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---

# 1 Abstract

## 1.1 Safety Precautions

To ensure safe and reasonable use of this product, please use the product only after fully understanding the safety precautions described in this manual.

- **Warning signs and their meanings**

The following markings are used in this manual to indicate that the place is important regarding safety. Failure to observe these precautions may result in personal injury or death, damage to this product and associated systems. And the listed points do not represent all safety matters to be observed, but only serve as a supplement to all safety precautions.

|                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------|
|  <b>Danger</b>                                |
| ● It indicates an emergency and dangerous situation that is likely to result in death, serious injury and fire if not avoided. |
|  <b>Warning</b>                               |
| ● Indicates a dangerous condition that could result in death, serious injury and fire if not avoided.                          |
|  <b>Attention</b>                             |
| ● Indicates a dangerous condition that could lead to moderate or minor injuries and fire if not avoided.                       |
| <b>Notice</b>                                                                                                                  |
| ● Indicates a dangerous condition that could lead to equipment damage if not avoided.                                          |

- **Safety Precautions**

- Overall Precautions

|                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>Danger</b>                                                                                                                                                                                                                                                                                            |
| ● For your safe use of the product, please be sure to read this manual.<br>● Keep this manual in a safe place so that it can be accessed by the person using the product at any time.<br>● Do not remove the cover, cables, connectors, and optional equipment while the servo unit is powered on.<br>Otherwise, it may cause electric shock, stop the operation of the product or burn out. |
|  <b>Warning</b>                                                                                                                                                                                                                                                                                           |
| ● Please use the product under the power specifications (phase, voltage, frequency) that match the product.<br>Otherwise, the product may be burnt, electric shock or fire.                                                                                                                                                                                                                  |

● Be sure to connect the ground terminal of the servo unit and servo motor to the ground pole.

Otherwise, it may cause electric shock or fire.

● Do not disassemble, repair or modify the product.

Otherwise, it may cause a fire or malfunction.

Disassembled, repaired or modified products are not covered by the warranty.



### Attention

● The heat sink of the servo unit, regenerative resistor servo motor, etc. may be at high temperature when the power is turned on or just after the power is turned off. Please take safety measures such as installing an outer cover to avoid accidental touching of hands and parts (cables, etc.).

Otherwise, it may cause burns.

● Do not damage or pull the cable by force, or subject the cable to excessive force, place it under heavy objects or cause it to be clamped.

Otherwise, it will cause malfunction, damage, and electric shock.

● Do not use the product in places where water can be splashed, in corrosive environments, in flammable gas environments, or near combustible materials.

Otherwise, it may cause electric shock or fire.

### Notice

● Do not use servo units and servo motors that are damaged or have missing parts.

● Set up an emergency stop circuit externally to ensure that power is cut off and operation is stopped immediately in the event of an abnormality.

● If the Servo Unit is used under poor power conditions, install protection equipment (AC reactor, etc.) to ensure that the input power is supplied within the specified voltage variation range.

Otherwise, the servo unit may be damaged.

● Use a noise filter, etc. to reduce the influence of electromagnetic interference.

Otherwise, electromagnetic interference may be caused to electronic equipment used near the servo unit.

● Use the Servo Unit and Servo Motor in the specified combination.

● Do not touch the servo unit and servo motor with wet hands.

Otherwise, the product may malfunction.

## ■ Precautions During Storage



### Attention

● Do not stack this product too much (follow the instructions), otherwise it may cause injury or malfunction.

### Notice

- Please keep and install it in the following environment.
  - Place where there is no direct sunlight
  - Place where the ambient temperature does not exceed the product specifications
  - Places where the relative humidity does not exceed the product specifications
  - Place where there is no condensation due to sharp changes in temperature
  - Places where there are no corrosive gases or combustible gases
  - Place where there are no combustible materials in the vicinity
  - Places where there is little dust, dirt, salt and metal powder
  - Places where water, oil and drugs are not easily splashed
  - Places where vibration or shock will not affect the product (places exceeding product specifications)
  - Places where the product will not be subjected to radiation that could cause product failure or damage when stored or installed in environments other than the above.

## ■ Precautions During Handling



### Attention

- Please use the correct method for handling according to the weight of the product.
- Do not use the lifting bolts of servo units and servo motors to carry the machinery. Failure to do so may result in injury or equipment failure.
- When handling the servo unit and servo motor, please pay attention to the sharp parts such as the corners of the equipment. Failure to do so may result in injury.
- Do not stack this product too much (Follow the instructions.), Failure to do so may result in injury or malfunction.

### Notice

- When handling the Servo Unit, do not hold the front cover and connectors. Otherwise, the servo unit may fall off.
- The servo unit and servo motor are precision equipment. Do not drop it or apply strong impact on it. Otherwise, malfunction or damage may occur.
- Do not apply impact to the connector part. Otherwise, poor connection or malfunction may occur.
- If wood for packaging (including wood frames, plywood, pallets, etc.) needs to be disinfected or disinfected, be sure to use a method other than fumigation.

Example: Heat treatment (core temperature of 56°C or more for more than 30 minutes) Also, treatment must be done at the material stage before packaging, not as a whole after packaging.

When packaging electrical products (stand-alone or loaded on machinery, etc.) with fumigated wood, the gases and vapors generated by the wood can be fatal to electronic components. In particular, halogen-based disinfectants (fluorine, chlorine, bromine, iodine, etc.) may cause internal corrosion of capacitors.

- Do not over-tighten the lifting bolts of the servo unit and servo motor.
  - Strong tightening with implements, etc. may cause breakage of the screw holes.

## ■ Precautions During Installation



### Attention

- Install the Servo Unit and Servo Motor in a position with sufficient weight resistance in accordance with the technical data.

- Install the servo unit, servo motor, regenerative resistor and dynamic braking resistor on non-combustible materials.

Direct installation on or near combustible materials can cause a fire.

- During installation, be sure to maintain the specified separation between the Servo Unit and the inner surface of the control cabinet and other machines.

Otherwise, it may cause a fire or malfunction.

- Install the Servo Unit in the specified direction.

Otherwise, it may cause a fire or malfunction.

- Do not step on this product or place heavy objects on it.

Otherwise, malfunction, damage or injury may occur.

- Do not allow other materials to enter the servo unit and servo motor.

Otherwise, it may cause malfunction or fire.

### Notice

- Please keep and install in the following environment.
- Places where there is no direct sunlight
- Place where the ambient temperature does not exceed the product specifications
- Place where the relative humidity does not exceed the product specifications
- Place where there is no condensation due to sharp temperature difference
- Place where there is no corrosive gas or combustible gas
- Place where there are no combustible materials nearby
- Place where there is little dust, dirt, salt and metal powder
- Place where water, oil and medicine are not easily splashed
- Place where vibration or shock will not affect the product (place that exceeds product specifications)
- Place where radiation will not be received
- When stored or installed in an environment other than the above, the product may malfunction or be damaged
- Please use it in an environment that meets the product specifications.

When used in an environment that exceeds the product specification, the product may fail or be damaged.

- The servo unit and servo motor are precision equipment. Do not drop it or apply strong impact on it.

Otherwise, it may cause malfunction or damage.

- Make sure that the servo unit is installed in the control cabinet.
- Do not block the air inlet and exhaust ports of the Servo Unit and Servo Motor with cooling fan, or allow other materials to enter the product.
- Otherwise, it may cause malfunction.

## ■ Precautions During Wiring



### Danger

- Do not change the wiring during the power-on process.
- Otherwise, it may cause electric shock or injury.



### Warning

- The wiring or inspection operation should be carried out by a professional technician.
- Otherwise, it may cause electric shock or product failure.
- Please check the wiring and power supply carefully.

The output circuit may be short-circuited due to incorrect wiring or the application of a different voltage. In the event of such a fault, the brake will not operate, which may result in mechanical damage or injury to personnel.

- When using a servo unit for which the dynamic brake option is available, connect the external dynamic brake resistor that corresponds to the specifications of the machine or device to the specified terminal.

Otherwise, in case of emergency stop, it may cause accidental operation, resulting in damage to equipment, burnout, and injury to personnel.



### Attention

- Make sure that the (CHARGE) light is off at least 10 minutes after the power is turned off, and then proceed with wiring and inspection. Even if the power is turned off, high voltage may remain inside the servo unit. Therefore, do not touch the power terminals while the (CHARGE) light is on.

Otherwise, it may cause electric shock.

- Follow the precautions and procedures described in this manual for wiring and test operation.

The servo unit malfunction caused by incorrect wiring of the brake circuit, application of a different voltage, etc. may cause mechanical damage or injury to persons.

- Make sure that the wiring is done correctly and reliably.

The pin arrangement of connectors and connectors varies depending on the model. Be sure to check the pin arrangement with the technical data of the model used.

Failure to do so may result in product failure or malfunction.

- Make sure to tighten and securely connect the wires of the power terminal and motor connection terminal according to the specified method and torque.

Failure to tighten them sufficiently may cause the wires and terminal blocks to heat up and cause a fire due to poor contact.

- Use shielded double-stranded stranded wire or multi-core double-stranded stranded integral shielded wire for input and output signal cables and encoder cables.

- When wiring the main circuit terminals of the servo unit, be sure to observe the following precautions.

Turn on the power to the Servo Unit after all the wiring, including the main circuit terminal, is completed.

If the main circuit terminal is a connector type, remove the connector from the main body of the Servo Unit before wiring.

Only one wire can be inserted into each wire socket of the main circuit terminal.

When inserting the wires, do not short-circuit the adjacent wires by making contact with the burrs of the core wires.

- Install a safety device such as a circuit breaker for wiring to prevent short circuiting of external wiring.

Otherwise, it may cause fire or malfunction.

### Notice

- Please use our specified cables for wiring as much as possible.

If you use a cable other than the one specified by us, use the wiring material specified by us or an equivalent product after checking the rated current of the type used and the operating environment.

- Make sure to tighten the fixing screws and locking mechanism of the cable connector.

Insufficient tightening may cause the cable connector to fall off during operation.

- Do not use the same sleeve for strong power cables (main circuit cables) and weak power cables (cables for input and output signals and encoder cables), or tie them together. If you do not put strong and weak cables in separate sleeves, keep a distance of 30cm or more between them when wiring.

If they are too close together, the weak power cables may be interfered with and cause malfunction.

- Install the battery on either side of the upper unit or encoder cable.

If the battery is installed on the upper unit and encoder cable at the same time, a loop circuit will be formed between the batteries and the product will be damaged or burned.

- When connecting the battery, please pay attention to the polarity.

A broken battery can cause the encoder to malfunction.

## ■ Precautions During Operation and Running



### Warning

- Before installing the machine and starting operation, perform the switch and parameter settings appropriate to the machine.

If you operate the machine without setting, it may cause accidental operation, malfunction or injury to people.

- Do not make extreme changes to the parameter settings.

Otherwise, it may cause unstable operation, mechanical damage or injury.

- To avoid accidents, install a limit switch or stopper at the end of the movable part of the machine.

Otherwise, it may cause damage or injury to the machine.

- Perform the test run with the servo motor fixed and disconnected from the machine.

Otherwise, injury may occur.

- Do not enter the operating range of the machine during operation.

Otherwise, injury may occur.

- Do not touch the servo motor or the movable part of the machine during operation.

Otherwise, injury may occur.



### Attention

- Please design a safety system to ensure safety even in the event of a fault such as a broken signal line.

For example, a safety action is performed when the P-OT signal and N-OT signal are disconnected at the factory setting. Do not change the polarity of these signals.

- When overtravel occurs, the motor is not energized and the brake is released. If the servo motor is used for vertical drive, set the motor to enter the zero fixed state after it stops. Also,

use safety devices (external brakes and counterweights, etc.) to prevent the movable part of the machine from falling off.

### Notice

- For gain adjustment when the system starts, check the torque waveform and speed waveform with a measuring instrument to make sure there is no vibration.

If vibration occurs due to high gain, the servo motor may be damaged prematurely.

- Do not turn ON/OFF the power frequently. After starting actual operation (regular operation), the power supply should be turned ON/OFF at intervals of at least 1 hour (approximate standard).

Do not use this product in applications where the power supply is turned ON/OFF frequently.

Otherwise, it may cause the components inside the servo unit to be damaged prematurely.

## ■ Precautions During Maintenance and Inspection



### Danger

- Do not change the wiring during the power-on process. Otherwise, it may cause electric shock or injury.



### Warning

- Wiring or inspection operations should be performed by a professional technician. Failure to do so may result in electric shock or product failure.



### Attention

- Make sure that the (CHARGE) light turns off after the power is turned off for at least 10 minutes, and then proceed with wiring and inspection. Even if the power is turned off, high voltage may remain inside the servo unit. Therefore, do not touch the power terminals while the (CHARGE) light is on.

Otherwise, it may cause electric shock.

- When replacing the Servo Unit, make a backup copy of the Servo Unit parameters before replacing it. Copy the backed-up parameters to the new Servo Unit, and make sure that the copy operation is completed correctly.

If the backed-up parameters are not copied or the copying operation is not completed correctly, it will cause damage to the machinery and the unit, and thus it will not operate properly.

### Notice

- Please remove static electricity before operating the buttons and switches inside the front cover of the servo unit.

Otherwise, it may cause damage to the machine.

## ■ Precautions Related to Handling in Case of Abnormalities



### Danger

- When the safety device (circuit breaker and fuse for wiring) set on the power line acts, please turn on the power supply of the servo unit after eliminating the cause. In addition,

please replace or repair the servo unit and check the wiring to eliminate the cause of the action of the safety device.

Otherwise, it may cause fire, electric shock or injury.



### Warning

- When the power is restored after a temporary power failure, it may restart suddenly. Please use a mechanical design that ensures that personal safety is not endangered when restarting. Otherwise, it may cause injury.



### Attention

- When an alarm occurs, please eliminate the cause of the alarm first to ensure safety. Then perform an alarm reset or turn the power back on to start operation again.

Otherwise, it may cause injury or mechanical damage.

- If an alarm reset is performed with the servo ON signal input to the servo unit, it may restart suddenly. Make sure that the servo is OFF and that it is safe before performing an alarm reset.

Otherwise, it may cause injury or mechanical damage.

- Be sure to connect a solenoid contactor between the main circuit power supply and the main circuit power terminal of the servo unit, so that the main circuit power supply side of the servo unit is designed to cut off power.

If the servo unit fails to connect the solenoid contactor, the continuous flow of high current may cause a fire.

- When an alarm occurs, disconnect the main circuit power.

Otherwise, the regenerative resistor may overheat and cause a fire due to a regenerative transistor failure, etc.

- Please configure the leakage circuit breaker for both overload and short circuit protection, or the leakage circuit breaker for ground short circuit protection combined with the circuit breaker for wiring.

Otherwise, it will cause servo unit failure or fire in case of short circuit to ground.

- When the power is cut off or abnormally stopped, the safety cannot be ensured by the brake of the servo motor in the dangerous condition of moving under the action of external force (gravity, etc.). In this case, be sure to install an external brake structure to ensure safety.

## ■ Precautions for Disposal

### Notice

- When disposing of this product, please dispose of it as general industrial waste. However, please take into consideration the regulations of each municipality and the laws of each country, and take measures such as labeling and notification of the final product as necessary.

## ■ General Precautions

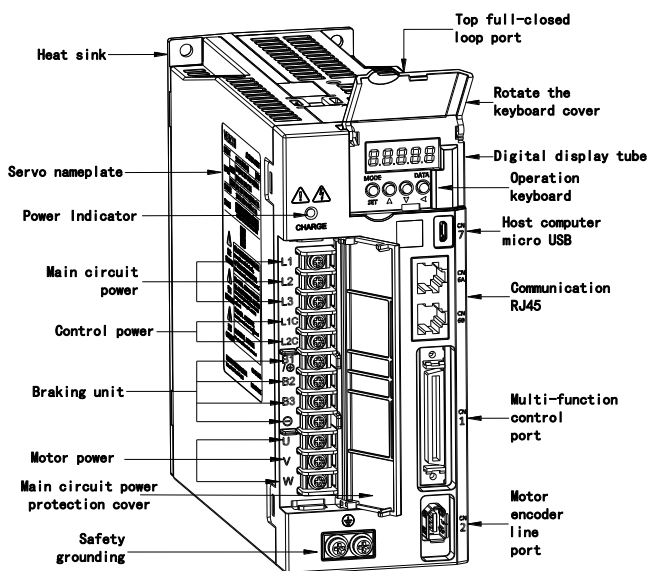
## Notice

- The illustrations in this manual are representative examples or conceptual diagrams. It may be different from the actual wiring, circuits and physical objects.
- In order to illustrate the detailed parts of the product, the product illustrations in this manual are depicted without the outer cover or safety protection body. When using the product, be sure to install the cover or safety protection body in its original position before using it.
- If you need to obtain a new copy of this manual due to damage or loss, please contact our agent or the nearest branch office listed on the back cover. Please inform us of the information number of this manual when contacting us.
- This manual may be changed from time to time due to product improvements, changes in specifications, or to improve the convenience of using this manual.  
After the change, the data number of this manual will be updated and issued as a new version.
- We do not guarantee the quality of products that have been modified by the customer. We are not responsible for any injury or damage caused by the modification of the product.

## 1.2 Series Introduction

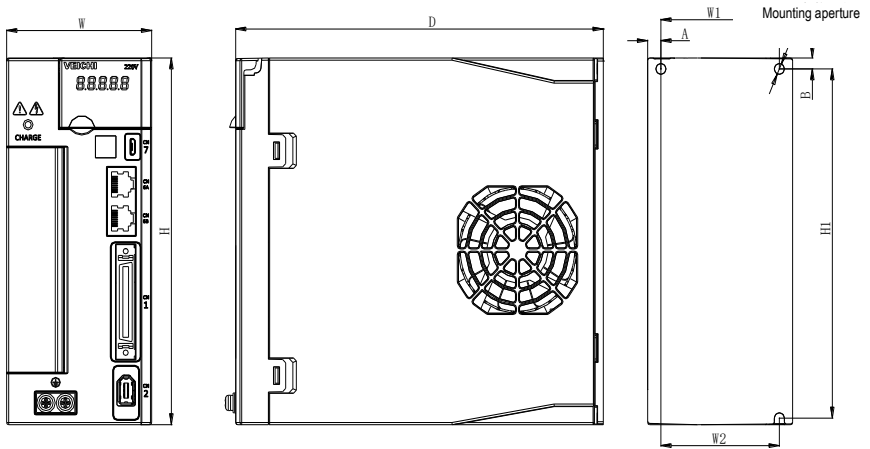
SD700 series servo drives are mainly used for the occasion of high speed, high frequency and high positioning accuracy. The servo unit can maximize the performance of the machine in the shortest time, which can improve the production efficiency. SD700 servo drive not only support PROFINET, EtherCAT, MECHATROLINK-II, MECHATROLINK-III, CANopen, RS-485 and other field bus in the market, but also has a full closed loop, electronic CAM, flying shear, gantry synchronization and other non-standard application functions, through USB can be connected to the PC for debugging, convenient and fast.

## 1.3 Name of Each Part of the Servo Drive

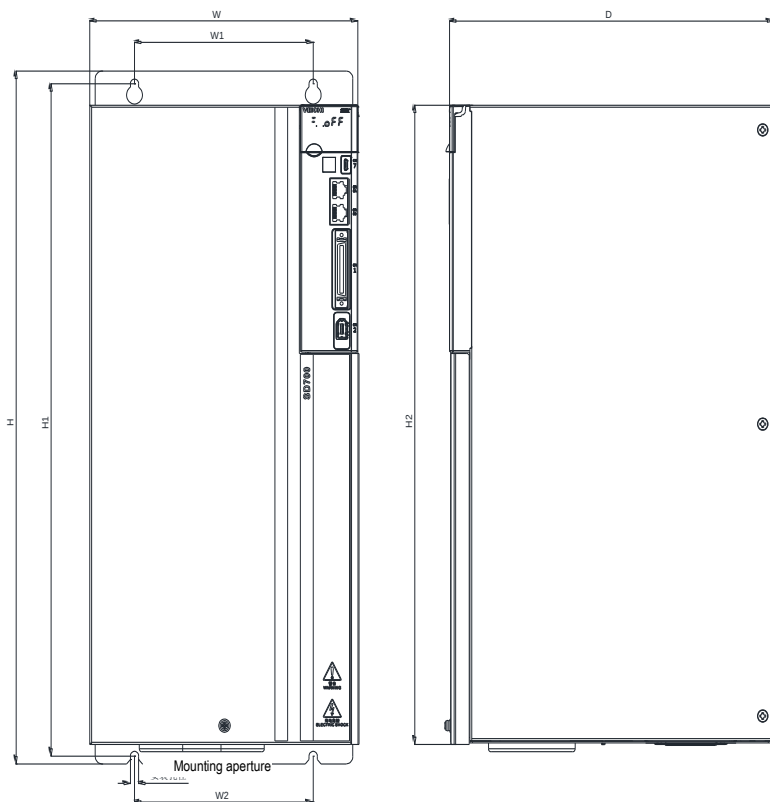


## 1.4 Basic Information of Servo Drive

### 1.4.1 Installation Dimensions

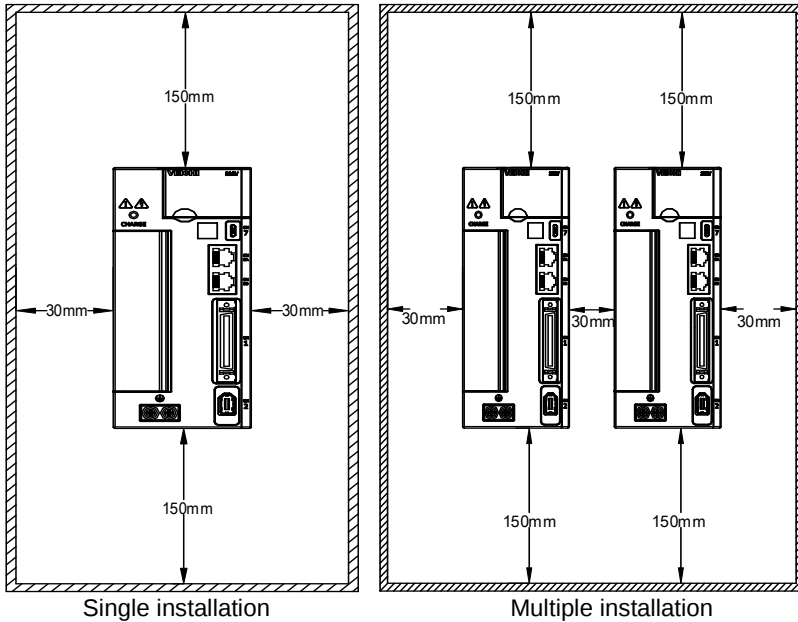


| Size     | Model<br>(SD700-<br>) | Allover size(mm) |     |     | Installation size(mm) |      |     |     |     |   | Mounting<br>aperture | Weight<br>(kg) |
|----------|-----------------------|------------------|-----|-----|-----------------------|------|-----|-----|-----|---|----------------------|----------------|
|          |                       | W                | H   | D   | W1                    | W2   | H1  | H2  | A   | B |                      |                |
| <b>A</b> | 1R1A-**-              | 45               | 168 | 170 | \                     | 20   | 160 | \   | 7.5 | 5 | 2-M4                 | 1.0            |
|          | 1R8A-**-              |                  |     |     |                       |      |     |     |     |   |                      | 1.0            |
|          | 3R3A-**-              |                  |     |     |                       |      |     |     |     |   |                      | 1.0            |
| <b>B</b> | 5R5A-**-              | 71               | 168 | 180 | 58                    | 58   | 160 | \   | 6.5 | 5 | 3-M4                 | 1.4            |
|          | 7R6A-**-              |                  |     |     |                       |      |     |     |     |   |                      | 1.4            |
|          | 9R5A-**-              |                  |     |     |                       |      |     |     |     |   |                      | 1.4            |
|          | 2R5D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 1.4            |
|          | 3R8D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 1.4            |
| <b>C</b> | 120A-**-              | 92.5             | 188 | 182 | 82.5                  | 75   | 180 | \   | 5   | 5 | 3-M4                 | 2.1            |
|          | 160A-**-              |                  |     |     |                       |      |     |     |     |   |                      | 2.1            |
|          | 6R0D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 2.1            |
|          | 8R4D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 2.1            |
|          | 110D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 2.1            |
| <b>D</b> | 170D-**-              | 120              | 260 | 210 | 100                   | 84.5 | 250 | 236 | \   | \ | 4-M5                 | 5.5            |
|          | 240D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 5.5            |
|          | 300D-**-              |                  |     |     |                       |      |     |     |     |   |                      | 5.5            |



| Size | Model<br>(SD700-) | Allover size(mm) |     |     | Installation size(mm) |     |     |           | Mounting<br>aperture | Weight (kg) |
|------|-------------------|------------------|-----|-----|-----------------------|-----|-----|-----------|----------------------|-------------|
|      |                   | W                | H   | D   | W1                    | W2  | H1  | H2        |                      |             |
| E    | 500D-**           | 210              | 471 | 254 | 140                   | 140 | 457 | 434.<br>5 | 4-M6                 | 15.0        |
|      | 600D-**           |                  |     |     |                       |     |     |           |                      | 15.0        |

## 1.4.2 Installation Way



### ! Notice

To ensure effective cooling through fans and natural convection, leave enough space around the driver for heat dissipation during installation. To ensure good heat dissipation effect, install a fan above the cabinet where the driver is installed to draw air outward. Ensure that the heat dissipation duct in the cabinet is the air inlet under the cabinet and the air outlet above the cabinet.

### 1.4.3 Specifications and Electric Parameters



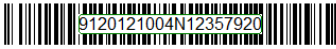
# VEICHI

**MODEL: SD700-9R5A-PA**

**INPUT: 3PH 200~240V 50/60Hz 5.2A**

**OUTPUT: 3PH 0~input 0~500Hz 9.5A**

**IPX0**



9120121004N12357920



**EHL CE**

**Protection class Class I**



**危险**  
**DANGER**



**警告**  
**WARNING**



**注意**  
**CAUTION**

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.

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.

请勿触摸散热器，有烫伤的危险。  
Do not touch the heatsink, there is a risk of scalding.

苏州伟创电气科技股份有限公司      **MADE IN CHINA**  
Suzhou Veichi Electric Co., Ltd.

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| Specification                   | 1R1A | 1R8A | 3R3A | 5R5A | 7R6A | 9R5A | 2R5D | 3R8D |
|---------------------------------|------|------|------|------|------|------|------|------|
| Size                            | A    |      |      | B    |      |      |      |      |
| Continuous output current /Arms | 1.1  | 1.8  | 3.3  | 5.5  | 7.6  | 9.5  | 2.5  | 3.8  |
| Maximum output current /Arms    | 3.9  | 6.3  | 11.6 | 16.5 | 22.8 | 23.8 | 7.5  | 11.4 |
| Specification                   | 120A | 160A | 6R0D | 8R4D | 110D | 170D | 240D | 300D |
| Size                            | C    |      |      |      |      | D    |      |      |

|                                 |      |      |      |      |      |      |      |      |
|---------------------------------|------|------|------|------|------|------|------|------|
| Continuous output current /Arms | 12.0 | 16.0 | 6.0  | 8.4  | 11.0 | 17.0 | 24.0 | 30.0 |
| Maximum output current /Arms    | 36.0 | 40.0 | 18.0 | 25.2 | 27.5 | 42.5 | 60.0 | 70.0 |
| Specification                   | 500D | 600D |      |      |      |      |      |      |
| Size                            | E    |      |      |      |      |      |      |      |
| Continuous output current /Arms | 50   | 60   |      |      |      |      |      |      |
| Maximum output current /Arms    | 115  | 120  |      |      |      |      |      |      |

### 1.4.4 Basic specifications

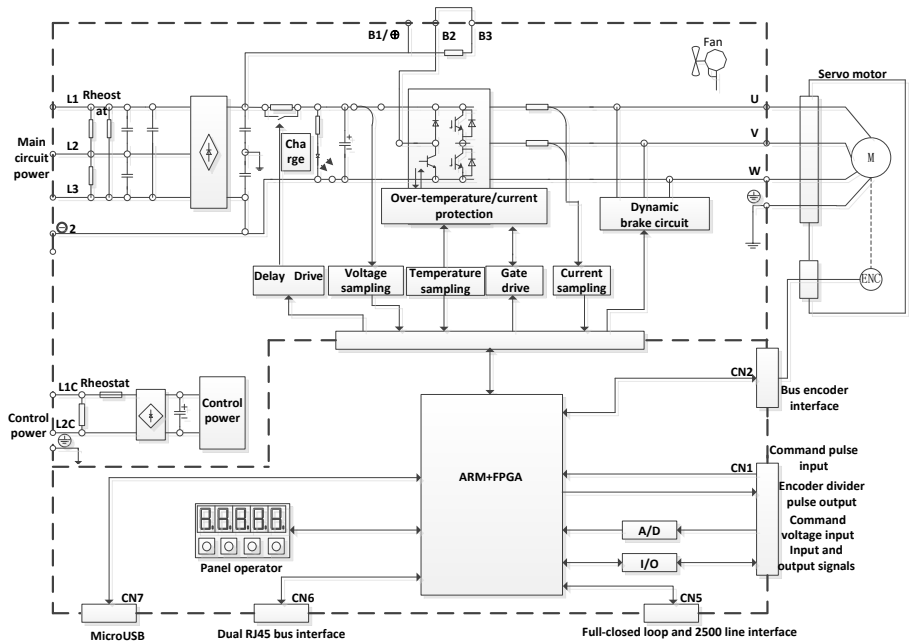
| Item                     |                        | Specification                                                                                                                      |
|--------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Drive method             |                        | IGBT PWM control sine wave current drive mode                                                                                      |
| Feedback                 | Rotary servo motor     | Serial encoder: 17-bit, 23-bit absolute encoder                                                                                    |
|                          | Linear servo           | Incremental linear encoder, parallel signal                                                                                        |
| Environmental conditions | Ambient temperature    | -5°C~50°C (-5°C~40°C doesn't require derating, use derating when temperature exceeds 40°C, and 2% derating for every 1°C increase) |
|                          | Storage temperature    | -20°C~85°C                                                                                                                         |
|                          | Ambient humidity       | 95% RH or less (no freezing, condensation)                                                                                         |
|                          | Storage humidity       | 95% RH or less (no freezing, condensation)                                                                                         |
|                          | Vibration resistance   | 4.9m/s <sup>2</sup>                                                                                                                |
|                          | Shock resistance       | 19.6m/s <sup>2</sup>                                                                                                               |
|                          | Protection level       | IPX0                                                                                                                               |
|                          | Cleanliness            | Non-corrosive gas, flammable gas, water, oil, and chemical splashes. Environments with less dust, salt, and metal powder           |
|                          | Altitude               | 1000m or less (1000m~2000m, it is necessary to lower the rated value)                                                              |
|                          | Overvoltage class      | III                                                                                                                                |
|                          | Protection class       | Class I                                                                                                                            |
|                          | Pollution level        | Level 2                                                                                                                            |
|                          | Grid power supply type | TN/TT                                                                                                                              |
|                          | Other                  | Free of static electricity, strong electromagnetic fields, magnetic fields or exposure to radioactivity                            |
| Applicable standard      |                        | EN/IEC61800-5-1, EN/IEC61800-3                                                                                                     |
| Installation type        |                        | Base mounting type      Standard                                                                                                   |

|                         |                                           |                          | Rack mounting type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Need accessories |
|-------------------------|-------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Performance             | Speed control range                       |                          | 1:5000 (The lower limit of the speed control range must be lower than the point at which the rated torque does not cause the servo motor to stop)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  |
|                         | Speed volatility                          | Load fluctuation         | ±0.01% of rated speed (load fluctuation: 0%～100%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  |
|                         |                                           | Voltage fluctuation      | ±0.01% of rated speed (voltage fluctuation: ± 10%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |
|                         |                                           | Temperature fluctuation  | ±0.1% of rated speed (temperature fluctuation: 25°C ± 25°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |
|                         | Torque control accuracy (reproducibility) |                          | ±1%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |
|                         | Soft start time setting                   |                          | 0s～30s (Can be set individually for acceleration and deceleration)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |
| Item                    |                                           |                          | Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
| Input and output signal | Encoder divided pulse output              |                          | Phase A, Phase B, Phase C: Linear Drive Output<br>C phase: Collector open circuit output<br>Number of divided pulses: any setting ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |
|                         | Sequence input signal                     | Fixed input              | Operating voltage range: DC5 V ± 5%<br>Input points: 1 point<br>Encoder absolute value data requires input (SEN) signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |
|                         |                                           | Assignable input signal  | Operating voltage range: DC24V ± 20%<br>Input points: 9 points<br>Input method: common collector input, common emitter input<br>• Servo ON (/S-ON)<br>• Positive limit (P-OT), negative limit (N-OT)<br>• Alarm Clear (/ALM-RST)<br>• Manual PI-P Control (/P-CON)<br>• Torque limit switching (/TLC)<br>• Motor rotation direction switching input (/SPD-D) signal<br>• Internal set speed switching (/SPD-A, /SPD-B)<br>• Control mode selection (/C-SEL)<br>• Zero clamping (/ZCLAMP)<br>• Reference pulse inhibit (/INHIBIT)<br>• Gain selection (/G-SEL)<br>• Reference pulse input multiplication switching (/PSEL)<br>(Assignable signals and change positive/negative logic. More details refer to chapter 3.8) |                  |
|                         | Sequential output signal                  | Fixed output             | Operating voltage range: DC5V ~ DC30V<br>Output points: 1 point<br>Output signal: servo alarm (ALM)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |
|                         |                                           | Assignable output signal | Operating voltage range: DC5V ~ DC30V<br>Output points: 3 points<br>(3 points, output mode: optocoupler output (isolated))<br>• Positioning completed (/COIN)<br>• Speed consistent detection (/V-CMP)<br>• Rotation detection (/TGON)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |

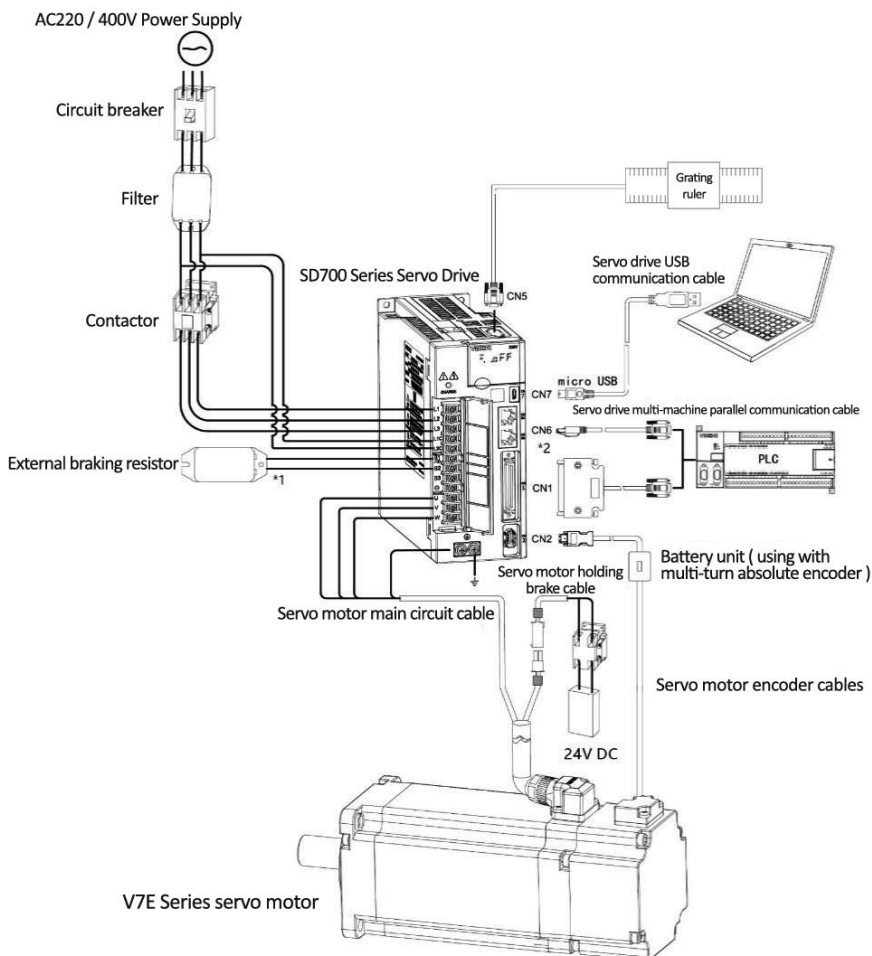
|                            |                         |                             | <ul style="list-style-type: none"><li>• Servo ready (/S-RDY)</li><li>• Torque limit detection (/CLT)</li><li>• Speed limit detection (/VLT)</li><li>• Brake (/BK)</li><li>• Warning (/WARN)</li><li>• Positioning near (/NEAR)</li><li>• Reference pulse input multiplication switching output (/PSELA)</li></ul> (Assignable signals and change positive/negative logic. More details refer to chapter 3.9) |                                                                                                                                                                   |
|----------------------------|-------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Item                       |                         |                             | Specification                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                   |
| Communication function     | Bus communication (CN6) | RS-485                      | Standard                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                   |
|                            |                         | CAN                         | Optional                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                   |
|                            |                         | M-II                        | Optional                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                   |
|                            |                         | M-III                       | Optional                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                   |
|                            |                         | PROFINET                    | Optional                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                   |
|                            |                         | EtherCAT                    | Optional                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                   |
|                            | USB communication (CN7) | Connecting device           | PC, standard, micro-USB(android USB)                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                   |
|                            |                         | Communication specification | Compliant with USB2.0 specification (12Mbps)                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                   |
| Display function           |                         |                             | CHARGE,8-segment LED × 5 digits                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                   |
| Panel operator function    |                         |                             | Button switch × 4                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                   |
| Dynamic brake (DB)         |                         |                             | Activated when a servo alarm or overtraveling occurs or when the power supply for the main circuit or servomotor is OFF                                                                                                                                                                                                                                                                                      |                                                                                                                                                                   |
| Regeneration treatment     |                         |                             | Function can be built in / external                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                   |
| Overtravel (OT) prevention |                         |                             | Dynamic brake stop, deceleration to a stop, or free run to a stop at P-OT or N-OT                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                   |
| Protective function        |                         |                             | Over current, over voltage, under voltage, overload, regenerative fault, encoder disconnection, etc                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                   |
| Accessibility              |                         |                             | Gain adjustment, alarm recording, JOG operation, origin search, etc                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                   |
| Control                    | Speed control           | Soft start time setting     |                                                                                                                                                                                                                                                                                                                                                                                                              | 0s ~ 30s (acceleration and deceleration can be set separately)                                                                                                    |
|                            |                         | Input signal                | Command voltage                                                                                                                                                                                                                                                                                                                                                                                              | Maximum input voltage: ±10V (motor forward rotation when positive voltage command)<br>• Rated speed at DC6V [factory setting]<br>Input gain setting can be varied |
|                            |                         |                             | Input Impedance                                                                                                                                                                                                                                                                                                                                                                                              | About 66kΩ                                                                                                                                                        |
|                            |                         |                             | Circuit Time Constant                                                                                                                                                                                                                                                                                                                                                                                        | 30μs                                                                                                                                                              |
|                            |                         | Internal set speed control  | Direction of rotation                                                                                                                                                                                                                                                                                                                                                                                        | Use /SPD-D signal selection                                                                                                                                       |
|                            |                         |                             | Speed selection                                                                                                                                                                                                                                                                                                                                                                                              | Use SPD-A/SPD-B signal input (1st ~ 3rd speed selection)<br>Stop or change to other control modes when both                                                       |



## 1.5 System Diagram



## 1.6 System Configuration Examples



## 1.7 Drive Name

**SD700-3R3A-PA\***

A B C D E F G

| Field ID | Field Explanation                                                               |               |          |          |          |          |          |         |
|----------|---------------------------------------------------------------------------------|---------------|----------|----------|----------|----------|----------|---------|
| A        | SD:Servo product code                                                           |               |          |          |          |          |          |         |
| B        | 700:Product series                                                              |               |          |          |          |          |          |         |
| C        | Current class :                                                                 |               |          |          |          |          |          |         |
|          | 1R1:1.1A                                                                        | 1R8:1.8A      | 3R3:3.3A | 5R5:5.5A | 7R6:7.6A | 9R5:9.5A | 120:12A  | 160:16A |
|          | 2R5:2.5A                                                                        | 3R8:3.8A      | 6R0:6A   | 8R4:8.4A | 110:11A  | 170:17A  |          |         |
|          | 240:24A                                                                         | 300:30A       | 500:50A  | 600:60A  | 700:70A  | 800:80A  | 121:120A |         |
|          | 171:170A                                                                        | 221:220A      | 321:320A | 421:420A | 521:520A |          |          |         |
| D        | Input voltage class:                                                            |               |          |          |          |          |          |         |
|          | A:200-240VAC;      D:380-440VAC;                                                |               |          |          |          |          |          |         |
| E        | Type:                                                                           |               |          |          |          |          |          |         |
|          | P:pulse type;    S:standard type;    C:CANopen bus type;    E:EtherCAT bus type |               |          |          |          |          |          |         |
|          | M:MECHATROLINK-II bus type;    L:MECHATROLINK-III bus type;                     |               |          |          |          |          |          |         |
|          | N:PROFINET bus type                                                             |               |          |          |          |          |          |         |
|          | F:Multiple I/O type                                                             |               |          |          |          |          |          |         |
| F        | Supported encoder types:                                                        |               |          |          |          |          |          |         |
|          | A                                                                               | Absolute type |          |          |          |          |          |         |
| G        | Product management number, standard product default                             |               |          |          |          |          |          |         |

Difference functions between different types:

| Code | Model                 | Input pulse | 16-bit analog value | Full closed loop | RS485 | CAN open | EtherCAT | MECHATROLINK II | MECHATROLINK III | PROFINET |
|------|-----------------------|-------------|---------------------|------------------|-------|----------|----------|-----------------|------------------|----------|
| P    | Pulse type            | √           | ×                   | √                | √     | ×        | ×        | ×               | ×                | ×        |
| S    | Standard type         | √           | √                   | √                | √     | √        | ×        | ×               | ×                | ×        |
| C    | CAN type              | √           | ×                   | √                | ×     | √        | ×        | ×               | ×                | ×        |
| E    | EtherCAT type         | ×           | ×                   | Δ                | ×     | ×        | √        | ×               | ×                | ×        |
| M    | MECHATROLINK II type  | ×           | ×                   | Δ                | ×     | ×        | ×        | √               | ×                | ×        |
| L    | MECHATROLINK III type | ×           | ×                   | Δ                | ×     | ×        | ×        | ×               | √                | ×        |
| F    | Multiple I/O type     | √           | ×                   | Δ                | ×     | ×        | ×        | ×               | ×                | ×        |
| N    | PROFINET              | ×           | ×                   | Δ                | ×     | ×        | ×        | ×               | ×                | √        |

|  |      |  |  |  |  |  |  |  |  |
|--|------|--|--|--|--|--|--|--|--|
|  | type |  |  |  |  |  |  |  |  |
|--|------|--|--|--|--|--|--|--|--|

\*1.M-II type refers to the servo unit interface specification for MECHATROLINK-II communication command type

\*2.M-III type refers to the servo unit interface specification for MECHATROLINK-III communication command type

Note: Pulse and CANopen servo is standard configured with 12 bit analog;

△ is optional configuration; √ is standard configuration; × is not configured.

## 1.8 Maintenance and Inspection of Servo Drive

The servo system is made up of many parts. The equipment performs its functions only when all the parts work properly. In mechanical parts and electronic parts, some parts need to be maintained depending on the conditions of use. It must be regularly checked or replaced according to the service-time to ensure that the servo motor and servo drive can operate normally for a long time.

### 1.8.1 Inspection of Servo Motor

Since the AC servo motor does not have the electric brush so that only a simple daily maintenance is required. The maintenance period in the table is a rough standard. Please judge and determine the most appropriate time for repair according to the conditions of use and use environment.

| Inspect items                     | Inspect time                                | The essentials of inspection and maintenance                                                                                   | Notes                                                              |
|-----------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Vibration and sound               | every day                                   | Tactile and auditory judgments                                                                                                 | No increase compared to usual                                      |
| Appearance overhaul               | According to the insult                     | Erasing with a cloth or cleaning with an air gun                                                                               | -                                                                  |
| Insulation resistance measurement | At least once a year                        | Disconnect the servo system and measure the insulation resistance with a 500V megger Resistance value exceeding 10MΩ is normal | When it is 10MΩ or less, please contact our maintenance department |
| Replacement of oil seals          | At least once every 5,000 hours             | Please contact our agents or technical support                                                                                 | Only servo motor with oil seal                                     |
| Comprehensive maintenance         | At least once every 20,000 hours or 5 years |                                                                                                                                | -                                                                  |

### 1.8.2 Inspection of Servo Drive

Although the servo drive does not require daily inspections, it should be Inspection more than once a year.

| Maintenance            | Inspect time         | The essentials of inspection and maintenance | Notes                                        |
|------------------------|----------------------|----------------------------------------------|----------------------------------------------|
| Appearance maintenance | At least once a year | No garbage, dust, oil traces, etc            | Erasing with a cloth or cleaning with an air |

|              |  |                                                                   |                |
|--------------|--|-------------------------------------------------------------------|----------------|
|              |  |                                                                   | gun            |
| Loose screws |  | Wiring board, connector mounting screws and so on must not loosen | Please tighten |

### 1.8.3 Approximate Standards for Changing Internal Parts of Servo Drive

Electrical and electronic parts are subject to mechanical wear and aging. To ensure safety, please do regular inspections. In addition, please refer to the following table for the standard number of years of replacement, and contact our agency or sales office. After the inspection, we will judge whether we need to replace the parts. The servo drive serviced by our company has its user parameters adjusted back to the factory settings. Be sure to reset the user parameters before use by yourself.

| Parts' name                                                | Standard replacement period        | Conditions of use                                                                                         |
|------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Cooling fan                                                | 4 years~5 years                    | Ambient temperature:annual average 30°C<br>Load rate: 80% or less<br>Operating rate: 20 hours or less/day |
| Smoothing capacitor                                        | 7 years~8 years                    |                                                                                                           |
| Relay                                                      | According to actual use conditions |                                                                                                           |
| Aluminum electrolytic capacitors on printed circuit boards | 5 years                            |                                                                                                           |

### 1.8.4 Precautions during Operation and Running

| Attention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Install the machine and before starting operation, perform the switch and parameter settings appropriate to the machine.</p> <p>If you operate the machine without setting, it may cause accidental operation, malfunction, or personal injury.</p> <ul style="list-style-type: none"> <li>● Do not make extreme changes to the parameter settings.</li> </ul> <p>Otherwise, it may cause unstable operation, mechanical damage or injury.</p> <ul style="list-style-type: none"> <li>● To avoid accidents, install a limit switch or stopper at the end of the movable part of the machine.</li> </ul> <p>Otherwise, it may cause damage or injury to the machine.</p> <ul style="list-style-type: none"> <li>● The test run should be performed when the servo motor is fixed and disconnected from the machine.</li> </ul> <p>Otherwise, injury may occur.</p> |

#### Operating Qualifications

This product must be operated by trained professionals. Moreover, the operator must be trained in professional skills, familiar with the installation, wiring, operation and maintenance of the equipment, and properly respond to various emergencies that occur during use.

#### Safety instructions

Warning signs are presented for your safety and are measures to prevent injury to the operator and damage to the product and associated systems. Please read this manual carefully before use, and strictly follow the safety rules and warning signs in this manual.

## 1.9 Motor Name

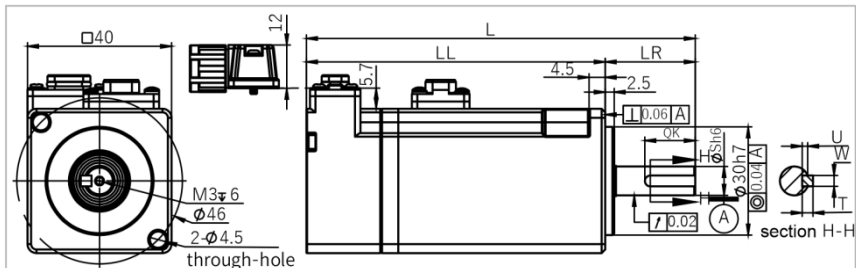
**VM7-L08A-1R030-D1\***

A B C D E F G H I

| Field ID | Field Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |  |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| A        | Series:<br>V7E<br>VM7<br>VM5                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |
| B        | Inertia:<br>L:Low inertia<br>M:midium inertia<br>H:High inertia                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  |
| C        | Flange:<br>04:40mm                      11:110mm<br>06:60mm                      13:130mm<br>08:80mm                      18:180mm<br>10:100mm                     20:200mm<br>26:263mm                                                                                                                                                                                                                                                                                      |  |  |  |  |
| D        | Rated voltage:                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |  |
|          | A:220VAC;    D:400VAC;                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |  |  |
| E        | Rated power:<br>R05:50W      R10:100W      R20:200W      R40:400W      R60:600W<br>R75:750W      R85:850W      1R0:1.0kW      1R2:1.2kW      1R3:1.3kW<br>1R5:1.5kW      1R8:1.8kW      2R0:2.0kW      2R3:2.3kW      2R6:2.6kW<br>2R9:2.9kW      4R4:4.4kW      5R5:5.5kW      7R5:7.5kW      011:11kW<br>015:15kW      020:20kW      022:22kW      030:30kW      037:37kW<br>045:45kW      055:55kW      075:75kW      090:90kW      110:110kW<br>150:150kW      200:200kW |  |  |  |  |
| F        | Rated speed(RPM):<br>15:1500<br>20:2000<br>25:2500<br>30:3000                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |
| G        | Type of encoder:<br>D:23 bit multi-turn absolute encoder(optical)<br>Q:17 bit sigle-turn absolute encoder(magnetic)<br>R:17 bit multi-turn absolute encoder(magnetic)<br>S: 20 bit multi-turn absolution optical cross shaft encoder                                                                                                                                                                                                                                         |  |  |  |  |
| H        | Type of shaft:<br>1: Key shaft; with threaded hole; oil seal; with out brake<br>2: Key shaft; with threaded hole; oil seal; with brake                                                                                                                                                                                                                                                                                                                                       |  |  |  |  |
| I        | Internal management number:A General shaft (Standard omission);B Same as Yaskawa shaft;Z Non-standard shaft (Letter replaceable)                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |

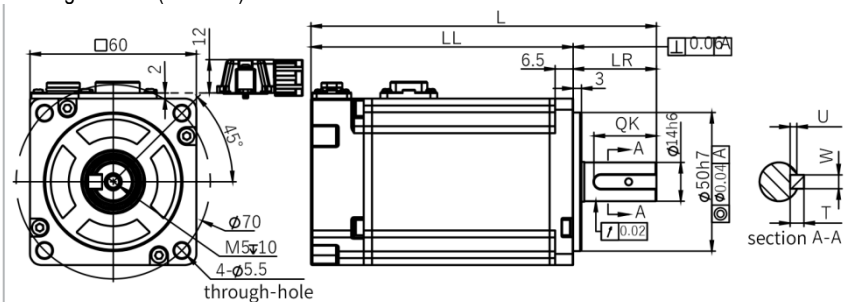
## 1.10 Dimension of Motors

40 Flange motors (Unit:mm):



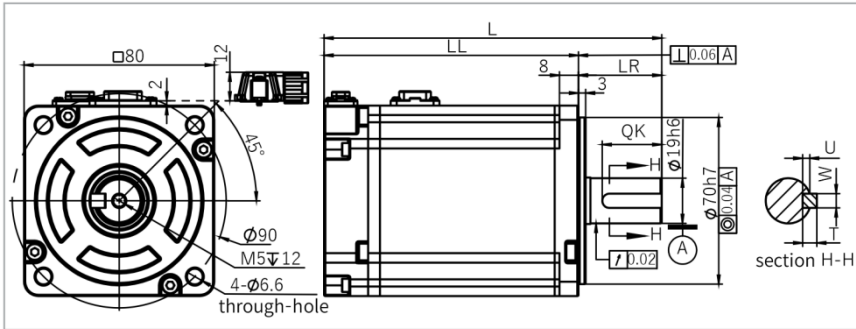
| Model             | L   | LL  | LR | S | QK | U   | W | T |
|-------------------|-----|-----|----|---|----|-----|---|---|
| V7E-L04A-R1030-□1 | 108 | 83  | 25 | 8 | 14 | 1.5 | 3 | 3 |
| V7E-L04A-R1030-□2 | 134 | 109 | 25 | 8 | 14 | 1.5 | 3 | 3 |

60 Flange motors (Unit:mm):



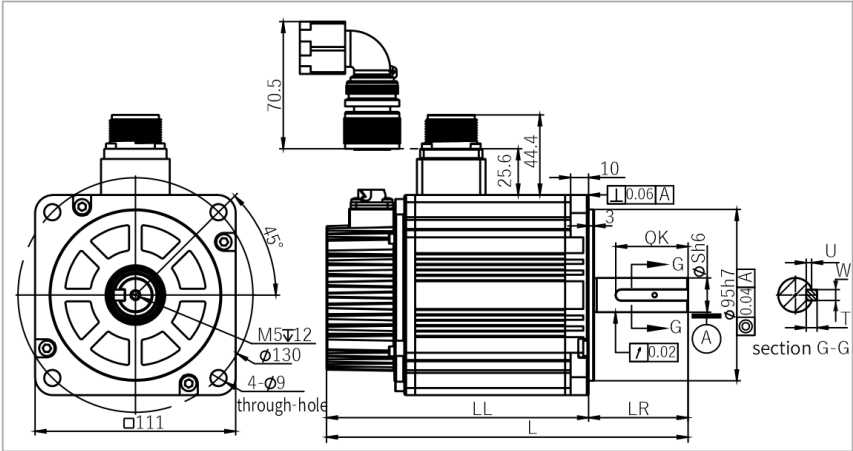
| Model             | L     | LL    | LR | S  | QK   | U   | W | T |
|-------------------|-------|-------|----|----|------|-----|---|---|
| V7E-L06A-R2030-□1 | 105.5 | 75.5  | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-L06A-R2030-□2 | 136.5 | 106.5 | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-L06A-R4030-□1 | 124.5 | 94.5  | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-L06A-R4030-□2 | 155.5 | 125.5 | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-M06A-R4030-□1 | 134.5 | 104.5 | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-M06A-R4030-□2 | 165.5 | 135.5 | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-L06A-R6030-□1 | 143.5 | 113.5 | 30 | 14 | 22.5 | 2.5 | 5 | 5 |
| V7E-L06A-R6030-□2 | 174.5 | 144.5 | 30 | 14 | 22.5 | 2.5 | 5 | 5 |

80 Flange motors: (Unit:mm):



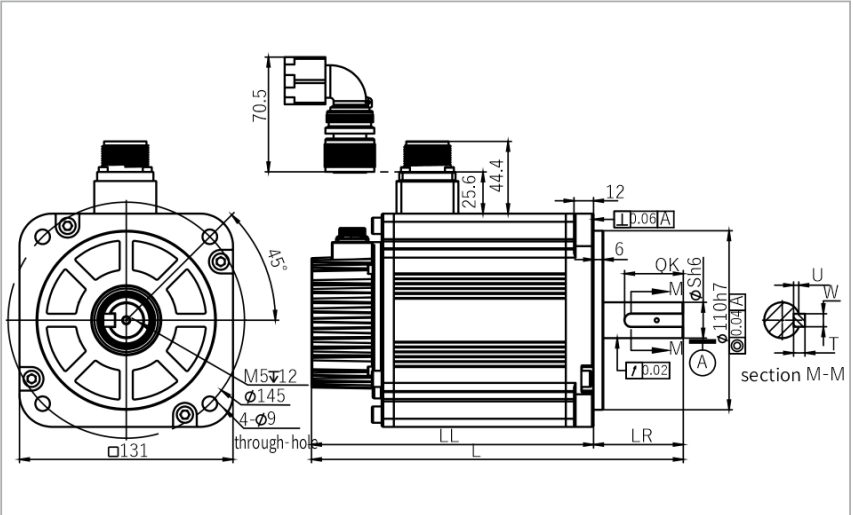
| Model              | L     | LL    | LR | S  | QK | U | W | T |
|--------------------|-------|-------|----|----|----|---|---|---|
| V7E-L08A-R7520-□1L | 156   | 121   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-R7520-□2L | 188   | 153   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-R7530-□1L | 142   | 107   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-R7530-□2L | 174   | 139   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-M08A-R7530-□1L | 152   | 117   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-M08A-R7530-□2L | 184.5 | 149.5 | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-R7530-□1  | 142   | 107   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-R7530-□2  | 174   | 139   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-M08A-R7530-□1  | 152   | 117   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-M08A-R7530-□2  | 184.5 | 149.5 | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-1R030-□1  | 156   | 121   | 35 | 19 | 25 | 3 | 6 | 6 |
| V7E-L08A-1R030-□2  | 188   | 153   | 35 | 19 | 25 | 3 | 6 | 6 |

110 Flange motors: (Unit-mm):



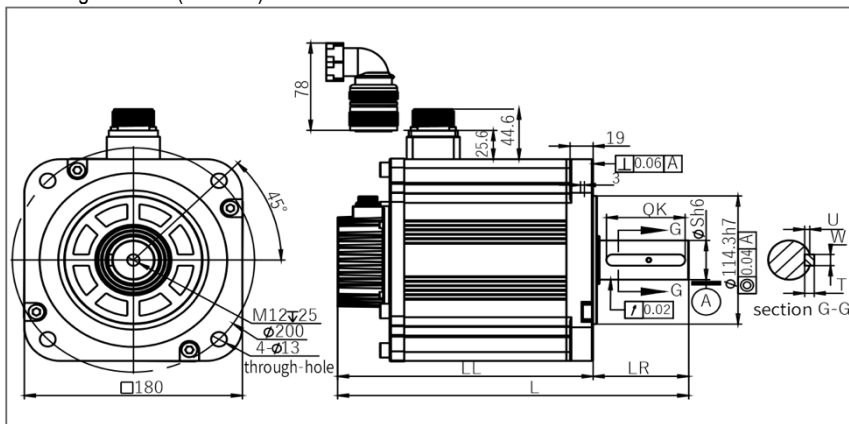
| Model             | L     | LL    | LR | S  | QK | U | W | T |
|-------------------|-------|-------|----|----|----|---|---|---|
| V7E-M11A-1R230-□1 | 190   | 135   | 55 | 19 | 40 | 3 | 6 | 6 |
| V7E-M11A-1R230-□2 | 221.2 | 166.2 | 55 | 19 | 40 | 3 | 6 | 6 |
| V7E-M11A-1R530-□1 | 200   | 145   | 55 | 19 | 40 | 3 | 6 | 6 |
| V7E-M11A-1R530-□2 | 231.2 | 176.2 | 55 | 19 | 40 | 3 | 6 | 6 |
| V7E-M11A-1R830-□1 | 210   | 155   | 55 | 19 | 40 | 3 | 6 | 6 |
| V7E-M11A-1R830-□2 | 241.2 | 186.2 | 55 | 19 | 40 | 3 | 6 | 6 |

130 Flange motors: (Unit-mm):



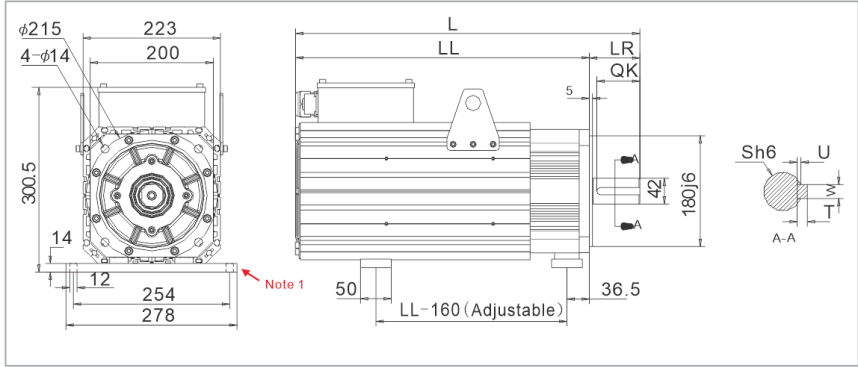
| Model              | L     | LL    | LR | S  | QK | U   | W | T |
|--------------------|-------|-------|----|----|----|-----|---|---|
| V7E-M13A-R8515-□1  | 193   | 138   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-R8515-□2  | 221.2 | 166.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R020-□1  | 193   | 138   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R020-□2  | 221.2 | 166.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R315-□1  | 208   | 153   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R315-□2  | 236.2 | 181.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R520-□1  | 208   | 153   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R520-□2  | 236.2 | 181.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R815-□1  | 228   | 173   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-1R815-□2  | 256.2 | 201.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-2R020-□1  | 228   | 173   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-2R020-□2  | 256.2 | 201.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-2R315-□1L | 258   | 203   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-2R315-□2L | 286.2 | 231.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-3R020-□1  | 258   | 203   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-3R020-□2  | 286.2 | 231.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-R8515-□1  | 193   | 138   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-R8515-□2  | 221.2 | 166.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R020-□1  | 193   | 138   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R020-□2  | 221.2 | 166.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R315-□1  | 208   | 153   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R315-□2  | 236.2 | 181.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R520-□1  | 208   | 153   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R520-□2  | 236.2 | 181.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R815-□1  | 228   | 173   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-1R815-□2  | 256.2 | 201.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-2R020-□1  | 228   | 173   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-2R020-□2  | 256.2 | 201.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-2R315-□1L | 258   | 203   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-2R315-□2L | 286.2 | 231.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-3R020-□1  | 258   | 203   | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13D-3R020-□2  | 286.2 | 231.2 | 55 | 22 | 36 | 3.2 | 8 | 7 |
| V7E-M13A-R8515-□1B | 193   | 138   | 55 | 19 | 40 | 3.1 | 6 | 6 |
| V7E-M13A-R8515-□2B | 221.2 | 166.2 | 55 | 19 | 40 | 3.1 | 6 | 6 |
| V7E-M13A-1R815-□1B | 228   | 173   | 55 | 24 | 36 | 3.3 | 8 | 7 |
| V7E-M13A-1R815-□2B | 256.2 | 201.2 | 55 | 24 | 36 | 3.3 | 8 | 7 |
| V7E-M13D-R8515-□1B | 193   | 138   | 55 | 19 | 40 | 3.1 | 6 | 6 |
| V7E-M13D-R8515-□2B | 221.2 | 166.2 | 55 | 19 | 40 | 3.1 | 6 | 6 |
| V7E-M13D-1R815-□1B | 228   | 173   | 55 | 24 | 36 | 3.3 | 8 | 7 |
| V7E-M13D-1R815-□2B | 256.2 | 201.2 | 55 | 24 | 36 | 3.3 | 8 | 7 |

180 Flange motors: (Unit:mm):



| Model               | L     | LL    | LR  | S  | QK | U   | W  | T  |
|---------------------|-------|-------|-----|----|----|-----|----|----|
| V7E-M18A-2R915-□1   | 266   | 187   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18A-2R915-□2   | 307.5 | 228.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18A-4R415-□1   | 290   | 211   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18A-4R415-□2   | 331.5 | 252.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-2R915-□1   | 266   | 187   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-2R915-□2   | 307.5 | 228.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-2R915-□1H  | 266   | 187   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-2R915-□2H  | 307.5 | 228.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-4R415-□1   | 290   | 211   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-4R415-□2   | 331.5 | 252.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-4R415-□1H  | 290   | 211   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-4R415-□2H  | 331.5 | 252.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-5R515-□1   | 325.5 | 246.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-5R515-□2   | 367   | 288   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-5R515-□1H  | 325.5 | 246.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-5R515-□2H  | 367   | 288   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-7R515-□1   | 372.5 | 293.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-7R515-□2   | 414   | 335   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-7R515-□1H  | 372.5 | 293.5 | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-7R515-□2H  | 414   | 335   | 79  | 35 | 65 | 4.3 | 10 | 8  |
| V7E-M18D-5R515-□1BH | 359.5 | 246.5 | 113 | 42 | 96 | 4.2 | 12 | 10 |
| V7E-M18D-5R515-□2BH | 401   | 288   | 113 | 42 | 96 | 4.2 | 12 | 10 |
| V7E-M18D-7R515-□1BH | 406.5 | 293.5 | 113 | 42 | 96 | 4.2 | 12 | 10 |
| V7E-M18D-7R515-□2BH | 448   | 335   | 113 | 42 | 96 | 4.2 | 12 | 10 |

200 Flange motor: (Unit:mm):

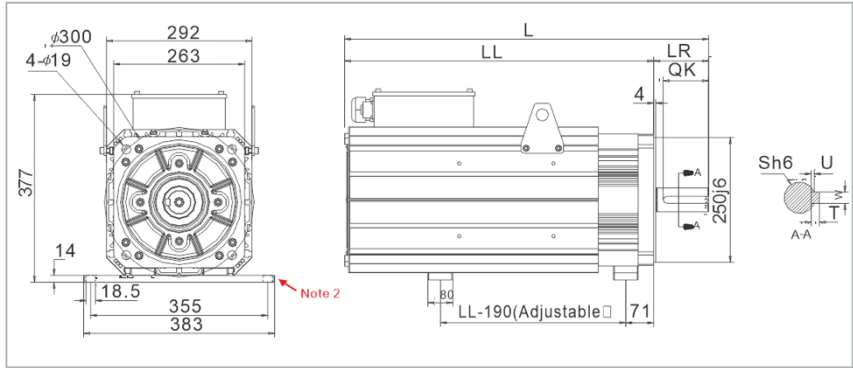


| Model               | L   | LL  | LR | S  | QK | U  | W | T  |
|---------------------|-----|-----|----|----|----|----|---|----|
| V7E-M20D-01115-□1FN | 451 | 369 | 82 | 42 | 4  | 12 | 8 | 70 |
| V7E-M20D-01515-□1FN | 488 | 406 | 82 | 42 | 4  | 12 | 8 | 70 |
| V7E-M20D-02015-□1FN | 560 | 478 | 82 | 42 | 4  | 12 | 8 | 70 |
| V7E-M20D-02215-□1FN | 607 | 525 | 82 | 42 | 4  | 12 | 8 | 70 |

Note 1: The foot plate of 200mm flange motor (optional).

Model code: S18      Material code: 6010000008

263 Flange motors: (Unit:mm):



| Model               | L   | LL  | LR  | S  | QK  | U  | W | T  |
|---------------------|-----|-----|-----|----|-----|----|---|----|
| V7E-M26D-03015-□1FN | 640 | 530 | 110 | 48 | 4.5 | 14 | 9 | 90 |
| V7E-M26D-03715-□1FN | 684 | 574 | 110 | 48 | 4.5 | 14 | 9 | 90 |

## 2 Panel Operation

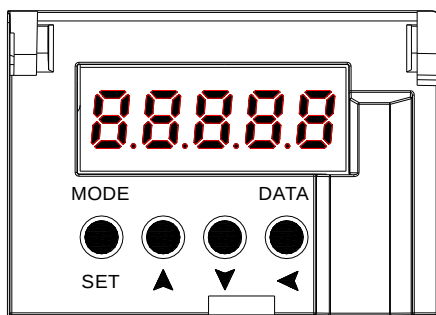
### 2.1 Basic Operation

#### 2.1.1 Keys' Names and Functions of the Panel Operator

The panel operator consists of display and keys.

The panel operator could display status, operate the accessory functions, set parameters and monitoring the servo drive.

The panel operator keys' names and functions are shown as below:



| Keys           | Functions                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| MODE/SET key   | Shift the function modes                                                                                                                 |
|                | Confirm parameter settings                                                                                                               |
|                | Operate the accessory functions                                                                                                          |
| ▲ UP key       | Select parameters up or increase the value, switch between high, medium, and low segment values in multiple segment display parameters   |
| ▼ DOWN key     | Select parameters down or decrease the value, switch between high, medium, and low segment values in multiple segment display parameters |
| DATA/SHIFT key | Press and hold the DATA/SHIFT key for about 1 second to enter or exit                                                                    |
|                | Short press to move to the left one (when flashing)                                                                                      |



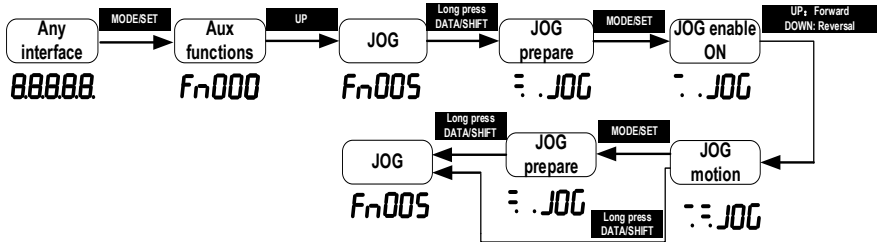
Press and hold the UP and DOWN keys simultaneously to reset the servo alarm. Before resetting the servo alarm, be sure to remove the cause of the alarm, otherwise a safety accident may occur.



## 2.2 Operations of Auxiliary Functions (Fn group)

Auxiliary functions are about performing the settings and adjustment of the servo drive. The panel operator displays the numbers which begin with Fn.

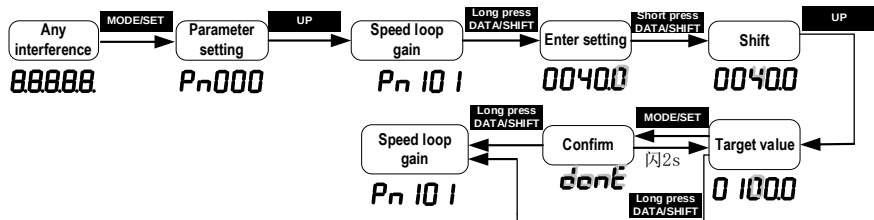
Let's take the JOG function (Fn005) as an example to explain the operating method of the auxiliary functions:



## 2.3 Operations of Parameter (Pn Group)

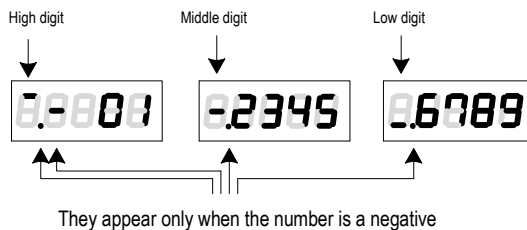
(1) When the setting range is within 5-digit numbers.

Let me introduce the parameters Pn's setting method: Take the setting method of the speed loop gain rise from 40.0 to 100.0 as an example:



(2) When the setting range is over 6-digit numbers:

Because the panel operator could only display 5-digit number, so the setting display with 6-digit number is shown as below:



## 2.4 Operations of Monitoring Display Un Group

The monitor displays can be used for monitoring the reference values, I/O signal status, and servo internal status.

The panel operator displays the numbers which begin with Un, then let's take this function as an example to explain the operating method of the monitoring display: when the motor speed is 3000rpm:

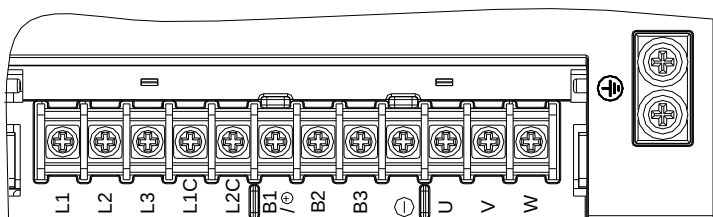


If you want the monitor to automatically display related information after the servo drive is powered on, set PN003 (default 0xFF) to a relevant value. For example, if you want the motor speed to automatically display after the drive is powered on, set PN003 to 00000 (motor speed). For details about the values of each monitoring information, see "Monitor Display".

## 3 Wiring and Connections

### 3.1 Main Circuit Wiring

#### 3.1.1 Terminals Description



| Pin No. | Signal name | Functions                                                                                    |
|---------|-------------|----------------------------------------------------------------------------------------------|
| 1       | L1 (R/L)    | Main circuit power input                                                                     |
| 2       | L2 (S/N)    | Main circuit power input                                                                     |
| 3       | L3 (T)      | Main circuit power input                                                                     |
| 4       | L1C         | Control circuit power input                                                                  |
| 5       | L2C         | Control circuit power input                                                                  |
| 6       | B1/+        | Positive of Internal and external braking resistor Pins/ DC power supply after rectification |
| 7       | B2(PB)      | Energy-consumption braking output                                                            |
| 8       | B3          | Pin of internal braking resistor                                                             |
| 9       | -           | Negative of DC power supply                                                                  |
| 10      | U           | Motor power U phase                                                                          |
| 11      | V           | Motor power V phase                                                                          |
| 12      | W           | Motor power W phase                                                                          |
| Casing  | Grounding   | Safely grounding                                                                             |



A volume drive main circuit wiring can only be connected to a single phase (two terminals are provided), and there is no built-in brake electronics, please pay attention to the correct wiring according to the wiring label when wiring.

### 3.1.2 Recommended Model and Specification of Main Circuit Connection Cable

#### Drive input/output current specifications

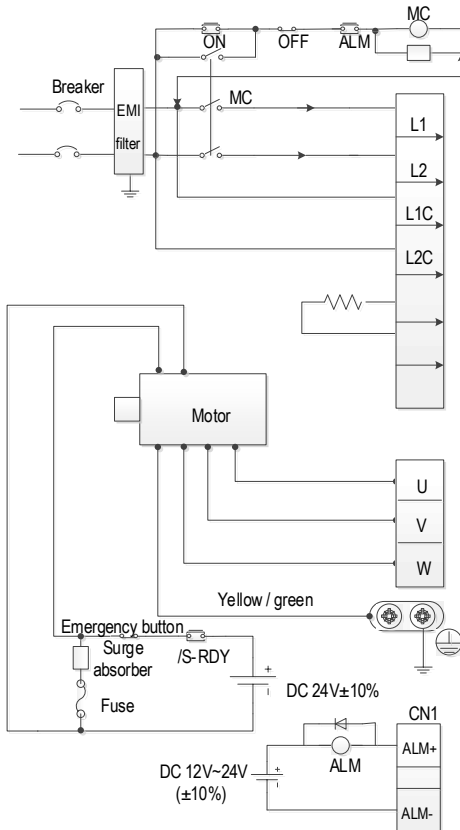
| Drive model<br>SD700-*R*A-** |      | Rated input current(A) | Rated output current(A) | Max. output current(A) |
|------------------------------|------|------------------------|-------------------------|------------------------|
| Single-phase 220V            |      |                        |                         |                        |
| SIZE A                       | 1R1A | 1.28                   | 1.1                     | 2.53                   |
|                              | 1R8A | 2.1                    | 1.8                     | 4.14                   |
|                              | 3R3A | 3.89                   | 3.3                     | 7.59                   |
| Three-phase 220V             |      |                        |                         |                        |
| SIZE B                       | 5R5A | 3.1                    | 5.5                     | 12.65                  |
|                              | 7R6A | 4.2                    | 7.6                     | 17.48                  |
|                              | 9R5A | 5.2                    | 9.5                     | 21.85                  |
| SIZE C                       | 120A | 10.3                   | 12                      | 27.6                   |
|                              | 160A | 13.7                   | 16                      | 36.8                   |
| Three-phase 380V             |      |                        |                         |                        |
| Size B                       | 2R5D | 2.8                    | 2.5                     | 5.75                   |
|                              | 3R8D | 4.18                   | 3.8                     | 8.74                   |
| SICE C                       | 6R0D | 8.8                    | 6.0                     | 13.8                   |
|                              | 8R4D | 12.4                   | 8.4                     | 19.32                  |
|                              | 110D | 16.2                   | 11                      | 25.3                   |
| SIZE D                       | 170D | 22.4                   | 17                      | 39.1                   |
|                              | 240D | 31.6                   | 24                      | 55.2                   |
|                              | 300D | 39.5                   | 30                      | 69                     |
| SIZE E                       | 500D | 46.7                   | 50                      | 115                    |
|                              | 600D | 56                     | 60                      | 138                    |

#### Main circuit terminal connecting cable recommendation

| Drive model SD700-*R*A-** |              |                           | L1C, L2C |     | L1, L2, L3 / R<br>、 S、 T |     | PΦ、 B2、 B3、 N<br>Φ、 |     | U、 V、 W、 PE |     | Grounding<br>terminal |     |
|---------------------------|--------------|---------------------------|----------|-----|--------------------------|-----|---------------------|-----|-------------|-----|-----------------------|-----|
| SIZE                      | Model<br>NO. | Rated input<br>current(A) |          | AWG |                          | AWG |                     | AWG |             | AWG |                       | AWG |
| Single-phase 220V         |              |                           |          |     |                          |     |                     |     |             |     |                       |     |
| SIZE A                    | 1R1A         | 1.28                      | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
|                           | 1R8A         | 2.1                       | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
|                           | 3R3A         | 3.89                      | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
| Three-phase 220V          |              |                           |          |     |                          |     |                     |     |             |     |                       |     |
| SIZE B                    | 5R5A         | 3.1                       | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
|                           | 7R6A         | 4.2                       | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
|                           | 9R5A         | 5.2                       | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
| SIZE C                    | 120A         | 10.3                      | 2×0.82   | 18  | 3×3.33                   | 12  | 3×3.33              | 12  | 3×3.33      | 12  | 2.08                  | 14  |
|                           | 160A         | 13.7                      | 2×0.82   | 18  | 3×5.27                   | 10  | 3×5.27              | 10  | 3×5.27      | 10  | 5.27                  | 10  |
| Three-phase 380V          |              |                           |          |     |                          |     |                     |     |             |     |                       |     |
| Size B                    | 2R5D         | 2.8                       | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
|                           | 3R8D         | 4.18                      | 2×0.82   | 18  | 3×1.31                   | 16  | 3×1.31              | 16  | 3×1.31      | 16  | 2.08                  | 14  |
| SICE C                    | 6R0D         | 8.8                       | 2×0.82   | 18  | 3×3.33                   | 12  | 3×3.33              | 12  | 3×3.33      | 12  | 2.08                  | 14  |
|                           | 8R4D         | 12.4                      | 2×0.82   | 18  | 3×5.27                   | 10  | 3×5.27              | 10  | 3×5.27      | 10  | 5.27                  | 10  |
|                           | 110D         | 16.2                      | 2×0.82   | 18  | 3×5.27                   | 10  | 3×5.27              | 10  | 3×5.27      | 10  | 5.27                  | 10  |
| SIZE D                    | 170D         | 22.4                      | 2×0.82   | 18  | 3×8.37                   | 8   | 3×8.37              | 8   | 3×8.37      | 8   | 8.37                  | 8   |
|                           | 240D         | 31.6                      | 2×0.82   | 18  | 3×8.37                   | 8   | 3×8.37              | 8   | 3×8.37      | 8   | 8.37                  | 8   |
|                           | 300D         | 39.5                      | 2×0.82   | 18  | 3×16.77                  | 5   | 3×16.77             | 5   | 3×16.77     | 5   | 16.77                 | 5   |
| SIZE E                    | 500D         | 46.7                      | 2×0.82   | 18  | 3×16.77                  | 5   | 3×16.77             | 5   | 3×16.77     | 5   | 16.77                 | 5   |
|                           | 600D         | 56                        | 2×0.82   | 18  | 3×16.77                  | 5   | 3×16.77             | 5   | 3×16.77     | 5   | 16.77                 | 5   |

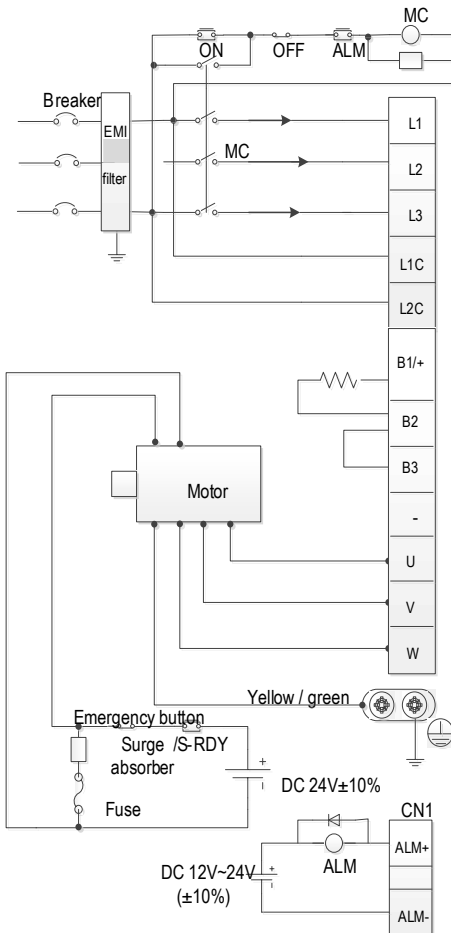
### 3.1.3 Wiring Diagram

#### A-volume single-phase wiring diagram



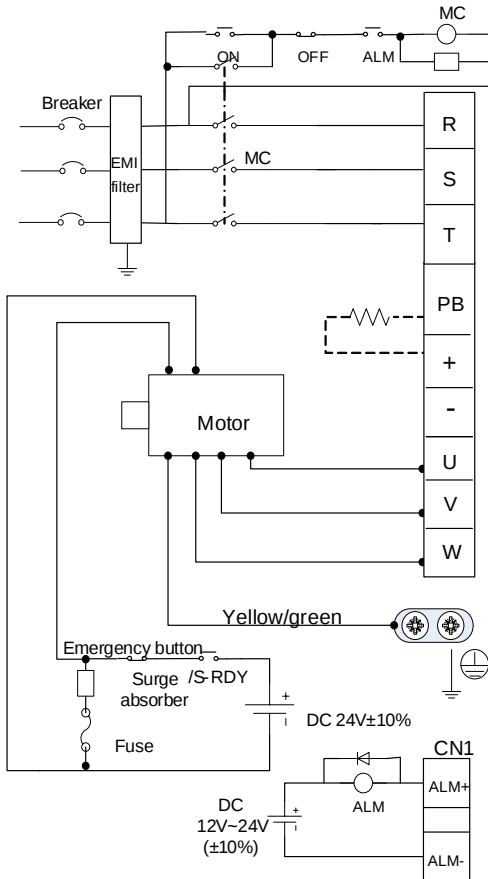
- Please make this emergency stop protection circuit.
- Electromagnetic contactor package surge absorbing device at both ends.
- 220V system input voltage range:  
AC 220V(-15%)~240V(+10%)
- 400V system input voltage range:  
AC 380V(-15%)~440V(+10%)
- When using an external regenerative braking resistor, connect it by the dotted line in the figure.
- Please connect the U, V, W, and output of the drive correctly according to the motor cable phase sequence of the servo motor. The wrong phase sequence will cause the drive to malfunction.
- Be sure to ground the servo drive to avoid electrical damage.
- The 24V power supply for electromagnetic braking needs to be provided by the user and must be isolated from the 12V~24V power supply for the control signal.
- Pay attention to the connection of the freewheeling diode. Reversing the positive and negative poles may damage the driver.

## B/C/D-volume three-phase wiring diagram



- Please make this emergency stop protection circuit.
- Electromagnetic contactor package surge absorbing device at both ends.
- 220V system input voltage range:  
AC 220V(-15%)~240V(+10%)
- 400V system input voltage range:  
AC 380V(-15%)~440V(+10%)
- Please connect the U, V, W, and output of the drive correctly according to the motor cable phase sequence of the servo motor. The wrong phase sequence will cause the drive to malfunction.
- Do not disconnect short wires between B2 and B3 unless using an external regenerative braking resistor.
- When using an external regenerative braking resistor, disconnect the short wiring between B2 and B3 and connect them by the dotted line in the figure.
- Be sure to ground the servo drive to avoid electrical damage.
- The 24V power supply for electromagnetic braking needs to be provided by the user and must be isolated from the 12V~24V power supply for the control signal.
- Pay attention to the connection of the freewheeling diode. Reserving the positive & negative poles may damage the drive.

## E/F-volume three-phase wiring diagram



- Please make this emergency stop protection circuit.
- Electromagnetic contactor package surge absorbing device at both ends.
- 400V system input voltage range:  
AC 380V(-15%)~440V(+10%)
- Please connect the U, V, W, and output of the drive correctly according to the motor cable phase sequence of the servo motor. The wrong phase sequence will cause the drive to malfunction.
- When using external regenerative resistor, connect according to the dotted line in the figure (Pb / +) .
- Be sure to ground the servo drive to avoid electrical damage.
- The 24V power supply for electromagnetic braking needs to be provided by the user and must be isolated from the 12V ~24V power supply for the control signal.
- Pay attention to the connection of the freewheeling diode. Reversing the positive and negative poles may damage the driver.

