# User Manual

# ISA-7X Servo Drive series

Standard General Purpose Servo Drive Technical Manual

# Revision History

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# PREFACE

Thank you for using our product. The manual provides the information for the use of the ISA-7X servo drive and motor.

The manual is provided as a reference for the following users:

- Designer of the system integration for the machine
- Personnel for installation or wiring
- Personnel for commissioning and tuning
- Personnel for maintenance or inspection

**The content includes:**

- The steps for installation and inspection of the drive and motor
- Description for the formation of wiring for the drive
- Steps for commissioning
- Introduction for the control function and the tuning method of the servo drive
- Description for the parameter function
- Description for the protocol
- Method for inspection and maintenance
- Troubleshooting
- Explanation for the application example

Contact the dealer or our customer service center for any problem with our product.

# Safety precautions

The ISA-7X series is an open type servo drive that must be installed in a shielded control box for operation. The drive uses precise feedback control and combines a digital signal processor (DSP) with high-performance computing. It controls the IGBT to generate current output to drive the three-phase permanent-magnet synchronous motor (PMSM) to achieve precise positioning.
The ISA-7X series can be used for industrial application. It is recommended to install it in the distribution box specified in the manual. (The drive, filament and motor must be installed in an environment that meets the minimum specifications for UL50 Type 1 or NEMA 250 Type 1.)

- **Acceptance inspection**
  - ✧ The servo motor and drive must be used according to specified methods to avoid fire or equipment breakdown.

- **Installation notes**
  - ✧ It is prohibited to use the product in the place exposed to the steam, corrosive or flammable gases, otherwise it may result in electric shock or fire.

- **Wiring notes**
  - ✧ The earth terminal must be connected to Class 3 earthing (below 100Ω). Poor earthing may cause electric shock or fire.
  - ✧ Do not connect the three-phase power supply to U, V and W motor output terminal; otherwise it may result in personal injury or fire.
  - ✧ Secure the set screw of the power supply and motor output terminal, otherwise it may cause fire.

- **Operation notes**
  - ✧ Before the operation of the machinery equipment, the set value must be adjusted according to the user parameter of the machinery equipment. The machinery equipment might lose control or breaks down if the set value is not adjusted to the adequate set value.
  - ✧ Before the operation of the machine, check if the emergency button can be activated anytime for shutdown.
  - ✧ It is prohibited to touch any motor part that is in rotation during motor operation, otherwise it may result in personal injury.
  - ✧ To avoid accidents, separate the coupling from the belt of the machinery equipment and keep them separate before the first commissioning.
  - ✧ When the servo motor and machinery equipment are connected and in operation, operating error may result in the damage of the machinery equipment and occasional personal injury.
  - ✧ Strongly recommended: Test the operation of the servo motor under the unloaded condition and connect the motor to the load afterwards to avoid danger.
  - ✧ Do not touch the radiator of the servo drive in operation, otherwise it may result in burn injuries due to heat.

■ **Maintenance and inspection**

- ✧ Do not touch the interior of the servo drive and motor, otherwise it may cause electric shock.
- ✧ Do not remove the drive panel when the power is on, otherwise it may result in electric shock.
- ✧ Do not touch the wiring terminal within 10 minutes after the power is off. The residual may cause electric shock.
- ✧ Do not remove the servo motor, otherwise it may cause electric shock or personal injury.
- ✧ Do not change the wiring while the power is on, otherwise it may result in electric shock or personal injury.
- ✧ The installation, wiring, repair and maintenance of the servo drive and motor are only allowed for qualified personnel specialized in electrical engineering.

■ **Wiring of the main circuit**

- ✧ Do not thread the power and signal cable into the same channel or bind them. For wiring, the distance between the power and signal cables must be above 30 cm (11.8 in.).
- ✧ As for the signal cable and the encoder signal cable, use the multi-stranded twisted-pair wires and multi-core shielded-pair wires. The length of the signal input cable is up to 3 m (9.84 ft.); the length of the encoder signal cable is up to 20 m (65.62 ft.).
- ✧ High power might remain in the interior of the servo drive after the power is off. Do not touch the power supply terminal for 10 minutes. Check that the "CHARGE" indicator is off before the inspection.

■ **Wiring for the terminal block of the main circuit**

- ✧ Only insert one piece of wire into a wire socket of the terminal block.
- ✧ As for wire insertion, do not short the core wire to the wire nearby.
- ✧ Use the Y terminal to secure the thread of the core wire.
- ✧ Check the wiring for accuracy before power on.

# 1. Panel and Operation

## 1.1. Product check

Damages may be caused by negligence and during delivery when the product is purchased. Check the following items.

Contact the factory or agent for the following.

| Inspection item | Contents |
|---|---|
| Accuracy of the product number | Check if the model number of the motor and drive is the same as the one on the order. Refer to the subsequent chapters for the description of the model number. |
| Smooth rotation of the motor shaft | Turn the motor by hand. The motor operates normally if it can be rotated smoothly. |
| Damage of the appearance | Visually check the appearance of the product for damage. |

The complete parts and components of the server should include:

A servo drive and motor

A power cable of the motor should be available. Connect the cable to the drive in the order of red (U), white (V) and black (W). The green earth line is connected to the earth of the drive.

A signal cable for the motor encoder should be available. One end of the cable is connected to the motor encoder and another end to the CN2 drive.

The 44PIN connector is used for CN1.

The 9PIN connector is used for CN2.

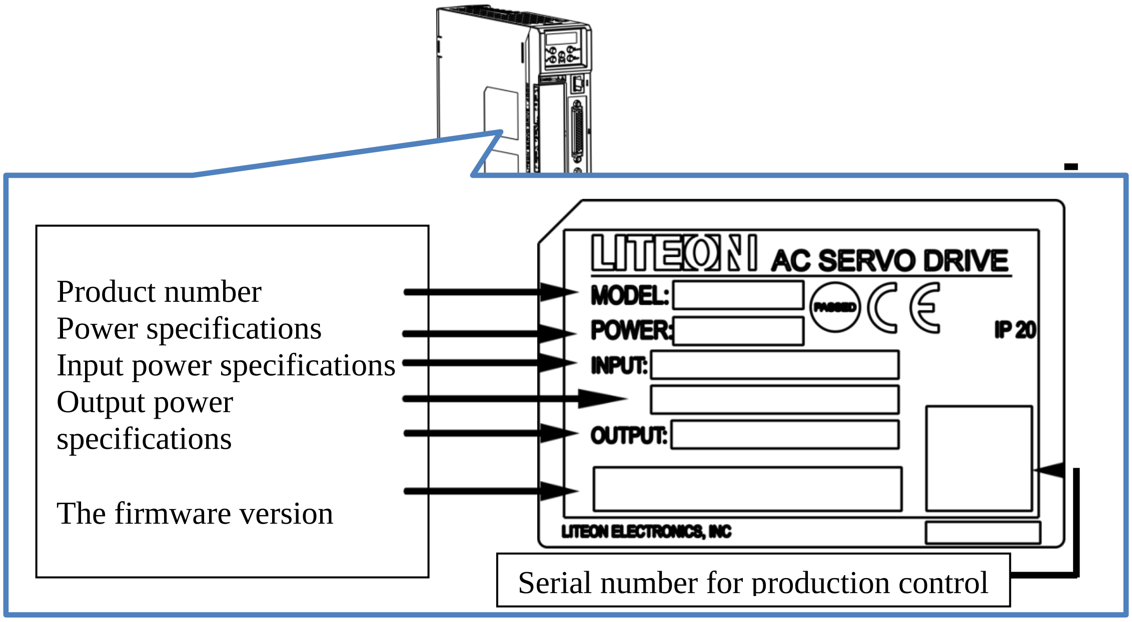
The 8PIN connector is used for CN3.

## 1.2. Comparison of the product numbers

### 1.2.1. Description for the name plate

ISA-7X series servo drive

- Description for the name plate



### 1.2.2. Description for the model number

#### Driver Moden name

ISA 7X □□□ S □

Product type
ISA : Intelligent Servo for Automation

Series
7:7 series
7X: 7X series

Rated power
010 : 100W
020 : 200W
040 : 400W
075 : 750W
100 : 1kW
150 : 1.5kW
200 : 2kW

Version
S: Standard version

Input power
1 : 220V 1&3Φ
2 : 220V 3Φ

#### Motor Moden name

IOSMPH A 04 010 M C 1 N

Motor series
SM motor

Rated Speed
A : 3000rpm
B : 2000rpm

Frame
04 : 40mm
06 : 60mm
08 : 80mm
13 : 130mm

Rated Power
010 : 100W
020 : 200W
040 : 400W
075 : 750W
1D0 : 1kW
1D5 : 1.5kW
2D0 : 2kW

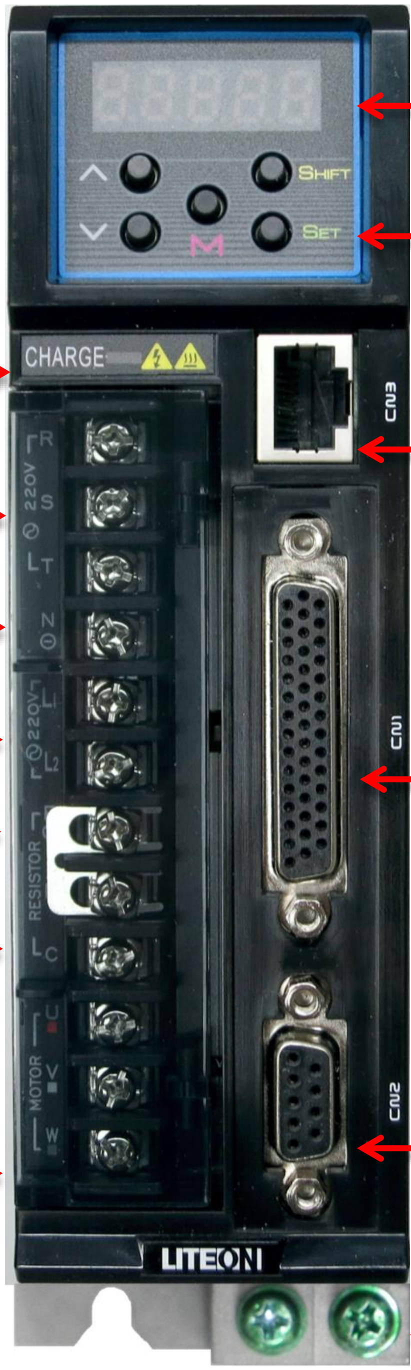
Inertia
M : Medium
L : Low

Encoder
C : Absolute encoder 20-bit single-turn
D : Absolute encoder 20-bit single-turn
+ 16-bit multi-turn
F : Absolute encoder 23-bit single-turn
+ 16-bit multi-turn

Shaft end
1: With key shaft, without oil seal
3: With key shaft, with oil sea

Brake
N: Without brake
E: With brake

## 1.3. Name of each part in the servo drive




Seven-segment display: It has five digits and shows the drive status or alarm.

Operating button: It can be used to switch the parameter/function and execute the monitoring setting.
MODE: It is used to return to the previous level or switch the status.
UP／DOWN: It is used to add or minus one.
SET: It is used to confirm the setting.
SHIFT: It is used to move the digit to the left.

