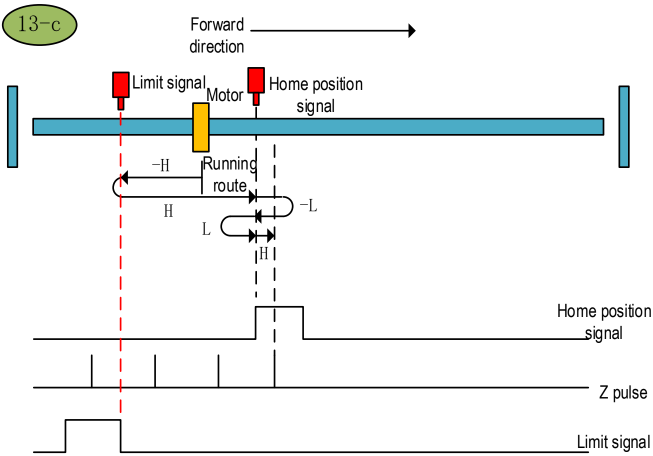
a. Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Search for the Z pulse in forward direction



a. Search for falling edge of home position signal in reverse direction, and then decelerate (not encounter the limit) to find Z in forward directionb. Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Search for the Z pulse in forward direction



b. Start from home position signal and then find Z in forward directionc. Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Touch the reverse limit →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Search for the rising edge of home position at low speed forward direction →Search for the Z pulse in forward direction

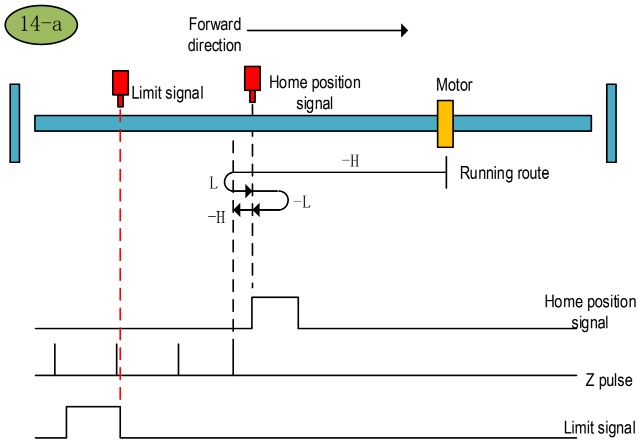


c. Reverse running and encounter the reverse limit, search for the rising edge of home position signal in forward direction, and then decelerate to find Z in forward direction

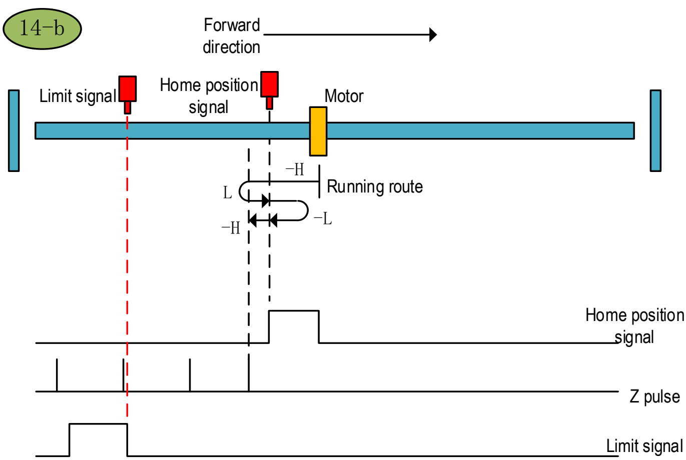
Fig.11.47 Home position return method 13

Home position return method 14(6098 00h = 14)

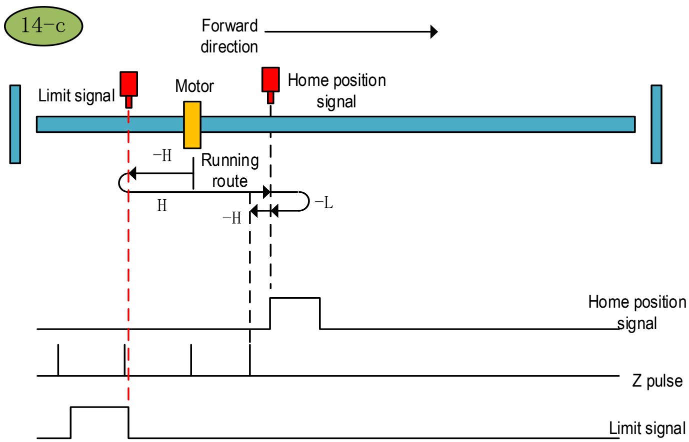
a. Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Search for the falling edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



a. Search for falling edge of home position signal in reverse direction, and then decelerate (not encounter the limit) to find Z in reverse directionb. Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Search for the falling edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



b. Start from home position signal and then find Z in reverse directionc. Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Touch the reverse limit →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Search for the Z pulse in reverse direction



c. Reverse running and encounter the reverse limit, search for the rising edge of home position signal in reverse direction, and then decelerate to find Z in reverse direction

Fig. 11.48 Home position return method 14

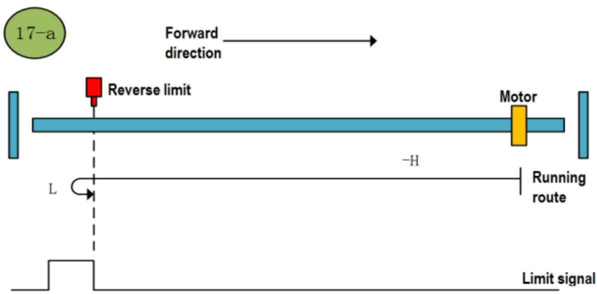
Fig. 11.48 Home position return method 14

Home position return method 15 (6098 00h = 15): Reserved。

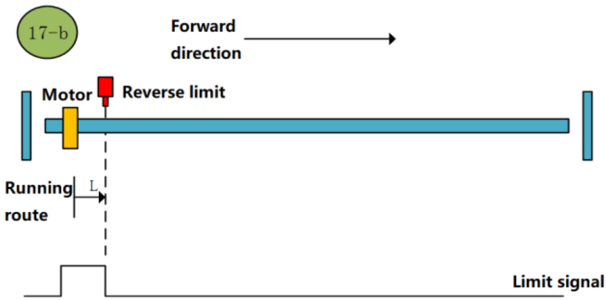
Home position return method 16 (6098 00h = 16): Reserved。

Home position return method 17 (6098 00h = 17)

a: Start the home position return → Search for the reverse limit at high speed reverse direction →Touch the rising edge of reverse limit→Decelerate to 0 →Stop after searching for the falling edge of reverse limit at low speed forward direction
b: Start the home position return →Reverse limit valid →Stop after searching for the falling edge of reverse limit at low speed forward direction



a. Search for the rising edge of reverse limit in reverse direction



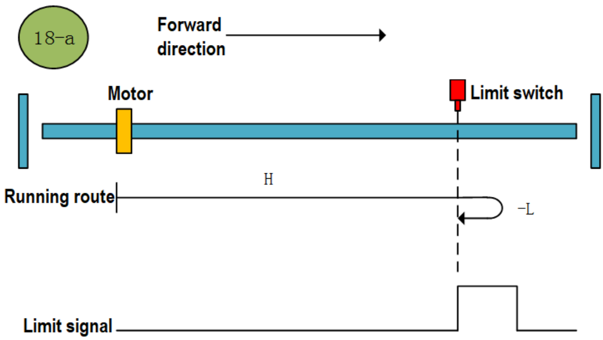
b. Start from rever limit, and search for the falling edge of limit signal in forward direction

Fig.11.49 Home position return method 17

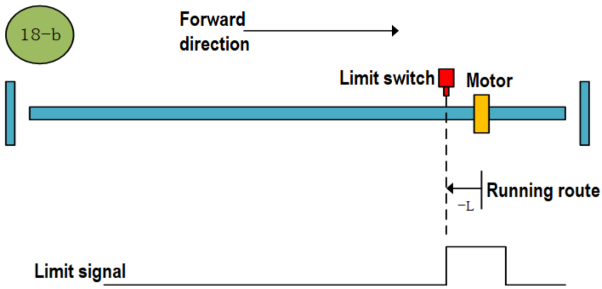
Home position return method 18 (6098 00h =18)

a: Start the home position return →Search for the forward limit at high speed forward direction →Touch the rising edge of forward limit →Decelerate to 0 →Stop after searching for the falling edge of forward limit at low speed reverse direction

b: Start the home position return →Forward limit valid →Stop after searching for the falling edge of forward limit at low speed reverse direction



a. Search for the rising edge of forward limit in forward direction



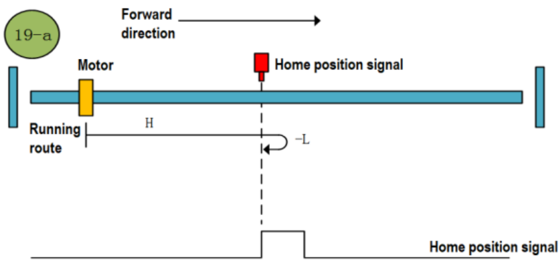
b. Start from forward limit, and search for the falling edge of limit signal in reverse direction

Fig.11.50 Home position return method 18

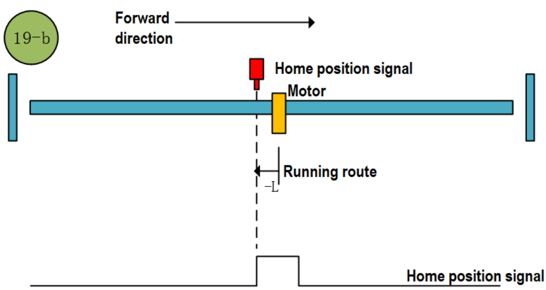
Home position return method 19 (6098 00h = 19)

a: Start the home position return →Search for the home position at high speed forward direction →Touch the rising edge of home position→Decelerate to 0 →Stop after searching for the falling edge of home position at low speed reverse direction

b: Start the home position return →Home position valid →Stop after searching for the falling edge of home position at low speed reverse direction



a. Search for the rising edge of home position signal in forward direction and stop at the right side of edge signal



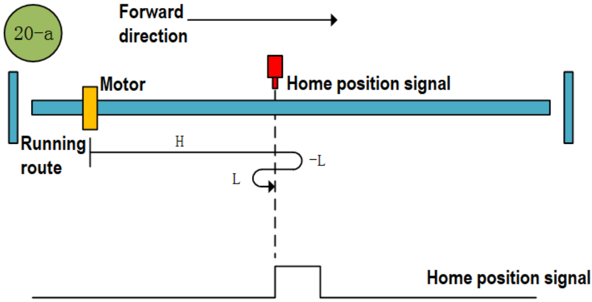
b. Start from the home position signal, and search for the falling edge of home position signal in reverse direction

Fig.11.51 Home position return method 19

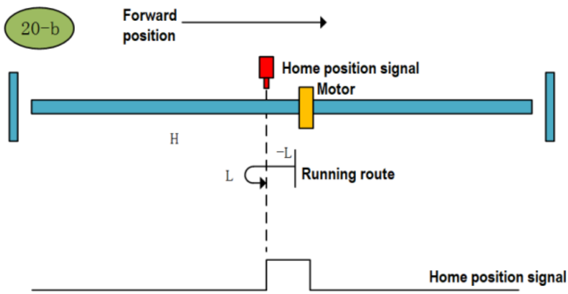
Home position return method 20 (6098 00h = 20)

a. Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Stop after searching for the rising edge of home position at low speed forward direction

b. Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed reverse direction →Stop after searching for the rising edge of home position at low speed forward direction



a. Search for the rising edge of home position signal in forward direction and stop at the left side of edge signal



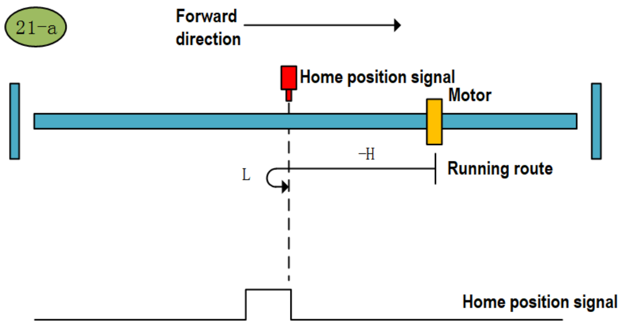
b. Start from the home position signal, and search for the falling edge of home position signal in reverse direction

Fig.11.52 Home position return method 20

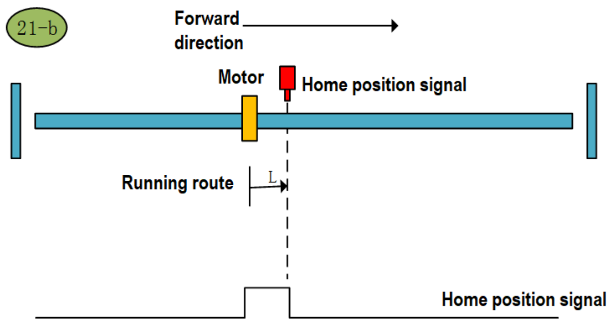
Home position return method 21 (6098 00h = 21)

a: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Stop after searching for the falling edge of home position at low speed forward direction

b: Start the home position return →Home position signal ON →Stop after searching for the falling edge of home position at low speed forward direction



a. Search for the rising edge of home position signal in reverse direction and stop at the left side of edge signal



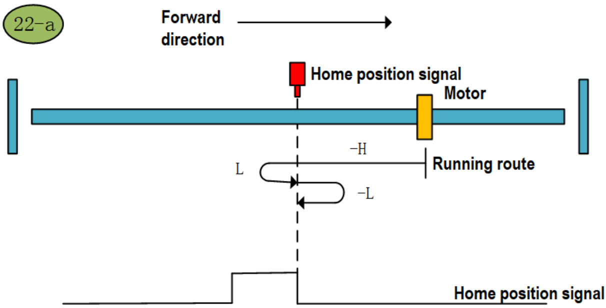
b. Start from the home position signal, and search for the falling edge of home position signal in forward direction