### 3.1.4 Main Circuit Wiring Requirements

The drive power input cable and motor cable can have strong electromagnetic interference. In order to avoid electromagnetic interference through strong interference cables and control circuits generated by long distance parallel wiring coupling. When wiring the main circuit cable and signal cable distance should be greater than 30cm. In addition, common main circuit cables are input RST line, output UVW line, DC bus and brake cables, signal cables are IO signal line, communication line and encoder line. The cables and trunking must be well connected and properly grounded. Aluminum wireways ensure that the equipment is equipotential, and that filters, drives, and motors should be well lapped to the system (mechanical or device), well protected by spraying in the installed section, and that conductive metals need to be fully contacted.

Terminal allowable wire diameter range and tightening torque table

| Drive model SD700-*R*A-* |       |                        | Wire diameter range | Limit tightening torque |
|--------------------------|-------|------------------------|---------------------|-------------------------|
| SIZE                     | Model | Rated input current(A) | AWG                 | N*m                     |
| <b>Single-phase 220V</b> |       |                        |                     |                         |
| SIZE A                   | 1R1A  | 1.28                   | 12~28               | /                       |
|                          | 1R8A  | 2.1                    | 12~28               | /                       |
|                          | 3R3A  | 3.89                   | 12~28               | /                       |
| <b>Three-phase 220V</b>  |       |                        |                     |                         |
| SIZE B                   | 5R5A  | 3.1                    | 14~22               | 1.176                   |
|                          | 7R6A  | 4.2                    | 14~22               | 1.176                   |
|                          | 9R5A  | 5.2                    | 14~22               | 1.176                   |
| SIZE C                   | 120A  | 10.3                   | 10~22               | 1.96                    |
|                          | 160A  | 13.7                   | 10~22               | 1.96                    |
| <b>Three-phase 380V</b>  |       |                        |                     |                         |
| Size B                   | 2R5D  | 2.8                    | 14~22               | 1.176                   |
|                          | 3R8D  | 4.18                   | 14~22               | 1.176                   |
| SICE C                   | 6R0D  | 8.8                    | 10~22               | 1.96                    |
|                          | 8R4D  | 12.4                   | 10~22               | 1.96                    |
|                          | 110D  | 16.2                   | 10~22               | 1.96                    |
| SIZE D                   | 170D  | 22.4                   | 8~20                | 2.45                    |
|                          | 240D  | 31.6                   | 8~20                | 2.45                    |
|                          | 300D  | 39.5                   | 8~20                | 2.45                    |
| SIZE E                   | 500D  | 46.7                   | 3~18                | 7.84                    |
|                          | 600D  | 56                     | 3~18                | 7.84                    |

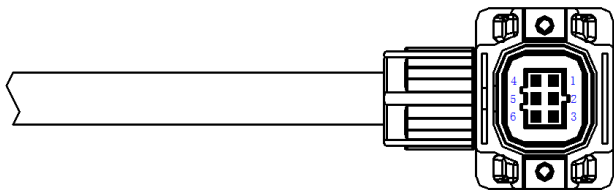
Wiring requirements

This product supports the wiring method in case of low voltage command.

- Terminals (P⊕ , C, N⊖) are for connecting optional parts. Do not connect these terminals to the AC power supply.
- To protect the main circuit, it is covered separately from the surface that may come into contact with it.
- Be careful not to allow other objects to enter the terminal block wiring section.
- Do not solder when using stranded core wires.
- The tightening torque of each terminal may be different, so tighten the screws according to the specified tightening torque. Use a torque driver, torque ratchet or torque wrench.
- If using an electric tool to tighten the terminal screws, use the low speed setting otherwise the terminal screws may be damaged.
- Do not tighten the terminal screws at an angle of more than 5 degrees, otherwise the terminal screws may be damaged.

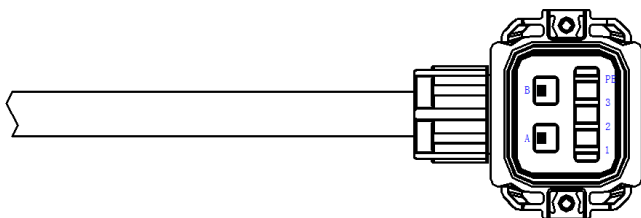
3.2 Motor Power Line Connection

V7E motor 40mm flange power cable definition

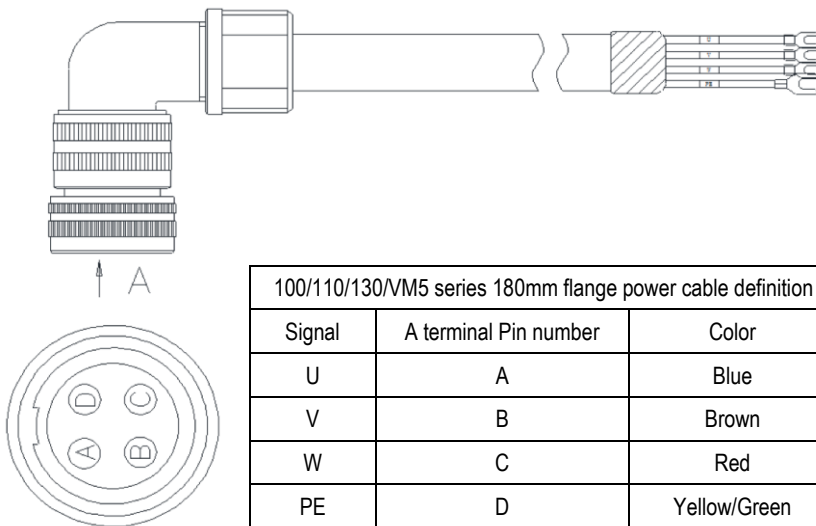


| WIRE RUN LIST |        |              |        |        |        |
|---------------|--------|--------------|--------|--------|--------|
| Specification | CONN.1 | Color        | CONN.2 | CONN.3 | Signal |
| 6*0.3         | U      | Blue         | 1      |        | U      |
|               | V      | Brown        | 2      |        | V      |
|               | W      | Red          | 3      |        | W      |
|               | PE     | Yellow/Green | 4      |        | PE     |
|               |        | White        | 5      | 1      | BAKE+  |
|               |        | Black        | 6      | 2      | BAKE-  |

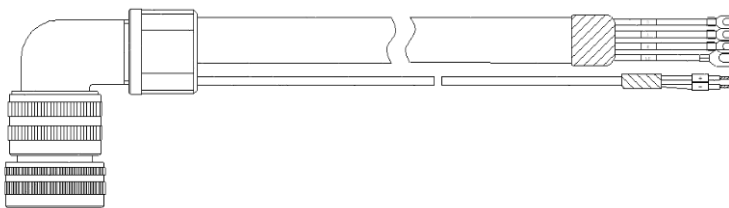
V7E motor 60mm/80mm flange power cable definition



| WIRE RUN LIST |        |              |        |        |        |
|---------------|--------|--------------|--------|--------|--------|
| Specification | CONN.1 | Color        | CONN.2 | CONN.3 | Signal |
| 4*0.5         | U      | Blue         | 3      |        | U      |
|               | V      | Brown        | 2      |        | V      |
|               | W      | Red          | 1      |        | W      |
|               | PE     | Yellow/Green | PE     |        | PE     |
| 2*0.3         |        | White        | A      | 1      | BAKE+  |
|               |        | Black        | B      | 2      | BAKE-  |



| 100/110/130/VM5 series 180mm flange power cable definition |                       |              |
|------------------------------------------------------------|-----------------------|--------------|
| Signal                                                     | A terminal Pin number | Color        |
| U                                                          | A                     | Blue         |
| V                                                          | B                     | Brown        |
| W                                                          | C                     | Red          |
| PE                                                         | D                     | Yellow/Green |



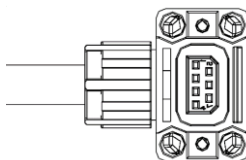
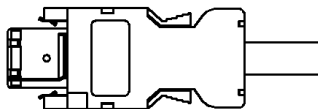
| 180 flange motor power cable definition<br>(D2M + VM7 series D2) motor with brake |                   |            |                 |
|-----------------------------------------------------------------------------------|-------------------|------------|-----------------|
|                                                                                   | Signal definition | Pin number | Wire core color |
|                                                                                   | U                 | D          | Blue            |
|                                                                                   | V                 | E          | Brown           |
|                                                                                   | W                 | F          | Red             |
|                                                                                   | P E               | G          | Yellow-green    |
|                                                                                   | BAKE+             | A          | Red             |
|                                                                                   | BAKE-             | B          | Black           |
| 110 flange + 130 flange motor power cable definition<br>motor with brake          |                   |            |                 |
|                                                                                   | Signal definition | Pin number | Wire core color |
|                                                                                   | U                 | F          | Blue            |
|                                                                                   | V                 | I          | Brown           |
|                                                                                   | W                 | B          | Red             |
|                                                                                   | P E               | E          | Yellow-green    |
|                                                                                   | BAKE+             | G          | Red             |
|                                                                                   | BAKE-             | H          | Black           |

### 3.3 CN2 Encoder Connection

V7E motor 40mm/60mm/80mm flange encoder cable definition

Drive terminal:

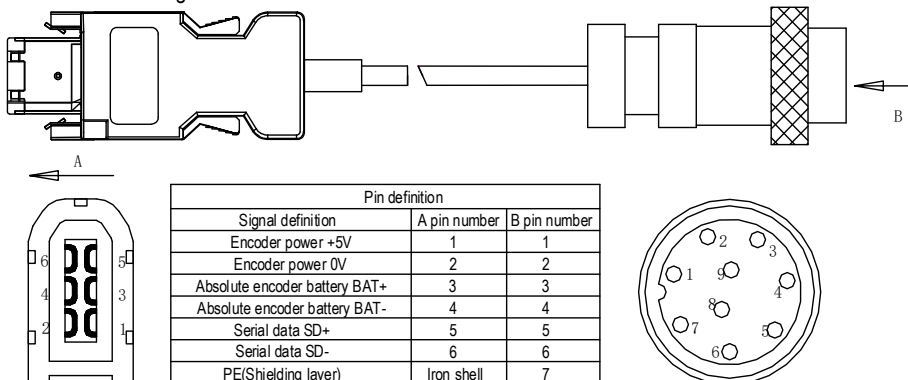
Motor terminal:



### WIRE RUN LIST

| Specification | CONN.1     | CONN.2 |                 | Signal |
|---------------|------------|--------|-----------------|--------|
| 2PX24AWG      | 1          | 1      |                 | +5V    |
|               | 2          | 2      |                 | 0V     |
|               | 5          | 5      |                 | SD+    |
|               | 6          | 6      |                 | SD-    |
|               | Iron shell | 7      | Shielding layer | PE+    |

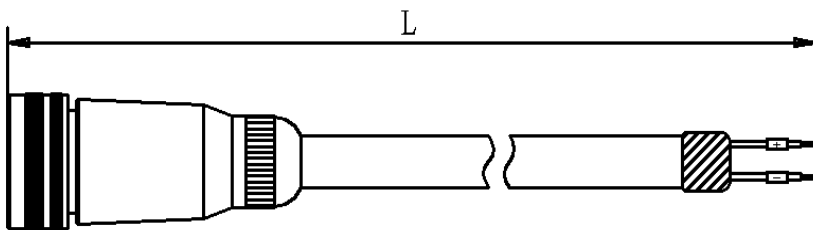
Encoder 110mm flange and above encoder definition



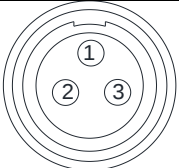
### Note:

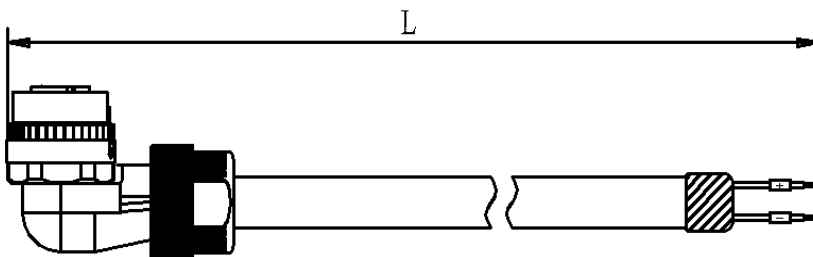
1. When welding the encoder, please pay attention to the definition of A-end and B-end pins (as shown in the table above). The encoder wire uses twisted pair shielded wire, and the shielding layers at both ends of the wire should be grounded.
2. When using the multi-turn absolute encoder, please pay attention to the positive and negative electrodes of the battery. It is recommended to use the lithium battery with rated voltage of 3.6V and rated capacity of 2.7AH.

## 3.4 Holding Brake Line Connection

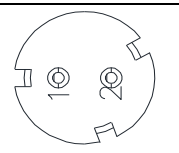


Holding brake line model: VB-\*-D\*

|                                                                                   |                                                                                     |            |                 |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------|-----------------|
|  | VM5 series 180 flange (D2) with holding brake motor's holding brake line definition |            |                 |
|                                                                                   | Signal definition                                                                   | Pin number | Wire core color |
|                                                                                   | BAKE+                                                                               | 1          | Orange          |
|                                                                                   | BAKE-                                                                               | 2          | Grey            |



Holding brake line model: VB-\*-C\*

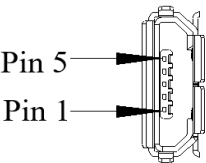
|                                                                                     |                                                                           |            |                 |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------|-----------------|
|  | 180 flange (E2M) with holding brake motor's holding brake line definition |            |                 |
|                                                                                     | Signal definition                                                         | Pin number | Wire core color |
|                                                                                     | BAKE+                                                                     | 1          | Orange          |
|                                                                                     | BAKE-                                                                     | 2          | Grey            |



110 flange, 130 flange and VM7 series 180 flange with brake motors have the holding brake line and the power line together (9 pins), so you only need to select the matching power line when selecting the motor.

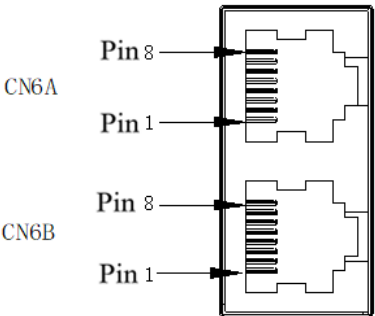
### 3.5 CN7 USD Communication Terminal (Connect to Host Machine)

Note: ordinary Android cable with data transmission function can also be used



| Pin No. | Name | Function                   |
|---------|------|----------------------------|
| 1       | VBUS | External power supply + 5V |
| 2       | D-   | Data-                      |
| 3       | D+   | Data+                      |
| 4       | -    | None                       |
| 5       | GND  | Signal ground              |

### 3.6 Connection of CN6A and CN6B Communication Terminal



According to different models, the definition of the port is different. When using it, you need to confirm the model before defining the interface. For model identification, please refer to “1.6 driver naming”. The field identification bit E is P: pulse type; S: standard type; C: CANopen bus type; N: PROFINET bus type.

| CN6A/CN6B port definition |             |                   |         |             |                   |
|---------------------------|-------------|-------------------|---------|-------------|-------------------|
| Pin No.                   | Signal name | Function          | Pin No. | Signal name | Function          |
| 1                         | CANH        | CAN Data+         | 6       | -           |                   |
| 2                         | CANL        | CAN Data -        | 7       | GND         | 485 Signal ground |
| 3                         | CANG        | CAN Signal ground | 8       | -           | -                 |
| 4                         | 485-        | 485 Data -        | Shell   | Shield      | Shield            |

|   |      |            |  |  |  |
|---|------|------------|--|--|--|
| 5 | 485+ | 485 Data + |  |  |  |
|   |      |            |  |  |  |

The field identification bit E is M:MECHATROLINK-II bus type.

| CN6A/CN6B port definition |             |             |         |             |          |
|---------------------------|-------------|-------------|---------|-------------|----------|
| Pin No.                   | Signal name | Function    | Pin No. | Signal name | Function |
| 1                         | SRD+        | M-II Data + | 6       | -           | -        |
| 2                         | SRD-        | M-II Data - | 7       | -           | -        |
| 3                         | -           | -           | 8       | -           | -        |
| 4                         | -           | -           | Shell   | Shield      | Shield   |
| 5                         | -           | -           |         |             |          |
|                           |             |             |         |             |          |

The field identification bit E is E:EtherCAT bus type;L: MECHATROLINK-III bus type; N: PROFINET bus type.

| CN6A/CN6B port definition |             |                    |         |             |                  |
|---------------------------|-------------|--------------------|---------|-------------|------------------|
| Pin No.                   | Signal name | Function           | Pin No. | Signal name | Function         |
| 1                         | TX+         | Data transmission+ | 6       | RX-         | Data reception - |
| 2                         | TX-         | Data transmission- | 7       | -           | -                |
| 3                         | RX+         | Data reception +   | 8       | -           | -                |
| 4                         | -           | -                  | Shell   | Shield      | Shield           |
| 5                         | -           | -                  |         |             |                  |

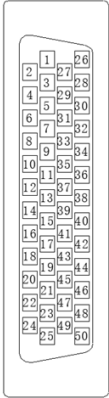
As for using multiple drivers at the same time, the cascade mode is CN6A in and CN6B out. Failure to follow the cascade mode of up in and down out may lead to abnormal communication. Please try to ensure that the length of the cascaded cable is less than 50cm, and the CN6B of the last one should be connected with the terminal resistance (Only CANopen bus/ Mechatrolink-II bus/ RS-485 bus should be considered with terminal resistance).

### 3.7 CN5 Full Closed Loop Port

| 2500 line encoder and full closed loop port (differential input) |             |                             |         |             |          |
|------------------------------------------------------------------|-------------|-----------------------------|---------|-------------|----------|
| Pin No.                                                          | Signal name | Function                    | Pin No. | Signal name | Function |
| 1                                                                | EA-         | Full closed loop signal EA- | 9       | -           | -        |
| 2                                                                | EB-         | Full closed loop signal EB- | 10      | -           | -        |

|   |     |                                |       |        |                            |
|---|-----|--------------------------------|-------|--------|----------------------------|
| 3 | EZ- | Full closed loop<br>signal EZ- | 11    | -      | -                          |
| 4 | -   | -                              | 12    | -      | -                          |
| 5 | -   | -                              | 13    | 0V     | Encoder power<br>supply 0V |
| 6 | EA+ | Full closed loop<br>signal EA+ | 14    |        |                            |
| 7 | EB+ | Full closed loop<br>signal EB+ | 15    | 5V     | Encoder power<br>supply 5V |
| 8 | EZ+ | Full closed loop<br>signal EZ+ | Shell | Shield | -                          |

## 3.8 CN1 Multifunctional Control Terminal Definition



|    |       |                                          |    |                |                                          |    |                |                                              |    |                 |                                           |
|----|-------|------------------------------------------|----|----------------|------------------------------------------|----|----------------|----------------------------------------------|----|-----------------|-------------------------------------------|
| 2  | GND   | Ground                                   | 1  | GND            | Ground                                   | 27 | /SO2+ (COIN+)  | General sequence control output 2            | 26 | /SO1- (S-RDY-)  | General sequence control output 1         |
| 4  | -     | Reserved                                 | 3  | PL1            | OC power output of command pulse         | 29 | /SO3+ (V-CMP+) | General sequence control output 3            | 28 | /SO2- (COIN-)   | General sequence control output 2         |
| 6  | SG    | Signal ground                            | 5  | V- REF         | Speed command input                      | 31 | ALM+           | Servo alarm output                           | 30 | /SO3- (V-CMP-)  | General sequence control output 3         |
| 8  | /PULS | Pulse command input                      | 7  | PULS           | Pulse command input                      | 33 | PAO            | A phase of encoder pulse division output     | 32 | ALM-            | Servo alarm output                        |
| 10 | GND   | Ground                                   | 9  | T- REF         | Torque command input                     | 35 | PBO            | B phase of encoder pulse division output     | 34 | /PAO            | A phase of encoder pulse division output  |
| 12 | /SIGN | Sign command input                       | 11 | SIGN           | Sign command input                       | 37 | -              | Reserved                                     | 36 | /PBO            | B phase of encoder pulse division output  |
| 14 | /CLR  | Clearance input of position deviation    | 13 | PL2            | OC power output of command pulse         | 39 | /SI7           | General sequence control input 7             | 38 | /SI8            | General sequence control input 8          |
| 16 | OCP   | OC power input of command pulse          | 15 | CLR            | Clearance input of position deviation    | 41 | /SI3 (P-CON)   | General sequence control input 3             | 40 | /SI0 (/S-ON)    | General sequence control input 0          |
| 18 | PL3   | OC power output of command pulse         | 17 | OCS            | OC input of pulse direction              | 43 | /SI2 (/N-OT)   | General sequence control input 2             | 42 | /SI1 (/P-OT)    | General sequence control input 1          |
| 20 | /PCO  | C phase of encoder pulse division output | 19 | PCO            | C phase of encoder pulse division output | 45 | /SI5 (/TCL)    | General sequence control input 5             | 44 | /SI4 (/ALM-RTS) | General sequence control input 4          |
| 22 | BAT-  | Battery(-) of absolute encoder           | 21 | BAT+           | Battery(+) of absolute encoder           | 47 | +24VIN         | Power input of sequence control input signal | 46 | /SI6            | General sequence control input 6          |
| 24 | OCS   | OC input of pulse clearance              | 23 | OCZ            | OC output of Z phase pulse division      | 49 | -              | Reserved                                     | 48 | -               | Reserved                                  |
|    |       |                                          | 25 | /SO1+ (S-RDY+) | General sequence control output 1        |    |                |                                              | 50 | TH              | Overheat protection input of linear motor |



### Cautions

When tightening the screw of CN1 terminal, the torque should not be greater than 0.2N. M, otherwise, the screw may slip.

## 3.9 Digital Input Signal

### 3.9.1 Input Signal Descriptions

| Control mode | Signal name  | Pin No.                       | Function number and Description                                                                                                                  |                                                                                                                                               |
|--------------|--------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Common       | /S-ON        | Allocated signal<br>(38 ~ 46) | 0x01                                                                                                                                             | Signal to control servo motor ON/OFF ( power on/power off )                                                                                   |
|              | POT          |                               | 0x02                                                                                                                                             | Positive limit to stop the servo motor drive when the mechanical movement exceeds the movable range (overtravel prevention function)          |
|              | NOT          |                               | 0x03                                                                                                                                             | Negative limit to stop the servo motor drive when the mechanical movement exceeds the movable range (overtravel prevention function)          |
|              | /ALM-RST     |                               | 0x04                                                                                                                                             | Alarm Reset                                                                                                                                   |
|              | /P-CON       |                               | 0x05                                                                                                                                             | P action command, when the signal is ON, the speed control loop switches from PI (proportional, integral) control to P (proportional) control |
|              | /TLC         |                               | 0x06                                                                                                                                             | Torque limit switching, used when the torque limit needs to be changed during operation                                                       |
|              | /SPD-D       |                               | 0x08                                                                                                                                             | Used to change the direction of motor control at internal speed                                                                               |
|              | /SPD-A       |                               | 0x09                                                                                                                                             | When running in internal speed mode, it is used to select the internal speed command of the segment                                           |
|              | /SPD-B       |                               | 0x0A                                                                                                                                             |                                                                                                                                               |
|              | /C-SEL       |                               | 0x0B                                                                                                                                             | Control mode switching, when the control mode is mixed mode, used to switch the control mode                                                  |
|              | /ZCLAMP      |                               | 0x0C                                                                                                                                             | Zero fixed signal, used as zero fixed in speed mode                                                                                           |
|              | /INHIBIT     |                               | 0x0D                                                                                                                                             | Pulse input prohibition, used as disable pulse input count in position mode                                                                   |
|              | /G-SEL       |                               | 0x0E                                                                                                                                             | Gain selection, when the gain is switched manually, it is used to switch the gain                                                             |
|              | /PSEL        |                               | 0x10                                                                                                                                             | Command pulse input rate switching, used to switch pulse input rate signal in position mode                                                   |
|              | +24VIN       | 47                            | Used when the control signal is input by control power<br>Operating voltage range: +11V ~ +25V ( +24V power supply should be provided by users.) |                                                                                                                                               |
|              | SEN          | 4                             | Input signal requiring initial data when using an absolute encoder                                                                               |                                                                                                                                               |
|              | BAT+<br>BAT- | 21<br>22                      | Spare battery connection pin for absolute encoder<br>(Note) Do not connect the encoder cable with the battery unit when using                    |                                                                                                                                               |
| Speed        | V-REF        | 5 ( 6 )                       | Input speed command. Max. input voltage: $\pm 10V$                                                                                               |                                                                                                                                               |
| Position     | PULS         | 7                             | Set any of the following input pulse patterns<br>Symbol + pulse sequence<br>CW+CCW pulse sequence<br>90° phase difference 2-phase pulse          |                                                                                                                                               |
|              | /PULS        | 8                             |                                                                                                                                                  |                                                                                                                                               |
|              | SIGN         | 11                            |                                                                                                                                                  |                                                                                                                                               |
|              | /SIGN        | 12                            |                                                                                                                                                  |                                                                                                                                               |
|              | CLR<br>/CLR  | 15<br>14                      | Clear position deviation during position control                                                                                                 |                                                                                                                                               |
| Torque       | T-REF        | 9 ( 10 )                      | Input torque command, input voltage range: $\pm 10V$                                                                                             |                                                                                                                                               |

### 3.9.2 Input Signal Configuration

1. The digital input signal distribution mode is internally fixed (Pn600=0). The function servo unit of each input signal is internally fixed and cannot be changed. When selecting different control modes, the functions of the pins are different as shown in the following table:

| Control mode<br>(Pn000)                                            | NO. of CN1 pins    |                    |                    |                                                      |                      |                                              |                                              |         |
|--------------------------------------------------------------------|--------------------|--------------------|--------------------|------------------------------------------------------|----------------------|----------------------------------------------|----------------------------------------------|---------|
|                                                                    | 40                 | 42                 | 43                 | 41                                                   | 44                   | 45                                           | 46                                           | 38/39   |
| 0- Position control                                                | /S-ON servo enable | P-OT forward limit | N-OT reverse limit | /P-CON<br>proportional control                       | /ALM-RST alarm clear | /TLC<br>torque limit switching               | Reserved                                     | Invalid |
| 1- Analog speed                                                    |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 2- Torque control                                                  |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 3- Internal speed                                                  |                    |                    |                    | /SPD-D<br>internal speed command direction selection |                      | /SPD-A<br>internal speed command selection A | /SPD-B<br>internal speed command selection B |         |
| 4- Internal speed <-> analog speed                                 |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 5- Internal speed <-> position                                     |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 6- Internal speed <-> torque                                       |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 7- Position <-> analog speed                                       |                    |                    |                    | /C-SEL<br>control mode switching                     |                      | /TLC torque limit switching                  | Reserved                                     |         |
| 8- Position <-> torque                                             |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 9- Torque <-> analog speed                                         |                    |                    |                    |                                                      |                      |                                              |                                              |         |
| 10- Speed <-> speed control with zero fixed function               |                    |                    |                    | /ZCLAMP<br>zero Position fixed                       |                      |                                              |                                              |         |
| 11- Speed <-> position control with command pulse inhibit function |                    |                    |                    |                                                      |                      |                                              |                                              |         |

2. The switching input signal distribution mode is the parameter configuration (Pn600=1 default parameter). The function of each input signal is configured by the user and is set by parameters Pn601 ~ Pn609.

a) Default setting

| Function code | NO. of CN1 pins | Default function             |
|---------------|-----------------|------------------------------|
| Pn601         | 40              | 0x01: Servo enable           |
| Pn602         | 42              | 0x02: Forward prohibition    |
| Pn603         | 43              | 0x03: Reverse prohibition    |
| Pn604         | 41              | 0x05: Manual PI-P control    |
| Pn605         | 44              | 0x04: Alarm reset            |
| Pn606         | 45              | 0x06: Torque limit switching |
| Pn607         | 46              | 0x07: Reserved               |
| Pn608         | 39              | 0x00: Invalid                |
| Pn609         | 38              |                              |

b) Reverse

The drive provides reverse input signal switching function in order to facilitate wiring:

1. Take the servo enable (/S-ON) as an example, the default setting is Pn601=0x01. When the signal is ON, the servo is enabled. When the setting is Pn601=0x101, the servo is disabled when the signal is ON.
2. Take the forward limit (POT) as an example, the default setting is Pn602=0x02. When the signal is OFF, the servo forward limit is set. If the setting is Pn602=0x102, the servo forward stroke limit is released when the signal is OFF.



1. Signal ON: The state when the switch input signal (/S - ON, etc.) is connected to the "ground terminal" of the external +24VIN power supply.
2. Signal OFF: The state when the switch input signal (/S - ON, etc.) is disconnected from the "ground terminal" of the external +24VIN power supply.
3. The positive travel limit (POT)/negative travel limit (NOT) of the switch input signal is a valid signal for OFF, and the other input signals are valid signals for ON, so pay attention to the distinction in use.

c) Always Valid

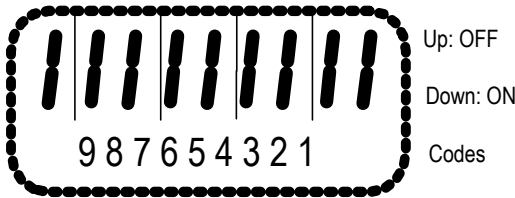
Through the setting of parameters Pn610, Pn611 and Pn612, the configured input signal can always be valid. For example, when Pn610=0x01 (servo enable), the servo is always in the enabled ON state after power-on, and the external enable signal (/S-ON) does not take effect.



If the same function is configured on different pin numbers, Er.040 (parameter setting abnormality alarm) will be reported, and the related alarm and handling methods are detailed in "Fault Code and Countermeasures".

### 3.9.3 Confirming the Input Status

The status of the input signal can be checked by input signal monitoring (Un100). The Un100 segment display and corresponding Pin No.s are as follows:



| Display LED | Pin No | Signal Name |
|-------------|--------|-------------|
| 1           | CN1-40 | /S-ON       |
| 2           | CN1-41 | /P-CON      |
| 3           | CN1-42 | P-OT        |
| 4           | CN1-43 | N-OT        |
| 5           | CN1-44 | /ALM-RST    |
| 6           | CN1-45 | /TLC        |
| 7           | CN1-46 | Reserved    |
| 8           | CN1-39 | Invalid     |
| 9           | CN1-38 | Invalid     |

The upper SEG (LED) lights up when the input signal is OFF.

The lower SEG (LED) lights up when the input signal is ON.

The value (address: 0XE100) read over the communication is hexadecimal, for example, the read value is 0x1FE. Under the default input configuration, it means that the input of /S-ON (CN1-40) is ON, that is, servo enable, and the input of other input pins is OFF.

## 3.10 Digital Output Signal

### 3.10.1 Output Signal Descriptions

| Control Mode | Signal Name | Pin No.                                                        | Descriptions |                                                                             |
|--------------|-------------|----------------------------------------------------------------|--------------|-----------------------------------------------------------------------------|
| Common       | /TGON       | Allocated signals<br>25(+) 26(-)<br>27(+) 28(-)<br>29(+) 30(-) | 0x03         | ON (closed) when the speed of the servo motor is higher than the set value. |
|              | /S-RDY      |                                                                | 0x00         | ON (closed) when servo ON (/S-ON) signal is acceptable.                     |
|              | /CLT        |                                                                | 0x04         | Torque limit ON (closed) when the motor output torque is limited.           |

|          |                   |               |                                                                         |                                                                                                                                                                                                              |
|----------|-------------------|---------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | /VLT              |               | 0x05                                                                    | In the speed limit, the motor speed is ON after closing the speed limit (closed).                                                                                                                            |
|          | /BK               |               | 0x06                                                                    | Brake interlocking, the output of the motor is ON during operation. Refer to "Retaining the brake" for timing details.                                                                                       |
|          | /WARN             |               | 0x07                                                                    | Warning output.                                                                                                                                                                                              |
| Speed    | /V-CMP            |               | 0x02                                                                    | Consistent speed output ON when the speed of the servo motor is the same as the command speed (closed).                                                                                                      |
| Position | /COIN             |               | 0x01                                                                    | Positioning completed output ON (closed) when the difference between the command pulse number and the servomotor movement amount (position deviation) is lower than the position reach range.                |
|          | /PSELA            |               | 0x09                                                                    | Command pulse override switching can be switched to operate with the value of the input command pulse n times (Pn203).                                                                                       |
|          | /NEAR             |               | 0x08                                                                    | Positioning close, output ON (closed) when the difference between the positioning command pulse number and the servo motor movement amount (position deviation) is lower than the position proximity signal. |
|          | PL1<br>PL2<br>PL3 | 3<br>13<br>18 | Position pulse is power supply for open collector command.              |                                                                                                                                                                                                              |
|          |                   |               |                                                                         |                                                                                                                                                                                                              |
| Common   | ALM+<br>ALM-      | 31(+) 32(-)   | OFF (disconnected) at alarm (Output logic can be changed by parameter). |                                                                                                                                                                                                              |
|          | PAO<br>/PAO       | 33<br>34      | Frequency division output A phase signal.                               |                                                                                                                                                                                                              |
|          | PBO<br>/PBO       | 35<br>36      | Frequency division output B phase signal.                               |                                                                                                                                                                                                              |
|          | PCO<br>/PCO       | 19<br>20      | Frequency division output C phase signal.                               |                                                                                                                                                                                                              |

### 3.10.2 Output Signal Configuration

#### a) Default

The function of each output signal is configured by the user and is set by parameters Pn613 ~ Pn615. The default functions are as follows:

| Function code | CN1 Pin No. | Default function            |
|---------------|-------------|-----------------------------|
| Pn613         | 25/26       | 0x00: Servo ready           |
| Pn614         | 27/28       | 0x01: Positioning completed |
| Pn615         | 29/30       | 0x02: Consistent speed      |

#### b) Negation

1. Common switch output signal inversion function, take the servo ready signal (/S-RDY) as an example, default setting Pn613=0x00, servo ready and then the output signal is ON; change the setting Pn613=0x100, the servo is ready, then the output signal is OFF.

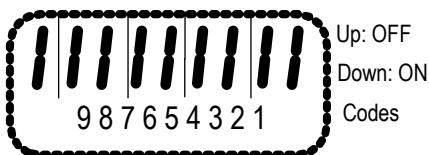
2. The alarm output signal (ALM) is the output of the fixed Pin No. The default setting is Pn622.1=0. If the servo alarm occurs, the output signal will be OFF. If the change is set to Pn622.1=1, the servo alarm will output the signal ON.



1. Pn622.1 indicates the first bit of parameter Pn622, see the explanation of function code parameter.
2. No output signal is "invalid" state. Eg: Speed control, positioning completion (/COIN) signal is "invalid".
3. If the polarity of the brake signal (/BK) is reversed and used with positive logic, the brake will not operate when the signal line is disconnected. When this setting has to be used, be sure to check the operation to ensure that there are no safety problems.
4. When multiple signals are assigned to the same output circuit, they will be output in heterogeneous logic.

### 3.10.3 Confirming the Output Status

The status of the output signal can be confirmed by the output signal monitor (Un101). The Un101 segment display and corresponding Pin No.s are as follows:



| Display LED | Pin No.   | Signal Name |
|-------------|-----------|-------------|
| 1           | CN1-31、32 | ALM         |

|   |           |        |
|---|-----------|--------|
| 2 | CN1-25、26 | /S-RDY |
| 3 | CN1-27、28 | /COIN  |
| 4 | CN1-29、30 | /V-CMP |

The upper SEG (LED) lights up when the output signal is OFF.

The lower SEG (LED) lights up when the output signal is ON.

The value read through communication is hexadecimal, for example: the read value is 0X8, and the default output configuration means that ALM (CN1-31, 32) output is ON, that is, no alarm output. /S-RDY (CN1-25, 26) output is OFF, that is servo ready. /COIN (CN1-27, 28) output is OFF, that is positioning is completed. /V-CMP (CN1-29 / 30) output is ON, and the speed is not consistent.

## 3.11 Connection with the Upper Device

### 3.11.1 Analog Input Circuit

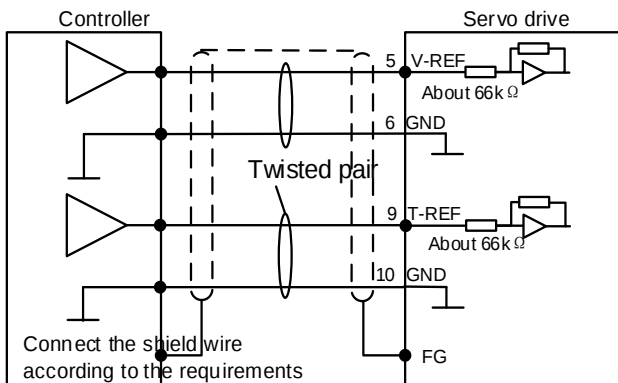
The following describes the 5-6 (speed command input) and 9-10 (torque command input) terminals of the CN1 connector.

Analog signals are speed commands or torque command signals. The input impedance is as follows.

Speed command input: about 66k $\Omega$ .

Torque command input: about 66k $\Omega$ .

The maximum allowable input signal voltage is  $\pm 10V$ .



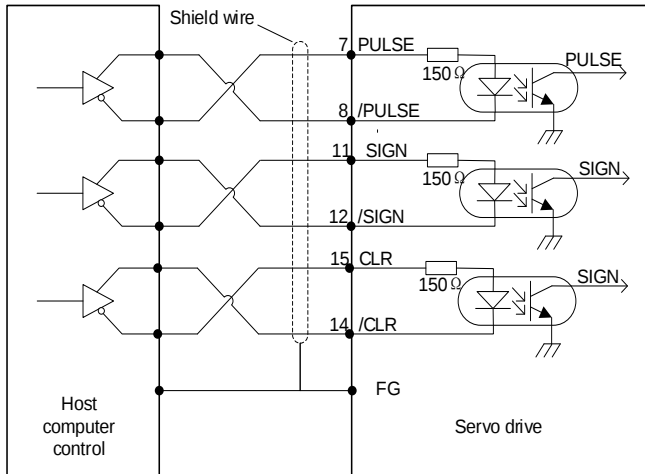
The above wiring is an example of wiring during forward rotation.

### 3.11.2 Position Instruction Input Circuit

The following describes the 7-8 (command pulse input), 11-12 (command symbol input), and 14-15 (clear input) terminals of the CN1 connector. The output circuit of the command pulse and position deviation clear signal from the host device may be one of the linear driver output and the open

collector output.

### Connection example of linear drive output

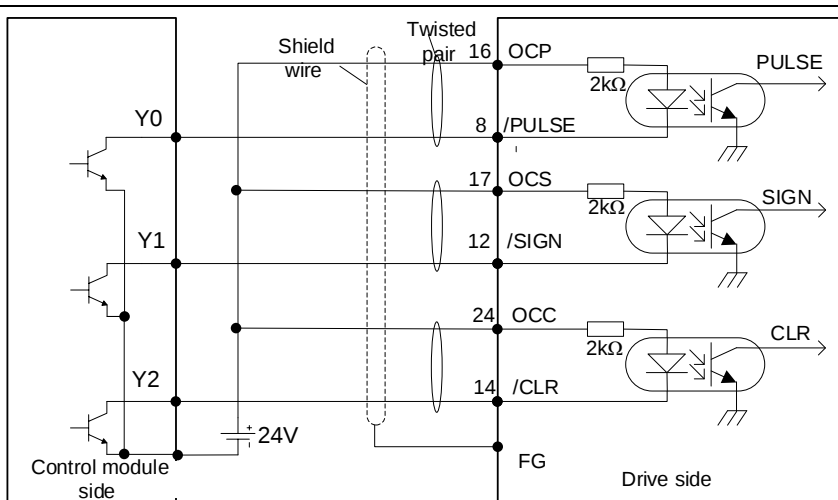


The differential pulse input signal voltage is  $\pm 3.3\text{V}$  and the maximum frequency is 4MHz. This signal transmission method has the best anti-noise capability. It is recommended to use this connection preferentially.

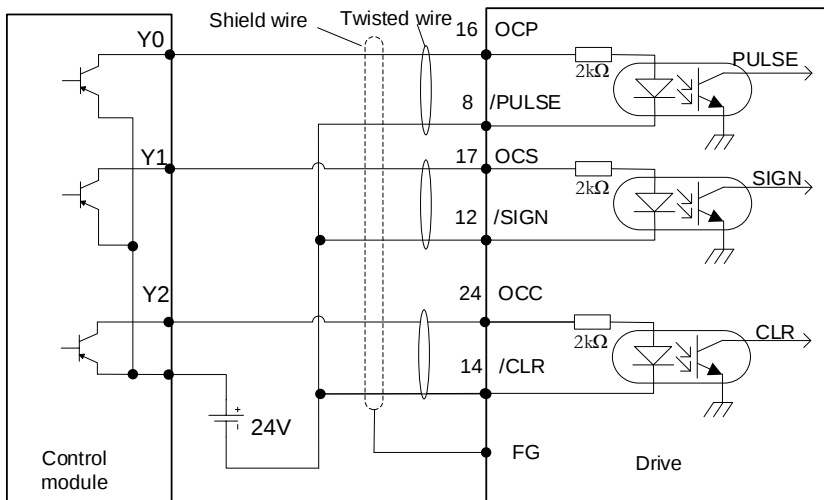
### Connection example of open collector output

#### External 24V power supply:

1. Control module is NPN type (common cathode):



2. Control modules is PNP type (common anode):

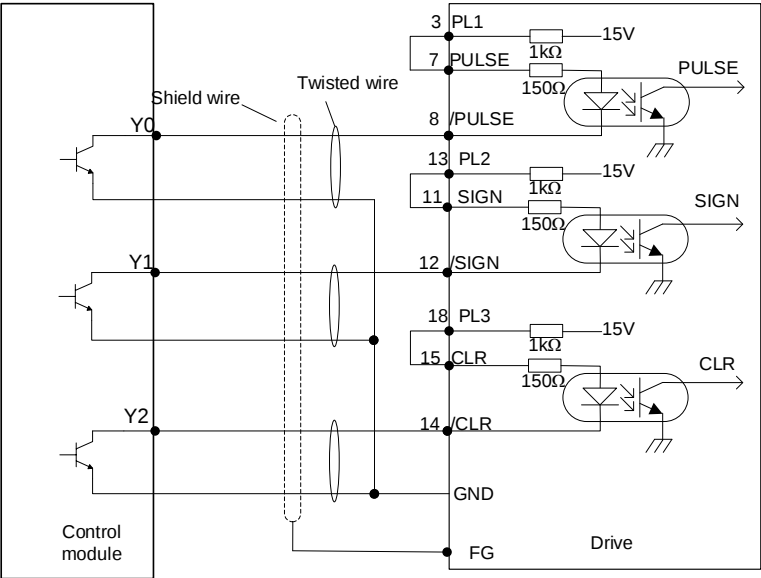


### ! Cautions

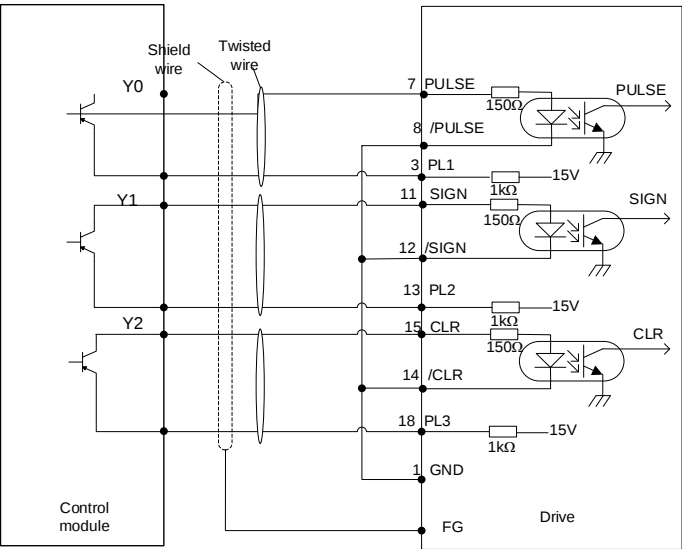
If the linear drive input port is used to receive the external 24 V collector open circuit input signal, connect a 2k resistor in series to limit the current in the circuit, otherwise, the linear drive input port will be damaged.

**Internal 15V power supply:**

1 Control module is NPN type (common cathode):

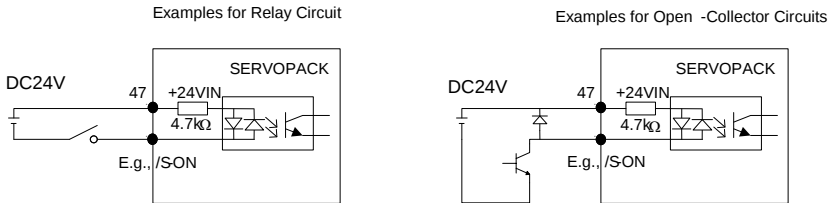


2 Control modules is PNP type (common anode):



### 3.11.3 Sequence Control Input Circuit

The following describes the 38 to 46 terminals of the CN1 port. Connect via a relay or open collector transistor circuit. When using a relay connection, select the relay for the minute current. If you do not use a minute current relay, it will cause poor contact.



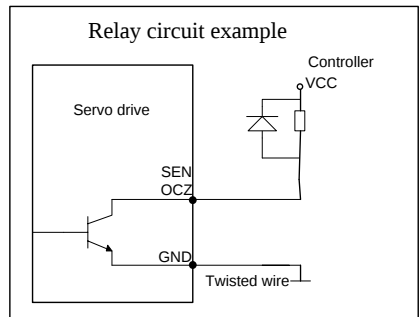
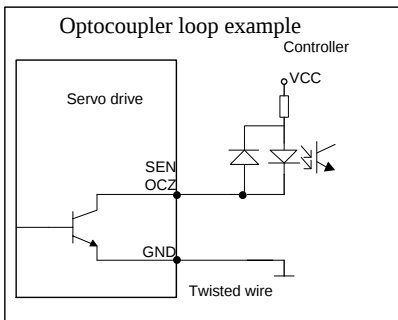
**Note:** The external power supply (DC24V) must have a capacity of 50 mA or more. The input loop of the servo unit uses a bidirectional optocoupler. Please select the sink circuit connection or the source circuit connection according to the specifications of the machine.

### 3.11.4 Sequence Output Loop

Servo unit signal output circuit is the following three kinds:

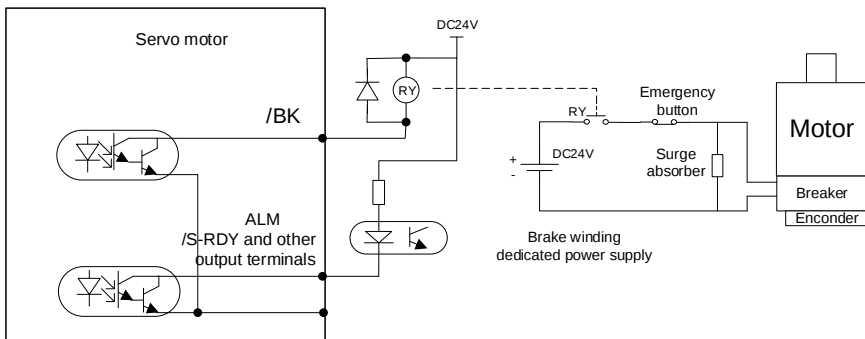
#### 1. Open collector output circuit

The output signal (SEN, OCZ) is an open collector transistor output circuit. Please receive through optocoupler circuit, relay circuit or linear receiver circuit.



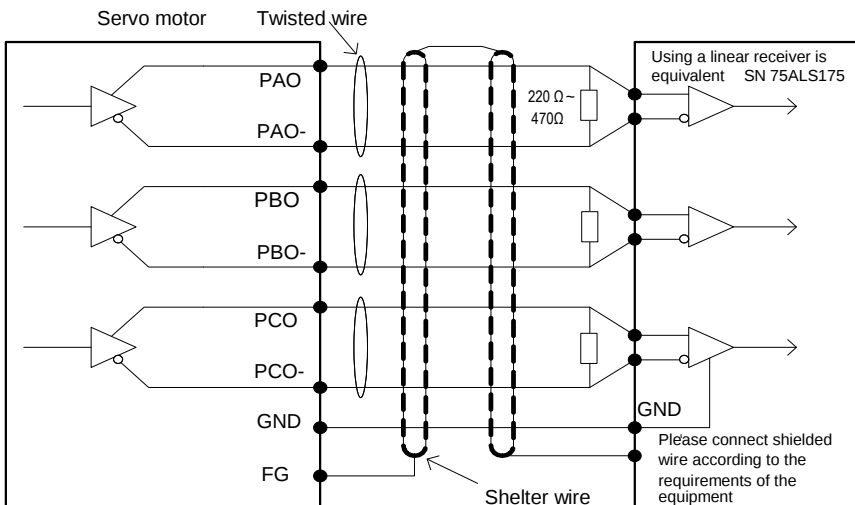
#### 2. Optocoupler output circuit

The brake linkage (/BK), servo alarm (ALM), servo ready (/S-RDY) and other sequence output signals belong to the optocoupler output circuit. Connect via relay or line receiver circuit.

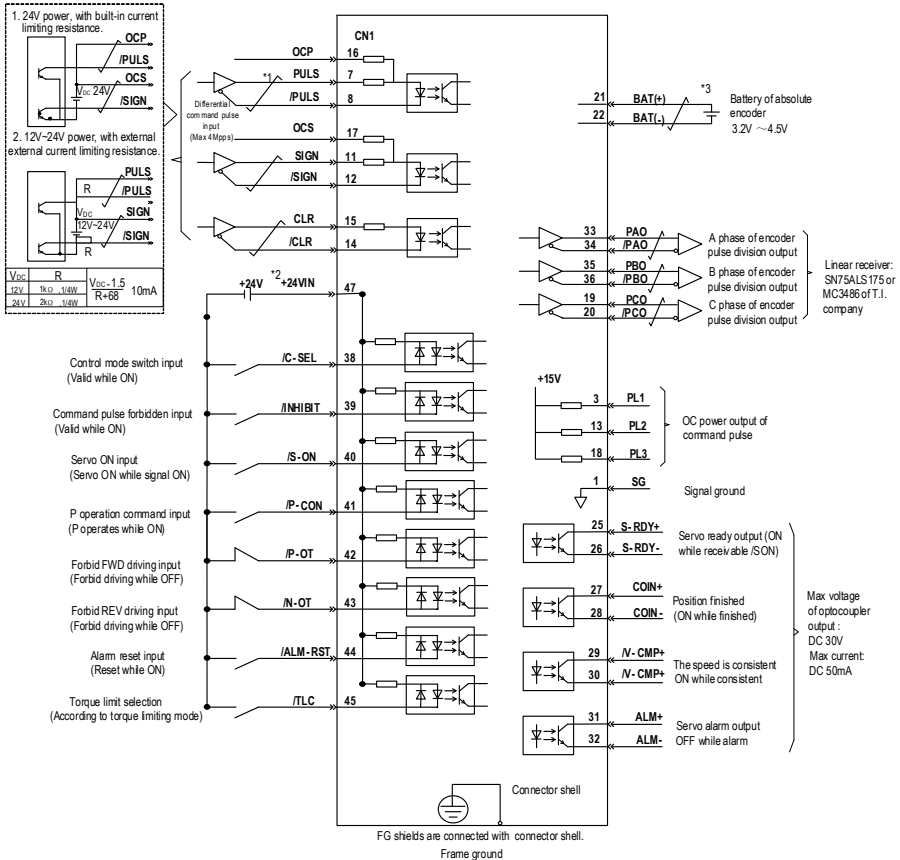


### 3. Linear drive output circuit

The following describes the 33-34 (phase A signal), 35-36 (phase B signal), and 19-20 (phase C signal) terminals of the CN1 port. The output signal (PAO, /PAO, PBO, /PBO) and the origin pulse signal (PCO, /PCO) of the encoder's serial data are converted into two-phase (A-phase, B-phase) pulses and output through the line driver output circuit. On the upper device side, please use a linear receiver circuit.



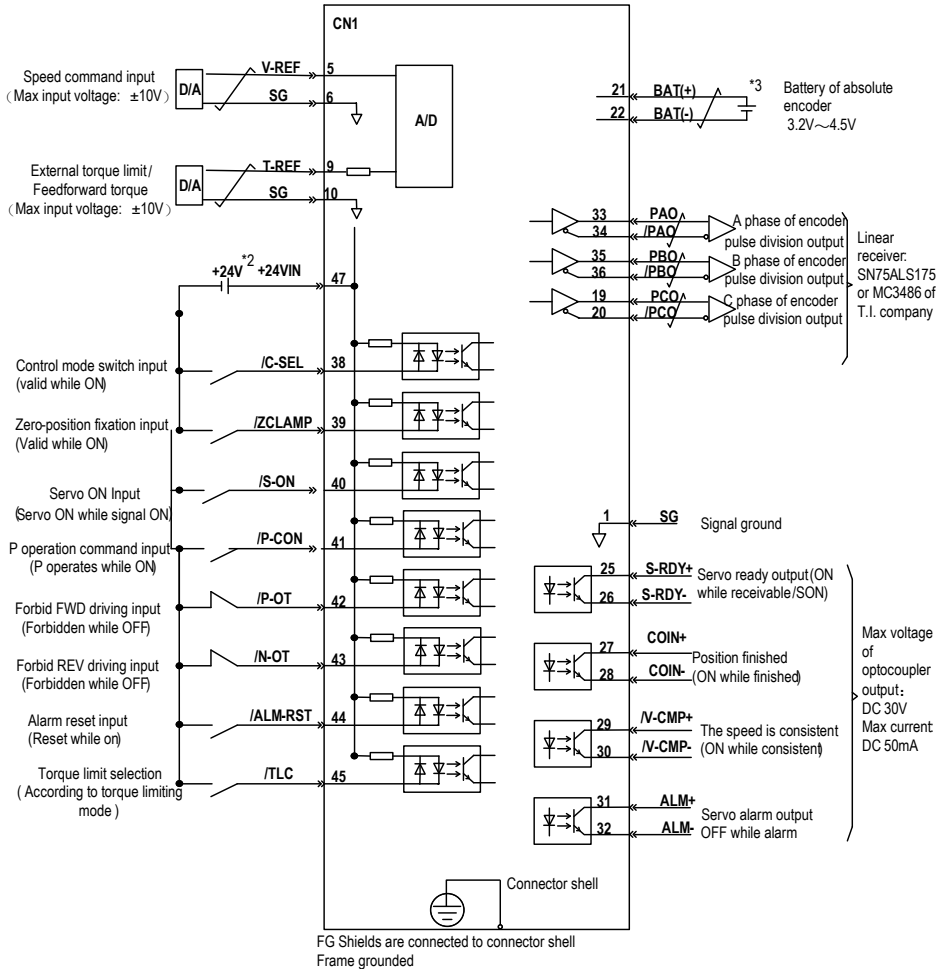
## 3.12 Position Control Wiring Diagram



### ! Cautions

If the input voltage of the linear drive input port is greater than 12V, please connect the appropriate current limiting resistor in series in the circuit, otherwise, the linear drive input port may be damaged.

### 3.13 Speed Control Wiring Diagram



\*1.  $\nabla$  is the twisted shields.

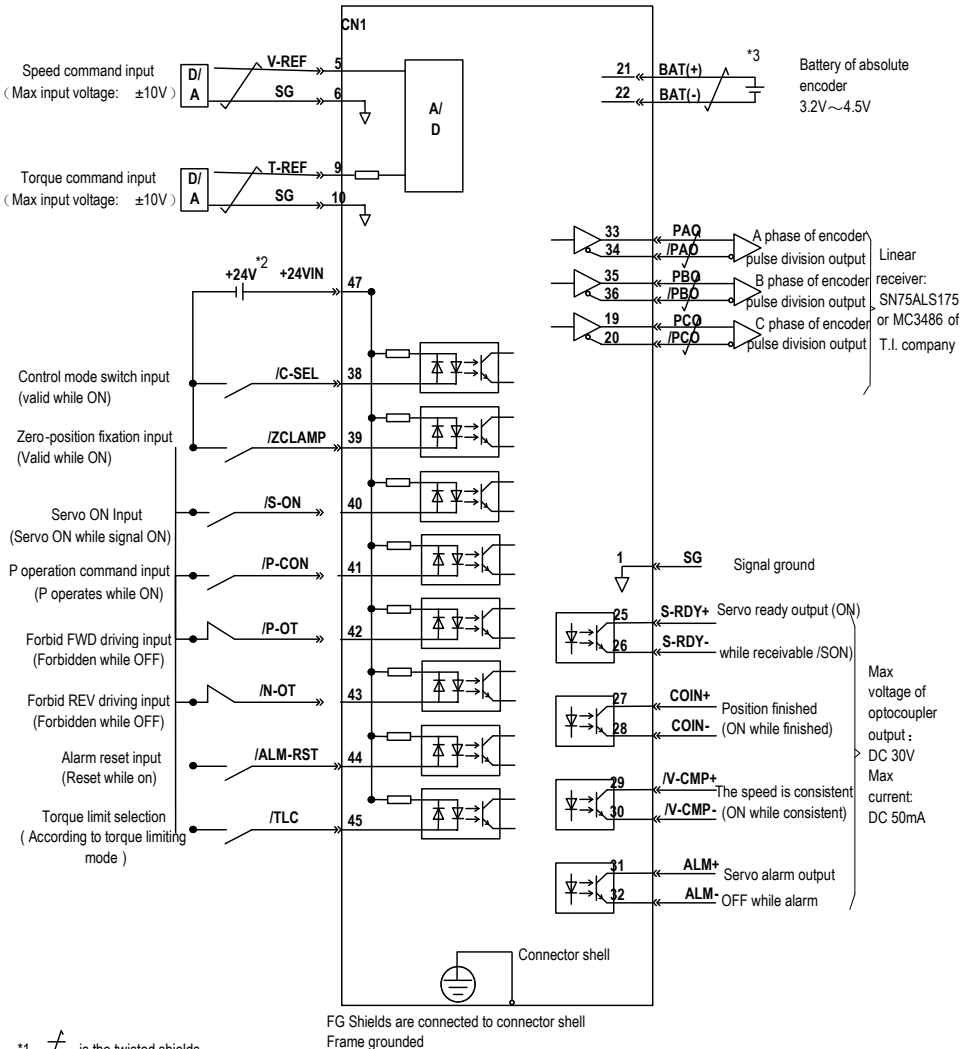
\*2. DC24V power should be prepared by user And double insulation or reinforced insulation equipment should be used for DC24V power .

\*3. Connected while using absolute encoder. But never connect backup battery while using encoder cables with battery unit.

\*4. Output signal should be received by linear receiver.

Note: while using 24V braker,DC24V power should be separated from the power for input and output signal(CN1). Please prepare other power individually otherwise, there may be misoperation of input and output signal while power on.

## 3.14 Torque Control Wiring Diagram



\*1.  $\text{---}\diagup\diagdown\text{---}$  is the twisted shields.

\*2. DC24V power should be prepared by user. And double insulation or reinforced insulation equipments should be used for DC24V power.

\*3. Connected while using absolute encoder. But never connect backup battery while using encoder cables with battery unit.

\*4. Output signal should be received by linear receiver.

Note: While using 24V braker, DC24V power should be separated from the power for input and output signal (CN1). Please prepare other power individually, otherwise, there may be misoperation of input and output signal while power on.

## 3.15 Regenerative Resistor Connection

When the regenerative energy processing capacity is insufficient, connect an external regenerative resistor as required to set the regenerative resistor capacity (Pn012) and the regenerative resistor value (Pn013).

### 3.15.1 Connection of Regenerative Resistors

The driver models 1R1A,1R7A,3R3A,500D,600D have no built-in regenerative resistor. When a regenerative resistor is externally connected, the resistor is connected to the B1/+ and B2 terminals. Refer to "A single-phase wiring diagram". Or it is connected to the + and PB terminals. Refer to "E/F single-phase wiring diagram".

In addition to 1R1A, 1R7A,3R3A,500D,600D the driver model has a built-in regenerative resistor. When the internal regenerative resistor does not meet the requirements, a regenerative resistor can be connected to remove the short wiring between the B2-B3 terminals and connect the external regenerative resistor to the driver. For B1/+, B2 terminals, refer to "B/C/D/E/F volume three-phase wiring diagram".

### 3.15.2 Selection of Regenerative Resistor

| Mode       | Braking Voltage(V) | Internal resistor | Min. value of external resistor( $\Omega$ ) | Max. value of external resistor( $\Omega$ ) |
|------------|--------------------|-------------------|---------------------------------------------|---------------------------------------------|
| SD700-1R1A | 380                | /                 | 40                                          | 400                                         |
| SD700-1R7A |                    | /                 | 40                                          | 200                                         |
| SD700-3R3A |                    | /                 | 40                                          | 100                                         |
| SD700-5R5A |                    | 40 $\Omega$ 60W   | 25                                          | 70                                          |
| SD700-7R6A |                    | 40 $\Omega$ 60W   | 15                                          | 50                                          |
| SD700-9R5A |                    | 40 $\Omega$ 60W   | 15                                          | 40                                          |
| SD700-120A |                    | 30 $\Omega$ 200W  | 10                                          | 30                                          |
| SD700-160A |                    | 30 $\Omega$ 200W  | 10                                          | 30                                          |
| SD700-2R5D | 700                | 80 $\Omega$ 60W   | 80                                          | 225                                         |
| SD700-3R8D |                    | 80 $\Omega$ 60W   | 55                                          | 180                                         |
| SD700-6R0D |                    | 40 $\Omega$ 60W   | 35                                          | 110                                         |
| SD700-8R4D |                    | 40 $\Omega$ 60W   | 25                                          | 85                                          |
| SD700-110D |                    | 40 $\Omega$ 60W   | 25                                          | 70                                          |
| SD700-170D |                    | 30 $\Omega$ 100W  | 30                                          | 50                                          |
| SD700-240D |                    | 30 $\Omega$ 200W  | 15                                          | 40                                          |

|            |  |          |    |    |
|------------|--|----------|----|----|
| SD700-300D |  | 30Ω 200W | 15 | 30 |
| SD700-500D |  | /        | 10 | 20 |
| SD700-600D |  | /        | 10 | 20 |

**Note:** When external braking resistor is needed, please select the resistance value of the braking resistor according to the above table. Select the braking resistor's power according to the braking frequency of the field conditions and the cooling conditions of the braking resistor, you could consult factory if you have any problem.

### 3.16 Fuse

To prevent accidents due to short circuits, be sure to connect a fuse or circuit breaker on the input side.

| Servo drive           |                        | Recommended fuse |                   |           |
|-----------------------|------------------------|------------------|-------------------|-----------|
| Drive model           | Rated input current(A) | Manufacturer     | Rated current (A) | Model No. |
| Single-phase 200-240V |                        |                  |                   |           |
| SD700-1R1A            | 1.28                   | SinoFuse         | 15                | RS309-MF  |
| SD700-1R8A            | 2.1                    | SinoFuse         | 15                | RS309-MF  |
| SD700-3R3A            | 3.89                   | SinoFuse         | 20                | RS309-MF  |
| Three-phase 200-240V  |                        |                  |                   |           |
| SD700-5R5A            | 3.1                    | SinoFuse         | 20                | RS309-MF  |
| SD700-7R6A            | 4.2                    | SinoFuse         | 25                | RS309-MF  |
| SD700-9R5A            | 5.2                    | SinoFuse         | 30                | RS309-MF  |
| SD700-120A            | 10.3                   | SinoFuse         | 35                | RS309-MF  |
| SD700-160A            | 13.7                   | SinoFuse         | 40                | RS309-MF  |
| Three-phase 380-440V  |                        |                  |                   |           |
| SD700-2R5D            | 2.8                    | SinoFuse         | 15                | RS309-MF  |
| SD700-3R8D            | 4.18                   | SinoFuse         | 15                | RS309-MF  |
| SD700-6R0D            | 8.8                    | SinoFuse         | 20                | RS309-MF  |
| SD700-8R4D            | 12.4                   | SinoFuse         | 20                | RS309-MF  |
| SD700-110D            | 16.2                   | SinoFuse         | 35                | RS309-MF  |
| SD700-170D            | 22.4                   | SinoFuse         | 50                | RS309-MF  |
| SD700-240D            | 31.6                   | SinoFuse         | 70                | RS309-MF  |
| SD700-300D            | 39.5                   | SinoFuse         | 90                | RS309-MF  |
| SD700-500D            | 46.7                   | SinoFuse         | 125               | RS309-MF  |
| SD700-600D            | 56                     | SinoFuse         | 125               | RS309-MF  |

**Note:** There is no restriction on the fuse manufacturer, and the fuse protection characteristics can be consistent with the recommended fuses in the above table.

### 3.17 Circuit Breaker

| Servo drive       |                        | Recommended circuit breaker |                   |             |
|-------------------|------------------------|-----------------------------|-------------------|-------------|
| Drive model       | Rated input current(A) | Manufacturer                | Rated current (A) | Model No.   |
| Single-phase 230V |                        |                             |                   |             |
| SD700-1R1A        | 1.28                   | Schneider Electric          | 6                 | OSMC32N2C6  |
| SD700-1R8A        | 2.1                    | Schneider Electric          | 6                 | OSMC32N2C6  |
| SD700-3R3A        | 3.89                   | Schneider Electric          | 6                 | OSMC32N2C6  |
| Three-phase 230V  |                        |                             |                   |             |
| SD700-5R5A        | 3.1                    | Schneider Electric          | 6                 | OSMC32N3C6  |
| SD700-7R6A        | 4.2                    | Schneider Electric          | 16                | OSMC32N3C16 |
| SD700-9R5A        | 5.2                    | Schneider Electric          | 16                | OSMC32N3C16 |
| SD700-120A        | 10.3                   | Schneider Electric          | 16                | OSMC32N3C16 |
| SD700-160A        | 13.7                   | Schneider Electric          | 20                | OSMC32N3C20 |
| Three-phase 400V  |                        |                             |                   |             |
| SD700-2R5D        | 2.8                    | Schneider Electric          | 4                 | OSMC32N3C4  |
| SD700-3R8D        | 4.18                   | Schneider Electric          | 6                 | OSMC32N3C6  |
| SD700-6R0D        | 8.8                    | Schneider Electric          | 6                 | OSMC32N3C6  |
| SD700-8R4D        | 12.4                   | Schneider Electric          | 16                | OSMC32N3C16 |
| SD700-110D        | 16.2                   | Schneider Electric          | 16                | OSMC32N3C16 |
| SD700-170D        | 22.4                   | Schneider Electric          | 16                | OSMC32N3C20 |
| SD700-240D        | 31.6                   | Schneider Electric          | 25                | OSMC32N3C25 |
| SD700-300D        | 39.5                   | Schneider Electric          | 32                | OSMC32N3C32 |
| SD700-500D        | 46.7                   | Schneider Electric          | 50                | OSMC32N3C50 |
| SD700-600D        | 56                     | Schneider Electric          | 63                | OSMC32N3C63 |

If residual current operated protective device (RCD) is to be used for the equipment, please select the type according to the following conditions:

- The drive equipment can generate DC leakage current in the protective conductor. Please be sure to use type B residual current operated protective device (RCD).
- When the drive is running, it will generate certain high-frequency leakage current. In order to avoid RCD misoperation, please select RCD with an operating current of not less than 100mA for each drive.
- When multiple drives are connected in parallel to share one RCD, select an RCD with an action current of not less than 300mA.
- We recommend to use RCD of Chint（正泰）, Schneider（施耐德） or other brands.

## 3.18 EMC Filter

### Selection of models

In order to make this product meet the radiation and conductive emission requirements of EN IEC 61800-3 standard, the EMC filter listed in the following table needs to be connected externally. The EMC filters available for customers are the FN2090 and FN3258 series of Schaffner Company. Please select from the following table according to the rated input current of the product:

| Servo drive       |             |                        | Recommended filter |              |
|-------------------|-------------|------------------------|--------------------|--------------|
| SIZE              | Drive model | Rated input current(A) | Manufacturer       | Model No.    |
| Single-phase 230V |             |                        |                    |              |
| SD700-1R1A        | SD700-1R1A  | 1.28                   | Schaffner          | FN2090-3-06  |
| SD700-1R8A        | SD700-1R8A  | 2.1                    | Schaffner          | FN2090-3-06  |
| SD700-3R3A        | SD700-3R3A  | 3.89                   | Schaffner          | FN2090-4-06  |
| Three-phase 230V  |             |                        |                    |              |
| SD700-5R5A        | SD700-5R5A  | 3.1                    | Schaffner          | FN3258-7-44  |
| SD700-7R6A        | SD700-7R6A  | 4.2                    | Schaffner          | FN3258-7-44  |
| SD700-9R5A        | SD700-9R5A  | 5.2                    | Schaffner          | FN3258-7-44  |
| SD700-120A        | SD700-120A  | 10.3                   | Schaffner          | FN3258-16-44 |
| SD700-160A        | SD700-160A  | 13.7                   | Schaffner          | FN3258-16-44 |
| Three-phase 400V  |             |                        |                    |              |
| SD700-2R5D        | SD700-2R5D  | 2.8                    | Schaffner          | FN3258-7-44  |
| SD700-3R8D        | SD700-3R8D  | 4.18                   | Schaffner          | FN3258-7-44  |
| SD700-6R0D        | SD700-6R0D  | 8.8                    | Schaffner          | FN3258-16-44 |
| SD700-8R4D        | SD700-8R4D  | 12.4                   | Schaffner          | FN3258-16-44 |
| SD700-110D        | SD700-110D  | 16.2                   | Schaffner          | FN3258-30-33 |
| SD700-170D        | SD700-170D  | 22.4                   | Schaffner          | FN3258-30-33 |
| SD700-240D        | SD700-240D  | 31.6                   | Schaffner          | FN3258-42-33 |
| SD700-300D        | SD700-300D  | 39.5                   | Schaffner          | FN3258-42-33 |
| SD700-500D        | SD700-500D  | 46.7                   | Schaffner          | FN3258-55-34 |
| SD700-600D        | SD700-600D  | 56                     | Schaffner          | FN3258-75-34 |

## 3.19 Noise and High Harmonic Countermeasures

The following describes noise and harmonic measures:

This servo unit has a built-in microprocessor. Therefore, it may be subject to noise from its peripheral equipment.

---

To prevent mutual noise interference between the servo unit and its peripheral devices, the following measures to prevent noise interference can be taken as required.

- Set the input command device and noise filter as close to the servo unit as possible.
- Be sure to connect a surge suppressor to the coils of relays, solenoids, and electromagnetic contactors.
- Do not use the same bushing for the main circuit cable and the input/output signal cable/encoder cable, and do not bind them together. When wired, the main circuit cable and the input/output signal cable/encoder cable should be separated by more than 30cm.
- Do not use the same power supply as the electric welder or EDM machine. Even if it is not the same power supply, connect a noise filter to the input side of the main circuit power cable and the control power cable when there is a high-frequency generator nearby.

---

## 4 Trial Operation

### 4.1 Inspections and Notes before Trail Operation

In order to ensure the safe and correct trail operation, please check the programs as below before that:

#### 4.1.1 Conditions of the Servo Motor

You need to check and confirm all programs as below, if there is any problem, please handle it properly before that trail operation

- Are the settings, wires and connections correct?
- Is there any looseness in each fastening part?
- When you use servo motors with oil seals, is the oil seal damaged? Is it smeared with organic oil?
- Is the brake released beforehand when it is a servo motor with a holding brake?

#### 4.1.2 Conditions of the Servo Drive

You need to check and confirm all programs as below, if there is any problem, please handle it properly before that trail operation.

- Are the settings, wires and connections correct?
- Is the supply voltage of the servo unit normal?
- Is the driver status display interface free of warnings and alarms?

#### 4.1.3 Installation

- Install the servo motor and servo unit according to the installation conditions.
- The servo motor may fall when it rotates, so be sure to fix it on the machine.
- Be sure to leave the servo motor at no load.

### 4.2 JOG Trail Operation

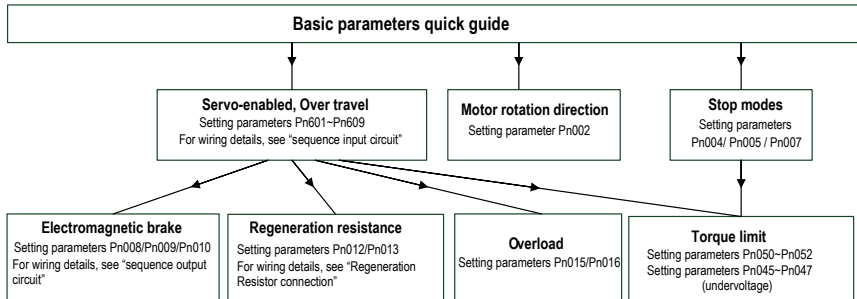
The trial run refers to the JOG operation of the servo motor unit. The purpose of the single trial operation of the servo motor is to confirm whether the servo unit and the servo motor are correctly connected and whether the servo motor is operating normally. Confirm the following points before running:

1. The motor is in the enabled state and the jog operation is invalid during the operation.
2. We suggest that the load inertia is not greater than 30 times of the motor inertia, or it could possibly cause strong mechanical vibration.
3. The Pn500, Pn310, Pn311 parameters set JOG speed, acceleration and deceleration time.

## 5 Operation

### 5.1 Basic Functions

#### 5.1.1 Quick Guide



#### 5.1.2 Servo Enable and Over-Travel Setting

##### Enable

Set the servo ON (/S-ON) signal that controls servo motor electrification / non- electrification. Pin numbers can be configured by parameters Pn601 ~ Pn609, and are always configured effectively by parameters Pn610 ~ Pn612. See “Input Signal Configuration” for details. The internal enable of the servo can also be turned on by setting the parameter PN001 (internal enable switch) to 1.

##### Over-travel

The over-travel prevention function of the servo unit refers to the safety function of forcibly stopping the servo motor by inputting a signal of the limit switch when the movement part of the machine exceeds the safe movement range. For rotating applications such as disc table and conveyor, the over-travel function may not be required. In this case, the input signal wiring for over-range is not required.



1. In the one way over travel state, commands in the opposite direction of over travel can be received.
2. In position control, when the servo motor stops due to over travel, the position deviation remains unchanged. To clear the position deviation, a clear signal (CLR) must be input.

##### 1. Signal Setting

Pin numbers can be configured by parameters Pn601 ~ Pn609, and are always configured effectively by parameters Pn610 ~ Pn612. See “Input Signal Configuration” for details.

## 2. Stop Mode

When an over-travel occurs, the servo motor can be stopped by any of the following three methods:

- Dynamic brake (DB) stop: By short-circuiting the electrical circuit, the servo motor can be quickly stopped.
- Deceleration stop: Decelerate to stop with the emergency stop torque (Pn053).
- Coast to a stop: Naturally stopped due to friction when the motor rotates.

The servo motor status after stopping is divided into the following two types:

- Coast mode: A state that naturally stops due to friction when the motor rotates.
- Zero clamp mode: The state of the zero position is maintained in the position loop.
- When the over-travel occurs, select the stopping method of the servo motor through Pn007.

For details, please see parameter Pn007.

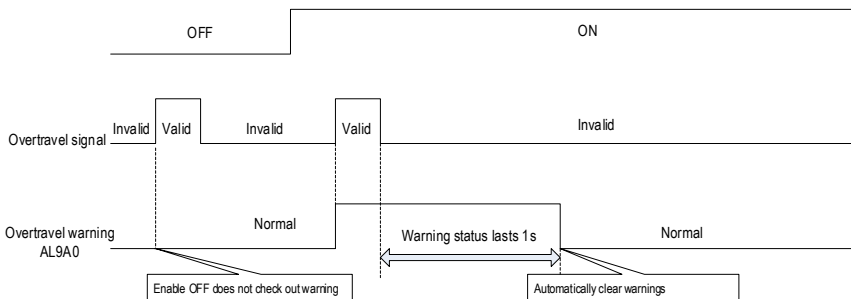


It cannot decelerate to stop during torque control. Pn007 is set to DB or free running stop. After the servo motor stops, it enters the free running state.

## 3. Warning Checkout

The over-travel warning function is a function that detects the over-travel warning (A.9A0) after the over-travel is entered when the servo is turned on. With this function, the servo unit can transmit the information on detecting the over-travel to the host device even if the over-travel signal is input instantaneously. When using this function, please set Pn006=1 “Check over-travel warning”.

The timing of check out over-travel warning:



- 1) A warning is detected when an over-travel occurs in the same direction as the instruction.
- 2) Warnings are not detected for over-travel in the reverse direction from the reference. Example: A warning will not be output for a forward instruction even if the N-OT signal (reverse run prohibited).

- 3) When there is no instruction, an over-travel warning in the forward or reverse direction will be detected.
- 4) When the servo is turned OFF, no warning will be detected even if it enters the over-travel status.
- 5) In the over-travel status, no warning is detected when the servo is switched from the servo OFF state to the servo ON status.
- 6) The warning I/O will remain output for 1 second after the over-travel status is released and will be automatically cleared afterwards.

### 5.1.3 Motor Rotation Direction

The actual rotation direction of the servo motor can be switched by Pn002 without changing the polarity of the speed reference/position reference. At this time, although the rotation direction of the motor is changed, the polarity of the output signal from the servo unit, such as the encoder frequency-divided pulse output, does not change.

Pn002=0 in the factory setting (forward rotation direction) indicates that the counterclockwise rotation (CCW) is positive when looking at the servo motor cover.

| Function mode | Parameter                                                                                                    | Range | Default | Unit | Communication address | When enabled  |
|---------------|--------------------------------------------------------------------------------------------------------------|-------|---------|------|-----------------------|---------------|
| Pn002         | Motor rotation direction selection                                                                           | 0 ~ 1 | 0       | -    | 0x0002                | After restart |
|               | Faces to the motor end:<br>0- Counterclockwise direction is positive.<br>1- Clockwise direction is positive. |       |         |      |                       |               |

### 5.1.4 Stop Mode

1. Servo OFF and class 1 alarms

Motor stop method can be selected by Pn004

- Dynamic brake (DB) stops and maintains DB status: By shorting the electrical circuit, the servo motor can be stopped in an emergency, and the DB status is maintained after stopping.
- Dynamic brake (DB) stops and DB status is released: By shorting the electrical circuit, the servo motor can be stopped in an emergency and the DB status is released after stopping.
- Coast to a stop: Stopped naturally, with no control, by using the friction resistance of the servomotor in operation.



When the servo motor stops or rotates at a very low speed, when dynamic braking stop is selected, it will be the same as the free running state. No braking force is generated as in the free running state.

2. Stopping modes for type 2 alarms

Type 2 alarms can select zero speed stop in addition to the servo OFF method and type 1 alarm stop method. See the description of parameter Pn053 for the torque limit at zero speed stop.

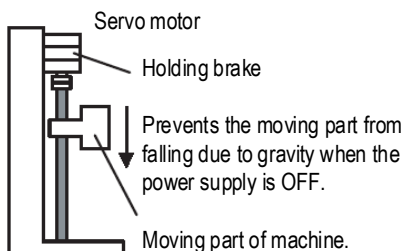


The setting of zero speed stop method is only valid for position control and speed control.

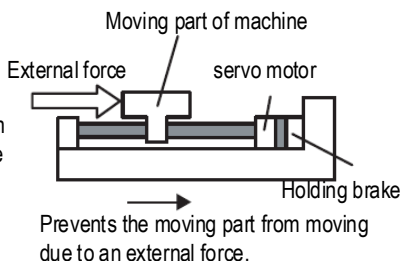
## 5.1.5 Electromagnetic Brake

A holding brake is a brake used to hold the position of the movable part of the machine when the Servo unit is turned OFF so that movable part does not move due to gravity or external forces. Holding brakes are built into servomotors with brakes. Please use it as shown below.

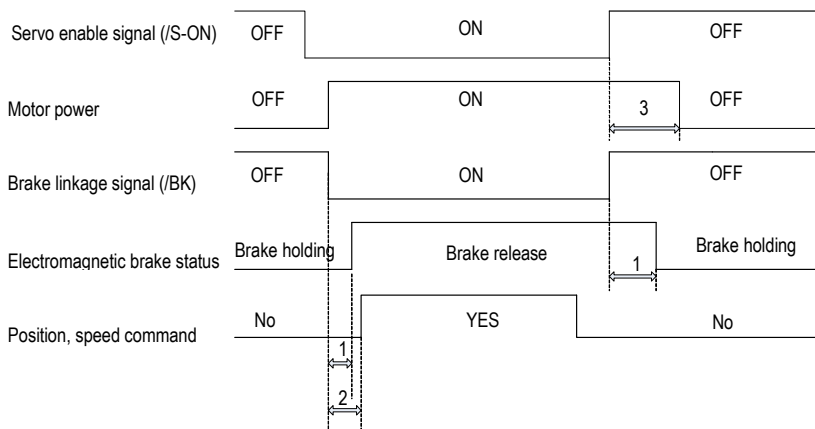
Vertical Axis



Shaft with External Force Applied



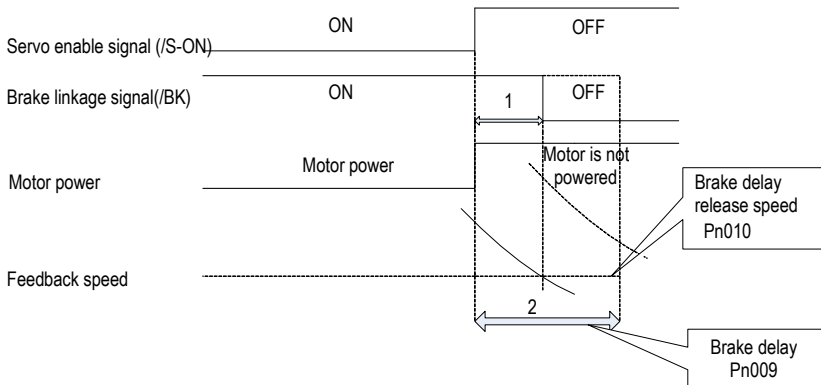
The brake has the following operation delay time. ON and OFF of the operation, please ensure the brake operation time.



2. Please ensure that the input command is after the brake opening operation to ensure the accuracy of the command.
3. When the motor is locked, it may cause danger when the servo motor is prevented from operating when the servo is turned off. The motor lock time (Pn008) can be set to ensure that the motor during the brake is not operated.

### (1) /BK signal OFF timing during the motor running

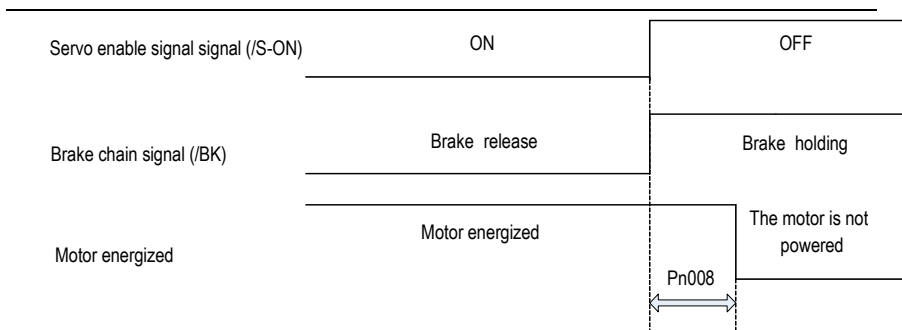
When an alarm occurs during servo motor rotation, the servo motor stops and the brake signal (/BK) turns OFF. At this time, the brake signal (/BK) output time can be adjusted by setting the brake command output speed value (Pn010) and the servo OFF - brake command waiting time (Pn009), the brake signal (/BK) output time can be adjusted.



1. When the motor speed is lower than the set value of Pn010 after the power to the servo motor is turned OFF, the /BK signal output time is subject to 1.
2. When the time set in Pn009 is exceeded after the power to the servo motor is turned OFF, and the output time of /BK signal is subject to 2.

### (2) /BK signal OFF timing during the motor stopped and locked

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 Pn008, it is possible to change the time from when the servo ON (/S-ON) signal is OFF to when the motor actually enters the non-energized state.



An alarm occurs when the servo motor is locked. Regardless of this setting, the servo motor immediately enters the non-energized state..

At this time, the machine may move before the brake due to the delay of the brake action.

### 5.1.6 Regenerative Resistor

Refer to “Regeneration Resistor Connection” for the wiring method. When connecting an external regenerative resistor, set parameters Pn012 and Pn013 according to the external resistance.

The regenerative resistor capacity should be set to a value that matches the allowable capacity of the connected external regenerative resistor. The setting differs depending on the cooling condition of the external regenerative resistor.

- Self-cooling method (natural convection cooling): Set to 20% or less of the regenerative resistor capacity (W).
- Forced air cooling: Set to 50% or less of the regenerative resistor capacity (W).