Power indicator: There is voltage remained in the main circuit when the light is on.

CN3: It is used to connect to the PC software.

Power supply of the main circuit: R, S and T are connect to the commercial power supply (AC 200~230 V 50/60 Hz).

N - : DCV $_{BUS-}$

Power supply of the control circuit: The L1 and L2 supply for the single-phase 100~230Vac and 50/60 Hz power supply

CN1: It is used to connect to the upper controller, such as the PLC or industrial computer.

P + : DCV $_{BUS+}$

Regenerative resistor:
1) When the external regenerative resistor is used, the P and C ends connect to the resistor and the P and D ends are open-circuit.
2) When the internal regenerative resistor is used, the P and C ends are open-circuit and the P and D ends must be short-circuit.

CN2: It is used to connect to the motor encoder.

Motor power output: It is used to connect to the motor UVW cable.

Do not connect to the power supply of the main circuit. Wrong connections may result in drive damage!

Earth terminal

## 1.4. Operating mode

This drive provides numerous operating modes for the user. These modes are shown as follow:

<table>
<tr><th colspan="2">Mode name</th><th>Mode code</th><th>Description</th></tr>
<tr><td rowspan="5">Single mode</td><td>Position mode<br>(Terminal input)</td><td>P</td><td>The drive receives the position command and controls the motor to move to the target position.<br>The position command is input from the terminal block. The signal type is pulse.</td></tr>
<tr><td>Speed mode</td><td>S</td><td>The drive receives the speed command and controls the motor to reach the target rotational speed.<br>The internal register provides the speed command (three registers available) or the external terminal block inputs the analog voltage (-10V ~ +10V).<br>The command selection is based on the DI signal.</td></tr>
<tr><td>Speed mode<br>(no analog input)</td><td>Sn</td><td>The drive receives the speed command and controls the motor to reach the target rotational speed.<br>The speed command can only be provided by the internal register (three registers available). It can't be provided by the external terminal block. The command selection is based on the DI signal. The DI status of the external input in the original S mode is the speed command zero.</td></tr>
<tr><td>Torque mode</td><td>T</td><td>The drive receives the torque command and controls the motor to reach the target torque.<br>The torque command can be provided by the internal register (three registers available).<br>It is also possible to input the analog voltage from the external terminal block (-10V ~ +10V).<br>The command selection is based on the DI signal.</td></tr>
<tr><td>Torque mode<br>(no analog input)</td><td>Tn</td><td>The drive receives the torque command and controls the motor to reach the target torque.<br>The torque command can only be provided by the internal register (three registers available). It can't be provided by the external terminal block. The command selection is based on the DI signal. The DI status of the external input in the original T mode is the torque command zero.</td></tr>
<tr><td colspan="2" rowspan="3">Mixed mode</td><td>S-P</td><td>S and P can be switched via the DI signal.</td></tr>
<tr><td>T-P</td><td>T and P can be switched via the DI signal.</td></tr>
<tr><td>S-T</td><td>S and T can be switched via the DI signal.</td></tr>
</table>

The mode can be selected via the PA-01 parameter. After the new mode is set, the power is transmitted to the drive. The new mode then becomes effective!

# 2. Steps for Commissioning and Tuning

## 2.1. Notes

The user must pay attention to the following:

- Do not pull the connecting line between the servo drive and motor tight.
- The servo drive must be fastened at every securing spot.
- The axle center of the servo motor must be centered to the axle rod adequately.
- If the connecting line between the servo drive and motor exceeds 20 m (65.62 ft.), the UVW line must be thickened. The connecting line of the encoder shall also be thickened.
- The four set screws of the servo motor must be fastened.

## 2.2. Condition of the storage environment

The product must be placed in the packing box before installation. Pay attention to the following for storage to make sure that the product condition is applicable to our warranty and future maintenance if the drive wouldn't be used for the moment:

- The product must be placed in a dustless and dry place.
- The ambient temperature of the storage location must be kept within -20°C ~ +65°C (-4°F ~ 149°F).
- The relative humidity of the storage location must be kept within 0% and 90%without condensation.
- Do not store the product in the environment with corrosive gas or liquid.
- The product should be packed properly and stored on the shelf or platform.

## 2.3. Condition of installation environment

Operating temperature:

- ISA-7X series servo drive: 0°C ~ 55°C (32°F ~ 131°F)
- ISA-7X series servo motor: 0°C ~ 40°C (32°F ~ 104°F)

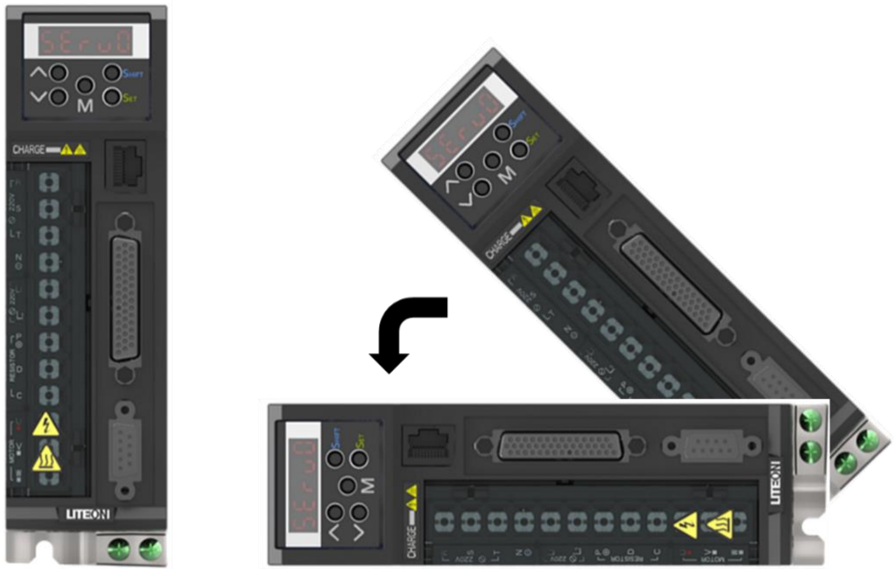
The product must be placed in a well ventilated area if the ambient temperature exceeds 45°C. If the product is placed in the distribution box, the size and ventilation of the distribution box must be able to prevent the electronic device in the distribution box from overheating. Pay attention to see if the machine vibration affects the electronic device of the distribution box.
Besides, the following must be observed for the selection of the installation location. If not, our server product might not be applicable to our warranty and future maintenance:

- Our server product can be installed in places without heat emitting device, water drop, steam, dust, oil dust, corrosive or flammable gas or liquid, floating dust or metal particle. It can also be installed in stable places without vibration or interference of electromagnetic noise.
- Keep the temperature and humidity of the place where the servo drive and motor are installed within the specified range.
- Do not store the servo drive or motor in the place with the vibration exceeding the specified degree.
- Make sure that the servo drive and motor are stored in locations that conform to the environmental specifications stated in our manual.

## 2.4. Direction of and space for installation

Notes:

- The direction for installation must conform to the specifications to prevent malfunction.
- To ensure the cooling circulation remains effective, it is required to keep a sufficient space between the upper, lower, left and right sides of the servo drive and the object and guard plate (wall) nearby for the installation of the AC servo drive. If not, it may cause breakdown.
- Do not seal the air inlet and outlet of the servo drive during installation or tilt the servo drive, otherwise it may result in malfunction.




Correct

Wrong

Drive installation:

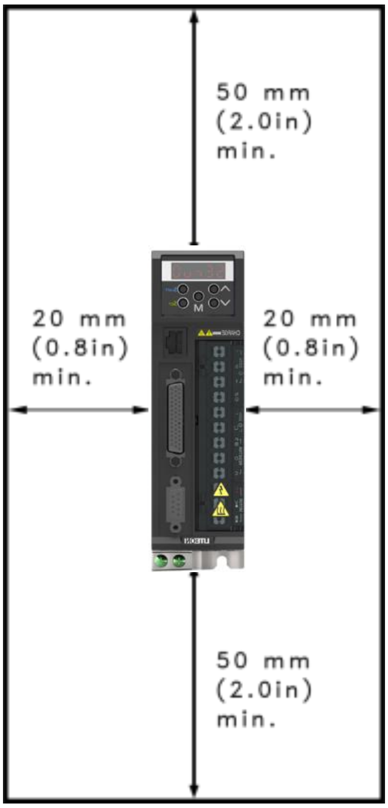
- The ISA-7X series server drive must be installed vertically on a dry and stable platform complying to the NEMA standard. To ensure the circulation of ventilation air and heat radiation remain effective, it is required to keep a sufficient space between the upper, lower, left and right sides of the servo drive and the object and guard plate (wall) nearby for the installation of the AC servo drive. (It is recommended to leave a free space of 50 mm, which is about 2 in.) Leave the space required for wiring, if necessary. Besides, the bracket or platform for drive installation must be made of materials with great thermal conductivity to prevent the platform and drive from overheating.

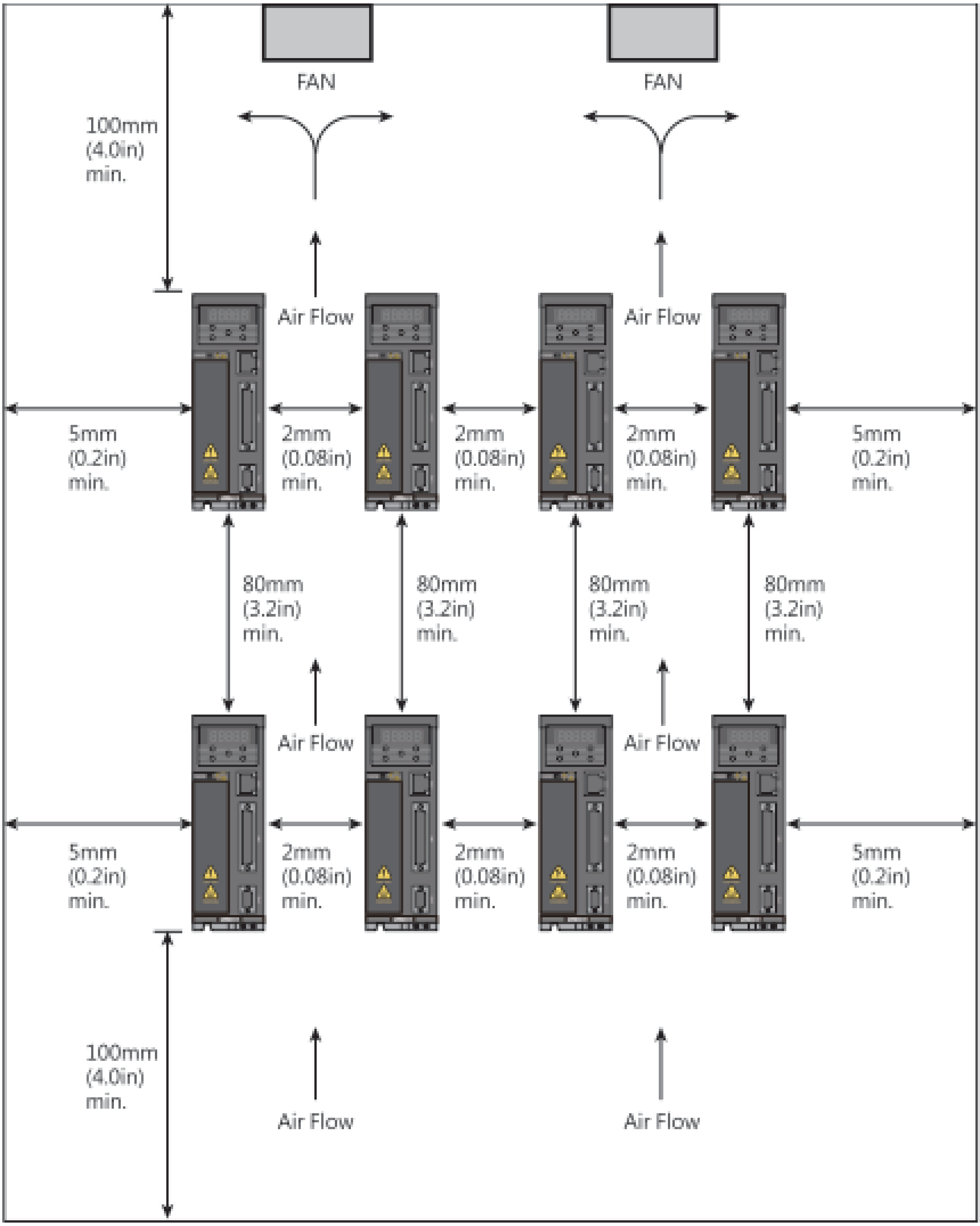
Motor installation:

- The ECMA series servo motor must be installed properly on a dry and stable platform. Ensure the circulation of the ventilation air and heat radiation remain effective for installation and keep the earth adequate.