Fig.11.53 Home position return method 21

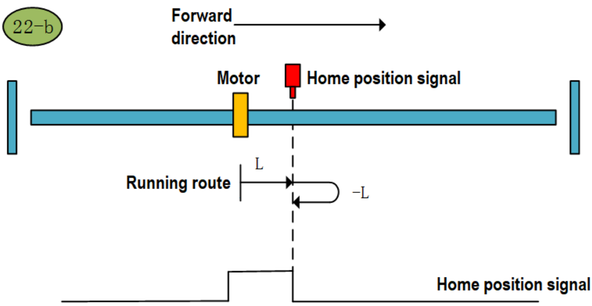
Home position return method 22 (6098 00h = 22)

a: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Stop after searching for the rising edge of home position at low speed reverse direction

b: Start the home position return→Home position signal ON→Search for the falling edge of home position at low speed forward direction→Stop after searching for the rising edge of home position at low speed reverse direction



a. Search for the rising edge of home position signal in reverse direction and stop at the right side of edge signal

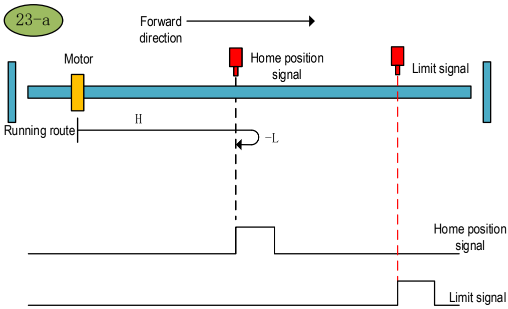


b. Start from the home position signal, and search for the falling edge of home position signal in forward direction

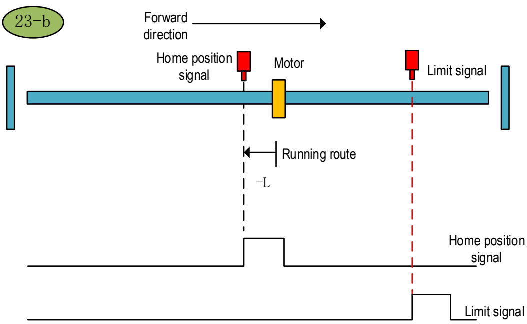
Fig.11.54 Home position return method 22

Home position return method 23 (6098 00h = 23)

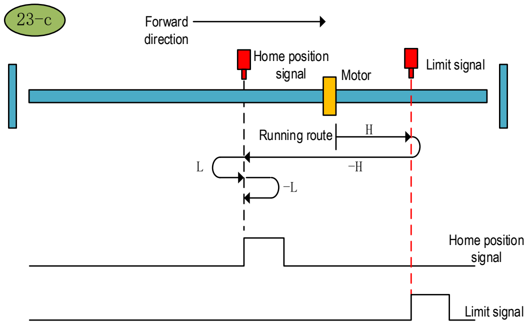
a: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Stop after searching for the falling edge of home position at low speed reverse direction
b: Start the home position return →Home position signal ON →Stop after searching for the falling edge of home position at low speed reverse direction
c: Start the home position return →Home position OFF →Search for the rising edge of home position at high speed forward direction →Touch the forward limit →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 → Search for the rising edge of home position at low speed forward direction →Stop after searching for the falling edge of home position at low speed reverse direction



a. Search for the rising edge of home position signal in forward direction (not touch the limit signal) and stop at the right side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in reverse direction



c. Touch the forward limit in forward direction, then search for the falling edge of home position signal in reverse direction and stop at the right side of edge signal

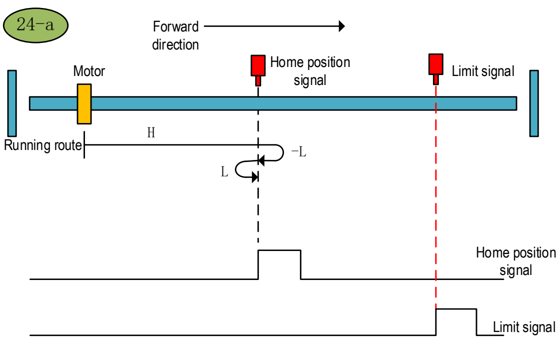
Fig.11.55 Home position return method 23

Home position return method 24 (6098 00h = 24)

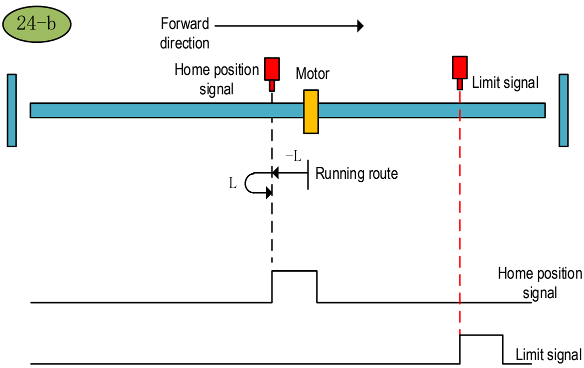
a: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed forward direction →Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Stop after searching for the rising edge of home position at low speed forward direction

b: Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed reverse direction →Stop after searching for the rising edge of home position at low speed forward direction

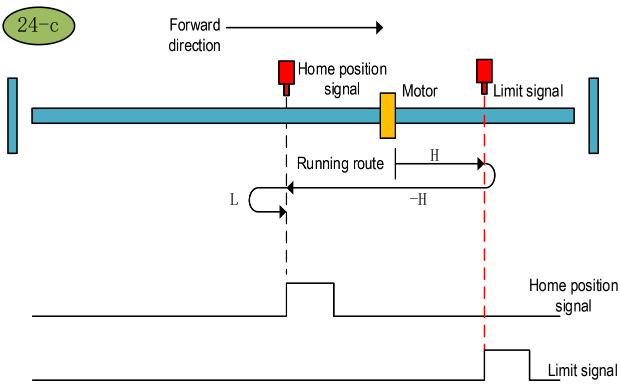
c: Start the home position return →Home position OFF →Search for the rising edge of home position at high speed forward direction →Touch the forward limit →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 → Stop after searching for the rising edge of home position at low speed forward direction



a. Search for the rising edge of home position signal in forward direction (not touch the limit signal) and stop at the left side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in reverse direction



c. Touch the forward limit in forward direction, then search for the falling edge of home position signal in reverse direction and stop at the left side of edge signal

Fig.11.56 Home position return method 24

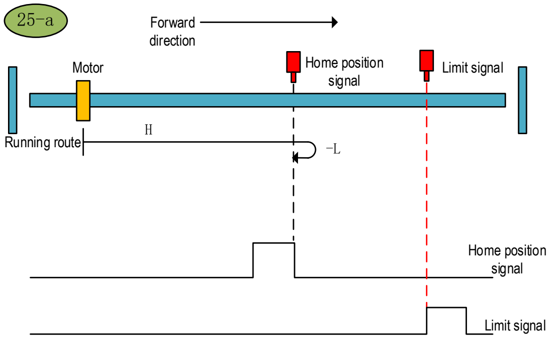
Home position return method 25 (6098 00h = 25)

a: Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Stop after searching for the rising edge of home position at low speed reverse direction

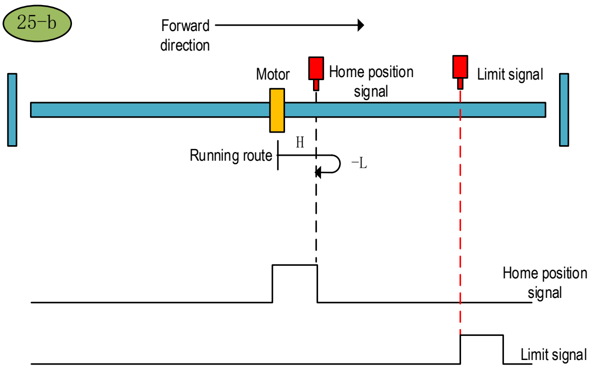
b: Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Stop after searching for the rising edge of home position at low speed reverse direction

c: Start the home position return →Home position OFF →Search for the falling edge of home position at high speed forward direction→Touch the forward limit →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →

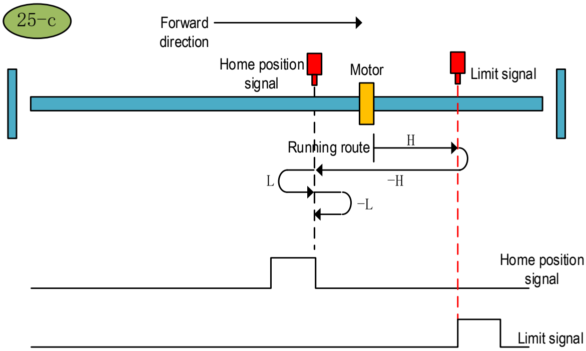
Search for the falling edge of home position at low speed forward direction →Stop after searching for the rising edge of home position at low speed reverse direction



a. Search for the falling edge of home position signal in forward direction (not touch the limit signal) and stop at the right side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in forward direction



c. Touch the forward limit in forward direction, then search for the falling edge of home position signal in reverse direction and stop at the right side of edge signal

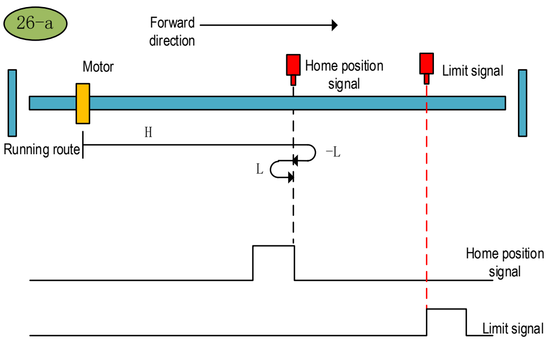
Fig.11.57 Home position return method 25

Home position return method 26 (6098 00h = 26)

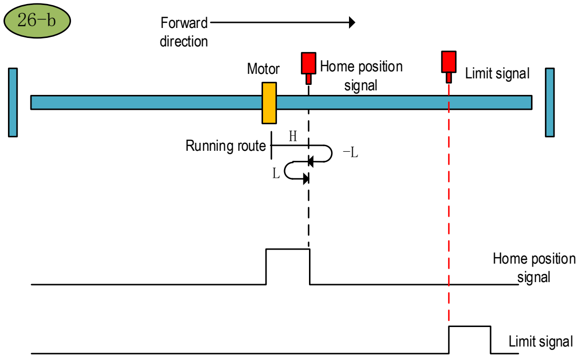
a: Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Stop after searching for the falling edge of home position at low speed forward direction

b: Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed forward direction→Decelerate to 0 →Search for the rising edge of home position at low speed reverse direction →Stop after searching for the falling edge of home position at low speed forward direction

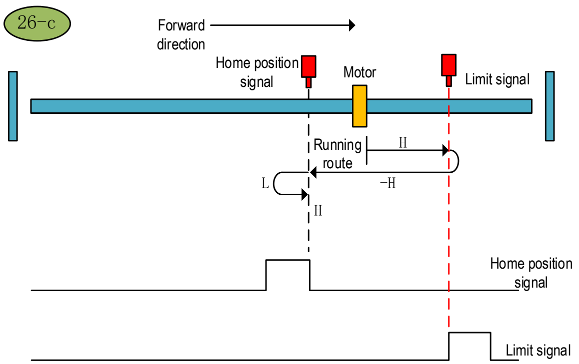
c: Start the home position return →Home position OFF →Search for the falling edge of home position at high speed forward direction→Touch the forward limit →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 → Stop after searching for the falling edge of home position at low speed forward direction



a. Search for the falling edge of home position signal in forward direction (not touch the limit signal) and stop at the left side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in forward direction



c. Touch the forward limit in forward direction, then search for the falling edge of home position signal in reverse direction and stop at the left side of edge signal

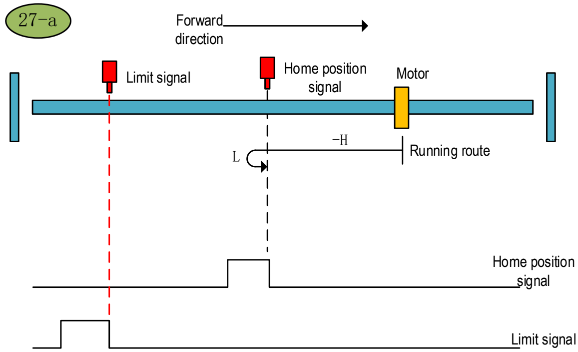
Fig.11.58 Home position return method 26

Home position return method 27 (6098 00h = 27)

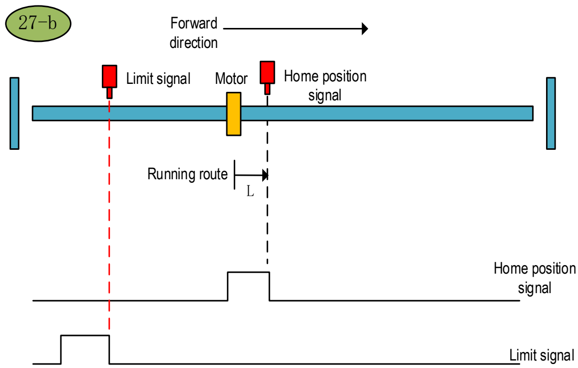
a: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Stop after searching for the falling edge of home position at low speed forward direction

b: Start the home position return →Home position signal ON →Stop after searching for the falling edge of home position at low speed forward direction

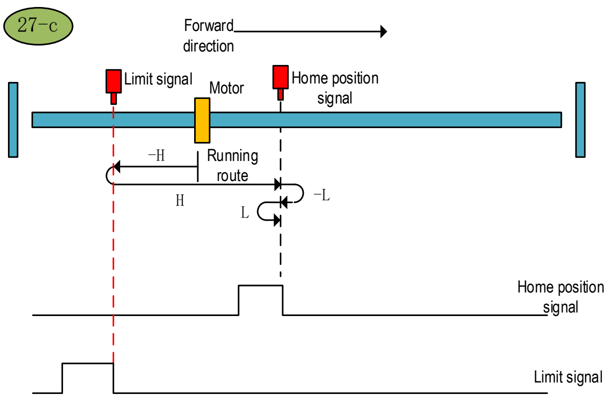
c: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Touch the reverse limit → Search for the falling edge of home position at high speed forward direction → Decelerate to 0 →Stop after searching for the rising edge of home position at low speed reverse direction



a. Search for the falling edge of home position signal in reverse direction (not touch the limit signal) and stop at the left side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in forward direction



c. Touch the reverse limit in reverse direction, then search for the falling edge of home position signal in reverse direction and stop at the left side of edge signal