Example: When the capacity of the self-cooling external regenerative resistor is 100W, the setting value is  $100\text{W} \times 20\% = 20\text{W}$ . Therefore, set Pn012 = 2 (setting unit: 10W).

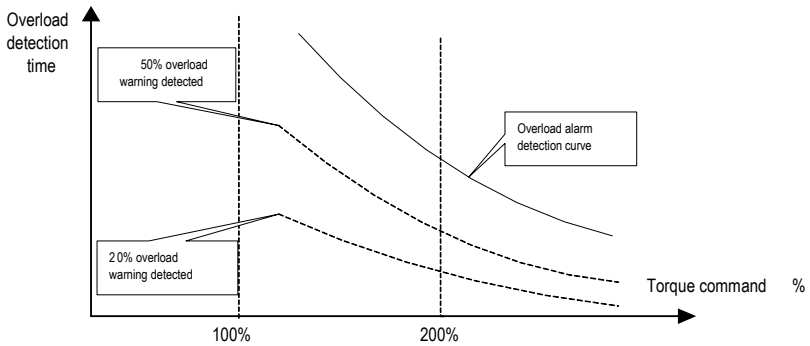
### 5.1.7 Overload

This servopack can change the detection time of the overload warning (AL.910) and overload (continuous maximum) alarm (Er. 720). However, it is not possible to change the overload characteristic and the detection value of the overload (instantaneous maximum) alarm (Er. 710). The factory defaults are:

1. Change of the time of detection of overload warning (AL.910)

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 can improve the security of the system.

For example, as shown below, after changing the overload warning value (Pn015) from 20% to 50%, the overload warning detection time is half (50%) of the overload alarm detection time.



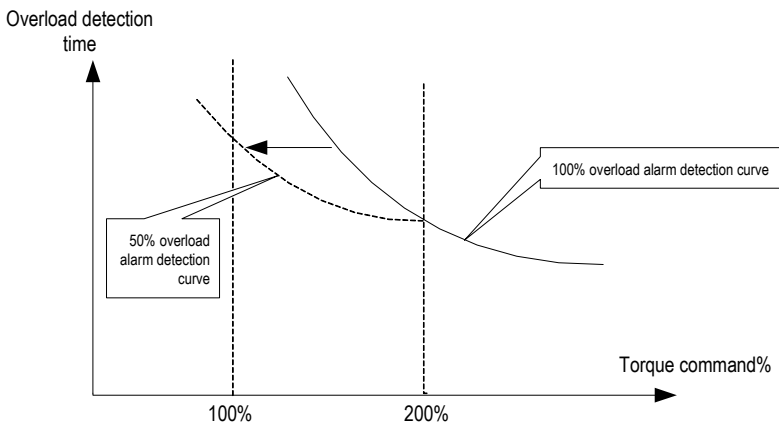
## 2. Change of the detection time of the overload warning (Er. 720)

The overload (continuous maximum) alarm (Er. 720) can be detected in advance to prevent motor overload.

By detecting the overload alarm by using the “decreased base current”, the overload alarm detection time can be shortened. The detection value of the overload (instantaneous maximum) alarm (Er. 710) cannot be changed.

Motor base current after rating reduction = motor current threshold for calculating overload alarm (default is 1.15 times motor) \* motor overload detection base current decrease rated (Pn016).

For example, as shown in the following figure, after setting Pn016 to 50%, the overload alarm can be detected earlier because the motor overload is calculated from 50% of the base current. When the value of Pn016 is changed, the overload alarm detection time will be changed.



## 5.1.8 Multi-turn Absolute Encoder

When using a multi-turn absolute encoder, an absolute value detection system can be constructed by a host device. With the absolute value detection system, it is not necessary to perform an origin return operation every time the power is turned on. In order to save the position data of the absolute encoder, a battery unit needs to be installed. Install the battery on the battery unit of the encoder cable with the battery unit. When using an encoder cable without a battery pack, install the battery in the host device. The battery voltage is 3.2V~4.5V. If the battery voltage is lower than 3.2V, a battery under-voltage alarm (ER.830) will appear. Generally, 3.6V/3.7V lithium batteries are used.

Related parameters setting:

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Range | Defaults | Unit | Communication address | When enabled  |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|------|-----------------------|---------------|
| Pn040         | Method to use absolute encoder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0 ~ 1 | 0        | —    | 0x0040                | After restart |
|               | 0- Use an absolute encoder as an absolute encoder: If the motor is an absolute multi-turn encoder, setting this parameter to 0 can use the multi-turn absolute function. This function must be used with the encoder cable with battery, otherwise the servo will alarm (ER.810).<br>1- Use an absolute encoder as an incremental encoder: When used as an incremental encoder, the power-off position won't be recorded and warning or alarm, corresponding to multiple revolutions, won't happen either when the battery is under-voltage or the drive is de-energized.                                             |       |          |      |                       |               |
| Pn041         | Absolute encoder battery warning/warning selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0 ~ 1 | 0        | —    | 0x0041                | After restart |
|               | 0- Set the low battery voltage as a fault: The driver powers up/resets for 4 ~ 9 seconds to monitor the battery status. Under-voltage will be reported as an under voltage alarm (Er. 830). Over time will not be detected. The drive cannot operate normally in a fault statue.<br>1- Set the low battery voltage as a warning: Under-voltage (below 3.2V) will be reported as an under voltage alarm (Al.930). It will always monitor the battery voltage and can be self-recovery meanwhile enable running is out of restriction.                                                                                  |       |          |      |                       |               |
| Pn792         | Absolute encoder operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0 ~ 2 | 0        | —    | 0x0792                | After restart |
|               | 0- No action.<br>1- Write motor parameters to encoder EEPROM: After modifying the motor parameters, you need to perform this operation to write the data to the encoder.<br>2- Clear multi-turn encoder laps: if you use it initially or replace or insert/remove the battery during power-down of the drive. After power on, an encoder backup alarm (Er. 810) will be reported. This parameter is set to 2 in the servo disenable status (after setting it to 2, the parameter will be Automatically return to 0, this is a normal phenomenon) and it can only be cleared after re-powered. The alarm clearing will |       |          |      |                       |               |

|  |                                                                                                  |
|--|--------------------------------------------------------------------------------------------------|
|  | clear the encoder multi-turn value at the same time, and the single-turn value will be retained. |
|--|--------------------------------------------------------------------------------------------------|

Related monitoring data:

| Monitoring code | Monitoring name                                                                                                                                                       | Range                   | Unit               | Communication address |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|-----------------------|
| Un010           | Absolute encoder single-turn value                                                                                                                                    | 0x80000000 ~ 0x7fffffff | Encoder pulse unit | 0xE011                |
|                 | Displays the single-turn absolute position of the absolute encoder.                                                                                                   |                         |                    |                       |
| Un011           | Absolute encoder multi-turn value                                                                                                                                     | 0x80000000 ~ 0x7fffffff | Encoder pulse unit | 0xE011                |
|                 | Display the number of turns of the multi-turn encoder when the multi-turn encoder is used. After the multi-turn encoder reset operation is performed, the value is 0. |                         |                    |                       |



1. When replacing the battery, please do it when the drive is powered on and the encoder line is connected normally, otherwise the encoder backup warning will be reported when it is connected again, at which time the absolute position is lost and it is necessary to clear the multi-turn encoding circle action again.

## 5.1.9 Torque Limit

### 1. Torque limit method

For the purpose of protecting the machine etc., the output torque can be limited and set by parameter Pn050. The torque limit can be set in the following five ways:

| Pn050 | Torque limit method description                                                                              | Related parameters |
|-------|--------------------------------------------------------------------------------------------------------------|--------------------|
| 0     | Analog torque (torque mode is invalid)                                                                       | Pn405              |
| 1     | Maximum torque limit 1                                                                                       | Pn051              |
| 2     | Positive torque limit 1 (Pn051), reverse maximum torque limit 2                                              | Pn051<br>Pn052     |
| 3     | Maximum torque limit 1 when the torque limit switching (/TLC) signal is OFF; Maximum torque limit 2 when ON. | Pn051<br>Pn052     |
| 4     | Restricted by internal torque command (effective in torque mode)                                             | Pn410              |



1. The input voltage of the analog command for torque limiting has no polarity. The absolute value of the voltage is taken, and the torque limiting value corresponding to that absolute value is used in both the forward direction and the reverse direction.  
2. If the set value exceeds the maximum torque of the servo motor used, the actual torque is also limited to ..

## 2.Torque limit output signal

The torque limit (/CLT) output is ON means the motor output torque is in the limit state. This signal can be used to confirm the status of the current torque limit of the motor. Refer to "Sequence Output Circuit" for the wiring method. Refer to "Switching Output Signal" for parameter setting.

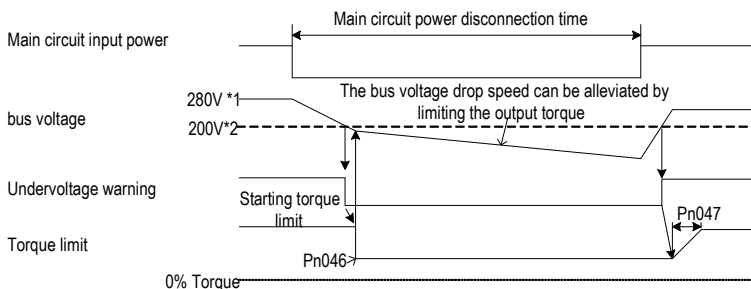
## 3.Torque limit under voltage

When the instantaneous power failure and the main circuit power supply voltage are insufficient for a short period of time, the main circuit DC voltage inside the servo unit is below the specified value, an under-voltage warning is detected, and the function for limiting the output torque can be selected. Related parameters are as below:

| Function code | Parameter                                                                                                                                                                                                                                                                                     | Range             | Default | Unit | Communication address | When enabled  |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------|------|-----------------------|---------------|
| Pn045         | Under-voltage function selection                                                                                                                                                                                                                                                              | 0x00<br>~<br>0x02 | 0       | —    | 0x0045                | After restart |
|               | 0 - No Detection of Main Circuit Descent Warning.<br>1 - Detection of Main Circuit Descent Warning.<br>2 - Detect main circuit down warning and perform torque limit. The relevant torque limit is matched with Pn046/Pn047. For details, refer to "Main circuit under-voltage torque limit". |                   |         |      |                       |               |
| Pn046         | Torque limit when main circuit voltage drops                                                                                                                                                                                                                                                  | 0<br>~<br>100     | 50      | %    | 0x0046                | Immediately   |
|               | According to the under voltage warning, it will impose the torque limit inside the servo unit.                                                                                                                                                                                                |                   |         |      |                       |               |
| Pn047         | Torque limit release time when main circuit voltage drops                                                                                                                                                                                                                                     | 0<br>~<br>1000    | 100     | ms   | 0x0047                | Immediately   |
|               | After the under-voltage warning signal releases, the torque limit value is controlled within the servo unit according to the set time. For details, see "Under-voltage limit of the main circuit".                                                                                            |                   |         |      |                       |               |

By combining this function with the setting function of the instantaneous stop holding time, when the power supply voltage is insufficient, it is possible to avoid the shutdown due to the alarm and continue the operation without performing the power restoration operation.

Under-voltage warning, apply torque limit inside the servo unit. After receiving the under voltage warning release signal, the torque limit value is controlled within the servo unit according to the set release time. The logical timing is as follows:



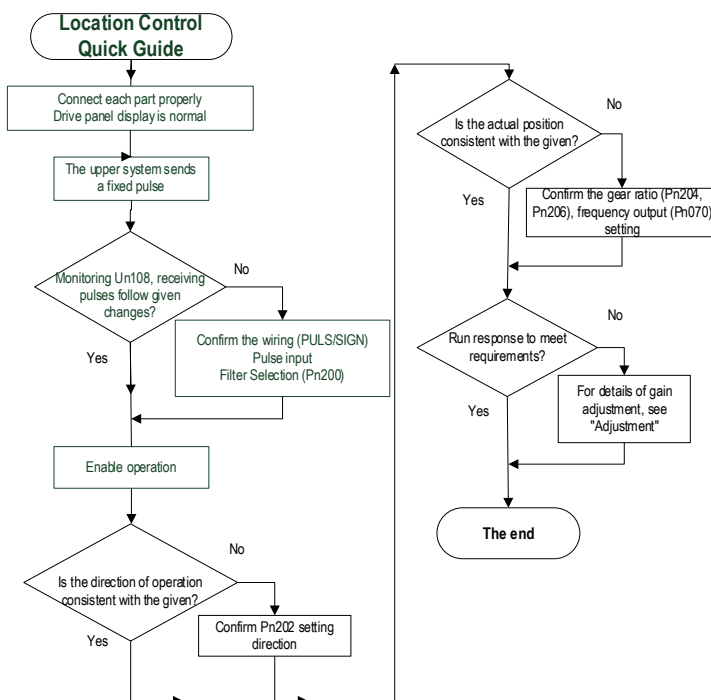
1: 560V at 400VAC

2: 400V at 400VAC

## 5.2 Position Mode

For details on the wiring related to the position mode; see "Connection Control Example for Position Control". The position control is selected by the control mode selection (Pn000 = 0, factory default).

### 5.2.1 Quick Guide



## 5.2.2 Basic Settings

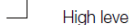
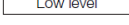
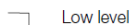
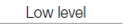
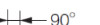
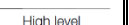
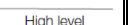
The following describes the basic settings for position control:

### 1. Command pulse filter selection

The appropriate command pulse filter can be selected according to the frequency of the highest pulse in operation, which can be set by parameter Pn200. For details, refer to the relevant description of the function code. If the selection is not appropriate, the received pulse of the servo unit may be lost or increased.

### 2. Pulse input form

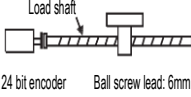
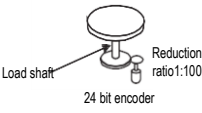
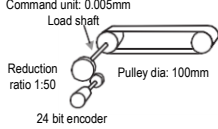
According to the pulse output form of the upper system, the pulse input form of the servo unit is selected.

| Function code | Setting value | Order form                       | Forward instruction                                                                                                                                                                                                                                                             | Reverse instruction                                                                                                                                                                                                                                                                                |
|---------------|---------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pn201         | 0             | Pulse + direction positive logic | PULS (CN1-7) <br>SIGN (CN1-11)  High level                                                                    | PULS (CN1-7) <br>SIGN (CN1-11)  Low level                                                                                      |
|               | 1             | CW+CCW positive logic            | CW (CN1-7)  Low level<br>CCW (CN1-11)                                                                         | CW (CN1-7) <br>CCW (CN1-11)  Low level                                                                                         |
|               | 4             | Quadrature encoding 4 times      |  90°<br>Phase A <br>Phase B  |  90°<br>Phase A (CN1-7) <br>Phase B (CN1-11)  |
|               | 5             | Pulse + direction negative logic | PULS (CN1-7) <br>SIGN (CN1-11)  Low level                                                                 | PULS (CN1-7) <br>SIGN (CN1-11)  High level                                                                                 |
|               | 6             | CW+CCW negative logic            | CW (CN1-7)  High level<br>CCW (CN1-11)                                                                    | CW (CN1-7) <br>CCW (CN1-11)  High level                                                                                    |

### 3. Electronic gear ratio

When the reduction ratio of the motor shaft and the load side is n/m (when the load shaft rotates by n revolutions when the motor rotates by m revolutions), the set value of the electronic gear ratio

can be obtained by the following formula:

| Steps | Content                                          | Mechanical system                                                                                                                                    |                                                                                                                                                                   |                                                                                                                                                                                         |
|-------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                                                  | Ball screw                                                                                                                                           | Rotary table                                                                                                                                                      | Belt + Pulley                                                                                                                                                                           |
|       |                                                  | Command unit: 0.001mm<br><br>24 bit encoder    Ball screw lead: 6mm | Command unit: 0.01°<br><br>Load shaft    24 bit encoder    Reduction ratio 1:100 | Command unit: 0.005mm<br><br>Load shaft    24 bit encoder    Pulley dia: 100mm    Reduction ratio 1:50 |
| 1     | Machine specification                            | Ball screw lead: 6mm<br>Reduction ratio: 1/1                                                                                                         | Rotation angel per turn: 360°<br>Reduction ratio: 1/100                                                                                                           | Pulley dia: 100mm (Pulley circumference 314mm)<br>Reduction ratio: 1/50                                                                                                                 |
| 2     | Encoder resolution                               | 8388608 (23 bit)<br>16777216 (24 bit)<br>131072 (17 bit)                                                                                             | 83886708 (23 bit)<br>16777216 (24 bit)<br>131072 (17 bit)                                                                                                         | 8388608 (23 bit)<br>16777216 (24 bit)<br>131072 (17 bit)                                                                                                                                |
| 3     | Command unit                                     | 0.001mm (1mm)                                                                                                                                        | 0.01°                                                                                                                                                             | 0.005mm (5mm)                                                                                                                                                                           |
| 4     | Load shaft movement in 1 rotation (command unit) | 6mm/0.001mm = 6000                                                                                                                                   | 360°/0.01° = 36000                                                                                                                                                | 314mm/0.005mm = 62800                                                                                                                                                                   |
| 5     | Electronic gear ratio                            |                                                                                                                                                      |                                                                                                                                                                   |                                                                                                                                                                                         |
| 6     | Parameters                                       | Pn204: 8388608                                                                                                                                       | Pn204: 838860800                                                                                                                                                  | Pn204: 419430400                                                                                                                                                                        |
|       |                                                  | Pn206: 6000                                                                                                                                          | Pn206: 36000                                                                                                                                                      | Pn206: 62800                                                                                                                                                                            |



1. Electronics gear ratio numerator (Pn204) set to 0, electronic gear ratio than the denominator (Pn206) set the value of the number of pulses corresponding to the motor running one lap, for example, Pn204 (numerator) set to 0, Pn206 (Denominator) set to 10000, it means that the upper computer (PLC, motion controller, etc.) send 10000 pulses servo motor turn one lap.
2.  $0.001 \leq \text{electronic gear ratio (B/A)} \leq 83887$  beyond this setting range, "Parameter Setting abnormality (Er.040) alarm" (for 23 bit encoder).

## 5.2.3 Deviation Clearance

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

### 1. Clear signal wiring

Deviation clear signal wiring can be divided into linear driver output and open collector output. Please refer to "Position Command Input Circuit" for wiring details.

### 2. Setting the deviation clear mode

The shape of the clear signal is set by Pn272.

| Function code | Parameter                                                                                                                                                                                                    | Range       | Default | unit | Communication address | When enabled         |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|----------------------|
| Pn272         | Position deviation clear mode                                                                                                                                                                                | 0x00 ~ 0x03 | 0       | —    | 0x0272                | Power down effective |
|               | Set the clear mode of the digital position deviation clear signal (/CLR):<br>0-level clear when cleared.<br>1-rising edge OFF->ON clear.<br>2-Clear when 2-level OFF.<br>3-falling edge clears when ON->OFF. |             |         |      |                       |                      |

When Pn272 = 0 or 2, in order to perform clear signal processing, the amplitude of the clear signal must be 250μs or more.

When Pn272 = 1 or 3, in order to perform clear signal processing, the amplitude of the clear signal must be 20μs or more.



If the setting is set to hold clear, the servo lock function is invalid. As a result, the servo motor will rotate slightly due to drift pulses in the speed loop.

### 3. Deviation clearing method selection

Depending on the status of the servo unit, you can choose when to clear the position deviation. Set the deviation clearing method by Pn273:

| Function code | Parameter                                                                                                                                                                                                                                                                                                                 | Range       | Default | Unit | Communication address | When enabled         |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|----------------------|
| Pn273         | Position deviation clear mode                                                                                                                                                                                                                                                                                             | 0x00 ~ 0x02 | 0       | —    | 0x0273                | Power down effective |
|               | Set the mode of the deviation clearing:<br>0-Servo OFF, alarm, / CLR signal position deviation can be cleared.<br>1-/CLR signal position deviation can be cleared.<br>2-Alarm/CLR signal position deviation can be cleared.<br>3-Cleared in case of servo OFF, alarm and limit.<br>4-Not clearing the position deviation. |             |         |      |                       |                      |

See the “Deviation Clearance” for details on the pulse amplitude of the clear signal.

In position control, the positional deviation remains unchanged when the servo motor is stopped due to the travel limit.



When the position mode is running, the servo motor stops due to the travel limit. If the upper computer continues to send pulses at this time, the position deviation will keep increasing and the position deviation will not be cleared automatically, which may cause the motor to fly when the travel limit is excluded.

## 5.2.4 Command Pulse Prohibition

The command pulse inhibition (/INHIBIT) function is a function that prohibits the command pulse input from being counted during position control. When this function is enabled, the servo unit enters a state where it cannot receive the command pulse input.

### 1. Configuration of Command Pulse Prohibition

The signal is not configured in the factory default switch configuration. Therefore, the pin number configuration (0x0D) needs to be performed by parameters Pn601 ~ Pn609.

### 2. Command pulse inhibited wiring

The command pulse disable signal is a universally configurable digital input. See “Sequence Input Circuit” for wiring details.

## 5.2.5 Positioning Approach

When positioning is close to (/NEAR) position control, the host device may receive the positioning proximity signal before confirming the positioning completion signal, so as to prepare for the sequence of actions after the positioning is completed. In this way, the time required to complete the positioning can be shortened. This signal is usually used in pair with the positioning completion signal. Refer to the “Positioning completed” instruction for the positioning completion signal.

### 1. Positioning close to the configuration

The signal is not configured in the factory default digital output configuration. Therefore, the pin number configuration (0x08) needs to be performed by parameters Pn613 ~ Pn615.

When the difference between the command pulse number of the host device and the movement amount of the servo motor (position deviation) is lower than the setting value of Pn260 (position proximity signal width), the signal is output when the positioning close output condition is satisfied.

### 2. Locating close wiring

The positioning proximity signal is a universally configurable digital output. See “Sequence Output Circuit” for wiring details.

## 5.2.6 Positioning Completion

In position control, it indicates the servo motor positioning completed (/COIN) signal.

### 1. Positioning completed configuration

In the factory default digital output configuration, the signal is configured as CN1's 27th and 28th pin numbers (Pn614=0x01) by default. Please confirm before use.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                  | Range          | Default | Unit         | Communication address | When enabled |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------|--------------|-----------------------|--------------|
| Pn262         | Positioning completion range                                                                                                                                                                                                                                                                                               | 0 ~ 1073741824 | 7       | Command unit | 0x0262<br>0x0263      | Immediately  |
|               | In the position control, the servo motor positioning completion signal will be output when the difference between the command pulse number from the host device and the servo motor movement amount (position deviation) is lower than the set value that means the host device confirming positioning has been completed. |                |         |              |                       |              |

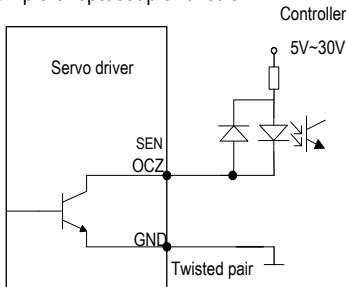
If the set value is too large, the permanent positioning completion signal may be output when the deviation is small during low-speed operation. When outputting a constant positioning signal, please lower the setting until the signal is no longer output.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Range       | Default | Unit | Communication address | When enabled |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|--------------|
| Pn274         | Positioning completion signal output time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0x00 ~ 0x02 | 0       | —    | 0x0274                | Immediately  |
|               | Set the output timing of the positioning completion signal /COIN:<br>0- Output when the absolute value of position deviation is less than the positioning completion range (Pn262).<br>1- Output when the absolute value of the position deviation is smaller than the positioning completion range (Pn262) and the command after the position command filtering is 0.<br>2- Output When the absolute value of the position deviation is smaller than the positioning completion range (Pn262) and the positioning command input is 0. |             |         |      |                       |              |

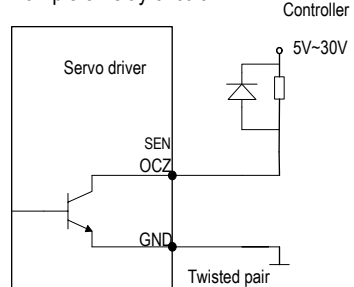
## 2. Positioning completion wiring

The positioning completion signal is a universally configurable digital output. For wiring details, refer to "Sequence Output Circuit".

Example of optocoupler circuit



Example of relay circuit



### 5.2.7 Command Pulse Input Magnification Switching

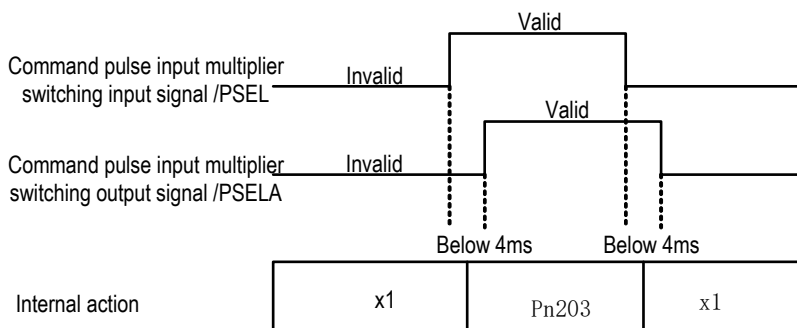
The ON/OFF of the override input switching signal (/PSEL) of the command pulse input switches the input override of the position command pulse to 1 and  $n$  times ( $n = 1$  to 100). The switching of the override can be confirmed by the command pulse input of the override switching output signal (/PSELA).

Please switch the command pulse magnification while the position command pulse is 0. If the position command pulse is not 0, the servo motor may cause a position error or cause a position loss.

#### 1. Configuration of command pulse input magnification switching

The signal is not configured in the factory default digital input configuration. Therefore, the pin number configuration (0x10) needs to be performed by parameters Pn601 ~ Pn609.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                  | Range   | Default | Unit     | Communication address | When enabled |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|----------|-----------------------|--------------|
| Pn203         | Command pulse input magnification                                                                                                                                                                                                                                                                                                                          | 1 ~ 100 | 1       | x1 times | 0x0203                | Immediately  |
|               | Set the command pulse input magnification value to be used in conjunction with ON/OFF of the command pulse magnification switching signal for switching the position command pulse input magnification to 1 and the parameter setting multiple.<br>Note: The input pulse frequency is too low. If the value is set too large, the speed may not be steady. |         |         |          |                       |              |



## 2. Command pulse input magnification switching wiring

The command pulse input override signal is a universally configurable digital input. See “Sequence Input Circuit” for wiring details.

### 5.2.8 Smooth Settings

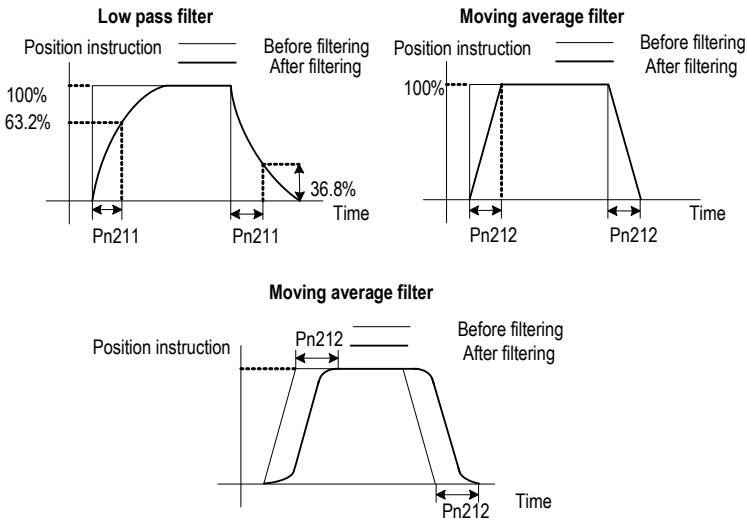
The command pulse input is filtered to make the rotation of the servo motor smoother. This function is more effective in the following situations:

- The host device that issued the command does not perform acceleration / deceleration.
- When the instruction pulse frequency is extremely low.
- When the position command smoothing function is set, the system response may be affected. Please use it reasonably.

The filter-related parameter settings are as follows:

| Function code | Parameter                                                                                                                                                                                                                                                                                                          | Range    | Default | Unit | Communication address | When enabled |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|------|-----------------------|--------------|
| Pn211         | Position command low-pass filter time constant                                                                                                                                                                                                                                                                     | 0 ~ 655  | 0       | ms   | 0x0211                | After stop   |
|               | This parameter is used to set the time constant of the first-order low-pass filter corresponding to the position command and it can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter. If set too large, the servo response will slow down. |          |         |      |                       |              |
| Pn212         | Moving average filtering time of position command                                                                                                                                                                                                                                                                  | 0 ~ 1000 | 0       | ms   | 0x0212                | After stop   |
|               | This parameter is used to set the time constant of the moving average filter of the corresponding position instruction. It can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter. If set too large, the servo response will slow down.      |          |         |      |                       |              |

The difference between the position command low-pass filter time constant and the position command's moving average filter time is shown below:



### 5.2.9 Frequency-division Output

The encoder frequency-divided pulse output is a signal that is output to the outside in the form of a two-phase pulse (phase A, phase B) with a phase difference of 90° after processing the signal from the encoder inside the servo unit. Used as position feedback in the host device.

#### Frequency-division pulse output parameter configuration

How to set the encoder frequency pulse output as follows:

| Function code | Parameter                                                                                                                                                                                                        | Range        | Default | Unit   | Communication address | When enabled  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|--------|-----------------------|---------------|
| Pn070         | Encoder divider pulses                                                                                                                                                                                           | 16 ~ 4194304 | 2048    | 0x0070 | After restart         |               |
|               | The number of pulses per cycle from the encoder is divided by frequency in accordance with the set value of this parameter. Please set it according to the system specifications of the machine and host device. |              |         |        |                       |               |
| Pn072         | Divided frequency output reversed                                                                                                                                                                                | 0 ~ 1        | 0       | -      | 0x0072                | After restart |

|  |                                                                                                                                                                                        |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | A/B pulse phase sequence logic when setting forward/reverse:<br>0- Don't revert the pulse output: When forward, A leads B.<br>1- 1- Revert the pulse output: When forward, B leads A . |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 1. Frequency division pulse

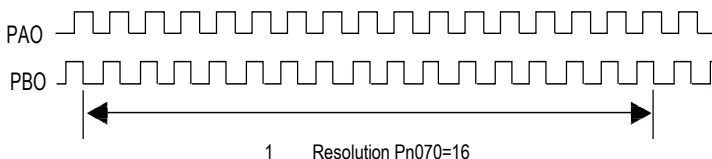
The number of pulses per revolution from the encoder is processed inside the servo pack and then divided down and output to the set value of Pn070.

The encoder's number of divided pulse outputs is set according to the system specifications of the machine and the host device.

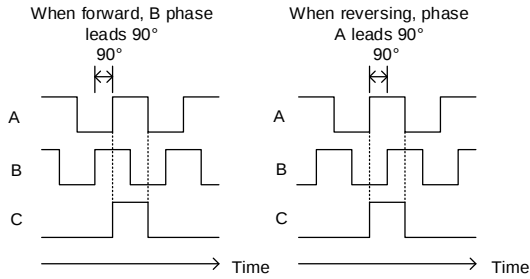
The setting of frequency division pulse number of encoder will be limited by the resolution of encoder. The maximum output frequency of frequency division pulse of encoder shall not exceed 4MHz (after 4 times frequency), as shown in the table below:

| Pulse Number of Encoder<br>Frequency Devision<br>(pulse/r) | Setting<br>increment | Encoder Resolution |         |         | Upper Limit of motor<br>Speed ( r/min) |
|------------------------------------------------------------|----------------------|--------------------|---------|---------|----------------------------------------|
|                                                            |                      | 17 bits            | 20 bits | 23 bits |                                        |
| 16 ~ 16384                                                 | 1                    | o                  | o       | o       | 6000                                   |
| 16386 ~ 32768                                              | 2                    | o                  | o       | o       | 3000                                   |
| 32772 ~ 65536                                              | 4                    | o                  | o       | o       | 1500                                   |
| 65544 ~ 131072                                             | 8                    | o                  | o       | o       | 750                                    |
| 131088 ~ 262144                                            | 16                   | -                  | o       | o       | 375                                    |
| 262176 ~ 524288                                            | 32                   | -                  | o       | o       | 187                                    |
| 524352 ~ 1048576                                           | 64                   | -                  | o       | o       | 93                                     |
| 1048704 ~ 2097152                                          | 128                  | -                  | -       | o       | 46                                     |
| 2097408 ~ 4194304                                          | 256                  | -                  | -       | o       | 23                                     |

Output example: When 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 below.



## 2. Frequency division output reversed

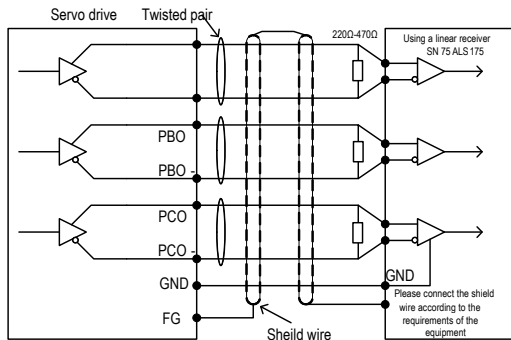


Parameter Pn072 can be set to revert the logic of the AB phase signal of the divided output pulse.

The amplitude of the Z-phase pulse varies with the number of encoder frequency-division pulses (Pn070) and is consistent with the amplitude of the A-phase. The smaller the frequency division pulse number (Pn070) is, the wider the Z-phase pulse amplitude is.

### Frequency division pulse output wiring

Refer to the “Linear Drive Output Circuit” for details on the wiring of the frequency division pulse output.



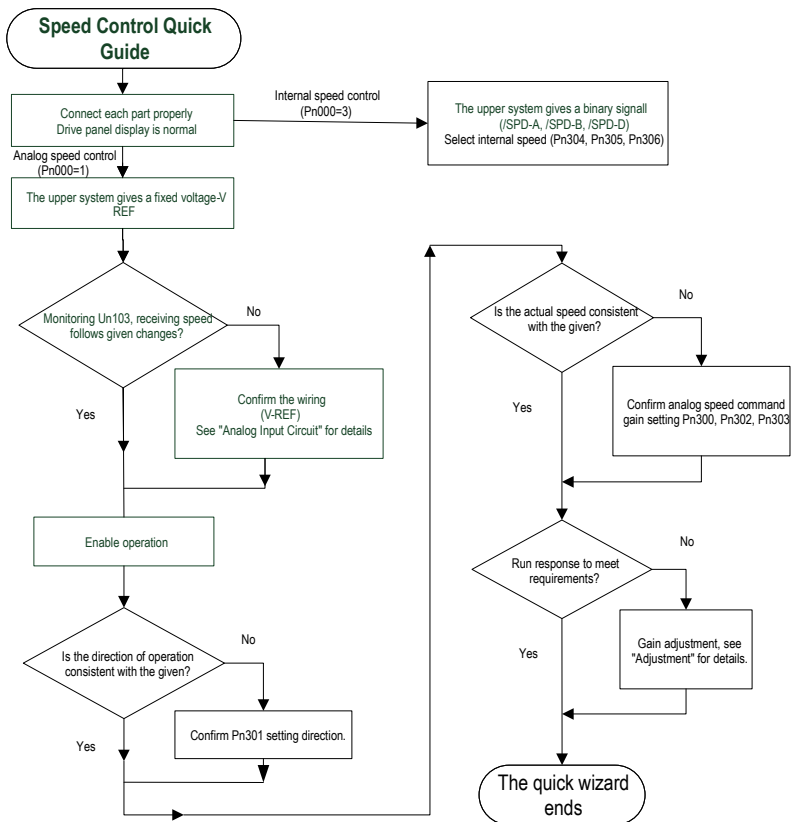
The voltage of the encoder divider pulse output is differential  $\pm 5V$ , the C (Z) phase pulse is very small because of the pulse width, so it is difficult to measure the change with a multimeter, and it needs to cooperate with the high-speed input point of the upper computer to capture the pulse, or the number of encoder divider pulses (Pn070) can be set to the minimum (16), and then cooperate with the multimeter voltage file to measure.

## 5.3 Speed Mode

For details on speed mode wiring, see “Speed Control Connection Example”. It is selected by control mode selection (Pn000).

The speed control mode is divided into internal speed mode (Pn000=3) and analog speed mode (Pn000=1) according to the command source.

### 5.3.1 Quick Guide



### 5.3.2 Basic Settings

Control mode selection (Pn000=3), internal speed mode, internal speed command direction selection based on digital input (/SPD-D) internal speed command selection A (/SPD-A), internal speed command selection B (/SPD- B) configuration to select the speed instruction.

The control mode selection (Pn000 = 1) is the analog speed mode. The speed command is given according to the voltage of V-REF (CN1-5, CN1-6) and the set value of analog speed command gain Pn300.

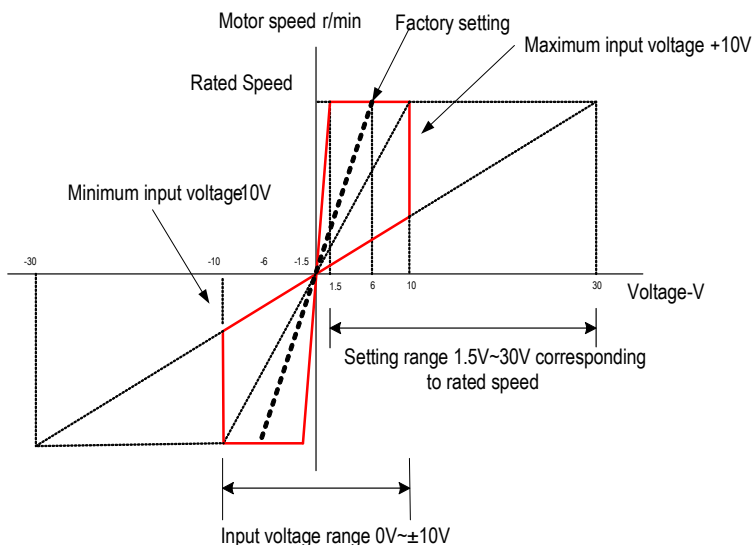
The basic settings for these two modes are described below:

### 1. Analog speed

| Function code | Parameter                                                                                                                                                                                                                                                                                             | Range      | Default | Unit                | Communication Address | When enabled |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------|---------------------|-----------------------|--------------|
| Pn300         | Analog speed command gain                                                                                                                                                                                                                                                                             | 150 ~ 3000 | 600     | 0.01V / rated speed | 0x0300                | Immediately  |
|               | This parameter is used to set servo motor speed that should be equal to analog voltage value (V-REF) required for the speed command of the rated value.<br>Caution: Do not apply more than -10V ~ 10V and exceeding this range may cause damage to the driver.                                        |            |         |                     |                       |              |
| Pn301         | Analog speed command negation                                                                                                                                                                                                                                                                         | 0 ~ 1      | 0       | -                   | 0x0301                | Immediately  |
|               | Set the voltage polarity of the analog speed command:<br>0-Positive polarity: positive voltage corresponds to positive speed command.<br>1- Negative polarity: positive voltage corresponds to negative speed command.                                                                                |            |         |                     |                       |              |
| Pn302         | Analog speed instruction filter time                                                                                                                                                                                                                                                                  | 0 ~ 655.35 | 0.40    | ms                  | 0x0302                | Immediately  |
|               | The function could be set to smooth the speed command when one delay filter is applied to the analog speed command (V-REF) input and it does not usually need to be changed. If the set value is too large, the responsiveness may decrease. Please set this parameter while confirming the response. |            |         |                     |                       |              |
| Pn303         | Analog speed command dead zone range                                                                                                                                                                                                                                                                  | 0 ~ 3      | 0       | V                   | 0x0303                | Immediately  |
|               | In the analog speed control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the commands inside the servo unit. This error can be eliminated by setting an appropriate analog speed command deadband range.            |            |         |                     |                       |              |

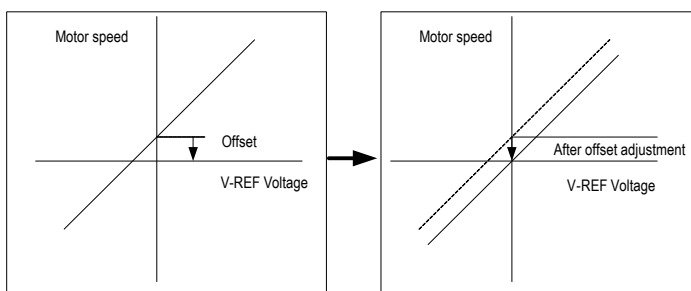
Set the analog voltage value of the speed command (V-REF, see “Analog Input Circuit” for wiring) that makes the speed of the servo motor rated as the analog speed command gain Pn300.

Example: The factory default parameter Pn300 = 600 (6V corresponds to the rated speed (assuming 3000rpm). If the V-REF input voltage is 1V, the speed command corresponds to 500rpm. If 3V is input, the speed command corresponds to 1500rpm.



### Adjustment of instruction offset

When analog speed control is used, even if the command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the instructions inside the servo unit. This slight deviation is called “offset”.



There are two methods of automatic adjustment and manual adjustment of offset adjustment. Automatic adjustment is automatic adjusting command offset (Fn100) and manual adjustment is manually adjusting command offset (Fn101). For details, see “Auxiliary Functions”.



1. For automatic adjustment, be sure to adjust the command bias amount in the state of servo OFF and the upper computer (PLC, knob, etc.) giving 0v voltage command.
2. When adjusting manually, observe the operation of the motor while adjusting in the state of servo ON.
3. If the factory setting is restored, the offset adjustment value will not be initialized.

## 2. Internal speed

| Function code | Parameter                                                                                                                                                                                                                                                                              | Range     | Default | Unit | Communication address | When enabled |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|------|-----------------------|--------------|
| Pn304         | Internal speed 1                                                                                                                                                                                                                                                                       | 0 ~ 10000 | 100     | rpm  | 0x0304                | Immediately  |
|               | Internal speed 2                                                                                                                                                                                                                                                                       | 0 ~ 10000 | 200     | rpm  | 0x0305                | Immediately  |
| Pn305         | Internal speed 3                                                                                                                                                                                                                                                                       | 0 ~ 10000 | 300     | rpm  | 0x0306                | Immediately  |
| Pn306         | When operating in the internal speed mode, the servo unit provides 3 internal speed commands and selects A and B through the switching value internal speed command. When the switching value internal speed command selects A and B at OFF state, the internal speed is default as 0. |           |         |      |                       |              |

The speed is selected through the digital input signal control:

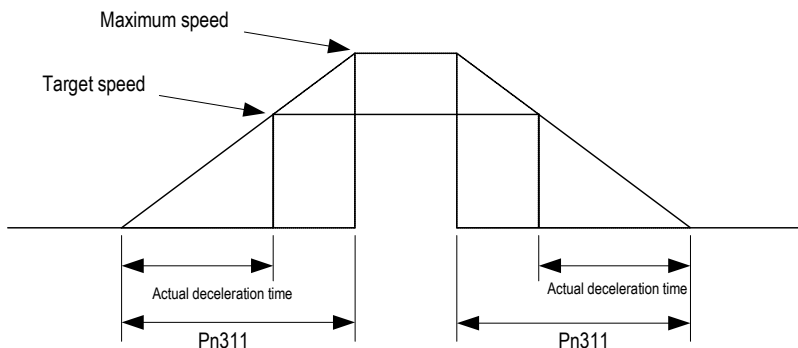
| Switching value input signal |        |        | Direction of speed instruction | Speed instruction       |
|------------------------------|--------|--------|--------------------------------|-------------------------|
| /SPD-D                       | /SPD-A | /SPD-B |                                |                         |
| OFF                          | OFF    | OFF    | Positive                       | 0                       |
|                              | OFF    | ON     |                                | Internal speed 1(Pn304) |
|                              | ON     | ON     |                                | Internal speed 2(Pn305) |
|                              | ON     | OFF    |                                | Internal speed 3(Pn306) |
| ON                           | OFF    | OFF    | Negative                       | 0                       |
|                              | OFF    | ON     |                                | Internal speed 1(Pn304) |
|                              | ON     | ON     |                                | Internal speed 2(Pn305) |
|                              | ON     | OFF    |                                | Internal speed 3(Pn306) |

### 5.3.3 Soft Start

The soft start function is a speed command that converts a step speed command to a smoother constant acceleration/deceleration. You can set the acceleration time and deceleration time, and use this function when you want to achieve smooth speed control during speed control.

| Function code | Parameter                                                                                                                                                                                                                 | Range     | Default | Unit | Communication address | When enabled |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|------|-----------------------|--------------|
| Pn310         | Speed command trapezoidal acceleration time                                                                                                                                                                               | 0 ~ 10000 | 0       | ms   | 0x0310                | Immediately  |
|               | Acceleration time of the set speed is from 0r/min to the max speed (corresponding to the motor model). When the given speed is more or less than the max speed, the actual acceleration time is calculated in proportion. |           |         |      |                       |              |
| Pn311         | Speed command                                                                                                                                                                                                             | 0 ~       | 0       | ms   | 0x0311                | Immediately  |

|                                                                                                                                                                                                                       |                                     |       |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------|--|--|--|--|
|                                                                                                                                                                                                                       | trapezoidal<br>deceleration<br>time | 10000 |  |  |  |  |
| Deceleration time of the set speed is from max speed (corresponding to the motor model) to 0r/min. When the given speed is more or less than the max speed, the actual deceleration time is calculated in proportion. |                                     |       |  |  |  |  |



Note that the acceleration and deceleration time refers to the acceleration from 0 to the maximum speed or deceleration from the maximum speed to 0. It is judged by the maximum speed and not by the rated speed or the given speed.

### 5.3.4 Zero Fixed Functions

The zero-fixed function means that when the zero-position fixed signal (/ZCLAMP) is ON, the servo lock is performed when the input voltage of the speed command (V-REF) is lower than the speed set by the fixed zero value (Pn501). At this time, the position loop is formed inside the servo unit, and the speed command will be ignored. Therefore, when used for speed control, the host device does not build a position loop.

The servo motor is fixed within  $\pm 1$  pulse of the zero position fixing effective position. Even if rotation occurs due to external force, it will return to the zero position.

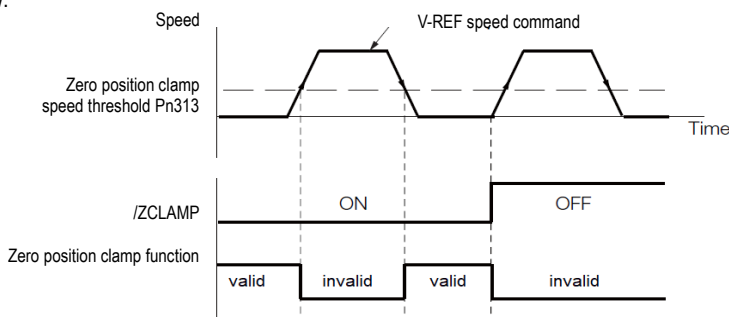
#### 1. Zero-fixed configuration

The signal is not configured in the factory default switch configuration. Therefore, the pin number configuration (0x0C) needs to be performed by parameters Pn601 ~ Pn609.

| Function code | Parameter             | Range | Default | Unit | Communication address | When enabled |
|---------------|-----------------------|-------|---------|------|-----------------------|--------------|
| Pn312         | Zero speed clamp mode | 0 ~ 3 | 3       | -    | 0x0312                | Immediately  |

|       |                                                                                                                                                                                                                                                                                                                                                                  |           |    |     |        |             |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----|-----|--------|-------------|
|       | Speed mode, setting the switching speed zero clamp signal (/ZCLAMP) working mode:<br>0- Invalid.<br>1- Speed command is set to 0, not clamped after shutdown.<br>2- Speed command is set to 0, clamped after shutdown.<br>3- Speed command is lower than “zero position clamp speed threshold”, and then speed command is set to 0 at first, clamped after stop. |           |    |     |        |             |
| Pn313 | Zero Speed Clamp Speed Threshold                                                                                                                                                                                                                                                                                                                                 | 0 ~ 10000 | 10 | rpm | 0x0313 | Immediately |
|       | Set the zero control switching threshold when “zero speed clamp mode”(Pn312) is set to 3.                                                                                                                                                                                                                                                                        |           |    |     |        |             |

The relationship between zero fixed speed thresholds and zero fixed function is shown in the figure below:



## 2. Zero-fixed wiring

The zero-fixed signal is a universally configurable digital input. See “Sequence Input Circuit” for wiring details.

## 5.3.5 Rotation Detection Signal

When the motor speed is greater than the set value, a digital rotation detection signal (/TGON) is output.

### 1. Configuration of rotation detection signal

| Function code | Parameter                                                                                                  | Range     | Default | Unit | Communication address | When enabled |
|---------------|------------------------------------------------------------------------------------------------------------|-----------|---------|------|-----------------------|--------------|
| Pn317         | Rotation determination threshold                                                                           | 1 ~ 10000 | 20      | rpm  | 0x0317                | Immediately  |
|               | When the motor speed is higher than the set value, the switch rotation detection signal (/TGON) is output. |           |         |      |                       |              |

This signal is not configured in the factory default digital output configuration. Please confirm before

use.

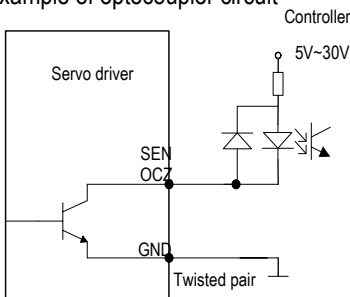
The signal is not configured in the factory default digital output configuration. Therefore, the pin number configuration (0x03) needs to be performed by parameters Pn613~Pn615.

The output condition is that the signal is output when the current feedback speed (absolute value) of the motor is higher than the setting value of Pn317 (rotation determination threshold).

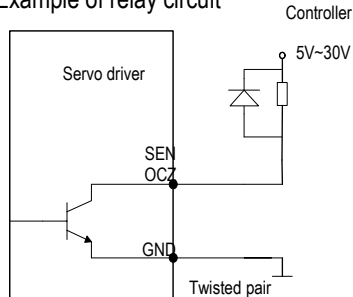
## 2. Wiring of rotation detection signals

The rotation detection signal is a universally configurable digital output signal. See “Sequence Output Circuit” for wiring details.

Example of optocoupler circuit



Example of relay circuit



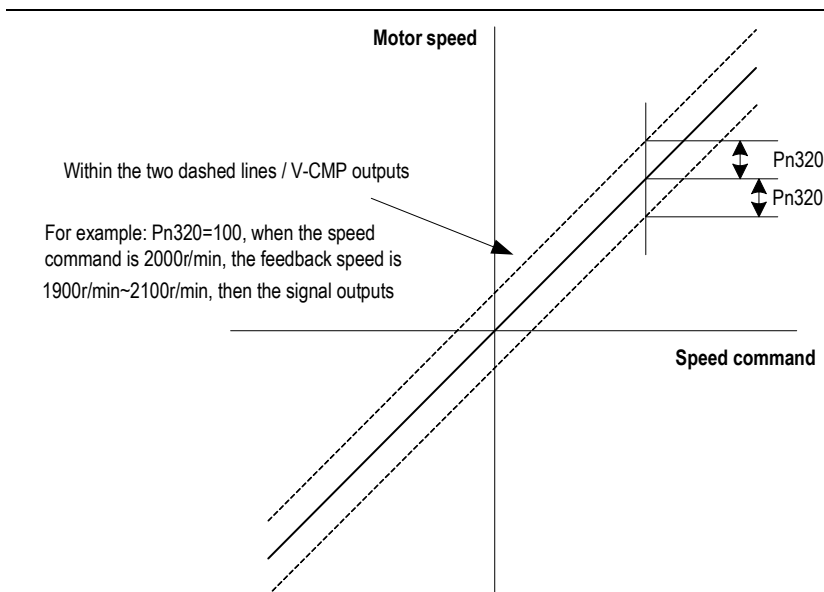
## 5.3.6 Consistent Speed

The speed coincidence signal (*V-CMP*) is a signal that is output when the difference between the speed of the servo motor and the command speed is equal to or lower than the set value of the speed coincidence range Pn320. Used when interlocking with the upper device. This signal is the output signal during speed control.

### 1. Configuration of Speed-consistent Signals

| Function code | Parameter                                                                                                                                                | Range   | Default | Unit | Communication address | When enabled |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|-----------------------|--------------|
| Pn320         | Speed consistent range                                                                                                                                   | 0 ~ 100 | 10      | rpm  | 0x0320                | Immediately  |
|               | When the difference between the motor speed and the command speed is lower than the set value, the switch-speed match signal ( <i>V-CMP</i> ) is output. |         |         |      |                       |              |

In the factory default digital output configuration, the signal is configured as CN129 and 30 pin numbers (Pn614=0x02) by default. Please confirm before use.



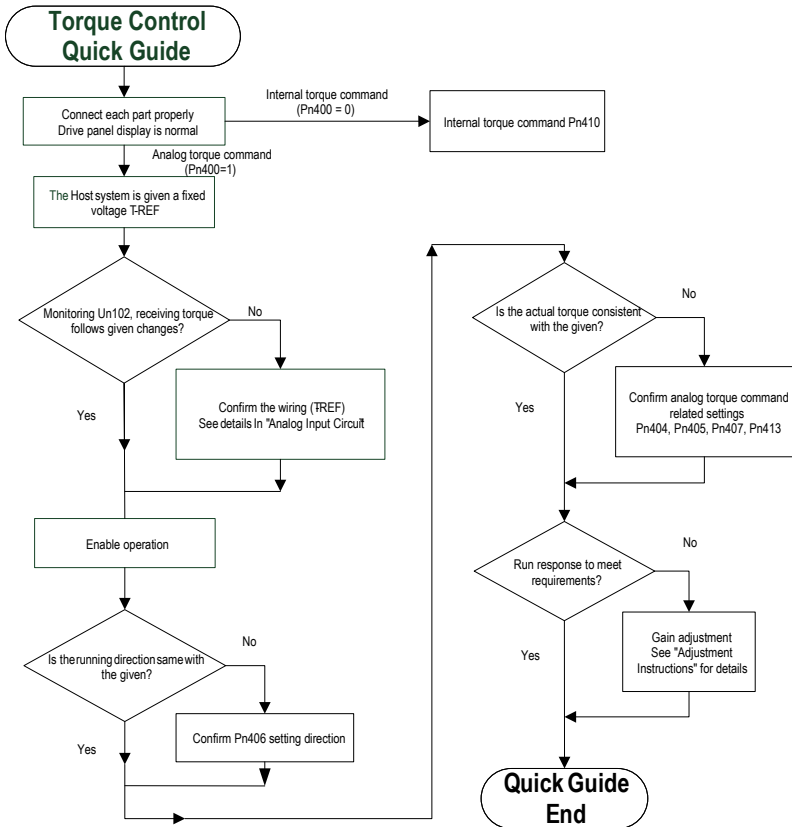
## 2. Wiring of speed-consistent signals

The speed-consistent signal is a universally configurable digital output signal. For details on wiring, see "Sequence Output Circuit".

## 5.4 Torque Mode

Refer to "Connection Example of Torque Control" for details on the wiring related to the torque mode. It is selected by control mode selection (Pn000=2). The torque mode is divided into the internal torque command (Pn400=0) and the analog torque command (Pn400=1, factory default) by the selection of the torque command source.

## 5.4.1 Quick Guide



## 5.4.2 Basic Setting

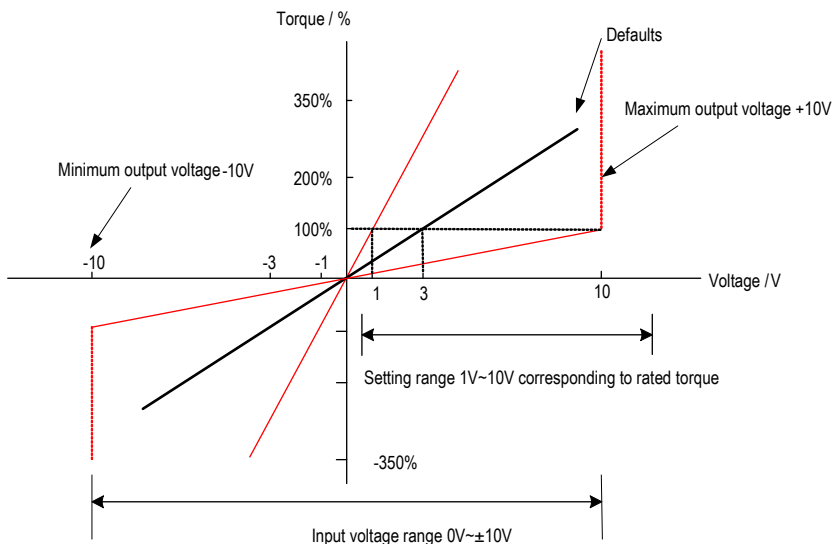
Torque control is the operation method of inputting the torque command to the servo unit and controlling the output of the servo motor through the size of the torque command.

When (torque command selection source)  $pn400 = 0$ , the internal torque command gives the torque, and the torque value is directly set by the parameter  $pn410$ . In this way, the internal torque can be given by writing the address 0x0410 through RS-485. When  $pn400 = 1$ , it is an analog torque command, and the torque command is given according to the voltage connected to t-ref (cn1-9, cn1-10) and the set value of  $pn405$  (analog torque command gain).

| Function code | Parameter                                                                                                                                                                                                                                                                             | Range        | Default | Unit                     | Communication address | When enabled |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|--------------------------|-----------------------|--------------|
| Pn400         | Torque command selection                                                                                                                                                                                                                                                              | 0~1          | 1       | -                        | 0x0400                | Immediately  |
|               | Select the command source of Torque control:<br>0 – Internal setting.<br>1 – Analog setting.                                                                                                                                                                                          |              |         |                          |                       |              |
| Pn404         | Analog torque command filter time                                                                                                                                                                                                                                                     | 0~<br>655.35 | 0.00    | ms                       | 0x0404                | Immediately  |
|               | The parameter is used to smooth the torque command when we apply a delay filter to the analog torque command (T-REF) input, usually it does not need to be changed. If the set value is too large, the responsiveness may decrease. So please set it up as we check the response.     |              |         |                          |                       |              |
| Pn405         | Analog torque command gain                                                                                                                                                                                                                                                            | 10~<br>100   | 30      | 0.1V<br>/Rated<br>Torque | 0x0405                | Immediately  |
|               | This parameter is used to set the analog voltage value (T-REF) required for the rated torque of the servo motor.<br>Note: Do not apply a voltage above -10V~10V. exceeding this range may damage the drive.                                                                           |              |         |                          |                       |              |
| Pn406         | Analog torque command inversion                                                                                                                                                                                                                                                       | 0~1          | 0       | -                        | 0x0406                | Immediately  |
|               | Analog voltage corresponds to the polarity setting of the torque command:<br>0- Positive polarity: Positive voltage corresponds to positive torque command.<br>1- Negative polarity: Positive voltage corresponds to negative torque command.                                         |              |         |                          |                       |              |
| Pn407         | Analog torque command dead-zone range                                                                                                                                                                                                                                                 | 0~3          | 0       | V                        | 0x0407                | Immediately  |
|               | In analog torque control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because a slight deviation occurs in the command inside the servo. This deviation can be eliminated by setting an appropriate analog torque command dead-zone range. |              |         |                          |                       |              |
| Pn410         | Internal torque command in torque control                                                                                                                                                                                                                                             | -500~<br>500 | 0       | %                        | 0x0410                | Immediately  |
|               | Set the internal torque command value during torque control.                                                                                                                                                                                                                          |              |         |                          |                       |              |

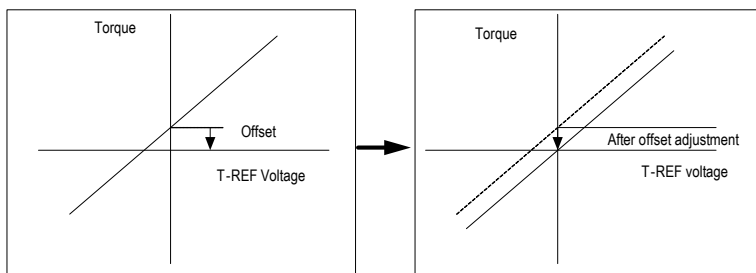
Example:

The factory default parameter Pn405=30 (3V corresponds to the rated torque). If the input voltage at the T-REF terminal is 1.5V, the torque command corresponds to 50%. If 3V is input, the torque command corresponds to 100%.



### 5.4.3 Adjustment of Command Offset

When using torque control, even if the command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the Commands inside the servo unit. This slight deviation is called "offset".



There are two methods of automatic adjustment and manual adjustment of offset adjustment. Automatic adjustment is automatically adjusting the command offset (Fn100) and manual adjustment is manually adjusting using command offset (Fn102). For details, see "Auxiliary Functions".



1. For automatic adjustment, be sure to adjust the command bias amount in the state of servo OFF and the upper computer (PLC, knob, etc.) giving 0v voltage command.
2. When adjusting manually, observe the operation of the motor while adjusting in the state of servo ON.
3. If the factory setting is restored, the offset adjustment value will not be initialized.

## 5.4.4 Speed Limit in Torque Control

A function to limit the speed of the servo motor to protect the machine.

During torque control, the servo motor is controlled to output a given torque command, but the motor speed is not controlled. Therefore, when the input command torque is greater than the load torque, the motor speed will increase significantly. In this case, the speed needs to be limited by this function.

## 5.5 Hybrid Control Mode Selection

The servo unit can combine the two modes from various control modes and switch them. The control mode is selected by Pn000. The following describes the switching method and switching conditions.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Range  | Default | Unit | Communication address | When enabled  |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------|------|-----------------------|---------------|
| Pn000         | Control mode selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 11 | 0       | -    | 0x0000                | After restart |
|               | 4 - Internal speed <-> Analog speed: Switch control mode via ON/OFF of switch /SPD-A and /SPD-B.<br>5 - Internal speed <-> Position mode: Switch control mode via ON/OFF of switch /SPD-A and /SPD-B.<br>6 - Internal speed <-> Torque mode: Switch control mode via ON/OFF of switch /SPD-A and /SPD-B.<br>7 - Position Mode <-> Analog speed: Switch the control mode through ON/OFF of the switch control mode switch (/C-SEL) signal.<br>8 - Position mode <-> Torque mode: Switch the control mode through ON/OFF of the switch control mode switch (/C-SEL) signal.<br>9 - Torque Mode <-> Analog Speed: ON/OFF Switching Control Mode of (C-SEL) Signal Switching Mode.<br>10 - Analog speed <-> Zero function of speed mode: When control speed, zero fixed function can be used.<br>11 - Position Mode <-> Position mode of command pulse disabled: When Control position, command pulse disable function can be used.<br>16 - EtherCAT mode. |        |         |      |                       |               |

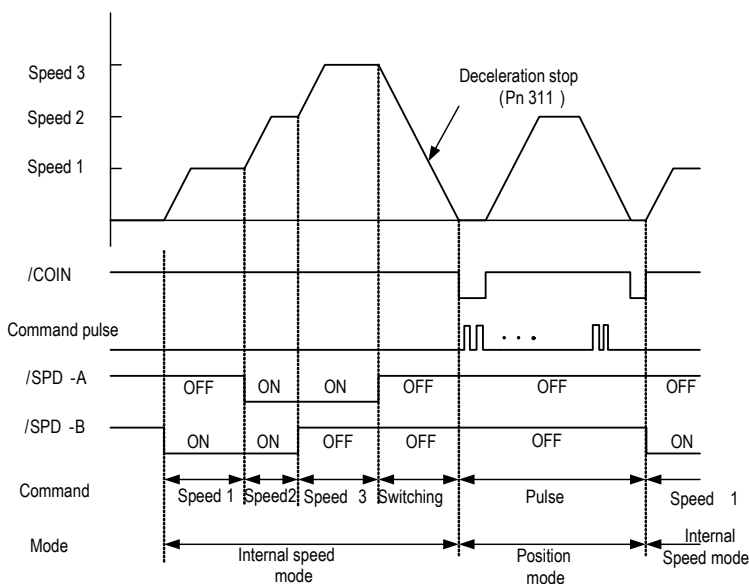
### 1. Internal speed control switching (Pn000 = 4, 5, 6)

- a) The digital input signal distribution mode is internally fixed (Pn600=0). The control mode (second mode) and internal set speed can be switched by the /SPD-A and /SPD-B signals.

| Digital input signal |                 |                 | Speed command positive and negative | Pn000 setting            |               |             |
|----------------------|-----------------|-----------------|-------------------------------------|--------------------------|---------------|-------------|
| /SPD-D (CN1-41)      | /SPD-A (CN1-45) | /SPD-B (CN1-46) |                                     | 4                        | 5             | 6           |
| OFF                  | OFF             | OFF             | Second mode determines              | Analog speed mode        | Position mode | Torque mode |
|                      | OFF             | ON              | Positive                            | Internal speed 1 (Pn304) |               |             |

|    |     |     |                        |                          |               |             |
|----|-----|-----|------------------------|--------------------------|---------------|-------------|
|    | ON  | ON  |                        | Internal speed 2 (Pn305) |               |             |
|    | ON  | OFF |                        | Internal speed 3 (Pn306) |               |             |
| ON | OFF | OFF | Second mode determines | Analog speed mode        | Position mode | Torque mode |
|    | OFF | ON  | Negative               | Internal speed 1 (Pn304) |               |             |
|    | ON  | ON  |                        | Internal speed 2 (Pn305) |               |             |
|    | ON  | OFF |                        | Internal speed 3 (Pn306) |               |             |

No limits for each mode switch. While motor running, speed control, position control or torque control can be switched to internal setting speed control.



Note : The internal speed mode is decelerated during the deceleration time set by Pn311 to stop the motor, then switch to the position mode

b) Digital input signal distribution mode is parameter configuration (Pn600=1 default parameter)

Through the ON/OFF switching control mode of the control mode switching (/C-SEL) signal, the signal is not configured in the factory default Digital input configuration. Therefore, the pin number configuration of the function is performed by parameters Pn601 ~ Pn609 (0x0B).

| Digital input signal                | Pn000 setting       |               |             |
|-------------------------------------|---------------------|---------------|-------------|
| /C-SEL<br>(Parameter configuration) | 4                   | 5             | 6           |
| ON                                  | Analog speed mode   | Position mode | Torque mode |
| OFF                                 | Internal speed mode |               |             |

2. Switch except internal setting speed control (Pn000 = 7, 8, 9)

a) The Digital input signal distribution mode is internally fixed (Pn600=0).

| Digital input signal | Pn000 Setting     |               |                   |
|----------------------|-------------------|---------------|-------------------|
| /C-SEL (CN1-41)      | 7                 | 8             | 9                 |
| ON                   | Analog speed mode | Torque mode   | Analog speed mode |
| OFF                  | Position mode     | Position mode | Torque mode       |

b) Digital input signal distribution mode is parameter configuration (Pn600=1 default parameter).

| Digital input signal                | Pn000 Setting     |               |                   |
|-------------------------------------|-------------------|---------------|-------------------|
| /C-SEL<br>(Parameter configuration) | 7                 | 8             | 9                 |
| ON                                  | Analog speed mode | Torque mode   | Analog speed mode |
| OFF                                 | Position mode     | Position mode | Torque mode       |

3. Internal setting speed control switching (Pn000 = 10, 11)

a) The digital input signal distribution mode is internally fixed (Pn600=0).

| Digital input signal | Pn000 setting                       |                                                   |
|----------------------|-------------------------------------|---------------------------------------------------|
| /C-SEL<br>(CN1-41)   | 10                                  | 11                                                |
| ON                   | Speed mode with zero fixed function | Position mode with command pulse inhibit function |
| OFF                  | Speed mode                          | Position control                                  |

b) Digital signal distribution mode is parameter configuration (Pn600=1 default parameter).

| Digital input signal                     |     | Pn000 Setting                               |                                                      |
|------------------------------------------|-----|---------------------------------------------|------------------------------------------------------|
|                                          |     | 10                                          | 11                                                   |
| /ZCLAMP<br>(parameter<br>configuration)  | ON  | Speed mode with zero fixed function<br>(*1) | -                                                    |
|                                          | OFF | Speed mode                                  | -                                                    |
| /INHIBIT<br>(parameter<br>configuration) | ON  | -                                           | Position mode with command<br>pulse inhibit function |
|                                          | OFF | -                                           | Position control                                     |

\*1: The enabled method of the Digital zero-position clamp signal (/ZCLAMP) must be used in conjunction with the parameters Pn312 and Pn313. Refer to the description of the function code.

## 5.6 Other Output Signals

### 5.6.1 Servo Ready Output Signal

The servo ready output signal (/S-RDY) is a indicate signal that the servo unit can receive servo ON (/S-ON) signals and command signals.

This signal is output under the following conditions:

- The main circuit power is on. For details on the output timing of /S-RDY during power-on, see “Power-up enable ON timing”.
- Non-hardwired base blocking status.
- No alarm occurred.
- When using an absolute encoder, the SEN signal turns ON (H level).

1) Parameter configuration of servo-ready

In the factory default digital output configuration, the signal is configured as CN1 25, 26 pin (Pn613=0x00) by default. Please confirm before use.

2) Wiring of servo ready

The servo ready signal is a general configurable Digital output. See “Sequence Output Circuit” for wiring details.

### 5.6.2 Warning Output Signal

The warning output signal (/WARN) is a warning function before the alarm, which makes it easier for the host device to judge the operation of the servo unit in advance. For detailed warning code, please refer to “Warning Code”.

1) Configuration of warning output signals

This signal is not configured in the factory default Digital output configuration. The pin number

configuration (0x07 / 0x107) needs to be performed by parameters Pn613 ~ Pn615.

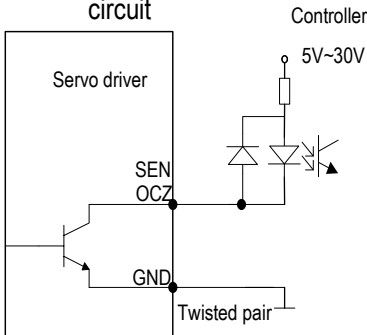
## 2) Polarity setting of warning output signals

The polarity of servo warning detection can be changed by setting the Digital output configuration as 0x07 / 0x107.

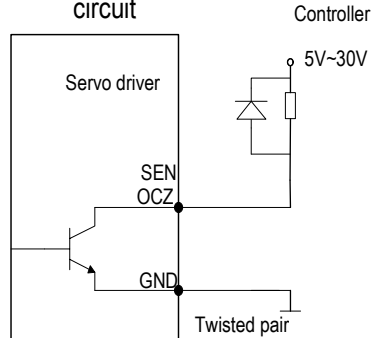
## 3) Wiring of warning output signal

The warning output signal is a general configurable Digital output signal. See “sequence control output circuit” for wiring details.

Example of optocoupler circuit

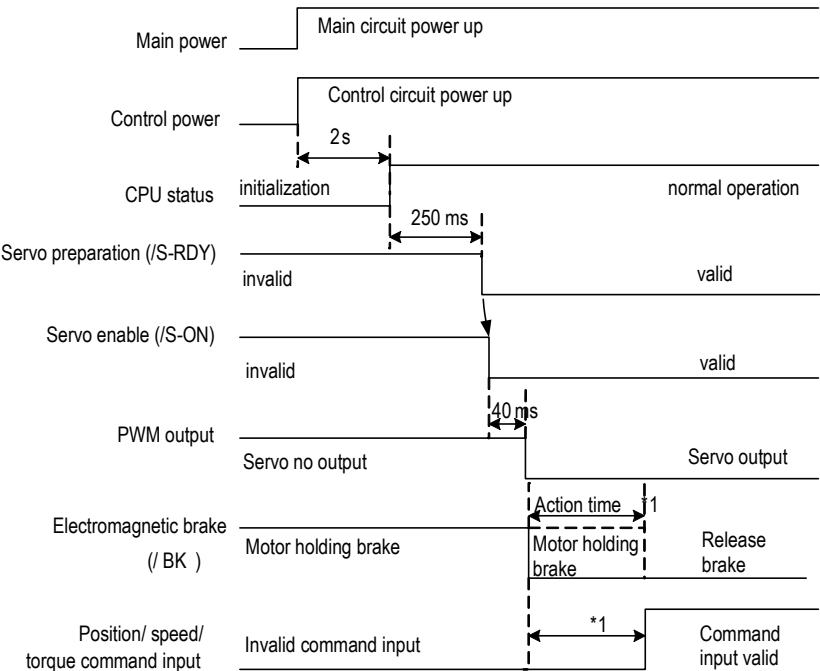


Example of relay circuit



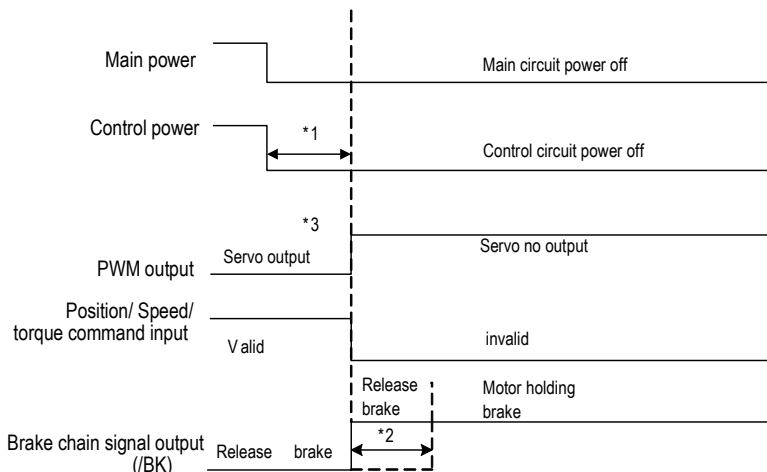
# 5.7 Timing Sequence

## 5.7.1 Power Enable ON Timing sequence



1: There is a delay in the electromagnetic brake operation. The operation time varies depending on the type of brake . It is recommended to be more than 100ms to ensure that the electromagnetic brake is completely released when the command is input. This time can be omitted when motor is not braked .

## 5.7.2 Power-Off Enable OFF Timing Sequence



1. Undervoltage fault occurs when the control power supply voltage drops below 170V/350V (220V series, 400V series.).
2. Output from /BK to the actual brake of the motor. The time varies depending on the type of the brake. See " Electromagnetic brake" for the timing of the /BK signal when the alarm or enable is OFF.
3. For the vertical axis, when the enable is ON, the power is off, the motor brake may not be completed, and the machine may move.

## 5.8 Full Closed Loop Control

### 5.8.1 What Is a Fully Closed Loop System

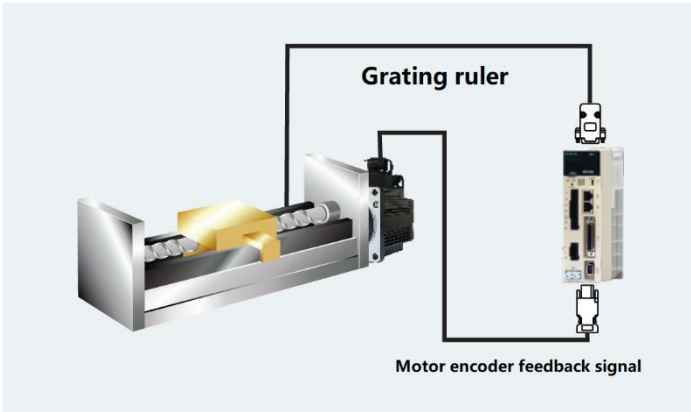
The full closed-loop system is a system that uses external position feedback device (external encoder or grating ruler, etc.) to detect the actual machine position of the controlled object and feed back the actual machine position information to the servo unit. Because the actual machine position is directly fed back to the driver, high-precision positioning control can be realized.

The full closed-loop servo system can eliminate the error caused by mechanical transmission mechanism, while the semi closed-loop servo system can only compensate part of the error. Therefore, the accuracy of the semi-closed-loop servo system is lower than that of the full closed-loop system. Because of the position detection device, the position control accuracy of the closed-loop feed system mainly depends on the resolution and accuracy of the detection device (grating ruler, etc.) after other factors are determined.

The structure of the full closed-loop and semi closed-loop servo system is more complicated than

that of the open-loop feed system because of the position detection device. In addition, because the mechanical transmission mechanism is partially or completely included in the system, the natural frequency, damping and clearance of the mechanical transmission mechanism will become unstable factors of the system. Therefore, the design and debugging of the closed-loop and semi closed-loop systems are more difficult than those of the open-loop systems.

The system structure is as follows:



1. The gain adjusted in the semi closed loop mode may not be applicable in the full closed loop mode, so after the completion of adjustment in the semi closed loop mode switch to the fully closed loop mode need to re-optimize the gain parameters, so that the machinery and equipment to achieve good operating conditions.

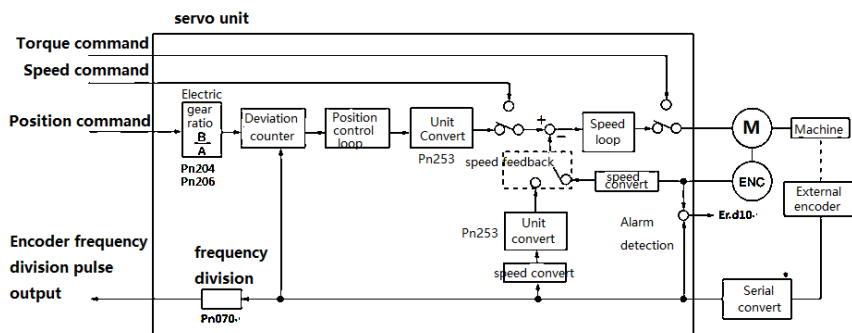
2. To use the full closed loop function must first make the system in the semi closed loop mode to run normally before switching to full closed loop mode for commissioning.

### 5.8.2 Parameter Setting of Full Closed-Loop Control

| Parameters      | Setting content                                                                            | Position control | Speed control | Torque control | Chapter |
|-----------------|--------------------------------------------------------------------------------------------|------------------|---------------|----------------|---------|
| Pn002           | Motor rotation direction selection                                                         | ○                | ○             | ○              | 3.2     |
| Pn250           | Application of external encoder in full closed loop control                                | ○                | ○             | ○              | 3.2     |
| Pn253           | Resolution of external grating ruler                                                       | ○                | ○             | ○              | 3.3     |
| Pn204/<br>Pn206 | Electronic gear ratio numerator / denominator                                              | ○                | —             | —              | 3.5     |
| Pn252           | The deviation coefficient between the load of the motor with one full closed-loop rotation | ○                | —             | —              | 3.6     |

|       |                                                       |   |   |   |     |
|-------|-------------------------------------------------------|---|---|---|-----|
| Pn257 | Setting of excessive deviation between motor and load | ○ | — | — | 3.6 |
|-------|-------------------------------------------------------|---|---|---|-----|

### 5.8.3 Control Block Diagram of Full Closed Loop Control



### 5.8.4 Setting of Motor Rotation Direction And Machine Moving Direction

When setting motor rotation direction and machine moving direction for full closed-loop control, pn002 (rotation direction selection) and PN250 (use method of external encoder in full closed-loop control) must be set at the same time.

| Parameter                           |   |                          | Pn250 Application of external encoder in full closed loop control |                 |             |                 |
|-------------------------------------|---|--------------------------|-------------------------------------------------------------------|-----------------|-------------|-----------------|
|                                     |   |                          | 1                                                                 |                 | 3           |                 |
| Pn002<br>(Motor rotation direction) | 0 | Command direction        | FWD command                                                       | Reverse command | FWD command | Reverse command |
|                                     |   | Motor rotation direction | CCW                                                               | CW              | CCW         | CW              |
|                                     |   | External encoder         | FWD move                                                          | REV move        | REV move    | FWD move        |
|                                     | 1 | Command direction        | FWD command                                                       | Reverse command | FWD command | Reverse command |
|                                     |   | Motor rotation direction | CW                                                                | CCW             | CW          | CCW             |
|                                     |   | External encoder         | REV move                                                          | FWD move        | FWD move    | REV move        |

- The frequency division pulse is independent of the setting of pn002, and becomes B-phase lead for forward rotation command.
- FWD direction: the direction in which the pulse count is positive.
- REV direction: pulse counting is the direction of counting down.

## Related parameters

### ◆ Pn002 Motor rotation direction selection

Facing the motor end face: 0 - Counter-clockwise direction is FWD, 1 - Clockwise direction is FWD.

### ◆ Pn250 Application of external encoder in full closed loop control

Set Pn250 = 1 or Pn250 = 3 in full closed-loop control.

| Parameters |                | Name                                                        | Definition                        | Effect time   | Variety |
|------------|----------------|-------------------------------------------------------------|-----------------------------------|---------------|---------|
| Pn250      | 0<br>(default) | Application of external encoder in full closed loop control | Not use full closed-loop control  | After restart | Set     |
|            | 1              |                                                             | Use in standard running direction |               |         |
|            | 2              |                                                             | Backup                            |               |         |
|            | 3              |                                                             | Use in reverse running direction  |               |         |

**Supplementary notes:** please confirm the setting value of PN250 according to the following points:

- (1) Set PN250 = 1, which is used in the standard running direction.
- (2) Manually rotate the motor shaft along the CCW direction.
- (3) When the full closed-loop feedback pulse counter counts positively (Un012), or the servo monitoring parameter Un007 (feedback pulse counter) and Un012 (external encoder feedback pulse counter) change in the same direction, the setting of PN250 remains unchanged (Pn250 = 1).
- (4) When the full closed loop feedback pulse counter counts down, or if the servo monitoring parameter Un007 (feedback pulse counter) and Un012 (external encoder feedback pulse counter) change in different directions, Pn250 = 3.

## 5.8.5 Resolution of External Grating Ruler

Through pn253, the pitch value of the external encoder grating ruler is set by pn253, which is also called the resolution of grating ruler.

**For example:**

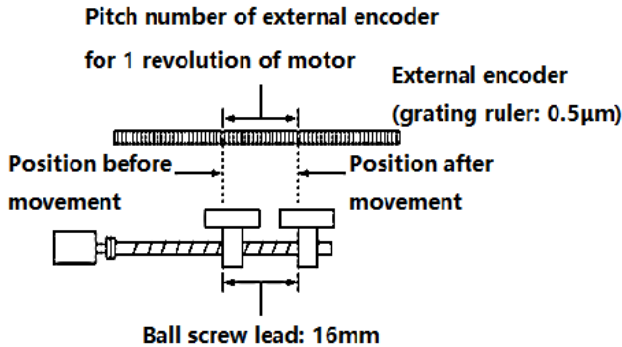
**[parameters]**

Pitch of grating ruler of external encoder: 0.5μM.

Ball screw lead: 16mm.

If the motor is not directly connected through the reduction mechanism.

Then 16mm / 0.0005mm = 32000, so the setting value is "32000".



(Note)1. When the mantissa appears, please round the number after the decimal point.

2. When the pitch value of the external encoder grating ruler with motor rotation for 1 turn is not an integer, relative to the position loop gain (KP), feedforward, position command speed, monitoring as the state of containing error. But it has nothing to do with the position loop, so it will not affect the position accuracy.

#### Related parameter

| Function code                                                                                                 | Parameter                            | Range     | Default | Unit    | Communication address | When enabled  |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------|---------|---------|-----------------------|---------------|
| Pn253                                                                                                         | Resolution of external grating ruler | 4~1048576 | 32768   | Pulse/r | 0x0253                | After Restart |
| Set the pitch value (feedback pulse number) of external grating ruler when the motor shaft rotates for 1 turn |                                      |           |         |         |                       |               |

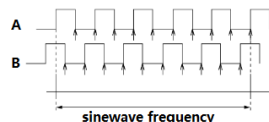
### 5.8.6 Setting of Frequency Division Pulse Output Signal of Grating Ruler / Encoder

Set the frequency division output of external position to pn070. The set value should input A, B phase edge values.

Pitch of grating ruler of external encoder: 16mm.

Ball screw lead: 16mm.

Speed: 160mm/s.



The setting value is "4000" when the output is 1 μm with 1 pulse (4 times of increasing value).

The setting value is "8000" when the output is 0.5 μm with 1 pulse (4 times of increasing value).

When the setting is "20", the output waveform of encoder frequency division pulse is shown in the "above figure".

The upper frequency limit value of encoder signal output is 4Mpps (4 times of increasing value), so

the setting value should not exceed 4Mpps. If the upper limit value is exceeded, A.511 (frequency division pulse output over speed alarm) will be output.

When setting value is “4000”, and speed is 1600mm/s,  
= 1600000 = 4Mpps,  
1.6Mpps < 4Mpps, so it can use this setting value.