## Installation diagram

The windage of the radiator fan must be reduced for effective heat emission. The suggested distance for one-to-many AC servo drives must be observed. (Refer to the figure below.)




FAN
FAN
100mm
(4.0in)
min.
Air Flow
Air Flow
5mm
(0.2in)
min.
2mm
(0.08in)
min.
2mm
(0.08in)
min.
2mm
(0.08in)
min.
5mm
(0.2in)
min.
80mm
(3.2in)
min.
80mm
(3.2in)
min.
80mm
(3.2in)
min.
80mm
(3.2in)
min.
Air Flow
Air Flow
5mm
(0.2in)
min.
2mm
(0.08in)
min.
2mm
(0.08in)
min.
2mm
(0.08in)
min.
5mm
(0.2in)
min.
100mm
(4.0in)
min.
Air Flow
Air Flow

## 2.5. Recommended specifications for the circuit breaker and fuse

Strongly recommended: CSA / UL certified fuse and circuit breaker

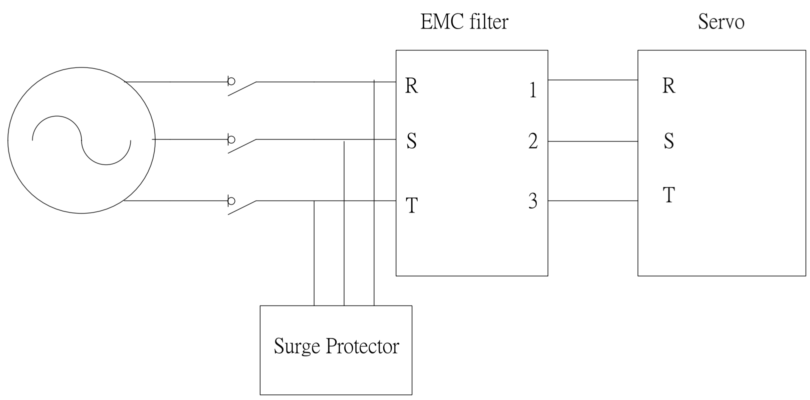
| Drive model | Circuit breaker | Fuse |
|---|---|---|
| Operating Mode | Normal | Normal |
| ISA-7X-010-A1 | 5A | 6A |
| ISA-7X-020-A1 | 10A | 10A |
| ISA-7X-040-A1 | 10A | 20A |
| ISA-7X-075-A1 | 15A | 25A |
| ISA-7X-100-A1 | 20A | 40A |
| ISA-7X-150-A2 | 30A | 50A |

## 2.6. EMI filter selection

### Notes for the installation of the EMI filter

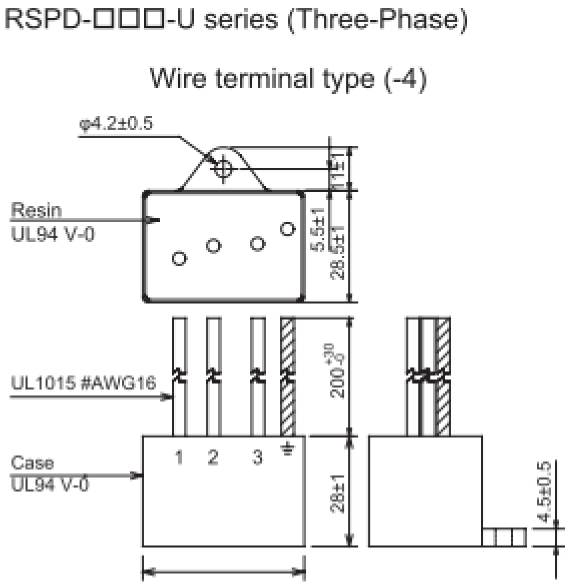
All electronic equipment (including the servo drive) generates certain high or low frequency noises during normal operation. Such noises interfere with the peripheral equipment via transmission or radiation. The interference can be minimized with correct installation of an appropriate EMI filter. Suppose that the servo drive and EMI filter are installed and wired according to the manual, we can be sure that they comply with the following standards:

1. EN61000-6-4（2001）
2. EN61800-3 （2004） PDS of category C2
3. EN55011+A2（2007） Class A Group 1



Surge Protector

| Model | Rated Voltage | DC Breakdown | Current Life 8/20μs-1,000A | Marker |
|---|---|---|---|---|
| RSPD-250-U4 | 250Vac | 700+-25% | Approx. 300times | OKAYA |




EMC Filter

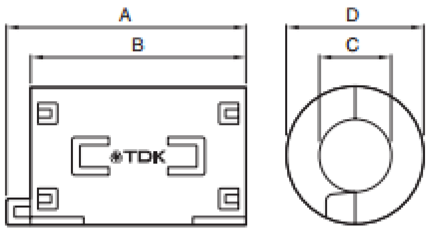
| Item | Power | Servo Drive | EMI Filter model number | | Marker |
|---|---|---|---|---|---|
| | | | 1PH | 3PH | |
| 1 | 200W | ISA-7X-020-A1 | B84113C0000x110 | B84143A0008R105 | EPCOS |
| 3 | 400W | ISA-7X-040-A1 | B84113C0000x110 | B84143A0008R105 | EPCOS |
| 4 | 750W | ISA-7X-075-A1 | B84113C0000x110 | B84143A0008R105 | EPCOS |
| 5 | 1000W | ISA-7X-100-A1 | B84113C0000x110 | B84143A0016R105 | EPCOS |
| 6 | 1500W | ISA-7X-150-A2 | - | B84143A16R105 | EPCOS |
| 7 | 2000W | ISA-7X-200-A2 | - | B84143A16R105 | EPCOS |

| Item | Power | Servo Drive | EMI Filter model number | | Marker |
|---|---|---|---|---|---|
| | | | 1PH | 3PH | |
| 1 | 200W | ISA-7X-020-A1 | TBD | FN 351 H-8-29 | Schaffner |
| 3 | 400W | ISA-7X-040-A1 | TBD | FN 351 H-8-29 | Schaffner |
| 4 | 750W | ISA-7X-075-A1 | TBD | FN 351 H-8-29 | Schaffner |

| | | | | | |
|---|---|---|---|---|---|
| 5 | 1000W | ISA-7X-100-A1 | TBD | FN 351 H-8-29 | Schaffner |
| 6 | 1500W | ISA-7X-150-A2 | - | FN3258-30-47 | Schaffner |
| 7 | 2000W | ISA-7X-200-A2 | - | FN3258-30-47 | Schaffner |

Clamp filter
<24V Power cable, Motor cable, Encoder cable, Interface cable>

■SHAPE & DIMENSIONS




| Manufacture's Part No. | Manufacturer | A | B | C | D |
|---|---|---|---|---|---|
| ZCAT3035-1330 | TDK | 39 +- 1 | 34 +- 1 | 13 +- 1 | 30 +- 1 |

## Installation notes

We hope that the EMI filter elaborates the maximum suppression against the interference from the servo drive. Therefore the servo drive must be installed and wired according to the manual. Furthermore, the following must be noted:

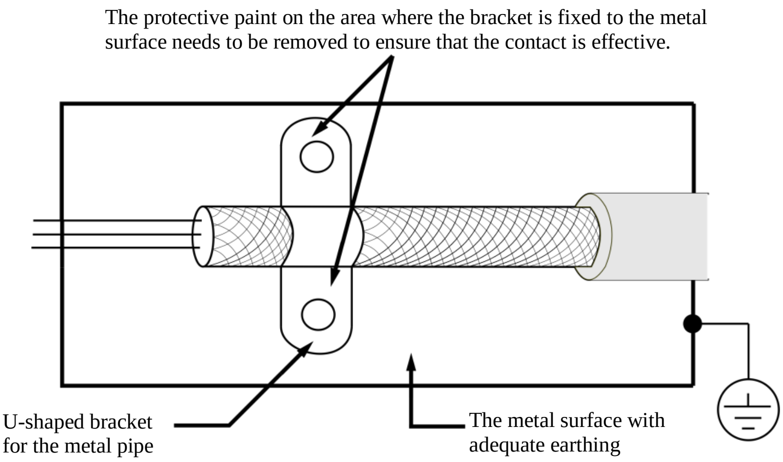
1. The servo drive and EMI filter must be installed on the same metal surface.
2. For the installation of the servo drive and EMI filter, the servo drive should be installed above the EMI filter, if possible.
3. The wiring must be as short as possible.
4. Adequate earthing is required for the metal surface.
5. The metal case or earth of the servo drive and EMI filter must be fixed firmly to the metal surface. The contact surface between the metal case or earth and the metal area must be as large as possible.

## Selection of and installation notes for the motor wire

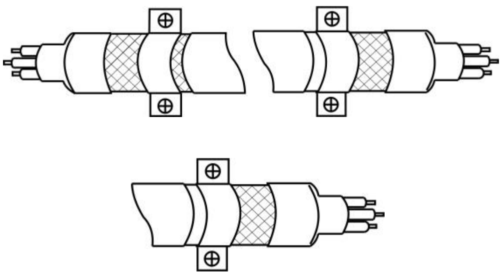
The selection and installation of the motor wire are associated with whether the EMI filter can elaborate the maximum suppression against the interference from the servo drive. Note the following:

1. The cable with copper mesh for separation must be used (double separation preferred).
2. The copper mesh for separation on both ends of the motor wire must be grounded with shortest distance and largest contact area.

The protective paint on the area where the U-shaped bracket for the metal pipe is fixed to the metal surface needs to be removed to ensure that the contact is effective. Refer to the figure as follows.