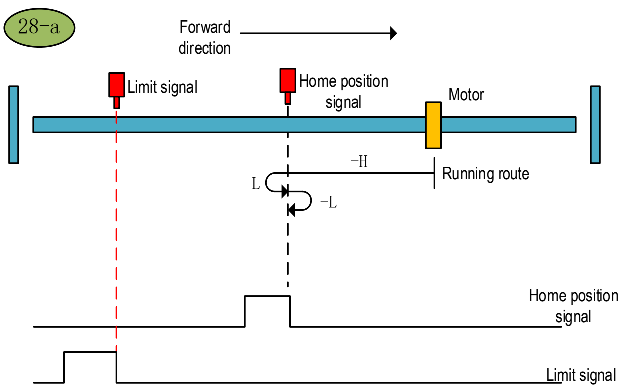
Fig.11.59 Home position return method 27

Home position return method 28 (6098 00h =28)

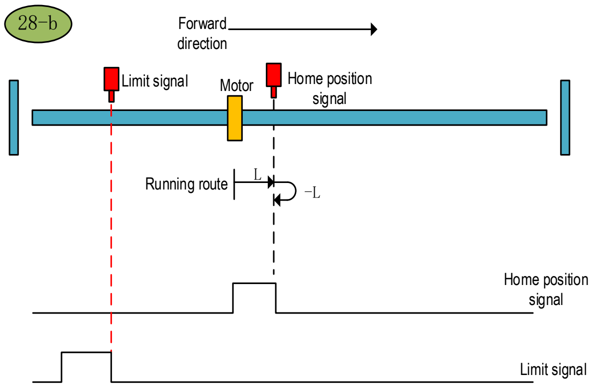
a: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Decelerate to 0 →Search for the falling edge of home position at low speed forward direction →Stop after searching for the rising edge of home position at low speed reverse direction

b: Start the home position return →Home position signal ON →Search for the falling edge of home position at low speed forward direction →Stop after searching for the rising edge of home position at low speed reverse direction

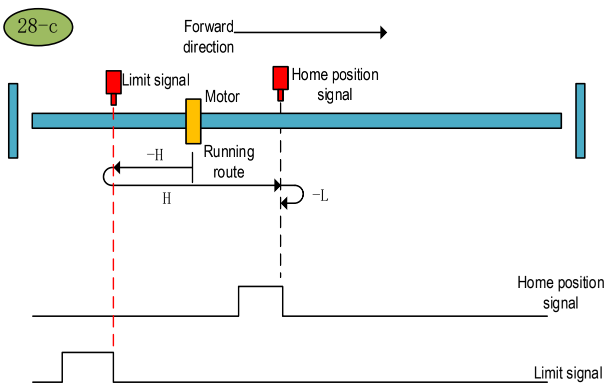
c: Start the home position return →Home position signal OFF →Search for the rising edge of home position at high speed reverse direction →Touch the reverse limit → Search for the falling edge of home position at high speed forward direction → Decelerate to 0 →Stop after searching for the rising edge of home position at low speed reverse direction



a. Search for the rising edge of home position signal in reverse direction (not touch the limit signal) and stop at the right side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in forward direction



c. Touch the reverse limit in reverse direction, then search for the falling edge of home position signal in forward direction and stop at the right side of edge signal

Fig.11.60 Home position return method 28

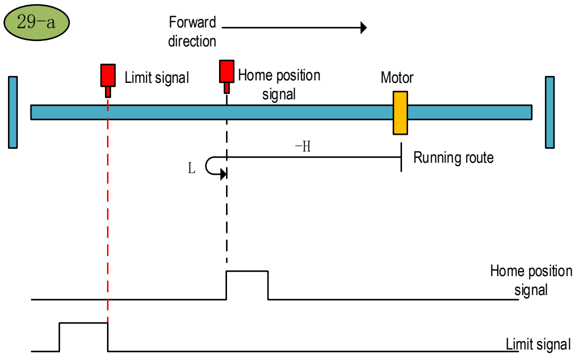
Home position return method 29 (6098 00h =29)

a: Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Stop after searching for the rising edge of home position at low speed forward direction

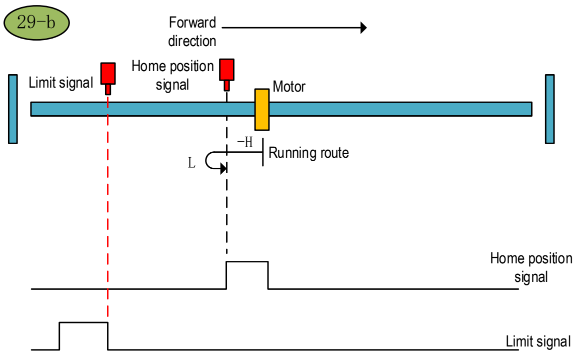
b: Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Stop after searching for the rising edge of home position at low speed forward direction

c: Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Touch the reverse limit → Search for the rising edge of home position at high speed forward direction →

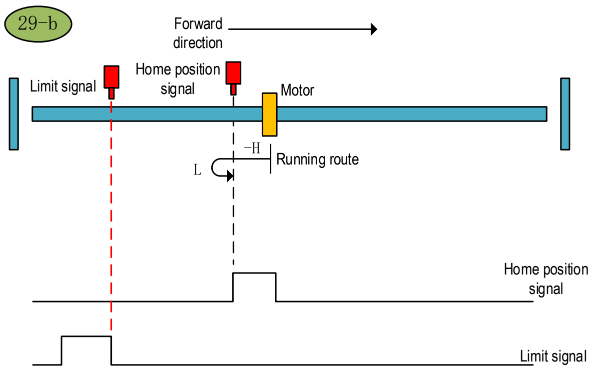
Decelerate to 0 →Search for the falling edge of home position at low speed reverse direction →Stop after searching for the rising edge of home position at low speed forward direction



a. Search for the falling edge of home position signal in reverse direction (not touch the limit signal) and stop at the left side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in forward direction



c. Touch the reverse limit in reverse direction, then search for the rising edge of home position signal in forward direction and stop at the left side of edge signal

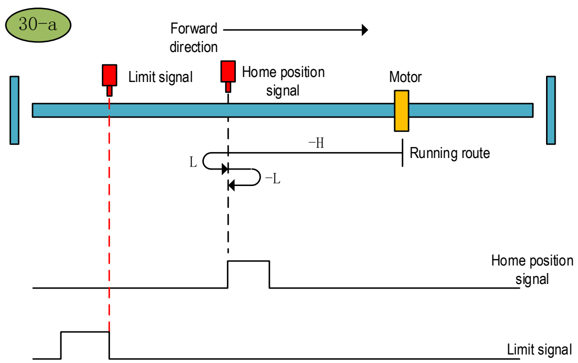
Fig.11.61 Home position return method 29

Home position return method 30 (6098 00h = 30)

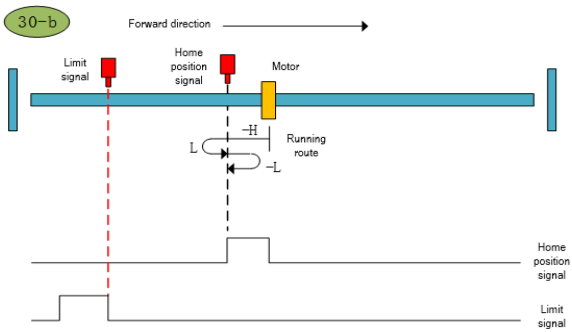
a: Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Stop after searching for the falling edge of home position at low speed reverse direction

b: Start the home position return →Home position signal ON →Search for the falling edge of home position at high speed reverse direction →Decelerate to 0 →Search for the rising edge of home position at low speed forward direction →Stop after searching for the falling edge of home position at low speed reverse direction

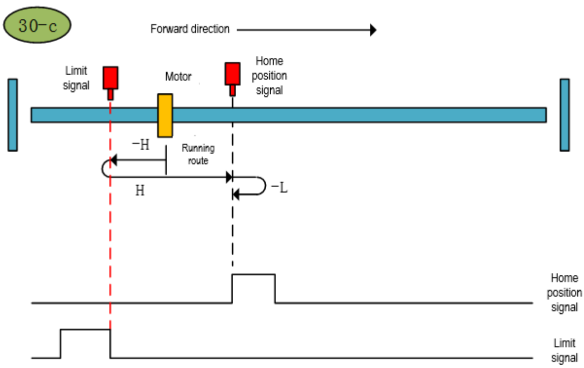
c: Start the home position return →Home position signal OFF →Search for the falling edge of home position at high speed reverse direction →Touch the reverse limit → Search for the rising edge of home position at high speed forward direction → Decelerate to 0 → Stop after searching for the falling edge of home position at low speed reverse direction



a. Search for the falling edge of home position signal in reverse direction (not touch the limit signal) and stop at the right side of edge signal



b. Start from the home position signal, and search for the falling edge of home position signal in reverse direction



c. Touch the reverse limit in reverse direction, then search for the rising edge of home position signal in forward direction and stop at the right side of edge signal

Fig.11.62 Home position return method 30

Home position return method 31 (6098 00h = 31): Reserved。

Home position return method 32 (6098 00h = 32): Reserved。

Home position return method 33 (6098 00h = 33)

Start the home position return →Find the first Z pulse in the reverse direction

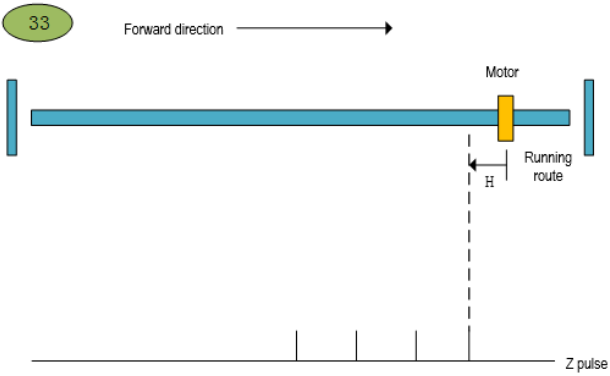


Fig.11.63 Home position return method 33

Home position return method 34 (6098 00h = 34)

Start the home position return →Find the first Z pulse in the forward direction

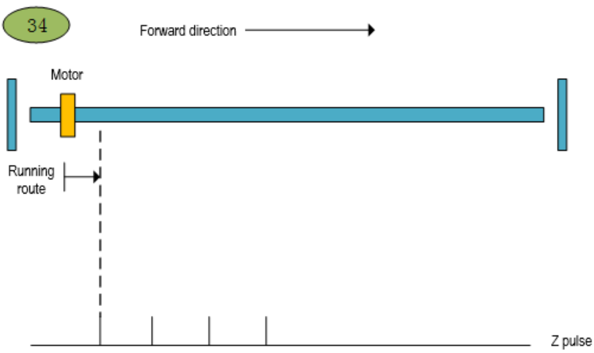


Fig.11.64 Home position return method 34

NOTE

Chapter 12 Motion Control

12.1 Home Position Return

12.1.1 Home position return

Home position: the mechanical home position, which can represent the home position or motor Z signal position. It is set by the function code Pn290.Y.

Zero point: the positioning target point, which can be expressed as the home position + offset (set by Pn294); when Pn294=0, the zero point coincides with the home position.

The home position return process is the process in which the servo drive controls the motor to locate the home position or zero point in a set method in the position mode.

The home position signal source can be given in three ways: limit signal, mechanical home position signal and Z pulse. The home position signal can generally be represented by a level signal with a certain pulse width. In order to accurately locate the home position signal, when selecting the home position signal source, it is necessary to select the forward or reverse rising edge of the home position signal source as the home position signal, as shown in Figure 12.1

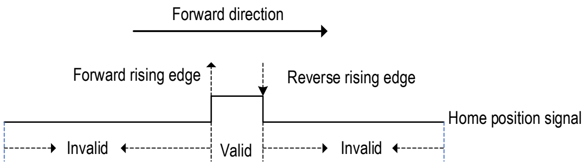


Fig. 12.1 Schematic diagram of home position signal direction selection

When starting the home position return, a large speed value is given to ensure the speed of finding the home position; Define the first time that touches the home position signal as **deceleration point**. After the deceleration point is touched, the home position return speed is switched to low speed to find home position accurately. The accuracy of the home position during home position return is affected by the speed of finding the home position at low speed; the higher the speed of fidning the home position at low speed , the greater the pulse deviation of the home position signal edge .