5.8.7 Setting of Electronic Gear

The setting range of the electronic gear ratio is as follows:

$0.001 \leq \text{electronic gear ratio (B/A)} \leq 16778.$

When the setting range is exceeded, ER.040 (parameter setting abnormal alarm) will occur.

| Function code | Parameter                           | Range        | Default | Unit | Communication address | When enabled  |
|---------------|-------------------------------------|--------------|---------|------|-----------------------|---------------|
| Pn204         | Electronic gear ratio (molecular)   | 0~1073741824 | 64      | 1    | 0x006/0x207           | After restart |
| Pn206         | Electronic gear ratio (denominator) | 0~1073741824 | 1       | 1    | 0x008/0x09            | After restart |

Calculation method of electronic gear ratio setting value

◆Semi closed-loop control

When the machine deceleration ratio of motor shaft and load side is n / M (when the motor rotates m turns, the load shaft rotates n turns), the setting value of electronic gear ratio can be obtained as following formula.

Electric gear ratio

==x =

Encoder resolution

The encoder resolution can be confirmed by the servo motor model. The suffix D1 or D2 is 23 bit encoder, the suffix is Q1, Q2, R1, R2 is 17 bit encoder, the suffix is E1, E2 is 24 bit encoder.

◆Full closed-loop control

Electric gear ratio

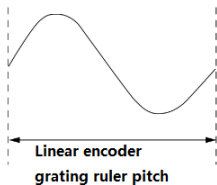
==  
=

Supplementary Notes

About resolution

The resolution used in the servo unit (the movement of 1 feedback pulse) can be obtained as following formula:

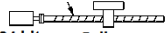
The servo unit controls the servo motor in the unit of feedback pulse.



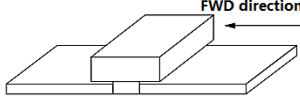
The grating ruler pitch of linear encoder = 1 cycle distance of analog voltage feedback signal sent by linear encoder.

The lead of screw rod is 16mm and the transmission ratio is 1:1 (direct connection).

Semi closed-loop mode:

| Steps | Contents                                                    | Mechanical composition                                                                                                                                                                                   |
|-------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                                                             | <div>Command unit: 0.0005mm</div> <div>load shaft</div> <div></div> <div>24 bit encoder      Ball screw lead:16mm</div> |
| 1     | Number of motor encoder lines                               | 24bit encoder lines number 16777216                                                                                                                                                                      |
| 2     | The number of pulses required for one turn of the screw rod | The command unit is 0.0005mm (0.5 μm), and the number of pulses is 32000                                                                                                                                 |
| 3     | Electronic gear ratio                                       | =                                                                                                                                                                                                        |
| 4     | Parameter                                                   | Pn204=16777216, Pn206=32000                                                                                                                                                                              |

### Full closed-loop mode:

| Steps | Contents                             | Mechanical composition                                                            |
|-------|--------------------------------------|-----------------------------------------------------------------------------------|
|       |                                      |  |
| 1     | Grating resolution of linear encoder | 0.0005mm (0.5μm)                                                                  |
| 2     | Command unit                         | 0.0005mm (0.5μm)                                                                  |
| 3     | Electronic gear ratio                | = =                                                                               |
| 4     | Parameter                            | Pn204=1, Pn206=1                                                                  |

### 5.8.8 Setting of alarm detection

The alarm detection settings (Pn252, Pn257) are shown below.

The setting of detection value excessive deviation between motor and load position (pn257) is the difference between motor encoder feedback (position) and full closed-loop external encoder feedback (load position). If the set value is exceeded, output=Er.d10 (alarm of excessive deviation between motor and load position).

| Pn257 | Detection value of excessive deviation between motor and load position (Position mode). |                |         |                |         |
|-------|-----------------------------------------------------------------------------------------|----------------|---------|----------------|---------|
|       | Setting range                                                                           | Setting unit   | Default | Effective time | Variety |
|       | 0 ~<br>1073741824                                                                       | 1 Command unit | 1000    | Immediately    | Setting |

(Note) when set to "0", Er.d 10 is not output.

### Setting of deviation coefficient (Pn252) between motor loads when full closed-loop rotation 1 turn.

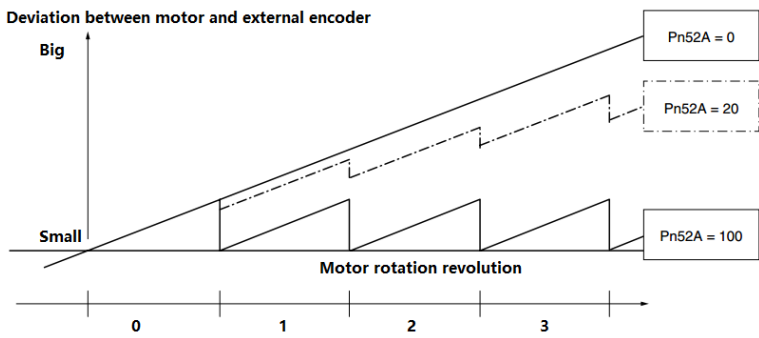
Set the "coefficient of deviation between motor and external encoder" when the motor rotates for 1 turn. It can be used to prevent out of control caused by damage of external encoder, or to detect "sliding" in belt mechanism.

#### ◆Setting Case

When the sliding rate of the belt is large or seriously twisted, please increase the value.

If the setting value is “0”, the value of the external encoder is read directly.

When the factory setting value is “20”, the second turn starts from the deviation after 1 revolution of the motor multiplied by 0.8.



◆Related parameter

|       |                                                                                                           |              |         |                |         |
|-------|-----------------------------------------------------------------------------------------------------------|--------------|---------|----------------|---------|
| Pn252 | Deviation coefficient between motor and external encoder for one full closed-loop rotation (Postion mode) |              |         |                |         |
|       | Setting range                                                                                             | Setting unit | Default | Effective time | Variety |
|       | 0 ~ 100                                                                                                   | 1%           | 20      | Immediately    | Setting |

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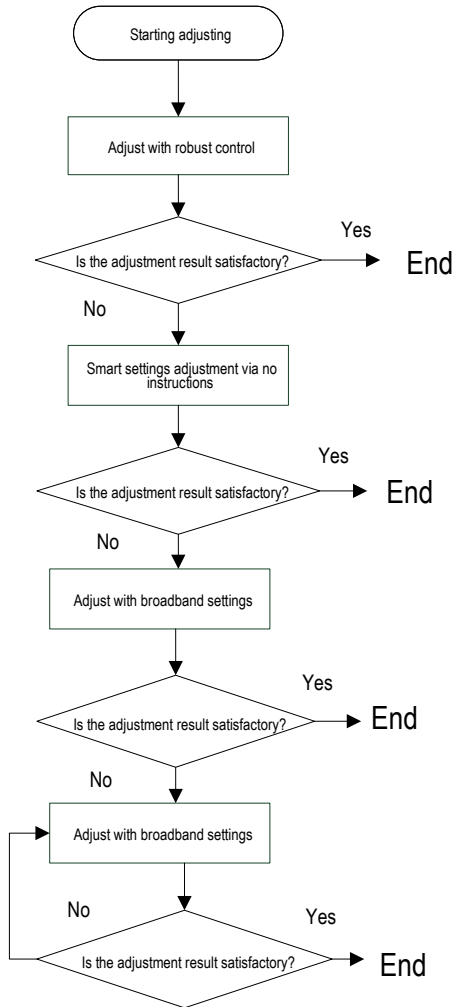
## 6 Adjustment

### 6.1 Adjustments

#### 6.1.1 Adjustments Steps

Adjustments refer to optimize the function of responsiveness by adjusting the servo unit's servo gain. Servo gain is set by the combinations of many parameters, including speed circle gain, position circle gain, filter, friction compensation, rotation inertia and so on. These parameters would influence with each other, so you must take the balance among all parameters into the consideration while setting. The factory settings of the servo gain are stable settings. Use all the adjusting functions according to the users' mechanical conditions in order to improve the responsiveness.

The following figure is basic adjustment procedure flow chart; please adjust the machine according to the status and operating conditions of the machine.



### 6.1.2 Safety Precautions When Adjusting

When you are making adjustments, please set the servopack protection functions shown below under appropriate conditions.

- 1) Set the overtravel

Please set the overtravel and you could refer to the servo enable and overtravel setting if you want more details.

---

## 2) The settings of the torque limit

The torque limit function is about calculate the torque that mechanical motions need in order to make sure that the torque is not greater than this troque limit value. If the torque is set below the value required for operation, overshoot or vibration may occur.

See more details in the “torque limit”.

## 3) Set excessive position deviation alarm value

The excessive position deviation alarm is an effective protection function when we are using servo unit for position control.

When the motor operation does not match the command, you can detect the abnormal condition and stop the motor by setting an appropriate position deviation alarm.

The position deviation is the difference between the position command value and the actual position.

The position deviation can be expressed by the relationship between the following position loop gain (Pn103) and motor speed.

When the acceleration/deceleration of the position command exceeds the tracking ability of the motor, the follow-up hysteresis will become large, resulting in the positional deviation not satisfying the above relation. Please reduce the acceleration and deceleration of the position command to the value that can be tracked by the motor or increase the value of the excessive position error alarm.

## 4) Set the vibration detection function

Please initialize (Fn105) the detection value detected by the vibration and set an appropriate value for the vibration detection function. For details, refer to the corresponding “Accessibility”.

## 5) Set excessive position deviation alarm value when servo is ON

If the servo is turned ON while the position deviation is accumulated, the motor will return to the original position to make the position deviation “0”and avoid causing a danger. In order to avoid this kind of situation, you can set an excessive position deviation alarm value when the servo is turned on to restrict the operation.

# 6.2 Robust Control

In factory default, the robust control function is valid. When resonance and vibration occur, please change the attune value and load value via Fn301 or set Pn177 and Pn178.

## 6.2.1 Summary

Robust function could get stable response through adjusting the whole system automatically no matter what kind of mechanism or fluctuation of load.

| Function code | Parameter | Range | Default | Unit | Communication address | When enabled |
|---------------|-----------|-------|---------|------|-----------------------|--------------|
|---------------|-----------|-------|---------|------|-----------------------|--------------|

|       |                                                                                                                                                                                                                                              |             |      |    |        |               |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|----|--------|---------------|
| Pn175 | Robust control selection                                                                                                                                                                                                                     | 0x00 ~ 0x01 | 1    | —  | 0x0175 | After restart |
|       | Set the robust control function switch:<br>0-invalid                      1-valid                                                                                                                                                            |             |      |    |        |               |
| Pn177 | Robust control tuning value                                                                                                                                                                                                                  | 10 ~ 80     | 40.0 | Hz | 0x0177 | Immediately   |
|       | Set a greater robust control gain tuning value, systematic response gets faster, but system overshoot and excessive noise may occur.                                                                                                         |             |      |    |        |               |
| Pn178 | The minimum value of robust control                                                                                                                                                                                                          | 0 ~ 500     | 0    | %  | 0x0178 | Immediately   |
|       | Set a greater load ratio of robust control, systematic response gets faster, but the systematic excessive noise may occur, and we could increase this value in order to decrease the over-adjustment and overshoot when torque is excessive. |             |      |    |        |               |

Robust control function is valid in position control or speed control and invalid in torque control. When robust control is valid, some of the control functions of below table would be restrained.

| Function name                                    | Operation | Executable conditions and notes                                                              |
|--------------------------------------------------|-----------|----------------------------------------------------------------------------------------------|
| Vibration detection value initialization (Fn105) | Yes       | Robust control is invalid in operation, and it turns to be valid when the operation is over. |
| Bandwidth setting (Fn303)                        | No        |                                                                                              |
| EasyFFT (Fn401)                                  | Yes       | Robust control is invalid in operation, and it turns to be valid when the operation is over. |
| Gain shift                                       | No        |                                                                                              |
| Inertia recognition                              | Yes       | Robust control is invalid in operation, and it turns to be valid when the operation is over. |
| Mechanical analysis                              | Yes       | Robust control is invalid in operation, and it turns to be valid when the operation is over. |

Which parameters become invalid when robust control function are valid.

When we set robust control function valid in factory default, the Pn100, Pn101, Pn102, Pn103, Pn105, Pn106, Pn107, Pn140, Pn110, Pn170 are invalid.

## 6.2.2 Operating Procedure

Robust control function could be set via the auxiliary function Fn301 on panel operator and more details on “Auxiliary function”, or we could set relevant parameters via “parameters setting”.



Before operating the robust control function, please confirm the setting below, if not, it will display /NO- OP in operation:

1. Robust control function is valid (Pn175=1).
2. No motor debugging function is invalid (Pn730=0).

6

In robust control, due to the increase of the tuning value, the system may cause resonance noise. It

can choose whether automatic setting by Pn151 (Notch filter 2 automatic adjustment selection). The factory default is “Auto-tuning”. Only when the corresponding notch function is not needed, it is set to “Auto-adjust without auxiliary function”.

| Function code | Parameter                                                                                             | Range       | Default | Unit | Communication address | When enabled |
|---------------|-------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|--------------|
| Pn151         | Notch filter 2 automatic adjustment selection                                                         | 0x00 ~ 0x01 | 1       | —    | 0x0151                | Immediately  |
|               | 0-No automatic adjustment via auxiliary functions.<br>1-Automatic adjustment via auxiliary functions. |             |         |      |                       |              |

## 6.2.4 Related Parameters

The parameters need to be set are shown as below when operating robust control function:

| Parameter | Name                          |
|-----------|-------------------------------|
| Pn175     | Robust switch                 |
| Pn104     | First torque command filter   |
| Pn156     | Second notch filter frequency |
| Pn157     | Second notch filter Q value   |

---

## 6.3 Inertia Identification

### 6.3.1 Summary

“Inertia identification” means that the servo unit performs automatic operation (forward and reverse reciprocating motion) without issuing commands from the host device, and the load rotary inertia is recognized during operation.

The rotary inertia ratio (ratio of load rotary inertia to motor rotor inertia) is the reference parameter for performing the gain adjustment, and the correct value must be set.

The load rotary inertia can be calculated based on the weight and composition of each part of the mechanism, but the operation is very complex. With this function, after the motor is driven several times in the positive/negative direction, a high-precision load rotary inertia can be obtained.

The motor operates according to the following operating specifications.

- Maximum speed:  $\pm 1000\text{min}^{-1}$  (changeable)
- Acceleration:  $\pm 20000\text{min}^{-1}/\text{s}$  (changeable)
- Travel distance: Maximum  $\pm 2.5$  turns (changeable)

### 6.3.2 Steps

The inertia recognition function can only be identified by the PC debugging software “VCSDsoft”. Inertia identification steps refer to “Host device debugging related”- “Inertia identification”.

### 6.3.3 Additional Notes

- When identifying the inertia, please make sure that the system can operate the range and set the operating conditions reasonably according to the operable range. Under different operating conditions, the recognition result may have minor deviations.
- If the servo torque limit is set too small, the result of inertia identification may be affected, resulting in discrepancy between the identification result and the actual inertia. Please confirm before identification.
- After inertia identification, after changing the inertia ratio (Pn100), the original gain-related parameters of the servo system need to be re-adjusted, otherwise vibration and noise may occur.
- Write operation is required after inertia identification, otherwise the inertia identification result is invalid.

---

## 6.4 Intelligent Setting

### 6.4.1 Summary

Users can choose intelligent setting with command input and no command input:

- 1) No command input (When there is no pulse from the controller)

It means the function of automatically adjusting the servo unit according to the mechanical characteristics when the automatic operation (forward and reverse reciprocating motions) is performed within the set range. Intelligent settings can be performed without connection to the control system.

The automatic operation is as follows:

- Highest speed: motor rated speed
  - Acceleration torque: motor rated torque about 100%
  - Move distance: can be set arbitrarily. The factory setting is equivalent to 3 turns of the motor
- 2) Command input (When a controller sends pulses)

It is the method of automatically adjusting the running command from the host control system.

The command intelligent setting can also be used for additional adjustments after the no-command intelligent setting. When the correct inertia ratio is set, no-command intelligent setting can be omitted, and only the intelligent setting operation with Commands is performed.



The command smart setting starts with the present speed loop gain (Pn101) as a reference. If vibration occurs at the start of the adjustment, correct adjustment cannot be performed. In this case, pls decrease the speed loop gain (Pn101) until the vibration disappears, and then readjust.

The intelligent setting process adjusts the following items:

- Rotary inertia ratio (No command intelligent setting)
- Gain adjustment (speed loop gain, position loop gain, etc.)
- Filter adjustment (torque command filter, notch filter)
- Friction compensation
- IF suppression control (intermediate frequency)
- Vibration suppression
- Low-frequency vibration suppression (only when Mode = 2 or 3) (No command intelligent setting)

## 6.4.2 Steps

The intelligent setting function cannot be set by the panel keyboard, and it needs to cooperate with the PC debugging software to perform related operations. No command intelligent setting is slightly different from the related operation of the command intelligent setting. For detailed steps, see "host computer operation instructions" - "Intelligent setting".

### 1) Confirmation before execution

Before perform intelligent settings, be sure to confirm the following settings. If set incorrectly, this function cannot be performed during operation.

- No overtravel has occurred
- Not torque control
- Gain switching selection switch is manual gain switching (Pn110 = 0) and is the first gain
- No motor test function is invalid (Pn730 = 0)
- No alarm or warning occurred
- Robust control function is invalid (Pn175 = 0)



1. When executing intelligent setting without command in speed control state, it will automatically switch to position control to execute adjustment, and return to speed control after adjustment.
2. The intelligent setting with command cannot be executed in the torque control state.
3. In the process of intelligent setting, the command pulse input multiplier switching function will become invalid.

### 2) Failed to perform adjustment or adjustment failed example

In the following occasions, intelligent settings will not be performed properly. Please use the bandwidth setting (see "Bandwidth setting" for details):

- The motor is power ON (servo ON) in position control (with command intelligent setting)
- When the mechanical system can only run in one direction
- The scope of activities is narrow, below 0.5 round
- When the rotary inertia changes within the set operating range
- When the mechanical dynamic friction is large
- The mechanical rigidity is low and vibration occurs during positioning
- When P (proportional) control is selected, "Load inertia moment measurement" is selected, In the process of rotary inertial identification, or when switching to P control through P/CON signal
- When using the mode switch, when "Load moment of inertia measurement" is selected, the mode switch function becomes invalid during the moment of inertia identification and becomes PI control. The mode switch function becomes valid again after the rotary

inertia identification is completed

- When speed feed forward and torque feed forward are input
- When the positioning complete width (Pn262) is small



1. When there is no command for intelligent setting, please change the adjustment mode and adjust with bandwidth setting or robust control when the adjustment fails for variable inertia load.  
2. For intelligent setting, please set "Electronic gear ratio (Pn204/Pn206)" and "Positioning completion range (Pn262)" are set to the actual operating values. Otherwise, the adjustment may fail or the adjustment result may not match the actual operation result.

### 6.4.3 Additional Notes

#### 1) Vibration suppression function

Before the intelligent setting, you can set whether the related vibration suppression function is automatically set. The factory default is automatically set, please set the corresponding function switch to "Do not adjust automatically" before you want to change the value of the intelligent setting.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Range       | Default | Unit | Communication address | When enabled |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|--------------|
| Pn140         | IF suppression control options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0x00 ~ 0x11 | 0x0010  | —    | 0x0140                | Immediately  |
|               | The IF (intermediate frequency) suppression control function can effectively suppress the continuous vibration of about 100Hz ~ 1000 Hz that occurs when the control gain is increased.<br>0x1#: Automatically set IF vibration suppression frequency through intelligent setting and bandwidth setting.<br>0x0#: Not set automatically through intelligent setting and bandwidth setting, only manual setting.<br>0x#1: IF suppression frequency setting is valid.<br>0x#0: IF suppression frequency setting is invalid. |             |         |      |                       |              |
| Pn150         | Notch filter 1 automatic adjustment selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0x00 ~ 0x01 | 1       | —    | 0x0150                | Immediately  |
|               | 0- Automatic adjustment without auxiliary functions.<br>1- Automatic adjustment through auxiliary functions.                                                                                                                                                                                                                                                                                                                                                                                                              |             |         |      |                       |              |
| Pn151         | Notch filter 2 automatic adjustment selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0x00 ~ 0x01 | 1       | —    | 0x0151                | Immediately  |
|               | 0- Automatic adjustment without auxiliary functions.<br>1- Automatic adjustment through auxiliary functions.                                                                                                                                                                                                                                                                                                                                                                                                              |             |         |      |                       |              |

|       |                                                                                                                                                                                                                                                                                                                                                                      |             |   |   |        |             |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---|---|--------|-------------|
| Pn231 | Low frequency vibration suppression function automatic adjustment selection                                                                                                                                                                                                                                                                                          | 0x00 ~ 0x01 | 1 | — | 0x0231 | Immediately |
|       | This parameter is set to select whether low-frequency vibration suppression is automatically set under the auxiliary functions such as intelligent setting and bandwidth setting:<br>0 - Vibration suppression function is not automatically adjusted by auxiliary functions.<br>1- Vibration suppression function is automatically adjusted by auxiliary functions. |             |   |   |        |             |

## 2) Feed forward function

In the factory setting mode, when the tuning mode is executed by “2”, “3”, “feedforward command (Pn109)”, “speed feedforward (VREF) input”, and “torque feedforward (T-REF) input” will become invalid.

According to the system configuration, if you want to use “Speed feedback (V-REF) input”, “Torque feedforward (T-REF) input” and model tracking control from the upper device at the same time, set Pn249 = 1.



When using model tracking control with this function, the model tracking control sets the optimal feedforward inside the servo. Therefore, the "velocity feedforward (V- REF) input" and "torque feedforward (T- REF) input" from the upper unit are usually not used simultaneously. If the input feedforward is incorrect, it may cause overshoot, but please note that it can be used as necessary.

## 6.4.4 Related Parameters

The parameters that may be changed when executing the intelligent setting function are as follows:

| Parameter | Name                                                                |
|-----------|---------------------------------------------------------------------|
| Pn100     | Rotary inertia ratio                                                |
| Pn101     | First speed gain                                                    |
| Pn102     | First speed integral time constant                                  |
| Pn103     | First position gain                                                 |
| Pn104     | First torque command filter                                         |
| Pn140     | Intermediate frequency (IF) vibration suppression control selection |
| Pn141     | IFvibration suppression inertia modification                        |
| Pn142     | IF suppression frequency                                            |
| Pn143     | IF suppressionattenuation gain                                      |

|       |                                                         |
|-------|---------------------------------------------------------|
| Pn153 | Notch filter 1 frequency                                |
| Pn154 | Notch filter 1 Q value                                  |
| Pn155 | Notch filter 1 depth                                    |
| Pn156 | Notch filter 2 frequency                                |
| Pn157 | Notch Filter 2 Q Value                                  |
| Pn158 | Notch filter 2 depth                                    |
| Pn240 | Model tracking control selection                        |
| Pn241 | Model tracking control gain                             |
| Pn242 | Model tracking control attenuation coefficient          |
| Pn243 | Model tracking control speed feed forward gain          |
| Pn244 | Model tracking control forward torque feed forward gain |
| Pn245 | Model tracking control reverse torque feed forward gain |

## 6.5 Bandwidth Setting

### 6.5.1 Profile

The bandwidth setting is a method of inputting a speed command or a position command from the host device, and manually adjusting the running speed.

By adjusting one or two values with the bandwidth setting, the relevant servo gain setting can be automatically adjusted.

The bandwidth setting adjusts the following items:

- Gain adjustment (speed loop gain, position loop gain, etc.)
- Filter adjustment (torque command filter, notch filter)
- Friction compensation
- IF (intermediate frequency) suppression control
- Low frequency vibration suppression
- Use the bandwidth setting when you cannot achieve satisfactory response characteristics after setting it by intelligent settings. If you want to further fine-tune each servo gain after adjusting the bandwidth setting, see “Manual Adjustment Function” for manual tuning

### 6.5.2 Steps

Before performing bandwidth setting, be sure to confirm the following settings. If it is set incorrectly, “NO-OP” will be displayed in the operation and this function cannot be performed.

- Invalid selection of no motor test function (Pn730 = 0)

- Robust control selection is invalid (Pn175 = 0)
- Tuning mode is set to 0 or 1 when tuning is performed by speed control

The bandwidth setting procedure can be performed by any one of the SERVO Keyboard or PC debugging software. However, the keyboard can only operate when the tuning mode is set to “0-stability” or “1-high response”. For detailed operation procedure, see “7.13 Bandwidth Setting (Fn303)”. When positioning-specific adjustments “2-positioning” and “3-positioning without overshoot” are required, it shall be used with “PC debugging software”.



Please set the bandwidth after the inertia recognition or the intelligent setting of the rotation inertia ratio (Pn100) correctly.

## 6.5.3 Additional Notes

### (1) Vibration suppression function

Before setting the bandwidth, confirm whether the related vibration suppression function is automatically setting. The factory default is automatically setting. Please set the corresponding function switch to “No adjust automatically” before you don’t want to change its value through the bandwidth setting.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Range       | Default | Unit | Communication address | When enabled |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|--------------|
| Pn140         | IF suppression control options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0x00 ~ 0x11 | 0x0010  | —    | 0x0140                | Immediately  |
|               | The IF(intermediate frequency) suppression control function effectively suppresses the continuous vibration of about 100 to 1000 Hz that occurs when the control gain is increased.<br>0x1#: Automatically set IF vibration suppression frequency through intelligent setting and bandwidth setting.<br>0x0#: Not set automatically through intelligent setting and bandwidth setting, only manual setting.<br>0x#1: IF suppression frequency setting valid.<br>0x#0: IF suppression frequency setting invalid. |             |         |      |                       |              |
| Pn150         | Notch filter 1 automatic adjustment selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0x00 ~ 0x01 | 1       | —    | 0x0150                | Immediately  |
|               | 0- Automatic adjustment without auxiliary functions.<br>1- Automatic adjustment through auxiliary functions.                                                                                                                                                                                                                                                                                                                                                                                                    |             |         |      |                       |              |
| Pn151         | Notch filter 2 automatic adjustment selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0x00 ~ 0x01 | 1       | —    | 0x0151                | Immediately  |

|       |                                                                                                                                                                                                                                                                                                                                                                   |             |   |   |        |             |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---|---|--------|-------------|
|       | 0- Automatic adjustment without auxiliary functions.<br>1- Automatic adjustment through auxiliary functions.                                                                                                                                                                                                                                                      |             |   |   |        |             |
| Pn231 | Low frequency vibration suppression function automatic adjustment selection                                                                                                                                                                                                                                                                                       | 0x00 ~ 0x01 | 1 | — | 0x0231 | Immediately |
|       | This parameter is set in the intelligent settings, bandwidth settings and other auxiliary functions under low-frequency vibration suppression is automatically set to choose:<br>0 - Vibration suppression function is not automatically adjusted by auxiliary functions.<br>1 - Vibration suppression function is automatically adjusted by auxiliary functions. |             |   |   |        |             |

## (2) Feed forward function

In the factory setting mode, when excute tuning mode by “2” & “3”, “feedforward command (Pn109)”, “speed feedforward (VREF) input”, and “torque feedforward (T-REF) input” will be invalid.

According to the system configuration, if you want to use “V-REF input”, “Torque feed forward (T-REF) input”, and model tracking control from the host device at the same time, set Pn249 = 1.



When using model tracking control with this function, the model tracking control sets the optimal feedforward inside the servo. Therefore, the “velocity feedforward (V- REF) input” and “torque feedforward (T- REF) input” from the upper unit are usually not used simultaneously. If the input feedforward is incorrect, it may cause overshoot, but please note that it can be used as necessary.

## 6.5.4 Related Parameters

The relevant parameters and parameters that are automatically set when executing the bandwidth setting function are as follows:

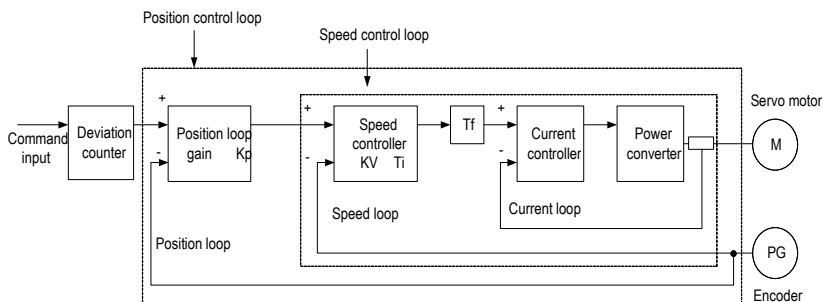
| Parameter | Name                                          |
|-----------|-----------------------------------------------|
| Pn100     | Rotary inertia ratio                          |
| Pn101     | First speed gain                              |
| Pn102     | First speed integral time constant            |
| Pn103     | First position gain                           |
| Pn104     | First torque command filter                   |
| Pn140     | IF vibration suppression control selection    |
| Pn141     | IF vibration suppression inertia modification |
| Pn142     | IF suppression frequency                      |
| Pn143     | IF suppression attenuation gain               |
| Pn153     | Notch filter 1 frequency                      |

|       |                                                         |
|-------|---------------------------------------------------------|
| Pn154 | Notch filter 1 Q value                                  |
| Pn155 | Notch filter 1 depth                                    |
| Pn156 | Notch filter 2 frequency                                |
| Pn157 | Notch Filter 2 Q Value                                  |
| Pn158 | Notch filter 2 depth                                    |
| Pn240 | Model tracking control selection                        |
| Pn241 | Model tracking control gain                             |
| Pn242 | Model tracking control attenuation coefficient          |
| Pn243 | Model tracking control speed feed forward gain          |
| Pn244 | Model tracking control forward torque feed forward gain |
| Pn245 | Model tracking control reverse torque feed forward gain |

## 6.6 Manual Adjustment Function

This function is needed for further individual adjustment requirement after the adjustment of intelligent setting and bandwidth setting.

### 6.6.1 Servo Gain



Please adjust each servo gain one by one after fully understanding the composition and characteristics of the servo units if the servo gain needs to be adjusted manually. In most cases, if one parameter changes significantly, the other parameters must be adjusted again. In order to confirm the response characteristics, preparations must be made to observe the output waveform of the analog monitor using a measuring instrument.

The servo unit consists of three feedback loops (position loop, speed loop, and current loop). The outermost is the position loop and the innermost is the current loop. The more the inner loop, the more it needs to improve the responsiveness. Failure to follow this principle will result in poor responsiveness or vibration.

Since the current loop ensures sufficient responsiveness, the user does not have to make adjustments.

The response characteristics of the servo unit can be adjusted by setting the following servo gains.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                               | Range      | Default | Unit | Communication address | When enabled |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------|------|-----------------------|--------------|
| Pn100         | Moment of inertia ratio                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 20000  | 100     | %    | 0x0100                | Immediately  |
|               | Moment of inertia ratio = load moment of inertia converted by motor shaft / rotor moment of inertia of servo motor *100%.                                                                                                                                                                                                                                                               |            |         |      |                       |              |
| Pn101         | First speed gain                                                                                                                                                                                                                                                                                                                                                                        | 1 ~ 2000   | 40.0    | Hz   | 0x0101                | Immediately  |
|               | Determine the parameters of the speed loop responsiveness. If the response of the speed loop is low, it will become a delay factor of the outer position loop, and overshoot or vibration of the speed command occurs. In the range where the mechanical system does not vibrate, the larger the setting, the more stable the servo system, and the better the responsiveness.          |            |         |      |                       |              |
| Pn102         | First speed integration time constant                                                                                                                                                                                                                                                                                                                                                   | 0.15 ~ 512 | 20.00   | ms   | 0x0102                | Immediately  |
|               | In order to respond to small inputs, the speed loop contains integral elements. Since the integral element is a delay element for the servo system, when the time parameter is set too large, overshoot may occur, or the positioning time may be prolonged, resulting in poor response.                                                                                                |            |         |      |                       |              |
| Pn103         | First position gain                                                                                                                                                                                                                                                                                                                                                                     | 1 ~ 2000   | 40.0    | 1/s  | 0x0103                | Immediately  |
|               | The position loop response is determined by the position loop gain. The higher the setting of the position loop gain, the higher the responsiveness and the shorter the positioning time. The position loop gain cannot be increased beyond the rigidity of the mechanical system. To increase the position loop gain to a larger value, the rigidity of the machine must be increased. |            |         |      |                       |              |
| Pn104         | First torque command filter                                                                                                                                                                                                                                                                                                                                                             | 0 ~ 655.35 | 1.00    | ms   | 0x0104                | Immediately  |
|               | Adjusting the parameters of the torque command filter may eliminate the machine vibration caused by the servo drive. The smaller the value, the better the responsiveness can be controlled. However, the conditions are restricted by the machine conditions.                                                                                                                          |            |         |      |                       |              |
| Pn401         | Torque command second-order low-pass filter cut-off frequency                                                                                                                                                                                                                                                                                                                           | 100 ~ 5000 | 5000    | Hz   | 0x0401                | Immediately  |
|               | Use this parameter to set the cutoff frequency of the second-order torque filter. When this parameter is set to 5000, the function of the filter is invalid.                                                                                                                                                                                                                            |            |         |      |                       |              |
| Pn402         | Torque command second-order low-pass filter Q value                                                                                                                                                                                                                                                                                                                                     | 0.5 ~ 1    | 0.50    | 1    | 0x0402                | Immediately  |
|               | Use this parameter to set the Q value of the second-order torque filter. Increasing the Q value can improve the system responsiveness, but noise will be generated when the setting is too large.                                                                                                                                                                                       |            |         |      |                       |              |

## 6.6.2 Gain Switching

The gain switching function includes “manual gain switching” that uses an external input signal and “automatic gain switching” that automatically switches.

By using the gain switching function, it could increase the gain and shorten the positioning time during positioning, and it could reduce the gain and suppress the vibration when the motor stops.

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Range             | Default | Unit | Communication address | When enabled |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------|------|-----------------------|--------------|
| Pn110         | Gain switching mode selection switch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0x00<br>~<br>0x01 | 0       | -    | 0x0110                | Immediately  |
|               | <p>The gain switching function includes two methods of “manual gain switching” using an external input signal and “automatic gain switching” that automatically switches. By using the gain switching function, it could increase the gain and shorten the positioning time during positioning, and it could reduce the gain and suppress the vibration when the motor stops.</p> <p>0-Manual gain switching by external input signal of manual gain switching (G-SEL).</p> <p>1-When the automatic switching condition is met (Pn111), it automatically switches from the first gain to the second gain; Otherwise, it switches back to the first gain.</p> |                   |         |      |                       |              |
| Pn111         | Position control gain automatic switching condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0x00<br>~<br>0x05 | 0       | -    | 0x0111                | Immediately  |
|               | <p>Set the conditions for automatic gain switching:</p> <p>0-positioning completion signal ON.</p> <p>1-positioning completion signal OFF.</p> <p>2-positioning proximity signal ON.</p> <p>3-positioning proximity signal OFF.</p> <p>4-position command is 0 after filter and pulse input is OFF.</p> <p>5-position command pulse input ON.</p> <p>If the condition is met, it will switch to the second gain, otherwise it switches back to the first gain.</p>                                                                                                                                                                                           |                   |         |      |                       |              |
| Pn112         | Gain switching transition time 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 ~ 65535         | 0       | ms   | 0x0112                | Immediately  |
|               | <p>After waiting for the waiting time from the time when the switching condition has been met, the first position loop gain is linearly changed to the second position loop gain during the switching transition time.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |         |      |                       |              |
| Pn113         | Gain switching transition time 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 ~ 65535         | 0       | ms   | 0x0113                | Immediately  |
|               | <p>After waiting for the waiting time from the time when the switching condition has been met, the second position loop gain is linearly changed to the first position loop gain during the switching transition time.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |         |      |                       |              |
| Pn114         | Gain switching wait time 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0 ~ 65535         | 0       | ms   | 0x0114                | Immediately  |

|       |                                                                                                                                                |           |   |    |        |             |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|----|--------|-------------|
|       | The waiting time from when the switching condition of the first gain to the second gain is met to the time when the switching actually starts. |           |   |    |        |             |
| Pn115 | Gain switching wait time 2                                                                                                                     | 0 ~ 65535 | 0 | ms | 0x0115 | Immediately |
|       | The waiting time from when the switching condition of the second gain to the first gain is met to the time when the switching actually starts. |           |   |    |        |             |

#### Switching gain combination

| Switching gain | Speed loop gain                | Speed loop integration time constant                | Position loop gain                | Torque command filter                | Model tracking control                     | Model tracking control gain correction                             |
|----------------|--------------------------------|-----------------------------------------------------|-----------------------------------|--------------------------------------|--------------------------------------------|--------------------------------------------------------------------|
| First gain     | First speed loop gain (Pn101)  | First speed loop integration time constant (Pn102)  | First position loop gain (Pn103)  | First torque command filter (Pn104)  | First model tracking control gain (Pn241)  | First model tracking control gain attenuation coefficient (Pn242)  |
| Second gain    | Second speed loop gain (Pn105) | Second speed loop integration time constant (Pn106) | Second position loop gain (Pn107) | Second torque command filter (Pn108) | Second model tracking control gain (Pn246) | Second model tracking control gain attenuation coefficient (Pn247) |



1. The gain switching of model tracking control gain and model tracking control attenuation coefficient is only applicable to "manual gain switching".
2. The gain switching of model tracking control gain and model tracking control attenuation coefficient can only be switched when the following conditions are met.
  - No command.
  - Motor is stopped.

#### (1) Manually switch

"Manual switching gain" means the first gain and the second gain are switched by the external input signal "gain switching signal (/G-SEL)".

##### a) Gain switching configuration

The signal is not configured in the factory default digital configuration. Therefore, the pin number configuration (0x0E) needs to be configured by parameters Pn601 ~ Pn609.

##### b) Gain switching wiring

The gain switching signal is a general configurable digital input. See "Sequence Input Circuit" for wiring details.

#### (2) Automatic switching

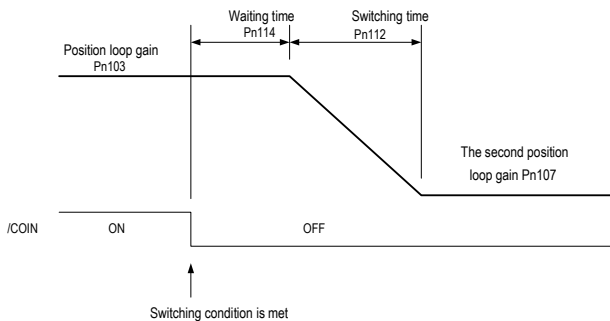
| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                   | Range       | Default | Unit | Communication address | When enabled |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|------|-----------------------|--------------|
| Pn111         | Position control gain automatic switching condition                                                                                                                                                                                                                                                                                                                                         | 0x00 ~ 0x05 | 0       | -    | 0x0111                | Immediately  |
|               | Set the conditions for automatic gain switching:<br>0-Position completion signal ON.<br>1-Position completion signal OFF.<br>2-positioning proximity signal ON.<br>3-positioning proximity signal OFF.<br>4-position command filtered to 0 and pulse input OFF.<br>5-position command pulse input ON.<br>If the condition is met, switch to the 2nd gain, otherwise switch to the 1st gain. |             |         |      |                       |              |

“Auto switching gain” is only valid in position control. The switching conditions are performed by the following settings:

Switching logic

| Parameter                               | Switching conditions  | Switching gain                     | Switching waiting time  | Switching time            |
|-----------------------------------------|-----------------------|------------------------------------|-------------------------|---------------------------|
| Pn111 setting corresponding condition A | Condition A is met    | The first gain<br>→<br>Second gain | Waiting time 1<br>Pn114 | Switching time 1<br>Pn112 |
|                                         | Condition A isn't met | The second gain<br>→<br>First gain | Waiting time 2<br>Pn115 | Switching time 2<br>Pn113 |

For example, in the automatic switching gain mode conditioned on the completion of the positioning signal (/COIN), it is assumed that the position loop gain Pn103 is switched 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 has been met, the gain is linearly changed from Pn103 to Pn107 during the switching time Pn112.



### 6.6.3 Speed Feedforward

Feedforward is the function of feedforward compensation to shorten the positioning time during position control.

The speed feedforward is divided into internal speed feed forward (Pn121/Pn122) and analog (V-REF) given speed feedforward (using V-REF as speed feedforward selection Pn123). This command is sent to the servo unit together with the position command.

Related parameters

| Function code | Parameter                                                                                                                                                                                                                                                                         | Range             | Default | Unit                  | Communication address | When enabled  |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------|-----------------------|-----------------------|---------------|
| Pn121         | Speed feedforward gain                                                                                                                                                                                                                                                            | 0 ~ 100           | 0       | %                     | 0x0121                | Immediately   |
|               | Speed feedforward is a function to shorten the positioning time. This function is effective when the servo unit performs position control.<br>Note: When the feedforward command is too large, position overshooting will occur. Please check the response and set appropriately. |                   |         |                       |                       |               |
| Pn122         | Speed feedforward filter time                                                                                                                                                                                                                                                     | 0 ~ 64            | 0.00    | ms                    | 0x0122                | Immediately   |
|               | Speed feedforward low-pass filter time constant, which can slow position overshoot and torque jump caused by feedforward.                                                                                                                                                         |                   |         |                       |                       |               |
| Pn123         | Use V-REF as speed feedforward selection                                                                                                                                                                                                                                          | 0x00<br>~<br>0x01 | 0       | -                     | 0x0123                | After restart |
|               | Speed feedforward is a function to shorten the positioning time. It is possible to select speed feedforward given via external analog V-REF.<br>0-None.<br>1-Use V-REF as speed feedforward input.                                                                                |                   |         |                       |                       |               |
| Pn300         | Analog speed command gain                                                                                                                                                                                                                                                         | 150<br>~<br>3000  | 600     | 0.01V/<br>rated speed | 0x0300                | Immediately   |
|               | Use this parameter to set the analog voltage value of (V-REF) required by speed command that makes the servo motor speed as rated value.<br>Note: Do not apply a voltage over-10V ~ 10V. Exceeding this range may damage the servo drive.                                         |                   |         |                       |                       |               |

### 6.6.4 Torque Feedforward

Torque feedforward is a function to shorten the positioning time. The command is generated by deviating the position command on the host device side. This command is sent to the servo together with the speed command.

The speed command from the host device is connected to V-REF (CN1-5, 6), and the torque

feedforward command is connected to T-REF (CN1-9, 10).

Related parameters

| Function code | Parameter                                                                                                                                                                                             | Range    | Default | Unit               | Communication address | When enabled  |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|--------------------|-----------------------|---------------|
| Pn124         | Speed/position control selection (T-REF assignment)                                                                                                                                                   | 0 ~ 1    | 0       | -                  | 0x0124                | After restart |
|               | Torque feedforward is a function to shorten the positioning time. Torque feedforward can be selected to given by external analog T-REF.<br>0-None.<br>1-T-REF as a torque feedforward input.          |          |         |                    |                       |               |
| Pn405         | Analog torque command gain                                                                                                                                                                            | 10 ~ 100 | 30      | 0.1V/ Rated torque | 0x0405                | Immediately   |
|               | Use this parameter to set the analog voltage value of (T-REF) required by servo motor rated torque.<br>Note: Do not apply a voltage over -10V ~ 10V. Exceeding this range may damage the servo drive. |          |         |                    |                       |               |

## 6.6.5 PI-P Switching

When the control mode is speed control or position control, it could switch to PI-P control. When the control mode is mixed, it is valid only when it is switched to internal speed, analog speed and position mode. The PI-P switching can be switched by the digital signal “manual PI-P control signal (/P-CON)”. When the /P-CON signal is ON, P control is performed. The conditions for selecting automatic switching can also be selected by the parameter speed loop PI-P switching condition selection switch Pn131.

### (1) Manual PI-P Control

#### a) Configuration of manual PI-P Control

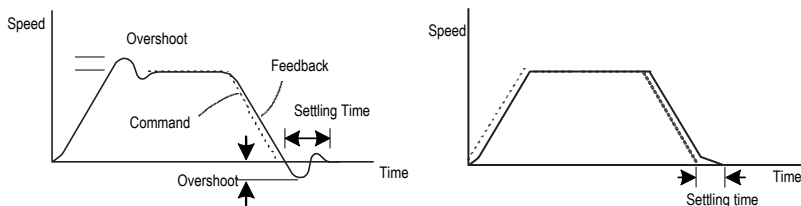
The signal is not configured in the factory default digital configuration. Therefore, the pin number configuration (0x05) needs to be performed by parameters Pn601 ~ Pn609.

#### b) The wiring of manual PI-P control

The gain switching signal is a general configurable digital input. See “Sequence Input Circuit” for wiring details.

### (2) Automatic switching

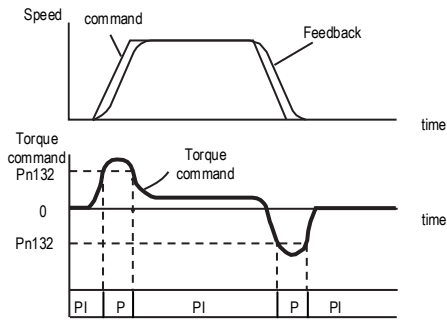
The switching condition of automatic PI-P switching is set by Pn131, and the switching condition value is set by Pn132, Pn133, Pn134, and Pn135. By properly setting the switching conditions and condition values, overshoot during acceleration and deceleration can be suppressed and the settling time can be shortened.



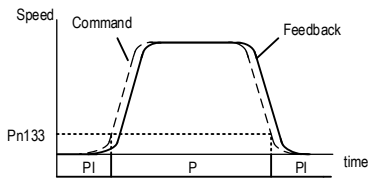
| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Range             | Default | Unit         | Communication address | When enabled |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------|--------------|-----------------------|--------------|
| Pn131         | Speed loop PI-P switching condition selection switch                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0x00<br>~<br>0x04 | 0       | -            | 0x0131                | Immediately  |
|               | <p>The mode switch is a function that automatically performs P control and PI control switching. Setting the switching condition by this parameter and satisfying the corresponding switching condition value can suppress overshoot during acceleration and deceleration and shorten the settling time.</p> <p>0 - Conditioned by internal torque command.<br/> 1 - Conditioned by speed command.<br/> 2 - Conditioned by acceleration.<br/> 3 - Conditioned by position deviation pulse.<br/> 4 - No mode switch function.</p> |                   |         |              |                       |              |
| Pn132         | Speed loop PI-P switching condition (torque command)                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 ~ 800           | 200     | %            | 0x0132                | Immediately  |
|               | When the torque command exceeds the torque set by this parameter, the speed loop will be switched to P control, otherwise to PI control.                                                                                                                                                                                                                                                                                                                                                                                         |                   |         |              |                       |              |
| Pn133         | Speed loop PI-P switching condition (speed command)                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 ~ 10000         | 0       | rpm          | 0x0133                | Immediately  |
|               | When the speed command exceeds the speed set by this parameter, the speed loop will be switched to P control, otherwise to PI control.                                                                                                                                                                                                                                                                                                                                                                                           |                   |         |              |                       |              |
| Pn134         | Speed loop PI-P switching conditions (acceleration)                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 ~ 30000         | 0       | rpm/s        | 0x0134                | Immediately  |
|               | When the speed command exceeds the acceleration set by this parameter, the speed loop will be switched to P control, otherwise to PI control.                                                                                                                                                                                                                                                                                                                                                                                    |                   |         |              |                       |              |
| Pn135         | Speed loop PI-P switching conditions (position deviation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0 ~ 10000         | 0       | command unit | 0x0135                | Immediately  |
|               | When the position deviation exceeds the value set by this parameter, the speed loop will be switched to P control, otherwise to PI control.                                                                                                                                                                                                                                                                                                                                                                                      |                   |         |              |                       |              |

When the switching condition of the mode switch is set as torque command [factory default], if the torque command exceeds the torque set in Pn132, the speed loop will be switched to P control.

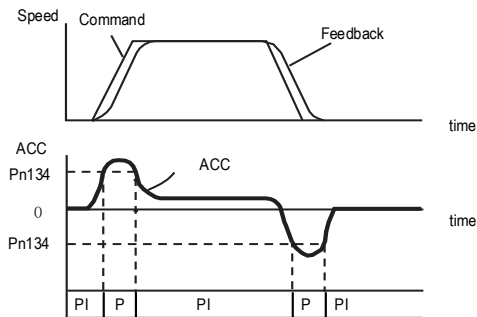
The factory torque command value is set to 200%.



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

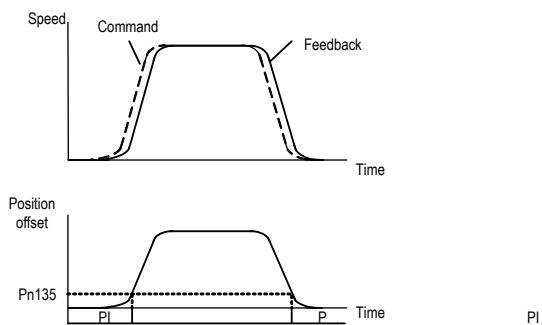


When the switching condition of the mode switch is set as acceleration, if the speed command exceeds the acceleration set in Pn134, the speed loop will be switched to P control.



When the switching condition of the mode switch is set as the position deviation, if the position deviation exceeds the value set in Pn135, the speed loop will be switched to P control.

This setting is valid only under position control.



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## 7 Auxiliary Functions

### 7.1 List of Auxiliary Functions

The auxiliary functions are used to execute the functions related to the operation and adjustment of the servo motor. Each auxiliary function has a number starting with Fn.

The following table lists the auxiliary functions and reference items.

| Auxiliary function Code | Function description                                     |
|-------------------------|----------------------------------------------------------|
| Fn 000                  | Alarm record display                                     |
| Fn 001                  | Clear alarm record                                       |
| Fn 002                  | Software reset                                           |
| Fn 003                  | Restore factory parameters                               |
| Fn 005                  | JOG operation                                            |
| Fn 006                  | Program JOG operation                                    |
| Fn 100                  | Automatic adjustment of command offset                   |
| Fn 101                  | Speed command offset manual adjustment                   |
| Fn 102                  | Torque command offset manual adjustment                  |
| Fn 103                  | Current offset automatic adjustment                      |
| Fn 104                  | Current offset manual adjustment                         |
| Fn 105                  | Initialize the detected value of the vibration detection |
| Fn 303                  | Bandwidth setting                                        |
| Fn 401                  | Easy FFT                                                 |
| Fn 402                  | Online vibration monitoring                              |

### 7.2 Alarm Records Display (Fn000)

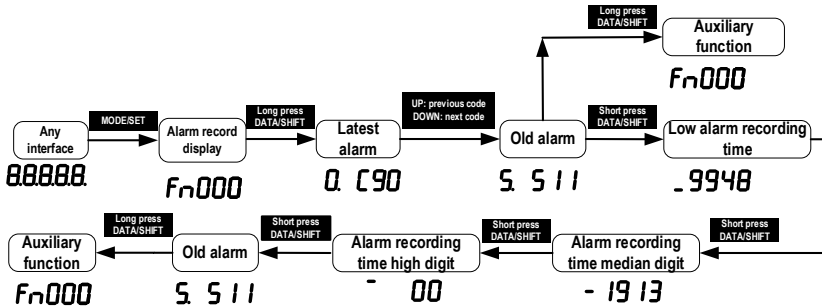
#### 7.2.1 Overview

The alarm record function can record up to 10 alarms that have occurred in the servo unit. You can confirm the alarm code and time that occurs. (measurement of the duration of the control power supply and the main circuit power supply in 100ms increments, and the function to display the total operation time in the event of an alarm, It can be measured continuously for about 31 years if it is operated 24 hours per day and 365 days per year).



1. When the same alarm occurs continuously, if the interval between alarms is less than 1 hour, it will not be saved, and if it exceeds 1 hour, all will be saved.
2. When no alarm occurs, "□- -" is displayed on the panel operator.
3. The alarm record can only be cleared by "clear alarm record (Fn001)".

## 7.2.2 Operating Procedure

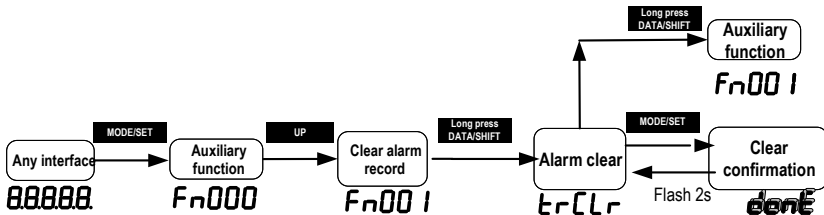


## 7.3 Clear Alarm Record (Fn001)

### 7.3.1 Summary

The alarm record of the servo unit can only be cleared by clearing the alarm record (Fn001) function. Alarm recording cannot be cleared by resetting the alarm or switching off the main circuit power of the servo unit.

### 7.3.2 Operating Procedure



## 7.4 Software Reset (Fn002)

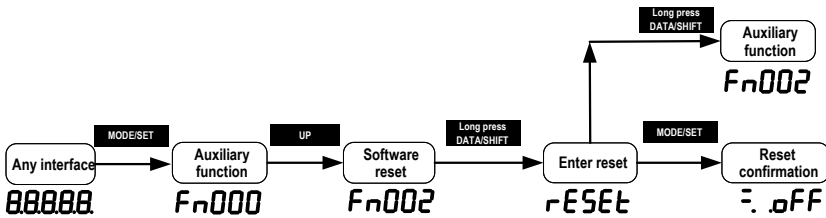
### 7.4.1 Summary

The function enables resetting the servo unit internally from software. It is used when it needs to re-power on or reset the alarm after changing the parameter setting. Parameter setting could also be enabled without re-power on.



1. This function must be operated in the state of servo OFF.
2. This function has nothing to do with the upper unit, and can reset the servo unit. Handling as when power is turned on. The servo unit will output the ALM signal, and other output signals may be changed forcibly.

## 7.4.2 Operating Procedure



## 7.5 Restore Factory Parameters (Fn003)

### 7.5.1 Overview

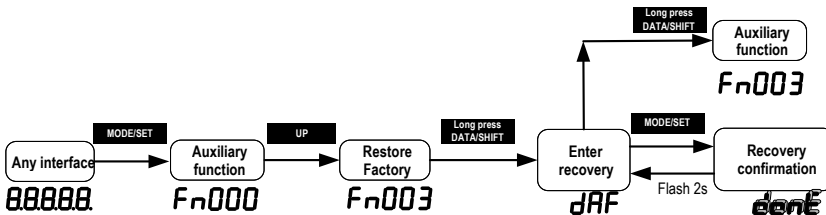
The function is used to restore the parameters to the factory settings.



**Cautions**

1. The parameter initialization must be executed in the servo OFF state. It cannot be executed in the servo ON state. The initialization of parameter settings must be performed in the servo OFF state.
2. To make the setting effective, the power to the servo unit must be turned back on after operation.
3. The values adjusted by Fn100, Fn101, Fn102, Fn103, and Fn104 will not be initialized when this function is executed.

### 7.5.2 Operating Procedure



## 7.6 JOG Operation (Fn005)

### 7.6.1 Overview

The JOG operation is a function that confirms the operation of the servo motor under speed control without connecting to a host device.

To perform JOG operation, the following confirmation must be made in advance:

- The motor is in the enabled state and the Jog operation is invalid during the operation.
- The load inertia is suggested not more than 30 times of the motor inertia; otherwise it may cause large mechanical vibration.
- Parameter Pn500, Pn310, Pn311 set the Jog speed, acceleration and deceleration time;

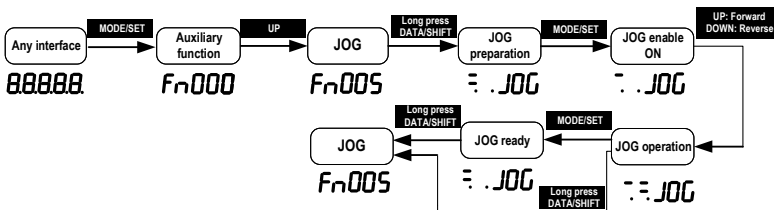
default Jog speed is 500rpm.

| Function code | Parameter name                                                                                                                                                                                                                  | Range     | Defaults | Unit | Communication address | When enabled |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|------|-----------------------|--------------|
| Pn500         | Jog speed                                                                                                                                                                                                                       | 0 ~ 1000  | 500      | rpm  | 0x0500                | Immediately  |
| Pn310         | Speed command trapezoidal acceleration time                                                                                                                                                                                     | 0 ~ 10000 | 0        | ms   | 0x0310                | Immediately  |
|               | Set the time required to accelerate from 0 r/min to the maximum speed (corresponding to the motor model). When the given speed is greater or less than the max speed, the actual acceleration time is calculated in proportion. |           |          |      |                       |              |
| Pn311         | Speed command trapezoidal deceleration time                                                                                                                                                                                     | 0 ~ 10000 | 0        | ms   | 0x0311                | Immediately  |
|               | Set the time required to decelerate from the maximum speed (corresponding to the motor model) to 0 r/min. When the given speed is greater or less than the max speed, the actual deceleration time is calculated in proportion. |           |          |      |                       |              |



The overtravel prevention function is not available during JOG operation. The operating range of the machinery used must be considered while running.

## 7.6.2 Operating Procedure



## 7.7 Program JOG Operation (Fn006)

### 7.7.1 Overview

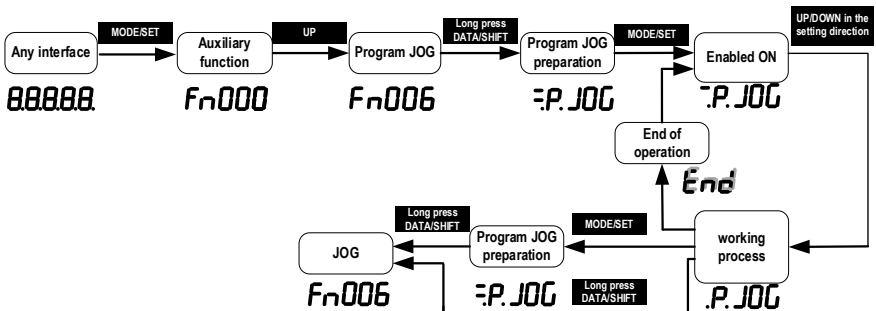
Program JOG operation is a function that continuously runs with the preset operation mode, movement distance, movement speed, acceleration/deceleration time, waiting time, and number of

times of movements. Same as JOG operation (Fn005), do not connect to the host device during setting while using this function. It could confirm the operation of the servo motor and perform simple positioning operations.



1. Program JOG runs as position control, gear ratio and position command filtering are valid, but it is not possible to input pulse command to the servo. The pulse command cannot be input to the servo unit.
2. Overtravel prevention function is effective.

## 7.7.2 Operating Procedure



## 7.8 Automatic Adjustment of Command Offset (Fn100)

### 7.8.1 Overview

The automatic adjustment command offset is a method of automatically adjusting the command voltage after measuring the offset.

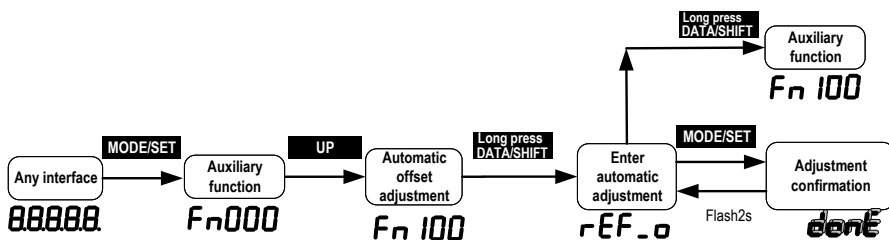
The measured offset will be stored in the servo unit.



1. Servo is in OFF state.
2. The bias adjustment is out of range or the voltage command is input during the bias adjustment, the adjustment may fail.

## 7.8.2 Operating Procedure

Turn off the servo drive and input the 0V command voltage from the host device or external circuit.



## 7.9 Speed command Offset Manual Adjustment (Fn101)

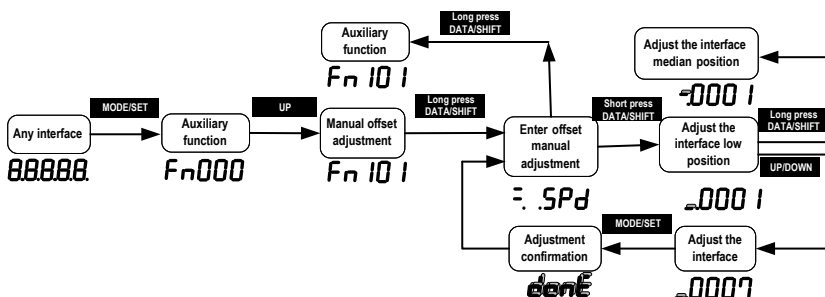
### 7.9.1 Overview

The method of directly inputting the command offset for adjustment.

Manual adjustments are used for the following occasions:

- The host device has built a position loop and when the position deviation of the servo lock stop is set to zero.
- When you need to set an offset.
- When confirming the offset set by automatic adjustment.

### 7.9.2 Operating Procedure



## 7.10 Torque Command Offset Manual Adjustment (Fn102)

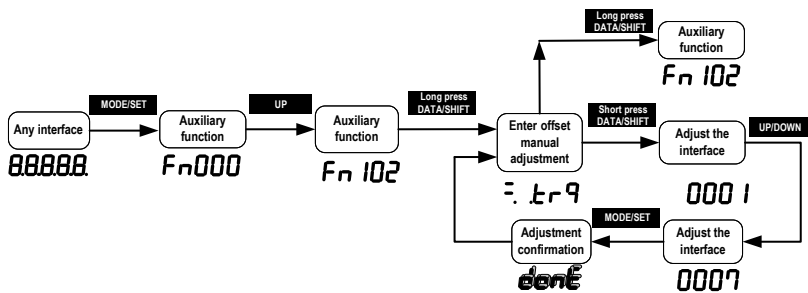
### 7.10.1 Overview

It is a method of directly input the torque command offset.

Manual adjustments are used for the following occasions:

- When you need to set an offset.
- When confirming the offset set by automatic adjustment.

## 7.10.2 Operating Procedure



## 7.11 Current Offset Automatic Adjustment (Fn103)

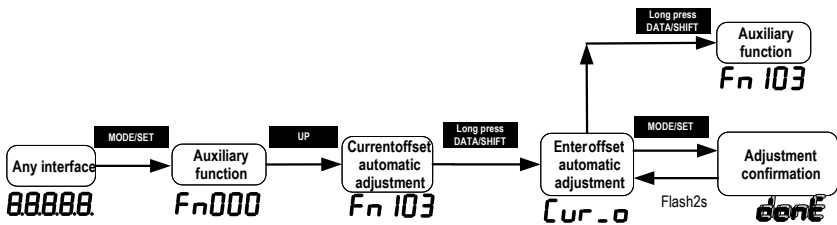
### 7.11.1 Overview

This function is only used when it is necessary to further reduce the torque ripple and other adjustments that need to be performed with higher precision, and usually does not require adjustment.



1. The automatic adjustment of the motor current detection signal offset must be performed while the servo is off.
2. When the generated torque ripple is significantly larger than other servo units, perform automatic adjustment of the offset.

### 7.11.2 Operating Procedure



## 7.12 Current Offset Manual Adjustment (Fn104)

### 7.12.1 Overview

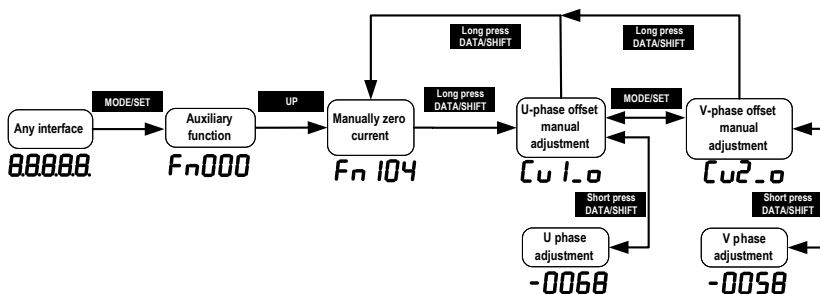
This function is used only when the torque ripple is still large after the motor current detection signal offset automatic adjustment (Fn103) is executed.



If this function is performed incorrectly during manual adjustment, the characteristics may be degraded. When performing manual adjustment, observe the following precautions.

- Make the servo motor speed approximately 100 min<sup>-1</sup>.
- Observe the torque command in the analog monitoring state and adjust the pulsation to the minimum. The offset of the U current and V current of the servo motor must be adjusted in a balanced manner. Please repeat the adjustment several times alternately.

## 7.12.2 Operating Procedure



## 7.13 Initializing the Detection Value of Vibration Detection (Fn105)

### 7.13.1 Overview

The vibration detection function can detect the vibration in the feedback speed of the servo motor. This function is used to detect the “vibration warning (Er. 520)” and “vibration alarm (AL. 911)” that is more accurately after detecting the machine vibration in the running state, and the function also could be used to automatically set the vibration detection value (Pn187).

Related parameters as below:

| Function code | Parameter                                                                                                                                                                                                                                                                                                       | Range       | Defaults | Unit | Communication address | When enabled |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|------|-----------------------|--------------|
| Pn185         | Vibration detection options                                                                                                                                                                                                                                                                                     | 0x00 ~ 0x02 | 0        | -    | 0x0185                | Immediately  |
|               | This function is to automatically detect related alarms or warnings after detecting machine vibration under normal operating conditions.<br>Set the servo action after vibration is detected:<br>0-No vibration detection.<br>1-Warning after vibration is detected.<br>2-Alarming after vibration is detected. |             |          |      |                       |              |
| Pn186         | Vibration detection                                                                                                                                                                                                                                                                                             | 50 ~ 500    | 100      | %    | 0x0186                | Immediately  |

|       |                                                                                                                                                                                                                                                                                                                                                         |          |    |     |        |             |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----|-----|--------|-------------|
|       | sensitivity                                                                                                                                                                                                                                                                                                                                             |          |    |     |        |             |
|       | Set the sensitivity of the vibration detection. The smaller the setting value is, the more sensitive it is. If the setting is too small, the vibration may be detected by mistake during normal operation.<br>Note: The detection sensitivity of vibration alarm and vibration warning may vary according to different mechanical conditions.           |          |    |     |        |             |
| Pn187 | Vibration detection value                                                                                                                                                                                                                                                                                                                               | 0 ~ 5000 | 50 | rpm | 0x0187 | Immediately |
|       | Set the threshold for vibration detection. The smaller the setting is, the easier it is to detect the vibration. If the setting is too small, the vibration may be detected by mistake during normal operation.<br>Note: The vibration detection values of vibration alarm and vibration warning may vary according to different mechanical conditions. |          |    |     |        |             |



**Cautions**

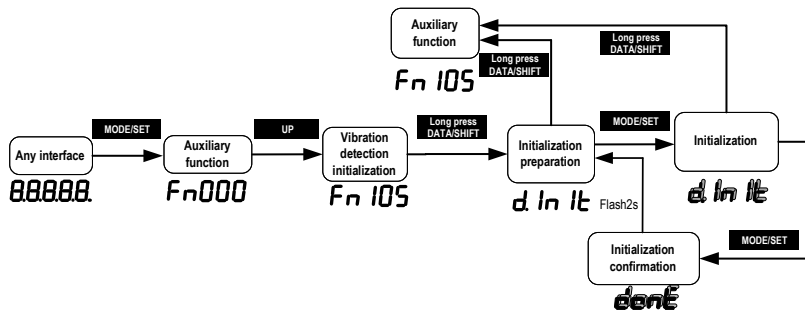
When the servo gain is set incorrectly, it may be difficult to detect the vibration. And it may not be possible to detect all the vibrations that have occurred.

When you set the improper moment of inertia ratio (Pn100), vibration warnings and vibration alarms may be detected by mistake or not detected.

This operation is performed when the motor is operated with actually used instructions.

When performing this action, make sure that the motor runs at a maximum speed of 10% or more.

## 7.13.2 Operating Procedure



## 7.14 Bandwidth Settings (Fn303)

### 7.14.1 Overview

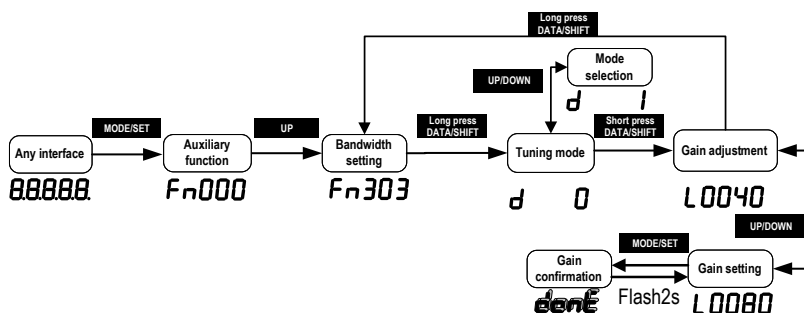
Bandwidth setting is a method of inputting a speed command or position command from the upper unit and manually adjusting it while running. By adjusting one or two values with the bandwidth setting, the setting value of the related servo gain can be adjusted automatically.

The bandwidth setting adjusts the following items:

- Gain adjustment (speed loop gain, position loop gain, etc.)
- Filter adjustment (Torque command filter, notch filter)

- Friction compensation
- Medium frequency vibration suppression control
- Low frequency vibration suppression
- Use the bandwidth setting when satisfactory response characteristics are not obtained by intelligent setting. If you want to further fine-tune each servo gain after adjusting the bandwidth setting, see "Manual tuning" for details and perform manual tuning.

## 7.14.2 Operating Procedure



## 7.15 EasyFFT (Fn401)

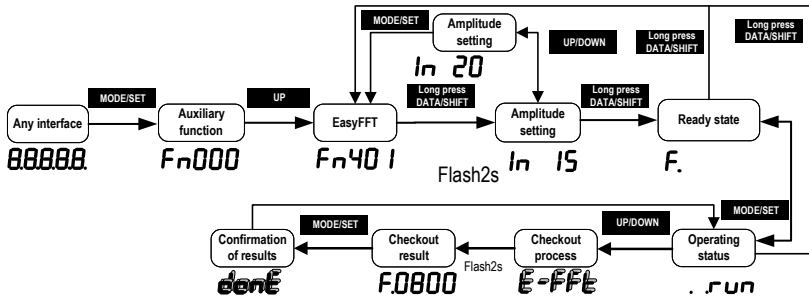
### 7.15.1 Overview

EasyFFT transfers the periodic waveform commands from the servo unit to the servo motor, and slightly rotates the servo motor several times over a certain period, causing the machine vibration. The servo unit detects the resonance frequency basing on the vibration generated by the machine, and then sets the corresponding notch filter according to the resonance frequency. The notch filter effectively eliminates high-frequency vibrations and noise. If vibration occurs with a loud sound (abnormal sound) during operation, perform this function after the servo is turned off.



1. It must be used in the low gain state such as the initial stage of servo adjustment. If you perform the EasyFFT function after setting a high gain, the machine may vibrate due to mechanical characteristics and gain balance.
2. The detected resonance frequency can be automatically set to the notch filter 1/2. If 1 has been set, it will be automatically set to 2. If 1/2 are both set, the notch filter cannot be set by this operation.
3. When changing the amplitude setting value, gradually increase the amplitude value and change it while observing the situation.

## 7.15.2 Operating Procedure



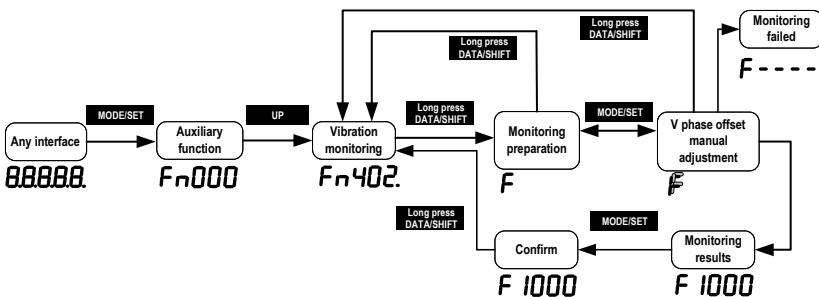
## 7.16 Online Vibration Monitoring (Fn402)

### 7.16.1 Overview

When the servo is ON and vibration occurs during operation, this operation can set the notch filter 1 or the torque command filter according to the vibration frequency, sometimes eliminating the vibration. Detect the vibration frequency of noise caused by mechanical resonance and display the vibration frequency with large peak on the operator. The effective torque command filter or notch filter 1 frequency for the vibration frequency will be automatically selected and the related parameters are automatically set.

When using the PC debugging software to adjust, it is recommended to perform the smart setting or bandwidth setting. Generally, no manual operation is required. Only when the PC debugging software is not available, it is key-assisted.

### 7.16.2 Operating Procedure



## 8 Home Position Return and Internal Positions

### 8.1 The Principle of Home Position Return Function

The home position return function is the process that the servo drive controls the motor to find and return to the home or zero point according to the set way in the position mode.

Home position: the starting position of servo motor operation. The limit signal, DI input signal or encoder Z pulse can be used mechanically as the home position.

Zero point: it defines the position offset from a certain position of the home position signal as the zero point position. The zero position is the zero value during the operation of the servo drive.

The home position return function is to find the home position of the motor on the machine according to the set home position return method. After finding the home position, it runs to the zero position according to the set zero position offset pulse, and uses the zero position as the starting position for subsequent motor operation.

According to the above home position definition, the home position signal source can be given in three ways: limit signal, DI input signal and Z pulse. The mechanical home position signal can generally be expressed by a level signal with a certain pulse width. A high level indicates that the signal is valid, and a low level indicates that the signal is invalid. In order to accurately locate the home position signal, when selecting the home position signal source, you need to select the forward or reverse rising edge of the home position signal source as the home position signal, as shown in the figure 1 below:

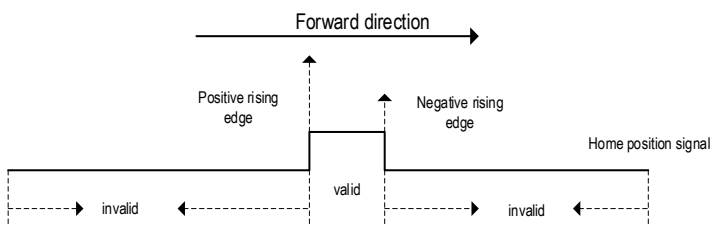


Figure 1 Home position signal source and signal edge selection diagram

During the home position return process, it is necessary to encounter the home position signal multiple times to determine the correct home position. When starting the home position return, given a relatively large speed for the home position return to ensure the speed of finding the home position. Define the first time that encounters the home position signal as the deceleration point. After encountering the deceleration point, the home position return speed is reversed to a low speed to ensure the accuracy of finding the home position. If encountering the home position signal again at low speed, it means that the home position is found. In the actual process, the accuracy of the home position is affected by finding the home position at low speed. The higher the speed when finding the home position at low speed, the greater the pulse deviation of the home position signal edge. In order to determine the home position signal more accurately, the Z signal of the encoder can be used as the home position signal, and define the second time that encounters the Z pulse near the home position signal as the home position signal, so that the home position is accurate and without deviation.

According to the home position signal source, home position signal edge, home position return

direction, deceleration point type, Z pulse direction, whether or not Z pulse is used, and encountering the limit, the home position return method can be classified as the following table 1:

| Coding table of 35 home position return methods |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find limit signal |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
|-------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------------------|--|----------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-----------------------------|--|--|--|
| Find DI signal                                  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |
| Find limit signal                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Reserved          |  | Find DI signal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Find home position directly |  |  |  |

Horizontal coded value

Table 1 Classification of home position return methods

Note: the definition of above 1 to 34 home position return methods is according to the CANopen protocol CIA402 standards, and is same as the home position return methods given in the CANopen protocol. The following describes the 1 to 34 methods of the home position return.

### 8.1.1 Home Position Return Trigger

The home position return trigger can automatically perform home position return via SI terminal trigger, point trigger, communication trigger and power-on.

### 8.1.2 Home Position Return SI Terminal Trigger

By configuring the universal SI terminal as the home position trigger function HomeTrig, the home position return is triggered. The rising edge of HomTrig could trigger the home return. The input function definition of SI terminal related to home return is shown in Table 2.1 below:

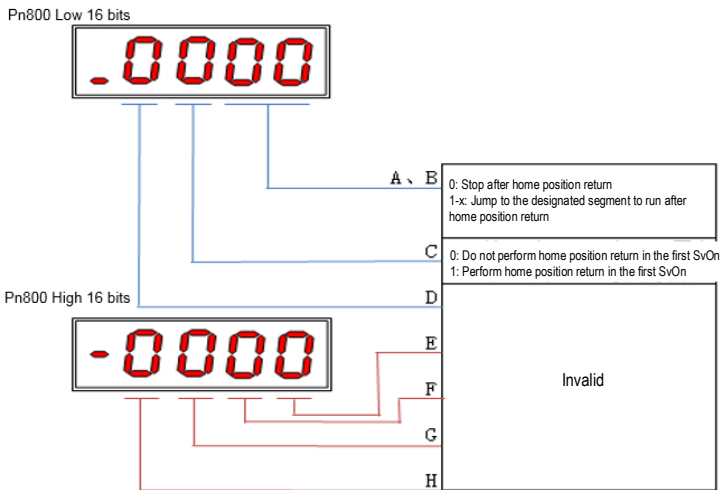
Table 2.1 SI terminal input function definition

| SI Terminal Name | SI Terminal Function Code | Function Description                                         |
|------------------|---------------------------|--------------------------------------------------------------|
| HomeTrig         | 0x1C                      | Home position return trigger function (valid on rising edge) |
| HomeReach        | 0x1D                      | External input home position signal (valid at high level)    |

Select the SI terminal as the home position trigger signal by configuring the general SI terminal function as 0x1C. When the rising edge of this SI terminal is valid, the home position return is triggered.

### 8.1.3 Home Position Return Automatically Trigger When Power On

The home position return function can be configured to automatically find the home position after the servo drive is powered on for the first time by configuring the function code Pn800. The function definition of Pn800 is shown in the figure below:



As shown in the figure above, section C of Pn800 is defined as home position return automatically trigger when power on. When the C segment is set to 1, it performs the home position return automatically when the servo is enabled for the first time.

The A and B sections of Pn800 are defined as the point number for automatic operation after the home position return is completed.

### 8.1.4 Home Position Return Triggered By Point Function

The home position return function can be triggered by the point function. The definitions of SI terminals related to point functions are shown in Table 2.3 below:

| SI Terminal Name | SI Terminal Function Code | Function Description                                      |
|------------------|---------------------------|-----------------------------------------------------------|
| PosTrig          | 0x16                      | Point trigger function (valid on rising edge)             |
| PosBit0          | 0x17                      | Point segment number selection Bit0 (valid at high level) |
| PosBit1          | 0x18                      | Point segment number selection Bit1 (valid at high level) |
| PosBit2          | 0x19                      | Point segment number selection Bit2 (valid at high level) |
| PosBit3          | 0x1A                      | Point segment number selection Bit3 (valid at high level) |
| PosBit4          | 0x1B                      | Point segment number selection Bit4 (valid at high level) |

Table 2.3 SI terminal point function definition

As shown in the above table, the point function is triggered by the external terminals. If the point segment number selection value is 0 when triggering, the home position return operation will be triggered. That is, when the rising edge of the PosTrig signal is valid, if the point segment number selection combination value is 0 (PosBit0 to PosBit4 are all 0), the home position return operation is triggered.

### 8.1.5 Communication Triggers Home Position Return

In addition to triggering the home return operation with the SI terminal, the home position return can also be triggered by communication. Through serial port communication, USB communication, keyboard operation, etc., the home position return operation is triggered in the case of writing 0 to the function code Pn898. Pn898 displays 10000 during the home position return process, and Pn898 displays 20000 after the home position return is completed.

Note: The home position return trigger is valid only when the servo drive is enabled. If the servo is not enabled, the home position return is invalid.

## 8.2 Home Position Return Function Code

|                           |                                              |                  |                        |                       |
|---------------------------|----------------------------------------------|------------------|------------------------|-----------------------|
| <b>Pn899</b>              | <b>Home position return method selection</b> |                  | <input type="radio"/>  | <b>Address: 0x899</b> |
| <b>Factory default: 1</b> | <b>Setting range: 1~34</b>                   | <b>unit: N/A</b> | <b>Control mode: P</b> |                       |

Parameter description: Home position return mode, any integer value between 1 and 34 can be

set.

|                             |                                                |                       |                        |
|-----------------------------|------------------------------------------------|-----------------------|------------------------|
| <b>Pn89A</b>                | <b>Home position return high speed setting</b> | <input type="radio"/> | <b>Address:0x89A</b>   |
| <b>Factory default:</b> 100 | <b>Setting range:</b> 0~2000                   | <b>unit:</b> rpm      | <b>Control mode:</b> P |

Parameter description: During the home position return process, set the high-speed home position search speed value.

|                            |                                               |                       |                        |
|----------------------------|-----------------------------------------------|-----------------------|------------------------|
| <b>Pn89B</b>               | <b>Home position return low speed setting</b> | <input type="radio"/> | <b>Address:0x89B</b>   |
| <b>Factory default:</b> 10 | <b>Setting range:</b> 0~1000                  | <b>unit:</b> rpm      | <b>Control mode:</b> P |

Parameter description: After encountering the home position signal at high speed, the home position signal is searched at the low speed in the reverse direction.

|                             |                                                                        |                       |                        |
|-----------------------------|------------------------------------------------------------------------|-----------------------|------------------------|
| <b>Pn89C</b>                | <b>Home position return acceleration and deceleration time setting</b> | <input type="radio"/> | <b>Address:0x89C</b>   |
| <b>Factory default:</b> 200 | <b>Setting range:</b> 10~1000                                          | <b>unit:</b> ms       | <b>Control mode:</b> P |

Parameter description: The acceleration and deceleration time is given during the home position return process. The time from 0rpm to the rated speed is treated as the acceleration/deceleration time of the home position return.

|                          |                                                                        |                  |                        |
|--------------------------|------------------------------------------------------------------------|------------------|------------------------|
| <b>Pn800</b>             | <b>Home position return acceleration and deceleration time setting</b> | ○                | <b>Address:0x800</b>   |
| <b>Factory default:0</b> | <b>Setting range:</b><br>0~0x0000FFFF                                  | <b>unit: N/A</b> | <b>Control mode: P</b> |

Parameter description: Pn800 function definition is shown in Figure 3 below.

Pn800 Low 16 bits



Pn800 High 16 bits



A、B

0: Stop after home position return  
1-x: Jump to the designated segment to run after home position return

C

0: Do not perform home position return in the first SvOn  
1: Perform home position return in the first SvOn

D

E

F

G

H

Invalid

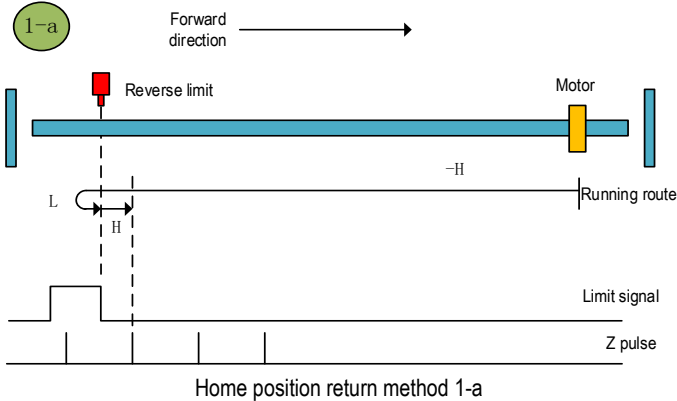
|                          |                                                 |                              |                        |
|--------------------------|-------------------------------------------------|------------------------------|------------------------|
| <b>Pn802</b>             | <b>Zero point offset pulse value</b>            | ○                            | <b>Address:0x802</b>   |
| <b>Factory default:0</b> | <b>Setting range:-</b><br>2147483648~2147483648 | <b>unit:</b><br>command unit | <b>Control mode: P</b> |

Parameter description: The pulse offset value that needs to be run after the home position signal is found during the home position return process.