3. The copper mesh for separation of the motor wire must be connected adequately to the metal surface. The U-shaped bracket for the metal pipe should be used to fix the copper mesh for separation at both ends of the motor wire to the metal surface. See the figure below for the correct connection.



## 2.7. Selection for the regenerative resistor

If the output torque and rotating speed are in opposite directions, the energy is transmitted from the loading end into the drive. The energy entered the capacitor of the DC bus so that the voltage of the capacitor increases. The energy recharged can only be consumed by the regenerative resistor when the voltage rises to a certain value. The regenerative resistor is included in the drive and available for external connection.

The table below lists the specifications of the regenerative resistor offered by the ISA-7X series.

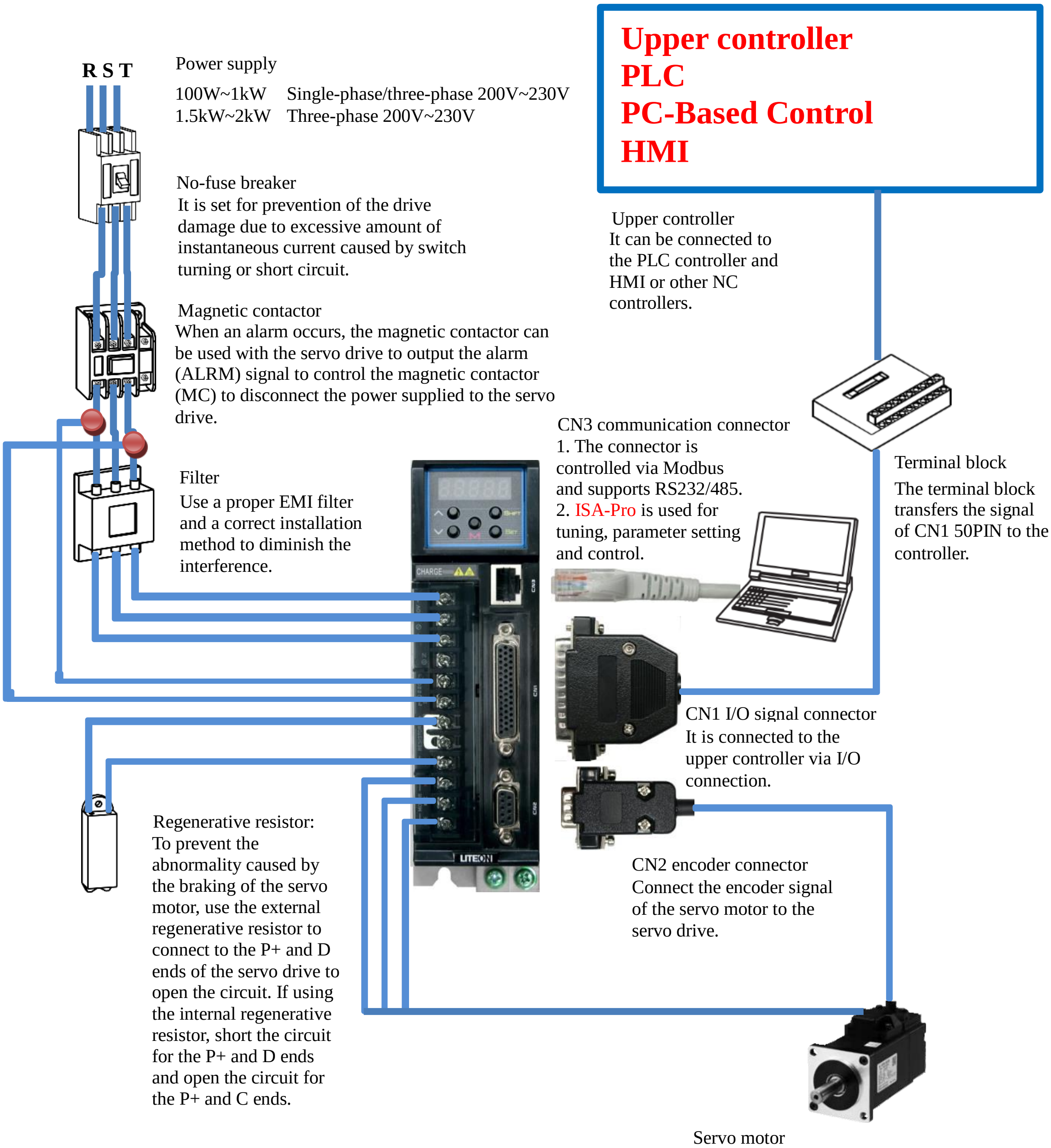
| Drive (kW) | Specifications of the built-in regenerative resistor | | The regenerative capacity processed by the built-in regenerative resistor | Minimum resistance tolerable |
|---|---|---|---|---|
| | Resistance (PD-45) | Capacity (PD-46) | | |
| 0.2 | -- | -- | -- | 40 |
| 0.4 | 40 | 40 | 20 | 40 |
| 0.75 | 40 | 40 | 20 | 40 |
| 1.0 | 40 | 40 | 20 | 40 |
| 1.5 | 20 | 100 | 50 | 20 |
| 2.0 | 20 | 100 | 50 | 20 |

# 3. Wiring

The chapter explains the connecting method of the servo drive and the meaning of all signals. It also lists the illustration of the standard wiring in various modes.

## 3.1. Connection for the peripheral device and main power circuit

### 3.1.1. Wiring diagram of the peripheral device



**Installation notes:**

1. Make sure that the power supply and wiring for the R S T and L1 and L2 must be accurate.
2. Make sure that the phase sequence regarding the wiring for the servo motor output U V W is correct. The motor will not work if the connection is wrong and an alarm will occur.
3. When using the external regenerative resistor, open the circuit for the P and D ends and connect the external regenerative resistor to the P and C ends. When using the internal external regenerative resistor, short the circuit for the P and D ends and open the circuit for the P and C ends.

   If using the external braking unit, connect P+ and P- of the braking unit to the P and N ends of the servo motor. Open the circuit for the P and D ends, as well as the P and C ends.
4. For the alarm or emergency stop, use ALM or WARN output to disconnect the magnetic contactor (MC) to cut off the power supply of the servo drive.

## 3.1.2. Connector and terminal of the drive

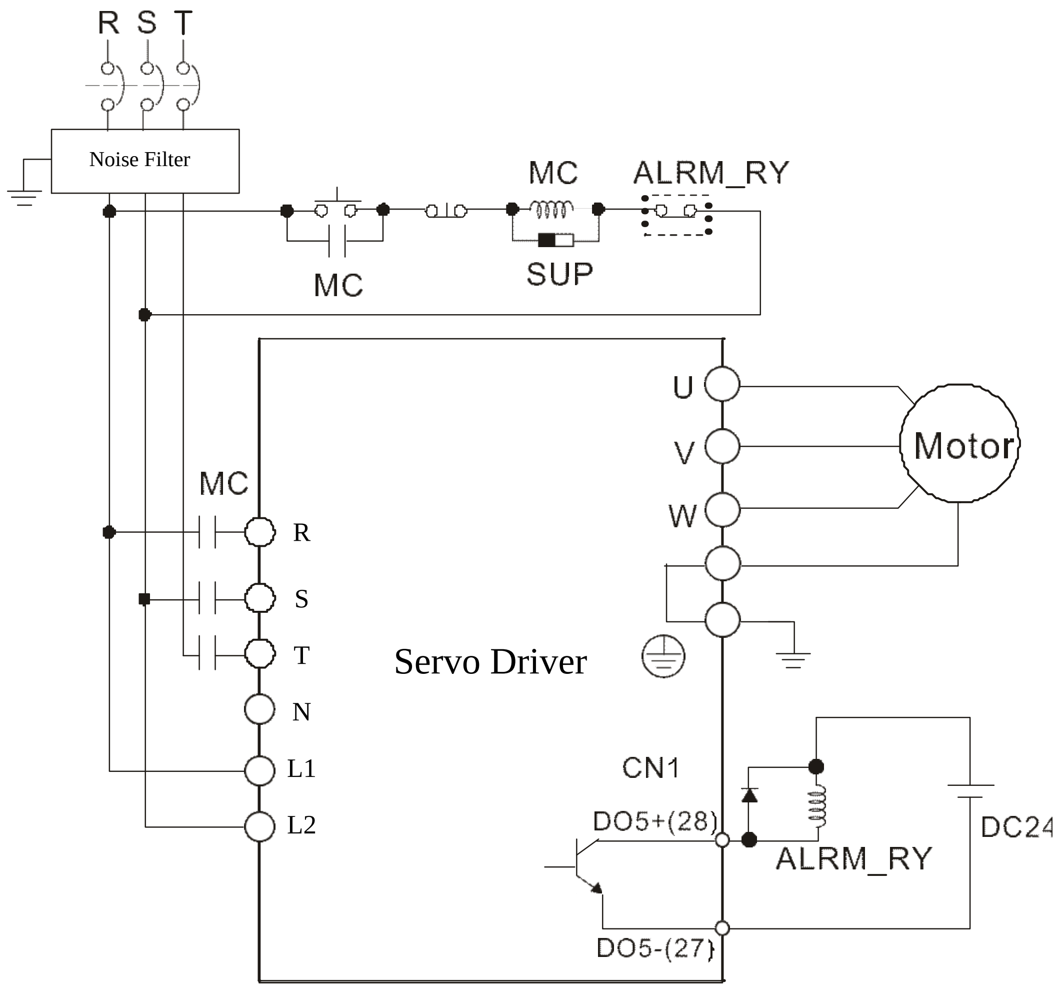
| Indication | Name | Description | |
|---|---|---|---|
| **R, S, T** | Three-phase main circuit for RST power input | Connect the three-phase AC power supply. (Select adequate input voltage based on the product number.) | |
| **L1, L2** | Control power input end | Connect the single-phase AC power supply. (Select adequate input voltage based on the product number.) | |
| **U, V, W**<br>**FG** | Motor power cable | Connect the cable to the motor. U (red) V (white) W (black) and FG (green) connect to the grounding area of the drive. ⏚ | |
| **P, D,**<br>**C,** | Regenerative resistor (braking resistor) contact | Use the internal resistor. | Make sure that it is short circuited between P and D and it is open circuited between P and C. |
| | | Use the external resistor. | Connect the regenerative resistor to P and C. Make sure that it is open circuited between P and D. |
| | | Use the external braking unit. | Connect P+ and P- of the braking unit to the P and N ends of the servo motor. Open the circuit for the P and D ends, as well as the P and C ends. |
| ⏚ | Electrical connection terminal | The contact for the earth wire of the power supply and motor | |
| **CN1** | I/O connector cable | It connects to the upper controller. | |
| **CN2** | Encoder connector | It connects to the motor encoder. | |
| **CN3** | Communication connector | It connects to the computer. | |
| **CN5** | *Analog voltage output terminal* | The monitoring (output) of the analog data, including MON1, MON2, GND | |

The following must be noted for wire connecting:

1. When the power is cut off, do not touch the six major power lines R, S, T and U, V, W. It is allowed to touch the lines after the charging light goes off.
2. Keep the six major power linesR, S, T and U, V, W away from other signal cables. Try to keep the distance above 30 cm.
3. For extending the connecting line for encoder CN2, use the twisted-pair signal cable with isolated grounding. Keep the cable within 20 m. If its length exceeds 20 m, use the one with the wire diameter twice larger than the current one to keep the signal level from excessive attenuation.