Related input terminal signals:

Setting value	Terminal name	Functional name	Description	Trigger method	Operation mode
0x02	P-OT	Forward limit	The motor forward rotation is prohibited at high level.	Level trigger	P
0x03	N-OT	Reverse limit	The motor reverse rotation is prohibited at high level.	Level trigger	P
0x27	ORGEN	Home position return enable	The terminal signal is used to trigger home position return in position control mode.	Level trigger; Signal edge	P

				trigger	
0x28	ORGS	Mechanical home position signal	Used as home position signal to feed back to the drive during the Home position return process.	Level trigger; Signal edge trigger	P

Related output terminals:

Setting value	Terminal name	Functional name	Description	Trigger method	Operating mode
0x15	ORGC	Home position return completion signal	Failure to perform home position return, interrupted home position return Home position return fails: Output OFF Home position return succeeds:Output ON	Level trigger	P

Home position return related function codes :

Function code	Parameter Name	Range	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 position return enable control	0: Disable the home position return function 1: Home position return triggered via DI terminal 2: Perform home position return immediately after power-on and servo is enabled 3: Perform home position return immediately 4: Define the current point as the home position	0
Pn290.Y	Home position return method	0 to 10 (refer to table 12-1 for details)	0
Pn290.Z	Home position return trigger method	0: Run at low level, stop at high level (falling edge trigger) 1: Rising edge trigger	1

		2: Falling edge trigger 3: Run at high level, stop at low level (rising edge trigger)	
Pn290.W	Home position return timeout time unit	0: ms 1: 10ms 2: 100ms	0
Pn291	Speed at high-speed home position return	0 ~ 30,000 (0.1rpm)	1000
Pn292	Speed at low-speed home position return	0 ~ 10000 (0.1rpm)	100
Pn293	Acceleration & deceleration time of home position return	0 ~ 3000 (ms)	3000
Pn294	The zero offset value after finding the 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 position return timeout period	0 ~ 65535 (ms)	10000

12.1.2 Overview of the home position return method

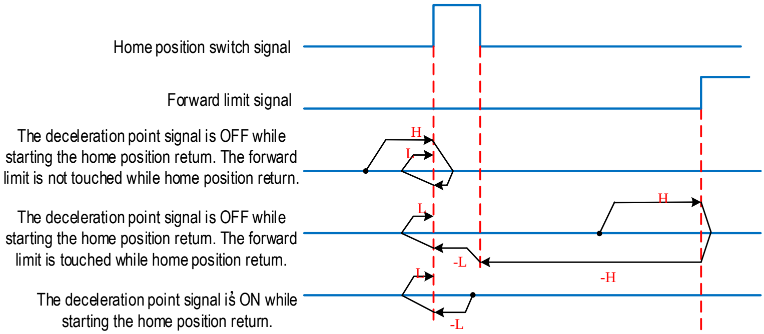
The Home position return method can be classified according to the home position signal source, home position return direction, deceleration point type, and whether or not the Z pulse is used, as shown in Table 12-1.

Table 12-1 Classification of SD780 home position return methods

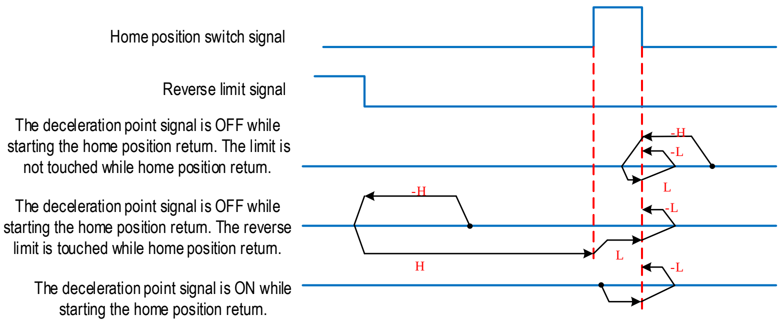
Home position return method	Starting running direction	Deceleration point	Home position
0	forward direction	home position	home position
1	reverse direction	home position	home position
2	forward direction	home position	Z-signal
3	reverse direction	home position	Z-signal
4	forward direction	forward limit	forward limit
5	reverse direction	reverse limit	reverse limit
6	forward direction	forward limit	Z-signal
7	reverse direction	reverse limit	Z-signal
8	forward direction operation	Z-signal	Z-signal
9	reverse direction operation	Z-signal	Z-signal

10	Absolute position back to zero, running to the specified position (This absolute position is set by Pn296 and Pn297)

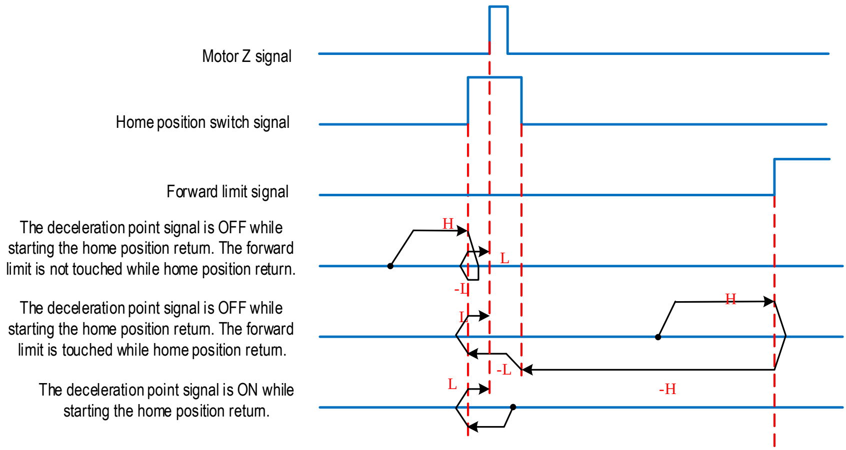
Home position return method 0:



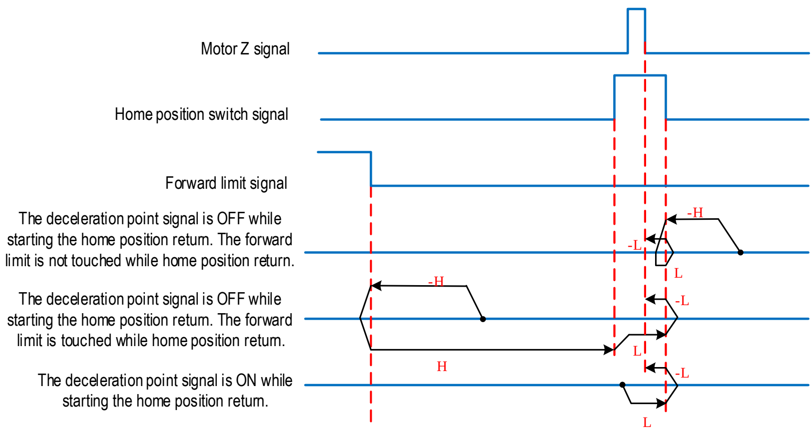
Home position return method 1:



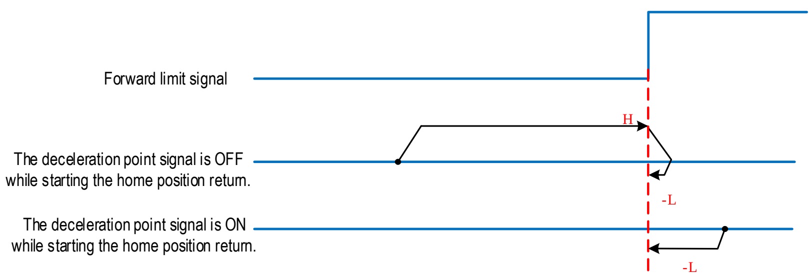
Home position return method 2:



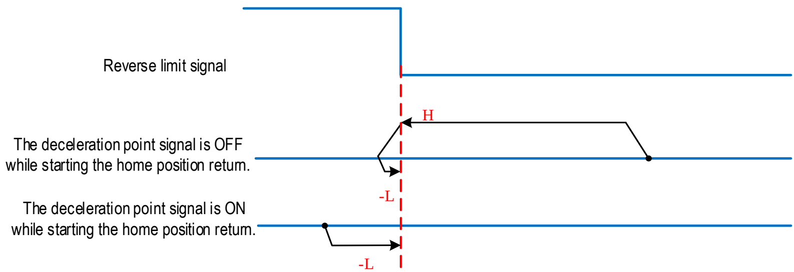
Home position return method 3:



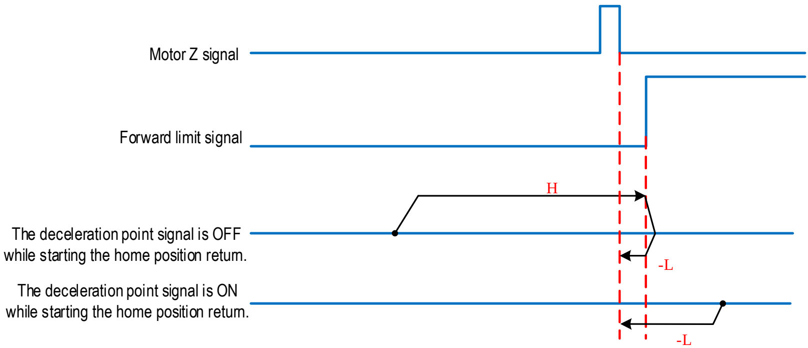
Home position return method 4:



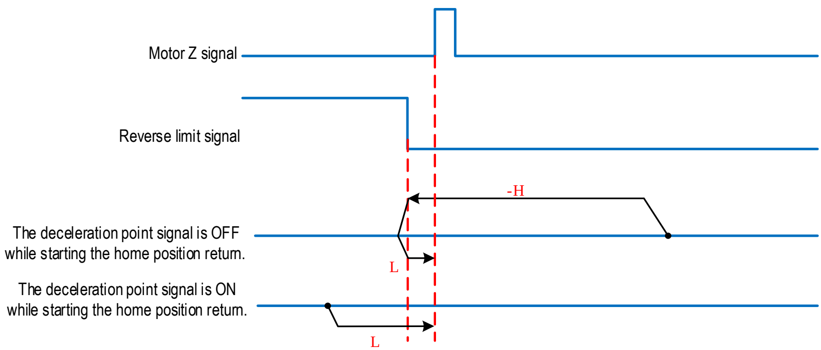
Home position return method 5:



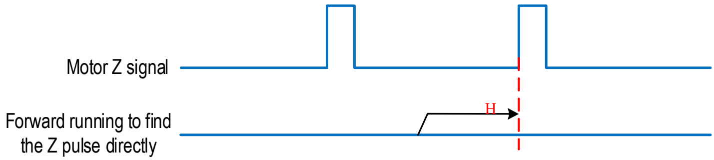
Home position return method 6:



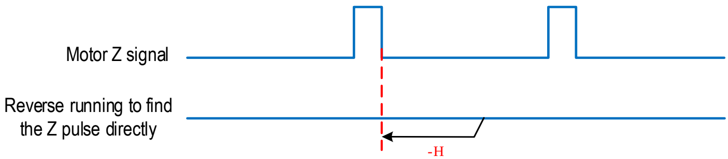
Home position return method 7:



Home position return method 8:



Home position return method 9:



The above home position return method 0 to 9 is the zero return method with the home position signal, limit signal or motor Z signal as the deceleration point or zero point. The specific zero return procedure is described in sections 12.1.3 to 12.1.8. These subsections take the forward direction return method (0, 2, 4, 6, 8, 10) as an example and describe the home position return process in details.

12.1.3 Home position return method 0

Home position return method 0 is the home position return method in forward direction. The deceleration point and home position are both home position switch.

(1) Home position return method 0 running route 1

Home position return method 0 running route 1: start running in forward direction, decelerate after touching the forward rising edge of the home position switch, find the deceleration point, and use the deceleration point as the home position signal. The process of home position return method 0 running route 1 to find the home position signal is shown in Figure 12.2.

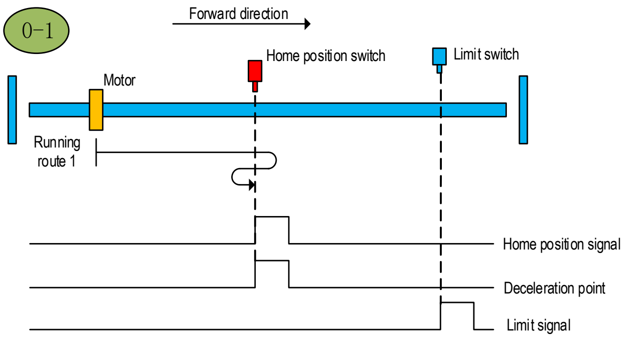


Fig. 12.2 Home position return method 0 running route 1

(2) Home position return method 0 running route 2

Home position return method 0 running route 2: The motor starts running at high speed of home position return in forward direction. During operation, it encounters the forward limit signal, and then the home position return changes direction, and reverse runs at high speed of home position return, searching for the forward rising edge of the home position switch. It stops immediately after finding the forward rising edge of the home position switch, and the running route is shown in Figure 12.3.

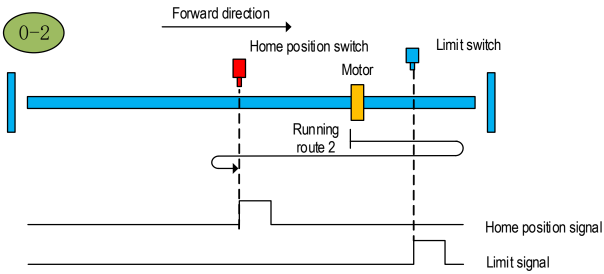


Fig. 12.3 Home position return method 0 running route 2

(3) Home position return method 0 running route 3

Home position return method 0 running route 3: While starting the operation, the current home position signal is high level, that is, already in the deceleration point. So the motor directly starts from the starting point, and reverse runs at low speed of home position return to find the home position switch reverse falling edge, The home position return method 0 running route 3 is shown in Figure 12.4.

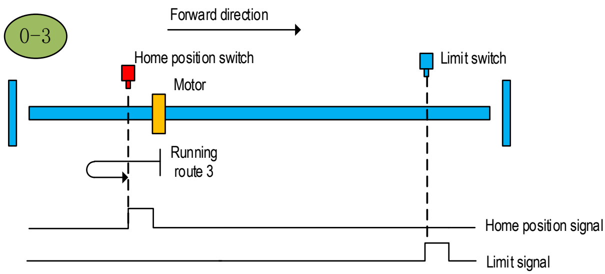


Fig. 12.4 Home position return method 0 running route 3

12.1.4 Home position return method 2

Home position return method 2 is the home position return method in forward direction. The deceleration point is the home position switch, and the home position is the Z signal.

(1) Home position return method 2 running route 1

Home position return method 2 running route 1: Start in the forward direction, decelerate after touching the forward rising edge of the home position switch, find the deceleration point, and use the first Z pulse in the forward direction as the home position signal. The home position return method 2 running route 1 is shown in Figure 12.5.

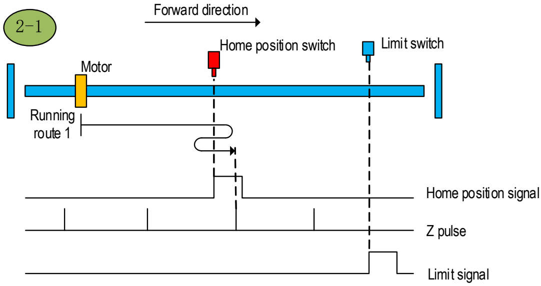


Fig. 12.5 Home position return method 2 running route1

(2) Home position return method 2 running route 2

Home position return method 2 running route 2: The motor starts running at high speed of home position return in the forward direction. During the running process, When the forward limit signal is encountered, the home position return changes direction and reverse runs at high speed of home position return, to find the reverse falling edge of the home position switch. After finding the reverse falling edge of the home position switch, the first Z pulse signal in the forward direction is used as the home position signal. The running route is shown in Figure 12.6.