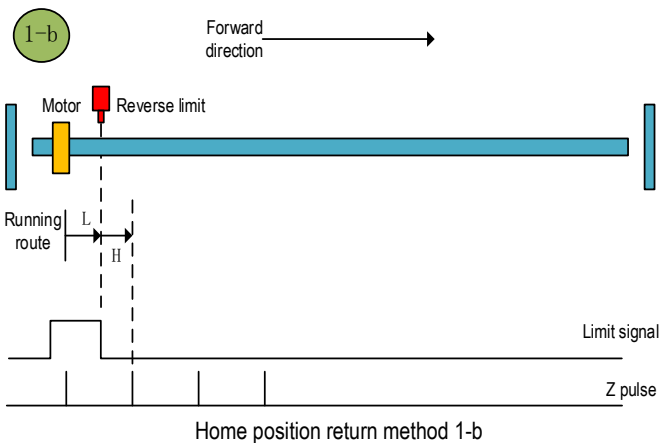
## 8.3 Home Position Return Method

### 8.3.1 Home Position Return Method 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.

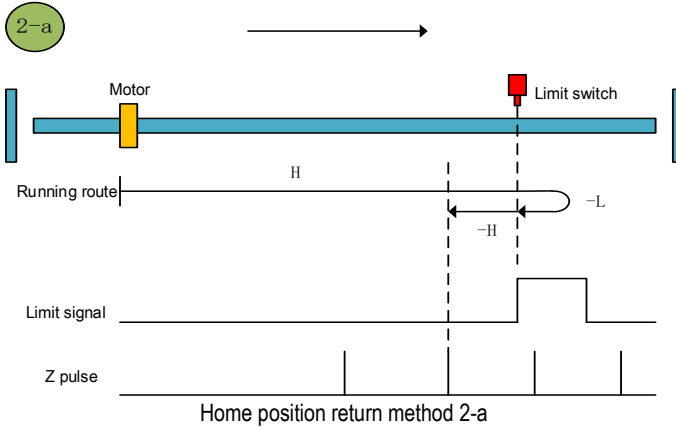


b. Start the home position return → reverse limit valid → Search for the falling edge of reverse limit at low speed forward direction → search for Z pulse in forward direction.

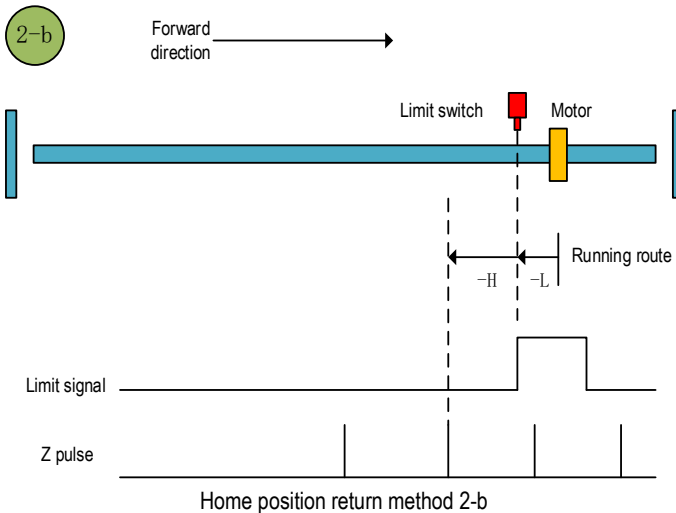


### 8.3.2 Home Position Return Method 2

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.

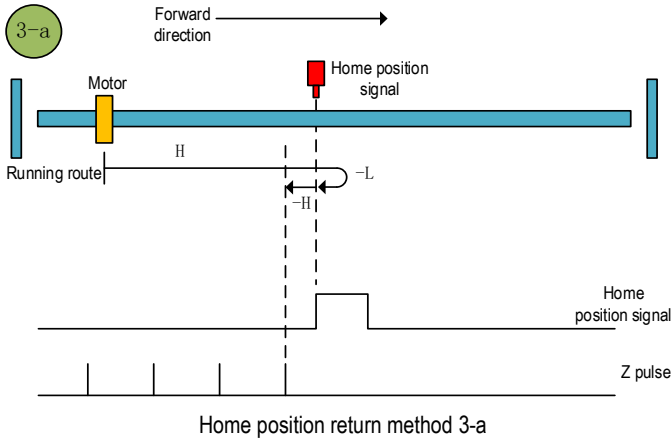


b. Start the home position return → forward limit valid → search for the falling edge of forward limit at low speed reverse direction → search for Z pulse in reverse direction.

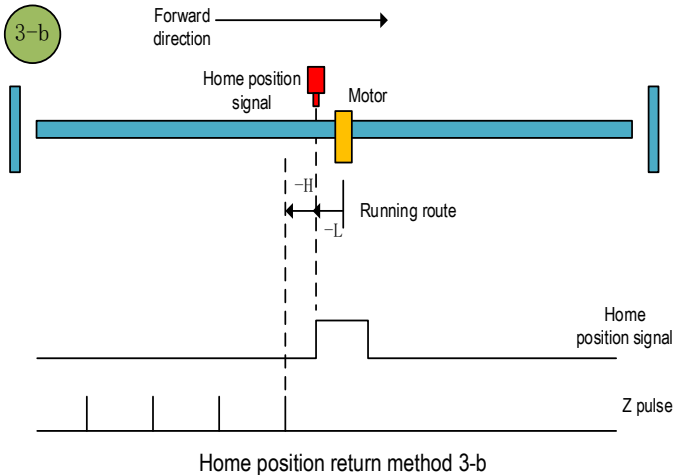


### 8.3.3 Home Position Return Method 3

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.

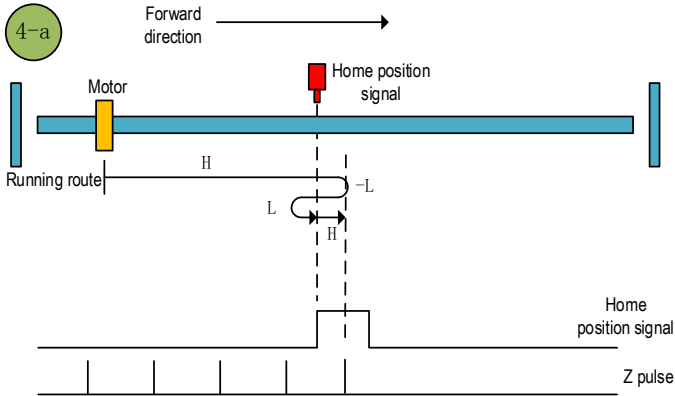


b. Start the home position return → Home position signal ON → Search for the falling edge of home position signal at low speed reverse direction → search for Z pulse in reverse direction.



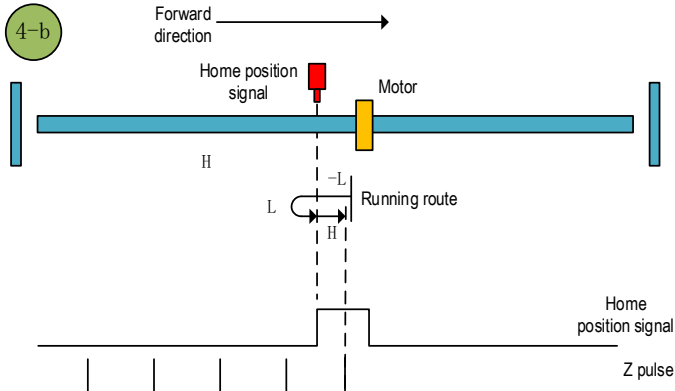
### 8.3.4 Home Position Return Method 4

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 → decelerate to 0 → search for the rising edge of home position at low speed forward direction → search for Z pulse in forward direction.



Home position return method 4-a

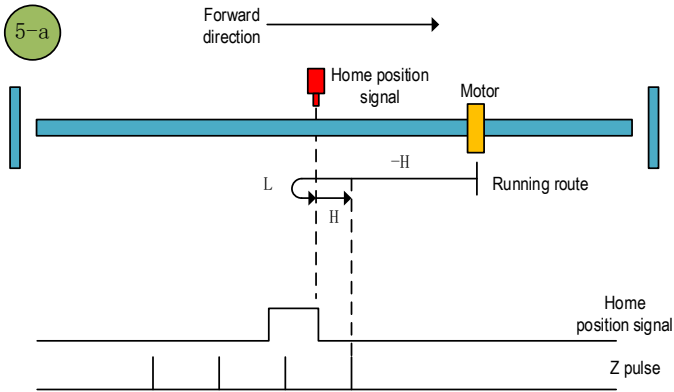
b. Start the home position return → home position signal ON → search for the falling edge of home position at low speed reverse direction → decelerate to 0 → search for the rising edge of home position at low speed forward direction → search for Z pulse in forward direction.



Home position return method 4-b

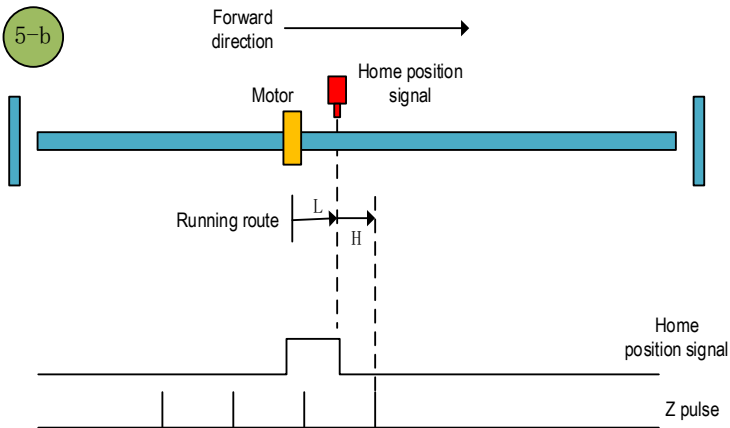
### 8.3.5 Home Position Return Method 5

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.



Home position return method 5-a

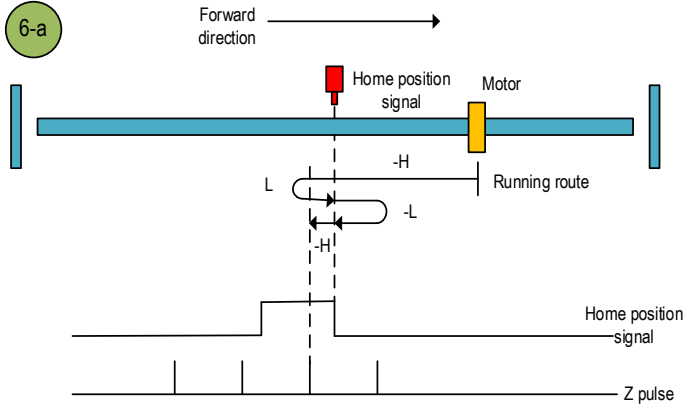
b. Start the home position return → home position signal ON → search for the falling edge of home position at low speed forward direction → search for Z pulse in forward direction.



Home position return method 5-b

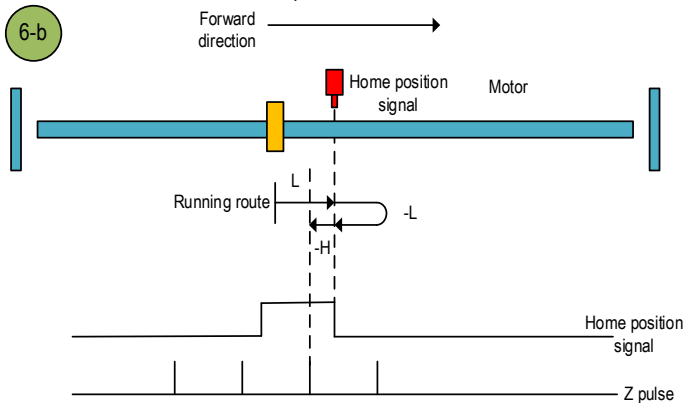
### 8.3.6 Home Position Return Method 6

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.



Home position return method 6-a

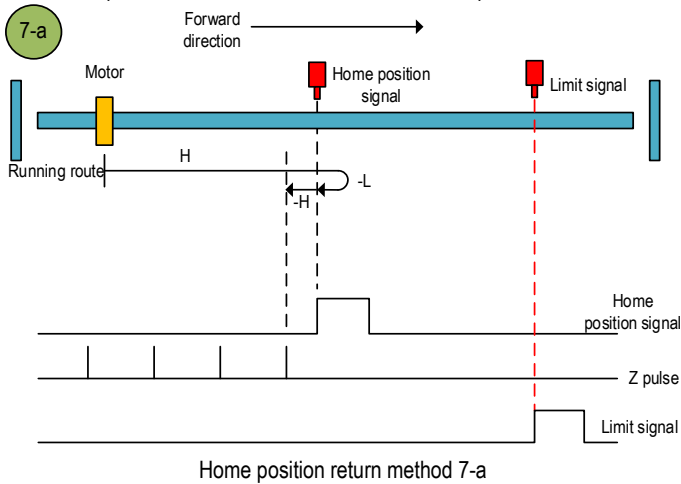
b. Start the home position return → Home position signal ON → Search for the falling edge of home position at low speed forward direction → Search for the rising edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.



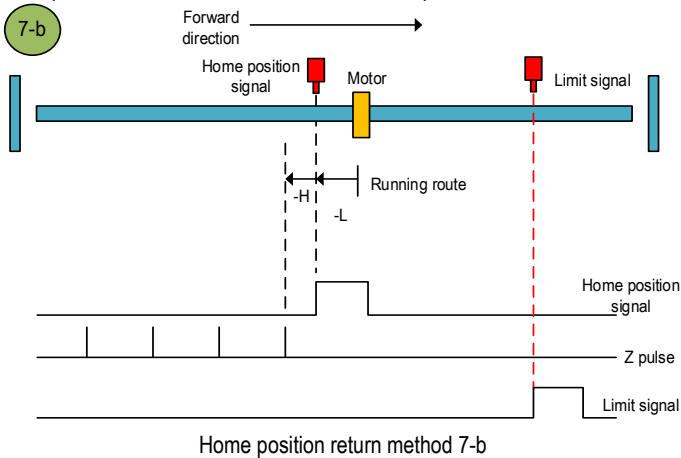
Home position return method 6-b

### 8.3.7 Home Position Return Method 7

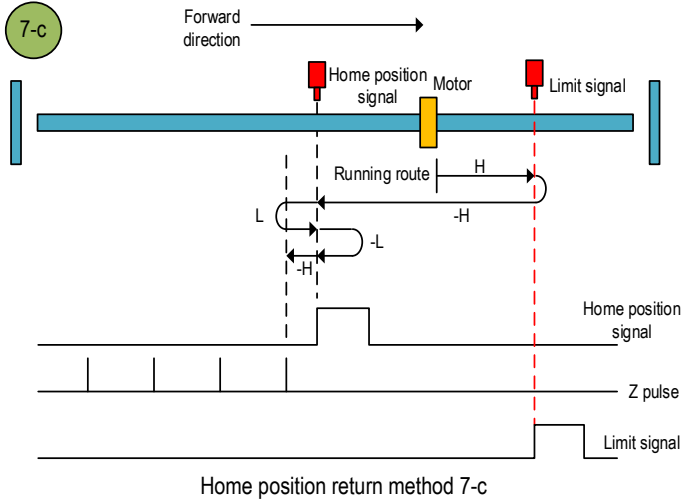
a. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed forward direction → Decelerate to 0 → Search for the falling edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.



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.

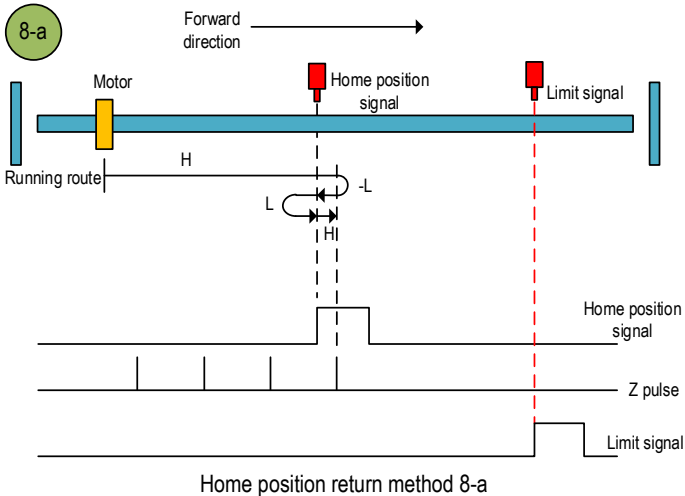


c. Start the home position return → Home position OFF → Search for the rising edge of home position at high speed forward direction → Touch the forward limit → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Search for the rising edge of home position 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.

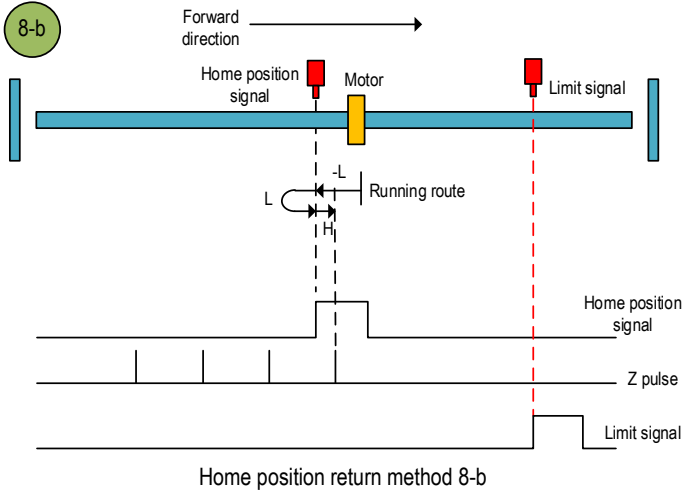


### 8.3.8 Home Position Return Method 8

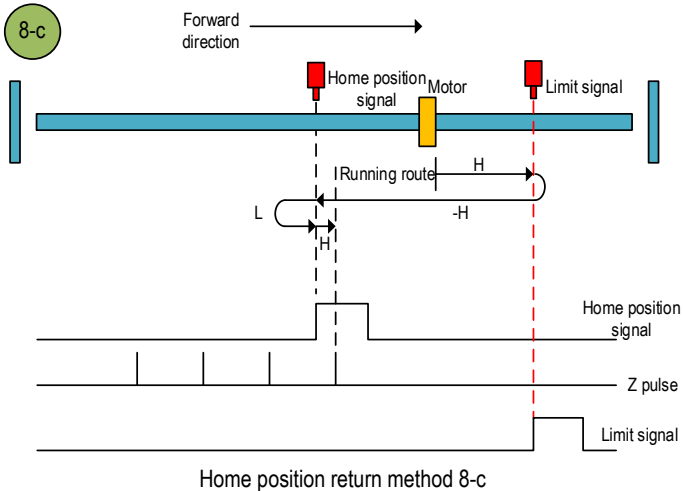
a. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed forward direction → Decelerate to 0 → Search for the falling edge of home position at low speed forward direction → Search for the rising edge of home position at low speed reverse direction → Search for the Z pulse 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.

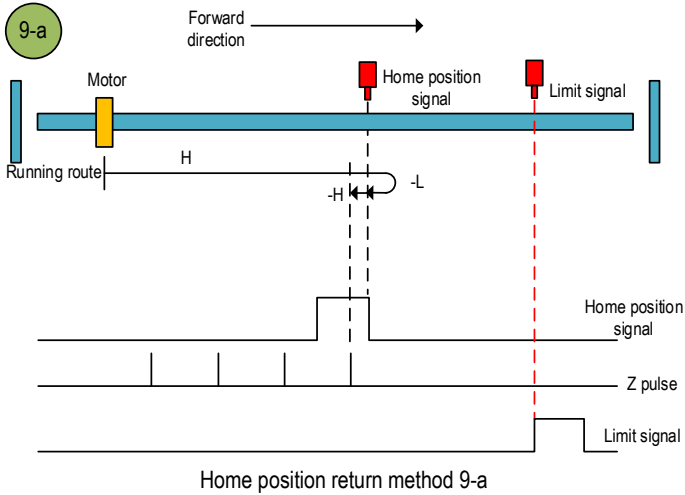


c. Start the home position return → Home position OFF → Search for the rising edge of home position at high speed forward direction → Touch the forward limit → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Search for the rising edge of home position at low speed forward direction → Search for the Z pulse in forward direction.

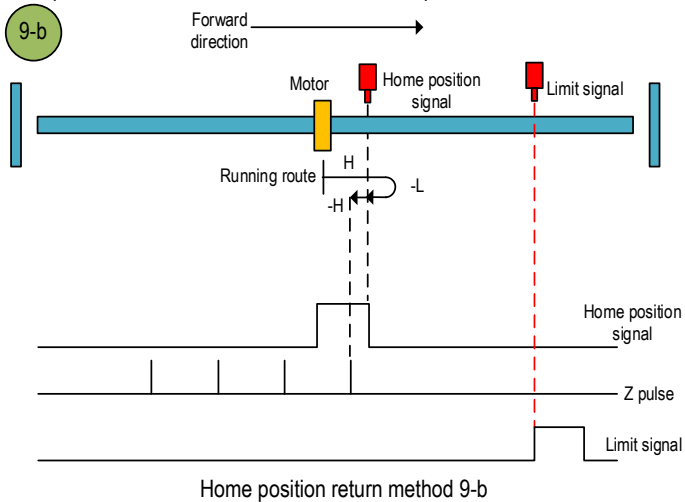


### 8.3.9 Home Position Return Method 9

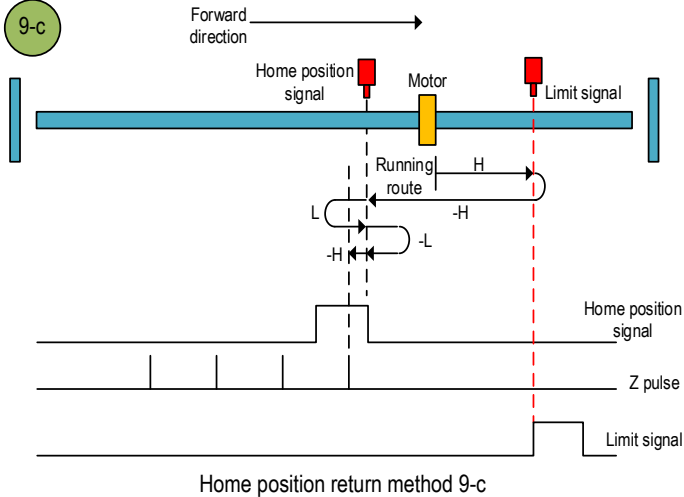
a. Start the home position return → Home position signal OFF → Search for the falling edge of home position at high speed forward direction → Decelerate to 0 → Search for the rising edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.



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.

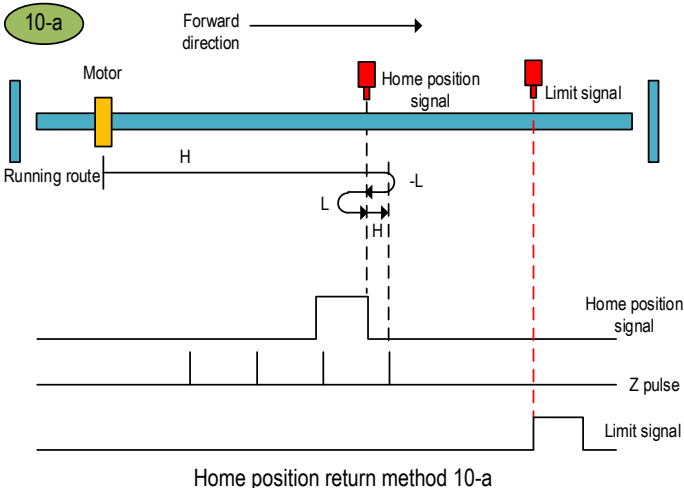


c. Start the home position return → Home position OFF → Search for the falling edge of home position at high speed forward direction → Touch the forward limit → Search for the rising edge of home position at high speed reverse direction → Decelerate to 0 → Search for the falling edge of home position at low speed forward direction → Search for the rising edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.



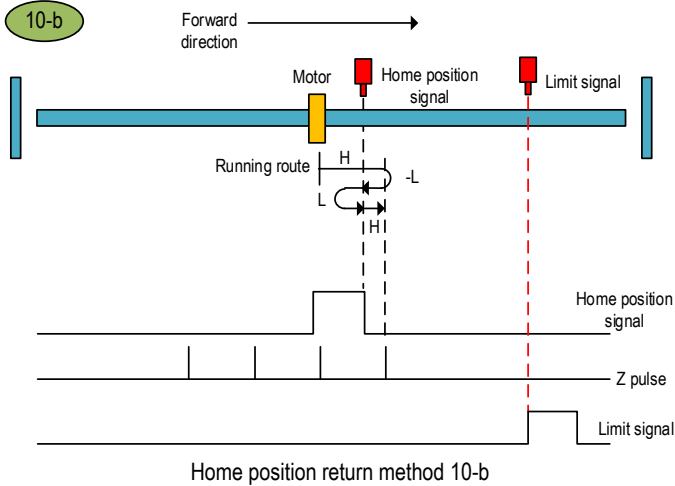
### 8.3.10 Home Position Return Method 10

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.

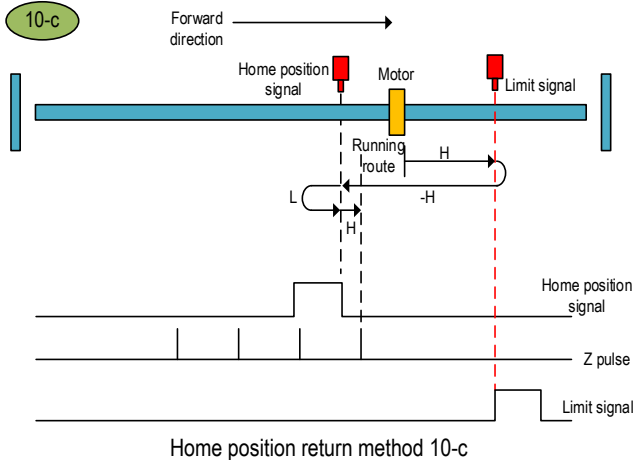


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b. Start the home position return → Home position signal ON → Search for the falling edge of home position at high speed forward direction → Decelerate to 0 → Search for the rising edge of home position at low speed reverse direction → Search for the falling edge of home position at low speed forward direction → Search for the Z pulse in forward direction.

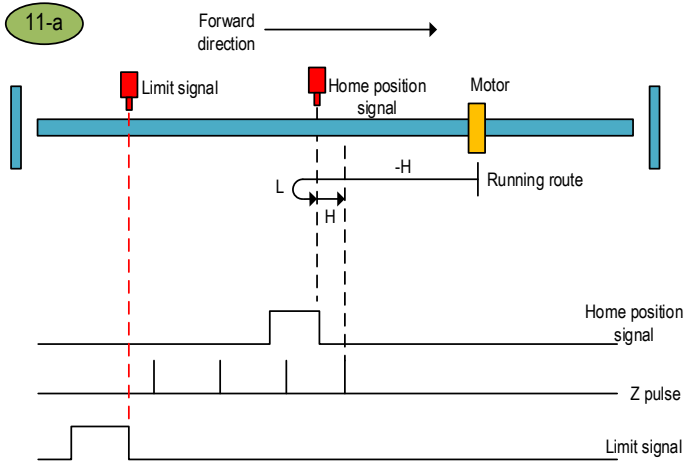


c. Start the home position return → Home position OFF → Search for the falling edge of home position at high speed forward direction → Touch the forward limit → Search for the rising edge of home position at high speed reverse direction → Decelerate to 0 → Search for the falling edge of home position at low speed forward direction → Search for the Z pulse in forward direction.



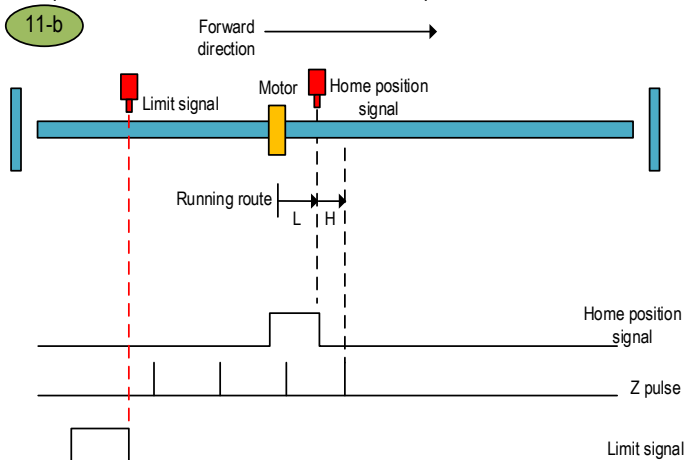
### 8.3.11 Home Position Return Method 11

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.



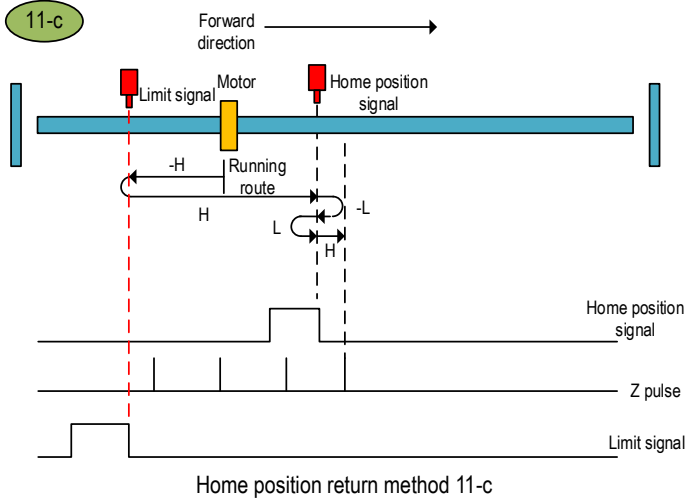
Home position return method 11-a

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 Z pulse in forward direction.



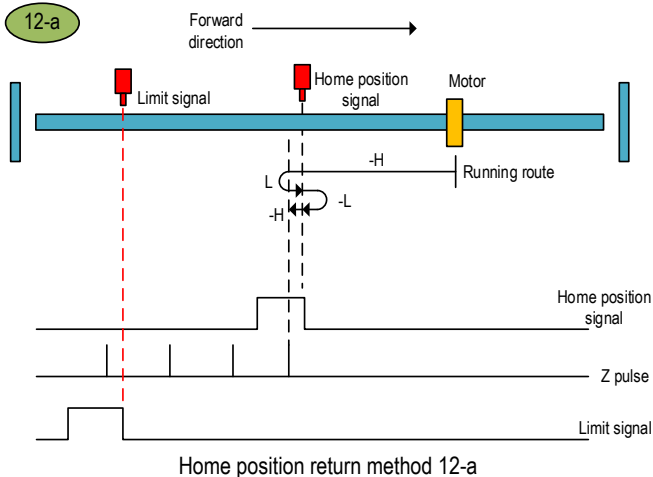
Home position return method 11-b

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.

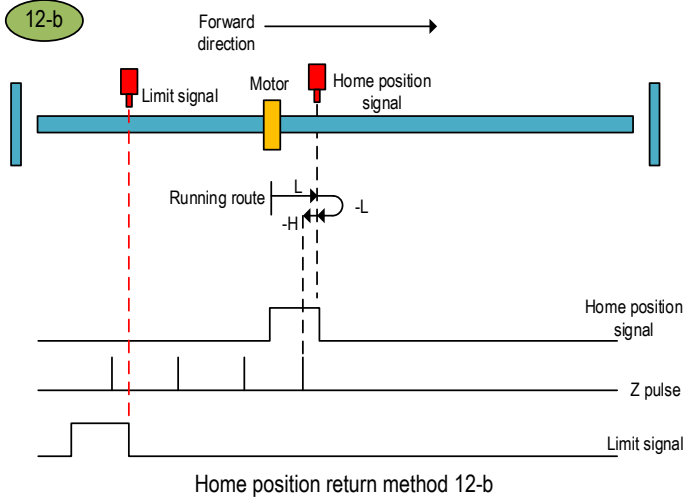


### 8.3.12 Home Position Return Method 12

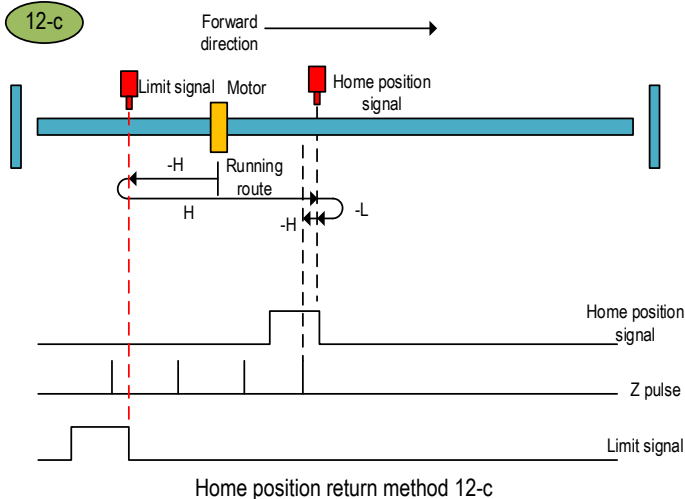
a. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed reverse direction → Decelerate to 0 → Search for the falling edge of home position at high speed forward direction → Search for the rising edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.



b. Start 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.

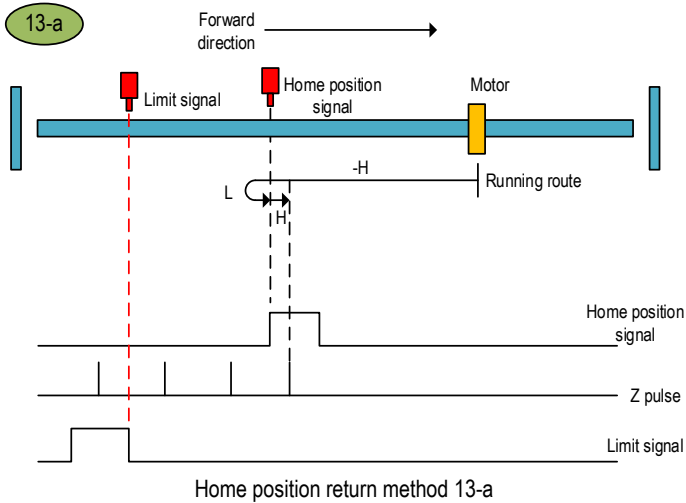


c. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed reverse direction → Touch the reverse limit → Search for the falling edge of home position at high speed forward direction → Decelerate to 0 → Search for the rising edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.

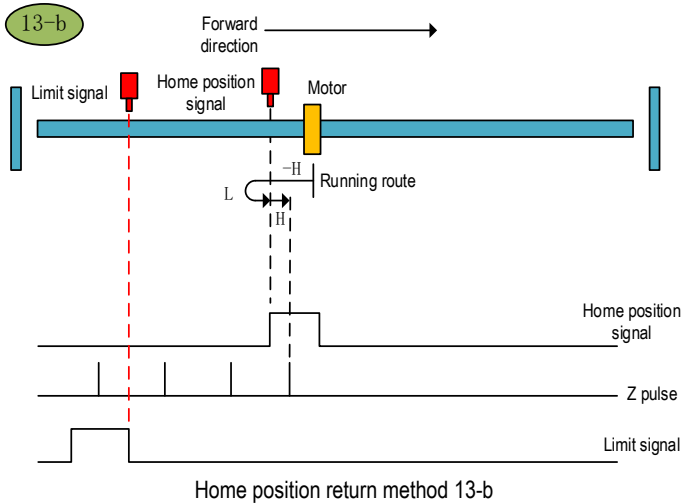


### 8.3.13 Home Position Return Method 13

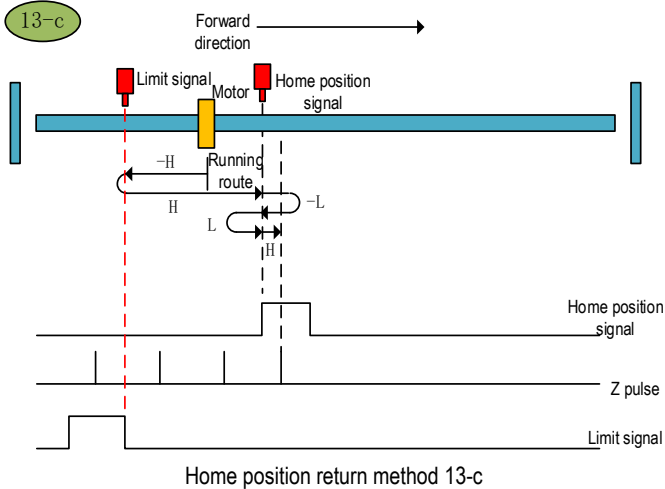
a. Start the home position return → Home position signal OFF → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Search for the rising edge of home position at low speed forward direction → Search for the Z pulse in forward direction.



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 → Search for the Z pulse in forward direction.

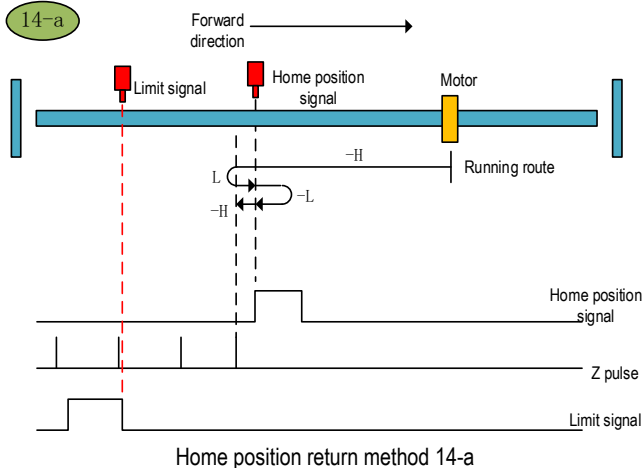


c. Start the home position return → Home position signal OFF → Search for the falling edge of home position at high speed reverse direction → Touch the reverse limit → Search for the rising edge of home position at high speed forward direction → Decelerate to 0 → Search for the falling edge of home position at low speed reverse direction → Search for the rising edge of home position at low speed forward direction → Search for the Z pulse in forward direction.

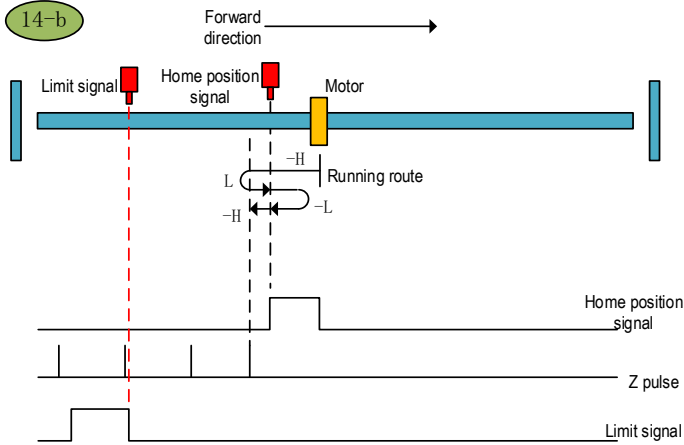


### 8.3.14 Home Position Return Method 14

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.

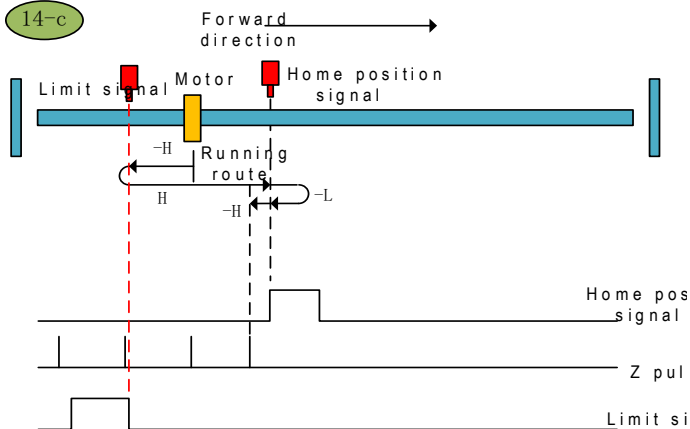


b. Start the home position return → Home position signal ON → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Search for the rising edge of home position at low speed forward direction → Search for the falling edge of home position at low speed reverse direction → Search for the Z pulse in reverse direction.



Home position return method 14-b

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 → Search for the Z pulse in reverse direction.



Home position return method 14-c

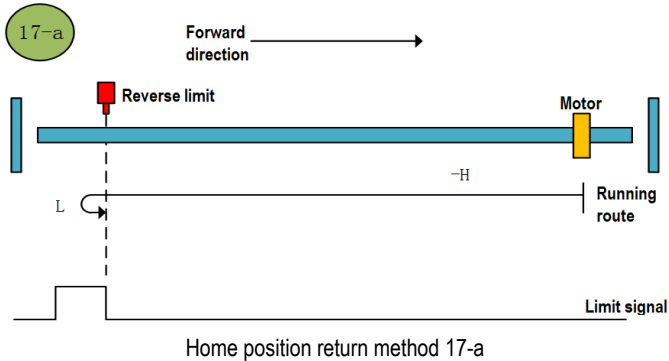
### 8.3.15 Home Position Return Method 15

After this home position return mode is triggered, the servo takes the current position as the home position and the servo absolute position is cleared (equivalent to the 35th home position return mode specified in CIA402).

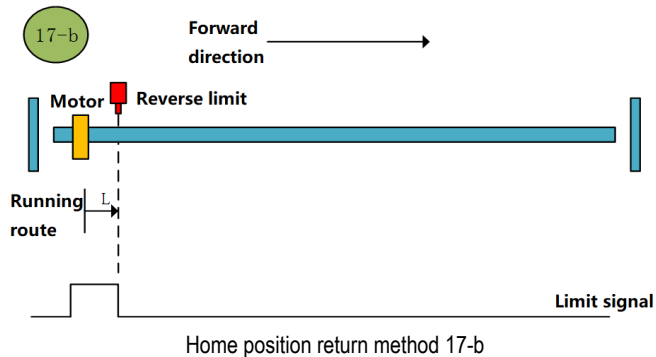
### 8.3.16 Home Position Return Method 16: Reserved

### 8.3.17 Home Position Return Method 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.

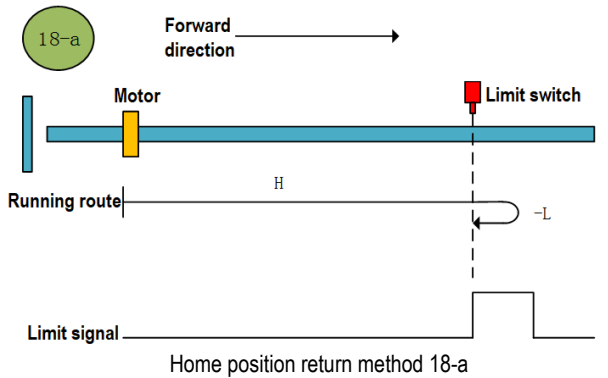


b. Start the home position return → Reverse limit valid → Stop after searching for the falling edge of reverse limit at low speed forward direction.

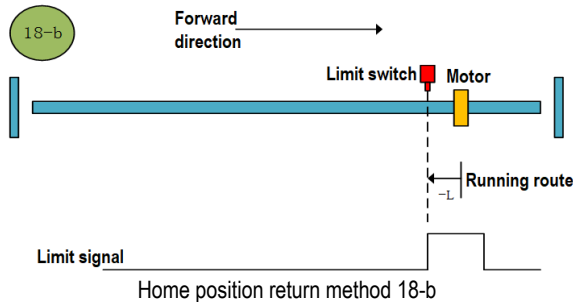


### 8.3.18 Home Position Return Method 18

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.

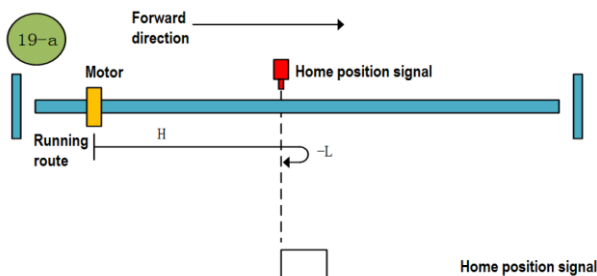


b. Start the home position return → Forward limit valid → Stop after searching for the falling edge of forward limit at low speed reverse direction.



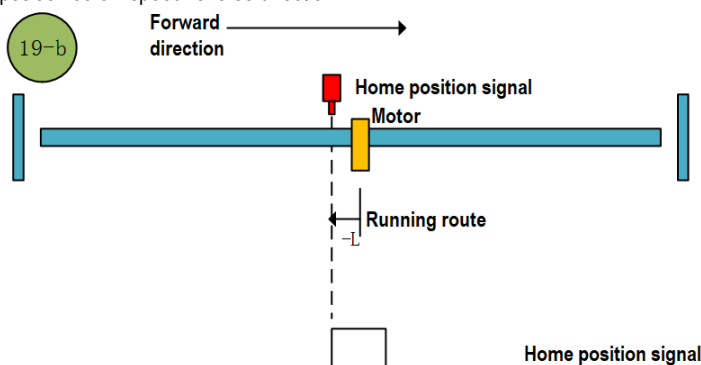
### 8.3.19 Home Position Return Method 19

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.



Home position return method 19-a

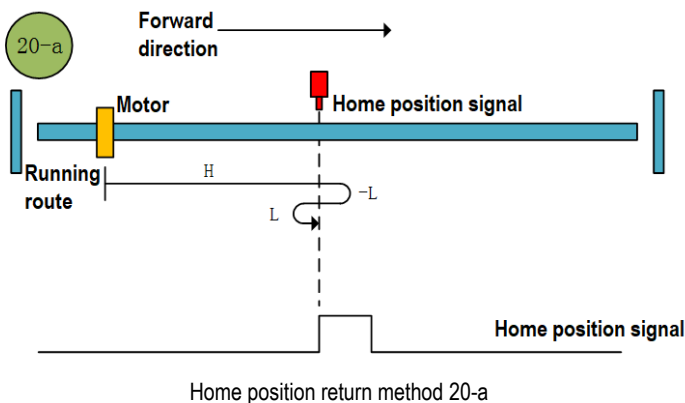
b. Start the home position return → Home position valid → Stop after searching for the falling edge of home position at low speed reverse direction.



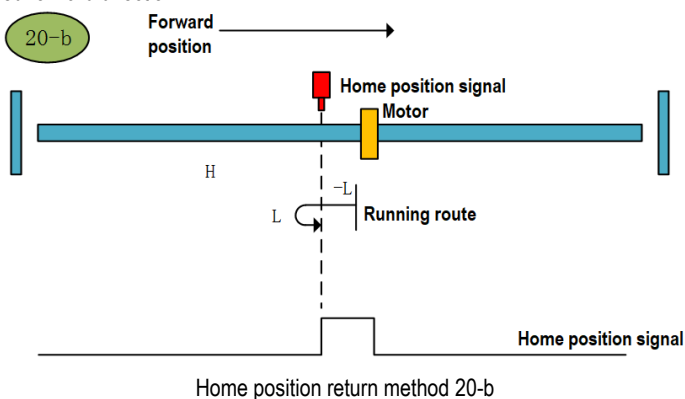
Home position return method 19-b

### 8.3.20 Home Position Return Method 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.

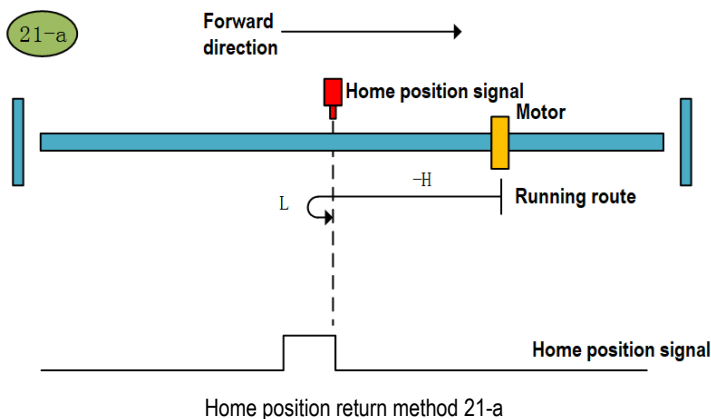


b. Start the home position return → Home position signal ON → Search for the falling edge of home position at low speed reverse direction → Stop after searching for the rising edge of home position at low speed forward direction.

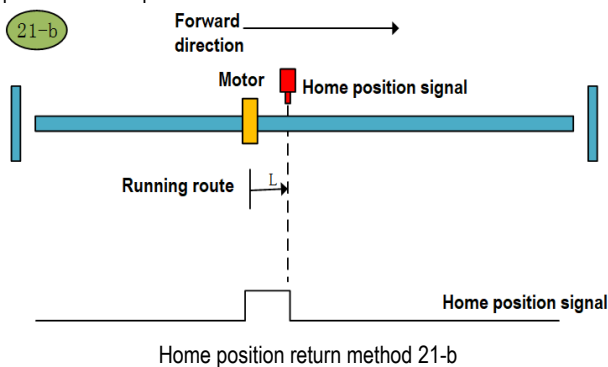


### 8.3.21 Home Position Return Method 21

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.

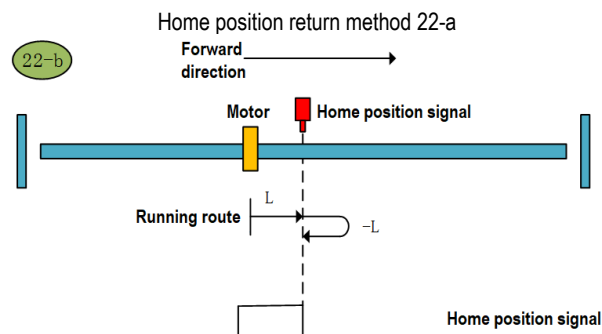
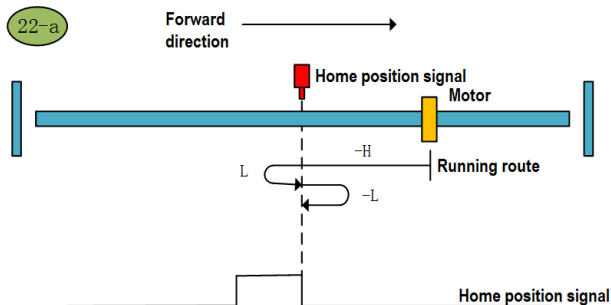


b. Start the home position return → Home position signal ON → Stop after searching for the falling edge of home position at low speed forward direction.



### 8.3.22 Home Position Return Method 22

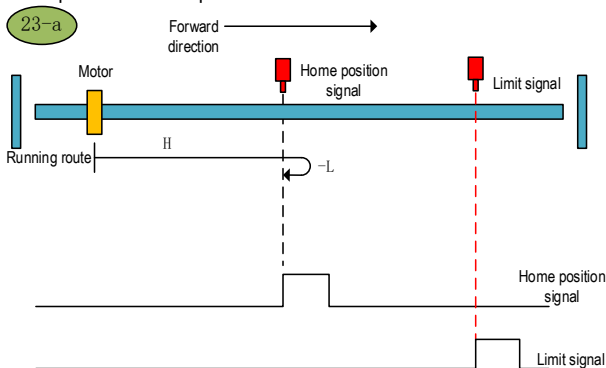
a. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed reverse direction → Decelerate to 0 → Search for the falling edge of home position at low speed forward direction → Stop after searching for the rising edge of home position at low speed reverse direction.



Home position return method 22-b

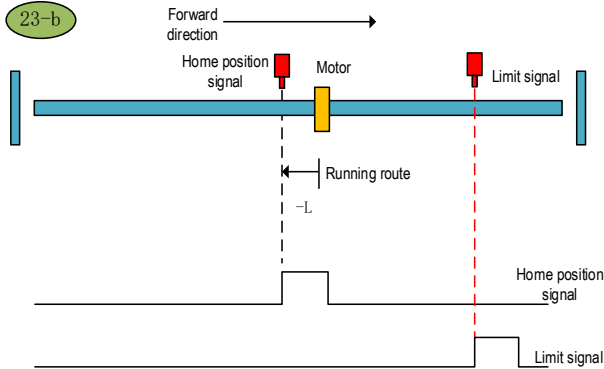
### 8.3.23 Home Position Return Method 23

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.



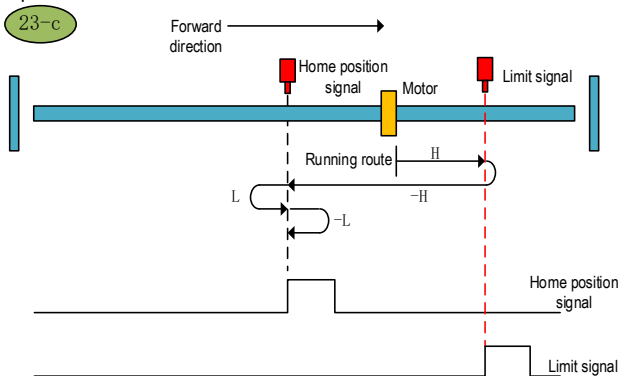
Home position return method 23-a

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.



Home position return method 23-b

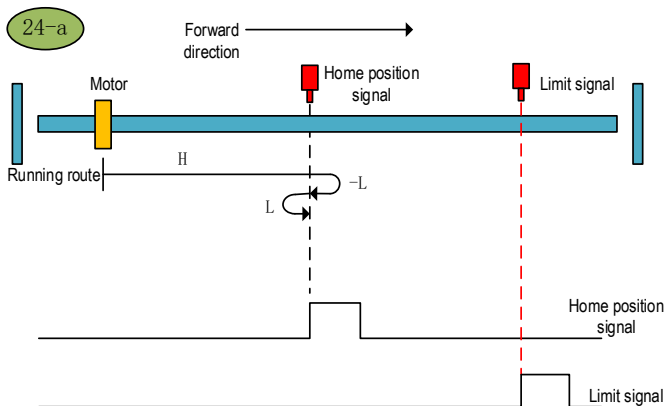
c. Start the home position return → Home position OFF → Search for the rising edge of home position at high speed forward direction → Touch the forward limit → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Search for the rising edge of home position at low speed forward direction → Stop after searching for the falling edge of home position at low speed reverse direction.



Home position return method 23-c

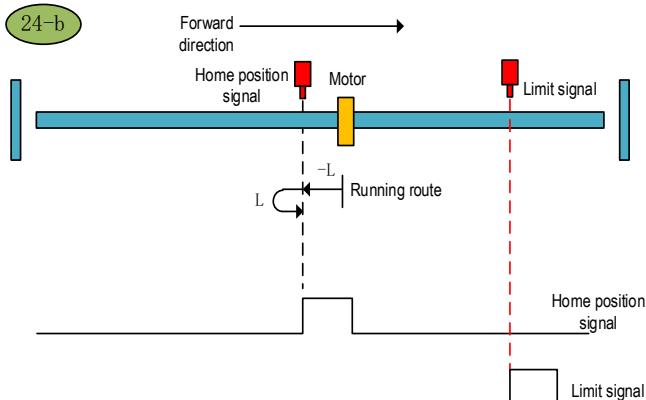
### 8.3.24 Home Position Return Method 24

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.



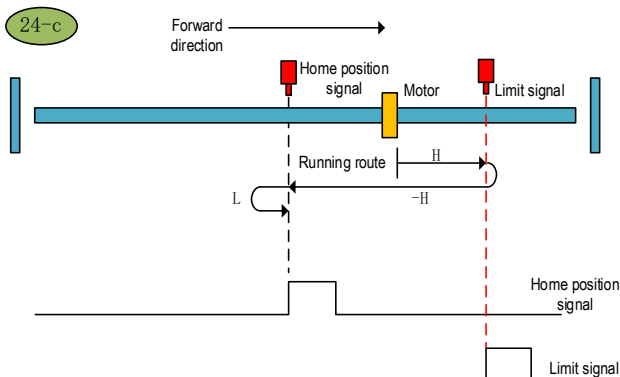
Home position return method 24-a

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.



Home position return method 24-b

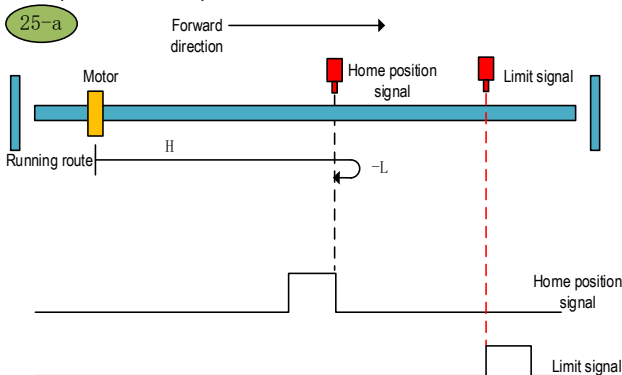
c. Start the home position return → Home position OFF → Search for the rising edge of home position at high speed forward direction → Touch the forward limit → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Stop after searching for the rising edge of home position at low speed forward direction.



Home position return method 24-c

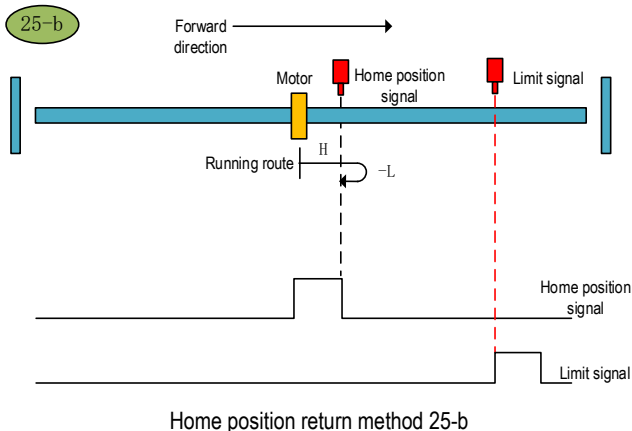
### 8.3.25 Home Position Return Method 25

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.

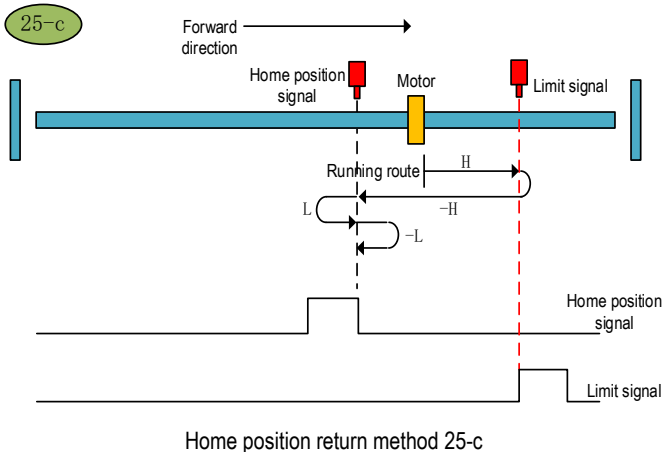


Home position return method 25-a

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.

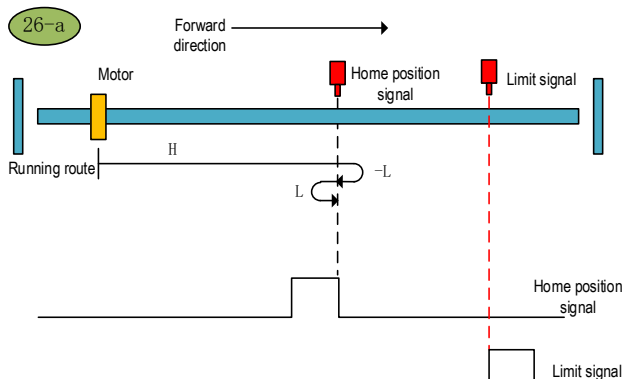


c. Start the home position return → Home position OFF → Search for the falling edge of home position at high speed forward direction → Touch the forward limit → Search for the rising edge of home position at high speed reverse direction → Decelerate to 0 → Search for the falling edge of home position at low speed forward direction → Stop after searching for the rising edge of home position at low speed reverse direction.



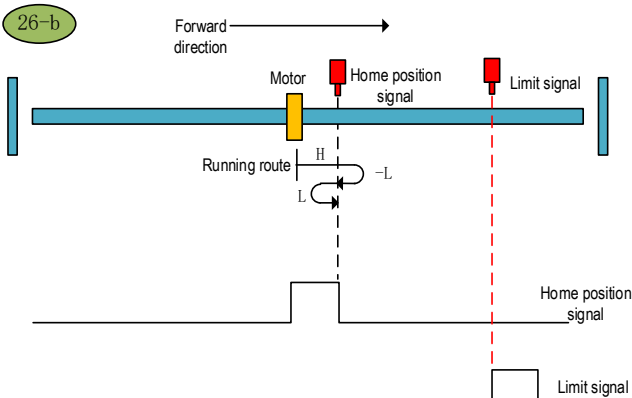
### 8.3.26 Home Position Return Method 26

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.



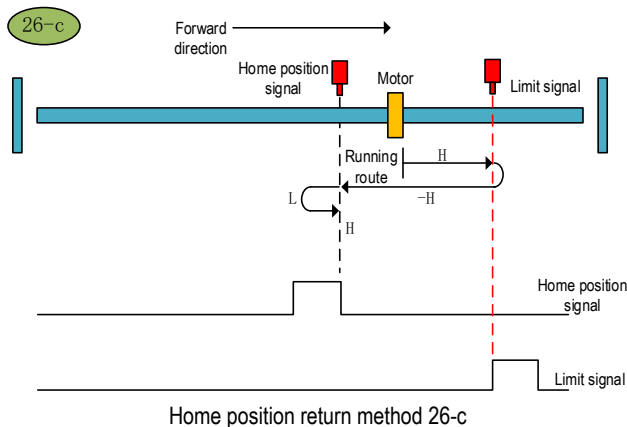
Home position return method 26-a

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.



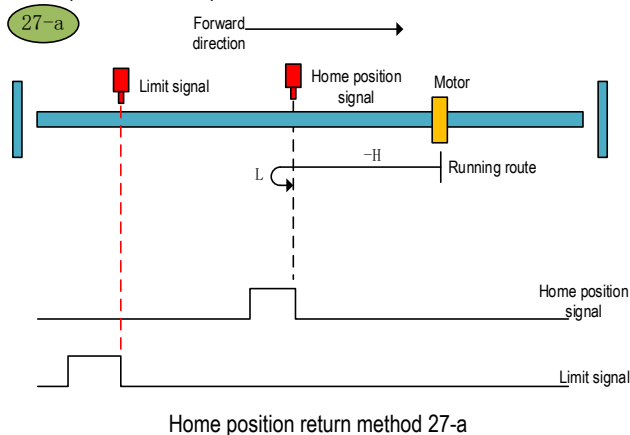
Home position return method 26-b

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.

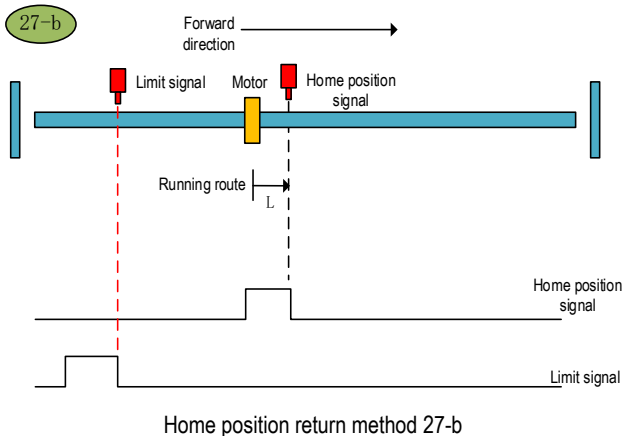


### 8.3.27 Home Position Return Method 27

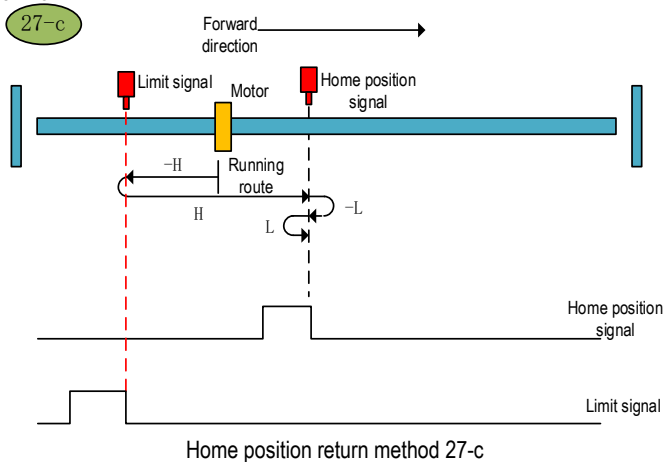
a. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed reverse direction → Decelerate to 0 → Stop after searching for the falling edge of home position at low speed forward direction.



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.

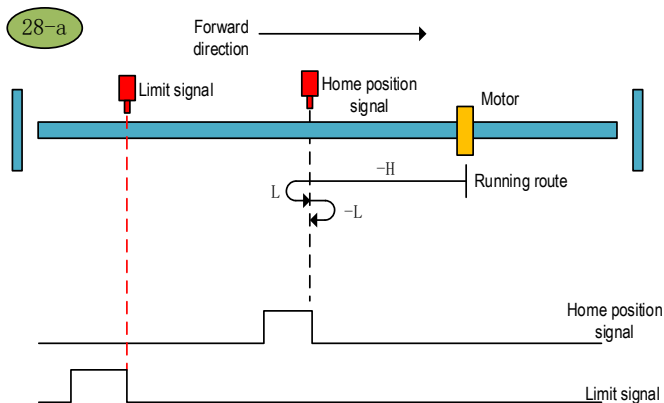


c. Start the home position return → Home position signal OFF → Search for the rising edge of home position at high speed reverse direction → Touch the reverse limit → Search for the falling edge of home position at high speed forward direction → Decelerate to 0 → Stop after searching for the rising edge of home position at low speed reverse direction.



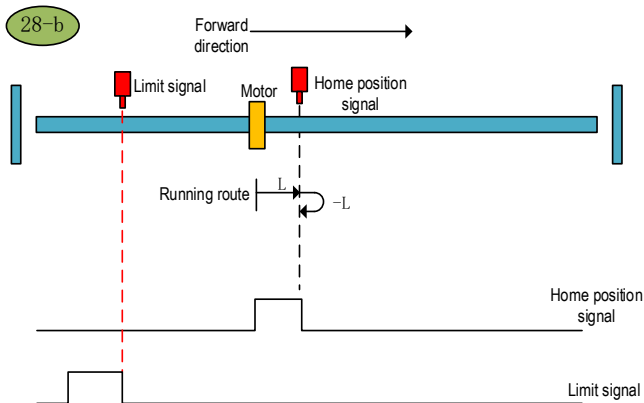
### 8.3.28 Home Position Return Method 28

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.



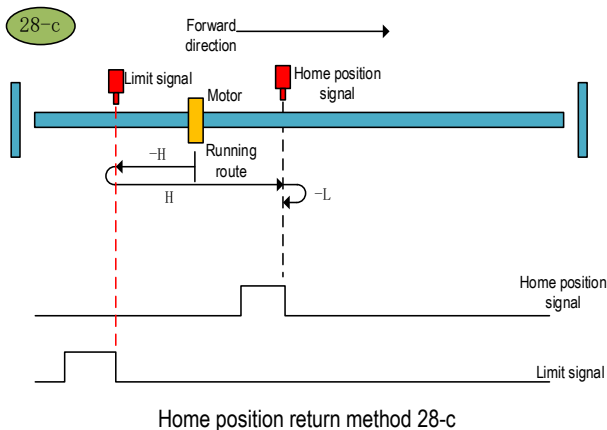
Home position return method 28-a

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.



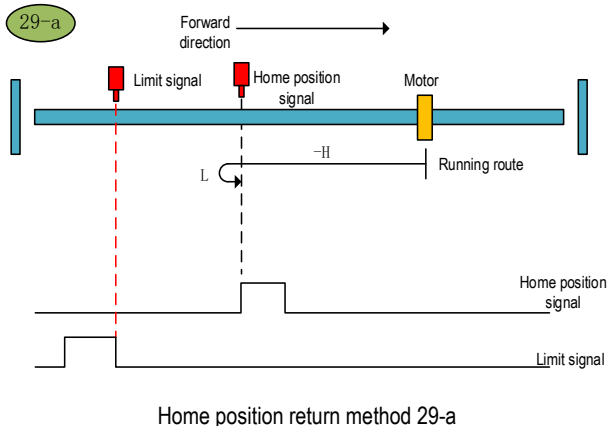
Home position return method 28-b

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.

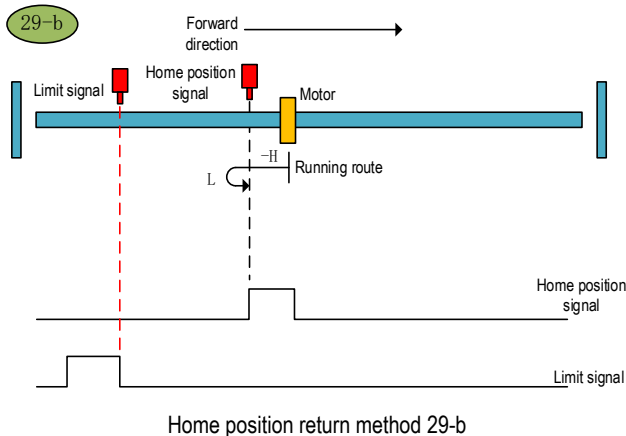


### 8.3.29 Home Position Return Method 29 (6098 00h=29)

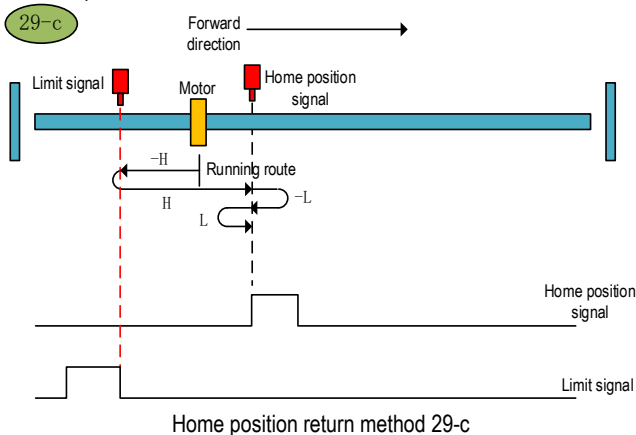
a. Start the home position return → Home position signal OFF → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Stop after searching for the rising edge of home position at low speed forward direction.



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.

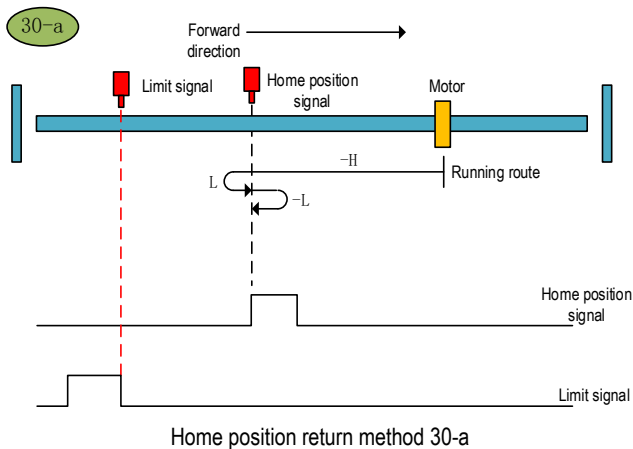


c. Start the home position return → Home position signal OFF → Search for the falling edge of home position at high speed reverse direction → Touch the reverse limit → Search for the rising edge of home position at high speed forward direction → Decelerate to 0 → Search for the falling edge of home position at low speed reverse direction → Stop after searching for the rising edge of home position at low speed forward direction.

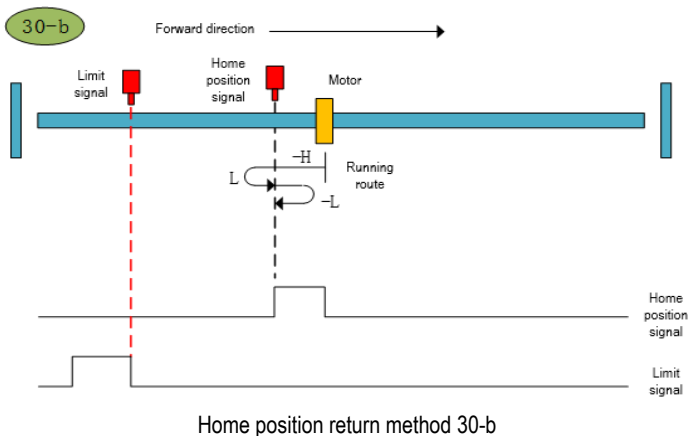


### 8.3.30 Home Position Return Method 30 (6098 00h=30)

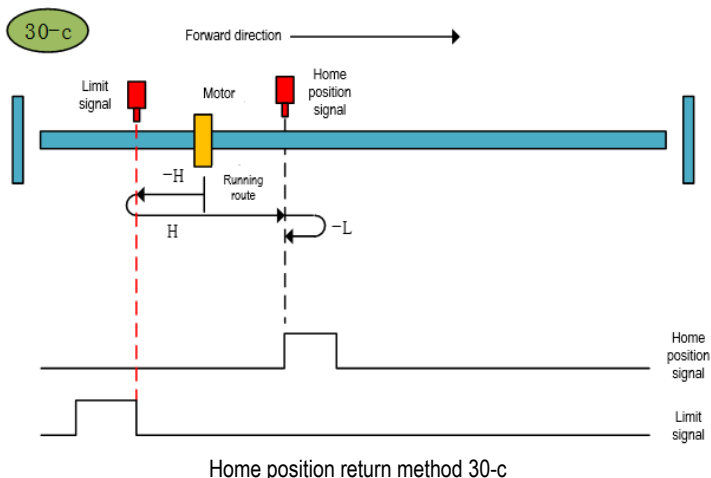
a. Start the home position return → Home position signal OFF → Search for the falling edge of home position at high speed reverse direction → Decelerate to 0 → Search for the rising edge of home position at low speed forward direction → Stop after searching for the falling edge of home position at low 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.

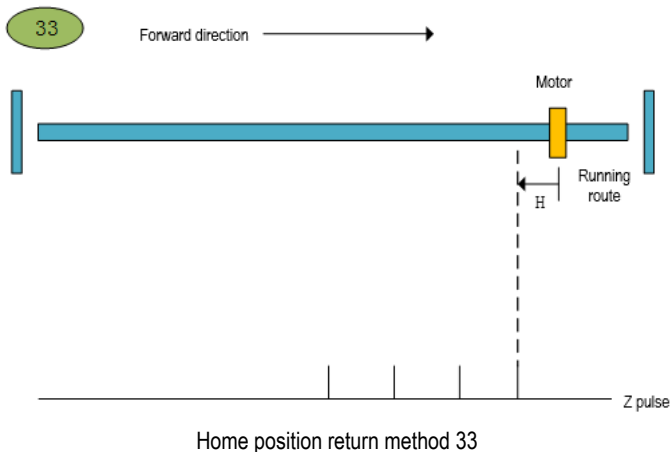


### 8.3.31 Home Position Return Method 31 (6098 00h=31): Reserved

### 8.3.32 Home Position Return Method 32 (6098 00h=32): Reserved

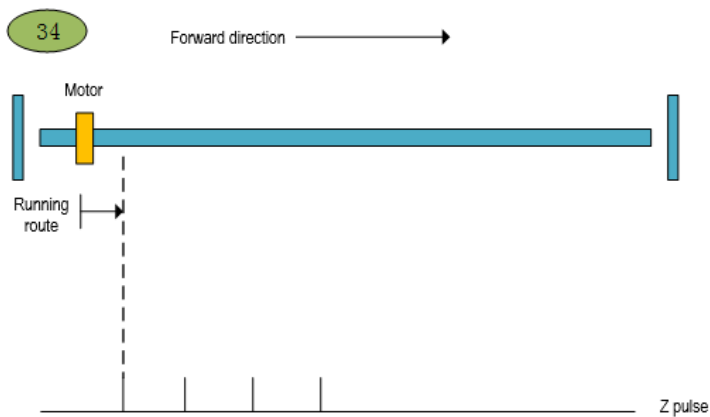
### 8.3.33 Home Position Return Method 33 (6098 00h=33)

Start the home position return → Find the first Z pulse in the reverse direction.



### 8.3.34 Home Position Return Method 34 (6098 00h=34)

Start the home position return → Find the first Z pulse in the forward direction.



Home position return method 34

## 9 Internal Position

### 9.1 The Position Control Function Code Parameter Setting

|              |                                |                       |                              |
|--------------|--------------------------------|-----------------------|------------------------------|
| <b>Pn000</b> | Control mode selection         | <input type="radio"/> | Communication address: 0x000 |
| Default: 0   | Setting range: 0x0000 ~ 0x000B | Unit: N/A             | Control mode: P, S, T        |

Parameter description: Control mode selection. The position control function is the internal position mode, and the position command is given by the parameter. Before running the position control function, firstly, you need to set the servo drive control mode to position mode.

| Pn000           | Features              |
|-----------------|-----------------------|
| 0               | Position control mode |
| not 0 or not 16 | Other control mode    |
| 16              | EtherCAT mode         |

|              |                                   |                       |                              |
|--------------|-----------------------------------|-----------------------|------------------------------|
| <b>Pn208</b> | Position command source selection | <input type="radio"/> | Communication address: 0x208 |
| Default: 0   | Setting range: 0x0000~ 0x0001     | Unit: N/A             | Control mode: P              |

Parameter description: internal and external position command selection. The point position control function is the internal position mode, so before selecting the position control mode, the position command source needs to be set to the internal position mode.

| Pn208 | Function                                                        |
|-------|-----------------------------------------------------------------|
| 0     | Position command source selects external pulse input            |
| 1     | Position command source selects internal position command input |

|              |                                |                       |                              |
|--------------|--------------------------------|-----------------------|------------------------------|
| <b>Pn204</b> | Electronic gear ratio molecule | <input type="radio"/> | Communication address: 0x204 |
| Default: 64  | Setting range: 1~ 1073741824   | Unit: N/A             | Control mode: P              |

Parameter description: electronic gear ratio molecule. The electronic gear ratio of the servo drive is given together with the electronic gear than the denominator.

|              |                                   |                       |                              |
|--------------|-----------------------------------|-----------------------|------------------------------|
| <b>Pn206</b> | Electronic gear ratio denominator | <input type="radio"/> | Communication address: 0x206 |
| Default: 1   | Setting range: 1~ 1073741824      | Unit: N/A             | Control mode: P              |

Parameter description: electronic gear ratio denominator. They are given together with the electronic gears.

Note: If the point position control mode is the internal mode, the electronic gear ratio can not be set arbitrarily set the electronic gear ratio, which will cause data overflow, so that the operation error line. When the internal position mode is selected, it is necessary to set the internal position mode. After the electronic gear ratio setting is completed, it is necessary to ensure that the maximum number of command pulses per revolution is less than  $2^K$  ( K-bit encoder ).

## 9.2 Position Control Related Function Code

### 9.2.1 Function Code Description

Position control function, according to the position command, positioning speed, acceleration time, deceleration time, delay time, Pr command type, absolute/incremental/relative position, interrupt function, overlap function, storage function to plan the position trajectory. In addition, the position command trigger can be set through the function code and DI terminal.

#### 9.2.1.1 Position Command Trigger, Select, Stop

Position command trigger, select and stop can be realized in two ways. The first method is to use the external input terminal (DI terminal) to realize the selection, trigger, and stop the position command segment number. The second method uses specific function codes to trigger, select, and stop position commands.

Position command trigger, selection and stop can be realized through DI terminal. The position command trigger is realized by configuring the POS0-POS4 function of the DI terminal. SD700 allows planning 31 internal position commands. Select the position segment to be operated according to the combination of POS0-POS3. Set the selected position segment number to NUM, then the corresponding relationship between POS0-POS4 and the segment number of the position command is:

| POS4 | POS3 | POS2 | POS1 | POS0 | Position segment number NUM |
|------|------|------|------|------|-----------------------------|
| 0    | 0    | 0    | 0    | 0    | 0                           |
| 0    | 0    | 0    | 0    | 1    | 1                           |
| 0    | 0    | 0    | 1    | 0    | 2                           |
| 0    | 0    | 0    | 1    | 1    | 3                           |
| 0    | 0    | 1    | 0    | 0    | 4                           |
| 0    | 0    | 1    | 0    | 1    | 5                           |
| 0    | 0    | 1    | 1    | 0    | 6                           |
| 0    | 0    | 1    | 1    | 1    | 7                           |
| 0    | 1    | 0    | 0    | 0    | 8                           |
| 0    | 1    | 0    | 0    | 1    | 9                           |
| 0    | 1    | 0    | 1    | 0    | 10                          |
| 0    | 1    | 0    | 1    | 1    | 11                          |

|   |   |   |   |   |    |
|---|---|---|---|---|----|
| 0 | 1 | 1 | 0 | 0 | 12 |
| 0 | 1 | 1 | 0 | 1 | 13 |
| 0 | 1 | 1 | 1 | 0 | 14 |
| 0 | 1 | 1 | 1 | 1 | 15 |
| 1 | 0 | 0 | 0 | 0 | 16 |
| 1 | 0 | 0 | 0 | 1 | 17 |
| 1 | 0 | 0 | 1 | 0 | 18 |
| 1 | 0 | 0 | 1 | 1 | 19 |
| 1 | 0 | 1 | 0 | 0 | 20 |
| 1 | 0 | 1 | 0 | 1 | 21 |
| 1 | 0 | 1 | 1 | 0 | 22 |
| 1 | 0 | 1 | 1 | 1 | 23 |
| 1 | 1 | 0 | 0 | 0 | 24 |
| 1 | 1 | 0 | 0 | 1 | 25 |
| 1 | 1 | 0 | 1 | 0 | 26 |
| 1 | 1 | 0 | 1 | 1 | 27 |
| 1 | 1 | 1 | 0 | 0 | 28 |
| 1 | 1 | 1 | 0 | 1 | 29 |
| 1 | 1 | 1 | 1 | 0 | 30 |
| 1 | 1 | 1 | 1 | 1 | 31 |
| 0 | 0 | 0 | 0 | 0 |    |

The position command trigger is realized through the PosTrig function of the DI terminal. First select the internal position command segment number through DI terminals POS0-POS3, and then use PosTrig to trigger to run. The rising edge of the PosTrig signal indicates that the currently selected position command segment operation is triggered.

Note: Trigger the point with the segment number 0 to perform the home position return operation; the point other than 0 is the normal point.

During the Pr internal position command execution, if you want the Pr position function of the DI terminal to stop immediately, you can stop the operation by the PosStop function of the DI terminal. Using the rising edge of PosStop means immediately stopping the current running position command segment.

POS0- POS3 position command selection, PosStop position command stopp, PosTrig position command trigger can be realized by DI terminal, defined as follows:

| Position DI function | DI function code number |
|----------------------|-------------------------|
| PosTrig              | 0x16                    |
| POS0                 | 0x17                    |
| POS1                 | 0x18                    |
| POS2                 | 0x19                    |
| POS3                 | 0x1A                    |
| POS4                 | 0x1B                    |

Position command triggering, selection, and stop can be implemented by an external DI terminal or by a specific function code assignment.

When we want to use the position command selection, trigger and stop, we need a lot of DI input terminals. For convenience, the function code mode is added to the position control program for position command selection, triggering and stopping operations.

The setting of the internal position command is related to the function code pn898. According to the input value of Pn898, it will perform the according Pr command operation. The correspondence between Pn898 and the Pr position command selection, trigger, and stop is shown in the following table:

| Pn898 | Pr command function                                                                             |
|-------|-------------------------------------------------------------------------------------------------|
| 1~31  | Pr command segment number, trigger Pr position instruction execution<br>Relative to Trig+PosNum |
| 1000  | The Pr command stop. Equivalent to a STOP bit                                                   |
| other | Invalid                                                                                         |

In addition to triggering the Pr instruction segment, Pn898 can also display the segment number of the current Pr instruction and whether it is completed. Reading Pn898, if current Pn898 is shown as 10000+PosNum, then the current Pr instruction segment number PosNum of Pr instruction is being executed. If Pn898 displays 20000+PosNum, it means that the current Pr instruction segment number PosNum position instruction has been executed, and can receive the next Pr instruction. The Pn898 function code is defined as shown in the following table:

| Pn898          | Communication given Pr command segment number |           | ○ | Communication address: 0x898 |
|----------------|-----------------------------------------------|-----------|---|------------------------------|
| Default: 10000 | Setting range: 0x0000 ~ 0xFFFF                | Unit: N/A |   | Control mode: P              |

Parameter description: Pr position command segment number given by communication. By setting Pn898, the Pr command segment that you want to execute can be given by communication method and keypad mode. If the internal position command mode of Pr is selected while the servo is enabled, when the value of Pn898 is set to between 1 and 31, the corresponding Pr position command segment will be executed. During the execution of the entire Pr internal position command, the value of Pn898 can be read to determine whether the current executing position command segment and whether the current position command segment are executed.