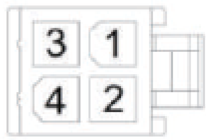
### 3.1.3. Power wiring

The servo drive and power wiring can be divided into the single- and three-phase. The single-phase can only be used for models with the power equal to 1kW or below. In the diagram, Power On is for Point a. Power Off and ALRM_RY are for Point b. MC indicates the coil of the magnetic contactor and self-holding power. It connects to the power supply of the main circuit.



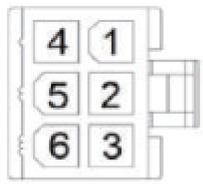
### 3.1.4. Specifications for the U, V, W connectors of the motor

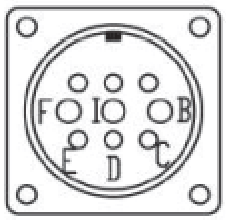
<table>
<tr><th>Motor number</th><th>U, V, W connector</th></tr>
<tr>
<td>100W~750W<br>IOSMPHA04010M□□□A<br>IOSMPHA06020M□□□A<br>IOSMPHA06040M□□□A<br>IOSMPHA08075M□□□A<br>Series</td>
<td>
Withnot brake connector




<table>
<tr><th>Pin</th><th>Singal</th></tr>
<tr><td>1</td><td>U</td></tr>
<tr><td>2</td><td>V</td></tr>
<tr><td>3</td><td>W</td></tr>
<tr><td>4</td><td>PE</td></tr>
</table>

With brake connector




<table>
<tr><th>Pin</th><th>Singal</th></tr>
<tr><td>1</td><td>U</td></tr>
<tr><td>2</td><td>V</td></tr>
<tr><td>4</td><td>W</td></tr>
<tr><td>5</td><td>PE</td></tr>
<tr><td>3</td><td>Brake_24V</td></tr>
<tr><td>6</td><td>Brake_0V</td></tr>
</table>
</td>
</tr>
<tr>
<td>1kW-2kW<br>IOSMPHB131D0M□□□A<br>IOSMPHB131D5M□□□A<br>IOSMPHB132D0M□□□A<br>Series</td>
<td>


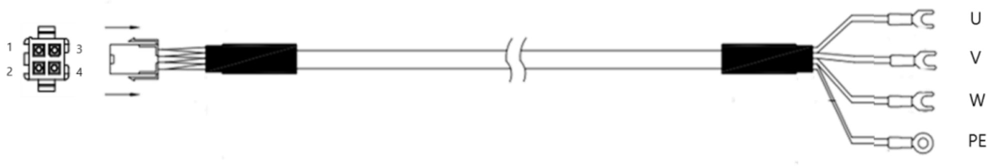

Withnot brake connector

<table>
<tr><th>Pin</th><th>Singal</th></tr>
<tr><td>E</td><td>PE</td></tr>
<tr><td>F</td><td>U</td></tr>
<tr><td>I</td><td>V</td></tr>
<tr><td>B</td><td>W</td></tr>
<tr><td>C</td><td>N/A</td></tr>
<tr><td>D</td><td>N/A</td></tr>
</table>

With brake connector

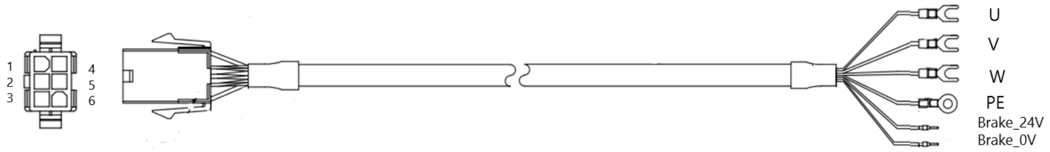
<table>
<tr><th>Pin</th><th>Singal</th></tr>
<tr><td>E</td><td>PE</td></tr>
<tr><td>F</td><td>U</td></tr>
<tr><td>I</td><td>V</td></tr>
<tr><td>B</td><td>W</td></tr>
<tr><td>C</td><td>N/A</td></tr>
<tr><td>D</td><td>N/A</td></tr>
</table>
</td>
</tr>
</table>

100W~750W（Withnot Brake）：



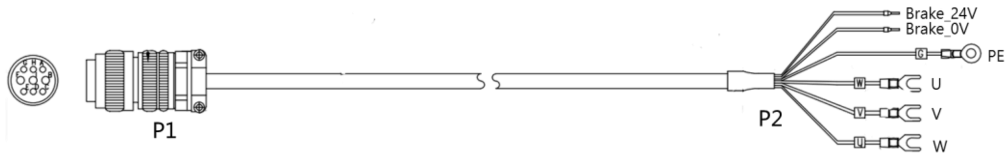

| P1 | P2 |
|---|---|
| 4-core connect | terminal |
| 1 | U |
| 2 | V |
| 3 | W |
| 4 | PE |

100W~750W（With Brake）：




| P1 | P2 |
|---|---|
| 6-core connect | terminal |
| 1 | U |
| 2 | V |
| 4 | W |
| 5 | PE |
| 3 | Brake_24V |
| 6 | Brake_0V |

1kW~2kW：




| P1 | P2 |
|---|---|
| Military connector | terminal |
| F | U |
| I | V |
| B | W |
| E | PE |
| C | Brake_24V ( with Brake ) |
| D | Brake_0V ( with Brake ) |

*Note：

1. For 1~2kW motors, if the motor does not have a brake, it is not necessary to connect the Brake_24V and Brake_0V signals.
2. Select the multi-core wire with the knitted wire mesh for the filament. The knitted wire mesh must be connected to the SHIELD end.

### 3.1.5. Filament selection

The following table shows the filament recommended for each terminal and signal wiring of the LITEON ISA-7X drive:

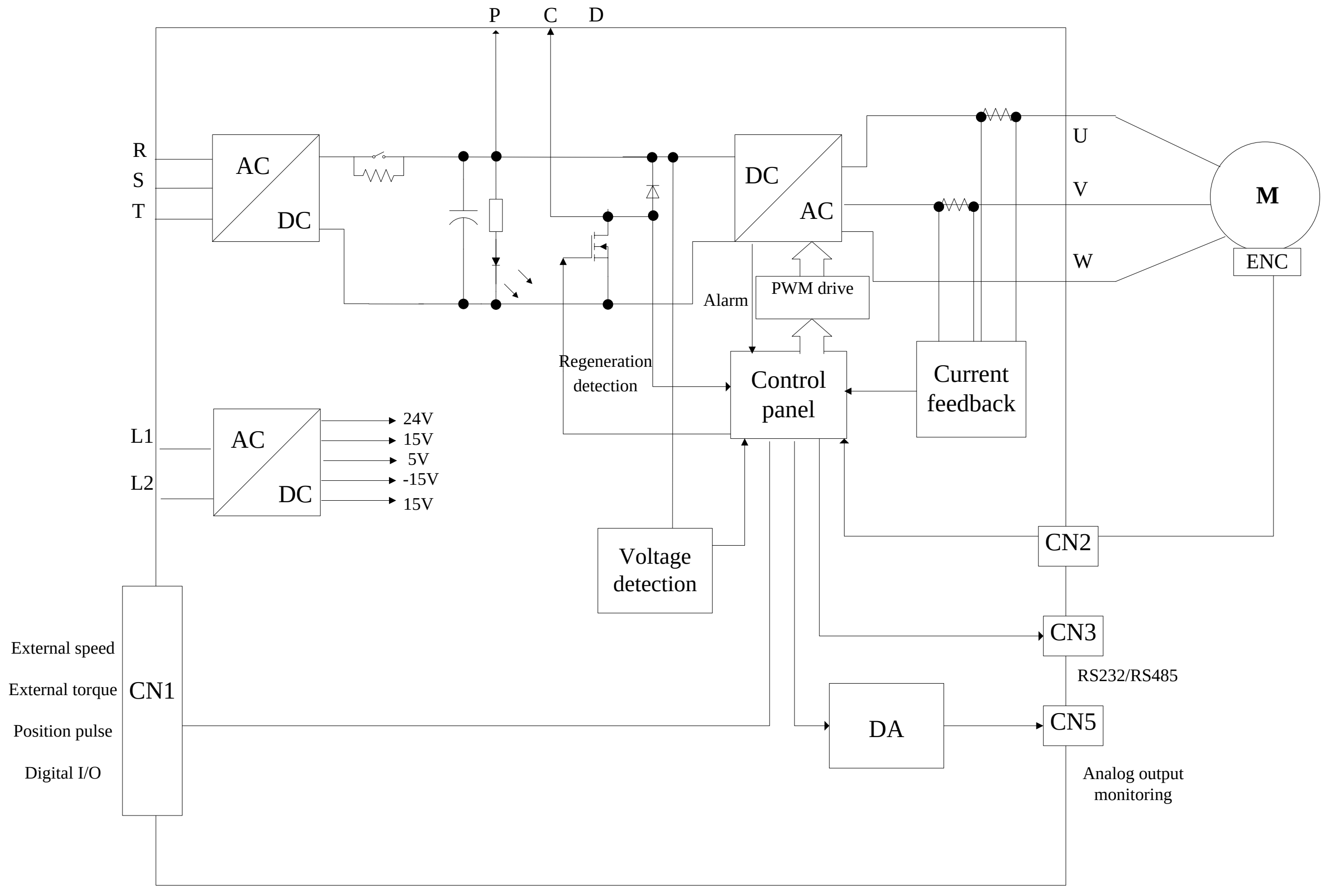
| Drive and corresponding motor number | | Power wiring- wire diameter ($mm^2$) (AWG) | | | |
|---|---|---|---|---|---|
| | | L1, L2 | R, S, T | U, V, W | P, C |
| ISA-7X-010-A1 | IOSMPHA04010M | 1.3 ( AWG16 ) | 2.1 ( AWG14 ) | 0.82 ( AWG18 ) UL2517 | 2.1 ( AWG14 ) |
| ISA-7X-020-A1 | IOSMPHA06020M | 1.3 ( AWG16 ) | 2.1 ( AWG14 ) | 0.82 ( AWG18 ) UL2517 | 2.1 ( AWG14 ) |
| ISA-7X-040-A1 | IOSMPHA06040M | 1.3 ( AWG16 ) | 2.1 ( AWG14 ) | 0.82 ( AWG18 ) UL2517 | 2.1 ( AWG14 ) |
| ISA-7X-075-A1 | IOSMPHA08075M | 1.3 ( AWG16 ) | 2.1 ( AWG14 ) | 2.1 ( AWG14 ) UL2733 | 2.1 ( AWG14 ) |
| ISA-7X-100-A1 | IOSMPHB131D0M | 1.3 ( AWG16 ) | 2.1 ( AWG14 ) | 2.1 ( AWG14 ) UL2733 | 2.1 ( AWG14 ) |
| ISA-7X-150-A2 | IOSMPHB131D5M | 1.3 ( AWG16 ) | 2.1 ( AWG14 ) | 2.1 ( AWG14 ) UL2733 | 2.1 ( AWG14 ) |

| Drive model | Encoder wiring - wire diameter ($mm^2$) (AWG) | | | |
|---|---|---|---|---|
| | Size of core wire | Number of core wires | Standards for wire type | Standard wire length |
| ISA-7X-010-A1 | 0.21 ( AWG24 ) | 9 | UL2464 | 3M |
| ISA-7X-020-A1 | 0.21 ( AWG24 ) | 9 | UL2464 | 3M |
| ISA-7X-040-A1 | 0.21 ( AWG24 ) | 9 | UL2464 | 3M |
| ISA-7X-075-A1 | 0.21 ( AWG24 ) | 9 | UL2464 | 3M |
| ISA-7X-100-A1 | 0.21 ( AWG24 ) | 9 | UL2464 | 3M |
| ISA-7X-150-A2 | 0.21 ( AWG24 ) | 9 | UL2464 | 3M |