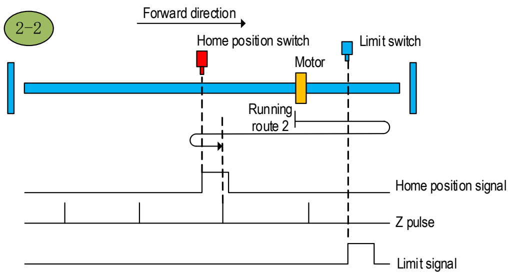


Fig. 12.6 Home position return method 2 running route 2

(3) Home position return method 2 running route 3

Home position return method 2 running route 3: While starting the operation, the current home position signal is high level, that is. already at the deceleration point. The motor directly starts from the deceleration point, and reverse runs at low speed of home position return to find the reverse falling edge of the home position switch, and then finds the first Z pulse in the forward direction. The process of finding the home position signal for the home position return method 2 running route 3 is shown in Figure 12.7.

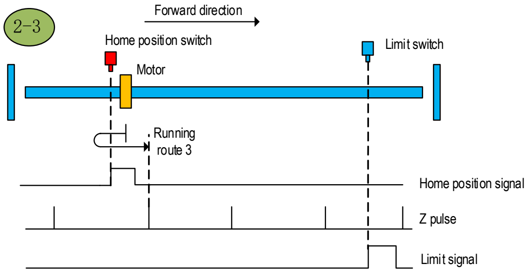


Fig. 12.7 Home position return method 2 running route3

12.1.5 Home position return method 4

Home position return method 4 is the home position return method in forward direction. The deceleration point and home position are limit switch.

(1) Home position return method 4 running route 1

Start in the forward direction, decelerate after touching the forward rising edge of the limit switch, find the deceleration point, and use the deceleration point as the home position signal. The home position return method 4 running route 1 is shown in Figure 12.8..

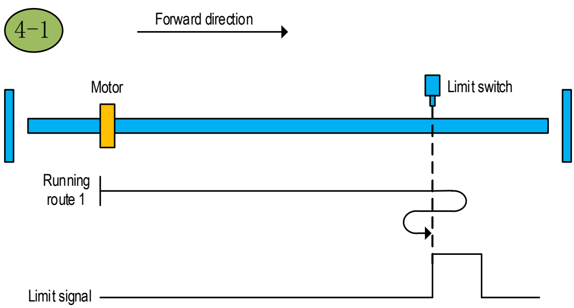


Fig. 12.8 Home position return method 4 running route 1

(2) Home position return method 4 running route 2

The forward limit signal is valid while starting, that is., the motor starts from the deceleration point, then the system reverses to find the home position, and use the reverse falling edge of the forward limit touched as the home position signal. The home position return process of the home position return method 4 running route 2 is shown in Figure 12.9.

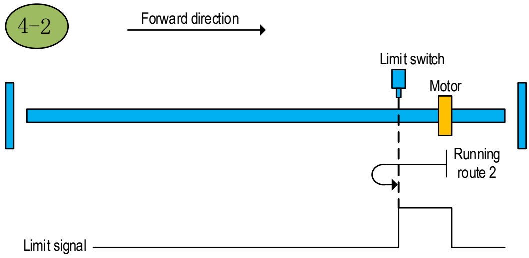


Fig. 12.9 Home position return method 4 running route 2

12.1.6 Home position return method 6

The home position return method 6 is the home return method in forward direction. The deceleration point is the forward limit switch, and the home position is the Z signal.

(1) Home position return method 6 running route 1

Start in the forward direction, decelerate after touching the forward rising edge of the limit switch, find the deceleration point, and use the first Z pulse in the reverse direction as the home position signal. The home position return method 6 running route 1 is shown in Figure 12.10.

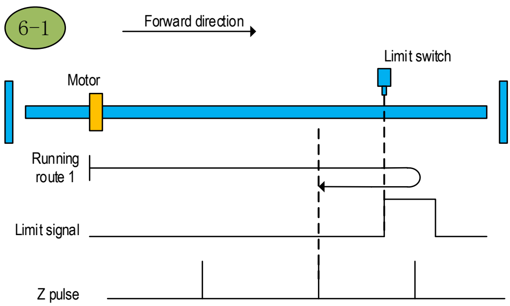


Fig. 12.10 Home position return method 6 running route1

(2) Home position return method 6 running route 2

Start in the forward limit signal and run in reverse direction, decelerate after touching the reverse falling edge of the limit switch, find the deceleration point, and use the first Z pulse in the reverse direction as the home position signal. The home position return method 6 running route 2 is shown in Figure 12.11.

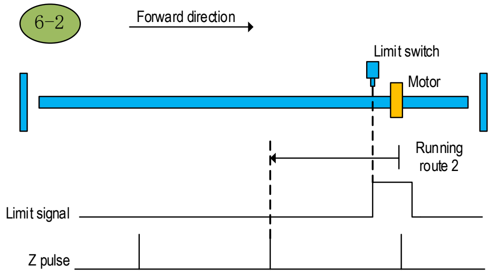


Fig. 12.11 Home position return method 6 running route 2

12.1.7 Home position return method 8

Home position return method 8 is the home position return method in forward direction. The deceleration point and home position are both Z-signal.

Home position return method 8: Start in the forward direction and decelerate to 0 and stop when it touches the first Z signal in the forward direction. The process of finding the home position signal for home position return method 8 is shown in Figure 12.12.

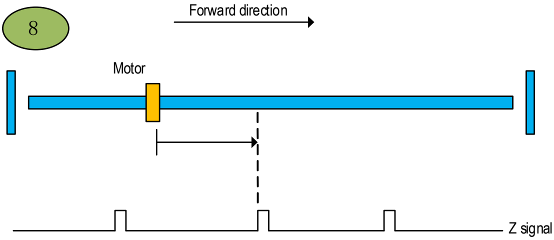


Fig. 12.12 Home position return approach8

12.1.8 Home position return method 10

Home position return method 10 is the home position return method that runs to the absolute position.

Set the zero point of absolute position by Pn296 and Pn297. When absolute position return is selected, the motor directly returns from the current position to the set absolute zero point at high speed of home position return speed, and this home position return method needs to be used with multi-turn absolute encoder.

Example: The current absolute position of the motor encoder is 5 turns 0 pulses, the set absolute return multi-turn value is 10, the single turn value is 0, then the motor runs directly at high speed for 5 turns.

12.2 Internal multi-segment positions

12.2.1 Basic internal position settings

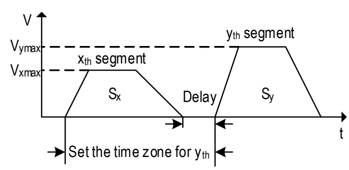
Function code	Parameter Name	Range	Setting value

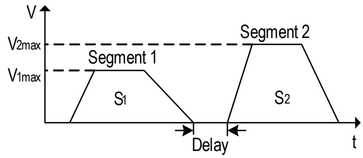
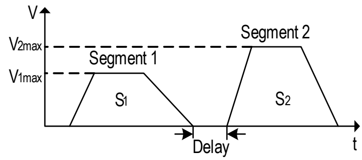
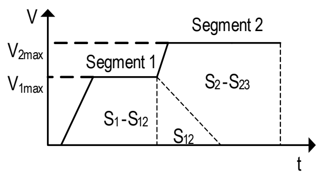
Pn000.X	Control mode selection	0: Position control mode 1: Speed control mode 2: Torque control mode 3: Speed-position control mode 4: Torque-position control mode 5: Speed-torque control mode	0
Pn002.X	Position mode command source selection	0: External pulse sequence (CN1) 1: Fully closed-loop pulse sequence (CN5) 2: Internal position given	2
Pn204	Electronic gear numerator (B)	0 ~ 1073741824	1
Pn206	Electronic gear denominator (A)	1 ~ 1073741824	1

Note	
	● 1. When the numerator of the electronic gear ratio is 0, the denominator setting is the number of command pulses corresponding to one revolution of motor operation. ● 2. 0.001 ≤ electronic gear ratio (B/A) ≤ 64000. If the setting range is exceeded, "Parameter error (Er.d04) alarm" will occur.

12.2. 2 Internal multi-segment position operation mode

Table 12-2 Description of internal multi-segment position operation

Pn802.X Setting value	running mode	note	Running waveform
0	single segment position	The segment number is controlled by the communication function code (Pn806) or the DI terminal (CTRG and POS0 ~ POS3). The next segment number can be set when running at the current segment number, and the motor stops when it completes the operation of current	 V_{xmax} and V_{ymax} are the maximum operation speeds (target speeds) for the x_{th} and y_{th} segments, respectively. S_x and S_y are the x_{th} and y_{th} segment displacements , respectively.

		segment command. CTRG rising edge triggered operation.	
1	Single-time multi-segment position	Automatic incremental switching between segment numbers, a settable delay between segments, the motor stops after 1 round operation. CTRG is active at high level and stops at low level.	 $V_{1max}$and V_{2max} are the maximum operation speeds (target speeds) for Segment 1 and Segment 2, respectively. $S_1$and S_2 are the segment 1 and segment 2 displacements, respectively.
2	Cyclic multi-segment position	Automatic incremental switching between segment numbers, a settable delay between segments, cyclic operation, Pr1 is used as the starting path each time. CTRG is active at high level and stops at low level.	
3	Sequential multi-segment position	Automatic incremental switching between segment numbers, no delay between segments. Can be cyclic or run only 1 round (When Pn804 = 0 or Pn804 > Pn803 only run 1 round). Round 1 starts with Pr1 as the starting path; Pn 804 is the starting segment number after Round 1.	 S_{12} is the displacement of the deceleration segment of S1. The segment position is directly skipped and run while executing S_2.

		CTRG is active at high level and stops at low level.	

Note	
	● When multi-segment position (Pn802.X=1, 2, 3), Pn806=1 (communication, panel) can also trigger operation ● When Pn806=1000, all the point position modes (Home position return and internal multi-segment position) can be forced to stop.

Related function codes:

Function code	Parameter Name	Range	Default
Pn802.X	Internal position operation mode	0: Single segment operation 1: Single continuous operation 2: Cyclic continuous operation 3: Sequential operation	0
Pn802.Y	Multi-segment position margin handling	0: Continue running the untracked path (start from the next section when paused) 1: Restarting from Pr1	0
Pn802.Z	New command processing for single segment positions	0: Non-immediate update. When a new command is available, execute the current command before executing the new command (Delay is valid) 1: Update immediately (Delay is not valid)	0
Pn802.W	Absolute position starting point selection	0: Motor position is the starting point after initial power-on or home position return 1: Absolute zero point set by Pn296, Pn297 is the starting point	0
Pn803	Multi-segment position (speed) endpoint path	1 ~ 15	1
Pn804	Sequential operation start path	0 ~ 15	1
Pn806	Pr command communication	0 ~ 65535	10000

	parameters (single-segment operation)		
Pn810.	PR Type (TYPE)	0: Positioning control 1: Fixed speed control	0
Pn810.Y	Type of positioning control	0: Positioning control as incremental position 1: Positioning control as absolute position 2: Positioning control as 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: Corresponds to function codes Pn890 ~ Pn897	0
Pn811.Y	Deceleration time (DEC)	0 ~ 7: Corresponds to function codes Pn890 ~ Pn897	0
Pn811.Z	Positioning control target speed	0 ~ 7: Corresponds to function codes Pn8A0 ~ Pn8A7	0
Pn811.W	delay time	0 ~ 7: Corresponds to function codes Pn898 ~ Pn89F	0
Pn812	Pr1 path information	-2^{31}~ $2^{31}-1$	0
...	...	...	...
Pn890 ~ Pn897	Pr acceleration and deceleration time 0 ~ 7	0 ~ 60000	-
Pn898 ~ Pn89F	Pr delay time 0 ~ 7	0 ~ 60000	-
Pn8A0 ~ Pn8A7	Pr target speed 0 ~ 7	0 ~ 60000	-

Note
● Round 1 of the sequential operation starts from Pr1 and runs to the path pointed to by Pn803. ● If Pn804 = 0 or Pn804 > Pn803 in sequential operation, motor stops after 1 round of operation. ● If Pn804 ≤ Pn803 in sequential operation, the cyclic operation peforms after round 1 and the starting segment number is Pn804.

12.2.3 Internal multi-segment position functional parameters

The point position function plans the corresponding position running route according to the set speed, acceleration and deceleration time, delay, and target position value. The operation parameters of the first position command segment are used as an example for illustration.

(1) Position command

In position mode, the pulse number of position command for point position control is given by Pn804+ POSNUM*4. The position command units are user units. The pulse number in one revolution of position command is given by the electronic gear ratio Pn204 and Pn206.

The target position value in position mode 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 Figure 12.13, the first segment position command is set to PosCmd0, and after running the pulses of Pos0, the operation ends, and the remaining pulses of PosRem0 are not completed. If the second segment incremental position command PosCmd1 is inserted at this point, the total number of pulses run by the second segment position command, is PosCmd1+ PosRem0, and the final operation position value is PosCmd0+ PosCmd1.

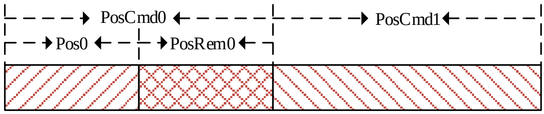


Fig. 12.13 Schematic diagram of the operation of the incremental position command

② The relative position command takes the actual position value as the reference point. The position command value of the next segment takes the actual position value in operation as the reference point to calculate the target position value. As shown in Figure 12.14, the Setting 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, then the total number of pulses run by the second segment position command is PosCmd1, and the final operation position value is Pos0+ PosCmd1.