If Pn898 is displayed in the format of 10000+PosNum, it indicates that the instruction segment whose current Pr instruction segment number is PosNum is being executed.

If Pn898 is displayed in the format of 2000+PosNum, it means that the instruction segment whose current Pr instruction segment number is PosNum has been executed, and the next Pr position command segment can be accepted.

Note: When the servo is enabled, after set the point number in Pn898 and then execute it. If the servo is not enabled, Pn898 will always display 20000, and the point operation will not be performed. By setting Pn898 = 1000, the Pr command segment can be stopped by communication.

## 9.2.2 Position Command Control Parameter Configuration

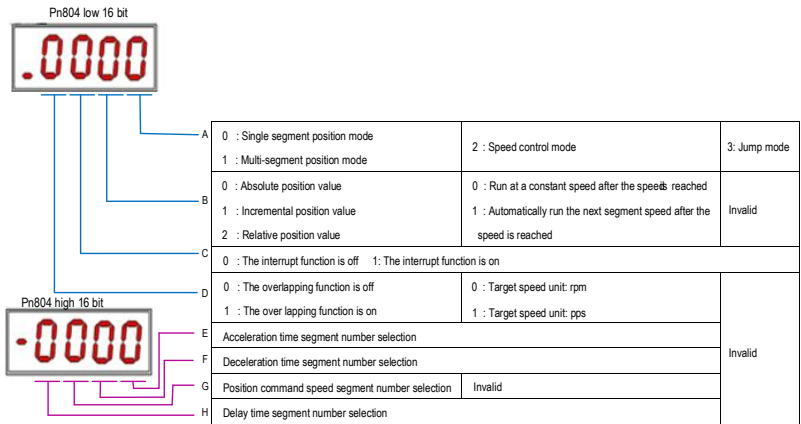
Position command segment can be divided into a control position command word and the position command pulses two parts. 31 segment position command segment is defined in the SD700.

Assuming that the position command segment number is POSNUM, the control word of the current position command segment is given by the function code Pn804+POSNUM\*4; the current position command pulse number is given by the function code Pn806+POSNUM\*4. By analogy, a total of 31 segment instruction segments are defined from function code Pn804 to Pn87E.

The control word for the position command segment is given by Pn804. The lower 16 bits define the point position control mode, and the higher 16 bits define the point operation parameter selection.

| Pn804                | Pr 1 control word               |           | ○               | Communication address: 0x804 |
|----------------------|---------------------------------|-----------|-----------------|------------------------------|
| Default: 0x 00000000 | Setting range: 0x0 ~ 0x80000000 | Unit: N/A | Control mode: P |                              |

Parameter description: The lower 16 bits of the internal position command control word are the internal position command trajectory planning control word. Interpolation, overlap, relative / absolute, single-segment / multi-segment / speed / jump of internal position commands can be planned by the lower 16 bits of the internal position command control word. The upper 16 bits define the speed, acceleration, deceleration, and delay time of the Pr position command. The function code from Pn880 to Pn897 defines the acceleration/deceleration time, positioning speed and delay time during the operation of the Pr position command.



Setting

Parameter attribute

Function code Pn804

Value(0x) 00000011

Name Pr1 control word

Set

Low 16 Bits

0000

A [0]single position mode

B [0]Absolute position value

C [0] Disable interrupt function

D [0]Disable overlap function

High 16 Bits

-0000

E [0]ACC time selection 0

F [0]DEC time selection 0

G [0]position command step selec

H [0]Delay time selection 0

Write

Function code A part function definition: select internal position mode.

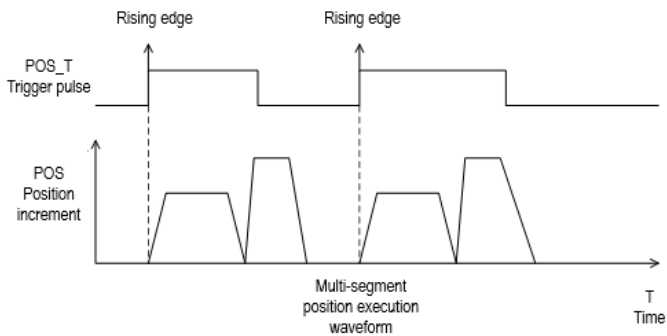
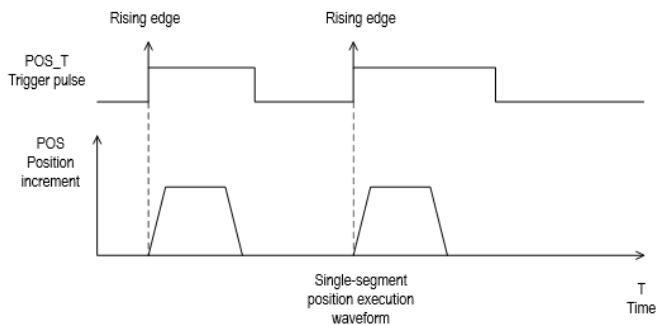
| A part | Features                     |
|--------|------------------------------|
| 0      | Single segment position mode |
| 1      | Multi-segment position mode  |
| 2      | Speed control mode           |
| 3      | Jump mode                    |

Single-segment, multi-segment description:

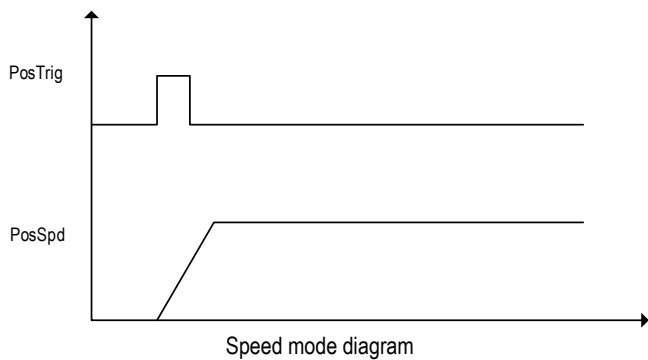
The single-segment position command indicates that the next position command is no longer executed after the current position command is executed. The multi-segment position command indicates that the next position command is executed after the current position command is executed. If several consecutive position commands are multiple segments, the multi-segment position command is executed continuously. The single-segment / multi-segment position instruction is executed as shown below:

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Speed mode description: If the current position command segment is given the speed mode, when the position command is planned, the motor runs at the set speed until the next Pr position command starts.



Jump mode description:

If the current position command segment bit jump mode, the current position command segment immediately jumps to the position command segment of the specified segment number, and the position command of the specified segment is executed.

Function code B part function definition: select command mode.

| Part B | Single / multi-segment position mode                                 | Speed mode                                                                           | Jump mode |
|--------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------|
| 0      | The current position command value is the absolute position value    | After the implementation of the current speed does not switch to the next Pr         | —         |
| 1      | The current position command value is the incremental position value | The next segment of Pr is automatically executed after the current speed is executed | —         |
| 2      | Current position command value is relative position value            | —                                                                                    | —         |

Single segment/ multi segment position mode: Part B of the position command type description:

1 Absolute position command: The motor running target position value is the given position command value.

$\text{TargetPos} = \text{PosAbs}$ .

2 Relative position command: The motor running target position value is the current actual position value plus the given relative position value.

$\text{TargetPos} = \text{PosFdb} + \text{PosRel}$ .

3 Incremental position command: motor running target position value is the previous position command value plus the current incremental position command value.

$\text{TargetPos} = \text{PosCmd} + \text{PosInc}$ .

Speed mode: Part B function description:

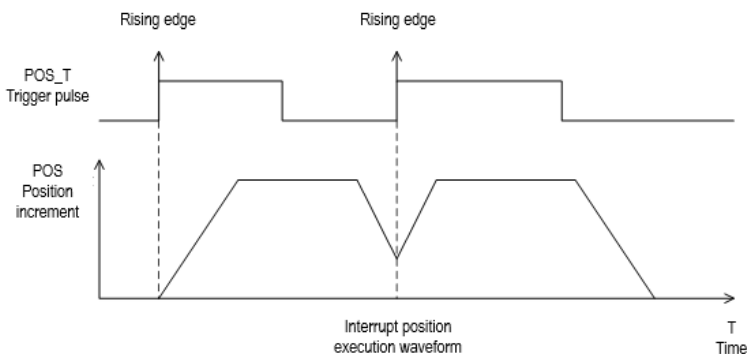
In the speed mode, the B part of the control word indicates whether the next Pr command value is automatically executed after the current speed command is reached. If the B part is 1, the next Pr command value is automatically executed. The next Pr instruction can be a single-segment, multi-segment position command, a speed command, or a jump command. If part B is 0, the motor will continue to run at the speed value given by the current Pr until the next Pr instruction starts execution.

Function code C part function definition: select the interrupt function.

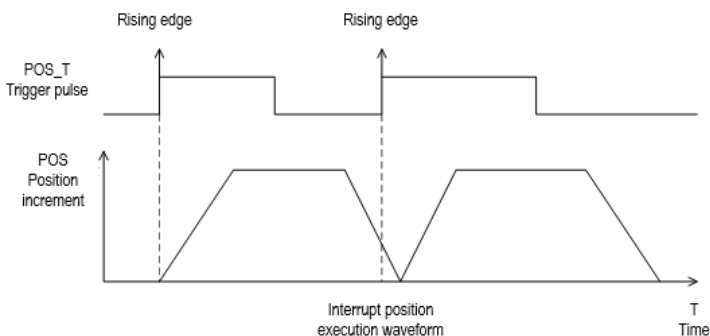
| Part C | Position mode                     | Speed mode                        | Jump mode                         |
|--------|-----------------------------------|-----------------------------------|-----------------------------------|
| 0      | Interrupt function is not enabled | Interrupt function is not enabled | Interrupt function is not enabled |
| 1      | Interrupt function enable         | Interrupt function enable         | Interrupt function enable         |

Interrupt Description: When the interrupt function is enabled, it will switch to the next position command immediately, regardless of whether the current position command is running or not. The

margin of the current position command is accumulated to the next position command for position command planning. If the interrupt function is not enabled, it will switch to the next position value execution only after the current position command is completed. The plug-in function is shown below:



Interrupt operation



Uninterrupted operation

Note: The interrupt function is valid after the Pr command is set, and the interrupt function is judged when the latter command is triggered.

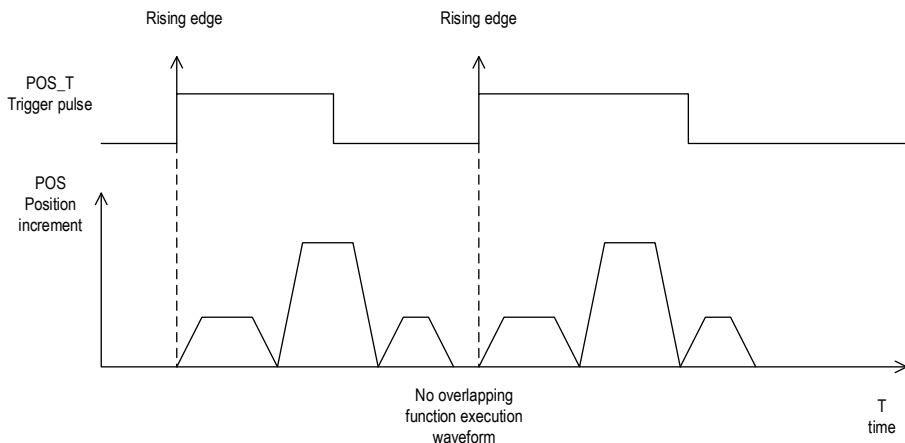
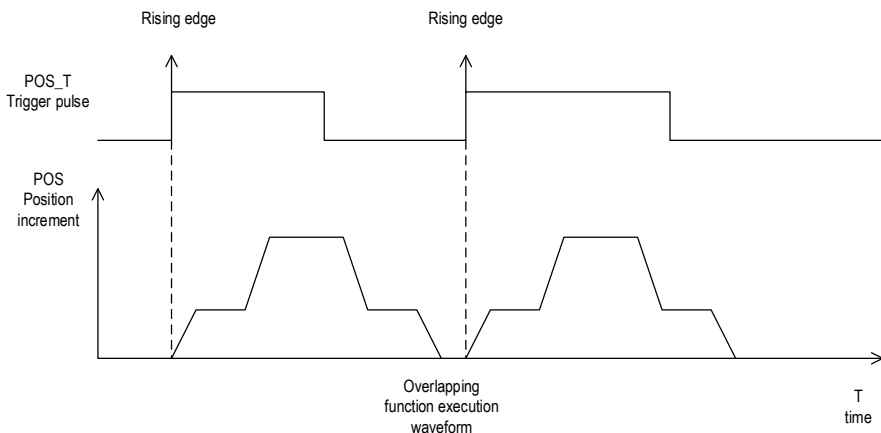
Function code D part function definition: select overlapping function

| Part D | Single / multi-segment position mode | Speed mode            | Jump mode |
|--------|--------------------------------------|-----------------------|-----------|
| 0      | Overlap function does not turn on    | Target speed unit rpm | —         |
| 1      | Overlap function on                  | Target speed unit PPS | —         |

Position overlap description: After the overlap function is turned on, when the multi-segment position command is executed, when each position command is executed to the deceleration phase, it will not decelerate to 0, and the next position command will be directly planned from the current speed. If the overlap function is not turned on, after the current position command is

executed, decelerate to 0 and then plan the next position command. The overlap function works only in multiple positions, the single-segment position does not work, and the multi-segment position delay time becomes 0 after the overlap function is turned on.

The multi-segment position overlap function is shown below:



Note: When the overlap occurs, the previous instruction setting takes effect. When the previous instruction runs to the deceleration point, it runs the next instruction.

Note: In speed mode, this bit indicates the speed command unit.

Speed unit description: The speed unit defines whether the speed value given by the current speed command segment is the rpm (how many revolutions per minute) speed value or the PPS (running pulses per second) speed value.

Function code E part function definition: Acceleration time selection.

| Part E | Single / multi-segment position mode function       | Speed mode                                          | Jump mode |
|--------|-----------------------------------------------------|-----------------------------------------------------|-----------|
| 0      | Acceleration time selects the time defined by Pn880 | Acceleration time selects the time defined by Pn880 | Invalid   |
| 1      | Acceleration time selects the time defined by Pn881 | Acceleration time selects the time defined by Pn881 | Invalid   |
| 2      | Acceleration time selects the time defined by Pn882 | Acceleration time selects the time defined by Pn882 | Invalid   |
| 3      | Acceleration time selects the time defined by Pn883 | Acceleration time selects the time defined by Pn883 | Invalid   |
| 4      | Acceleration time selects the time defined by Pn884 | Acceleration time selects the time defined by Pn884 | Invalid   |
| 5      | Acceleration time selects the time defined by Pn885 | Acceleration time selects the time defined by Pn885 | Invalid   |
| 6      | Acceleration time selects the time defined by Pn886 | Acceleration time selects the time defined by Pn886 | Invalid   |
| 7      | Acceleration time selects the time defined by Pn887 | Acceleration time selects the time defined by Pn887 | Invalid   |

Function code F part function definition: Deceleration time selection.

| Part F | Single / multi-segment position mode function       | Speed mode                                          | Jump mode |
|--------|-----------------------------------------------------|-----------------------------------------------------|-----------|
| 0      | Deceleration time selects the time defined by Pn880 | Deceleration time selects the time defined by Pn880 | Invalid   |
| 1      | Deceleration time selects the time defined by Pn881 | Deceleration time selects the time defined by Pn881 | Invalid   |
| 2      | Deceleration time selects the time defined by Pn882 | Deceleration time selects the time defined by Pn882 | Invalid   |
| 3      | Deceleration time selects the time defined by Pn883 | Deceleration time selects the time defined by Pn883 | Invalid   |
| 4      | Deceleration time selects the time defined by Pn884 | Deceleration time selects the time defined by Pn884 | Invalid   |
| 5      | Deceleration time selects the time defined by Pn885 | Deceleration time selects the time defined by Pn885 | Invalid   |
| 6      | Deceleration time selects the time defined by Pn886 | Deceleration time selects the time defined by Pn886 | Invalid   |
| 7      | Deceleration time selects the time defined by Pn887 | Deceleration time selects the time defined by Pn887 | Invalid   |

Function code G part function definition: Running speed selection.

| Part G | Single / multi-segment position mode function | Speed mode | Jump mode |
|--------|-----------------------------------------------|------------|-----------|
|--------|-----------------------------------------------|------------|-----------|

|   |                                                |         |         |
|---|------------------------------------------------|---------|---------|
| 0 | Speed value selects the value defined by Pn888 | Invalid | Invalid |
| 1 | Speed value selects the value defined by Pn889 | Invalid | Invalid |
| 2 | Speed value selects the value defined by Pn88A | Invalid | Invalid |
| 3 | Speed value selects the value defined by Pn88B | Invalid | Invalid |
| 4 | Speed value selects the value defined by Pn88C | Invalid | Invalid |
| 5 | Speed value selects the value defined by Pn88D | Invalid | Invalid |
| 6 | Speed value selects the value defined by Pn88E | Invalid | Invalid |
| 7 | Speed value selects the value defined by Pn88F | Invalid | Invalid |

Function code H part function definition: Delay time selection.

| Part G | Single / multi-segment position mode function | Speed mode                                    | Jump mode |
|--------|-----------------------------------------------|-----------------------------------------------|-----------|
| 0      | Delay time selects the value defined by Pn890 | Delay time selects the value defined by Pn890 | Invalid   |
| 1      | Delay time selects the value defined by Pn891 | Delay time selects the value defined by Pn891 | Invalid   |
| 2      | Delay time selects the value defined by Pn892 | Delay time selects the value defined by Pn892 | Invalid   |
| 3      | Delay time selects the value defined by Pn893 | Delay time selects the value defined by Pn893 | Invalid   |
| 4      | Delay time selects the value defined by Pn894 | Delay time selects the value defined by Pn894 | Invalid   |
| 5      | Delay time selects the value defined by Pn895 | Delay time selects the value defined by Pn895 | Invalid   |
| 6      | Delay time selects the value defined by Pn896 | Delay time selects the value defined by Pn896 | Invalid   |
| 7      | Delay time selects the value defined by Pn897 | Delay time selects the value defined by Pn897 | Invalid   |

### 9.2.3 Position Command Segment Pulse Given

Assuming the position command segment number is NUM, in the single-segment / multi-segment position mode, the position command pulse number is given by the function code Pn806 +4 \*NUM. In speed mode, the given speed value is given by Pn806 +4\*NUM.

|       |                                                                                      |   |                              |
|-------|--------------------------------------------------------------------------------------|---|------------------------------|
| Pn806 | Single / multi-segment position command pulse number<br>Speed mode given speed value | ○ | Communication address: 0x806 |
|-------|--------------------------------------------------------------------------------------|---|------------------------------|

|            |                                                   |              |                 |
|------------|---------------------------------------------------|--------------|-----------------|
| Default: 0 | Setting range: - 2 <sup>31</sup> ~2 <sup>31</sup> | Unit: circle | Control mode: P |
|------------|---------------------------------------------------|--------------|-----------------|

Parameter description: In the single-segment / multi-segment position mode, it is the position command pulse number given. In speed mode, it is the running target speed given.

Note: Pay attention to the speed given unit when the speed value is given in the speed mode, and the speed unit is given by the D part of Pn804.

## 9.2.4 Position Command Segment Sharing Parameters

The speed, acceleration/deceleration time, and delay time of the Pr position command are common parameters. Each of the Pr position command segments can select one of eight speeds, acceleration/deceleration time, and delay time as the operating parameters of the current position command segment. The shared parameter definition is as follows:

|             |                                                                            |          |                              |
|-------------|----------------------------------------------------------------------------|----------|------------------------------|
| Pn880       | Internal multi-segment position acceleration/deceleration time selection 0 | ○        | Communication address: 0x880 |
| Default:100 | Setting range:0~60000                                                      | Unit:N/A | Control mode: P              |

Parameter description: Internal position command acceleration/deceleration time selection. From the function code Pn880 to the function code Pn887, a total of 8 sets of internal multi-segment position acceleration/deceleration time are defined. Control the actual internal multi-segment position, according to the part E of the position of the control command multi-segment word high 16 bit of , select Pn880 to Pn887 a parameter as an internal position command acceleration time; controlled according to an internal position multistage position The F- part of the upper 16 bits of the word selects one of Pn880 to Pn887 as the deceleration time of the internal multi-segment position command.

Note: When several different position command segments select the same acceleration /deceleration time function code, modify the acceleration/deceleration time value of the corresponding function code, and the acceleration/deceleration time of several position commands will be changed at the same time. Deceleration time setting is from 0rpm to accelerate to rated speed of the motor required.

|              |                                                                            |          |                              |
|--------------|----------------------------------------------------------------------------|----------|------------------------------|
| Pn881        | Internal multi-segment position acceleration/deceleration time selection 1 | ○        | Communication address: 0x881 |
| Default: 200 | Setting range: 0 ~ 60000                                                   | Unit: ms | Control mode: P              |

Same as Pn881

|              |                                                                            |          |                              |
|--------------|----------------------------------------------------------------------------|----------|------------------------------|
| Pn882        | Internal multi-segment position acceleration/deceleration time selection 2 | ○        | Communication address: 0x882 |
| Default: 300 | Setting range: 0 ~ 60000                                                   | Unit: ms | Control mode: P              |

Same as Pn881

|       |                                                                            |   |                              |
|-------|----------------------------------------------------------------------------|---|------------------------------|
| Pn883 | Internal multi-segment position acceleration/deceleration time selection 3 | ○ | Communication address: 0x883 |
|-------|----------------------------------------------------------------------------|---|------------------------------|

|              |                          |          |                 |
|--------------|--------------------------|----------|-----------------|
| Default: 400 | Setting range: 0 ~ 60000 | Unit: ms | Control mode: P |
|--------------|--------------------------|----------|-----------------|

Same as Pn881

|              |                                                                            |          |                              |
|--------------|----------------------------------------------------------------------------|----------|------------------------------|
| <b>Pn884</b> | Internal multi-segment position acceleration/deceleration time selection 4 | ○        | Communication address: 0x884 |
| Default: 500 | Setting range: 0 ~ 60000                                                   | Unit: ms | Control mode: P              |

Same as Pn881

|              |                                                                            |          |                              |
|--------------|----------------------------------------------------------------------------|----------|------------------------------|
| <b>Pn885</b> | Internal multi-segment position acceleration/deceleration time selection 5 | ○        | Communication address: 0x885 |
| Default: 600 | Setting range: 0 ~ 60000                                                   | Unit: ms | Control mode: P              |

Same as Pn881

|              |                                                                            |          |                              |
|--------------|----------------------------------------------------------------------------|----------|------------------------------|
| <b>Pn886</b> | Internal multi-segment position acceleration/deceleration time selection 6 | ○        | Communication address: 0x886 |
| Default: 700 | Setting range: 0 ~ 60000                                                   | Unit: ms | Control mode: P              |

Same as Pn881

|              |                                                                            |          |                              |
|--------------|----------------------------------------------------------------------------|----------|------------------------------|
| <b>Pn887</b> | Internal multi-segment position acceleration/deceleration time selection 7 | ○        | Communication address: 0x887 |
| Default: 800 | Setting range: 0 ~ 60000                                                   | Unit: ms | Control mode: P              |

Same as Pn881

|              |                                                         |           |                              |
|--------------|---------------------------------------------------------|-----------|------------------------------|
| <b>Pn888</b> | Internal multi-segment position speed value selection 0 | ○         | Communication address: 0x888 |
| Default: 100 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P              |

Parameter description: Internal multi-segment position command speed selection. From the function code P n888 to P n88F , a total of 8 sets of internal multi-segment position velocity values are provided. When the internal multi-segment position control is actually performed, a set of parameters between Pn888 and Pn88F is selected as the speed reference value for the internal multi-segment position operation according to the value of the F part of the internal multi-segment position control word high 16 bits.

|              |                                                         |           |                              |
|--------------|---------------------------------------------------------|-----------|------------------------------|
| <b>Pn889</b> | Internal multi-segment position speed value selection 1 | ○         | Communication address: 0x889 |
| Default: 200 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P              |

Same as Pn888

|              |                                                         |   |                              |
|--------------|---------------------------------------------------------|---|------------------------------|
| <b>Pn88A</b> | Internal multi-segment position speed value selection 2 | ○ | Communication address: 0x88A |
|--------------|---------------------------------------------------------|---|------------------------------|

|              |                         |           |                 |
|--------------|-------------------------|-----------|-----------------|
| Default: 500 | Setting range: 0 ~ 6000 | Unit: rpm | Control mode: P |
|--------------|-------------------------|-----------|-----------------|

Same as Pn888

|               |                                                         |           |                              |
|---------------|---------------------------------------------------------|-----------|------------------------------|
| <b>Pn88B</b>  | Internal multi-segment position speed value selection 3 | ○         | Communication address: 0x88B |
| Default: 1000 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P              |

Same as Pn888

|               |                                                         |           |                               |
|---------------|---------------------------------------------------------|-----------|-------------------------------|
| <b>Pn88C</b>  | Internal multi-segment position speed value selection 4 | ○         | Communication address : 0x88C |
| Default: 1500 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P               |

Same as Pn888

|               |                                                         |           |                              |
|---------------|---------------------------------------------------------|-----------|------------------------------|
| <b>Pn88D</b>  | Internal multi-segment position speed value selection 5 | ○         | Communication address: 0x88D |
| Default: 2000 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P              |

Same as Pn888

|               |                                                         |           |                              |
|---------------|---------------------------------------------------------|-----------|------------------------------|
| <b>Pn88E</b>  | Internal multi-segment position speed value selection 6 | ○         | Communication address: 0x88E |
| Default: 2500 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P              |

Same as Pn888

|                     |                                                         |           |                              |
|---------------------|---------------------------------------------------------|-----------|------------------------------|
| <b>Pn88F</b>        | Internal multi-segment position speed value selection 7 | ○         | Communication address: 0x88F |
| Factory value: 3000 | Setting range: 0 ~ 6000                                 | Unit: rpm | Control mode: P              |

Same as Pn888

|              |                                                        |            |                              |
|--------------|--------------------------------------------------------|------------|------------------------------|
| <b>Pn890</b> | Internal multi-segment position delay time selection 0 | ○          | Communication address: 0x890 |
| Default: 0   | Setting range: 0 ~ 60000                               | Unit: 0.1s | Control mode: P              |

Parameter description: Internal multi-segment position command delay time selection. From the function code Pn890 to Pn897, a total of 8 sets of internal multi-segment position delay time selection are provided. When the internal multi-segment position control is actually performed, a set of parameters between Pn890 and Pn897 is selected as the internal multi-segment position between the two-point position command according to the value of the D portion of the internal multi-segment position control word high 16 bits. Interval time (unit: 0.1s, delay time range is 0s ~ 6000s).

Note: For the position command, the delay time is the calculated after the position command pulse is sent. For the speed mode, the delay time is calculated after the speed value reaches the set target speed.

|              |                                                           |            |                                 |
|--------------|-----------------------------------------------------------|------------|---------------------------------|
| <b>Pn891</b> | Internal multi-segment position delay time<br>selection 1 | ○          | Communication<br>address: 0x891 |
| Default: 1   | Setting range: 0 ~ 60000                                  | Unit: 0.1s | Control mode: P                 |

Same as Pn890.

|              |                                                           |            |                                  |
|--------------|-----------------------------------------------------------|------------|----------------------------------|
| <b>Pn892</b> | Internal multi-segment position delay time<br>selection 2 | ○          | Communication<br>address : 0x892 |
| Default: 5   | Setting range: 0 ~ 60000                                  | Unit: 0.1s | Control mode: P                  |

Same as Pn890.

|              |                                                           |            |                                 |
|--------------|-----------------------------------------------------------|------------|---------------------------------|
| <b>Pn893</b> | Internal multi-segment position delay time<br>selection 3 | ○          | Communication<br>address: 0x893 |
| Default: 10  | Setting range: 0 ~ 60000                                  | Unit: 0.1s | Control mode: P                 |

Same as Pn890.

|               |                                                           |            |                                 |
|---------------|-----------------------------------------------------------|------------|---------------------------------|
| <b>Pn894</b>  | Internal multi-segment position delay time<br>selection 4 | ○          | Communication<br>address: 0x894 |
| Default : 100 | Setting range : 0 ~ 60000                                 | Unit: 0.1s | Control mode: P                 |

Same as Pn890.

|               |                                                           |            |                                 |
|---------------|-----------------------------------------------------------|------------|---------------------------------|
| <b>Pn895</b>  | Internal multi-segment position delay time<br>selection 5 | ○          | Communication<br>address: 0x895 |
| Default: 1000 | Setting range: 0 ~ 60000                                  | Unit: 0.1s | Control mode: P                 |

Same as Pn890.

|                     |                                                           |            |                                 |
|---------------------|-----------------------------------------------------------|------------|---------------------------------|
| <b>Pn896</b>        | Internal multi-segment position delay time<br>selection 6 | ○          | Communication<br>address: 0x896 |
| Factory value: 5000 | Setting range: 0 ~ 60000                                  | Unit: 0.1s | Control mode: P                 |

Same as Pn890.

|                |                                                           |             |                                 |
|----------------|-----------------------------------------------------------|-------------|---------------------------------|
| <b>Pn897</b>   | Internal multi-segment position delay time<br>selection 7 | ○           | Communication<br>address: 0x897 |
| Default: 10000 | Setting range: 0 ~ 60000                                  | Unit : 0.1s | Control mode: P                 |

Same as Pn890.

## 9.3 The Point Function Operating Parameters

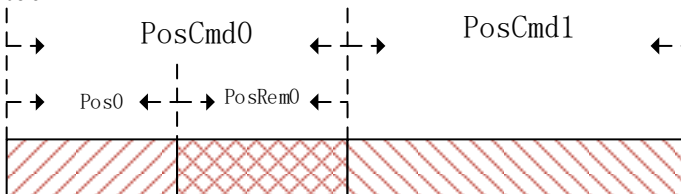
The point function plans the corresponding position trajectory according to the set speed, acceleration/deceleration time, delay time, and target position value. The operation parameters of the first segment of the command segment are taken as an example for description.

### 9.3.1 Position Command

In position mode, the number of position command pulses for point position control is given by  $Pn806 + POSNUM \times 4$ . The position command unit is the user unit. The position command pulse number is given by the electronic gear ratio  $Pn204$  and  $Pn206$ .

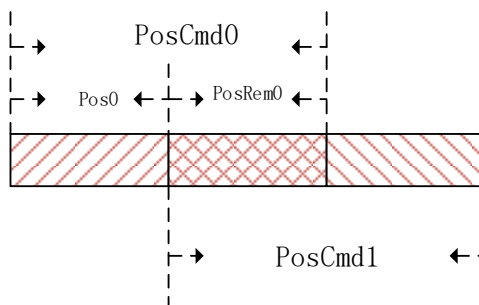
In position mode, the target position value can be an incremental position value, a relative position value, and an absolute position value.

The incremental position command is mainly used for the operation mode in which the target position is clear and the target position value is independent of the actual position. The reference point for the incremental position is the position command value. The incremental position operation mode is as shown below:



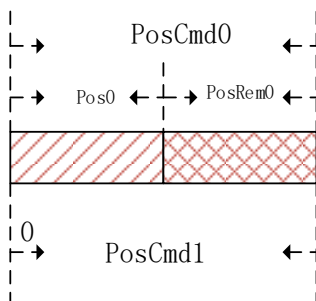
As shown in the figure above, the first position command setting value is  $PosCmd0$ . After the pulse of  $Pos0$  is run, the operation ends and the remaining  $PosRem0$  pulses are not completed. If the second incremental position command  $PosCmd1$  is inserted at this time, the total number of pulses of the second position command operation is  $PosCmd1 + PosRem0$ . That is, the second incremental position value  $PosCmd1$  is based on the first position position command  $PosCmd0$ , and the final running position value is  $PosCmd0 + PosCmd1$ .

The relative position command is referenced to the actual position value. The position command value of the latter segment is used as a reference point for the actual position value at the time of operation, and the target position value is calculated. The relative position operation mode is as shown below:



As shown in the figure above, the first position command setting value is PosCmd0. After the pulse of Pos0 is run, the operation ends and the remaining PosRem0 pulses are not completed. If the second relative position command PosCmd1 is inserted at this time, the total number of pulses of the second position command operation is PosCmd1. That is, the second relative position value PosCmd1 is the reference point of the actual position Pos0, and the final running position value is  $Pos0 + PosCmd1$ .

The absolute position command is referenced to the absolute position value relative to zero. Regardless of the current actual position value, whether or not there is a pulse margin has not been completed. The absolute position command values are all distances that must be taken relative to absolute zero. As shown below:

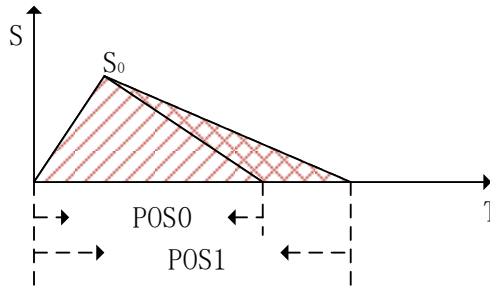


As shown in the figure above, the first position command setting value is PosCmd0. After the pulse of Pos0 is run, the operation ends and the remaining PosRem0 pulses are not completed. If the second absolute position command PosCmd1 is inserted at this time, the total number of pulses of the second position command operation is  $PosCmd1 - Pos0$ . That is, the second absolute position value PosCmd1 is the absolute position 0 bit reference point, and the final running position value is PosCmd1.

### 9.3.2 Acceleration and Deceleration Time

Position control function during operation, during the operation of the point position control function, the acceleration and deceleration base value is calculated based on the maximum speed of the motor. . For example, setting the acceleration time of the motor running for 100ms means that when the motor is running from 0rpm to the maximum speed, it needs to accelerate from 0rpm to the maximum speed in 100ms.

The point position control function sets the maximum acceleration/deceleration time to 60000ms and the minimum value to 0ms. In the point position control position trajectory planning, if the relationship between the acceleration/deceleration time, speed and position value is unreasonable and cannot be operated according to the set acceleration/deceleration time, the point position control program will be based on the current speed and target position value, recalculate the acceleration/deceleration time of the operation, and run according to the re-planned acceleration/deceleration time, as shown in the following figure:



As shown in the figure above, when the motor runs to  $S_0$  according to the set acceleration time, if it continues to decelerate according to the set deceleration time, the final running position value of the motor will reach the distance indicated by  $Pos1$ . In the point position control position command planning, the set target position value is  $Pos0$ . In order to ensure that the final running position of the motor reaches the position of  $Pos0$  accurately, it is necessary to re-plan the deceleration time to ensure that the motor finally runs to the  $Pos0$  position.

### 9.3.3 Point Position Control Speed and Delay Time

The point position control speed reference is divided into two types: position control mode and speed mode.

For the position mode, when the position command is planned, the desired running speed is given by the speed selected by the G part of the 16 bit a high word of the Pr command segment control word. This speed value can only be given a positive speed value. When planning according to the position command, the positive and negative values of the target position are used to set the forward and reverse of the desired speed.

For speed mode, the target speed value is given by  $P\ n806 + POSNUM * 4$  when the Pr is running. If you want to run in reverse in speed mode, you can set the value of  $P\ n806 + POSNUM * 4$  to a negative value.

During the point position control operation, whether the target speed in the speed mode or the desired speed in the position mode, the given maximum speed value is allowed to be 6000 rpm, given speed is limit to 6000 rpm. . In the speed mode, when the given speed unit is PPS, the maximum value of 6 000 rpm will be converted to the limit of the PPS unit.

For non-interrupted and non-overlapping operations, the delay time of the point position control is valid. After completing a current Pr instruction, how long it takes to execute the next Pr instruction.

The unit of delay time is 0.1s. For the speed mode, the delay time is defined as how long it takes for the motor running speed command to reach the set speed command value before the next Pr command can be run.

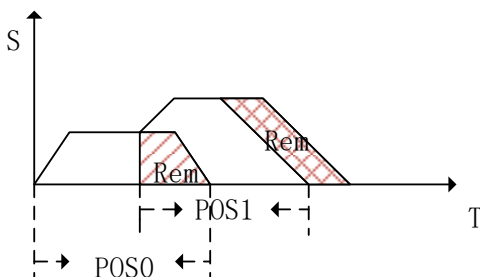
When the interrupt operation is performed, the next Pr instruction will be executed immediately, so the delay time can be interrupted in the interrupt mode. That is, when the current Pr instruction is not completed, or the execution completion has not reached the delay time, the next Pr instruction can be executed immediately by the interrupt function.

When the operation is overlapped, the set delay time is automatically ignored, and the next position command is planned immediately when the deceleration point is reached.

## 9.4 The Interrupt Function

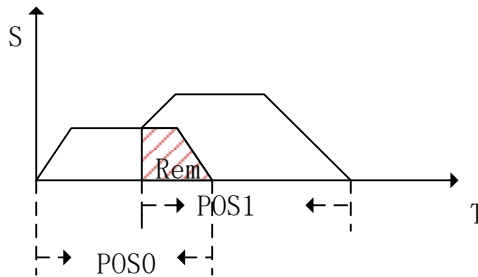
In the point position control function, the interrupt function can interrupt the previous position command operation and immediately execute the newly inserted position command. Run according to the newly inserted position command target position. Incremental position into a position command, the absolute and relative positions of three forms, not different from each other between a position command interrupt, having different operating modes.

### 9.4.1 Incremental Position Interrupt Position Command



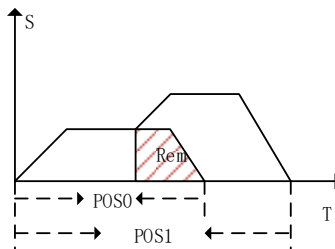
As shown in the figure above, the incremental position interrupt position command is running. For first position command segment, the target position is Pos0, during operation it is interrupted by position command of the second segment. Now the pulses number of the first segment after interrupting remains Rem. The second position command is an incremental position command, and the target position value is Pos1. After the second position command interpolates the first position command, it immediately runs according to the set speed of the second position command. Because the second position command is the incremental position, the second position command runs the total pulse value  $Pos0 + Pos1$ . Equivalent to, as shown above in the picture, the first segment position command margin is transferred to the second segment position to execute.

## 9.4.2 Equivalent Position Command Insertion Position Command



As shown in the figure above, it is operation of the relative position insertion position. For the first position command, the target position is  $Pos0$ , it is interrupted by the second position command during running, and the remaining pulse is  $Rem$ . The second position command is a relative position command, the target position is  $Pos1$ . After the second position command is interrupted, it immediately runs at the target speed of the second position and runs the pulse number  $Pos1$  relative to the actual position value. The total pulse number  $Pos0 + Pos1 - Rem$  that has passed after the end of the two-stage operation. That is, when the relative position is interrupted, the position margin value of the previous segment is ignored, and a position is directly run based on the current actual position. As shown in the figure above, the position equivalent to the  $Rem$  area is ignored.

## 9.4.3 Absolute Position Interrupt Position Command



As shown in the figure above, it is absolute position interrupt position. For the first position command, the target position is  $Pos0$ , it is interrupted by the second position command during running, and the remaining pulse is  $Rem$ . The second position command is an absolute position command and the target position is  $Pos1$ . After the second segment position command is interrupted, it is immediately run according to the target speed of the second segment position, run into an absolute position  $Pos1$ . The total pulse number is  $Pos1$  after the two position operation. That is, after the insertion, the previous position command value is ignored, and the absolute position command value is directly operated according to the insertion.

Function code A part function definition:

| A part | Function           |
|--------|--------------------|
| 0~9    | Point buffer depth |

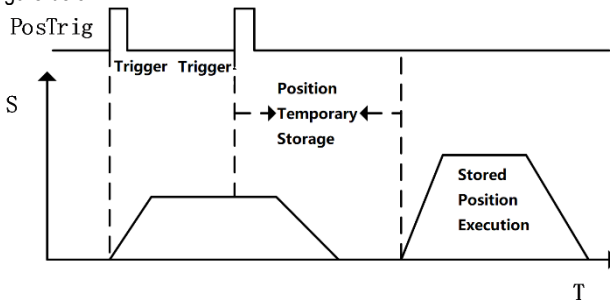
Function code E part function definition:

| E part | Function           |
|--------|--------------------|
| 0      | Jogging is invalid |
| 1      | Forward jog        |
| 2      | Reverse jog        |

The maximum point buffer depth is 10-level. When the buffer depth is set to 0, the point buffer function is turned off.

Note: In the point position control program, it is allowed to store up to 10 Pr instruction segments. Pr instruction segments exceeding 10 segments will overwrite the previously stored instruction segments. The stored Pr command segment can be a single-segment position command or a segment head command of a multi-segment position command.

The previous Pr position command is a single-segment position command. During the operation, the new position command is triggered through the PosTrig function, and the newly triggered position command is temporarily stored. After the previous Pr command is completed, the stored position command is read for operation. The schematic diagram of the single-segment storage function is shown in the figure below:



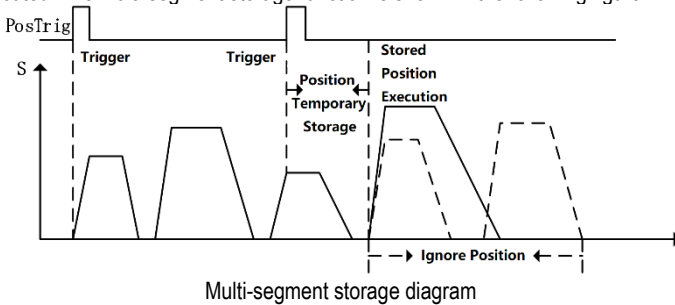
Single-segment storage diagram

As shown in the figure above, during the operation of a single position command, another Pr command is triggered. If the interrupt is not set for another Pr instruction, you need to wait for the current Pr instruction to complete before executing. From the triggering to the execution of the second Pr instruction, the second Pr instruction is temporarily stored in the position instruction storage Buffer.

#### 9.4.4 Multi-segment Storage Function

When the previous Pr command is a multi-segment Pr command, if a new position command is inserted, and the newly inserted position command is not set to interrupt, it will be temporarily stored.

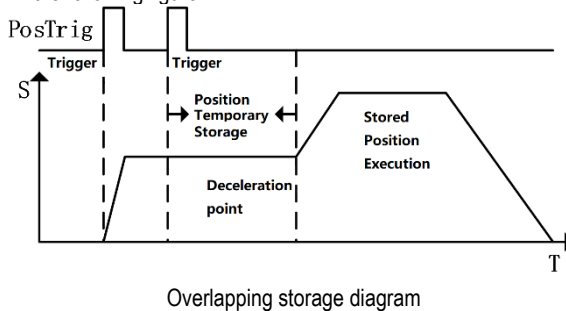
When the execution of the position segment currently being executed by the multi segment PR instruction is completed, the stored position instruction segment is executed immediately. The remaining unexecuted position command segments of multiple positions will be discarded and no longer executed. The multi-segment storage function is shown in the following figure:



As shown in the figure above, the first position command is a multi-segment position command, and there are 5 position command segments. During operation, when the multi-segment position command is executed to the third position, a new position command value is inserted through an external trigger. The command does not set the interrupt function for the newly inserted position, so when the execution of the third position instruction of the previous multi segment position instruction series is completed, the newly inserted position instruction value is executed. The fourth and fifth position command values of the multi-segment position command series will no longer be executed.

#### 9.4.5 Overlapping Storage Function

When the previous position command is set to overlap the function, during the operation of the position command, if a new position command is inserted through an external trigger, and under the situation that there is no interrupt function in the new position command, when the previous position command execute to the deceleration point position, start to read the stored position command value, and plan the stored position command value in an overlapping manner. The overlapping storage function is shown in the following figure:

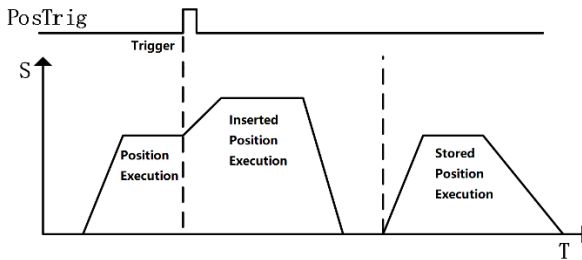


As shown in the figure above, the first position command sets the overlap function, and the new position command is inserted by external trigger during operation. When the new position command is not set to interrupt, the newly received position command is temporarily stored. At the first position when the command runs to the deceleration point position, it is judged that the first position command overlap function is turned on. At this time, the value of the temporarily stored position command is

directly read, and the execution process of the temporarily stored position command is planned in an overlapping manner.

### 9.4.6 Interrupt Storage Function

The position command storage function of internal multi-segment position control allows storing up to 3 position command values. If there is currently a stored position command being executed, and there is still a stored position command that has not been executed, use an external trigger to insert a new one position command. The new position command sets the interrupt function, it will immediately interrupt the executing position command segment, and execute the newly inserted position command value. After the newly inserted position command is executed, read the stored ones that have not been executed. Position command value, continue to execute. Interrupt storage function as shown below:

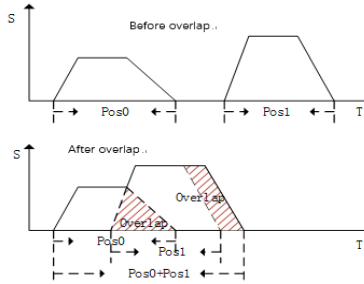


Interrupt storage diagram

As shown in the figure above, during the execution of the first position command, there is a stored position waiting to be executed. When the first position is executed, a new position command is inserted through an external trigger, and the newly inserted position command enables the interrupt function and executes the newly inserted position command immediately. After the newly inserted position command is executed, execute the stored position command value.

## 9.5 Overlapping Function

When the multi-segment position is continuously running, the transition of the multi-segment position command speed can be realized by setting the multi-segment position overlapping function. The function of the overlapping function is to directly read the operating parameters (running position, speed, acceleration/deceleration time, etc.) of the next section when the first position is moved to the position of the deceleration point, and directly plan the next section of the running trajectory from the deceleration point, thereby achieving a smooth transition of the two-segment position trajectory. The overlay function is shown below:

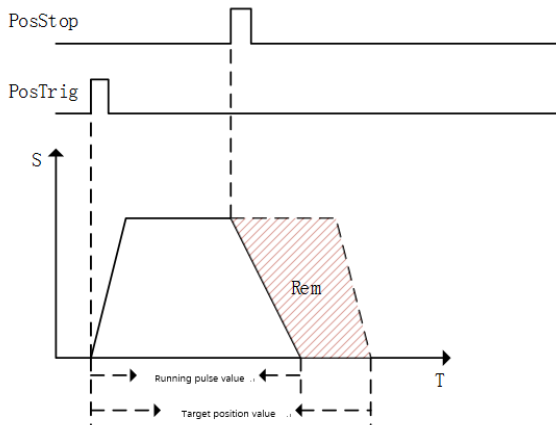


Overlapping function diagram

As shown in the figure above, when multiple positions overlap is operating, when it reaches the deceleration point of the previous position, the operating parameters of the next position command are directly read, and the running trajectory of the next position command is planned on the basis of the current speed to realize the smoothing of the two positions transition. In the process of overlapping operation, the remaining pulse value that is not completed in the previous position command will be compensated to run on the next position command, and there will be no pulse loss problem.

## 9.6 Stop Function

During the operation of internal multi-segment position control, PosStop can be used to trigger the current running position command to stop. PosStop can be triggered by the rising edge of DI terminal by configuring external DI terminal 0x20; it can also be triggered by means of communication, setting Pn898=1000, PosStop function is realized. After stopping the currently running position command through the stop function, the remaining pulse value of the current position that is not running will be temporarily stored in the program. Before starting to run the next Pr command program, you need to consider the remaining pulse. The stop function is shown in the figure below:



Stop function diagram

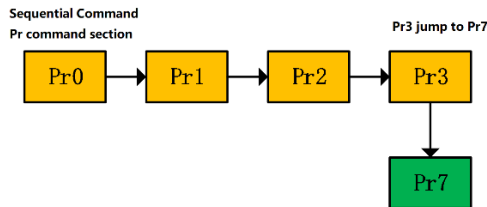
As shown in the figure above, the current running position command value is stopped by PosStop

function during position command operation. After the stop command is triggered, the motor decelerates from the current speed to 0 according to the 500ms deceleration time. After the motor stops, the remaining pulse value of the current position will not clear.

Before starting the next Preposition command planning, the current position command pulse needs to be processed. If you want to clear the remaining amount of the current position command pulse, you can clear the remaining pulse by sending a relative position command with a relative position of 0; if you want to change the current position The remaining pulse of the command is completed, and the remaining pulse can be run by sending an incremental position command with an incremental position of 0; if the next position command is an absolute position command, the current remaining pulse has no effect on the operation of the absolute position command.

## 9.7 Jump Function

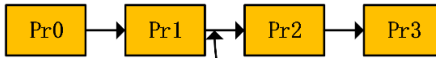
In the internal multi-segment position control program, the Pr command section allowed to be set is a jump command. When a certain section of the Pr command section is set as a jump command, when the current stage is executed, it will jump to Pr command section, immediately jump to the specified Pr command section for execution. The value of the Pr command jumped to can be a single-segment position command, the first value of a multi-segment position command, speed command, etc. During the jump process, if Jump command jump in its own situation, the jump error occurs, and the servo drive automatically stops. The schematic diagram of the jump function is shown below:



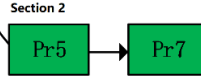
Jump function diagram

As shown in the figure above, the current position command is executed in sequence. When executed to the Pr3 command segment, the Pr3 command segment jumps to the Pr7 specified segment, and immediately execute the position command defined by Pr7 command value. Jump can be realized by sequential execution or by external trigger. Jump command can enable interrupt function, if the triggered jump function is enabled Interrupt function, interrupt the currently executing Pr command, and immediately jump to the specified Pr command section; If the triggered jump function does not enable interrupt, the triggered jump command will be temporarily stored and wait for the current Pr Jump after the execution of the specified segment is completed. The interrupt jump function diagram is shown below:

Sequential command  
Section 1



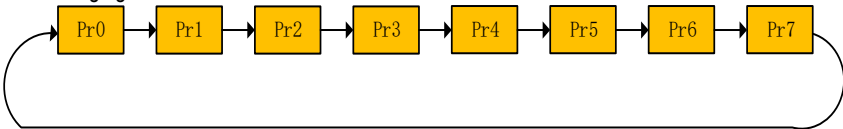
Sequential command  
Section 2



Interrupt jump function

As shown in the figure above, there are two command segments 1 and 2 that are executed sequentially. When multiple segments of command1 are currently being executed, by external trigger segment 5, and segment 5 is specified by Pr as a jump command, interrupt function is enabled, and jump the target command segment number is 7. The currently running multi-segment command ends and immediately starts to execute the position command value of Pr command segment 7.

In addition to jumping to any available Pr command segment number, the jump function can also implement multi-segment position command loop execution through the jump function, as shown in the following figure:



Multi-section position command loop

As shown in the figure above, when the Pr command of the last paragraph of the multi-segment position command is set as a jump command, from the last Pr command to the Pr command at the beginning, so that multiple Pr commands can be executed in a loop.

---

## 9.8 Jog Function

The jog function can realized by means of communication or internal jog operation via external terminals. The jog function must be operated when the servo is enabled. In the process of jog execution, the point function is no longer executed. The point can be executed normally after the jog execution is completed.

The internal jog function code is shown in the following table:

|              |                       |           |                              |
|--------------|-----------------------|-----------|------------------------------|
| Pn500        | Jog speed             | ○         | Communication address: 0x500 |
| Default: 500 | Setting range: 0~1000 | Unit: rpm | Control mode: P,S            |

Parameter description: Jog speed setting. Unit rpm

|              |                                        |          |                              |
|--------------|----------------------------------------|----------|------------------------------|
| Pn505        | Jog acceleration and deceleration time | ○        | Communication address: 0x505 |
| Default: 100 | Setting range: 2~10000                 | Unit: ms | Control mode: P,S            |

Parameter description: In jog mode, acceleration and deceleration time setting.

|              |                        |          |                              |
|--------------|------------------------|----------|------------------------------|
| Pn506        | Jog delay time         | ○        | Communication address: 0x505 |
| Default: 100 | Setting range: 0~10000 | Unit: ms | Control mode: P,S            |

Parameter description: After the point reaches the set speed, the delay time.

---

### 9.8.1 Jog Operation of External Terminals

External terminal jog, terminal function definition is shown in the following table:

| Terminal function definition | Description |
|------------------------------|-------------|
| 0x1E                         | Forward jog |
| 0x1F                         | Reverse jog |

The external terminal input and jog execution satisfy the following logic table:

| Forward jog 0x1E terminal status | Reverse jog 0x1E terminal status | Jog function description |
|----------------------------------|----------------------------------|--------------------------|
| OFF                              | OFF                              | Not executed jog         |
| ON                               | OFF                              | Forward jog              |
| OFF                              | ON                               | Reverse jog              |
| ON                               | ON                               | Not executed jog         |

As shown in the above table, the relationship between Forward Jog and Reverse Jog is “exclusive OR”. That is, if only one terminal of Reverse Jog is valid, the Jog can be executed normally.

### 9.8.2 Communication Jog

Communication Jog is realized by the high 16 bits of function code Pn89F.

| Value | Function    |
|-------|-------------|
| 0     | Jog invalid |
| 1     | Forward jog |
| 2     | Reverse jog |

As shown in the above table, when the function code Pn89F is 0, the Jog function is turned off; when the function code is 1, Forward Jog is performed; when the given value is 2, Reverse Jog is performed.

**Note:** Regardless of the external terminal Jog or the communication Jog, you need to set the servo enable first.

# 10 Function Code Instructions

## 10.1 Pn0 Group Basic Control Related Parameters

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Range        | Default | Unit | Communication address | When enabled  |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|------|-----------------------|---------------|
| Pn000         | Control mode selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 ~ 11       | 0       | -    | 0x0000                | After restart |
|               | 0-Position mode: The position of the motor is controlled by the pulse sequence position command. The position is controlled by the number of input pulses, and the speed is controlled by the frequency of the input pulse that is used in the place where positioning action is required.<br>1-1-Analog speed: The servo motor speed is controlled by the analog voltage speed command.<br>2-2-Torque Mode: The output torque of the servo motor is controlled by the analog voltage torque command/internal torque command which is used to output the necessary torque (pressing action, etc.).<br>3-3-Internal speed: The speed is controlled by three internally set speeds set in the servo unit. When this control method is selected, no analog voltage is required.<br>4-4-Internal Speed <-> Analog Speed: Switch control mode via ON/OFF of switch/SPD-A and /SPD-B.<br>5-5-Internal Speed <-> Position Mode : Switch control mode via ON/OFF of switch/SPD-A and /SPD-B.<br>6-6-Internal Speed <-> Torque Mode: Switch control mode via ON/OFF of switch/SPD-A and /SPD-B.<br>7-7-Position Mode <-> Analog Speed: ON/OFF switching control mode by (C-SEL) signal switching.<br>8-8-Position mode <-> Torque mode:ON/OFF switching control mode by (C-SEL) signal switching.<br>9-Torque mode <-> Analog speed: ON/OFF switching control mode by (C-SEL) signal switching.<br>10-Analog speed <-> Speed mode for zero function: When controlling speed, zero fixed function can be used.<br>11-Position mode <-> Position mode when command pulse inhibit: The command pulse inhibit function can be used when controlling the position. See "selection of hybrid control mode" for specific switching sequence.<br>16-EtherCAT mode (-EA model, this parameter defaults to 16). |              |         |      |                       |               |
| Pn001         | Internal enable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 ~ 1        | 0       | -    | 0x001                 | Immediately   |
|               | 0-Enable OFF.<br>1-Enable ON.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |         |      |                       |               |
| Pn002         | Motor rotation direction selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0 ~ 1        | 0       | -    | 0x0002                | After restart |
|               | Facing motor end:<br>0-Counterclockwise is forward.<br>1-Clockwise direction is forward.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |         |      |                       |               |
| Pn003         | Default monitoring parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0x0 ~ 0xffff | 0xffff  | -    | 0x0003                | Immediately   |
|               | Set the monitoring parameters that are displayed by default after power-on. The setting values are detailed in the monitoring parameters. 0xffff indicates that the monitoring parameters are not displayed and the system status is displayed.<br>Note: The alarm is displayed first when the alarm is displayed. The setting parameter cannot be displayed normally.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |         |      |                       |               |
| Pn004         | Servo OFF and stop method selection when type 1 alarm occurs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 2        | 0       | -    | 0x0004                | After restart |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |     |     |        |               |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----|-----|--------|---------------|
|       | 0- Stop motor by DB.<br>1- Stop the motor through the DB and then release the DB.<br>2- Do not use DB to keep the motor free.<br>Note: DB (Dynamic Brake) is an emergency stop function. If the servo motor is started or stopped by ON/OFF power supply or servo ON in the state that the command is input, the DB circuit will frequently operate, which may cause the internal components of the servo unit to deteriorate. Please execute start and stop of the servo motor with speed input command or position command. |             |     |     |        |               |
| Pn005 | Second type alarm stop method selection of servo generation                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0x00 ~ 0x01 | 0   |     | 0x0005 | After restart |
|       | 0- Zero speed stop: Set the speed command to "0" and perform a quick stop.<br>1- Same as Pn004 stop method.                                                                                                                                                                                                                                                                                                                                                                                                                   |             |     |     |        |               |
| Pn006 | Override warning checkout selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0 ~ 1       | 0   |     | 0x0006 | After restart |
|       | 0-No overtravel warning when limit is checked.<br>1-Overtravel warning is detected when the limit is checked.                                                                                                                                                                                                                                                                                                                                                                                                                 |             |     |     |        |               |
| Pn007 | Stopping method selection at servo overtravel (OT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0 ~ 2       | 0   |     | 0x0007 | After restart |
|       | Set the stop mode and status after stop when servo overtravel occurs:<br>0- Same as Pn004 stop method.<br>1- Use the torque set by Pn053 as the maximum value, and enter the locked state after decelerating to stop.<br>2- Use the torque set by Pn053 as the maximum value, enter the free state after decelerating to stop.                                                                                                                                                                                                |             |     |     |        |               |
| Pn008 | Servo lock time after electromagnetic brake holding                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0 ~ 50      | 0   | 0ms | 0x0008 | Immediately   |
|       | When the servo motor is enabled but not running(stop state) and the brake (/BK) signal and the servo ON (/S-ON) signal are off at the same time, setting this parameter can change the time from the brake (/BK) signal OFF to the actual non-power input status of the motor.<br>Note: The brake delay time is slightly different. When this parameter is set, the motor can be prevented from the slight moving by the weight or the external force of the vertical-axis mechanical movement.                               |             |     |     |        |               |
| Pn009 | Electromagnetic brake holding time delay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10 ~ 100    | 50  | 0ms | 0x0009 | Immediately   |
|       | The servo motor won't be powered when the Servo OFF/Alarm/Main circuit OFF occur during the rotation. By setting this parameter and Pn010 (any one is met), the output timing of the brake signal (/BK) OFF can be adjusted.<br>Note: The relevant logic is described in "Keep brake action".                                                                                                                                                                                                                                 |             |     |     |        |               |
| Pn010 | Electromagnetic brake delay release speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0 ~ 10000   | 100 | rpm | 0x0010 | Immediately   |
|       | See the description of "Electromagnetic brake delay" for details.                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |     |     |        |               |
| Pn012 | External regenerative resistor power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0 ~ 65535   | 0   | 10W | 0x0012 | Immediately   |
|       | When connecting an external regenerative resistor, the regenerative resistor power should be set to a value that matches the allowable capacity of the connected external regenerative resistor. The setting differs depending on the cooling condition of the external regenerative resistor.<br>Note: Refer to "Setting the regenerative resistor" for details.                                                                                                                                                             |             |     |     |        |               |
| Pn013 | External regenerative resistor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0 ~ 65535   | 0   | Ω   | 0x0013 | Immediately   |
|       | When connecting an external regenerative resistor, the regenerative resistor value should be set to the value matching the connected external regenerative resistor.<br>Note: The minimum regenerative resistance of each power section could be different. Please refer to "Set regenerative resistor" for details. Otherwise, the internal components of the servo unit may be damaged.                                                                                                                                     |             |     |     |        |               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |     |   |        |               |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|---|--------|---------------|
| Pn015 | Overload warning value                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1 ~ 100   | 20  | % | 0x0015 | After restart |
|       | Setting this parameter can change the overload warning detection time.<br>Note: The overload alarm detection time is detailed in "Overload alarm".                                                                                                                                                                                                                                                                                                                             |           |     |   |        |               |
| Pn016 | Motor overload detection base current derating setting                                                                                                                                                                                                                                                                                                                                                                                                                         | 10 ~ 100  | 100 | % | 0x0016 | After restart |
|       | This parameter can change the motor current threshold for calculating the overload alarm, which can shorten the overload alarm detection time.<br>Note: This value is invalid when the motor current is rated above 200%.                                                                                                                                                                                                                                                      |           |     |   |        |               |
| Pn030 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 ~ 65535 | 0   | - | 0x0030 | Immediately   |
| Pn031 | Parameter modification operation lock                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0 ~ 1     | 0   | - | 0x0031 | After restart |
|       | 0-Allow panel parameters modification.<br>1-Prohibit panel parameters modification.                                                                                                                                                                                                                                                                                                                                                                                            |           |     |   |        |               |
| Pn040 | Method to use absolute encoder                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 1     | 0   | - | 0x0040 | After restart |
|       | 0-Use an absolute encoder as an absolute encoder: If the motor is an absolute multi-turn encoder, setting this parameter to 0 can use the multi-turn absolute function.<br>1-Use an absolute encoder as an incremental encoder: When used as an incremental encoder, the position won't be recorded when power-off and warning or alarm, corresponding to multiple revolutions, won't happen either when the battery is undervoltage or the drive is de-energized.             |           |     |   |        |               |
| Pn041 | Absolute encoder battery alarm/warning selection                                                                                                                                                                                                                                                                                                                                                                                                                               | 0 ~ 1     | 0   | - | 0x0041 | After restart |
|       | 0- Set the low battery voltage as a fault: Monitor the battery status within 4 ~ 9 seconds after the driver is powered on / reset, and the undervoltage alarm (Er.830) will be reported when the undervoltage. Over time will not be detected.<br>1- Set the low battery voltage as a warning: Undervoltage (below 3V) will be reported as an under voltage alarm (Al.930). It will always monitor the battery voltage and can be self-recovery, enable is out of restriction. |           |     |   |        |               |

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Range  | Default | Unit | Communication address | When enabled  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------|------|-----------------------|---------------|
| Pn044         | Full closed loop application related selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 ~ 51 | 1       | —    | 0x0045                | After restart |
|               | 0: Encoder pulse frequency division output, grating ruler power supply is valid, and grating ruler signal is not filtered.<br>1: Pulse output, grating ruler power supply is valid, and grating ruler signal is not filtered.<br>2: Encoder pulse frequency division output, grating ruler power supply is invalid, and grating ruler signal is not filtered.<br>3: Pulse output, the grating ruler power supply is invalid, and the grating ruler signal is not filtered.<br>4: Encoder pulse frequency division output, grating ruler power supply is valid, 0MHz ~ 4MHz filtering.<br>16: Grating ruler pulse output, grating ruler power supply is valid, 0MHz ~ 4MHz filtering.<br>18: Encoder pulse frequency division output, grating ruler power supply is invalid, 0MHz ~ 4MHz filtering.<br>19: Grating ruler pulse output, grating ruler power supply is invalid, 0MHz ~ 4MHz filtering.<br>32: Encoder pulse frequency division output, grating ruler power supply is effective, 0MHz ~ 1MHz filtering.<br>33: Grating ruler pulse output, grating ruler power supply is effective, 0MHz ~ 1MHz filtering.<br>34: Encoder pulse frequency division output, grating ruler power supply invalid, |        |         |      |                       |               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |    |        |               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|----|--------|---------------|
|       | 0MHz ~ 1MHz filtering.<br>35: Grating ruler pulse output, grating ruler power supply is invalid, 0MHz ~ 1MHz filtering.<br>48: Encoder pulse frequency division output, grating ruler power supply is effective, 0MHz ~ 500kHz filtering.<br>49: Grating ruler pulse output, grating ruler power supply is effective, 0MHz ~ 500kHz filtering.<br>50: Encoder pulse frequency division output, grating ruler power supply invalid,<br>0MHz ~ 500kHz filtering 51: Grating ruler pulse output, grating ruler power supply invalid, 0MHz ~ 500kHz filtering.<br>51: Grating ruler pulse output, grating ruler power supply is invalid, 0MHz ~ 500MHz filtering. |            |      |    |        |               |
| Pn045 | Under-voltage function selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~2        | 1    | —  | 0x0045 | After restart |
|       | 0 - No Detection of main circuit drop warning.<br>1 - Detect main circuit drop warning.<br>2 - Detect main circuit drop warning and perform torque limit. The relevant torque limit is matched with Pn046/Pn047.<br>For details, refer to "Torque limit when main circuit voltage drops".                                                                                                                                                                                                                                                                                                                                                                     |            |      |    |        |               |
| Pn046 | Torque limit when main circuit voltage drops                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~100      | 50   | %  | 0x0046 | Immediately   |
|       | According to the under voltage warning, it will impose the torque limit inside the servo unit. For details, see the "Torque limit when under voltage" instruction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |      |    |        |               |
| Pn047 | Torque limit release time when main circuit voltage drops                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~1000     | 100  | ms | 0x0047 | Immediately   |
|       | After the under-voltage warning signal releases, the torque limit value is controlled within the servo unit according to the setting time. For details, see "Torque limit when the main circuit under-voltage".                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |      |    |        |               |
| Pn050 | Torque limit setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~4        | 1    | —  | 0x0050 | Immediately   |
|       | 0- Analog torque (torque mode is invalid).<br>1- Maximum torque limit 1.<br>2- Maximum torque limit 1 when forward running; maximum torque limit 2 when reverse running.<br>3- Maximum torque limit 1 when the "Torque Limit Switching" switch is OFF while Maximum torque limit 2 when it's ON.<br>4- Limit by the torque command(valid when in torque mode).                                                                                                                                                                                                                                                                                                |            |      |    |        |               |
| Pn051 | Maximum torque limit 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0~500      | 500  | %  | 0x0051 | Immediately   |
| Pn052 | Maximum torque limit 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0~500      | 500  | %  | 0x0052 | Immediately   |
| Pn053 | Emergency stop torque                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0~800      | 800  | %  | 0x0053 | Immediately   |
|       | The torque when set the motor to deceleration stop.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |      |    |        |               |
| Pn061 | Panel parameter display selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0x00~0x01  | 1    | —  | 0x0061 | After restart |
|       | 0 - Only display setting parameters.<br>1 - Show all parameters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |      |    |        |               |
| Pn070 | Encoder frequency division pulses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 16~4194304 | 2048 | -  | 0x0070 | After restart |
|       | The number of pulses per cycle from the encoder is divided by frequency in accordance with the set value of this parameter. Please set it according to the system specifications of the machine and host device.<br>Note: The set value is the number of A/B quadrature output pulses in one turn. The setting of the number of encoder division pulses will be limited due to the resolution of the encoder. For details, see the "Division pulses output setting" instruction.                                                                                                                                                                              |            |      |    |        |               |
| Pn072 | Frequency division output inversion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~1        | 0    | -  | 0x0072 | After restart |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |       |    |        |               |
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|       | A/B pulse phase sequence selection.<br>0- Don't negate the pulse output: When forward run, B is ahead of A.<br>1- Negate the pulse output: When forward run, A is ahead of B.                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |       |    |        |               |
| Pn080 | Local communication address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0x00～0x7F     | 1     | —  | 0x0080 | After restart |
|       | During RS-485 communication, this parameter is the 485 communication station number, and during CANopen communication, this parameter is the CANopen slave station number.                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |    |        |               |
| Pn081 | 485 communication baud rate selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0～4           | 1     | —  | 0x0081 | After restart |
|       | 0bps-9600bps      1bps-19200bps      2bps-38400bps      3bps-57600bps      4bps-115200bps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |       |    |        |               |
| Pn082 | 485 communication verification method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0～5           | 1     | —  | 0x0082 | After restart |
|       | 0-No check (N,8,1)      1-Even check (E,8,1)<br>2-Odd check (O,8,1)      3-No check (N,8,2)<br>4-Even Check (E,8,2)      5-Odd Check (O,8,2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |       |    |        |               |
| Pn083 | CANopen communication baud rate selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0～6           | 4     | -  | 0x0083 | After restart |
|       | 0: 20kbps      1: 50kbps<br>2: 100kbps      3: 125kbps<br>4: 250kbps      5: 500kbps<br>6: 1000kbps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |       |    |        |               |
| Pn085 | Communication data storage EEPROM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0x0～0xFF      | 0x1   | -  | 0x0085 | Immediately   |
|       | Bit0:<br>0: Store data to EEPROM.<br>1: Do not store data to EEPROM.<br>Bit1:<br>0: During power on and start, the value Bit0 of Pn085 is forced to be 1.<br>1: During power on and start, the value Bit0 of Pn085 is not forced to be 1.<br>Panel keypad operation setting:<br>00: Modify the data, power off and store it in EEPROM. After servo restart, Pn085 changes to 01. After connecting the upper computer, 00 is displayed. Disconnect the upper computer and power on again. The panel displays Pn085 as 01 again (Data is not stored in EEPROM when power on, but is stored in EEPROM when power off). |               |       |    |        |               |
| Pn086 | Communication address mapping function selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0～1           | 0     | -  | 0x0086 | Immediately   |
|       | 0:Close      1:On                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |       |    |        |               |
| Pn087 | Mapping source address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0x0000～0xFFFF | 0x110 | -  | 0x0087 | Immediately   |
| Pn088 | Mapping destination address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0x0000～0xFFFF | 0x410 | -  | 0x0088 | Immediately   |
| Pn089 | Mapping source address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0x0000～0xFFFF | 0x201 | -  | 0x0089 | Immediately   |
| Pn08A | Mapping destination address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0x0000～0xFFFF | 0x304 | -  | 0x008A | Immediately   |
| Pn08B | Encoder over temperature alarm threshold (°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0～255         | 80    | °C | 0x008B | After restart |
|       | The over temperature alarm value of Nikon encoder is fixed at 90°C. and Pn08b has no effect on the change of over temperature alarm value of Nikon encoder. There is no encoder over temperature alarm for Tamagawa encoder below 80 (including) flange. For encoder that cannot detect over temperature alarm, pn08b will be automatically written as 0 in the program; The encoder over temperature alarm will                                                                                                                                                                                                    |               |       |    |        |               |

|       |                                                                                                                                                                                                                                        |             |      |   |        |               |
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|       | be valid for tamogawa encoder above 130 (including) flange only when bit4 of Pn08c must equal to 1, and Pn08b is written into encoder EEPROM, otherwise it will not be executed (Pn08b = 0, turn off over temperature alarm function). |             |      |   |        |               |
| Pn08C | Encoder alarm detection selection                                                                                                                                                                                                      | 0x00 ~ 0x11 | 0x00 | - | 0x008C | After restart |
|       | Only when bit4 of Pn08c must equal to 1, and Pn08b is written into encoder EEPROM, or it will not be executed.                                                                                                                         |             |      |   |        |               |

## 10.2 Pn1 Group Gain Parameters

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                      | Range      | Default | Unit | Communication address | When enabled |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------|------|-----------------------|--------------|
| Pn100         | Rotary inertia ratio                                                                                                                                                                                                                                                                                                                                                                                           | 0 ~ 20000  | 100     | %    | 0x0100                | Immediately  |
|               | Rotary inertia ratio = converted load inertia of motor shaft / rotor rotary inertia of servo motor *100%.                                                                                                                                                                                                                                                                                                      |            |         |      |                       |              |
| Pn101         | First speed gain                                                                                                                                                                                                                                                                                                                                                                                               | 1 ~ 2000   | 40.0    | Hz   | 0x0101                | Immediately  |
|               | It becomes a delay element of the outer position loop when the response of the speed loop is low, so overshoot or vibration of the speed command occurs. In the range where the mechanical system does not vibrate, the larger the value is set, the more stable the servo system becomes and the better the responsiveness will be.                                                                           |            |         |      |                       |              |
| Pn102         | First speed integration time constant                                                                                                                                                                                                                                                                                                                                                                          | 0.15 ~ 512 | 20.00   | ms   | 0x0102                | Immediately  |
|               | In order to respond to small input, the speed loop contains integral elements. Since this integral element is a delay factor for the servo system, when the time parameter is set too large, overshoot may occur, or the positioning time may be extended meanwhile resulting in poor responsiveness.                                                                                                          |            |         |      |                       |              |
| Pn103         | First position gain                                                                                                                                                                                                                                                                                                                                                                                            | 1 ~ 2000   | 40.0    | 1/s  | 0x0103                | Immediately  |
|               | The position loop response is determined by the position loop gain. The higher the setting of the position loop gain is, the higher the responsiveness and the shorter the positioning time will be. The position loop gain cannot be increased beyond the rigidity of the mechanical system. If you want to increase the position loop gain to a larger value, the rigidity of the machine must be increased. |            |         |      |                       |              |
| Pn104         | First torque command filter                                                                                                                                                                                                                                                                                                                                                                                    | 0 ~ 655.35 | 1.00    | ms   | 0x0104                | Immediately  |
|               | Adjusting the parameters of the torque command filter may eliminate the machine vibration caused by the servo drive. The smaller the value is, the better the responsiveness can be. However, the conditions are restricted by the machine conditions.                                                                                                                                                         |            |         |      |                       |              |
| Pn105         | Second speed gain                                                                                                                                                                                                                                                                                                                                                                                              | 1 ~ 2000   | 40.0    | Hz   | 0x0105                | Immediately  |
|               | See Pn101                                                                                                                                                                                                                                                                                                                                                                                                      |            |         |      |                       |              |
| Pn106         | Second speed integration time constant                                                                                                                                                                                                                                                                                                                                                                         | 0.15 ~ 512 | 20.00   | ms   | 0x0106                | Immediately  |
|               | See Pn102                                                                                                                                                                                                                                                                                                                                                                                                      |            |         |      |                       |              |
| Pn107         | Second position gain                                                                                                                                                                                                                                                                                                                                                                                           | 1 ~ 2000   | 40.0    | 1/s  | 0x0107                | Immediately  |
|               | See Pn103                                                                                                                                                                                                                                                                                                                                                                                                      |            |         |      |                       |              |
| Pn108         | Second torque command filter                                                                                                                                                                                                                                                                                                                                                                                   | 0 ~ 655.35 | 1.00    | ms   | 0x0108                | Immediately  |
|               | See Pn104                                                                                                                                                                                                                                                                                                                                                                                                      |            |         |      |                       |              |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |      |    |        |               |
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| Pn110 | Gain switching mode selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0x00 ~ 0x01  | 0    | —  | 0x0110 | Immediately   |
|       | <p>The gain switching function includes two methods, "Manual gain switching" using an external input signal and "Automatic gain switching" automatically switch. By using the gain switching function, gain can be increased and positioning time can be shortened during the positioning time. When the motor is stopped, reduce gain and suppress vibration.</p> <p>0- Manual gain switch by using the external input signal (G-SEL).</p> <p>1- When the automatic switching condition is met (Pn111), it automatically switches from the first gain to the second gain; otherwise, it switches back to the first gain.</p> |              |      |    |        |               |
| Pn111 | Gain automatic switching condition of position control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0x00 ~ 0x05  | 0    | —  | 0x0111 | Immediately   |
|       | <p>Set the conditions for automatic gain switching:</p> <p>0-Positioning completion signal ON.</p> <p>1-Positioning completion signal OFF.</p> <p>2-Positioning proximity signal ON.</p> <p>3-Positioning proximity signal OFF.</p> <p>4-Position command is 0 after filtering and pulse input is OFF.</p> <p>5-Position command pulse input is ON.</p> <p>If the conditions are met, then switch to the second gain, otherwise switch to the first gain.</p>                                                                                                                                                                 |              |      |    |        |               |
| Pn112 | Gain switching transition time 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 ~ 65535    | 0    | ms | 0x0112 | Immediately   |
|       | Starting from the time when the switching condition has been established, after the waiting time, change the gain of the 1 <sup>st</sup> position loop to the gain of the 2 <sup>nd</sup> position loop in a straight line within the switching transition time.                                                                                                                                                                                                                                                                                                                                                              |              |      |    |        |               |
| Pn113 | Gain switching transition time 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 ~ 65535    | 0    | ms | 0x0113 | Immediately   |
|       | Starting from the time when the switching condition has been established, after the waiting time, change the gain of the 2 <sup>nd</sup> position loop to the gain of the 1 <sup>st</sup> position loop in a straight line within the switching transition time.                                                                                                                                                                                                                                                                                                                                                              |              |      |    |        |               |
| Pn114 | Gain switching waiting time 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 65535    | 0    | ms | 0x0114 | Immediately   |
|       | It refers to the time when the switching conditions the 1 <sup>st</sup> gain to the 2 <sup>nd</sup> gain is established and the switching really starts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |              |      |    |        |               |
| Pn115 | Gain switching waiting time 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 65535    | 0    | ms | 0x0115 | Immediately   |
|       | It refers to the time when the switching condition of the 2 <sup>nd</sup> gain to the 1 <sup>st</sup> gain is established and the switching really starts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |      |    |        |               |
| Pn121 | Speed feedforward gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0 ~ 100      | 0    | %  | 0x0121 | Immediately   |
|       | <p>Speed feedforward is a function to shorten the positioning time. This function is effective when position control.</p> <p>Note: position overshoot will occur when the feedforward command is too large. Please set it appropriately while observing the response.</p>                                                                                                                                                                                                                                                                                                                                                     |              |      |    |        |               |
| Pn120 | Position integral time constant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.0 ~ 5000.0 | 0.0  | ms | 0x0120 | Immediately   |
| Pn122 | Speed feedforward filter time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 ~ 64       | 0.00 | ms | 0x0122 | Immediately   |
|       | Speed feedforward low-pass filter time constant can slow position overshoot and torque jump caused by feedforward.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |      |    |        |               |
| Pn123 | Use V-REF as speed feedforward selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0x00 ~ 0x01  | 0    | —  | 0x0123 | After restart |
|       | <p>Speed feedforward is a function to shorten the positioning time. It is possible to select speed feed forward via external analog V-REF.</p> <p>0-None.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |      |    |        |               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |     |                   |        |               |
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|       | 1- Use V-REF as speed feed forward input.                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |     |                   |        |               |
| Pn124 | Speed/position control selection (T-REF assignment)                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~1           | 0   | —                 | 0x0124 | After restart |
|       | Torque feedforward is a function to shorten the positioning time. Torque feedforward can be selected by external analog T-REF.<br>0-None.<br>1- Use T-REF as a torque feed forward input.                                                                                                                                                                                                                                                                                              |               |     |                   |        |               |
| Pn125 | Time constant of speed feedback filtering                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.0~655.35    | 0.0 | ms                | 0x0124 | After restart |
| Pn126 | Velocity feedback moving average filter time constant                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0x0000~0x0014 | 0   | 125us             | 0x0124 | After restart |
| Pn130 | Speed loop control method (PI/IP)                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~1           | 0   | —                 | 0x0130 | After restart |
|       | 0-PI control.<br>1-IP control.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |     |                   |        |               |
| Pn131 | Speed loop P-PI switching condition selection                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0x00<br>0x04  | 0   | —                 | 0x0131 | Immediately   |
|       | This is a function that automatically switches P control and PI control. Through setting the switching condition by this parameter and meeting the corresponding switching condition can suppress overshoot during acceleration and deceleration and shorten the settling time.<br>0- Conditioned by internal torque command.<br>1- Conditioned by speed instruction.<br>2- Conditioned by acceleration.<br>3- Conditioned by position deviation pulse.<br>4- No mode switch function. |               |     |                   |        |               |
| Pn132 | Speed loop P-PI switching condition (torque command)                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0~800         | 200 | %                 | 0x0132 | Immediately   |
|       | When the torque command exceeds the torque set by this parameter, the speed loop will be switched to P control, otherwise PI control.                                                                                                                                                                                                                                                                                                                                                  |               |     |                   |        |               |
| Pn133 | Speed loop P-PI switching condition (speed command)                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~10000       | 0   | rpm               | 0x0133 | Immediately   |
|       | When the speed command exceeds the speed set by this parameter, the speed loop will be switched to P control, otherwise PI control.                                                                                                                                                                                                                                                                                                                                                    |               |     |                   |        |               |
| Pn134 | Speed loop P-PI switching conditions (acceleration)                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~30000       | 0   | rpm/s             | 0x0134 | Immediately   |
|       | When the speed command exceeds the acceleration set by this parameter, the speed loop will be switched to P control, otherwise PI control.                                                                                                                                                                                                                                                                                                                                             |               |     |                   |        |               |
| Pn135 | Speed loop P-PI switching conditions (position deviation)                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~10000       | 0   | command unit      | 0x0135 | Immediately   |
|       | When the position deviation exceeds the value set by this parameter, the speed loop will be switched to P control, otherwise PI control.                                                                                                                                                                                                                                                                                                                                               |               |     |                   |        |               |
| Pn136 | The speed loop P/PI switching condition (line) (speed)                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0~10000       | 0   | mm/s              | 0x0136 | Immediately   |
| Pn137 | Speed loop P/PI switching condition                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~30000       | 0   | mm/s <sup>2</sup> | 0x0137 | Immediately   |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |        |    |        |             |
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|       | (straight line)<br>(acceleration)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |        |    |        |             |
| Pn140 | IF suppression control options                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0x00 ~ 0x11 | 0x0010 | —  | 0x0140 | Immediately |
|       | <p>The IF suppression control function effectively suppresses the continuous vibration of about 100 to 1000 Hz that occurs when the control gain is increased.</p> <p>0x1#: Automatic setting of IF suppression frequency through intelligent setting and bandwidth setting.</p> <p>0x0#: Not set by intelligent setting, bandwidth setting, only manual setting.</p> <p>0x#1: IF suppression frequency setting is valid.</p> <p>0x#0: IF suppression frequency setting is invalid.</p> |             |        |    |        |             |
| Pn141 | Inertial modification of IF vibration suppression                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 ~ 1000    | 100    | %  | 0x0141 | Immediately |
| Pn142 | IF suppression frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1 ~ 3000    | 100.0  | Hz | 0x0142 | Immediately |
|       | Set IF vibration frequency value.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |        |    |        |             |
| Pn143 | IF vibration suppression attenuation gain                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0 ~ 300     | 0      | %  | 0x0143 | Immediately |
|       | <p>Increasing this parameter can increase the vibration suppression effect. However, if the setting is too large, the vibration may be increased. When confirming the vibration suppression effect, simultaneously gradually increase the setting value by each 10% in the range of 0% to 200%. If the vibration suppression effect is still not achieved after reaching 200%, please stop the setting and reduce the control gain appropriately.</p>                                   |             |        |    |        |             |
| Pn150 | Notch filter 1 automatic adjustment selection                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0x00 ~ 0x01 | 1      | —  | 0x0150 | Immediately |
|       | <p>0 - Automatic adjustment without auxiliary functions.</p> <p>1 - Automatic adjustment through auxiliary functions.</p>                                                                                                                                                                                                                                                                                                                                                               |             |        |    |        |             |
| Pn151 | Notch filter 2 automatic adjustment selection                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0x00 ~ 0x01 | 1      | —  | 0x0151 | Immediately |
|       | <p>0 - Automatic adjustment without auxiliary functions.</p> <p>1 - Automatic adjustment through auxiliary functions.</p>                                                                                                                                                                                                                                                                                                                                                               |             |        |    |        |             |
| Pn152 | Automatic notch resonance detection sensitivity                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1 ~ 200     | 100    | %  | 0x0152 | Immediately |
|       | It's used to set the sensitivity for automatically detecting the resonant frequency. The smaller the value is set, the more sensitive it will be for resonance, the easier it is to detect vibration, and the smaller it is, the more likely it is to falsely detect the resonance frequency.                                                                                                                                                                                           |             |        |    |        |             |
| Pn153 | Notch filter 1 frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50 ~ 5000   | 5000   | Hz | 0x0153 | Immediately |
|       | <p>Set the frequency of the first notch filter that suppresses resonance. When this parameter is set to 5000, the function of the notch filter is invalid.</p> <p>Note: Do not set the notch filter frequency close to the response frequency of the speed loop. At least this frequency should be set to more than 4 times of the speed loop gain, otherwise it may affect the overall performance of the system.</p>                                                                  |             |        |    |        |             |
| Pn154 | Notch filter 1Q value                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.5 ~ 10    | 0.70   | -  | 0x0154 | Immediately |
|       | The Q value of the notch filter refers to the setting value of the filter frequency width related to the notch filter frequency. The width of the recess varies with the Q value of the notch filter, and the larger the Q value of the notch filter is set, the more sunk and the narrower the width of the filter frequency will be.                                                                                                                                                  |             |        |    |        |             |
| Pn155 | Notch filter 1 depth                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0 ~ 1       | 0.000  | -  | 0x0155 | Immediately |
|       | The notch filter depth refers to the setting of the filter frequency depth related to the notch filter frequency. The depth of the recess varies with the depth of the notch filter.                                                                                                                                                                                                                                                                                                    |             |        |    |        |             |

|       |                                                                                                                                                                                                                                                                                                                                                                                                              |           |       |     |        |               |
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|       | The smaller the notch filter depth value is, the deeper the depression and the higher the vibration suppression effect will be. But setting it too small will increase the vibration.                                                                                                                                                                                                                        |           |       |     |        |               |
| Pn156 | Notch filter 2 frequency                                                                                                                                                                                                                                                                                                                                                                                     | 50~5000   | 5000  | Hz  | 0x0156 | Immediately   |
|       | Set the frequency of the second notch filter that suppresses resonance. When this parameter is set to 5000, the function of the notch filter is invalid.<br>Note: Do not set the notch filter frequency close to the response frequency of the speed loop. At least this frequency should be set to more than 4 times of the speed loop gain, otherwise it may affect the overall performance of the system. |           |       |     |        |               |
| Pn157 | Notch filter 2Q value                                                                                                                                                                                                                                                                                                                                                                                        | 0.5~10    | 0.70  | -   | 0x0157 | Immediately   |
|       | The Q value of the notch filter refers to the setting value of the filter frequency width related to the notch filter frequency. The width of the recess varies with the Q value of the notch filter, and the larger the Q value of the notch filter is set, the more sunk and the narrower the width of the filter frequency will be.                                                                       |           |       |     |        |               |
| Pn158 | Notch filter 2 depth                                                                                                                                                                                                                                                                                                                                                                                         | 0~1       | 0.000 | -   | 0x0158 | Immediately   |
|       | The notch filter depth refers to the setting of the filter frequency depth related to the notch filter frequency. The depth of the recess varies with the depth of the notch filter.<br>The smaller the notch filter depth value is, the deeper the depression and the higher the vibration suppression effect will be. But setting it too small will increase the vibration.                                |           |       |     |        |               |
| Pn160 | Disturbance compensation function selection                                                                                                                                                                                                                                                                                                                                                                  | 0x00~0x01 | 0     | —   | 0x0160 | Immediately   |
|       | 0- Not use.<br>1- Use.                                                                                                                                                                                                                                                                                                                                                                                       |           |       |     |        |               |
| Pn161 | Disturbance observer cutoff frequency                                                                                                                                                                                                                                                                                                                                                                        | 1~1000    | 150.0 | Hz  | 0x0161 | Immediately   |
|       | Set the disturbance compensation gain. Increasing it can improve the effect of suppressing the disturbance, but excessive noise will occur.                                                                                                                                                                                                                                                                  |           |       |     |        |               |
| Pn163 | Disturbance compensation coefficient                                                                                                                                                                                                                                                                                                                                                                         | 0~100     | 0     | %   | 0x0163 | Immediately   |
|       | Set the disturbance compensation coefficient, that is, the received position command or speed command plus the disturbance compensation value of torque command.                                                                                                                                                                                                                                             |           |       |     |        |               |
| Pn165 | Disturbance observer inertia correction coefficient                                                                                                                                                                                                                                                                                                                                                          | 1~1000    | 100   | %   | 0x0165 | Immediately   |
|       | The disturbance observer inertia is set by this parameter to adjust the identification error caused by inaccurate inertia setting.<br>Note: When the inertia ratio is set correctly, the value is set to 100.                                                                                                                                                                                                |           |       |     |        |               |
| Pn166 | Speed observer switch                                                                                                                                                                                                                                                                                                                                                                                        | 0~1       | 0     |     | 0x0166 | After restart |
|       | Set speed observation function switch:<br>0- Invalid.<br>1- Valid.                                                                                                                                                                                                                                                                                                                                           |           |       |     |        |               |
| Pn167 | Speed observer cutoff frequency                                                                                                                                                                                                                                                                                                                                                                              | 1~500     | 80    | Hz  | 0x0167 | Immediately   |
|       | This parameter sets the speed observer bandwidth. Increasing the set value will increase the response speed of the speed feedback value to track the real speed. If the speed is too large, vibration and noise may occur.                                                                                                                                                                                   |           |       |     |        |               |
| Pn170 | Friction torque compensation cutoff speed                                                                                                                                                                                                                                                                                                                                                                    | 0~1000    | 20    | rpm | 0x0170 | Immediately   |
|       | Friction compensation function is a function that compensates for viscous friction and fixed load changes. It is adjusted according to the friction compensation coefficient. Generally, please set the friction compensation coefficient to 95% or less. If the effect is not obvious enough, please increase the                                                                                           |           |       |     |        |               |

|       |                                                                                                                                                                                                                                                                                                                                                       |           |      |          |        |               |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|----------|--------|---------------|
|       | friction compensation cut-off speed at a rate of 10% each within the range that does not generate vibration.                                                                                                                                                                                                                                          |           |      |          |        |               |
| Pn171 | Friction torque positive compensation coefficient                                                                                                                                                                                                                                                                                                     | 0~100     | 0    | %/100rpm | 0x0171 | Immediately   |
|       | The setting value is higher, the effect is better. However, if the setting value is too high, the response is more likely to vibrate. Usually we set the value below 95%.                                                                                                                                                                             |           |      |          |        |               |
| Pn172 | Friction torque reverse compensation coefficient                                                                                                                                                                                                                                                                                                      | 0~100     | 0    | %/100rpm | 0x0172 | Immediately   |
|       | The setting value is higher, the effect is better. However, if the setting value is too high, the response is more likely to vibrate. Usually we set the value below 95%.                                                                                                                                                                             |           |      |          |        |               |
| Pn175 | Robust control selection                                                                                                                                                                                                                                                                                                                              | 0x00~0x01 | 1    | —        | 0x0175 | After restart |
|       | Robust control function means that the function of stable response can be obtained through automatic adjustment within a certain range, regardless of mechanical type, load fluctuation, or inertia change.<br>0-Invalid.<br>1-Valid.                                                                                                                 |           |      |          |        |               |
| Pn177 | Robust control tuning value                                                                                                                                                                                                                                                                                                                           | 10~80     | 40.0 | Hz       | 0x0177 | Immediately   |
|       | Set the gain-tuning value of the robust control. The setting value is larger, system responds is faster, but system overshoot and excessive noise may occur.                                                                                                                                                                                          |           |      |          |        |               |
| Pn178 | Minimum load value of robust control                                                                                                                                                                                                                                                                                                                  | 0~500     | 0    | %        | 0x0178 | Immediately   |
|       | Set the robust control load factor. The larger the value is set, the faster the system responds, but it will be noisier. When the inertia is large, increasing the value properly could reduce overshoot.                                                                                                                                             |           |      |          |        |               |
| Pn185 | Vibration detection selection                                                                                                                                                                                                                                                                                                                         | 0x00~0x02 | 0    | —        | 0x0185 | Immediately   |
|       | This function refers to the function of automatically selecting alarm or warning after detecting the machine vibration under normal operation.<br>Set the expression after vibration detection:<br>0 - No vibration detected.<br>1 - Warning after vibration detected.<br>2 - Alarm after vibration detected.                                         |           |      |          |        |               |
| Pn186 | Vibration detection sensitivity                                                                                                                                                                                                                                                                                                                       | 50~500    | 100  | %        | 0x0186 | Immediately   |
|       | Set the sensitivity of the detected vibration. The setting value is smaller, the sensitive is more. If the setting is too small, the vibration may be detected by mistake during normal operation.<br>Note: The detection sensitivity of the vibration warning and vibration alarm may differ depending on the state of the machine being used.       |           |      |          |        |               |
| Pn187 | Vibration detection value                                                                                                                                                                                                                                                                                                                             | 0~5000    | 50   | rpm      | 0x0187 | Immediately   |
|       | Set the threshold for vibration detection. The setting value is smaller, the vibration detected is easier. If the setting is too small, the vibration may be detected by mistake during normal operation.<br>Note: The vibration detection values of vibration warning and vibration alarm may differ according to the condition of the used machine. |           |      |          |        |               |