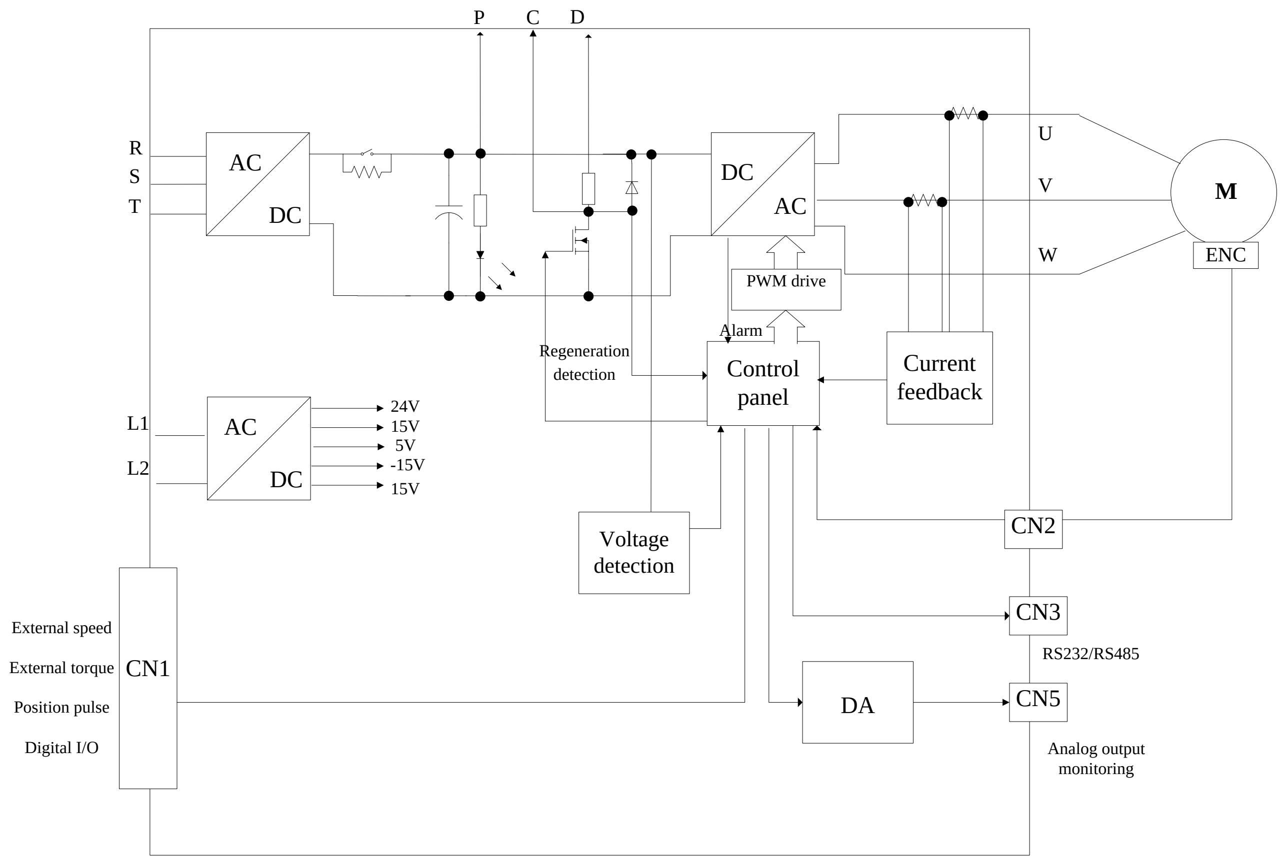
1. Use the shielded twisted-pair cable for the wiring of the encoder to mitigate the interference of the noise.
2. The wire mesh ⏚ must be connected to the SHIELD end.
3. The wiring depends on the filament selected to avoid accidents.

# 3.2. Basic block diagram of the server system

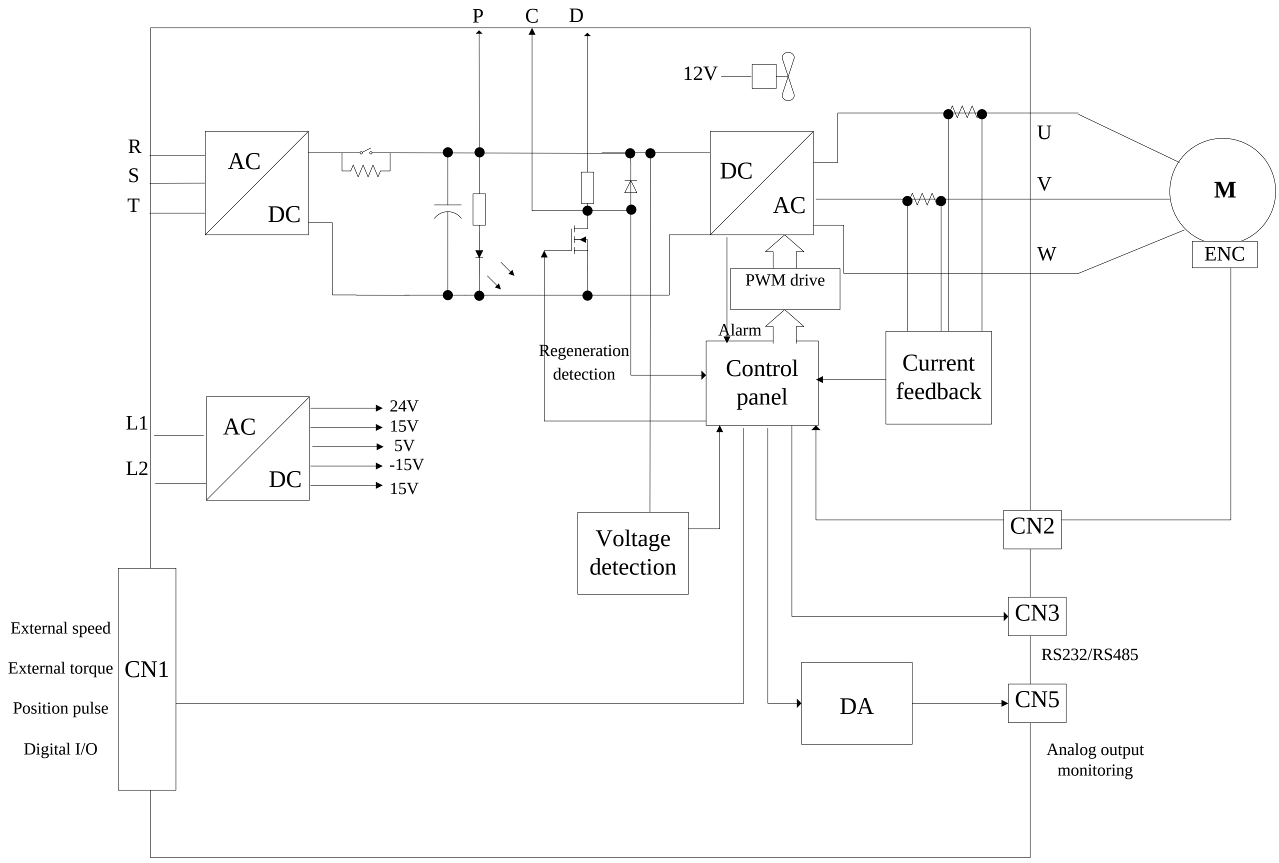
## 3.2.1. Models with the power equal to or below 200W (no built-in regenerative resistor or fan)



## 3.2.2. 400W / 750W model (with regeneration resistor but no fan)



## 3.2.3. 1kW ~ 2kW model (with regeneration resistor and fan)



## 3.3. CN1 I/O Signal wiring

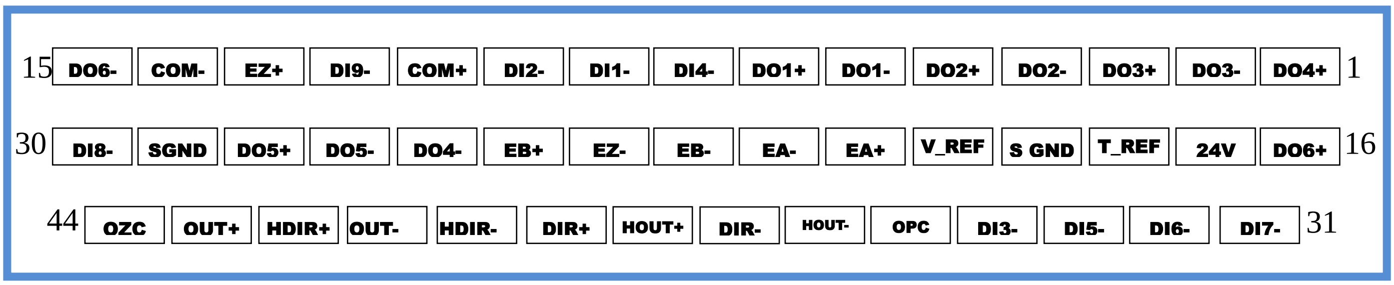
### 3.3.1. CN1 I/O layout of the connector terminal

ISA-7X provides 6 sets of outputs and 9 sets of inputs that can be planned as wish. ISA-7X also offers the signals of the differential output encoder, which are A+, A-, B+, B-, Z+ and Z-. In addition, it providesthe analog torque command input, analog speed/position command input and pulse position command input. Its pin-out diagram is as follows:


Front view

Side view


Rear view




| | | | | | |
|---|---|---|---|---|---|
| **1** | DO4+ | Digital output | **23** | EB- | Encoder B pulse output |
| **2** | DO3- | Digital output | **24** | EZ- | Encoder Z pulse output |
| **3** | DO3+ | Digital output | **25** | EB+ | Encoder B pulse output |
| **4** | DO2- | Digital output | **26** | DO4- | Digital output |
| **5** | DO2+ | Digital output | **27** | DO5- | Digital output |
| **6** | DO1- | Digital output | **28** | DO5+ | Digital output |
| **7** | DO1+ | Digital output | **29** | S GND | Grounding of the analog input signal |

| | | | | | |
|---|---|---|---|---|---|
| **8** | DI4- | Digital Input | **30** | DI8- | Digital Input |
| **9** | DI1- | Digital Input | **31** | DI7- | Digital Input |
| **10** | DI2- | Digital Input | **32** | DI6- | Digital Input |
| **11** | COM+ | Power input end<br>(12~24V) | **33** | DI5- | Digital Input |
| **12** | DI9- | Digital Input | **34** | DI3- | Digital Input |
| **13** | EZ+ | Encoder Z pulse<br>Differential output | **35** | OPC | External power supply of the command pulse |
| **14** | COM- | VDD (24V)<br>Grounding of the power supply | **36** | HOUT- | High speed position<br>Command pulse (-) |
| **15** | DO6- | Digital output | **37** | DIR- | Position command symbol (-) |
| **16** | DO6+ | Digital output | **38** | HOUT+ | High speed position<br>Command pulse (+) |
| **17** | 24V | +24V power output<br>(for external I/O) | **39** | DIR+ | Position command symbol (+) |
| **18** | T Ref | Analog command input torque | **40** | HDIR- | High speed position<br>Command symbol (-) |
| **19** | S GND | Grounding of the analog input signal | **41** | OUT- | Position command pulse (-) |
| **20** | V Ref | Analog command input speed (+) | **42** | HDIR+ | High speed position<br>Command symbol (+) |
| **21** | EA+ | Encoder A pulse output | **43** | OUT+ | Position command pulse (+) |
| **22** | EA- | Encoder/A pulse output | **44** | OZC | Encoder Z pulse<br>Open collector |