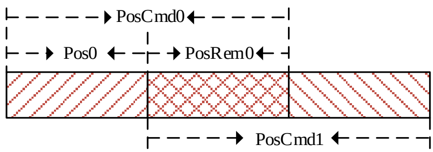


Fig. 12.14 Schematic diagram of relative position command operation

③ The absolute position command takes the position value relative to the absolute zero (set by Pn296 and Pn297) as the reference point. As shown in Figure 12.15, the first segment position command is set to PosCmd0, and after running the pulse of Pos0, the second segment absolute position command PosCmd1 is inserted, then the total number of pulses run by the second segment position command, is PosCmd1-Pos0, and the final operation position value is PosCmd1.

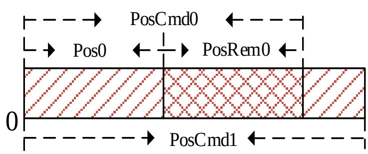


Fig. 12.15 Schematic diagram of absolute position command operation

(2) Acceleration and deceleration time

During the operation of the point position control function, the acceleration and deceleration times for motor operation are calculated with the acceleration and deceleration base value of 3000rpm. For example, if the acceleration time for motor operation is 300ms and the target speed is 1000rpm, it means that it takes 300ms to accelerate from 0rpm to 3000rpm during the set motor operation, and 100ms to accelerate from 0rpm to the target speed of 1000rpm.

(3) Speed control

The speed given of internal multi-segment position is divided into two types: position control mode and speed control mode.

① For the position control mode, when planning the position command, the desired operation speed is given by the speed set by bit 8 ~ bit 11 of the high 16 bits of the control word in the Pr command segment (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, when planning the speed command, the target speed value is given by the corresponding Pr information. For example, if Pr1 is speed control, the target speed unit (0.1rpm or PPS) can be selected by setting Pn810.Z and then set the value of Pn812 to control the target speed of Pr1; if the motor is expected to run in reverse, Pn812 can be set to a negative value.

(4) Time delay

① For single-segment position, single-time multi-segment position and cyclic multi-segment position modes, the **time delay is valid**. Set the delay for Pr1 to T (ms), and after the Pr1 command is completed, a delay of T (ms) is required before the next Pr command segment can be executed. If the delay is 0, the deceleration process of the current Pr command or the acceleration process of the next Pr command is skipped. For example, if the target speed of Pr1 is 800rpm and the target speed of Pr2 is 1000rpm, when switching from Pr1 to Pr2, if the delay is 0, the acceleration is directly from 800rpm to 1000rpm.

② For sequential multi-segment position, the **delay is not valid,** and the deceleration process or acceleration process will be skipped between segments, and it will start directly 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.

12.2.4 Single-segment position operation

For the single segment operation mode (Pn802.X=0) in the multi-segment position, it means that the Pr command segment is changed and triggered by the user through an external DI terminal or communication function code (Pn806). When the Pr path is selected through an external terminal, the terminal-Pr path relationship is shown in Table 12-3. When triggered by the communication function code, the home position return is executed when Pn806 = 0, and the corresponding Pr path is executed when it is 1 ~ 15. During the operation, Pn806=10000+Num (Num is the Pr path segment, for example, when running the Pr1, Num=1); after the operation, Pn806=20000+Num.

Table 12-3 Terminals and corresponding Pr paths during single-segment position operation

POS3	POS2	POS1	POS0	CTRG ↑ Command Execution	CTRG ↓ Command Execution
0	0	0	0	Home position return	stop immediately
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

Steps	Items	Specific actions
1	Mode Selection	**Pn000.X=0** (control mode is position control) **Pn002.X=2** (Position control command source is internal multi-segment position) **Pn802.X=0** (single segment operation mode selected). **Pn204=0, Pn206=20000** (23-bit encoder motor, electronic gear ratio is 8388608: 20000).
2	Terminal Assignment	**Pn601.YX=0x01** (assign terminal X1 as servo enable terminal S-ON). **Pn604.YX=0x20** (assign terminal X4 as internal position trigger termsinal CTRG). **Pn605.YX=0x21** (assign terminal X5 as internal position selection POS0).
3	Acceleration & deceleration time setting	**Pn890=600** (The acceleration and deceleration time for the 0th segment is 600, and the acceleration from 0 to 3000rpm or deceleration from 3000rpm to 0 is 600ms).
4	Pr1 command	**Pn810.X=0, Pn810.Y=0** (i.e. incremental positioning mode

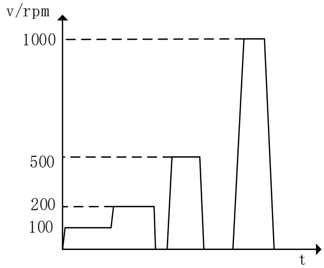
	control word setting	selected). **Pn811=0x0000** (target speed is Pn8A0, i.e. 100rpm; acceleration and deceleration time is Pn890, i.e. 600ms; delay time is Pn898, i.e. 0ms, no delay).
5	Terminal trigger operation Pr1	Enabling servo with POS0 = 1, i.e. selecting the Pr1 path. Pn812 = 100000, i.e. Pr1 information is100000 pulses. Slide CTRG from 0 to 1 to run Pr1 for 100,000 pulses at 100 rpm. After running, Un013 has increased by 100000 to the value before the running.
6	Communication trigger operation Pr1	Let Pn812 = 200000 and Pn806 = 1, then the servo runs the internal position Pr1 for 200000 pulses. If Pn806=1000 during operation, the servo stops immediately.

12.2.5 Single continuous run

The single multi-segment position (Pn802.X=1) is an operation mode of the internal multi-segment position, which starts from Pr1 and runs only once per trigger. The end segment of the internal position is controlled by the value of Pn803, e.g. 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 run

Steps	Items	Specific actions
1	Mode Selection	**Pn000.X=0** (control mode is position control) **Pn002.X=2** (Position control command source is internal multi-segment position) **Pn802.X=1** (select single continuous operation mode). **Pn204=0, Pn206=20000** (23-bit encoder motor, electronic gear ratio is 8388608: 20000).
2	Terminal Assignment	**Pn601.YX=0x01** (assign terminal X1 as servo enable terminal S-ON). **Pn604.YX=0x20** (assign terminal X4 as internal position trigger terminal CTRG).
3	Multi-segment position Pr command setting	**Pn803 = 4,** (the internal multi-segment position endpoint is 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 & deceleration time 0~3, target speed 0~3, and delay 0~3 are default values.
4	Terminal trigger single multi-segment	Enabling servo. Slide CTRG from 0 to 1 to trigger a single multi-segment operation command. The speed waveform of the operation is shown below with an encoder position feedback pulse increment of 100000 PUU.

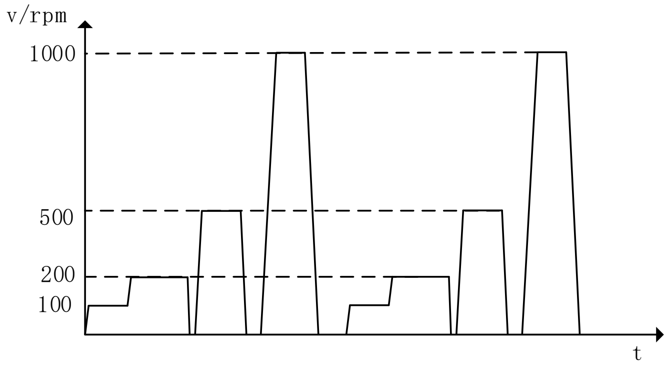
	position	

12.2.6 Cyclic continuous operation

Cyclic continuous operation (Pn802.X=2) is the second operation method of internal multi-segment position, which starts from Pr1 and the end segment is controlled by the value of Pn803, for example, Pn803=3, the cyclic multi-segment position is triggered to run from Pr1 to Pr3; then it starts from Pr1 again and runs to Pr3, and the cycle repeats.

Table 12-6 Example of Cyclic Multi-Segment Position Run

steps	Items	Specific actions
1	Mode Selection	**Pn000.X=0** (control mode is position control) **Pn002.X=2** (Position control command source is internal multi-segment position) **Pn802.X=2** (select cyclic continuous operation mode). **Pn204=0, Pn206=20000** (23-bit encoder moto, electronic gear ratio is 8388608: 20000).
2	Terminal Assignment	**Pn601.YX=0x01** (assign terminal X1 as servo enable terminal S-ON). **Pn604.YX=0x20** (assign terminal X4 as internal position trigger terminal CTRG).
3	Multi-segment position Pr command setting	**Pn803 = 4**, (the internal multi-segment position endpoint is 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 ~ 3, target speed 0 ~ 3, and delay time 0 ~ 3 are default values.
4	Terminal trigger cyclic multi-segment position	Enable servo: Slide CTRG from 0 to 1 to trigger a single multi-segment run command. The speed waveform of the operation is shown below, running from Pr1 to Pr4 and then Pr1 again, cyclically.

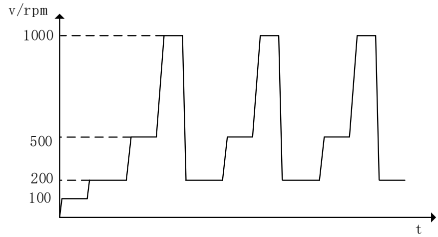
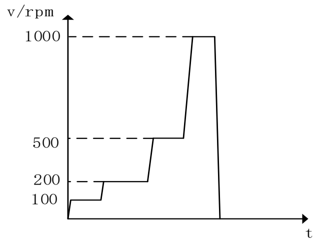
		

12.2.7 Sequential operation

Sequential operation (Pn802.X=3) is the third operation mode for internal multi-segment positions, starting from Pr1 and the end segment is controlled by the value of Pn803. For example, if Pn803=4, the sequential multi-segment position runs from Pr1 to Pr4 when triggered. after the first round, the starting point is controlled by Pn804, and the operation ends after the first round if Pn804=0 or Pn804>Pn803. 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 a Sequential Multi-Segment Position Run

steps	Items	Specific actions
1	Mode Selection	**Pn000.X=0** (control mode is position control) **Pn002.X=2** (Position control command source is internal multi-segment position) **Pn802.X=3** (select sequential operation mode). **Pn204=0, Pn206=20000** (23-bit encoder motor, electronic gear ratio is 8388608: 20000).
2	Terminal Assignment	**Pn601.YX=0x01** (assign terminal X1 as servo enable terminal S-ON). **Pn604.YX=0x20** (assign terminal X4 as internal position trigger terminal CTRG).
3	Multi-segment position Pr command setting	**Pn803 = 4,** (the internal multi-segment position endpoint is 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 ~ 3, target speed 0 ~ 3, and delay 0 ~ 3 are default values.

<table>
<tr>
<td>4</td>
<td>Terminal trigger sequence multi-segment position</td>
<td>Enable servo; make Pn804=2 (0<Pn804<Pn 803), slide CTRG from 0 to 1, then trigger the single multi-segment operation command. The speed waveform of the operation is shown in the figure below :

</td>
</tr>
<tr>
<td>5</td>
<td>Modify Pn804 to run again</td>
<td>(a) Slide CTRG from 1 to 0 to stop the sequential multi-segment position operation.
Let Pn804 = 5 (Pn804 > Pn803 or Pn804 = 0).
The single multi-segment operation command is triggered again and the speed waveform of the operation is shown in the figure below:

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

12.3 Terminal Function Definition

Schedule 1 Input Terminal Function Definition

Setting value: 0x01			
Symbol	Servo Enable	Trigger method	Control mode
S-ON	This signal is used to start the servo (Servo On): Invalid: Servo motor not enabled (Servo Off). Valid: Servo motor enable (Servo On).	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x02			
Symbol	Disable forward rotation drive	Trigger method	Control mode
P-OT	This signal is used to disable the motor from forward rotation when an external forward rotation command is sent: Invalid: motor continues in forward rotation. Valid: Motor is stationary.	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x03			
Symbol	Disable reverse rotation drive	Trigger method	Control mode
N-OT	This signal is used to disable motor from reverse rotation when an external reverse rotation command is sent: Invalid: motor continues in reverse rotation. Valid: Motor is stationary.	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x04			
Symbol	Alarm Reset	Trigger method	Control mode
ALM-RST	This signal is used to clear a fault alarm that has occurred on the drive: Invalid: Alarm clearance is prohibited. Valid: Alarm cleared.	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x05			
Symbol	Speed loop PI<->P switching	Trigger method	Control mode
P-CON	This signal is used to switch between the PI (proportional/integral) regulator and the P (proportional) regulator of the drive's speed loop: Invalid: Change to PI controller (proportional/integral). Valid: Change to P controller (proportional).	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x06			
Symbol	Torque limiting switching	Trigger method	Control mode
TL-SEL	This signal is used for forward and reverse torque limiting of the drive: Invalid: Limit the forward and reverse torque by function code Pn053.	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

	Valid: Limit the forward and reverse torque by function code Pn054.		