## 10.3 Pn2 Position Related Parameters

| Function code  | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Range            | Default | Unit | Communication address | When enabled  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|------|-----------------------|---------------|
| Pn200          | Pulse input filter selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~2              | 0       | -    | 0x0200                | After restart |
|                | Use this parameter to select the position command filter to better suppress the interference in the command pulse.<br>0-Line drive filter ~1MHz.<br>1-Collector open-circuit filter.<br>2-Line drive filter 14MHz~4MHz.<br>3-Collector open-circuit filter 1MHz.<br>5-Collector open-circuit filter 0kHz ~ 500kHz.<br>10- Collector open-circuit filter 0kHz ~ 400kHz.<br>20- Collector open-circuit filter 0kHz ~ 200kHz.<br>50- Collector open-circuit filter 0kHz ~ 100kHz.<br>120- Collector open-circuit filter 0kHz ~ 50kHz.<br>200- Collector open-circuit filter 0kHz ~ 30kHz.<br>255- Collector open-circuit 0khz ~ 20kHz.<br>Note: Please set a reasonable filter according to the pulse frequency, otherwise it may cause poor pulse immunity or pulse loss.FPGA versions before 3728 do not support multi-level filtering. |                  |         |      |                       |               |
| Pn201          | Pulse input form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0~6              | 0       | -    | 0x0201                | After restart |
|                | 0-Pulse + direction positive logic.<br>1-CW+CCW positive logic.<br>5-Pulse + direction negative logic.<br>4- 4 times of quadrature encoding.<br>6-CW+CCW negative Logic.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |         |      |                       |               |
| Pn202          | Pulse input direction negation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0~1              | 0       | -    | 0x0202                | After restart |
|                | Select the negation of pulse input direction:<br>0-Positive .<br>1-Negative .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |         |      |                       |               |
| Pn203          | Command pulse input magnification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1~100            | 1       | x1   | 0x0203                | Immediately   |
|                | Set the command pulse input magnification value to be used in conjunction with ON/OFF of the command pulse magnification switching signal for switching the position command pulse input magnification to the parameter setting multiple.<br>Note: If the input pulse frequency is too low and this value set too large, the speed may not be steady.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |         |      |                       |               |
| Pn204<br>Pn206 | Electronic gear ratio numerator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0~<br>1073741824 | 64      | -    | 0x0204<br>0x0205      | Immediately   |
|                | Electronic gear ratio denominator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1~<br>1073741824 | 1       | -    | 0x0206<br>0x0207      | Immediately   |
|                | Position mode full closed loop invalid:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |         |      |                       |               |
|                | The electronic gear ratio is a function for setting the workpiece movement amount of 1 pulse unit of the upper device input command. Take the screw drive as an example, it has a screw pitch of 10mm, When the host system requires that reduction ratio of the motor shaft and the load side machine is N1/N2 (the motor shaft rotates N2 circles when the load shaft rotates N1 circles ), the set value of the electronic gear ratio is obtained by the following formula:<br>Electronic Gear Ratio numerator /Electronic Gear Ratio denominator = Encoder Resolution / Pulse Number of Upper System 1r * Reduction Ratio N1/N2.                                                                                                                                                                                                   |                  |         |      |                       |               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |   |    |        |                      |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|----|--------|----------------------|
|       | $\frac{\text{Electronic Gear Ratio numerator}}{\text{Electronic Gear Ratio denominator}} = \frac{\text{Encoder Resolution}}{\text{Pulse Number of Upper System 1r}} \times \text{Reduction Ratio} \frac{N1}{N2}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |   |    |        |                      |
|       | <p>When the full closed loop is valid:<br/> The electronic gear ratio is the ratio of the workpiece movement of 1 pulse unit input command by the host device to the movement of 1 pulse output by the grating ruler.<br/> If the screw is driven, the screw pitch is 10mm and the resolution of the grating ruler is 0.5μm.<br/> The number of pulses required by the host system for the motor to rotate 1r is 20000, that is, the pulse equivalent is 0.5μm/pulse, and the movement of the grating ruler is 0.5μm, corresponding to outputting one pulse, then:</p> $\frac{\text{Electronic Gear Ratio numerator}}{\text{Electronic Gear Ratio denominator}} = \frac{\text{Input command 1 pulse corresponding movement}}{\text{Grating ruler output 1 pulse corresponding movement}} = \frac{0.5}{0.5} = \frac{1}{1}$ |           |   |    |        |                      |
| Pn208 | Internal position command                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0~4       | 0 | —  | 0x0208 | After restart        |
|       | 0-Position command select external pulse input.<br>1-Position command select internal position command.<br>2-Chasing and shearing electronic cam .<br>3-Reserved.<br>4-CANopen mode.<br>When using CANopen mode, Pn208 must be set to 4 (CANopen mode).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |   |    |        |                      |
| Pn211 | Position command low-pass filter time constant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0~655     | 0 | ms | 0x0211 | Cease to take effect |
|       | This parameter is used to set the time constant of the first-order low-pass filter corresponding to the position command and it can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |   |    |        |                      |
| Pn212 | Average filter time in position instruction rolling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0~1000    | 0 | ms | 0x0212 | Cease to take effect |
|       | This parameter is used to set the time constant of the moving average filter of the corresponding position instruction. It can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |   |    |        |                      |
| Pn230 | Low-frequency vibration suppression selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0x00~0x02 | 0 | —  | 0x0230 | Immediately          |
|       | This parameter is used with Pn231 as the automatic adjustment mode setting.<br>0- No vibration suppression.<br>1- Additional vibration suppression function for specific frequency.<br>2- Additional vibration suppression to 2 different frequencies.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |   |    |        |                      |
| Pn231 | Automatic adjustment selection in low-frequency vibration suppression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0x00~0x01 | 1 | —  | 0x0231 | Immediately          |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |       |     |        |             |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|-----|--------|-------------|
|       | <p>This parameter is set to choose if the low-frequency vibration suppression is automatically set in the intelligent settings, bandwidth settings and other auxiliary functions:<br/> 0 - Vibration suppression function won't be automatically adjusted via auxiliary functions.<br/> 1 - Vibration suppression function will be automatically adjusted via auxiliary functions.</p>                                                                       |           |       |     |        |             |
| Pn232 | Low-frequency vibration detection sensitivity                                                                                                                                                                                                                                                                                                                                                                                                                | 0.1~300   | 40.0  | %   | 0x0232 | Immediately |
|       | <p>This parameter is used to set the sensitivity of low-frequency vibration detection when the positioning is completed. The smaller the sensitivity is set, the easier it is to automatically detect the low frequency vibration frequency point.</p>                                                                                                                                                                                                       |           |       |     |        |             |
| Pn235 | Low-frequency vibration suppression 1 frequency                                                                                                                                                                                                                                                                                                                                                                                                              | 1~200     | 200.0 | Hz  | 0x0235 | Immediately |
|       | <p>This parameter is used to set the frequency of low frequency vibration suppression 1.</p>                                                                                                                                                                                                                                                                                                                                                                 |           |       |     |        |             |
| Pn236 | Low Frequency Vibration suppression 1 correction                                                                                                                                                                                                                                                                                                                                                                                                             | 10~1000   | 100   | %   | 0x0236 | Immediately |
|       | <p>This parameter is used to set the correction coefficient of low-frequency vibration suppression 1. The larger the value is set, the more obvious the suppression effect of low-frequency is, and setting it too small may cause long positioning time.</p>                                                                                                                                                                                                |           |       |     |        |             |
| Pn237 | Low-frequency vibration suppression 2 frequency                                                                                                                                                                                                                                                                                                                                                                                                              | 1~200     | 200.0 | Hz  | 0x0237 | Immediately |
|       | <p>This parameter is used to set the frequency of low-frequency vibration suppression 2.</p>                                                                                                                                                                                                                                                                                                                                                                 |           |       |     |        |             |
| Pn238 | Low-frequency Vibration Suppression 2 Correction                                                                                                                                                                                                                                                                                                                                                                                                             | 10~1000   | 100   | %   | 0x0238 | Immediately |
|       | <p>This parameter is used to set the correction coefficient of low-frequency vibration suppression 2. The larger the value is set, the more obvious the suppression effect of low-frequency is, and setting it too small may cause long positioning time.</p>                                                                                                                                                                                                |           |       |     |        |             |
| Pn240 | Model tracking control selection                                                                                                                                                                                                                                                                                                                                                                                                                             | 0x00~0x01 | 0     | —   | 0x0240 | Immediately |
|       | <p>0- Not use model tracking control.<br/> 1- Use model tracking control.</p>                                                                                                                                                                                                                                                                                                                                                                                |           |       |     |        |             |
| Pn241 | Model tracking control gain                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1~2000    | 50.0  | 1/s | 0x0241 | Immediately |
|       | <p>The size of the model tracking control gain determines the response speed of the servo system. If the model tracking control gain is increased, the responsiveness becomes faster and the positioning time becomes shorter. When the model tracking control is effective, the position response and deviation of the servo system are determined by this parameter, rather than position gain.</p>                                                        |           |       |     |        |             |
| Pn242 | Model tracking control attenuation coefficient                                                                                                                                                                                                                                                                                                                                                                                                               | 50~200    | 100.0 | %   | 0x0242 | Immediately |
|       | <p>The tracking attenuation coefficient of the model decreases, and the position tuning section is easy to cause excessive overshoot. If the setting is too small, the position oscillates easily. When the setting increases, the position overshoot decreases, but when the position is too large, the position easily rebounds, causing the positioning time to change long. It is recommended to keep this value, 100%, unchanged during normal use.</p> |           |       |     |        |             |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |       |     |        |               |
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| Pn243 | Model tracking control speed feedforward gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0~1000    | 100.0 | %   | 0x0243 | Immediately   |
|       | The feed forward gain of the model tracking speed is reduced, and the responsiveness is slower, but position overshoot doesn't easily occur. If the feedforward gain is too small, the position deviation will end in a long time.                                                                                                                                                                                                                                                                                                                                                   |           |       |     |        |               |
| Pn244 | Model tracking control forward torque feedforward gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0~1000    | 100.0 | %   | 0x0244 | Immediately   |
|       | It's a forward position command and could be used when adjusting the forward response separately. When it is increased, the torque feed forward rises faster and the positioning time can be shortened appropriately.                                                                                                                                                                                                                                                                                                                                                                |           |       |     |        |               |
| Pn245 | Model tracking control reverse torque feedforward gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0~1000    | 100.0 | %   | 0x0245 | Immediately   |
|       | It's a reverse position command and could be used when adjusting the forward response separately. When it is increased, the torque feed forward rises faster and the positioning time can be shortened appropriately.                                                                                                                                                                                                                                                                                                                                                                |           |       |     |        |               |
| Pn246 | Second model tracking control attenuation coefficient                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1~2000    | 50.0  | 1/s | 0x0246 | Immediately   |
|       | Use 2 <sup>nd</sup> gain when model tracking is valid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |       |     |        |               |
| Pn247 | Second model tracking control attenuation coefficient                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50~200    | 100.0 | %   | 0x0247 | Immediately   |
|       | Use 2 <sup>nd</sup> gain when model tracking is valid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |       |     |        |               |
| Pn249 | Speed feedforward/torque feedforward selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0x00~0x01 | 0     | —   | 0x0249 | Immediately   |
|       | 0-Do not use model tracking control, external speed and torque feed forward at the same time.<br>1-Use model tracking control, external speed and torque feed forward at the same time.<br>When using the model tracking control, the optimal feedforward will be set and it is not recommended to use the "speed feed forward (V-REF) input" and "torque feed forward (T-REF) input" from the upper unit at the same time. However, it can be used at the same time as needed. In this case, if the input feed forward is incorrect, it may cause overshoot and system instability. |           |       |     |        |               |
| Pn250 | Application method of external encoder in full closed loop control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0~3       | 0     | —   | 0x0250 | After restart |
|       | 0 - Full closed loop function is not used .<br>1 - Use in standard direction.<br>2 - Use in reverse direction .<br>When setting the forward rotation of the motor, if the moving direction of the grating ruler is set incorrectly, it may cause an alarm of speeding or excessive deviation between the motor and load. Before operation, manually move the load and change this parameter to make the change direction of the monitoring parameter Un007 (feedback pulse counter) and Un012 (feedback pulse counter of external encoder) consistent before operation.              |           |       |     |        |               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |            |              |                  |               |
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| Pn252 | Deviation coefficient between motor loads of fully closed-loop rotating for 1 turn                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0~100        | 20         | %            | 0x0252           | Immediately   |
|       | <p>If this parameter is set to 0%, the deviation will be 1000 after one cycle of operation, and the deviation will be accumulated on the basis of 1000 at the beginning of the second cycle of operation. If it is set to 20%, the deviation will be accumulated on the basis of 200(1000) at the beginning of the second cycle of operation.</p> <p>If the value is set too large, Er.d10 may not be detected normally. It needs to be set according to the load and the allowable installation error between motors.</p> |              |            |              |                  |               |
| Pn253 | Resolution of external grating ruler                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4~1048576    | 32768      | Pulse /r     | 0x0253<br>0x0254 | After restart |
|       | Set the resolution of the external grating ruler after the motor runs for 1 turn (after 4 times the frequency).                                                                                                                                                                                                                                                                                                                                                                                                            |              |            |              |                  |               |
| Pn257 | Setting of excessive deviation between motor and load                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~1073741824 | 1000       | Command unit | 0x0257<br>0x0258 | Immediately   |
|       | Set the alarm threshold value of excessive deviation between motor and load, which is too small, which may lead to false detection of Er.d10.                                                                                                                                                                                                                                                                                                                                                                              |              |            |              |                  |               |
| Pn260 | Position proximity signal width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1~1073741824 | 1073741824 | Command unit | 0x0260<br>0x0261 | Immediately   |
|       | In the position control, the host device can receive the positioning proximity signal before confirming the positioning completion signal, so as to prepare for the sequence of actions after the positioning is completed and shorten the time required for the positioning to complete the operation. The signal will be output when the difference between the command pulse number of the host device and the servo motor movement (position deviation) is lower than the set value.                                   |              |            |              |                  |               |
| Pn262 | Positioning completion range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0~1073741824 | 7          | Command unit | 0x0262<br>0x0263 | Immediately   |
|       | In the position control, the servo motor positioning completion signal will be output when the difference between the command pulse number from the host device and the servo motor movement amount (position deviation) is lower than the set value that means the host device confirming positioning has been completed.                                                                                                                                                                                                 |              |            |              |                  |               |
| Pn264 | Maximum position deviation threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1~1073741823 | 5242880    | Command unit | 0x0264<br>0x0265 | Immediately   |
|       | When the motor operation does not match the instruction, by setting the appropriate Pn264 (maximum position deviation threshold), an abnormal condition can be detected and the motor can be stopped.                                                                                                                                                                                                                                                                                                                      |              |            |              |                  |               |
| Pn266 | Excessive position deviation warning setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10~100       | 100        | %            | 0x0266           | Immediately   |
|       | This parameter is used to set the position deviation excessive warning threshold. When the position deviation is greater than the product of the Pn264 (maximum position deviation threshold) and this parameter, an excessive position deviation warning will be generated.                                                                                                                                                                                                                                               |              |            |              |                  |               |
| Pn267 | Position deviation alarm threshold when the servo is ON                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1~1073741823 | 5242880    | Command unit | 0x0267<br>0x0268 | Immediately   |
|       | This parameter is used to set the threshold for excessive position deviation alarm at the moment of servo ON. When the servo is ON, if the position deviation value exceeds this setting value, an excessive servo deviation alarm will be generated when the servo is ON.                                                                                                                                                                                                                                                 |              |            |              |                  |               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |       |     |        |               |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|-----|--------|---------------|
| Pn269 | Position deviation warning threshold when the Servo is ON                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10~100    | 100   | %   | 0x0269 | Immediately   |
|       | This parameter is used to set the warning threshold for excessive position deviation at the servo ON moment. When the servo is turned ON and the position deviation is greater than the product of "Excessive position deviation warning threshold at servo ON" and the parameter, the warning will be generated when the servo is ON.                                                                                                                                                         |           |       |     |        |               |
| Pn270 | Speed limit value when the Servo is ON                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0~10000   | 10000 | rpm | 0x0270 | Immediately   |
|       | If the servo is turned ON with the position deviation accumulated, the speed limit is executed by this parameter.<br>If the servo is turned ON with the position deviation accumulated, the speed limit is executed by this parameter. When the command pulse is input in this state, the alarm Er.D02 (Excessive position deviation alarm caused by speed limit during servo ON) is displayed when the set value of Pn264 (maximum position deviation threshold) is exceeded.                 |           |       |     |        |               |
| Pn272 | Position deviation clear mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0x00~0x03 | 0     | —   | 0x0272 | After restart |
|       | Set the clear mode of the switch position deviation clear signal (/CLR):<br>0- Clear when level is ON.<br>1- Clear when the rising edge OFF->ON.<br>2- Clear when level is OFF.<br>3- Clear when the falling edge ON->OFF.<br>4- Position deviation removal .<br>5- Clear in case of servo off, alarm and limit .                                                                                                                                                                              |           |       |     |        |               |
| Pn273 | Selection of position deviation clearing method                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0x00~0x02 | 0     | —   | 0x0273 | After restart |
|       | Set the deviation clearing method:<br>0- Clear when servo OFF or alarm.<br>1- Clear when there is /CLR signal.<br>2- Clear when there is alarm.<br>3- Do not clear.<br>4- Clear when servo OFF, alarm, position limit.<br>Note:<br>1. For details on the pulse amplitude of the clear signal, refer to the description of "Deviation clearance".<br>2. In the position control, the position deviation remains unchanged when the servo motor stops due to the travel limit.                   |           |       |     |        |               |
| Pn274 | Positioning completion signal output time                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0x00~0x02 | 0     | —   | 0x0274 | After restart |
|       | Set the output timing of positioning completion signal /COIN:<br>0- Output when the absolute value of position deviation is less than the positioning completion range (Pn262).<br>1- Output when the absolute value of position deviation is less than the positioning completion range (Pn262) and the filtered position command is 0.<br>2- Output when the absolute value of position deviation is less than the positioning completion range (Pn262) and the position command input is 0. |           |       |     |        |               |

## 10.4 Pn3 Group Speed Related Parameters

| Function code           | Parameter                                                                                                                                                                                                                                                                                                                                                                                          | Range    | Default | Unit                  | Communication address | When enabled |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|-----------------------|-----------------------|--------------|
| Pn300                   | Analog speed command gain                                                                                                                                                                                                                                                                                                                                                                          | 150～3000 | 600     | 0.01V/<br>rated speed | 0x0300                | Immediately  |
|                         | Use this parameter to set the analog voltage value of (V-REF) when the speed of servo motor is rated speed.<br>Note: do not apply a voltage above - 10 ～ 10V. Exceeding this range may cause damage to the drive.                                                                                                                                                                                  |          |         |                       |                       |              |
| Pn301                   | Reversed analog speed command                                                                                                                                                                                                                                                                                                                                                                      | 0～1      | 0       | -                     | 0x0301                | Immediately  |
|                         | Set the voltage polarity of the analog speed command:<br>0- Positive polarity: positive voltage corresponds to positive speed command.<br>1- Negative polarity: positive voltage corresponds to negative speed command.                                                                                                                                                                            |          |         |                       |                       |              |
| Pn302                   | Analog speed instruction filter time                                                                                                                                                                                                                                                                                                                                                               | 0～655.35 | 0.40    | ms                    | 0x0302                | Immediately  |
|                         | The function could be set to smooth the speed command when one delay filter is applied to the analog speed command (V-REF) input and it does not usually need to be changed. If the set value is too large, the responsiveness may decrease. Please set this parameter while confirming the response.                                                                                              |          |         |                       |                       |              |
| Pn303                   | Analog speed command dead zone range                                                                                                                                                                                                                                                                                                                                                               | 0～3      | 0       | V                     | 0x0303                | Immediately  |
|                         | In the analog speed control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the commands inside the servo unit. This error can be eliminated by setting an appropriate analog speed command deadband range.                                                                                                         |          |         |                       |                       |              |
| Pn304<br>Pn305<br>Pn306 | Internal speed 1                                                                                                                                                                                                                                                                                                                                                                                   | 0～10000  | 100     | rpm                   | 0x0304                | Immediately  |
|                         | Internal speed 2                                                                                                                                                                                                                                                                                                                                                                                   | 0～10000  | 200     | rpm                   | 0x0305                | Immediately  |
|                         | Internal speed 3                                                                                                                                                                                                                                                                                                                                                                                   | 0～10000  | 300     | rpm                   | 0x0306                | Immediately  |
|                         | When operating in the internal speed mode, the servo unit provides three internal speed commands and through Switch Internal Speed Command Selection A and B we could select as follow:<br>/SPD-A        /SPD-B        Speed Command<br>OFF        OFF        Zero Speed<br>OFF        ON        Internal speed 1<br>ON        ON        Internal speed 2<br>ON        OFF        Internal speed 3 |          |         |                       |                       |              |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                    |          |         |                       |                       |              |
| Pn310                   | Speed command trapezoidal acceleration time                                                                                                                                                                                                                                                                                                                                                        | 0～30000  | 0       | ms                    | 0x0310                | Immediately  |
|                         | Acceleration of the set speed from 0r/min to the rated speed (corresponding to the motor model).<br>When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.                                                                                                                                                                        |          |         |                       |                       |              |
| Pn311                   | Speed command trapezoidal deceleration time                                                                                                                                                                                                                                                                                                                                                        | 0～30000  | 0       | ms                    | 0x0311                | Immediately  |
|                         | Acceleration time of the set speed from to the rated speed (corresponding to the motor model) to 0r/min. When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.                                                                                                                                                                   |          |         |                       |                       |              |

|       |                                                                                                                                                                                                                                                                                                                                                               |         |    |     |        |             |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----|-----|--------|-------------|
| Pn312 | Zero speed clamp mode                                                                                                                                                                                                                                                                                                                                         | 0~3     | 3  | -   | 0x0312 | Immediately |
|       | Speed mode, setting the switching speed zero clamp signal (/ZCLAMP) working mode:<br>0-Invalid.<br>1-Speed command is set to 0, not clamped after shutdown.<br>2-Speed command is set to 0, clamped after shutdown.<br>3-Speed command is lower than "zero speed clamp speed threshold"( Pn313), the first speed command is set to 0, clamped after shutdown. |         |    |     |        |             |
| Pn313 | Zero speed clamp speed threshold                                                                                                                                                                                                                                                                                                                              | 0~10000 | 10 | rpm | 0x0313 | Immediately |
|       | Set the zero control switching threshold when "zero speed clamp mode"( Pn312) is set to 3.                                                                                                                                                                                                                                                                    |         |    |     |        |             |
| Pn317 | Rotation determination threshold                                                                                                                                                                                                                                                                                                                              | 1~10000 | 20 | rpm | 0x0317 | Immediately |
|       | When the motor speed is higher than the set value, the switch rotation detection signal (/TGON) is output.                                                                                                                                                                                                                                                    |         |    |     |        |             |
| Pn320 | Speed consistent range                                                                                                                                                                                                                                                                                                                                        | 0~100   | 10 | rpm | 0x0320 | Immediately |
|       | When the difference between the motor speed and the command speed is lower than the set value, the switch-speed match signal (/V-CMP) would be output.                                                                                                                                                                                                        |         |    |     |        |             |

## 10.5 Pn4 Group Torque Related Parameters

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                      | Range    | Default | Unit | Communication address | When enabled |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------|------|-----------------------|--------------|
| Pn400         | Torque command selection                                                                                                                                                                                                                                                                                                                                                                                                       | 0~1      | 1       | -    | 0x0400                | Immediately  |
|               | Select the torque control command source:<br>0- Internal setting.<br>1- Analog input.                                                                                                                                                                                                                                                                                                                                          |          |         |      |                       |              |
| Pn401         | Torque command second-order low-pass filter cut-off frequency                                                                                                                                                                                                                                                                                                                                                                  | 100~5000 | 5000    | Hz   | 0x0401                | Immediately  |
|               | This parameter is used to set the cut-off frequency of the second-order torque filter. When this parameter is set to 5000, the filter function is invalid.                                                                                                                                                                                                                                                                     |          |         |      |                       |              |
| Pn402         | Torque command second-order low-pass filter Q                                                                                                                                                                                                                                                                                                                                                                                  | 0.5~1    | 0.50    | 1    | 0x0402                | Immediately  |
|               | This parameter is used to set the Q value of the second-order torque filter. Increasing the Q value can improve the system response, but noise will be generated when the setting is too large.                                                                                                                                                                                                                                |          |         |      |                       |              |
| Pn403         | Torque command direction setting                                                                                                                                                                                                                                                                                                                                                                                               | 0~1      | 0       | -    | 0x0403                | Immediately  |
|               | Set the switching torque command direction selection (/T-SIGN) signal to activate the switch:<br>0 - Torque command direction selection (/T-SIGN) signal is invalid.<br>1 - Torque command direction selection (/T-SIGN) signal is valid.<br>Note: Torque command reversion is invalid when /T-SIGN is valid. Torque command is positive when /T-SIGN signal is ON, and torque command is negative when /T-SIGN signal is OFF. |          |         |      |                       |              |
| Pn404         | Analog torque command filter time                                                                                                                                                                                                                                                                                                                                                                                              | 0~655.35 | 0.00    | ms   | 0x0404                | Immediately  |

|       |                                                                                                                                                                                                                                                                                       |           |      |                       |        |               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|-----------------------|--------|---------------|
|       | The parameter is used to smooth the torque command when we apply 1 delay filter to the analog torque command (T-REF) input, usually it does not need to be changed. If the set value is too large, the responsiveness may decrease. So please set it up as we check the response.     |           |      |                       |        |               |
| Pn405 | Analog torque command gain                                                                                                                                                                                                                                                            | 10~100    | 30   | 0.1V/<br>Rated torque | 0x0405 | Immediately   |
|       | This parameter is used to set the analog (T-REF) voltage value which corresponds the rated torque of the servo motor.<br>Caution: Do not apply more than -10V~10V, exceeding this range may cause damage to the driver.                                                               |           |      |                       |        |               |
| Pn406 | Reversed analog torque command                                                                                                                                                                                                                                                        | 0~1       | 0    | -                     | 0x0406 | Immediately   |
|       | The analog voltage corresponds to the polarity setting of the torque command:<br>0-Positive polarity: Positive voltage corresponds to positive torque command.<br>1-Negative polarity: Positive voltage corresponds to negative torque command.                                       |           |      |                       |        |               |
| Pn407 | Analog torque command dead zone range                                                                                                                                                                                                                                                 | 0~3       | 0    | V                     | 0x0407 | Immediately   |
|       | In analog torque control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because a slight deviation occurs in the command inside the servo unit. This error can be eliminated by setting an appropriate analog torque command deadband range. |           |      |                       |        |               |
| Pn410 | Internal torque command in torque control                                                                                                                                                                                                                                             | -500~500  | 0    | %                     | 0x0410 | Immediately   |
|       | Select the torque command setting when the command source of torque control is internal setting.                                                                                                                                                                                      |           |      |                       |        |               |
| Pn411 | Speed limit mode setting during torque control                                                                                                                                                                                                                                        | 0~1       | 1    | -                     | 0x0411 | After restart |
|       | 0-The smaller value between the speed corresponding to the analog voltage (V-ref) and the speed set by Pn413.<br>1-The speed set by Pn413.                                                                                                                                            |           |      |                       |        |               |
| Pn412 | Speed limit selection                                                                                                                                                                                                                                                                 | 0x00~0x01 | 0    | —                     | 0x0412 | After restart |
|       | 0- Motor maximum speed (determined by internal part of the motor model) + torque mode speed limit (Pn411).<br>1- Overspeed detection alarm speed (determined by internal part of the motor model) + torque mode speed limit (Pn411).                                                  |           |      |                       |        |               |
| Pn413 | Speed limit in torque control                                                                                                                                                                                                                                                         | 0~10000   | 1000 | rpm                   | 0x0413 | Immediately   |
|       | This parameter is used to set speed limit in torque control with Pn411.                                                                                                                                                                                                               |           |      |                       |        |               |
| Pn415 | Internal torque control command smooth acceleration time                                                                                                                                                                                                                              | 0~30000   | 100  | ms                    | 0x0415 | Immediately   |
|       | Set the internal torque control command smooth acceleration time.                                                                                                                                                                                                                     |           |      |                       |        |               |
| Pn416 | Internal torque control command smooth deceleration time                                                                                                                                                                                                                              | 0~30000   | 100  | ms                    | 0x0416 | Immediately   |
|       | Set the internal torque control command smooth deceleration time.                                                                                                                                                                                                                     |           |      |                       |        |               |
| Pn420 | Target torque reaching value setting                                                                                                                                                                                                                                                  | 0.0~500.0 | 100  | -                     | 0x0420 | Immediately   |

|       |                                         |        |   |    |        |             |
|-------|-----------------------------------------|--------|---|----|--------|-------------|
|       | Set the target torque reaching value.   |        |   |    |        |             |
| Pn421 | Target torque reaching time window      | 0~1000 | 5 | ms | 0x0422 | Immediately |
|       | Set target torque reaching time window. |        |   |    |        |             |

## 10.6 Pn5 JOG Related Parameters

| Function code | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Range        | Default | Unit         | Communication address | When enabled |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|--------------|-----------------------|--------------|
| Pn500         | JOG speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~1000       | 500     | rpm          | 0x0500                | Immediately  |
| Pn502         | Program JOG operation mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0x00~0x05    | 0       | —            | 0x0502                | Immediately  |
|               | 0-(waiting time->forward running)*number of cycles.<br>1-(waiting time->backward running)*number of cycles.<br>2-(waiting time->forward running)*number of cycles->(waiting time->backward running)*number of cycles.<br>3-(waiting time->backward running)*number of cycles->(waiting time->forward running)*number of cycles.<br>4-(waiting time->forward running->waiting time->backward running)*number of cycles.<br>5-(waiting time->backward running->waiting time->forward running)*number of cycles. |              |         |              |                       |              |
|               | Program JOG running distance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1~1073741824 | 32768   | command unit | 0x0503                | Immediately  |
|               | Set the JOG movement distance of the running program as the command unit.                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |         |              |                       |              |
|               | Program JOG acceleration/ deceleration time                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2~10000      | 100     | ms           | 0x0505                | Immediately  |
| Pn505         | Set the time of accelerating from 0r/min to the rated speed (corresponding to the motor model). When the set speed is greater or less than the rated speed, calculate the actual acceleration/deceleration time according to the ratio.                                                                                                                                                                                                                                                                       |              |         |              |                       |              |
|               | Program JOG waiting time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~10000      | 100     | ms           | 0x0506                | Immediately  |
| Pn506         | Set the waiting time between JOG sections of the running program in conjunction with the program JOG operation mode (Pn502).                                                                                                                                                                                                                                                                                                                                                                                  |              |         |              |                       |              |
|               | Program JOG movement times                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~1000       | 1       | circle       | 0x0507                | Immediately  |
| Pn507         | Set the movement times of the running program in conjunction with JOG operation mode (Pn502)<br>Note: it is infinite when set to 0.                                                                                                                                                                                                                                                                                                                                                                           |              |         |              |                       |              |
|               | Program JOG movement speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1~10000      | 500     | rpm          | 0x0508                | Immediately  |

## 10.7 Pn6 Group Switch Configuration Related Parameters

| Function code | Parameter                                      | Range | Default | Unit | Communication address | When enabled  |
|---------------|------------------------------------------------|-------|---------|------|-----------------------|---------------|
| Pn600         | Switching value input signal distribution mode | 0~1   | 1       | -    | 0x0600                | After restart |

|                                                                               |                                                                                                                                                                                                                                                                                                                        |         |                                                              |   |        |               |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------|---|--------|---------------|
|                                                                               | Set switching value input signal distribution mode:<br>0-Internal fixed: used by pins and functions are fixed inside by servo unit. See "CN1 terminal" for details.<br>1-Parameter configuration: It is used according to the function configured on each pin and is configured and used by function code Pn601~Pn609. |         |                                                              |   |        |               |
| Pn601<br>Pn602<br>Pn603<br>Pn604<br>Pn605<br>Pn606<br>Pn607<br>Pn608<br>Pn609 | CN1-40 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x01                                                         | - | 0x0601 | After restart |
|                                                                               | CN1-42 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x02                                                         | - | 0x0602 | After restart |
|                                                                               | CN1-43 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x03                                                         | - | 0x0603 | After restart |
|                                                                               | CN1-41 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x05                                                         | - | 0x0604 | After restart |
|                                                                               | CN1-44 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x04                                                         | - | 0x0605 | After restart |
|                                                                               | CN1-45 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x06                                                         | - | 0x0606 | After restart |
|                                                                               | CN1-46 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x07                                                         | - | 0x0607 | After restart |
|                                                                               | CN1-39 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x00                                                         | - | 0x0608 | After restart |
|                                                                               | CN1-38 input configuration                                                                                                                                                                                                                                                                                             | 0~0x114 | 0x00                                                         | - | 0x0609 | After restart |
|                                                                               | 0x00: Invalid                                                                                                                                                                                                                                                                                                          |         |                                                              |   |        |               |
|                                                                               | 0x01: Servo enable                                                                                                                                                                                                                                                                                                     |         | 0x101: Servo enable negation                                 |   |        |               |
|                                                                               | 0x02: Run in positive direction                                                                                                                                                                                                                                                                                        |         | 0x102: Positive direction is prohibited                      |   |        |               |
|                                                                               | 0x03: Run in negative direction                                                                                                                                                                                                                                                                                        |         | 0x103: Negative direction is prohibited                      |   |        |               |
|                                                                               | 0x04: Alarm clear                                                                                                                                                                                                                                                                                                      |         | 0x104: Alarm clear negation                                  |   |        |               |
|                                                                               | 0x05: Manual P-PI control                                                                                                                                                                                                                                                                                              |         | 0x105: Manual P-PI control negation                          |   |        |               |
|                                                                               | 0x06: Torque limit switch                                                                                                                                                                                                                                                                                              |         | 0x106: Torque limit switch negation                          |   |        |               |
|                                                                               | 0x07: Reserved                                                                                                                                                                                                                                                                                                         |         | 0x107: Reserved                                              |   |        |               |
|                                                                               | 0x08: Internal speed command direction selection                                                                                                                                                                                                                                                                       |         | 0x108: Internal speed command direction selection negation   |   |        |               |
|                                                                               | 0x09: Internal speed command selection A                                                                                                                                                                                                                                                                               |         | 0x109: Internal speed command selection A negation           |   |        |               |
|                                                                               | 0x0A: Internal speed command selection B                                                                                                                                                                                                                                                                               |         | 0x10A: Internal speed command selection B negation           |   |        |               |
|                                                                               | 0x0B: Control mode switch                                                                                                                                                                                                                                                                                              |         | 0x10B: Control mode switch negation                          |   |        |               |
|                                                                               | 0x0C: Zero speed clamp                                                                                                                                                                                                                                                                                                 |         | 0x10C: Zero speed clamp negation                             |   |        |               |
|                                                                               | 0x0D: Command pulse inhibit                                                                                                                                                                                                                                                                                            |         | 0x10D: Command pulse inhibit negation                        |   |        |               |
|                                                                               | 0x0E: Gain switching                                                                                                                                                                                                                                                                                                   |         | 0x10E: Gain switching negation                               |   |        |               |
|                                                                               | 0x0F: Direction selection of torque command                                                                                                                                                                                                                                                                            |         | 0x10F: Direction selection of torque command negation        |   |        |               |
|                                                                               | 0x10: Command pulse rate switching                                                                                                                                                                                                                                                                                     |         | 0x110: Command pulse rate switch negation                    |   |        |               |
|                                                                               | 0x12: Motor over temperature input                                                                                                                                                                                                                                                                                     |         | 0x112: Motor over temperature input negation                 |   |        |               |
|                                                                               | 0x16: Internal position command trigger                                                                                                                                                                                                                                                                                |         | 0x116: Internal position command triggers negation           |   |        |               |
|                                                                               | 0x17: Internal position instruction selection bit0                                                                                                                                                                                                                                                                     |         | 0x117: Internal position instruction selection bit0 negation |   |        |               |
|                                                                               | 0x18: Internal position instruction selection bit1                                                                                                                                                                                                                                                                     |         | 0x118: Internal position instruction selection bit1 negation |   |        |               |
|                                                                               | 0x19: Internal position instruction selection bit2                                                                                                                                                                                                                                                                     |         | 0x119: Internal position instruction selection bit2 negation |   |        |               |

|                         |                                                    |        |                                                              |   |        |               |
|-------------------------|----------------------------------------------------|--------|--------------------------------------------------------------|---|--------|---------------|
|                         | 0x1A: Internal position instruction selection bit3 |        | 0x11A: Internal position instruction selection bit3 negation |   |        |               |
|                         | 0x1B: Internal position instruction selection bit3 |        | 0x11B: Internal position instruction selection bit3 negation |   |        |               |
|                         | 0x1C: Home position return enable                  |        | 0x11C: Home position return enable negation                  |   |        |               |
|                         | 0x1D: Origin signal                                |        | 0x11D: Origin signal negation                                |   |        |               |
|                         | 0x1E: Forward JOG                                  |        | 0x11E: Forward JOG negation                                  |   |        |               |
|                         | 0x1F: Reverse JOG                                  |        | 0x11F: Reverse JOG negation                                  |   |        |               |
|                         | 0x20: Internal position stop bit                   |        | 0x120: Internal position stop bit negation                   |   |        |               |
|                         | 0x21: Capture function on                          |        | 0x121: Capture function on negation                          |   |        |               |
| Pn610<br>Pn611<br>Pn612 | Switch input internal configuration 1              | 0~0x14 | 0x00                                                         | - | 0x0610 | After restart |
|                         | Switch input internal configuration 2              | 0~0x14 | 0x00                                                         | - | 0x0611 | After restart |
|                         | Switch input internal configuration 3              | 0~0x14 | 0x00                                                         | - | 0x0612 | After restart |
|                         | 0x00: Invalid                                      |        |                                                              |   |        |               |
|                         | 0x01: Servo enable                                 |        | 0x101: Servo enable negation                                 |   |        |               |
|                         | 0x02: Run in positive direction                    |        | 0x102: Positive direction is prohibited                      |   |        |               |
|                         | 0x03: Run in negative direction                    |        | 0x103: Negative direction is prohibited                      |   |        |               |
|                         | 0x04: Alarm clear                                  |        | 0x104: Alarm clear negation                                  |   |        |               |
|                         | 0x05: Manual P-PI control                          |        | 0x105: Manual P-PI control negation                          |   |        |               |
|                         | 0x06: Torque limit switch                          |        | 0x106: Torque limit switch negation                          |   |        |               |
|                         | 0x07: Reserved                                     |        | 0x107: Reserved                                              |   |        |               |
|                         | 0x08: Internal speed command direction selection   |        | 0x108: Internal speed command direction selection negation   |   |        |               |
|                         | 0x09: Internal speed command selection A           |        | 0x109: Internal speed command selection A negation           |   |        |               |
|                         | 0x0A: Internal speed command selection B           |        | 0x10A: Internal speed command selection B negation           |   |        |               |
|                         | 0x0B: Control mode switch                          |        | 0x10B: Control mode switch negation                          |   |        |               |
|                         | 0x0C: Zero speed clamp                             |        | 0x10C: Zero speed clamp negation                             |   |        |               |
|                         | 0x0D: Command pulse inhibit                        |        | 0x10D: Command pulse inhibit negation                        |   |        |               |
|                         | 0x0E: Gain switching                               |        | 0x10E: Gain switching negation                               |   |        |               |
|                         | 0x0F: Direction selection of torque command        |        | 0x10F: Direction selection of torque command negation        |   |        |               |
|                         | 0x10: Command pulse rate switching                 |        | 0x110: Command pulse rate switch negation                    |   |        |               |
|                         | 0x12: Motor over temperature input                 |        | 0x112: Motor over temperature input negation                 |   |        |               |
|                         | 0x16: Internal position command trigger            |        | 0x116: Internal position command triggers negation           |   |        |               |
|                         | 0x17: Internal position instruction selection bit0 |        | 0x117: Internal position instruction selection bit0 negation |   |        |               |
|                         | 0x18: Internal position instruction selection bit1 |        | 0x118: Internal position instruction selection bit1 negation |   |        |               |
|                         | 0x19: Internal position instruction selection bit2 |        | 0x119: Internal position instruction selection bit2 negation |   |        |               |
|                         | 0x1A: Internal position instruction selection bit3 |        | 0x11A: Internal position instruction selection bit3 negation |   |        |               |
|                         | 0x1B: Internal position instruction selection bit3 |        | 0x11B: Internal position instruction selection bit3 negation |   |        |               |

|                         |                                                                                                                                                                             |           |       |                                                                    |        |               |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|--------------------------------------------------------------------|--------|---------------|
|                         | 0x1C: Home position return enable                                                                                                                                           |           |       | 0x11C: Home position return enable negation                        |        |               |
|                         | 0x1D: Origin signal                                                                                                                                                         |           |       | 0x11D: Origin signal negation                                      |        |               |
|                         | 0x1E: Forward JOG                                                                                                                                                           |           |       | 0x11E: Forward JOG negation                                        |        |               |
|                         | 0x1F: Reverse JOG                                                                                                                                                           |           |       | 0x11F: Reverse JOG negation                                        |        |               |
|                         | 0x20: Internal position stop bit                                                                                                                                            |           |       | 0x120: Internal position stop bit negation                         |        |               |
|                         | 0x21: Capture function on                                                                                                                                                   |           |       | 0x121: Capture function on negation                                |        |               |
|                         |                                                                                                                                                                             |           |       |                                                                    |        |               |
| Pn613<br>Pn614<br>Pn615 | CN1-25, 26 output configuration                                                                                                                                             | 0~0x109   | 0x000 | -                                                                  | 0x0613 | After restart |
|                         | CN1-27, 28 output configuration                                                                                                                                             | 0~0x109   | 0x001 | -                                                                  | 0x0614 | After restart |
|                         | CN1-29, 30 output configuration                                                                                                                                             | 0~0x109   | 0x002 | -                                                                  | 0x0615 | After restart |
|                         | 0x00: Servo ready (S-RDY)                                                                                                                                                   |           |       | 0x100: Servo ready signal negation                                 |        |               |
|                         | 0x01: Positioning completed (COIN)                                                                                                                                          |           |       | 0x101: Positioning completion signal negation                      |        |               |
|                         | 0x02: Speed is consistent (V-CMP)                                                                                                                                           |           |       | 0x102: Speed match signal negation                                 |        |               |
|                         | 0x03: Rotation detection signal                                                                                                                                             |           |       | 0x103: Rotation detection signal negation                          |        |               |
|                         | 0x04: In the torque limit                                                                                                                                                   |           |       | 0x104: The signal in the torque limit negation                     |        |               |
|                         | 0x05: In speed limit                                                                                                                                                        |           |       | 0x105: The signal in speed limit negation                          |        |               |
|                         | 0x06: Brake chain                                                                                                                                                           |           |       | 0x106: Brake chain signal negation                                 |        |               |
|                         | 0x07: Warning                                                                                                                                                               |           |       | 0x107: Warning signal negation                                     |        |               |
|                         | 0x08: Positioning proximity signal                                                                                                                                          |           |       | 0x108: Positioning proximity signal negation                       |        |               |
|                         | 0x09: Command pulse input magnification switching signal                                                                                                                    |           |       | 0x109: Command pulse input magnification switching signal negation |        |               |
|                         | 0x0A: Torque reaching signal output                                                                                                                                         |           |       | 0x10A: Torque reaching signal output negation                      |        |               |
|                         | 0x11: Home position return completion signal                                                                                                                                |           |       | 0x111: Home position return completion signal negation             |        |               |
| Pn622                   | Function selector switch                                                                                                                                                    | 0x00~0x11 | 0     | —                                                                  | 0x0622 | After restart |
|                         | Function selector switch:<br>0x1#: Output (ALM) signal high effective.<br>0x0#: Output (ALM) signal low effective.<br>0x#1: No warning detected.<br>0x#0: Warning detected. |           |       |                                                                    |        |               |
| Pn623                   | Si terminal input filtering time                                                                                                                                            | 0~32767   | 0     | ms                                                                 | 0x0623 |               |

## 10.8 Pn7 Group Expansion Related Parameters

| Function code | Parameter                                               | Range    | Default | Unit | Communication address | When enabled |
|---------------|---------------------------------------------------------|----------|---------|------|-----------------------|--------------|
| Pn702         | Inertia identification movable range                    | 0.2~20.0 | 2       | r    | 0x0702                | Immediately  |
|               | Number of rotations of motor in inertia identification. |          |         |      |                       |              |
| Pn705         | Initial value of inertia identification                 | 0~20000  | 0       | %    | 0x0705                | Immediately  |
|               | Initial value setting of inertia identification.        |          |         |      |                       |              |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |            |              |        |               |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------|--------------|--------|---------------|
| Pn706 | Vibration detection level (rotation) in inertia identification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0~5000                | 0          | r/min        | 0x0705 | Immediately   |
|       | Vibration detection level (rotation) setting in inertia identification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                       |            |              |        |               |
| Pn730 | Function test selection without motor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0x00~0x01             | 0          | —            | 0x0730 | After restart |
|       | The function test without motor is not to start the real motor, simulate the action of the motor in the servo unit, and confirm the action of the host device and peripheral equipment. Through this function, wiring confirmation, parameter value verification and verification in case of system commissioning failure can be carried out, so as to shorten the set operation time and avoid mechanical damage caused by wrong action. When no motor test function is running, the motor action can be confirmed whether the motor is connected or not.<br>0-Invalid.<br>1-Valid.           |                       |            |              |        |               |
| Pn731 | Encoder resolution selection when no-motor test function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0~3                   | 1          | —            | 0x0731 | After restart |
|       | When no-motor test mode is selected, the motor encoder resolution is set:<br>0-13 bits      1-17 bits<br>2-20 bits      3-23 bits<br>Note: when the encoder is actually connected, the resolution of the actual encoder is used.                                                                                                                                                                                                                                                                                                                                                               |                       |            |              |        |               |
| Pn732 | No-Motor test function encoder type selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0x00~0x01             | 0          | —            | 0x0732 | After restart |
|       | Set no-motor test function encoder type:<br>0-Incremental encoder.<br>1-Absolute encoder.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |            |              |        |               |
| Pn792 | Absolute encoder operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~2                   | 0          | —            | 0x0792 | After restart |
|       | 0 - No action.<br>1 - Write motor parameters to encoder EEPROM.<br>2 - Clear multi-turn encoder circles: if you use it initially or replace or insert/remove the battery during power-down of the drive. After power on, an encoder backup alarm (Er. 810) will be reported. This parameter is set to 2 and it can only be cleared after re-powered.<br>3 - Only clear encoder alarm: when the encoder gives an alarm (Er.810, Er.860,), set this parameter to 3 to clear the encoder alarm, but do not clear the multi turn value of the encoder, and keep the current position of the motor. |                       |            |              |        |               |
| Pn798 | Zero offset of multi turn absolute encoder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~2147483647          | 0          | command unit | 0x0792 | After restart |
|       | Set zero offset of multi turn absolute encoder.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |            |              |        |               |
| Pn79A | Minimum software limit absolute position (32 bits)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2147483648~2147483647 | 2147483648 | command unit | 0x079A | After restart |
|       | When the absolute position of the motor (Un021) is less than this position, the servo enters the limit alarm state.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |            |              |        |               |
| Pn79C | Maximum software limit absolute position (32 bits)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2147483648~2147483647 | 2147483648 | command unit | 0x079C | After restart |
|       | When the absolute position of the motor (Un021) is greater than this position, the servo enters the limit alarm state.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |            |              |        |               |
| Pn79E | Software limit absolute position switch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0~1                   | 0          | N/A          | 0x079E | Immediately   |
|       | 0: Close      1: Open                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |            |              |        |               |

|       |                                                                                                                                                                                                                                                                          |              |   |     |        |               |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---|-----|--------|---------------|
| Pn7A0 | Encoder overflow times                                                                                                                                                                                                                                                   | -32768～32767 | 0 | N/A | 0x07A0 | Immediately   |
|       | Record the number of times the multi turn absolute encoder overflows.                                                                                                                                                                                                    |              |   |     |        |               |
| Pn7A1 | Percentage of motor locked rotor overload protection time                                                                                                                                                                                                                | 0～100        | 8 | N/A | 0x07A1 | After restart |
|       | This parameter sets the time percentage of motor overload after locked rotor. If the setting is too large, the driver may be damaged. In order to protect the safety of the driver, please change this value under the guidance of the manufacturer's technical support. |              |   |     |        |               |

## 10.9 Pn8 Group Internal Position/Home Position Return Parameters

| Function code | Parameter                                                                  | Range                              | Default | Unit         | Communication address | When enabled  |
|---------------|----------------------------------------------------------------------------|------------------------------------|---------|--------------|-----------------------|---------------|
| Pn800         | Home position return control word                                          | 0～<br>0xFFFFFFFF                   | 0x0     | -            | 0x0800                | Immediately   |
|               | Home position return control word mode setting, see Chapter 8 for details. |                                    |         |              |                       |               |
| Pn802         | Zero position offset value                                                 | -<br>2147483648<br>～<br>2147483647 | 0       | command unit | 0x0802                | Immediately   |
|               | Set zero position offset position.                                         |                                    |         |              |                       |               |
| Pn804         | Pr1 control word                                                           | 0～<br>0x80000000                   | 0x0     | —            | 0x0804                | Immediately   |
|               | Position setting of the first section, see Chapter 8 for details.          |                                    |         |              |                       |               |
| Pn806         | Pr1 pulse number                                                           | -<br>2147483648<br>～<br>2147483647 | 0       | command unit | 0x0806                | Immediately   |
|               | Set the position of the 1 <sup>st</sup> segment.                           |                                    |         |              |                       |               |
| Pn808         | Pr2 control word                                                           | 0～<br>0x80000000                   | 0x0     | —            | 0x0808                | Immediately   |
|               | Same as Pn804.                                                             |                                    |         |              |                       |               |
| Pn80A         | Pr2 pulse number                                                           | -<br>2147483648<br>～<br>2147483647 | 0       | command unit | 0x0810                | After restart |
|               | Set the position of the 2 <sup>nd</sup> segment.                           |                                    |         |              |                       |               |
| Pn80C         | Pr3 control word                                                           | 0～<br>0x80000000                   | 0x0     | —            | 0x080C                | After restart |
|               | Same as Pn804.                                                             |                                    |         |              |                       |               |
| Pn80E         | Pr3 pulse number                                                           | -<br>2147483648<br>～<br>2147483647 | 0       | command unit | 0x080E                | Immediately   |
|               | Set the position of the 3 <sup>rd</sup> segment.                           |                                    |         |              |                       |               |
| Pn810         | Pr4 control word                                                           | 0～<br>0x80000000                   | 0x0     | —            | 0x0810                | Immediately   |

|       |                                                  |                                    |     |                 |        |             |
|-------|--------------------------------------------------|------------------------------------|-----|-----------------|--------|-------------|
|       | Same as Pn804.                                   |                                    |     |                 |        |             |
| Pn812 | Pr4 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x0812 | Immediately |
|       | Set the position of the 4 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn814 | Pr5 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0814 | Immediately |
|       | Same as Pn804.                                   |                                    |     |                 |        |             |
| Pn816 | Pr5 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x0816 | Immediately |
|       | Set the position of the 5 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn818 | Pr6 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0818 | Immediately |
|       | Same as Pn804.                                   |                                    |     |                 |        |             |
| Pn81A | Pr6 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x081A | Immediately |
|       | Set the position of the 6 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn81C | Pr7 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x081C | Immediately |
|       | Same as Pn804.                                   |                                    |     |                 |        |             |
| Pn81E | Pr7 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x081E | Immediately |
|       | Set the position of the 7 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn820 | Pr8 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0820 | Immediately |
|       | Same as Pn804.                                   |                                    |     |                 |        |             |
| Pn822 | Pr8 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x0822 | Immediately |
|       | Set the position of the 8 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn824 | Pr9 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0824 | Immediately |
|       | Same as Pn804.                                   |                                    |     |                 |        |             |
| Pn826 | Pr9 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x0826 | Immediately |
|       | Set the position of the 9 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn828 | Pr10 control word                                | 0~<br>0x80000000                   | 0x0 | —               | 0x0828 | Immediately |
|       | Same as Pn804.                                   |                                    |     |                 |        |             |

|       |                                                   |                                    |     |                 |        |             |
|-------|---------------------------------------------------|------------------------------------|-----|-----------------|--------|-------------|
| Pn82A | Pr10 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x082A | Immediately |
|       | Set the position of the 10 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn82C | Pr11 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x082C | Immediately |
|       | Same as Pn804.                                    |                                    |     |                 |        |             |
| Pn82E | Pr11 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x082E | Immediately |
|       | Set the position of the 11 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn830 | Pr12 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0830 | Immediately |
|       | Same as Pn804.                                    |                                    |     |                 |        |             |
| Pn832 | Pr12 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x0832 | Immediately |
|       | Set the position of the 12 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn834 | Pr13 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0834 | Immediately |
|       | Same as Pn804.                                    |                                    |     |                 |        |             |
| Pn836 | Pr13 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x0836 | Immediately |
|       | Set the position of the 13 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn838 | Pr14 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0838 | Immediately |
|       | Same as Pn804.                                    |                                    |     |                 |        |             |
| Pn83A | Pr14 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x083A | Immediately |
|       | Set the position of the 14 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn83C | Pr15 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x083C | Immediately |
|       | Same as Pn804.                                    |                                    |     |                 |        |             |
| Pn83E | Pr15 pulse number                                 | -<br>2147483648<br>~<br>2147483647 | 0   | command<br>unit | 0x083E | Immediately |
|       | Set the position of the 15 <sup>th</sup> segment. |                                    |     |                 |        |             |
| Pn840 | Pr16 control word                                 | 0~<br>0x80000000                   | 0x0 | —               | 0x0840 | Immediately |

|       |                                                   |                                                                       |     |              |        |             |
|-------|---------------------------------------------------|-----------------------------------------------------------------------|-----|--------------|--------|-------------|
|       | Same as Pn804.                                    |                                                                       |     |              |        |             |
| Pn842 | Pr16 pulse number                                 | <div>-</div> <div>2147483648</div> <div>~</div> <div>2147483647</div> | 0   | command unit | 0x0840 | Immediately |
|       | Set the position of the 16 <sup>th</sup> segment. |                                                                       |     |              |        |             |
| Pn844 | Pr17 control word                                 | <div>0~</div> <div>0x80000000</div>                                   | 0x0 | —            | 0x0844 | Immediately |
|       | Same as Pn804.                                    |                                                                       |     |              |        |             |
| Pn846 | Pr17 pulse number                                 | <div>-</div> <div>2147483648</div> <div>~</div> <div>2147483647</div> | 0   | command unit | 0x0846 | Immediately |
|       | Set the position of the 17 <sup>th</sup> segment. |                                                                       |     |              |        |             |
| Pn848 | Pr18 control word                                 | <div>0~</div> <div>0x80000000</div>                                   | 0x0 | —            | 0x0848 | Immediately |
|       | Same as Pn804.                                    |                                                                       |     |              |        |             |
| Pn84A | Pr18 pulse number                                 | <div>-</div> <div>2147483648</div> <div>~</div> <div>2147483647</div> | 0   | command unit | 0x084A | Immediately |
|       | Set the position of the 18 <sup>th</sup> segment. |                                                                       |     |              |        |             |
| Pn84C | Pr19 control word                                 | <div>0~</div> <div>0x80000000</div>                                   | 0x0 | —            | 0x084C | Immediately |
|       | Same as Pn804.                                    |                                                                       |     |              |        |             |
| Pn84E | Pr19 pulse number                                 | <div>-</div> <div>2147483648</div> <div>~</div> <div>2147483647</div> | 0   | command unit | 0x084E | Immediately |
|       | Set the position of the 19 <sup>th</sup> segment. |                                                                       |     |              |        |             |
| Pn850 | Pr20 control word                                 | <div>0~</div> <div>0x80000000</div>                                   | 0x0 | —            | 0x0850 | Immediately |
|       | Same as Pn804.                                    |                                                                       |     |              |        |             |
| Pn852 | Pr20 pulse number                                 | <div>-2147483648 ~</div> <div>2147483647</div>                        | 0   | Unit         | 0x0852 | Immediately |
|       | 20 <sup>th</sup> position setting.                |                                                                       |     |              |        |             |
| Pn854 | Pr21 control word                                 | <div>0~</div> <div>0x80000000</div>                                   | 0x0 | —            | 0x0854 | Immediately |
|       | Like Pn804.                                       |                                                                       |     |              |        |             |
| Pn856 | Pr21 pulse number                                 | <div>-2147483648 ~</div> <div>2147483647</div>                        | 0   | Unit         | 0x0856 | Immediately |
|       | 21 <sup>th</sup> position setting.                |                                                                       |     |              |        |             |
| Pn858 | Pr22 control word                                 | <div>0~</div> <div>0x80000000</div>                                   | 0x0 | —            | 0x0858 | Immediately |
|       | Like Pn804.                                       |                                                                       |     |              |        |             |
| Pn85A | Pr22 pulse number                                 | <div>-2147483648 ~</div> <div>2147483647</div>                        | 0   | Unit         | 0x085A | Immediately |

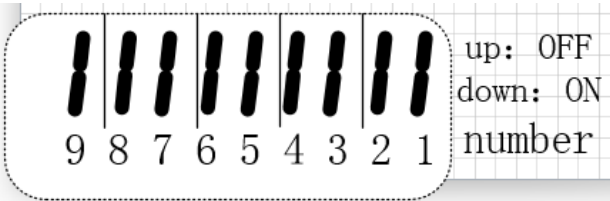
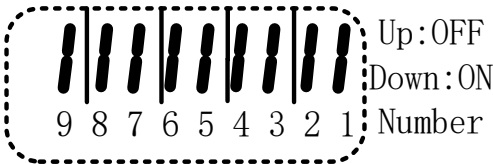
|       |                        |                            |     |      |        |             |
|-------|------------------------|----------------------------|-----|------|--------|-------------|
|       | 22th position setting. |                            |     |      |        |             |
| Pn85C | Pr23 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x085C | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn85E | Pr23 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x085E | Immediately |
|       | 23th position setting. |                            |     |      |        |             |
| Pn860 | Pr24 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x0860 | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn862 | Pr24 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x0862 | Immediately |
|       | 24th position setting. |                            |     |      |        |             |
| Pn864 | Pr25 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x0864 | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn866 | Pr25 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x0866 | Immediately |
|       | 25th position setting. |                            |     |      |        |             |
| Pn868 | Pr26 control word      | 0~0x80000000               | 0x0 | —    | 0x0868 | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn86A | Pr26 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x086A | Immediately |
|       | 26th position setting. |                            |     |      |        |             |
| Pn86C | Pr27 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x086C | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn86E | Pr27 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x086E | Immediately |
|       | 27th position setting. |                            |     |      |        |             |
| Pn870 | Pr28 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x0870 | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn872 | Pr28 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x0872 | Immediately |
|       | 28th position setting. |                            |     |      |        |             |
| Pn874 | Pr29 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x0874 | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |
| Pn876 | Pr29 pulse number      | -2147483648~<br>2147483647 | 0   | Unit | 0x0876 | Immediately |
|       | 29th position setting. |                            |     |      |        |             |
| Pn878 | Pr30 control word      | 0~<br>0x80000000           | 0x0 | —    | 0x0878 | Immediately |
|       | Like Pn804.            |                            |     |      |        |             |

|       |                             |                             |      |       |        |             |
|-------|-----------------------------|-----------------------------|------|-------|--------|-------------|
| Pn87A | Pr30 pulse number           | -2147483648 ~<br>2147483647 | 0    | Unit  | 0x087A | Immediately |
|       | 30th position setting.      |                             |      |       |        |             |
| Pn87C | Pr31 control word           | 0 ~<br>0x80000000           | 0x0  | —     | 0x087C | Immediately |
|       | Like Pn804.                 |                             |      |       |        |             |
| Pn87E | Pr31 pulse number           | -2147483648 ~<br>2147483647 | 0    | Unit  | 0x087E | Immediately |
|       | 31th position setting.      |                             |      |       |        |             |
| Pn880 | Pr Acc and dec time 0       | 0 ~ 60000                   | 50   | ms    | 0x0880 | Immediately |
|       | Acc and dec time setting 0. |                             |      |       |        |             |
| Pn881 | Pr Acc and dec time 1       | 0 ~ 60000                   | 200  | ms    | 0x0881 | Immediately |
|       | Acc and dec time setting 1. |                             |      |       |        |             |
| Pn882 | Pr Acc and dec time 2       | 0 ~ 60000                   | 300  | ms    | 0x0882 | Immediately |
|       | Acc and dec time setting 2. |                             |      |       |        |             |
| Pn883 | Pr Acc and dec time 3       | 0 ~ 60000                   | 400  | ms    | 0x0883 | Immediately |
|       | Acc and dec time setting 3. |                             |      |       |        |             |
| Pn884 | Pr Acc and dec time 4       | 0 ~ 60000                   | 500  | ms    | 0x0884 | Immediately |
|       | Acc and dec time setting 4. |                             |      |       |        |             |
| Pn885 | Pr Acc and dec time 5       | 0 ~ 60000                   | 600  | ms    | 0x0885 | Immediately |
|       | Acc and dec time setting 5. |                             |      |       |        |             |
| Pn886 | Pr Acc and dec time 6       | 0 ~ 60000                   | 700  | ms    | 0x0886 | Immediately |
|       | Acc and dec time setting 6. |                             |      |       |        |             |
| Pn887 | Pr Acc and dec time 7       | 0 ~ 60000                   | 800  | ms    | 0x0887 | Immediately |
|       | Acc and dec time setting 7. |                             |      |       |        |             |
| Pn888 | Pr target speed 0           | 0 ~ 6000                    | 100  | r/min | 0x0888 | Immediately |
|       | target speed 0 setting.     |                             |      |       |        |             |
| Pn889 | Pr target speed 1           | 0 ~ 6000                    | 200  | r/min | 0x0889 | Immediately |
|       | target speed 1 setting.     |                             |      |       |        |             |
| Pn88A | Pr target speed 2           | 0 ~ 6000                    | 500  | r/min | 0x088A | Immediately |
|       | target speed 2 setting.     |                             |      |       |        |             |
| Pn88B | Pr target speed 3           | 0 ~ 6000                    | 1000 | r/min | 0x088B | Immediately |
|       | target speed 3 setting.     |                             |      |       |        |             |
| Pn88C | Pr target speed 4           | 0 ~ 6000                    | 1500 | r/min | 0x088C | Immediately |
|       | target speed 4 setting.     |                             |      |       |        |             |
| Pn88D | Pr target speed 5           | 0 ~ 6000                    | 2000 | r/min | 0x088D | Immediately |
|       | target speed 5 setting.     |                             |      |       |        |             |

|       |                         |         |      |       |        |             |
|-------|-------------------------|---------|------|-------|--------|-------------|
| Pn88E | Pr target speed 6       | 0~6000  | 2500 | r/min | 0x088E | Immediately |
|       | target speed 6 setting. |         |      |       |        |             |
| Pn88F | Pr target speed 7       | 0~6000  | 3000 | r/min | 0x088F | Immediately |
|       | target speed 7 setting. |         |      |       |        |             |
| Pn890 | Pr delay time0          | 0~6000  | 0    | 0.1s  | 0x0890 | Immediately |
|       | Delay time0 setting.    |         |      |       |        |             |
| Pn891 | Pr delay time 1         | 0~6000  | 1    | 0.1s  | 0x0891 | Immediately |
|       | Delay time 1 setting.   |         |      |       |        |             |
| Pn892 | Pr delay time 2         | 0~6000  | 5    | 0.1s  | 0x0892 | Immediately |
|       | Delay time 2 setting.   |         |      |       |        |             |
| Pn893 | Pr delay time 3         | 0~6000  | 10   | 0.1s  | 0x0893 | Immediately |
|       | Delay time 3 setting.   |         |      |       |        |             |
| Pn894 | Pr delay time 4         | 0~60000 | 100  | 0.1s  | 0x0894 | Immediately |
|       | Delay time4 setting.    |         |      |       |        |             |
| Pn895 | Pr delay time 5         | 0~60000 | 1000 | 0.1s  | 0x0895 | Immediately |
|       | Delay time 5 setting.   |         |      |       |        |             |

# 11 Monitoring Parameters

| Monitoring code | Monitoring name                                                                                                                                                       | Range                 | Unit                  | Communication address |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|
| Un000           | Motor rotation speed                                                                                                                                                  | 0x80000000~0x7fffffff | rpm                   | 0xE000                |
|                 | Display the actual speed of the servo motor.                                                                                                                          |                       |                       |                       |
| Un001           | Speed command                                                                                                                                                         | 0x80000000~0x7fffffff | rpm                   | 0xE001                |
|                 | Display the current speed command of the servo motor.<br>Note: When it is not enabled, this value shows the analog speed (corresponding to V-REF).                    |                       |                       |                       |
| Un002           | Internal torque command                                                                                                                                               | 0x80000000~0x7fffffff | %                     | 0xE002                |
|                 | Display current actual torque command with servo motor rated torque as 100%.                                                                                          |                       |                       |                       |
| Un003           | Rotor pulse position relative to the Z axis                                                                                                                           | 0x80000000~0x7fffffff | pulse                 | 0xE003                |
|                 | Shows the mechanical absolute position of the motor within one revolution of the encoder.                                                                             |                       |                       |                       |
| Un004           | Electrical angle                                                                                                                                                      | 0x80000000~0x7fffffff | °                     | 0xE004                |
|                 | Displays the electrical angle of the current position of the servo motor rotor.                                                                                       |                       |                       |                       |
| Un005           | Speed of input pulse command                                                                                                                                          | 0x80000000~0x7fffffff | rpm                   | 0xE005                |
|                 | Display input position pulse command speed.                                                                                                                           |                       |                       |                       |
| Un006           | Counter of input command pulse                                                                                                                                        | 0x80000000~0x7fffffff | Command Unit          | 0xE006                |
|                 | Displays the number of command pulses received by the servo motor.                                                                                                    |                       |                       |                       |
| Un007           | Counter of feedback pulse                                                                                                                                             | 0x80000000~0x7fffffff | Command Unit          | 0xE007                |
|                 | Displays cumulative pulses fed back from the servo motor encoder.                                                                                                     |                       |                       |                       |
| Un008           | Counter of feedback pulse 1                                                                                                                                           | 0x80000000~0x7fffffff | Encoder pulse unit    | 0xE008                |
|                 | Displays cumulative pulses fed back from the servo motor encoder.                                                                                                     |                       |                       |                       |
| Un009           | Position deviation                                                                                                                                                    | 0x80000000~0x7fffffff | Command Unit          | 0xE009                |
|                 | Display the difference between the command pulse number of the upper device and the servo motor movement amount.                                                      |                       |                       |                       |
| Un010           | Absolute encoder single-turn value                                                                                                                                    | 0x80000000~0x7FFFFFFF | Encoder unit          | 0xE010                |
|                 | Display the absolute position value of one-turn of the absolute encoder.                                                                                              |                       |                       |                       |
| Un011           | Absolute encoder multi-turn value                                                                                                                                     | 0x80000000~0x7FFFFFFF | -                     | 0xE011                |
|                 | Displays the number of multi-turn encoder turns value when the multi-turn encoder is used. After the multi-turn encoder reset operation is performed, the value is 0. |                       |                       |                       |
| Un012           | External encoder feedback pulse counter                                                                                                                               | 0x80000000~0x7FFFFFFF | External encoder unit | 0xE012                |
|                 | Display external encoder feedback pulse counter when external grating encoder is connected.                                                                           |                       |                       |                       |
| Un021           | Motor absolute position                                                                                                                                               | 0x80000000~0x7FFFFFFF | command unit          | 0xE021                |
|                 | Display the absolute position of the motor, the unit is the command unit.                                                                                             |                       |                       |                       |

| Un00A | Cumulative load rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0x80000000~0x7fffffff                  | %     | 0xE00A           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-------|------------------|-----|------------------|----------------------------------------|-----|------------------|---|--------|-------|---|--------|---|--------|--------|---|--------|---|--------|------|---|--------|---|--------|------|---|--------|---|--------|----------|--|
| Un00B | Regeneration load rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0x80000000~0x7fffffff                  | %     | 0xE00B           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un00C | Electricity consumption of DB resistance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0x80000000~0x7fffffff                  | %     | 0xE00C           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un00D | Effective gain monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1~2                                    | -     | 0xE00D           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un00E | Total running time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~0xFFFFFFFF                           | 100ms | 0xE00E           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un00F | Overload rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~0xFFFFFFFF                           | %     | 0xE00F           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un035 | DSP software version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0~0xFFFF                               | -     | 0xE035           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un036 | FPGA software version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~0xFFFF                               | -     | 0xE036           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un087 | Encoder communication abnormal times                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0~0xFFFF                               | -     | 0xE087           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un089 | Heat sink temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~0xFFFF                               | °C    | 0xE090           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un091 | Motor temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~0xFFFF                               | °C    | 0xE091           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un100 | IO port input signal monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0~0xFFFF                               | -     | 0xE100           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
|       |  <table border="1"> <thead> <tr> <th>LED</th><th>Input pin number</th><th>Signal name<br/>(Factory configuration)</th><th>LED</th><th>Input pin number</th></tr> </thead> <tbody> <tr> <td>1</td><td>CN1-40</td><td>/S-ON</td><td>6</td><td>CN1-45</td></tr> <tr> <td>2</td><td>CN1-41</td><td>/P-CON</td><td>7</td><td>CN1-46</td></tr> <tr> <td>3</td><td>CN1-42</td><td>P-OT</td><td>8</td><td>CN1-39</td></tr> <tr> <td>4</td><td>CN1-43</td><td>N-OT</td><td>9</td><td>CN1-38</td></tr> <tr> <td>5</td><td>CN1-44</td><td>/ALM-RST</td><td></td><td></td></tr> </tbody> </table> |                                        |       |                  | LED | Input pin number | Signal name<br>(Factory configuration) | LED | Input pin number | 1 | CN1-40 | /S-ON | 6 | CN1-45 | 2 | CN1-41 | /P-CON | 7 | CN1-46 | 3 | CN1-42 | P-OT | 8 | CN1-39 | 4 | CN1-43 | N-OT | 9 | CN1-38 | 5 | CN1-44 | /ALM-RST |  |
| LED   | Input pin number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Signal name<br>(Factory configuration) | LED   | Input pin number |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| 1     | CN1-40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | /S-ON                                  | 6     | CN1-45           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| 2     | CN1-41                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | /P-CON                                 | 7     | CN1-46           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| 3     | CN1-42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | P-OT                                   | 8     | CN1-39           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| 4     | CN1-43                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N-OT                                   | 9     | CN1-38           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| 5     | CN1-44                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | /ALM-RST                               |       |                  |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
| Un101 | IO port output signal monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0~0xFFFF                               | -     | 0xE101           |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                        |       |                  |     |                  |                                        |     |                  |   |        |       |   |        |   |        |        |   |        |   |        |      |   |        |   |        |      |   |        |   |        |          |  |

|       | LED                                                                                  |              | Input pin number |        |
|-------|--------------------------------------------------------------------------------------|--------------|------------------|--------|
|       | 1                                                                                    |              | CN1-31/32        |        |
|       | 2                                                                                    |              | CN1-25/26        |        |
|       | 3                                                                                    |              | CN1-27/28        |        |
|       | 4                                                                                    |              | CN1-29/30        |        |
| Un102 | T-REF monitoring                                                                     | 0~0xFFFF     | %                | 0xE102 |
|       | Corresponds to the T-REF input voltage, according to the analog torque command gain. |              |                  |        |
| Un103 | V-REF monitoring                                                                     | 0~0xFFFF     | rpm              | 0xE103 |
|       | Corresponds to the T-REF input voltage, according to the analog torque command gain. |              |                  |        |
| Un104 | Pulse command input frequency                                                        | 0~0xFFFFFFFF | Hz               | 0xE104 |
| Un108 | External input command pulse counter                                                 | 0~0xFFFFFFFF | Command Unit     | 0xE108 |
| Un110 | Integrated monitoring of internal signal status                                      | 0~0xFFFFFFFF | -                | 0xE110 |
| Un120 | Integrated monitoring of internal input signal status                                | 0~0xFFFFFFFF | -                | 0xE120 |
| Un130 | Integrated monitoring of internal output signal                                      | 0~0xFFFFFFFF | -                | 0xE130 |
| Un140 | Main circuit bus voltage                                                             | 0~0xFFFF     | V                | 0xE140 |
| Un141 | Effective current feedback                                                           | 0~0xFFFF     | 0.01A            | 0xE141 |
|       | Three-phase synthetic feedback current effective value.                              |              |                  |        |
| Un14B | D-axis current command monitoring                                                    | 0~0xFFFF     | %                | 0xE14B |
| Un220 | Torque command voltage (uncorrected)                                                 | 0~0xFFFF     | mv               | 0xE220 |
| Un221 | Torque command voltage (after correction)                                            | 0~0xFFFF     | mv               | 0xE221 |
| Un222 | Speed command voltage (uncorrected)                                                  | 0~0xFFFF     | mv               | 0xE222 |
| Un223 | Speed command voltage (after correction)                                             | 0~0xFFFF     | mv               | 0xE223 |
| Un300 | Current alarm code                                                                   | 0~0xFFFF     | -                | 0xE300 |
| Un301 | Last alarm code                                                                      | 0~0xFFFF     | -                | 0xE301 |
| Un302 | Timestamp while alarm occurs                                                         | 0~0xFFFFFFFF | 100ms            | 0xE302 |
| Un303 | Motor speed while alarm occurs                                                       | 0~0xFFFF     | rpm              | 0xE303 |
| Un304 | Speed command while alarm occurs                                                     | 0~0xFFFF     | rpm              | 0xE304 |
| Un305 | Internal torque command while alarm occurs                                           | 0~0xFFFF     | %                | 0xE305 |
| Un306 | Input command pulse speed while alarm occurs                                         | 0~0xFFFF     | rpm              | 0xE306 |
| Un307 | Deviation counters (position deviation)while alarm occurs                            | 0~0xFFFFFFFF | pulse            | 0xE307 |
| Un308 | DC bus voltage while alarm occurs                                                    | 0~0xFFFF     | V                | 0xE308 |

|       |                                                                               |              |   |        |
|-------|-------------------------------------------------------------------------------|--------------|---|--------|
| Un309 | Effective current feedback while alarm occurs                                 | 0~0xFFFF     | % | 0xE309 |
| Un30A | Cumulative load rate while alarm occurs                                       | 0~0xFFFF     | % | 0xE30A |
| Un30B | Regenerative load rate while alarm occurs                                     | 0~0xFFFF     | % | 0xE30B |
| Un30C | Electricity consumption of DB resistance while alarm occurs                   | 0~0xFFFF     | % | 0xE30C |
| Un30D | Maximum cumulative load rate while alarm occurs                               | 0~0xFFFF     | % | 0xE30D |
| Un30E | Rotation inertia ratio while alarm occurs                                     | 0~0xFFFF     | % | 0xE30E |
| Un30F | Abnormal times of serial encoder communication while alarm occurs             | 0~0xFFFF     | - | 0xE30F |
| Un310 | Internal signal monitoring while alarm occurs                                 | 0~0xFFFFFFFF | - | 0xE310 |
| Un313 | Internal input signal monitoring while alarm occurs                           | 0~0xFFFFFFFF | - | 0xE313 |
| Un317 | Internal output signal monitoring while alarm occurs                          | 0~0xFFFFFFFF | - | 0xE317 |
| Un30F | The number of serial encoder communication abnormalities when an alarm occurs | 0~0xFFFF     | — | 0xE30F |
| Un320 | Fault code history 1                                                          | 0~0xFFFF     | - | 0xE320 |
| Un321 | Fault code history 2                                                          | 0~0xFFFF     | - | 0xE321 |
| Un322 | Fault code history 3                                                          | 0~0xFFFF     | - | 0xE322 |
| Un323 | Fault code history 4                                                          | 0~0xFFFF     | - | 0xE323 |
| Un324 | Fault code history 5                                                          | 0~0xFFFF     | - | 0xE324 |
| Un325 | Fault code history 6                                                          | 0~0xFFFF     | - | 0xE325 |

| Monitoring code | Monitoring name       | Range        | Unit  | Communication address |
|-----------------|-----------------------|--------------|-------|-----------------------|
| Un326           | Fault code history 7  | 0~0xFFFF     | -     | 0xE326                |
| Un327           | Fault code history 8  | 0~0xFFFF     | -     | 0xE327                |
| Un328           | Fault code history 9  | 0~0xFFFF     | -     | 0xE328                |
| Un329           | Fault code history 10 | 0~0xFFFF     | -     | 0xE329                |
| Un330           | Fault time history 1  | 0~0xFFFFFFFF | 100ms | 0xE330                |
| Un331           | Fault time history 2  | 0~0xFFFFFFFF | 100ms | 0xE331                |
| Un332           | Fault time history 3  | 0~0xFFFFFFFF | 100ms | 0xE332                |
| Un333           | Fault time history 4  | 0~0xFFFFFFFF | 100ms | 0xE333                |
| Un334           | Fault time history 5  | 0~0xFFFFFFFF | 100ms | 0xE334                |
| Un335           | Fault time history 6  | 0~0xFFFFFFFF | 100ms | 0xE335                |
| Un336           | Fault time history 7  | 0~0xFFFFFFFF | 100ms | 0xE336                |
| Un337           | Fault time history 8  | 0~0xFFFFFFFF | 100ms | 0xE337                |
| Un338           | Fault time history 9  | 0~0xFFFFFFFF | 100ms | 0xE338                |
| Un339           | Fault time history 10 | 0~0xFFFFFFFF | 100ms | 0xE339                |