## 3.3.2. CN1 I/O Connector signal

General signal

| Name | | Pin No | Function | Remark |
|---|---|---|---|---|
| **Analog command (input)** | V Ref | 20 | (1) The speed command of the motor -10V ~ +10V indicates the rotation speed -3000~ +3000 r/min (default). The corresponding range can be changed via the parameter. | |
| | T Ref | 18 | The torque command of the motor -10V ~ +10V indicates the rated torque command -100% ~+100%. | |
| **Position pulse command (input)** | OUT+<br>OUT-<br>DIR+<br>DIR-<br>OPC(PULL HI) | 43<br>41<br>39<br>37<br>35 | The position pulse can be input via the line driver (maximum single-phase pulse frequency 500KHz) or open collector (maximum single-phase pulse frequency 200KHz). Three command forms are available (forward reverse pulse, pulse and direction, as well as AB phase pulse) and can be selected via the parameter.<br>When the position pulse is input via the open collector, the terminal must be connected to an external power supply for level increasing. | |
| **High speed position pulse command (input)** | HOUT+<br>HOUT-<br>HDIR+<br>HDIR- | 38<br>36<br>42<br>40 | The high speed position pulse only allows the input via the line driver (+5V). The maximum single-phase pulse frequency is 4 MHz. For the command forms, three pulse types are available, which are AB phase, CW+CCW, as well as plus and direction. | |
| **Position pulse command (output)** | EA+<br>EA- | 21<br>22 | The A, B and Z signals of the encoder are output via the line driver. | |
| | EB+<br>EB- | 25<br>23 | | |
| | EZ+<br>EZ- | 13<br>24 | | |
| | OZC | 44 | The encoder Z-phase with the open collector | |
| **Power supply** | 24V | 17 | The VDD is the +24V power supply provided by the drive. It can be used for the DI and DO signals and it has a resistor of 500mA. | |
| | COM+<br>COM- | 11<br>14 | The COM+ is the command end for DI voltage input. When the VDD is used for the voltage, the VDD must be connected to COM+. If the VDD is not used, the user must provide the external power supply (+12V ~ +24V). The positive pole of the external power supply must connect to COM+ and the negative pole to COM-. | |
| | S GND | 19 | Grounding of the analog input signal | |

The user selects the operating mode based on his or her own need and refers to the DI/DO table to find out the default DI/DO signal in the selected mode and the Pin No of the signal for wiring. The following table lists the default DI/DO signal function and pin number:

Description for the default DO signal

| DO Name | Operating Mode | Pin No | | Function | Remark |
|---|---|---|---|---|---|
| | | + | - | | |
| **SRDY** | ALL | 7 | 6 | After the drive is electrified, this input is ON if there is no alarm (ALRM) for the control circuit and motor power circuit. | |
| **SVON** | | | | If the input SVON is ON, this input is ON after it is confirmed that the motor servo circuit operates smoothly. | |
| **ZSPD** | ALL | 5 | 4 | If the rotation speed of the motor is less than the set value of the parameter (PC-20), this input is ON. | |
| **RSPD** | ALL (P excluded) | | | If the actual rotation speed (r/min) of the motor exceeds the set value of the parameter (PD-43), this input is ON. | |
| **INP** | P, P-S, P-T | 16 | 15 | If the error (PULSE) between the motor command and the actual position is less than the set value of the parameter (PA-20), this input is ON. | |
| **ALM** | ALL | 28 | 27 | An alarm occurs for the servo drive. (The WARN is input when the positive and negative limits, emergency stop, communication abnormality and low voltage occur.) | |
| **BREAK** | ALL | | | The control contact of the electromagnetic brake | |
| **OLW** | ALL | | | When the overload level setting is reached, the input is ON. | |
| **WARN** | ALL | | | Warning output of the servo drive<br>The warning output is generated when the positive and negative limits, emergency stop, communication abnormality and low voltage occur. | |
| **S_CMP** | S, Sn | | | If the error value between the speed command and motor feedback speed is below the set value of the parameter (PC-23), this input is ON. | |
| **HomOK** | Msc | | | When the origin return is completed, the output is ON. | |
| **MscBusy** | Msc | | | When the Msc function is executed, the output is ON. | |
| **MscDelay** | Msc | | | When the Msc function is executed delay, the output is ON. | |
| **CamPrdOn** | Msc | | | When the e-cam drive shaft completes one cycle, it will toggle (Toggle) this DO level once. | |

The following describes the default DI signal.

| DI Name | Operating Mode | Pin No | Function | Remark |
|---|---|---|---|---|
| **SVON** | ALL | 9 | If the mode is ON, the servo circuit is activated and the motor coil is excited. | |
| **ARST** | ALL | 33 | After the alarm (ALRM) occurs, this signal is used to reset the drive to output the Ready (SRDY) signal again. | |
| **GAINUP** | ALL | | It is used to switch the controller gain. | |
| **CCLR** | P | | It is used to clear the error counter. | |
| **ZCLMP** | ALL | | If this signal is ON and the motor speed is below the set value of the parameter PC-20, the position of the motor is locked to the one that the signal is generated instantly. | |
| **CMDV** | T, S | | If this signal is ON, the direction that the motor moves to is reversed. | |
| **TRQL** | S, Sn | 10 | ON indicates that the torque limiting command is effective. | |
| **SPDL** | T, Tn | 10 | ON indicates that the speed limiting command is effective. | |
| **SPD0** | S, Sn, PT-S, S-T | 34 | The source of the speed command is selected: | |
| **SPD1** | | 8 | SPD1 / SPD0 / Command Source<br>0 / 0 / The S mode is the analog input;<br>0 / 1 / Parameter setting<br>1 / 0 / Parameter setting<br>1 / 1 / Parameter setting | |
| **TCM0** | PT,T, Tn, PT-T | 34 | The source of the torque command is selected: | |
| **TCM1** | S-T | 8 | TCM1 / TCM0 / Command Source<br>0 / 0 / The T mode is the analog input;<br>0 / 1 / Parameter setting<br>1 / 0 / Parameter setting<br>1 / 1 / Parameter setting | |
| **S-P** | P-S | 31 | It is used for switching of the mixed mode. OFF: Speed; ON: Position | |
| **S-T** | S-T | 31 | It is used for switching of the mixed mode. OFF: Speed; ON: Torque | |
| **T-P** | P-T | 31 | It is used for switching of the mixed mode. OFF: Torque; ON: Position | |
| **EMG** | ALL | 30 | B contact is used. This mode must be conducted (ON) often, otherwise the drive shows an alarm (ALRM). | |
| **NL** | P, S, T Sn, Tn | 32 | This mode indicates the CCW-limit. B contact is used. This mode must be conducted (ON) often, otherwise the drive shows an alarm (ALRM). | |
| **PL** | PT, S, T Sn, Tn | 31 | This mode indicates the CW-limit. B contact is used. This mode must be conducted (ON) often, otherwise the drive shows an alarm (ALRM). | |
| **TLLM** | | | It indicates the reverse torque limit. | |
| **TRLM** | | | It indicates the forward torque limit. | |
| **JOGEN** | ALL | | It allows the selection of the jog function for external terminals. This signal must be connected to use the jog function for external terminals. | |
| **JOGU** | ALL | | When the signal is connected, the motor moving forward changes to inching rotation. | |
| **JOGD** | ALL | | When the signal is connected, the motor moving in reverse changes to inching rotation. | |
| **GNUM0** | P, P-S | | Select 0 for the electronic gear ratio. (The numerator of the gear ratio available (PA-11 ~ PA-13)) | |
| **GNUM1** | P, P-S | | Select 1 for the electronic gear ratio. (The numerator of the gear ratio available (PA-11 ~ PA-13)) | |
| **INHP** | P, P-S | | The pulse input is prohibited. In the position mode, the external | |

<table>
<tr><td></td><td></td><td></td><td>pulse input command is ineffective when this signal is connected.</td><td></td></tr>
<tr><td>MscNo1</td><td>Msc</td><td></td><td rowspan="6">Select the source of the Msc command:<br>Map the MscNo1~6 DI status to a specific MSC numbering instruction
<table>
<tr><td>No6</td><td>No5</td><td>No4</td><td>No3</td><td>No2</td><td>No1</td><td>Msc command source</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>No command</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>PG61 set value</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>PG62 set value</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>PG63 set value</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>PG64 set value</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>PG65 set value</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>PG65 set value</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>PG67 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>PG68 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>PG69 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>PG70 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>PG71 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>PG72 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>PG73 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>PG74 set value</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>PG75 set value</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>No.16 command</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>No.17 command</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>No.18 command</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>No.19 command</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>No.20 command</td></tr>
<tr><td colspan="7">Other DI status combinations, see 7.6.5</td></tr>
</table></td><td></td></tr>
<tr><td>MscNo2</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscNo3</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscNo4</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscNo5</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscNo6</td><td>Msc</td><td></td><td></td></tr>
<tr><td>Hom</td><td>Msc</td><td></td><td>Origin return</td><td></td></tr>
<tr><td>Org</td><td>Msc</td><td></td><td>Origin signal trigger</td><td></td></tr>
<tr><td>MscTrg</td><td>Msc</td><td></td><td>Start the Msc command with the Msc No. status</td><td></td></tr>
<tr><td>MscEv1</td><td>Msc</td><td></td><td rowspan="4">Msc command source and start：
<table>
<tr><td>DI</td><td>Type</td><td colspan="2">Msc Command</td></tr>
<tr><td rowspan="2">Ev1</td><td>Upper limit</td><td rowspan="2">PG76 set value</td><td>High value</td></tr>
<tr><td>Lower limit</td><td>Low value</td></tr>
<tr><td rowspan="2">Ev2</td><td>Upper limit</td><td rowspan="2">PG77 set value</td><td>High value</td></tr>
<tr><td>Lower limit</td><td>Low value</td></tr>
<tr><td rowspan="2">Ev3</td><td>Upper limit</td><td rowspan="2">PG78 set value</td><td>High value</td></tr>
<tr><td>Lower limit</td><td>Low value</td></tr>
<tr><td rowspan="2">Ev4</td><td>Upper limit</td><td rowspan="2">PG79 set value</td><td>High value</td></tr>
<tr><td>Lower limit</td><td>Low value</td></tr>
</table></td><td></td></tr>
<tr><td>MscEv2</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscEv3</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscEv4</td><td>Msc</td><td></td><td></td></tr>
<tr><td>MscStp</td><td>Msc</td><td></td><td>Stop the MSC execution.</td><td></td></tr>
<tr><td>CamOn</td><td>Msc</td><td></td><td>The electronic cam performs the trigger.</td><td></td></tr>
<tr><td>CamZp</td><td>Msc</td><td></td><td>The electronic cam drive shaft phase angle is reset to zero.</td><td></td></tr>
<tr><td>Msc-P</td><td>P-Msc</td><td></td><td>Mixed mode switching, OFF: Position ON: PR.</td><td></td></tr>
<tr><td>Msc-S</td><td>S-Msc</td><td></td><td>Mixed mode switching, OFF: Speed ON: PR.</td><td></td></tr>
<tr><td>MscBusy</td><td>Msc<br>S-Msc<br>P-Msc</td><td></td><td>When the PR position command is executed, the signal is triggered.</td><td>See 7.6.12</td></tr>
<tr><td>MscStRd</td><td>Msc<br>S-Msc<br>P-Msc</td><td></td><td>When a non-absolute and indexed position command is executed, the trigger causes the system to stop the PR command.</td><td>See7.6.12</td></tr>
</table>