Setting value: 0x07			
Symbol	Absolute multi-turn position information DI/DO output switch	Trigger method	Control mode
ABS-En	This signal is used for the host computer to request the absolute multi-turn position information of the drive to be output in DI/DO. Invalid: Disable the absolute multi-turn position information DI/DO function. Valid: Enables the absolute multi-turn position information DI/DO function.	high and low levels	P S T

Setting value: 0x08			
Symbol	Speed command direction selection in speed mode	Trigger method	Control mode
SPD-D	This signal is used to adjust the direction of the speed command in speed mode: Invalid: Same direction with the original speed command. Valid: Reverse direction of the original speed command.	high and low levels	S

<table>
<tr><td colspan="4">Setting value: 0x09, 0x0A</td></tr>
<tr><td>Symbol</td><td>Internal register speed command buffer selection</td><td>Trigger method</td><td>Control mode</td></tr>
<tr><td>SPD-A
SPD-B</td><td>SPD-A: Internal register speed command buffer selection 1
SPD-B: Internal register speed command buffer selection 2
<table>
<tr><th>SPDB</th><th>SPDA</th><th>Command Source Selection</th></tr>
<tr><td>0</td><td>0</td><td>Pn303.X setting</td></tr>
<tr><td>0</td><td>1</td><td>Pn303.Y setting</td></tr>
<tr><td>1</td><td>0</td><td>Pn303.Z setting</td></tr>
<tr><td>1</td><td>1</td><td>Pn303.W setting</td></tr>
</table></td><td>high and low levels</td><td>S</td></tr>
</table>

<table>
<tr><td colspan="4">Setting value: 0x0B</td></tr>
<tr><td>Symbol</td><td>Control mode switching</td><td>Trigger method</td><td>Control mode</td></tr>
<tr><td>C-SEL</td><td>This signal is used for control mode switching selection
<table>
<tr><th rowspan="2">P000.X Setting</th><th colspan="2">Control mode switching signal</th></tr>
<tr><th>High level</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>high and low levels</td><td>P S T</td></tr>
</table>

Setting value: 0x0C			
Symbol	zero-speed clamping	Trigger method	Control mode

ZCALMP	This signal is used to give a zero speed clamping command signal to the drive. Invalid: Disable the zero position fixing function. Valid: Enable the zero position fixing function.	high and low levels	S

Setting value: 0x0D			
Symbol	Command pulse disable	Trigger method	Control mode
INHIBIT	This signal is used to control the drive from receiving further pulse commands. Invalid: Disable the reception of pulse commands and stop counting. Valid: Allow the reception of pulse command and continue counting.	high and low levels	P

Setting value: 0x0E			
Symbol	Gain Switching	Trigger method	Control mode
G-SEL	This signal is used to select the switch between the two gains in speed mode and position mode: Invalid: switch to gain 1. Valid: Switch to gain 2.	high and low levels	P S T

Setting value: 0x0F			
Symbol	Torque command direction switching in torque mode	Trigger method	Control mode
TPR-D	This signal is used to adjust the output direction of the torque command via this terminal in the torque control mode: Invalid: Same direction with the torque command. Valid: Reverse direction of torque command.	high and low levels	T

Setting value: 0x10			
Symbol	Command pulse input multiplier switching	Trigger method	Control mode
P-GAIN	This signal is used to change the frequency of the command pulse input in position mode. Invalid: switch to normal pulse input mode. Valid: Switch to the set multiplier.	high and low levels	P

Setting value: 0x11			
Symbol	Pulse deviation clearing	Trigger method	Control mode
CCLR	This signal is used to clear the pulse count buffer and the definition of clear pulse is set by parameter Pn200.Y. Clear the position pulse deviation, when this signal is valid, the position pulse deviation accumulated by the servo driver is cleared.	high and low levels edge trigger	P

Setting value: 0x12, 0x13			
Symbol	Internal register torque command buffer selection	Trigger method	Control mode

<table>
<tr><td>TOR-A
TOR-B</td><td>TOR-A: Internal register torque command buffer selection 1
TOR-B: Internal register torque command buffer selection 2
<table><tr><th>TOR-B</th><th>TOR-A</th><th>Command Source Selection</th></tr><tr><td>0</td><td>0</td><td>Pn409.X setting</td></tr><tr><td>0</td><td>1</td><td>Pn409.Y setting</td></tr><tr><td>1</td><td>0</td><td>Pn409.Z setting</td></tr><tr><td>1</td><td>1</td><td>Pn409.W setting</td></tr></table></td><td>high and low levels</td><td>$\boxed{T}$</td></tr>
</table>

Setting value: 0x14			
Symbol	Torque command trigger	Trigger method	Control mode
T-CTRG	This signal is used to select the required torque command in torque control. The corresponding trigger edge signal is configured via the function code Pn430.	high and low levels edge trigger	$\boxed{T}$

Setting value: 0x15			
Symbol	Torque mode speed limit source selection	Trigger method	Control mode
T-SLMT	This signal is used to select the required speed limit source in torque control mode. Invalid: Limited by function code Pn415 Valid: Limited by function code Pn416	high and low levels edge trigger	$\boxed{T}$

Setting value: 0x16			
Symbol	Position feedback signal source selection at full closed loop	Trigger method	Control mode
FENCS	In position control, this signal is used to select the position feedback signal source when the full closed loop function is turned on Invalid: Use encoder position feedback. Valid: Use optical scale position feedback.	high and low levels	$\boxed{P}$

Setting value: 0x17			
Symbol	Forward JOG	Trigger method	Control mode
JOGP	This terminal is used to input a JOG speed command to the drive Invalid: Stop the input of JOG speed command. Valid: Forward JOG speed command input.	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x18			
Symbol	Reverse JOG	Trigger method	Control mode
JOGN	This terminal is used to input a JOG speed command to the drive Invalid: Stop the input of JOG speed command. Valid: Reverse JOG speed command input.	high and low levels	$\boxed{P}$ $\boxed{S}$ $\boxed{T}$

Setting value: 0x19			
Symbol	Emergency stop	Trigger method	Control mode

EMSTOP	This terminal is used to input an emergency stop command to drive Invalid: The servo drive remains in its current operating state. Valid: Zero speed stop, remain in position lockout state.	high and low levels	[P] [S] [T]

Setting value: 0x1A			
Symbol	Three control mode switching options 2	Trigger method	Control mode
C-SEL2	This signal is used for control mode switching selection at Pn000.X=6.	high and low levels	[P] [S] [T]

Setting value: 0x1B			
Symbol	Three control mode switching options confirmation selection	Trigger method	Control mode
C-Trig	This terminal is used for confirmation of the selected control mode at Pn000.X=6.	Edge signal	[P] [S] [T]

Pn000.X Setting value	Control mode switching		C-Trig	Control mode
	C-SEL	CSEL2		
6	0	0	↑	speed mode
	0	1		position
	1	0		Torque mode

Setting value: 0x20			
Symbol	Internal position command trigger	Trigger method	Control mode
CTRG	In PR mode, the position command selected by POS0 ~ POS5 is read into the controller at the moment of CTRG conduction (rising edge).	high and low levels	[P]

Setting values: 0x21, 0x22, 0x23, 0x24			
Symbol	Position command source selection	Trigger method	Control mode
POS0 POS1 POS2 POS3	POS0 ~ POS3 are combined into a 4-bit binary number, i.e., the values 0 ~ 15, which represent the home position return when 0, and 1 ~ 15 represent the Pr path for.	high and low levels	[P]

POS3	POS2	POS1	POS0	Command execution
0	0	0	0	Home position return
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

Setting value: 0x27			
Symbol	Home position return enabled	Trigger method	Control mode
ORGEN	When the terminal triggers home position return in position mode, the home position return command is read into the controller.	high and low levels edge trigger	P

Setting value: 0x28			
Symbol	Mechanical home position signal	Trigger method	Control mode
ORGS	This signal is used as the home position signal source during the home position return. Invalid: home position signal not touched. Valid: The home position signal is touched.	Rising edge	P

Schedule 2 Output Terminal Function Definition

Setting value: 0x01			
Symbol	Servo ready	Trigger method	Control mode
RDY	The servo drive is ready, there is no fault at present, and this signal output is ON. The servo drive is not ready or there is a fault at present, and this signal output is OFF.	high and low levels	P S T

Setting value: 0x02			
Symbol	Positioning completed	Trigger method	Control mode
COIN	This signal output is ON when the current position deviation is within the positioning completion signal threshold (Pn262). This signal output is OFF when the current position deviation is beyond the positioning completion signal threshold (Pn262).	high and low levels	P

Setting value: 0x03			
Symbol	Speed consistency	Trigger method	Control mode
V-CMP	This signal output is ON when the deviation between the motor feedback speed and the given speed is within the speed consistency signal threshold (Pn315). This signal output is OFF when the deviation between the motor feedback speed and the given speed is beyond the speed consistency signal threshold (Pn315).	high and low levels	P S T

Setting value: 0x04			
Symbol	Motor rotation signal	Trigger method	Control mode
TGON	This signal output is OFF when the motor running	high and	P S T

	speed is below the motor rotation detection threshold (Pn317). This signal output is ON when the motor running speed is higher than the motor rotation detection threshold (Pn317).	low levels	

Setting value: 0x05			
Symbol	Torque limiting in	Trigger method	Control mode
TLT	This signal output is ON when the output torque of the motor is within the setting range. This signal output is OFF when the output torque of the motor is beyond the setting range.	high and low levels	P S T

Setting value: 0x06			
Symbol	Speed limit in progress	Trigger method	Control mode
VLT	In torque mode: This signal output is ON when the speed of the motor is beyond the set speed limit range. This signal output is OFF when the speed of the motor is within the set speed limit.	high and low levels	T

Setting value: 0x07			
Symbol	Brake switch signal	Trigger method	Control mode
BK	Brake output signal. When this signal is invalid, the brake power is off. The brake acts, and the motor is in position lock state. When valid, the holding brake power is on, the holding brake is released, and the motor can rotate.	high and low levels	P S T

Setting value: 0x08			
Symbol	Warning signal	Trigger method	Control mode
WARN	This signal output is ON when the current drive is in the warning signal state. This signal output is OFF when there is no warning signal status for the current drive.	high and low levels	P S T

Setting value: 0x09			
Symbol	Positioning near signals	Trigger method	Control mode
NEAR	This signal output is ON when the current position deviation is within the position near signal threshold (Pn260). This signal output is OFF when the current position deviation is beyond the position near signal threshold (Pn260).	high and low levels	P S T

Setting value: 0x0A

Symbol	Command pulse input multiplier switching output	Trigger method	Control mode
PSELA	This signal output is ON when entering the pulse input multiplier signal state. This signal output is OFF when the pulse input multiplier signal state is not entered.	high and low levels	P S T

Setting value: 0x0B			
Symbol	Fault signal	Trigger method	Control mode
Alarm	This signal output is ON when the drive has a fault signal status. This signal output is OFF when the drive has no fault signal status.	high and low levels	P S T

Setting value: 0x0C			
Symbol	Set torque reached	Trigger method	Control mode
TorqR	The corresponding timing sequence is set by function codes Pn420 and Pn421.	high and low levels	P S T

Setting value: 0x11			
Symbol	PR position send completed	Trigger method	Control mode
CMDOK	This flag bit is used to mark whether the current PR position command send is completed (including the delay). ON when the current PR position command is sent. OFF when the current PR position command send is not completed.	high and low levels	P

Setting value: 0x12			
Symbol	PR position send completed and target position reached, not including delay	Trigger method	Control mode
TPOS0	This flag bit is used to mark whether the current PR position command send is completed (not including delay). ON when the current PR position command is sent. OFF when the current PR position command send is not completed.	high and low levels	P

Setting value: 0x13			
Symbol	PR position send completed and target position reached, including delay	Trigger method	Control mode
TPOS1	This flag bit is used to mark whether the current PR position command send is completed and the target position is reached. ON when the current PR position command is sent and the target position is reached; otherwise, OFF.	high and low levels	P

Setting value: 0x15

Symbol	Home position return completion marker	Trigger method	Control mode
ORGC	After the home position return function is used, the home position return fails and this signal is OFF. This signal is ON if the home position return function is not enabled, or if the home position return function is enabled and the home position return is successful.	high and low levels	P

Chapter 13 STO Safety Function

13.1 Standards of Compliance

- Safety standards

Item	Standard
Functional safety standards	EN/ISO 13849-1:2015 EN/IEC 61508:2010, Parts 1-7 EN/IEC 62061:2021 EN/IEC 61800-5-2:2017
EMC	EN/IEC 61326-3-1:2017

Table 13- 1 Safety standards

- Safety performance

Item	Performance indicators
Security integrity level (SIL)	SIL3
Average frequency of dangerous failure (PFH)	7.61×10-10[1/h]
Performance level (PL)	PLe/Cat.3
Mean time to dangerous faliure (MTTFD)	high
Diagnostic coverage (DC)	medium
Service life	20 years
Hardware Fault Tolerance (HFT)	1
Application mode	High-demand mode
Response time	5ms

Table 13- 2 Safety performance

Attention :In order to meet SIL3/PLe/Cat.3,the inverter must trigger the STO function at least once every three months for fault diagnosis.

13.2 Installation

Attention : installers must be trained to understand the safety requirements associated with product design and installation.

13.2.1 Terminal Distribution and Definition

The STO safety function is integrated into the inverter module. See Section 4.3 Electrical Connection Guide, Section 4.4 Terminal Connections of the Module for the distribution and definition of the input terminals.

13.2.2 Input Terminal Electrical Specifications and Connection Method

- Electrical specifications

Item	Specification
Voltage range	24Vdc (±10%)
Input current	7mA (per channel)
Input resistance	4kΩ

Table 13-3 STO input signal electrical specifications

- **Logic level**

Channel	Status	Description
STO1	High level	Normal operation of the Inverter
	Low level	Trigger STO
STO2	High level	Normal operation of the Inverter
	Low level	Trigger STO

Table 13-4 STO input signals

- **Wiring instruction**

  - Single module

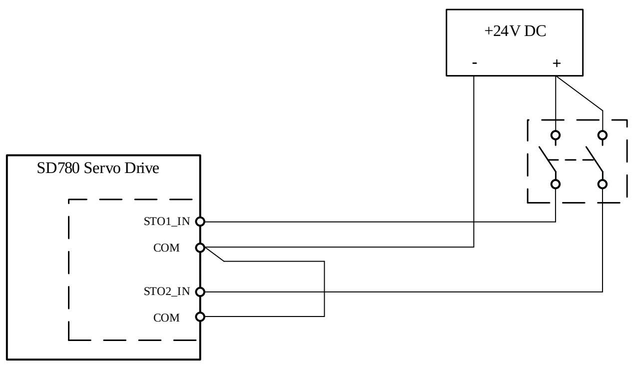


Figure 13-1 SD780 series inverter module STO terminal connection diagram

  - Multiple modules in parallel

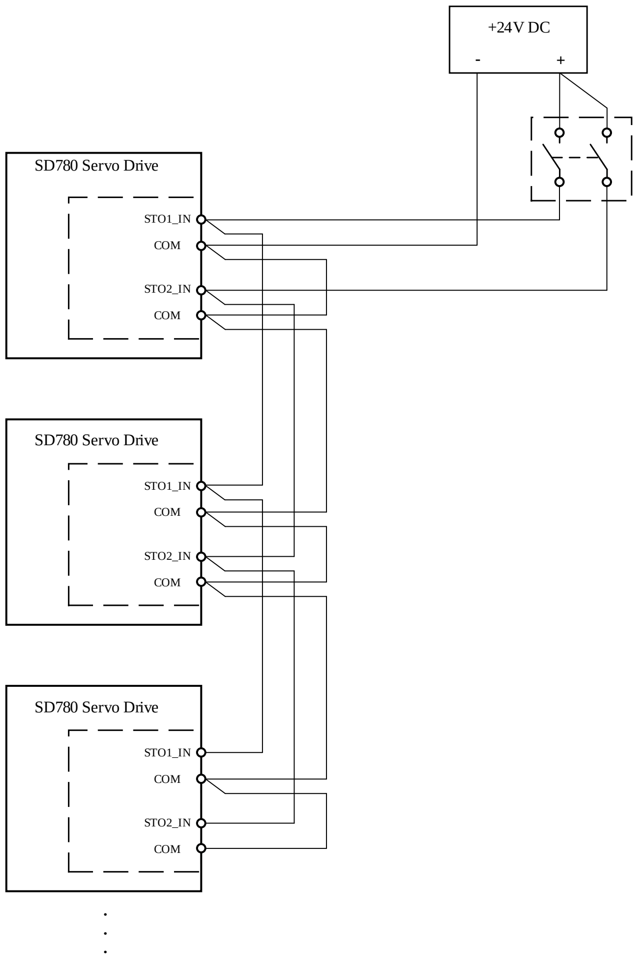


Figure 13-2 SD780 series STO terminal connection diagram for multiple parallel inverter modules

:

A maximum of 10 parallel modules expansions is allowed for SD780 series, and The STO terminals of all inverter modules involved in parallel should be configured and the wiring method should be referred to the above diagram.