# 12 Fault Code and Countermeasures

## 12.1 Fault Code

| Fault code | Fault type                                                   | Solutions                                                                                                                                                                                                                                                                                                                                                             | Alarm category |
|------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Er.020     | Abnormal parameter and check                                 | 1. Enter the parameters again after initializing parameter settings.<br>2. Write the power level of the driver to 0 first, and then write the correct power level. Note: Remember to perform the current detection correction, analog input correction and bus voltage correction after writing the power level.<br>3. servo driver failure, replace the servo drive. | Category 1     |
| Er.021     | Parameter formatting exception (inconsistent version number) | 1. Perform a soft reset. If the fault is still reported, write the driver's power level to 0 and then write the correct power level. Note: Remember to perform the current detection correction, analog input correction and bus voltage correction after writing the power level.<br>2. servo driver failure and replace the servo drive.                            | Category 1     |
| Er.022     | Abnormal system and check                                    | 1. Perform a soft reset. If the fault is still reported, write the driver's power level to 0 and then write the correct power level. Note: Remember to perform the current detection correction, analog input correction and bus voltage correction after writing the power level.<br>2. servo driver failure and replace the servo drive.                            | Category 1     |
| Er.030     | Abnormal detection in main circuit                           | 1. Servo driver fails, replace the servo driver.                                                                                                                                                                                                                                                                                                                      | Category 1     |
| Er.040     | Abnormal parameter setting                                   | 1. Check whether the changed parameters are out of range.<br>2. Check if the setting of electronic gear ratio is within the setting range (electronic gear ratio: 0.001 ~ 16777216/1000).<br>3. Check whether the servo drive and servo motor capacity match.<br>4. I/O terminal definition repeat.                                                                   | Category 1     |
| Er.041     | Abnormal frequency division pulse output setting             | According to the number of encoder bits, the number of encoder frequency division pulses is set to an appropriate value, see the specification.                                                                                                                                                                                                                       | Category 1     |
| Er.042     | Abnormal parameter combination                               | 1. Make the setting value of electronic gear ratio within the setting range.<br>2. make the program JOG settings related to logic.                                                                                                                                                                                                                                    | Category 1     |
| Er.044     | Abnormal setting of loop parameters                          | 1. Set the half closed loop / full closed loop parameters correctly.                                                                                                                                                                                                                                                                                                  | Category 1     |
| Er.050     | Unmatched drive and motor capacity                           | 1. check if the driver power and motor power are correct.<br>2. replace the drive or motor so that it is within a reasonable range.                                                                                                                                                                                                                                   | Category 1     |
| Er.051     | Alarm caused by product technical support failure            | 1. Connect the function modules can not be supported by the product, please select the matching combination.                                                                                                                                                                                                                                                          | Category 1     |
| Er.080     | Abnormal distance setting corresponding to unit pulse of     | 1. Correctly set the distance corresponding to the unit pulse of the encoder.                                                                                                                                                                                                                                                                                         | Category 1     |

|        |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |
|--------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|        | encoder                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |
| Er.08A | Abnormal resolution setting of position sensor | 1. Set the resolution of position sensor correctly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Category 1 |
| Er.0B0 | Invalid servo ON command alarm                 | Re-power on or perform a soft reset.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Category 1 |
| Er.100 | Over-current fault                             | 1. Check whether the motor phase sequence is wrong.<br>2. Check whether the motor is damaged and use a multimeter to measure whether U/V/W is short together.<br>3. Check the motor encoder angle is correct.<br>4. Monitor the UV phase current sampling AD value in the disabled state through a virtual oscilloscope to determine whether it is a driver hardware current sampling fault. Normally, it is near zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Category 1 |
| Er.300 | Braking resistor failure                       | 1. Correctly wire the external regenerative resistor.<br>2. After troubleshooting the wiring, it may be a servo drive problem, replace the servo drive.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Category 1 |
| Er.320 | Regeneration overload                          | 1. Check whether the bus voltage of the driver is within a reasonable range when it is not enabled. If the bus voltage is detected incorrectly, there is a possibility of accidental braking or accidental protection.<br>2. Confirm the brake resistor wiring is correct; see the instructions for details.<br>3. According to the load situation, consider the current choice of braking resistor is appropriate; see the braking resistor selection rules for details.<br>4. If the wiring is correct, and the braking resistor is selected properly, and the operation still reports regenerative overload, you can monitor whether there is a small drop when the bus voltage reaches the braking point during operation by the host computer or the keyboard. If the bus voltage reaches the braking point and it still rises smoothly, it can be judged that the brake pipe is damaged.<br>5. If the fault is reported in the last operation, run after waiting for a while after powering on.                                                                               | Category 2 |
| Er.330 | Main circuit power wiring error                | 1. Connect the main circuit power cord correctly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Category 1 |
| Er.400 | Over-voltage                                   | 1. When the power supply voltage is not enabled, measure the power supply voltage at the same time monitor whether the bus voltage (Un140) is 1.414 times of the input power voltage (AC RMS). If the deviation is large, it can be determined as bus voltage detection hardware failure.<br>2. Measure the power supply voltage. If the power supply voltage is adjustable, adjust the power supply voltage within the product specification range. If it is not adjustable and the power supply voltage is in an unstable state, you may consider installing a voltage regulator.<br>3. Consider the operating conditions and load, determine the brake resistor selection is reasonable (whether the resistance is too large), if the overvoltage caused by frequent acceleration and deceleration, you may consider replacing the brake resistor.<br>4. there may be brake pipe damage, check the brake pipe.<br>5. Make sure to guarantee that the motor is running at a tolerable moment of inertia ratio and mass ratio.<br>6. servo drive failure, replace the servo drive. | Category 1 |

|        |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
|--------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Er.410 | Under-voltage                         | <ol style="list-style-type: none"> <li>1. Check whether the power input terminal line is connected.</li> <li>2. When the power supply voltage is not enabled, measure the power supply voltage at the same time monitor whether the bus voltage (Un140) is 1.414 times of the input power voltage (AC RMS). If the deviation is large, it can be determined as bus voltage detection hardware failure.</li> <li>3. Measure the power supply voltage. If the power supply voltage is adjustable, adjust the power supply voltage within the product specification range.</li> <li>4. Measure the power supply voltage. If the power supply voltage is in an unstable state, you may consider installing a voltage regulator.</li> <li>5. If the power capacity is adjustable, you can advise customers to increase in power capacity.</li> </ol> | Category 2 |
| Er.42A | Motor over temperature                | <ol style="list-style-type: none"> <li>1. Reduce motor load.</li> <li>2. Strengthen motor heat dissipation.</li> <li>3. Check the motor over temperature signal circuit.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Category 1 |
| Er.510 | Over-speed                            | <ol style="list-style-type: none"> <li>1. Check whether there is any problem with the motor wiring and whether the UVW three-phase connection is reversed.</li> <li>2. Confirm that the encoder connection is abnormal.</li> <li>3. Check if the maximum speed setting in the motor parameters is correct.</li> <li>4. Check whether the input command exceeds the over-speed value.</li> <li>5. Reduce the servo gain or set a certain smoothing time.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                              | Category 1 |
| Er.511 | Divided pulse output speed            | <ol style="list-style-type: none"> <li>1. Reduce the number of divided output pulses per revolution (Pn070).</li> <li>2. If the working conditions are allowed, you may reduce the motor speed.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Category 1 |
| Er.520 | Vibration alarm                       | <ol style="list-style-type: none"> <li>1. If the working conditions are allowed, you may reduce the motor speed or reduce the speed loop gain.</li> <li>2. correctly set the rotary inertia ratio.</li> <li>3. properly set the vibration detection value (Pn187) and vibration detection sensitivity (Pn186).</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Category 1 |
| Er.550 | Abnormal maximum speed setting        | Set the maximum speed setting correctly                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Category 1 |
| Er.710 | Overload (instantaneous maximum load) | <ol style="list-style-type: none"> <li>1. Check if the motor is stalled during operation.</li> <li>2. Check whether there is any problem with the motor wiring (phase sequence, connection) and encoder wiring.</li> <li>3. consider the operating conditions and load and determine if the driver or motor selection is reasonable.</li> <li>4. Observe whether there is large vibration in the running process of the motor. If there is a large noise, adjust the gain parameter to eliminate noise or jitter. At the same time, you can use the virtual oscilloscope to monitor whether the motor output torque is abnormal or not.</li> </ol>                                                                                                                                                                                              | Category 2 |
| Er.720 | Overload (continuous maximum load)    | <ol style="list-style-type: none"> <li>1. Check whether there is any problem in the motor wiring (phase sequence and connection) and encoder wiring.</li> <li>2. consider the operating conditions and load and determine the driver or motor selection is reasonable.</li> <li>3. Observe whether the motor has large jitter during operation. If there is a huge noise, adjust the gain parameter to eliminate noise or jitter. Also, use a virtual oscilloscope to monitor whether the motor output torque is abnormal.</li> </ol>                                                                                                                                                                                                                                                                                                           | Category 1 |

|        |                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |
|--------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Er.730 | DB overload 1                            | <ol style="list-style-type: none"> <li>1. The load is too heavy when the machine stops that cause the overload of DB resistor and you could try to reduce the operating speed or reduce the load.</li> <li>2. check whether the motor is driven by external force.</li> <li>3. according to customer needs, re-evaluate whether it needs to pass the DB mode requirements during the shutdown, if you do not need, you can choose other ways to stop.</li> <li>4. If the fault is reported in the last operation, run after waiting for a while after powering on.</li> </ol> | Category 1 |
| Er.731 | DB overload 2                            | <ol style="list-style-type: none"> <li>1. Reduce the command speed of servo motor.</li> <li>2. Reduce the moment of inertia ratio.</li> <li>3. Servo driver problem, replace servo.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                | Category 1 |
| Er.740 | Inrush current limiting resistance fault | <ol style="list-style-type: none"> <li>1. The servo driver is faulty. Replace the servo driver.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Category 1 |
| Er.7A0 | Heat sink over-heat                      | <ol style="list-style-type: none"> <li>1. Check whether the air duct is blocked and the fan is damaged with a fan drive.</li> <li>2. Check the installation conditions of the driver, whether the heat dissipation condition is good or not and increase the heat dissipation condition of the driver as much as possible.</li> <li>3. Check the drive load conditions, if the load is too heavy, you can suggest that customers replace a high-power segment of the drive.</li> <li>4. If possible, reduce the driver carrier frequency.</li> </ol>                          | Category 2 |
| Er.7AA | Abnormal temperature of control board    | <ol style="list-style-type: none"> <li>1. Improve the installation condition of servo driver and reduce the ambient temperature.</li> <li>2. Reconfirm the load conditions and operation conditions.</li> <li>3. Servo driver failure, replace the servo driver.</li> </ol>                                                                                                                                                                                                                                                                                                   | Category 1 |
| Er.7AB | The fan inside the drive does not turn   | <ol style="list-style-type: none"> <li>1. Is there any foreign matter blocking the fan.</li> <li>2. Servo driver failure, replace servo driver.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                    | Category 1 |
| Er.810 | Abnormal encoder backup                  | <ol style="list-style-type: none"> <li>1. Check the multi-turn encoder battery power condition.</li> <li>2. Perform multi-turn encoder clear operation.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                            | Category 1 |
| Er.830 | Battery under-voltage                    | Replace multi-turn encoder battery.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Category 1 |
| Er.840 | Encoder data is abnormal                 | Encoder data is abnormal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Category 1 |
| Er.850 | Encoder overspeed                        | Encoder overspeed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Category 1 |
| Er.860 | Encoder temperature is high              | <ol style="list-style-type: none"> <li>1. Reduce the motor load rate.</li> <li>2. Strengthen the heat dissipation effect of the motor.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                             | Category 1 |
| Er.900 | CANopen node protection failure          | <ol style="list-style-type: none"> <li>1. Check if the slave is offline.</li> <li>2. Check whether the node protection time setting is correct.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                    | Category 1 |
| Er.901 | CANopen heartbeat detection timeout      | <ol style="list-style-type: none"> <li>1. Check if the host is offline.</li> <li>2. Check whether the heartbeat detection time matches the host heartbeat production time.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                         | Category 1 |
| Er.BF4 | Hardware over-current                    | Unplug the power cable and turn on the servo unit again. If an alarm still occurs, the servo unit may be malfunctioning, and then you could replace the servopack. If not, confirm whether it is power line or motor failure.                                                                                                                                                                                                                                                                                                                                                 | Category 1 |

|        |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |
|--------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Er.C10 | Out of control alarm                                                     | <ol style="list-style-type: none"> <li>1. Check if the motor wiring is normal.</li> <li>2. Check if the motor and encoder are normal.</li> <li>3. Re-connect the servo drive power, if an alarm still occurs, it may be a servo drive failure.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Category 1 |
| Er.C90 | Encoder communication failure: line-broken                               | <ol style="list-style-type: none"> <li>1. Use multimeter to test every signal line of the encoder line and see if signal lines break.</li> <li>2. Check the encoder line model and confirm the model is correct.</li> <li>3. Check the length of the encoder line and the encoder line can not be too long.</li> <li>4. It may be caused by interference, try to ground the driver or wire the encoder around the magnetic ring.</li> <li>5. check the motor group parameters and confirm the motor is correct.</li> <li>6. If you already exclude various reasons and the servo driver may malfunction, then you could consider replacing the servo unit.</li> </ol>                                                                                                                                                                                                                     | Category 1 |
| Er.C91 | Abnormal encoder communication position data acceleration                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Category 1 |
| Er.CA0 | Abnormal encoder parameters                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Category 1 |
| Er.D00 | Excessive position deviation                                             | <ol style="list-style-type: none"> <li>1. Set the appropriate position deviation excessive alarm value.</li> <li>2. Check whether the encoder cable and motor cable are connected properly. You can use the hand to rotate the motor and monitor whether the Un003 (rotor relative Z pulse position) varies between 0 and 16777216 (24-bit encoder).</li> <li>3. Calculate the pulse frequency input and acceleration planning and check if the electronic gear ratio setting is reasonable.</li> <li>4. Determine whether the relevant parameters are reasonable. For example: you could check the torque limit, speed limit, inertia ratio, position gain, speed gain is too small or the position filter is too large, etc.</li> <li>5. Calculate if the motor selection is too small or the acceleration and deceleration are too slow that cause huge position deviation.</li> </ol> | Category 1 |
| Er.D01 | Excessive position deviation during servo ON                             | Set correct value of Pn267 (overrunning position deviation when servo is ON).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Category 1 |
| Er.D02 | Excessive position deviation alarm caused by speed limit during servo ON | Set correct Maximum position deviation threshold (Pn264) or set correct speed limit value (Pn270) during servo ON.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Category 2 |
| Er.D10 | Excessive deviation between motor and load position                      | <ol style="list-style-type: none"> <li>1. Confirm the rotation direction of the motor and the installation direction of the external encoder.</li> <li>2. Check the mechanical installation.</li> <li>3. Set the parameter Pn250 to the correct value.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Category 2 |

## 12.2 Warning Code

| Warning code | Type                                 | Solutions                                                                                                                    |
|--------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| AL.900       | Excessive Position deviation warning | 1. Correctly set relevant parameters such as gear ratio, gain, position filtering, torque limit, etc.                        |
|              |                                      | 2. confirm the encoder line motor wiring is correct.                                                                         |
|              |                                      | 3. If you already exclude various reasons, the servo driver may malfunction and you could consider replacing the servo unit. |

|        |                                                      |                                                                                    |
|--------|------------------------------------------------------|------------------------------------------------------------------------------------|
| AL.901 | Excessive position deviation warning during servo ON | Set correct excessive position deviation value during servo ON.                    |
| AL.910 | Overload warning                                     | 1. Check if there is any problem of the motor wiring and encoder wiring.           |
|        |                                                      | 2. Incorrect motor or driver selection.                                            |
| AL.911 | Vibration warning                                    | 1. Reduce the motor speed or reduce the speed loop gain.                           |
|        |                                                      | 2. Set the moment of inertia ratio correctly.                                      |
| AL.920 | Regeneration overload warning                        | 1. Set the power supply voltage within the specification range.                    |
|        |                                                      | 2. Set resistance value and capacity correctly.                                    |
|        |                                                      | 3. Replace the servo drive because of servo driver failure.                        |
| AL.921 | DB overload warning                                  | 1. Reduce the servo motor command speed.                                           |
|        |                                                      | 2. Reduce the rotary inertia ratio.                                                |
|        |                                                      | 3. Replace the servo drive because of servo driver failure.                        |
| AL.930 | Battery under-voltage warning                        | Replace the battery.                                                               |
| AL.941 | Parameter change warning needed to re-power off      | Power down the drive before restart it.                                            |
| AL.971 | Under-voltage warning                                | 1. Adjust the AC/DC power supply voltage to the product specifications.            |
|        |                                                      | 2. increase the power capacity.                                                    |
| AL.9A0 | Servo overtravel                                     | 1. Connect the overtravel signal correctly.                                        |
|        |                                                      | 2. Confirm the accuracy of the operating instructions of the host computer device. |

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## 13 Communication

### 13.1 Communication Introduction

Servo driver can support RS485, CANopen bus type, EtherCAT bus type, MECHATROLINK-II bus type. Here we mainly introduce the related content of general model RS485 communication. Other communication needs to refer to the special communication manual. 485 communications can realize the following functions.

- a) Read and write servo driver function code related parameters
- b) Monitor the working status of the servo drive
- c) Constitute a multi-axis control system
- d) Operate the servo assist function

### 13.2 RS485 Communication Protocol Description

Provide RS485 communication interface, the wiring is detailed in CN6, and the master-slave communication is carried out by the international standard Modbus communication protocol. Users can achieve centralized control through PC/PLC, control PC, etc. to suit specific application requirements.

The Modbus serial communication protocol defines the frame content and usage format for asynchronous transmission in serial communication. These include: host polling and broadcast frame, slave response frame format; host organization frame content includes: slave address (or broadcast address), execution commands, data and error check. The response of the slave is also the same structure, including: action confirmation, return data and error check. If the slave encounters an error while receiving a frame, or fails to complete the action requested by the host, it will organize a fault frame as a response to the host.

The communication protocol is an asynchronous serial master-slave Modbus communication protocol. Only one device (host) in the network can establish a protocol (called "query/command"). Other devices (slave) can only respond to the host's "query/command" by providing data, or according to the host's "query/command". The host here refers to a personal computer (PC), an industrial control device or a programmable logic controller (PLC), etc. The slave refers to a servo drive or other control device having the same communication protocol. The host can communicate with a slave separately and broadcast information to all slaves. For a host "query/command" that is accessed separately, the slave must return a message (called a response). For the broadcast message sent by the host, the slave does not need to feed back the response message to the host.

### 13.3 Communication Frame Structure

Modbus only supports RTU transmission mode. The user can configure the serial communication parameters (baud rate, check mode, etc.).

Each 8Bit byte in the message frame contains two 4Bit hexadecimal characters.

| Start bit   | Device address | command | data   | CRC check | Terminator  |
|-------------|----------------|---------|--------|-----------|-------------|
| T1-T2-T3-T4 | 8Bit           | 8Bit    | N 8Bit | 16Bit     | T1-T2-T3-T4 |

In this mode, the message transmission starts at least at a pause interval of 3.5 characters. During transmission, the network device continuously detects the network bus, including the pause interval. When the first field (address field) is received, the corresponding device decodes the next transmitted character, and if there is a pause of at least 3.5 characters, it indicates the end of the message.

In RTU mode, the entire message frame must be transmitted as a continuous stream. If there is a pause time of more than 1.5 characters before the frame is completed, the receiving device will refresh the incomplete message and assume that the next byte is the address of a new message. area. Similarly, if a new message begins with the previous message in less than 3.5 character times, the receiving device will consider it a continuation of the previous message. If the above two situations occur during the transmission, the CRC check will inevitably generate an error message and feed back to the sender device.

## 13.4 Command Code and Communication Data Description

In the communication command, the data address read and written is the hexadecimal number of the parameter name, for example, the address of the inertia ratio Pn100 is 0x0100.

(1) Command code: 03H

Function: Read N words (Word can read up to 16 words in succession).

For example, if the servo drive with the slave address 01H reads the address e003 and reads two consecutive words, the structure of the frame is described as follows:

Host command information:

| START                           | T1-T2-T3-T4 (3.5 bytes of transmission time) |
|---------------------------------|----------------------------------------------|
| ADDR                            | 01H                                          |
| CMD                             | 03H                                          |
| Read start address high         | e0H                                          |
| Read start address low          | 03H                                          |
| high number of data (in word)   | 00H                                          |
| low number of data is (in word) | 02H                                          |
| CRC CHK low bit                 | 03H                                          |
| CRC CHK high bit                | CBH                                          |
| END                             | T1-T2-T3-T4 (3.5 bytes of transmission time) |

The slave responds to the message:

| START           | T1-T2-T3-T4 (3.5 bytes of transmission time) |
|-----------------|----------------------------------------------|
| ADDR            | 01H                                          |
| CMD             | 03H                                          |
| Number of bytes | 04H                                          |

|                                                          |                                              |
|----------------------------------------------------------|----------------------------------------------|
| The high content of the starting data address<br>03F 2H  | 3AH                                          |
| Content status of the starting data address 03F<br>2H    | 9AH                                          |
| The content of the second data address 03F<br>3H is high | 00H                                          |
| The lower content of the second data<br>address 03F 3H   | 05H                                          |
| CRC CHK low bit                                          | 16H                                          |
| CRC CHK high bit                                         | C7H                                          |
| END                                                      | T1-T2-T3-T4 (3.5 bytes of transmission time) |

(2) Command code: 10H

Function: Write N words (Word),  $N \geq 2$ .

For example, write 100 to the 0100H address of the slave address 01H servo drive and 400 to the 0101H address of the slave address 01H servo drive.

The structure of the frame is described as follows:

Host command information:

|                                            |                                              |
|--------------------------------------------|----------------------------------------------|
| START                                      | T1-T2-T3-T4 (3.5 bytes of transmission time) |
| ADDR                                       | 01H                                          |
| CMD                                        | 10H                                          |
| Write data address high                    | 01H                                          |
| Write data address low                     | 00H                                          |
| The number of data is high (in word)       | 00H                                          |
| Number of data status (calculated in word) | 02H                                          |
| Number of bytes                            | 04H                                          |
| The first word high of the data content    | 00H                                          |
| The first word of the data content is low  | 64H                                          |
| The second word high of the data content   | 01H                                          |
| The second word of the data content is low | 90H                                          |
| CRC CHK low bit                            | BEH                                          |
| CRC CHK high bit                           | 1CH                                          |
| END                                        | T1-T2-T3-T4 (3.5 bytes of transmission time) |

The slave responds to the message:

|                                            |                                              |
|--------------------------------------------|----------------------------------------------|
| START                                      | T1-T2-T3-T4 (3.5 bytes of transmission time) |
| ADDR                                       | 01H                                          |
| CMD                                        | 10H                                          |
| Write data start address high              | 01H                                          |
| Write data start address low               | 00H                                          |
| The number of data is high (in word)       | 00H                                          |
| Number of data status (calculated in word) | 02H                                          |
| CRC CHK low bit                            | 40H                                          |
| CRC CHK high bit                           | 34H                                          |
| END                                        | T1-T2-T3-T4 (3.5 bytes of transmission time) |

---

## 13.5 Communication Frame Error Check Mode:

The error check mode of the frame mainly includes two parts of the check, that is, the bit check of the byte (odd/even check) and the entire data check of the frame (CRC check or LRC check).

### 13.5.1 Byte Bit Check

Users can choose different bit verification methods as needed, or they can choose no parity, which will affect the parity bit setting of each byte.

The meaning of even parity: an even parity bit is added before data transmission to indicate whether the number of “1” in the transmitted data is odd or even. When it is even, the check position is “0”, otherwise it is set. It is “1” to keep the parity of the data unchanged.

The meaning of the odd check: an odd parity bit is added before the data transmission to indicate whether the number of “1” in the transmitted data is odd or even. When it is odd, the check position is “0”, otherwise it is set. It is “1” to keep the parity of the data unchanged.

For example, you need to transfer “11001110”, the data contains 5 “1”, if you use even parity, its even parity bit is “1”, if you use odd parity, its odd parity bit is “0”, transmission In the case of data, the parity bit is calculated at the position of the check bit of the frame, and the receiving device also performs parity check. If the parity of the accepted data is found to be inconsistent with the preset, it is considered that the communication has an error.

### 13.5.2 CRC Check Method --- CRC (Cyclical Redundancy Check)

Using the RTU frame format, the frame includes a frame error detection field calculated based on the CRC method. The CRC field detects the contents of the entire frame. The CRC field is two bytes and contains a 16-bit binary value. It is calculated by the transmission device and added to the frame. The receiving device recalculates the CRC of the received frame and compares it with the value in the received CRC field. If the two CRC values are not equal, the transmission has an error.

The CRC is first stored in 0xFFFF, and then a procedure is called to process the consecutive 6 or more bytes in the frame with the values in the current register. Only the 8Bit data in each character is valid for the CRC, and the start and stop bits as well as the parity bit are invalid.

During the CRC generation process, each 8-bit character is individually different from the register contents (XOR), and the result moves to the least significant bit direction, and the most significant bit is padded with 0. The LSB is extracted and detected. If the LSB is 1, the register is individually or different from the preset value. If the LSB is 0, it is not performed. The entire process is repeated 8 times. After the last bit (bit 8) is completed, the next octet is individually different from the current value of the register. The value in the final register is the CRC value after all the bytes in the frame have been executed.

This calculation method of CRC adopts the international standard CRC check rule. When editing the CRC algorithm, the user can refer to the CRC algorithm of the relevant standard to write a CRC calculation program that truly meets the requirements.

## 13.6 Error Message Response

When the slave responds, it uses the function code field and the fault address to indicate whether it is a normal response (no error) or an error (called an objection response). For a normal response,

the slave responds with the corresponding function code and data address or sub-function code. In response to the objection, the device returns a code equivalent to the normal code, but the first position is logic 1.

For example, if a message sent by a master device to a slave device requires reading a set of servo driver function code address data, the following function code will be generated:

0 0 0 0 0 1 1 (hex 03H)

For a normal response, the slave responds with the same function code. In response to the objection, it returns:

1 0 0 0 0 1 1 (hexadecimal 83H)

In addition to the modification of the function code due to an objection error, the slave device will respond with a one-byte exception code, which defines the cause of the exception.

After the master application responds with an objection, the typical process is to resend the message or make a command change for the corresponding failure.

| Modbus exception code |                      |                                                                                                                                                                                                                                                                                          |
|-----------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code                  | Name                 | Meaning                                                                                                                                                                                                                                                                                  |
| 01H                   | Illegal function     | When the function code received from the host computer is an operation that is not allowed, this may be because the function code is only applicable to the new device and is not implemented in the device; at the same time, the slave may also process the request in an error state. |
| 02H                   | Illegal data address | For the servo drive, the request data address of the upper computer is an unallowable address; in particular, the combination of the register address and the transmitted byte number is invalid.                                                                                        |
| 03H                   | Illegal data value   | The received data value exceeds the range of the address parameter, causing the parameter change to be invalid.                                                                                                                                                                          |
| 11H                   | Parity error         | When the RTU format CRC check bit or the ASCII format LRC check bit is different from the check calculation number of the lower computer in the frame information sent by the host computer, the check error information is reported.                                                    |

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## 14 Host Debugging Instruction

### 14.1 System Requirements

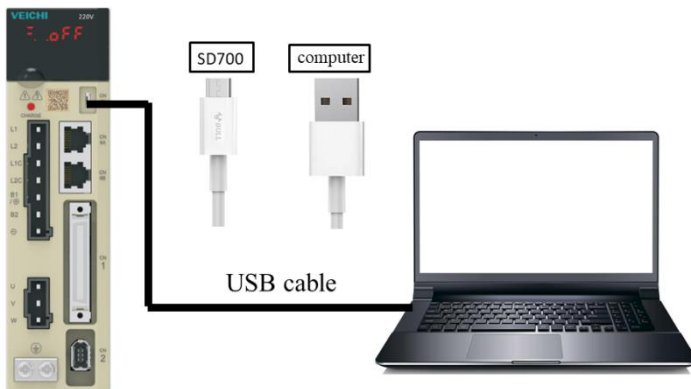
#### 14.1.1 System Configuration

1. When the user uses the software for the first time, please confirm whether the NET3.5 and NET4.0 frameworks are installed. This is a prerequisite; otherwise the software cannot be opened. But for Win7 and above operating systems, there is no need to install NET 3.5 and NET 4.0 frameworks.
2. The host computer system currently supports USB communication debugging.
3. The system only supports servo SD700 series servo product debugging.
4. Verify that the “Use FIPS-compliant algorithms for encryption” option is set to disabled (Control Panel - Administrative Tools - Local Security Policy - Security Options - Use FIPS-compliant algorithms for encryption - disabled).

#### 14.1.2 Connection Configuration

The servo driver is connected to the computer through the communication connector, and the interface type is USB. Basic configuration:

- Anti-jamming Android micro phone data cable.

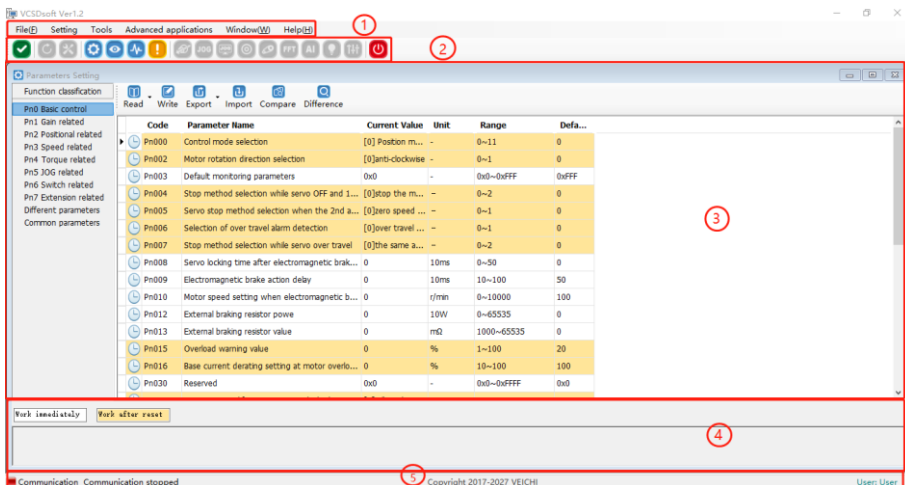


1. Connection between PC and SD700 servo drive via Android micro mobile phone data cable.
2. Click My Computer - Manage - Device Manager and find  Other devices  VEICHI SD700 SERIES.
3. Right-click and select “Update Driver”, select “Browse calculations to find driver software”.
4. Manually select the upper machine installation package file for driver installation.

5. Then the device manager |  **VEICHI SD700 SERIES** appears, indicating that the installation has been successful.

## 14.2 Main Interface

The main interface includes menu bar, toolbar, function display area, information bar, status bar and other functions, as shown in the following figure;



### (1). Menu bar

The menu bar includes functions such as files, settings, tools, advanced applications, windows, and help.

[File]: Open and exit the system.

[Settings]: user rights, service personnel rights, developer rights.

[Tools]: parameter settings, real-time monitoring, digital oscilloscope, fault information, screenshots and other functions.

[Advanced applications]: inertia identification, JOG, program JOG, homing, mechanical characteristics, FFT analysis, single parameter adjustment, intelligent adjustment, offset adjustment.

[Window]: Cascading display, horizontal display, vertical display, all off.

[Help]: about;

### (2). [Toolbar]

The toolbar includes communication disconnection, communication connection, JOG, program JOG, soft reset, factory reset, parameter setting, monitoring parameters, digital oscilloscope, fault maintenance, screenshot, mechanical characteristics, FFT analysis, intelligent adjustment, offset adjustment, single parameter adjustment, exit and other functions.

---

(3). Function display area

The function display area is used as a form container to provide sub-window display of reading and writing parameters, monitoring parameters, digital oscilloscope, fault maintenance, and function debugging.

(4). Information columns

[Some parameters] show supplementary explanation.

(5). Status bar

The status bar includes the current communication status and servo work status.

## 14.3 Features

(1) File

Documents include open, exit, etc.

(2) Turn on

Open function: open the existing file.

Step:

Click the menu bar [File] -> [Open] -> [Select the current system directory folder Test32] -> [Select VCDGSmsyc.vcb file].

(3) Exit

Exit function: Close the current system.

Step:

Click [Exit] in the file column, exit the system, or click [Exit System] on the motor toolbar to exit the system.

(4) Read and write parameters

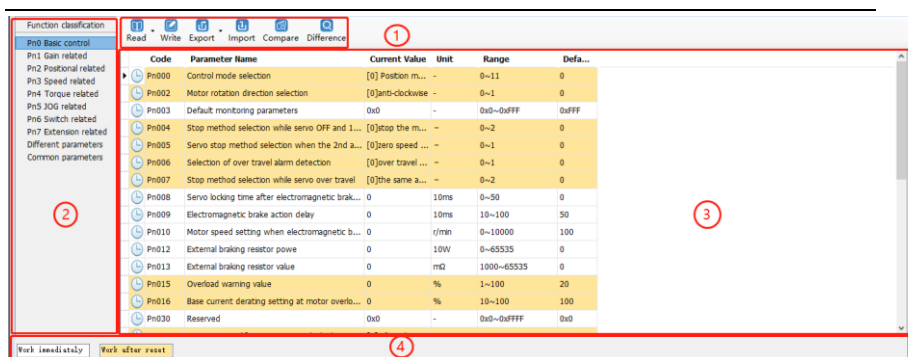
Read and write parameters include functions such as reading and writing of function codes, import, and export.

Step:

a). Start reading and writing parameters interface:

Click on the menu bar "Tools" -> "Parameter Settings".

b). The pop-up read/write parameters (parameter setting) interface is displayed in the display area, as shown in the following figure:



## i-Toolbar

The toolbar includes reading the current page function code, reading all page function codes, writing function codes to EERPOM, exporting the current page function code, exporting all function codes, importing function codes in batches, comparing the differences of two file parameters and finding out modified parameters, as shown below:

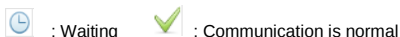


## ii-Multi page

Each page is displayed in different functional groups. At the same time, common parameters and different parameter pages are added to facilitate viewing of function codes.

## iii-function code

The function code is a specific function and provides relevant information such as the current state, name, current value, unit, default value, minimum value, maximum value, and attribute, etc. When a row is clicked, the corresponding function code comment is provided as below:



## iv-Information column

Display parameter modification after the effective mode and function code supplementary explanation:

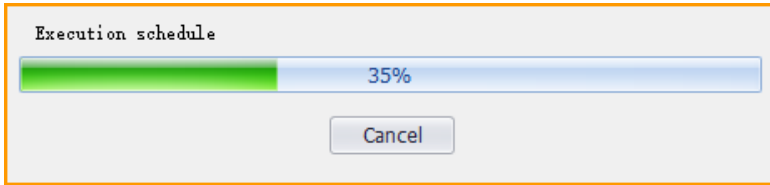
### (5) Function code reading

Function code reading can be read individually or in batches.

Step:

- Current group read: switch to a group of parameters, left-click on [read] -> select [current group], read the current group parameters.

b). Read all: Left-click on [Read] -> Select [All] to read all parameters and the pop-up dialog box will display the progress of the read function code in the form of a progress bar; as shown in the following figure:



#### (6) Function code write/import

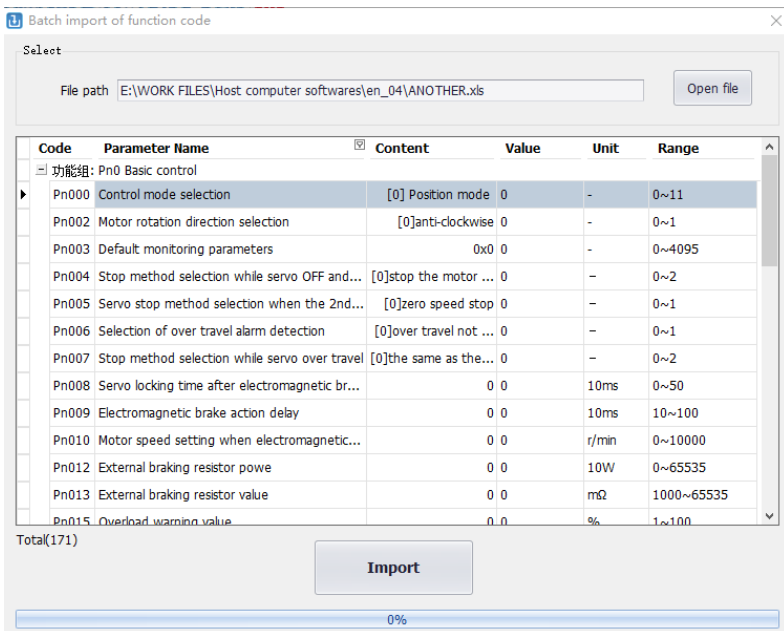
Function code writing can be individually written.

Step:

a). write individually: select a function code, click on the column corresponding to the current value, click twice in succession, it may enter the editing state, enter the value then click on Enter, the system will automatically send a write command, or directly click [Write] on the toolbar after editing to finish writing the parameters.

b). Steps to import in batches:

Click [Import] → [Select File] -> Click [Import], as shown in the following figure:



---

### (7) Function code export

Function code export can export current and all function codes:

Step:

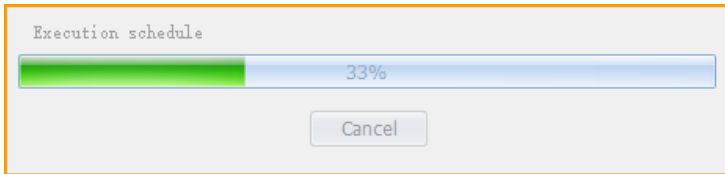
Click on the toolbar icon  to select the current group and complete the current group export; or select all to complete the export of all function codes.

### (8) Find different function codes

Finding different function codes can find out the modified parameters to facilitate user analysis.

Step:

Click on the toolbar icon  to find out the modified parameters. At the same time, the pop-up dialog box will display the progress in the form of a progress bar as shown in the following figure.

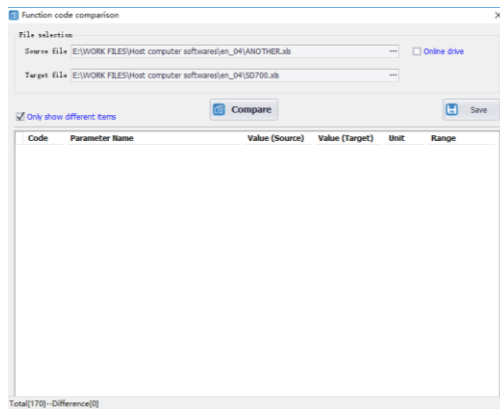


### (9) Function code comparison

Compare two sets of exported function codes.

Step:

Click on the toolbar icon , the function code comparison file selection interface appears. Select the source file and the target file respectively then click on [Compare], and the following interface appears. Click on Save to save the two parameters of the two files.

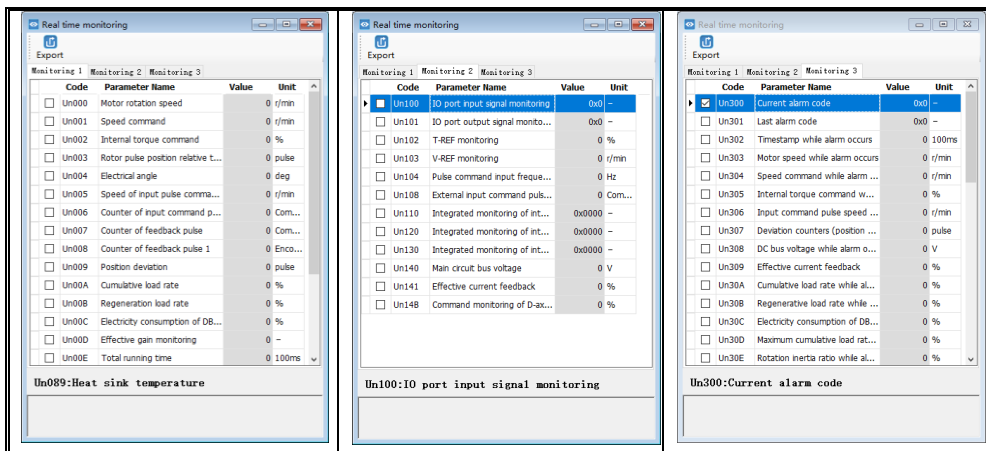


## 14.4 Real-Time Monitoring

1. Real-time monitoring provides real-time monitoring of monitoring parameters and I/O status, as well as current fault information:

Step:

a). Start the real-time monitoring interface. As shown in the figure below, the monitoring parameters are divided into three groups. The monitoring parameters can be added to the common parameters.



b). Check the monitored parameters and monitor the servo. During the monitoring process, you can also export and save the monitoring content.

### 2. Monitoring parameter export

The export of monitoring parameters is a way to output and save the monitoring parameters, which can facilitate the customer to save the monitored parameters.

Step:

a). Check the monitored parameters. If you want to export all parameters in the current group, right-click in the monitored parameters area, select All group, and then click Export. Select the save path and save the monitoring data in the EXCEL file format.

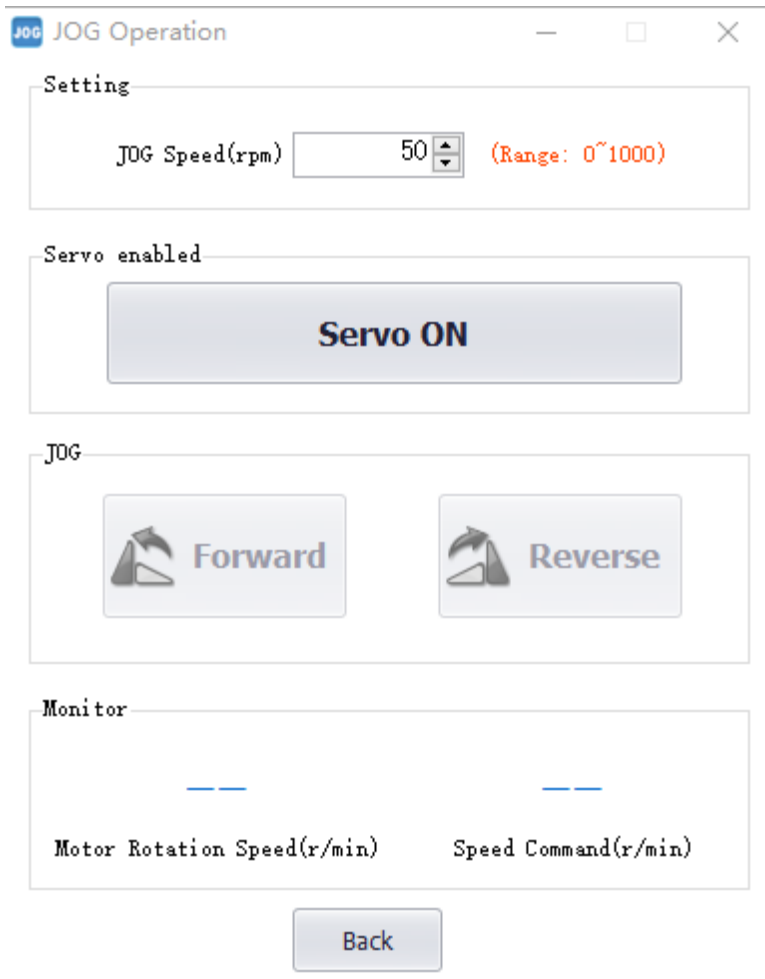
## 14.5 Auxiliary Functions

### 14.5.1 JOG

The JOG operation is a function to confirm the operation of the servo motor by driving the servo motor at the previously set JOG speed (rotation speed) without connecting the host device. By performing this operation confirmation, it is possible to confirm whether or not the connection to the wire is improper and whether the servo motor has failed.

Step:

a). Click the icon  on the main interface of the host computer to enter the jog operation interface. As shown in the left figure below, click Start, and then click forward rotation. The servo will execute forward rotation, click Reverse, and the motor will perform reverse rotation.



The screenshot shows a software window titled "JOG Operation". It contains four main sections: "Setting" with a "JOG Speed(rpm)" input set to 50 and a range of 0~1000; "Servo enabled" with a large "Servo ON" button; "JOG" with "Forward" and "Reverse" buttons featuring motor icons; and "Monitor" with two data fields, "Motor Rotation Speed(r/min)" and "Speed Command(r/min)", each preceded by a blue dashed line. A "Back" button is located at the bottom center.

### 14.5.2 Inertia Identification

The inertia Identification function allows the servo unit to perform automatic operation (forward and reverse reciprocating motions), and estimates the moment of inertia of the load during operation.

Step:

a). Click [Inertia Identification]→[Next] on the host interface to enter the following interface in the

inertia identification operation process, as shown in the following figure.

**Step 1 -> Parameter adjustment**

Command selection: Maximum 2.5 circle( $\pm 1000$ [m])

Accelerated speed(rpm/s): 20000.00 (Range: 5000.00 - 20332.23)

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

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

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

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

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

**Note** The rotation inertia ratio cannot be calculated normally when there is a torque limit. When the execution is completed, reset or electrify the drive again.

< Back Next > Cancel

b). As shown in the above figure, set the corresponding parameters according to the actual situation (usually keep the default), and click [Next] → [Write] → [Next] → [Enable] → [Forward] → [Reverse] After the forward rotation is repeated three times, the final inertia identification result is displayed, as shown in the following figure.

**Step 3 -> Running Measurement**

step 1: Servo enabled

Servo ON

step 2: Operation

Forward Reverse

Inertia identification Result

Current value: — Inertia ratio: 100

Write

< Back Next > Cancel

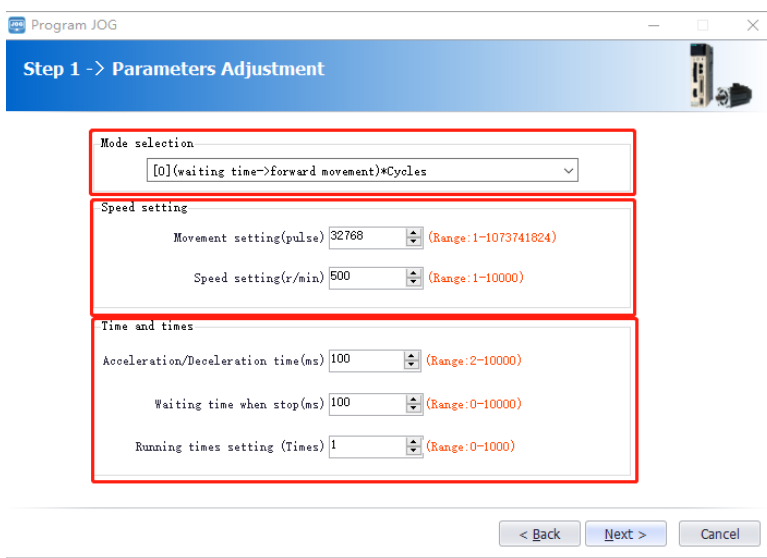
c). Click [Write]→[Next]→[Complete] to finish the inertia recognition process.

### 14.5.3 Program JOG

The JOG operation of the program refers to the function of executing the continuous operation in the previously set operation mode (moving distance, moving speed, acceleration/deceleration time, waiting time, number of movements). This function is the same as the JOG operation, and the upper apparatus is not connected during the setting. The servo motor operation can be confirmed and a simple positioning operation can be performed.

Step:

- a). Click on  of the main interface of the host computer to enter the program jog operation process, and then click on [Next] to enter the parameter adjustment interface and set related parameters as required. The detailed interface is as shown in the figure below.



- b). After setting the corresponding parameters, click on [Next] → [Write] → [Next] → [Enable] → [Execution] → [Next] → [Complete]. The program JOG operation process ends.

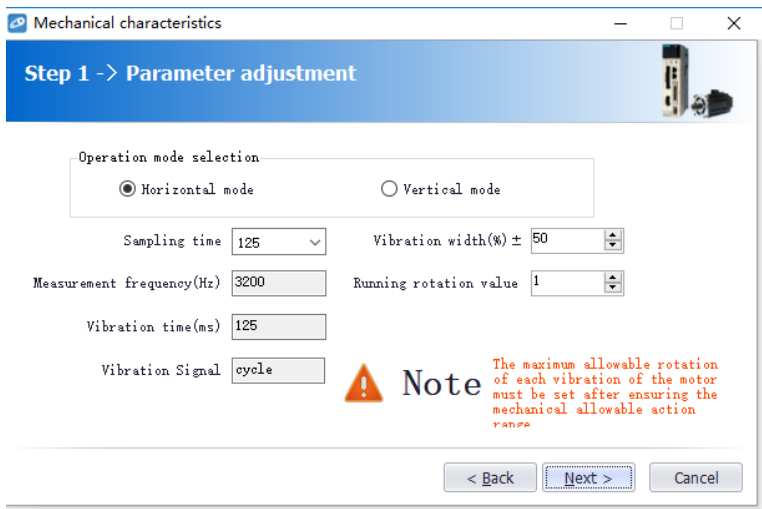
### 14.5.4 Mechanical Characteristics

Mechanical analysis characteristics mean that the servo unit performs automatic operation (positive and negative reciprocating motion) without issuing an instruction from the host computer, and the function of estimating the common vibration frequency of the mechanical system during operation is performed.

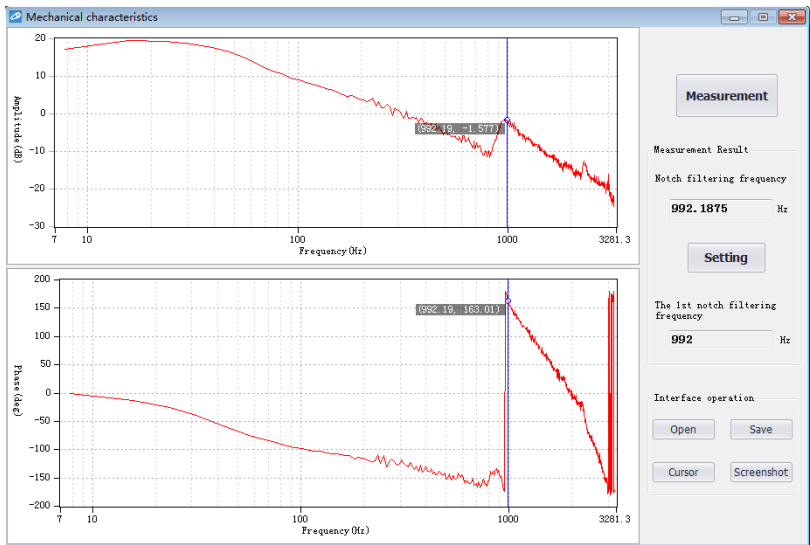
Step:

- a). Click on  of the main interface of the upper computer to enter the mechanical characteristics analysis operation process, click on [Next] → [Next] to enter the parameter

adjustment interface, and adjust the corresponding parameters according to the actual situation, as shown in the following figure.



b). Click [Next] → [Write] → [Next] → [Enable] → [Forward] → [Enable] → [Reverse] → [Next] → [Complete] to enter the mechanical properties FFT analysis interface, as shown in the figure below:



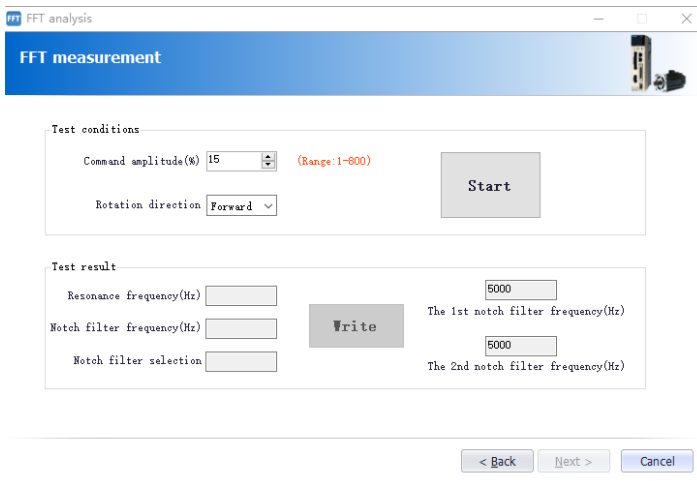
c). From the above figure, you can analyze the frequency, amplitude, and phase of the resonance frequency. Click on [Settings] to set the frequency of the first notch filter. After the setting is completed, the screen is closed. Mechanical properties are completed.

### 14.5.5 FFT Analysis

EasyFFT transfers the periodic waveform commands from the servo unit to the servo motor and rotates the servo motor slightly for a certain time to cause the vibration of the machine. The servo unit detects the resonance frequency based on the vibration generated by the machine, and then sets the corresponding notch filter according to the resonance frequency. The notch filter effectively removes high-frequency vibrations and noise.

Step:

a). Click on  to enter the FFT measurement interface. Set the command amplitude and rotation direction in the measurement conditions. Click to start measurement and you can measure the frequency of the first notch filter, as shown in the figure below:



FFT analysis

FFT measurement

Test conditions

Command amplitude(%) 15 (Range:1-600)

Rotation direction Forward

Start

Test result

Resonance frequency(Hz)

Notch filter frequency(Hz)

Notch filter selection

Write

The 1st notch filter frequency(Hz) 5000

The 2nd notch filter frequency(Hz) 5000

< Back Next > Cancel

b). Click on [Start] to measure the first notch, and then click on [Write] to write the frequency of the first notch filter.

c). Click on [Start] to measure the second notch, and then click on [Write] to write the second notch filter frequency.

d). Click on [Next] → [Done] to close the operation interface and the FFT analysis is completed.

### 14.5.6 Bandwidth setting

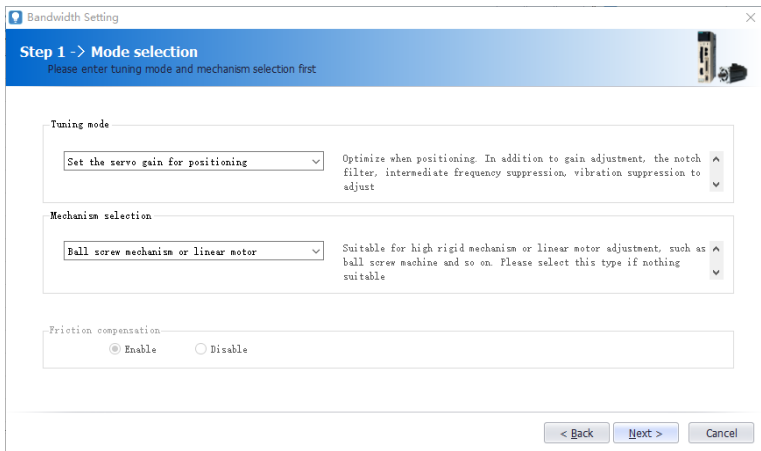
Bandwidth setting is the method of inputting a speed command or position command from the host device and manually adjusting it while it is running. By adjusting one or two values via bandwidth setting, the relevant servo gain settings can be automatically adjusted.

Bandwidth setting adjusts the following items.

- Gain adjustment (speed loop gain, position loop gain, etc.).
- Filter adjustment (torque command filter, notch filter).
- IF suppression control.

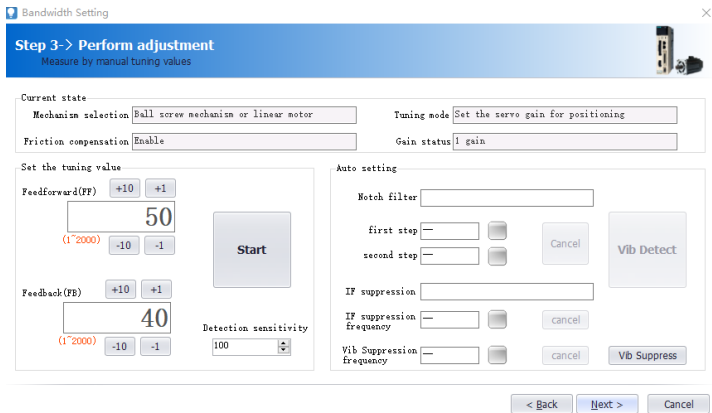
Step:

a). Click  of the main interface of the upper computer to enter the single parameter adjustment prompt interface, click on [Next] to enter the parameter adjustment interface, select the organization selection according to the actual situation, and select the desired mode, as shown in the following figure.



b). Click on [Next] to enter the setting interface of inertia moment ratio and set the inertia ratio (inertia ratio can be obtained through inertia identification function).

c). Click on [Next] to enter the single parameter tuning interface as shown in the following figure.



---

d). Click on [Adjust Start] to tune the tuning value (generally increase). During the process of increasing the tuning value, the servo will vibrate. At this time, vibration detection will be performed automatically. If not, operation can be performed manually, and the tuning value can be set in combination with the figure captured by the digital oscilloscope, or 80% of the tuning value of the motor can be selected as the tuning value. Specific or combined with the actual site requirements for adjustment settings.

e). In the tuning process, when the servo motor is vibrating, it will detect the resonance frequency and the intermediate frequency suppression frequency. After the tuning is completed, click on [Next] to enter the auto tuning completion interface and click on [Finish] to complete the single parameter adjustment operation.

### 14.5.7 Offset Adjustment

Offset adjustment is divided into two parts:

- 1: Speed/torque command offset (automatic/manual) adjustment.
- 2: Motor/current detection signal offset (automatic/manual) adjustment.

Step:

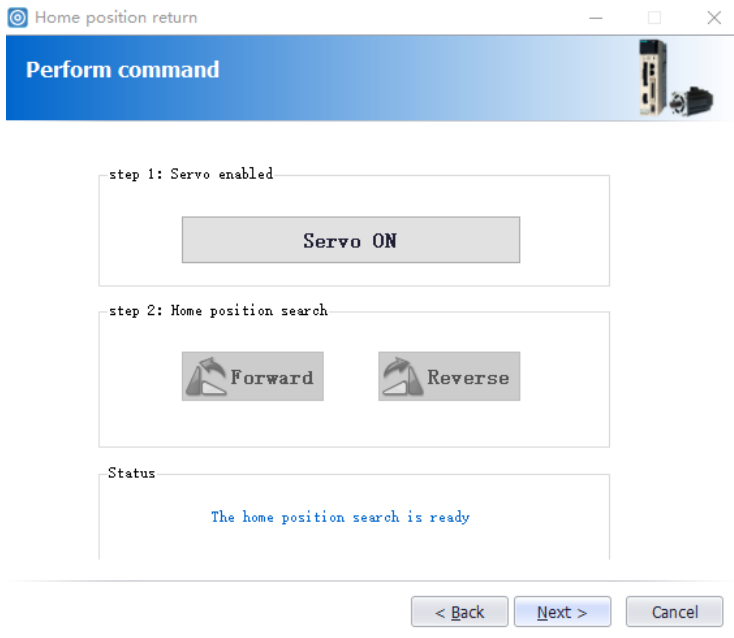
- a). Click  on the main interface of the host computer to enter the offset wizard interface. Click on [Next] to enter the offset adjustment function selection interface, select the function you need to adjust, and click on [Next] to enter the adjustment interface.
- b). Set the adjustment method, click on [Next], click on [Finish], the offset adjustment screen closes, and the adjustment process ends.

### 14.5.8 Return to Origin

The origin search is a function that determines the position of the origin pulse (Z phase) of the incremental encoder and stops at this position.

Step:

- a). Click  on the main interface of the host computer to enter the origin setting wizard interface. Click [Next] to enter the execution instruction interface, as shown in the following figure.



- b). Click [Enable] to enable the servo motor to enter the enable state, and then click [Forward Run] or [Reverse Run] to perform the origin search. After the search is completed, click [Next] to enter the back to origin setting interface and click [Completed] to return to origin operation.

### 14.5.9 Soft Reset

The function could reset the servo unit from the inside by software. Used to re-power on or reset the alarm after changing the parameter setting. It is also possible to validate the setting without turning the power back on.

Step:

- Click  on the main interface of the host computer to perform a soft reset operation.

### 14.5.10 Restoring the Factory Value

The function is used to restore the parameter to the factory setting. Parameter initialization should note the problems as bellow:

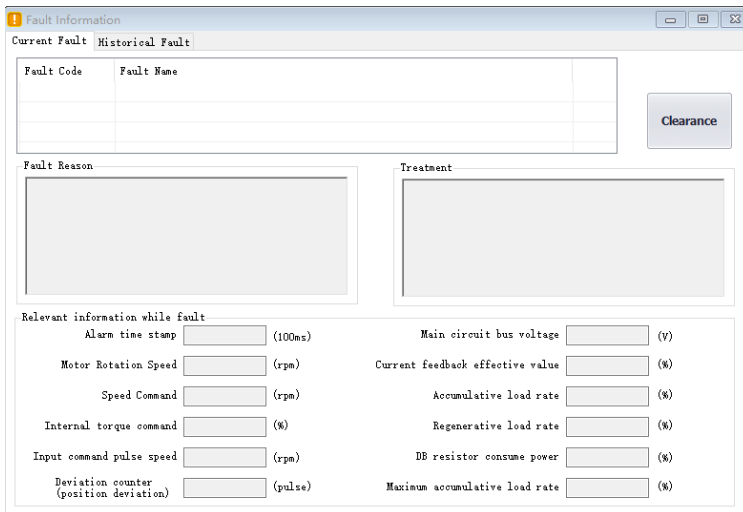
1. Initialization of the parameter setting value must be performed during the servo OFF and it cannot be executed during the servo ON.
2. For the setting to take effect, the servo unit must be turned on again after the operation.

Steps:

Click  on the main interface of the upper computer to restore the factory value. After the operation is completed, power it on again.

### 14.5.11 Fault Information

The fault information can display current faults, historical faults, causes of faults, handling measures, information related to faults, and clearing of fault information. Click  to display the following interface.



The screenshot shows a 'Fault Information' window with a title bar containing a warning icon and standard window controls. It has two tabs: 'Current Fault' (selected) and 'Historical Fault'. The 'Current Fault' tab contains a table with two columns: 'Fault Code' and 'Fault Name'. Below the table is a 'Clearance' button. The 'Historical Fault' tab is currently empty. Below the table, there are two large empty rectangular boxes labeled 'Fault Reason' and 'Treatment'. At the bottom, there is a section titled 'Relevant information while fault' containing two columns of data fields with input boxes and units: Alarm time stamp (100ms), Motor Rotation Speed (rpm), Speed Command (rpm), Internal torque command (%), Input command pulse speed (rpm), Deviation counter (position deviation) (pulse), Main circuit bus voltage (V), Current feedback effective value (%), Accumulative load rate (%), Regenerative load rate (%), DB resistor consume power (%), and Maximum accumulative load rate (%).

According to the above information, the servo fault is repaired.

## 14.6 Digital Oscilloscope

Digital oscilloscopes collect data at high speeds and display them graphically to analyze data.

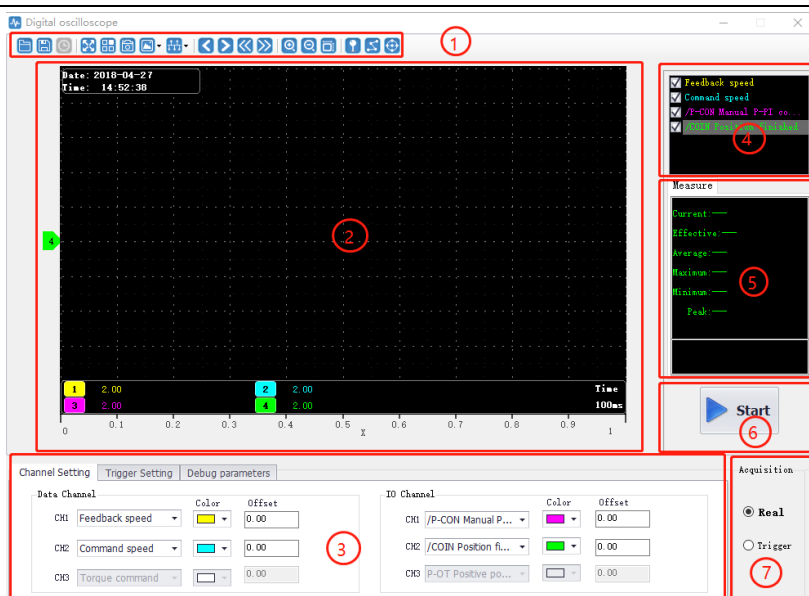
Steps:

a). start the data oscilloscope interface (provide two ways):

Method 1: Click on the main menu of the host computer menu [Tools] -> [Oscilloscope], start the oscilloscope;

Method 2: Click the icon  on the main interface of the host computer to start the oscilloscope.

b). Display data oscilloscope interface, as shown below:



#### i - Toolbar

The toolbar includes open, save, full screen, style (switch to display background), settings, screenshots, legend, timeline, back, forward, rewind, fast forward, zoom in, zoom out, adaptive, zero position, dot/line, measurement and other functions.

#### ii - Curve display area

Different curves provide visual display and measurement results for display.

#### iii - Channel setting and trigger setting

It provides channel-related parameter settings and trigger related parameter settings. Parameter setting includes trigger condition settings and channel settings; data channel detailed functions are as follows.

| Data channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | I/O channel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div> <div></div> <div> <div>▶ Command speed</div> <div>Feedback speed</div> <div>Torque command</div> <div>Position command speed</div> <div>Command speed before position l...</div> <div>Position command difference</div> <div>Position feedback difference</div> <div>Position error</div> <div>Speed feedforward</div> <div>Torque feedforward</div> <div>Friction compensating torque</div> <div>Vibration deviation control speed</div> <div>Position loop regulator deviation</div> </div> </div> | <div> <div></div> <div> <div>▶ /S-ON Servo enable</div> <div>/P-CON Manual P-PI control</div> <div>P-OT Positive position limit</div> <div>N-OT Negative position limit</div> <div>/ALM-RST Alarm clearance</div> <div>/TLC Torque limit selection</div> <div>/SPD-D Internal speed command ...</div> <div>/SPD-A AInternal speed command...</div> <div>/SPD-B Internal speed command s...</div> <div>/C-SEL Control mode switch</div> <div>/ZCLAMP Zero speed clamping</div> <div>/INHIBIT Pulse input inhibit</div> <div>/G-SEL Gain switching</div> </div> </div>                                                                                                                     |
| <div> <div></div> <div> <div>Torque command before disturba...</div> <div>Active gain</div> <div>Main circuit voltage</div> <div>Current detection value</div> <div>Cumulative load rate</div> <div>Regeneration load rate</div> <div>Motor position feedback difference</div> <div>Full closed loop position feedback ...</div> <div>Electric angle</div> <div>VREF</div> <div>▶ TREF</div> <div>None</div> </div> </div>                                                                                 | <div> <div> <div>SEN</div> <div>PULS</div> <div>SIGN</div> <div>CLR Pulse clearance</div> <div>/HWBB1</div> <div>/HWBB2</div> <div>ALM Alarm output</div> <div>/COIN Position finished</div> <div>/V-CMP Same speed</div> <div>▶ /TGON Rotational detection signal</div> <div>/S-RDY Servo ready</div> <div>/CLT Torque limit</div> <div>/VLT Speed limit</div> <div>/BK Brake linkage</div> <div>/WARN Warning output</div> <div>/NEAR Position approach signal</div> <div>/C-PHASE</div> <div>PAO Frequency division output A</div> <div>PBO Frequency division output B</div> <div>PCO Frequency division output C</div> <div>ACON</div> <div>DEN</div> <div>None</div> </div> </div> |

iv - Waveform display selection area.

It provides selection and display of desired waveforms.

v - Digital display of measured value.

It provides display of current value, effective value, average value, maximum value, minimum value, peak value, etc.

vi - Record button operation button.

It's used to start and stop recording.

vii - Collection method selection.

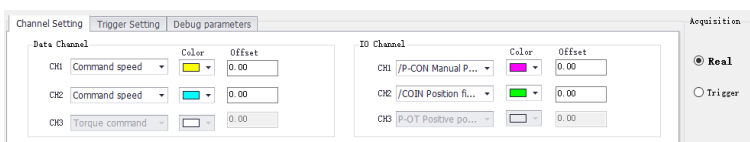
It's used to choose the mode of wave recording, real-time and triggered acquisition.

## 14.6.1 Real-Time Acquisition

Real-time acquisition is displayed in real time in the form of waveforms on the servo operating conditions.

Steps:

a). Start: Select real-time acquisition mode, set the channel settings, as shown in the figure below, then click the record button , start recording, and the status of the icon changes to .



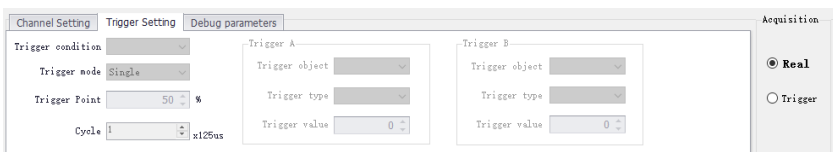
b). Stop: click on the record button  to stop recording, and the status of the icon changes to .

## 14.6.2 Trigger Acquisition

The trigger acquisition is based on the trigger condition and the acquisition cycle and makes the servo operation status displayed in the form of a waveform.

Steps:

a). Select the trigger for the acquisition mode. After the data channel and trigger conditions are set, as shown in the following figure, click the record button , which triggers the start of recording.



Note: After setting the trigger condition parameters, the terminal receives the trigger condition and will automatically judge according to the conditions.

b). After the waveform to be triggered is received, the waveform will remain in the last state; the record button will change to .

c). If you need to trigger again, you need to start recording again.

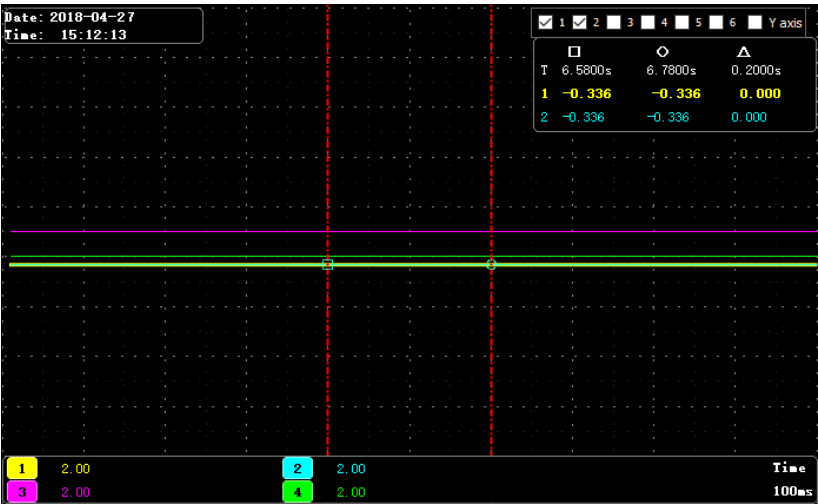
### 14.6.3 Graphic Operations

Graphic operations include X/Y zoom, XY label value, Y axis curve point and point display/hide and measurement, X axis curve point and point display/hide and measurement, curve zoom in/out, curve shift, curve zero adjustment , curve adaptive adjustment, graphics attribute settings and other functions.

X axis cursor

Steps:

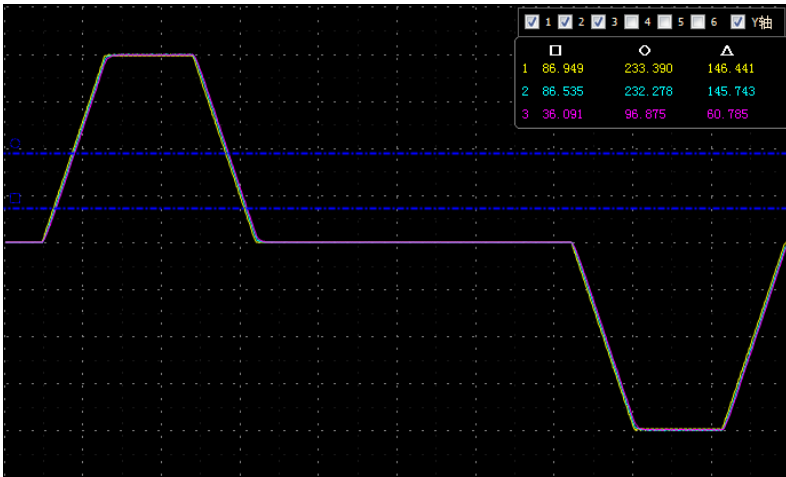
a). Click on the toolbar icon  , the graph will automatically display the two axes of the X-axis, and the upper right corner will automatically display the two axis values corresponding to the X-axis cursor, the difference between the data and real time as shown in the figure below:



Y axis cursor

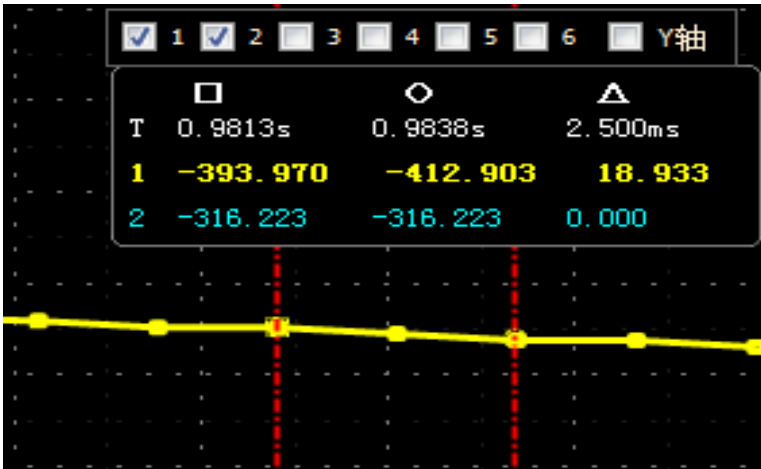
The Y-axis has two coordinate axes and functions are similar to the X-axis.

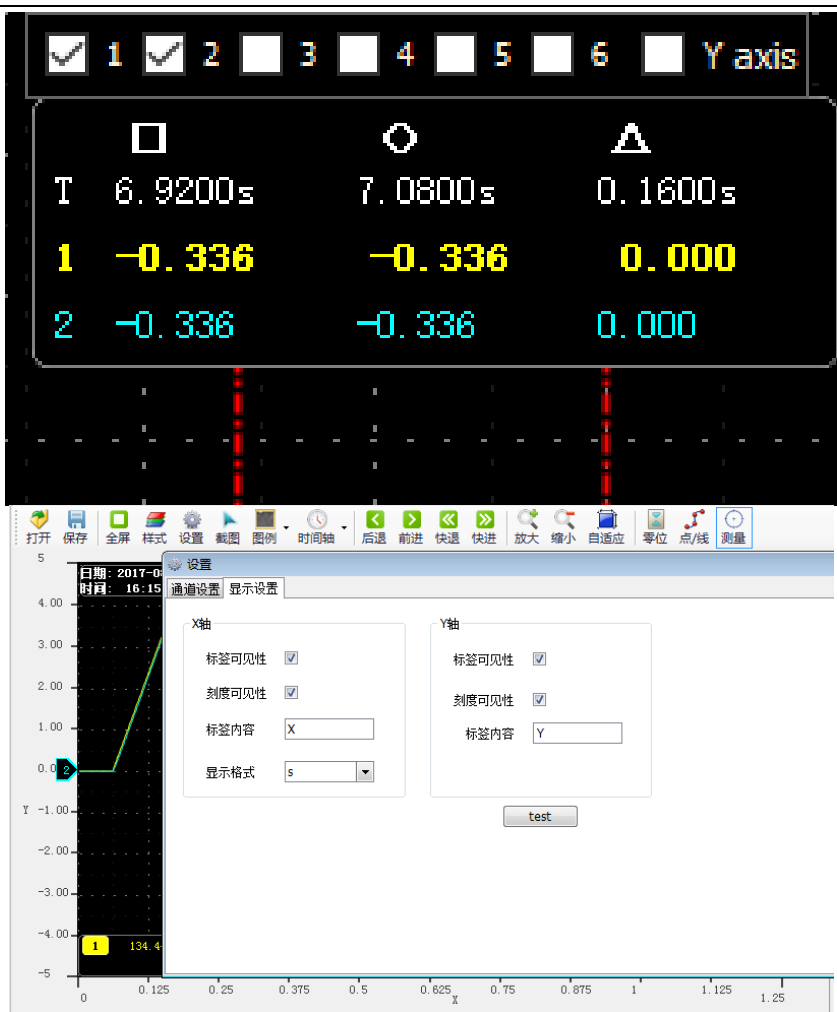
1. Click on the toolbar icon  to check the Y axis. The graph will automatically display the two axes of the Y axis. The two axes of the X axis cursor are automatically displayed in the upper right corner. The data difference between the two axes is shown in the figure below:



### XY digital display

There are multiple axes on the Y axis, which can be selected according to the needs. Through the measurement function, the mouse will display the XY value of the current point in digital form as shown in the following figure.





### Y axis scale display/hide

The Y coordinate scale is displayed as a fixed value, and the Y axis scale display/hide can be modified through the toolbar settings.

Steps:

- Click the top right corner of the oscilloscope interface and in the Y axis option, check the label visibility and scale visibility.

### Y-axis curve display/hide

The Y-axis has multiple curves, which can be selected according to the channel. The Y-axis curve is displayed by default.

## Steps:

a). In the interface of digital oscilloscope, remove the unnecessary waveform options, and the corresponding Y-axis curve will be automatically hidden in the graphics; for example, let the position instruction speed waveform be hidden, remove the check signal in the corresponding options as shown in the following figure.



## Curve zooms in/out

### Steps:

- Zoom in the area: Press the left mouse button and pull a zone from the upper left corner to the lower right corner, this area can be enlarged.
- Zoom out the area: Press the left mouse button and pull a zone from the lower right corner to the upper left corner, this area can be reduced.
- Zoom in curve X/Y: click on the button .
- Zoom out curve X/Y: click on the button .
- Zoom in curve X: Click on the button  to decrease the time in the options.
- Zoom out curve X: Click on the button  to increase the time in the options.
- Zoom in curve Y: Click on the gain option of the corresponding curve to decrease the gain value. As shown in the figure below, you can adjust the gain of six Y curves.
- Zoom out curve Y: Click on the gain option of the corresponding curve to increase the gain value. As shown below:



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## Curve translation

Steps:

- a). Horizontal panning of the curve: left-click on the toolbar , move left and right and move right and left fast (Note: When you move to the right to the maximum scale point, it will no longer move to the right).
- b). A single curve vertical translation: left-click and hold the corresponding curve number and drag it up and down to perform a vertical translation.

Graphic import/export:

According to the current graph, data and pictures can be exported at the same time. Only the bak format export is supported. In addition, the exported data can be imported for viewing.

Steps:

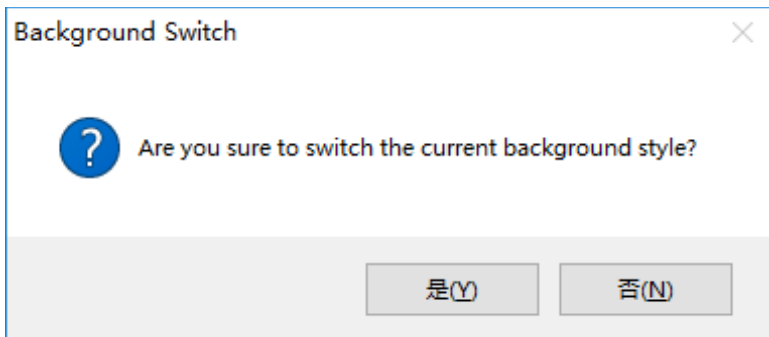
- a). Data import: Click the digital oscilloscope toolbar icon  to pop up the open dialog box and find the existing file.
- b). Data export: Click the toolbar icon  to pop up the save dialog and save it to the specified path.

Background:

Digital oscilloscope display area provides two backgrounds, black color and white color.

Steps:

- a). Click the icon  on the oscilloscope toolbar to display the prompt interface. As shown in the figure below, click OK to switch the display interface.



## 14.7 Others

### 14.7.1 Window Display

The window display is divided into: cascade, horizontal, vertical display, all off;

1. Cascade: click on the main menu of the host computer window [window] -> [cascade display];

2. Horizontal: click on the host computer interface menu bar [window] -> [horizontal display];
3. vertical: click on the main interface of the host computer menu window [window] -> [vertical display];
4. Close: Click on the main window of the host computer menu bar [Window] -> [Close all].

## 14.7.2 Help

Provide servo debug software version and other information, as well as servo drive arm version number, FPGA version number, and some related information of motor, etc.

Steps:

Click the menu bar [Help]->[Product Information] to display the servo unit information, Click the menu bar [Help] -> [About the software] to show the software version information.



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## 15 Appendix

### 15.1 Compliance with Certification and Standard Requirements

| Product directive table |                |            |                          |
|-------------------------|----------------|------------|--------------------------|
| Certification name      | Directive name |            | Standard compliance      |
| CE certification        | EMC Directive  | 2014/30/EU | EN IEC 61800-3           |
|                         | LVD Directive  | 2014/35/EU | EN 61800-5-1<br>EN 60034 |

#### 15.1.1 CE Certification



Figure 15-1 CE certification mark

- "CE Marking" is a mark that indicates compliance with the Low Voltage Safety (LVD) and Electromagnetic Compatibility (EMC) Directives for commercial trade (production, import, and sale) in the European region.  
The CE mark is required for commercial trade (production, import, and sales) in the European region.
- This product complies with the Low Voltage Directive (LVD) and Electromagnetic Compatibility (EMC), and is labeled with the CE mark.
- Machinery and devices in which this product is installed must also meet CE requirements when sold in the European region.
- When the CE mark is affixed to the terminal where this product is installed, the responsibility shall be borne by the customer who finally assembles the product, and it is up to the customer to confirm that the machinery and devices of the final product comply with CE marking.

#### 15.1.2 Conditions of Compliance with EMC Directive

This product complies with the European EMC Directive 2014/30/EU and meets the requirements of the standard EN IEC 61800-3 and is suitable for both Type I and Type II environments.

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

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reliable grounding of the filter and reliable 360° lap of the output cable shield.

**Note:** If used in a Type I environment, this product may cause radio interference. In addition to the CE compliance requirements mentioned in this chapter, the user should take measures to prevent external interference when necessary.

### 15.1.3 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.

EN IEC 61800-3 defines the following two types of environments:

- Type I environment: Facilities that include civil environments and also include facilities that are directly connected to the low-voltage grid supplying power to civil buildings without an intermediate transformer.
- Type II environment: Facilities other than those directly connected to the low-voltage grid supplying power to residential buildings.

The products are classified into the following four categories according to the intended use environment:

- Category C1 equipment: Electrical drive systems with a rated power supply of less than 1000V, used in the first environment.
- Category C2 equipment: The rated voltage of the electrical drive system is less than 1000 V. It cannot be plug-in equipment or removable equipment, and can only be installed and commissioned by professionals when used in the first environment.
- Category C3 equipment: The rated voltage of the electrical drive system is less than 1000 V. It is suitable for the second environment, but not for the first environment.
- Category C4 equipment: The rated voltage of the electrical drive system is not less than 1000 V, or the rated current is not less than 400 A, or in a complex system suitable for the second environment.

### 15.1.4 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.

**Scan the following QR code to download the relevant electronic files:**



**SD700 Servo drive manual**



**SD700 Servo product catalog**