- **EMC requirements.**

In order to avoid short circuits between two adjacent conductors, it is recommended to use a shielded cable with the shielding layer connected to ground and a maximum cable between the inverter and the safety switch is no longer than 20m.

13.3 Commissioning, Operation, and Maintenance Requirements

13.3.1 Basic Requirements

- Technical personnel must be trained with the requirements and principles of safety-related system design and commissioning.
- Personnel who perform and maintain must be trained with the requirements and principles of safety-related system design and operation.

- Operators must be trained with the requirements and principles of safety-related system design and operation.
- If a safety-related circuit does not work, the board must be replaced with a new one since it is irreparable.

13.3.2 Commissioning Steps and Acceptance Checklist

Safety functions of the devices needs to be verified via acceptance tests according to EN/IEC 61508, EN/IEC 62061 and EN/ISO 13849 and acceptance tests must be performed during the following stages:

- initial start-up of the safety function;
- after any changes (wiring, components, settings, etc.) related to the safety function;
- after any maintenance work related to the safety function;

Acceptance testing of safety functions must be performed by personnel with according expertise, and must be recorded and signed by the testers. Technicians, operators, maintenance and repair personnel must be trained with the requirements and principles of safety-related system design and commissioning.

A signed acceptance test report must be kept in the machine's logbook. This report should include documentation of start-up activities and test results, fault report references, and trouble shooting. Any new acceptance tests performed due to changes or maintenance shall be recorded in the logbook.

Step	Testing method	Result
1	Ensure normal operation and shutdown of the servo drive during commissioning	
2	Stop the servo drive, disconnect the inverter input main power and servo drive control power	
3	Check if the STO circuit is wired correctly according to the manual	
4	Turn on the servo drive control power and the servo drive input main power	
	Make sure servo drive is not running and the motor remains off	
	STO1 and STO2 channels are connected to 24V power supply through safety switch and set to high level	
	Cut the safety switch so that STO1 and STO2 are at low level at the same time	
	LED keypad shows "STO fault/trigger, safety torque off"	
	Start the servo drive and ensure the motor remains stopped	
	Reset the safety switch so that STO1 and STO2 are at high	

	level and manually restore the STO fault state via the LED keypad	
	Start the servo drive and make sure the motor can run normally, then stop the servo drive and wait until the motor shaft is perfectly still	
5	Start the servo drive to make sure the motor can run normally	
	Cut off the safety switch so that STO1 and STO2 are at low level at the same time	
	LED keypad shows "STO fault/trigger, safety torque off"	
	Servo drive stops output and the motor stops freely, and wait unitl the motor shaft is perfectly still	
	Keep the safety switch off and manually restore the STO fault state via the LED keypad	
	Make sure the LED keypad still shows "STO fault/trigger, safety torque off" and that STO status cannot be restored	
	Start the servo drive and the motor still remains stopped	
	Reset the safety switch so that STO1 and STO2 are at high level, and manually restore the STO fault state via the LED keypad	
6	Record and sign the acceptance test report to prove that the STO safety function is normal and can be put into operation.	

Table 13-5 SD780 STO test procedure and acceptance checklist

13.4 Safety Detection

13.4.1 Fault Code Table of the Security Function

When the STO safety function is triggered, or there is a fault in the STO safety function, the LED keypad will display the corresponding fault name and fault code as shown in the following table.

Code	Name	Subcode	Name	Description
38	STO failure /trigger	00	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	01	Hardware fault	abnormal STO hardware circuit

38	STO failure /trigger	02	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	03	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	04	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	05	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	06	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	07	Hardware fault	abnormal STO hardware circuit
38	STO failure /trigger	08	Power fault	abnormal STO hardware circuit
38	STO failure /trigger	09	Power fault	abnormal STO hardware circuit
38	STO failure /trigger	10	Power fault	abnormal STO hardware circuit
38	STO failure /trigger	11	Safety torque off	STO safety function triggered
38	STO failure /trigger	12	MCU fault	abnormal MCU master control
38	STO fault/trigger	13	MCU fault	abnormal MCU master control
38	STO failure /trigger	14	MCU fault	abnormal MCU master control
38	STO failure /trigger	15	MCU fault	abnormal MCU master control
38	STO failure /trigger	16	Power fault	Abnormal STO power supply
38	STO failure /trigger	17	Hardware fault	abnormal STO hardware circuit

Table 13-6 STO fault code list

13.4.2 Safety function troubleshooting

The methods to deal with the malfunctions of the safety function are shown in the following table. If the problem cannot be solved, please record the specific fault code and resort to with Veichi technical support.

Fault Name	Cause	Method
Safety torque off	STO safety function is triggered, or STO input 24V power is not properly connected	Check if the safety switch is triggered. Check if the STO dual channel input is wired correctly.
Hardware fault	Hardware fault detected in STO dual channel circuit	Replace the STO safety expansion card, and please contact Veichi technical support
Power fault	Overvoltage or undervoltage detected in STO power supply	Replace the STO safety expansion card, and please contact Veichi technical support
MCU fault	Abnormal operation of STO master control MCU detected	Replace the STO safety expansion card, and please contact Veichi technical support

Table 13-7 Fault causes and handling measures

13.4.3 STO Safety Function Status Recovery

Attention: Before releasing the STO safety torque off status, please make sure the inverter system can resume normal operation. Only the STO safety torque off state triggered by the safety switch can be released, while other fault states cannot be manually released, please contact Veichi technical support directly.

When the STO safety function is triggered through the safety switch, the servo will remain down state. The STO safety torque shutdown state can be manually lifted through the LED keypad to bring the servo back to normal operation, steps are as follows:

1. reset the safety switch so that the STO dual channel is reconnected to 24 V power supply, before this operation, please confirm again that the inverter system is in good condition and can be restored to normal operation.
2. power off and on to release the STO state.

13.5 Preventive Measures

Please read the following safety precautions, risk assessment information, and restriction information before starting operation, and use the safety features after correctly understanding all the information.

Attention : Designing safety-related systems requires specialized knowledge. To ensure the safety of a complete control system, it is necessary to design the entire system in accordance with accepted safety principles. A single subsystem with a safety torque shutdown function is intentionally designed for safety-related applications but does not guarantee the safety of the entire system.

13.5.1 Safety Protection Measures

Please read the following important precautions and observe carefully when using the safety function.

- The STO function is not an alternative to emergency stop. If no additional measures are taken, it is not possible to cut off the power facing an emergency. The strong electrical parts of the motor or inverter are still electrically charged and there is a risk of electric shock or other risks generated by electricity. Therefore, maintenance of the electrical parts of the inverter or motor can only be carried out after the inverter system has been isolated from the main power supply.

- Depending on the standards and requirements of a particular application, it is possible to use STO as an integral part of an emergency stop system. But in any case, it is mainly used for specialized safety control layouts to prevent hazards instead of emergency stop.
- Emergency stop is often used in machines to enable the operator exposed to an unexpected hazard to act to prevent an accident.
- The design requirements for the emergency stop are different from the safety interlocks. In general, emergency stop requires independence from any complex or intelligent control. It may use purely electromechanical devices in order to either cut power or initiate a controlled quick stop by other means such as dynamic or regenerative braking.
- STO safety function can be used to stop the servo in the event of an emergency stop, but it should be noted that stopping the servo via STO function will cause the motor to stop gradually by inertia. Please use other quick stop methods instead of the STO function if you don’t want the motor to stop too.

13.5.2 Risk Assessment

- When using the STO safety function, a risk assessment of the drive system needs to be performed in advance to ensure that the standard safety integrity level is met.
- Even when the safety function is in operation, some residual risk may exist. Therefore, safety must always be considered when performing a risk assessment.
- If external forces (e.g. gravity on a vertical axis) are applied while the safety function is operating, the motor will rotate due to these external forces. Please use a separate mechanical brake to hold the motor in place.
- If the drive fails, the motor can work within a range of 180 degrees to ensure safety even in hazardous situations.

Chapter 14 Foreign Standards for Compliance

14 Notes of European Standards

14.1 CE Mark

(1) The "CE Mark" indicates compliance with required safety and environmental standards when commercial trades (production, import, and sales) are carried out in euro areas. European harmonized standards include standards for mechanical products (Machinery Directive), electrical products (Low Voltage Directive), and electromagnetic interference (EMC Directive).

（2）Products for commercial trade (production, import, sales) in the European region must be marked with CE.

Figure Appendix II -1

(3) The inverter complies with the Low Voltage Directive and EMC Directive and is marked with CE already.

-Low Voltage Directive: 2014/35/EC

-EMC Directive: 2014/30/EC

(4) Machinery and devices installed with servos must also have CE marking.

(5) When the CE mark is applied to the product with the inverter, the responsibility shall be borne by the customer who finally assembles the product. Customers need to confirm if the machinery and devices of the final product comply with the European harmonized standards.

14.2 Conditions for compliance with the Low Voltage Directive

This servos has been tested and qualified in accordance with EN61800-5-1 and Low Voltage Directive.

The following conditions must be met so that the machinery and equipment in which this inverter is installed will comply with the Low Voltage Directive.

● Installation site

When the servos is installed, it must comply with the conditions of overvoltage class 3 and pollution class 2 or less as specified in IEC60664.

● Fuse connection of input side (primary side)

To prevent accidents due to short circuits, be sure to connect a fuse on the input side. The input-side fuse must comply with UL standards.

14.3 Conditions of Compliance with EMC Directive

This product complies with the European EMC Directive 2014/30/EU and meets the requirements of the standard EN61800-3 and is suitable for both the first

environment and second environment.
In order to make this product comply with EMC Directive and standard requirements, it is necessary to install EMC filter on the input side of the driver and select the recommended shielded cable on the output side, and it is necessary to comply with the cabinet installation requirements to ensure reliable grounding of the filter and reliable 360° lap of the output cable shield.

⚠ Warning

When applied in the first environment, the AC drive may generate radio interference. Besides the CE compliance

14.4 EMC Standard Introduction

EMC (Electromagnetic Compatibility) refers to the ability of electrical and electronic equipment to work normally in an environment with electromagnetic interference, and the ability not to release excessive electromagnetic interference to other local equipment or systems so as not to affect the stable work of other equipment. Therefore, EMC includes two requirements: on the one hand, it means that the electromagnetic interference generated by the equipment to the environment where it is located during normal operation cannot exceed a certain limit; on the other hand, it means the ability to work normally with a certain degree of immunity to the electromagnetic interference present in the environment, i.e. electromagnetic sensitivity.

EN61800-3 defines the following two types of environments:

● First environment: Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes.

● Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

The products are classified into the following four categories according to the intended use environment:

● Category C1 equipment: Power Drive System (PDS) of rated voltage less than 1 000 V, intended for use in the first environment.

● Category C2 equipment: PDS of rated voltage less than 1 000 V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional person.

● Category C3 equipment: PDS of rated voltage less than 1 000 V, intended for use in the second environment and not intended for use in the first environment.

● Category C4 equipment: PDS of rated voltage equal to or above 1 000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

14.5 Conditions of compliance with the LVD Low Voltage Directive

This product has been tested in accordance with EU safety standard EN61800-5-1 and is confirmed to comply with the Low Voltage Directive. The following requirements need to be met in order for the machinery and devices in which this product is installed to comply with the low voltage directive.

Installation Site

Please install this product in places with overvoltage level III and pollution level 2 or less as specified in IEC 60664-1.

Installation Environment

See "1.4.4 Installation Environment Requirements" on page 16 for installation environment requirements.

Installation Protection Requirements

This product is a control cabinet mounted product and needs to be installed in the final system for use. The final system should be provided with the appropriate fireproof enclosure, electrical enclosure and mechanical enclosure, etc., and comply with local laws and regulations and relevant IEC standard requirements.

When installing the in-cabinet mounting type (IP20) products, please install them in a structure where external objects cannot enter from the top and front.

Main Circuit Wiring Requirements

Main circuit terminal wiring requirements, please refer to page 41 "3.1.4 Main circuit wiring requirements" for details.

Protection Device Requirements

In order to meet the requirements of the European Union safety standard EN 61800-5-1, please be sure to connect the fuse/circuit breaker at the input side to prevent accidents caused by internal circuit short circuit.

Install sufficient branch circuit short circuit protection devices in accordance with applicable regulations and this manual. This product is applicable to circuits with rated fusing capacity below 5000A and maximum voltage of 440VAC (Class 400).

Refer to the selection table of "fuse" and "circuit breaker" in the manual for the recommended selection requirements of fuse/filter.

Version Change Log

Date	Changed version	Changed content
2023.03	V1.0	First edition released
2023.04	V1.1	STO instructions added