The default DIs and DOs under each operating mode are arranged as follows:
Table for definitions of the default DI input

## 3.3.3. Table 1 DI definition table of input default.

| Name | DI Code | Input function | P | S | T | Sn | Tn | PS | PT | ST | Msc | MscP | MscS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DISABLE | 0x00 | No function | DI9 | DI9 | DI9 | DI9 | DI9 | | | | | | |
| SVON | 0x01 | Servo on | DI1 | DI1 | DI1 | DI1 | DI1 | DI1 | DI1 | DI1 | DI1 | DI1 | DI1 |
| ARST | 0x02 | Error reset | DI5 | DI5 | DI5 | DI5 | DI5 | DI5 | DI5 | DI5 | DI5 | | |
| GAINUP | 0x03 | Gain switching | | | | | | | | | | | |
| CCLR | 0x04 | Pulse cleaning | DI2 | | | | | DI2 | DI2 | | | | |
| ZCLMP | 0x05 | Zero speed clamping | | | | | | | | | | | |
| CMDV | 0x06 | Command input reverse control | | | | | | | | | | | |
| TRQL | 0x07 | Torque limit | | DI2 | | DI2 | | | | DI2 | | | |
| SPDL | 0x08 | Speed limit | | | DI2 | | DI2 | | | | | | |
| SPD0 | 0x09 | Selection of Speed Command 0 | | DI3 | | DI3 | | DI3 | | DI3 | | | DI3 |
| SPD1 | 0x0A | Selection of Speed Command 1 | | DI4 | | DI4 | | DI4 | | DI4 | | | DI4 |
| TCM0 | 0x0B | Selection of Torque Command 0 | DI3 | | DI3 | | DI3 | | DI3 | DI6 | | | |
| TCM1 | 0x0C | Selection of Torque Command 1 | DI4 | | DI4 | | DI4 | | DI4 | DI7 | | | |
| S-P | 0x0D | Switching of the speed/position mixed mode | | | | | | DI9 | | | | | |
| S-T | 0x0E | Switching of the speed/torque mixed mode | | | | | | | | DI9 | | | |
| T-P | 0x0F | Switching of the torque/position mixed mode | | | | | | | DI9 | | | | |
| AENC_E | 0x10 | Absolute encoder terminal function start | | | | | | | | | | | |
| AENC_C | 0x11 | Absolute encoder pulse value reset | | | | | | | | | | | |
| AENC_Q | 0x12 | The position of the hand that is held as a terminal transmission | | | | | | | | | | | |
| EMG | 0x15 | Emergency stop | DI8 | DI8 | DI8 | DI8 | DI8 | DI8 | DI8 | DI8 | DI8 | DI5 | |
| NL | 0x16 | Limit of reverse inhibition | DI6 | DI6 | | DI6 | | DI6 | | | DI6 | | DI5 |
| PL | 0x17 | Limit of forward inhibition | DI7 | DI7 | | DI7 | | DI7 | | | DI7 | DI8 | DI8 |
| JOGEN | 0x19 | Selection of the jog control for the terminal | | | | | | | | | | DI6 | DI6 |
| JOGU | 0x1A | Forward jog input | | | | | | | | | | DI7 | DI7 |
| JOGD | 0x1B | Reverse jog input | | | | | | | | | | | |
| MscStRd | 0x1F | System stops PR command | | | | | | | | | | | |
| MscBusy | 0x20 | System PR position completed | | | | | | | | | | | |
| GNUM0 | 0x21 | Selection of the | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Numerator of the Electronic Gear Ratio 0 | | | | | | | | | | | |
| GNUM1 | 0x22 | Selection of the Numerator of the Electronic Gear Ratio 1 | | | | | | | | | | | |
| MscNo1 | 0x26 | Msc command selection 1 | | | | | | | | | | | |
| MscNo2 | 0x27 | Msc command selection 2 | | | | | | | | | | | |
| MscNo3 | 0x28 | Msc command selection 3 | | | | | | | | | | | |
| MscNo4 | 0x29 | Msc command selection 4 | | | | | | | | | | | |
| MscNo5 | 0x2A | Msc command selection 5 | | | | | | | | | | | |
| MscNo6 | 0x2B | Msc command selection 6 | | | | | | | | | | | |
| Hom | 0x2C | Origin return | | | | | | | | | | | |
| Org | 0x2D | Origin signal trigger | | | | | | | | | | | |
| MscTrg | 0x2E | Msc starts the command according to the No1~4 state. | | | | | | | | | | | |
| MscEv1 | 0x2F | Msc command selection and start 1 | | | | | | | | | DI2 | | |
| MscEv2 | 0x30 | Msc command selection and start 2 | | | | | | | | | DI9 | | |
| MscEv3 | 0x31 | Msc command selection and start 3 | | | | | | | | | | DI2 | DI2 |
| MscEv4 | 0x32 | Msc command selection and start 4 | | | | | | | | | DI3 | DI9 | DI9 |
| MscStp | 0x33 | Msc command stops immediately | | | | | | | | | DI4 | | |
| CamOn | 0x34 | E-cam execution trigger | | | | | | | | | | DI3 | |
| CamZp | 0x35 | E-cam drive shaft phase angle zeroing trigge | | | | | | | | | | DI4 | |

### 3.3.4. Table 2 DO definition table of output default.

Table for definitions of the default DO output

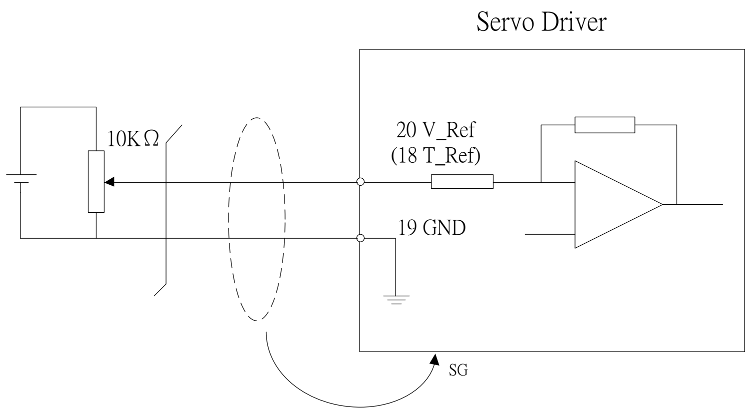
| Name | DO code | Output Function | P | S | T | Sn | Tn | PS | PT | ST | **Msc** | **MscP** | **MscS** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SRDY | 0x01 | Servo ready | DO1 | DO1 | DO1 | DO1 | DO1 | DO1 | DO1 | DO1 | DO1 | DO1 | DO1 |
| SVON | 0x02 | Servo on | DO4 | DO4 | DO4 | DO4 | DO4 | DO4 | DO4 | DO4 | DO4 | DO4 | DO4 |
| ZSPD | 0x03 | Zero speed detection | DO2 | DO2 | DO2 | DO2 | DO2 | DO2 | DO2 | DO2 | | | |
| RSPD | 0x04 | Target speed reached | DO3 | DO3 | DO3 | DO3 | DO3 | DO3 | DO3 | DO3 | | | |
| INP | 0x05 | Target position reached | DO6 | | | | | DO6 | DO6 | | DO6 | DO6 | DO6 |
| ALM | 0x06 | Servo alarm | DO5 | DO5 | DO5 | DO5 | DO5 | DO5 | DO5 | DO5 | DO5 | DO5 | DO5 |
| BREAK | 0x07 | Electromagnetic brake | | | | | | | | | | | |
| OLW | 0x08 | Overload alert | | | | | | | | | | | |
| TQL | 0x09 | Torque limit | | | | | | | | | | | |
| WARN | 0x0A | Servo warning | | | | | | | | | | | |
| SNL | 0x0B | Software limit (reverse direction) | | | | | | | | | | | |
| SPL | 0x0C | Software limit (forward direction) | | | | | | | | | | | |
| AENC_D | 0x0D | Absolute encoder data output pin | | | | | | | | | | | |
| AENC_ERR | 0x0E | Absolute encoder related alarm output | | | | | | | | | | | |
| SP_IN | 0x0F | Speed reaching output | | | | | | | | | | | |
| HomOk | 0x13 | Origin return completio | | | | | | | | | DO2 | DO2 | DO2 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n output | | | | | | | | | | | |
| MscBusy | 0x14 | Msc command execution output | | | | | | | | | DO3 | DO3 | DO3 |
| MscDelay | 0x15 | Msc command execution output in delay time | | | | | | | | | | | |
| CamPrdOn | 0x16 | When the e-cam drive shaft completes one cycle, it will toggle (Toggle) this DO level once. | | | | | | | | | | | |

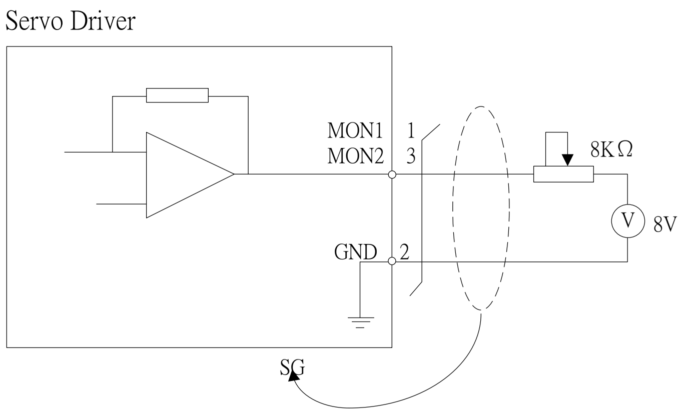
## 3.3.5. Interface wiring diagram (CN1)

The analog monitoring output relates to MON1 and MON2. The effective voltage range for the speed and torque analog command input is -10V ~ +10V. The command value corresponding to the voltage range may be set via the relevant parameter. The input impedance is 10K.

Analog command input for the speed and torque

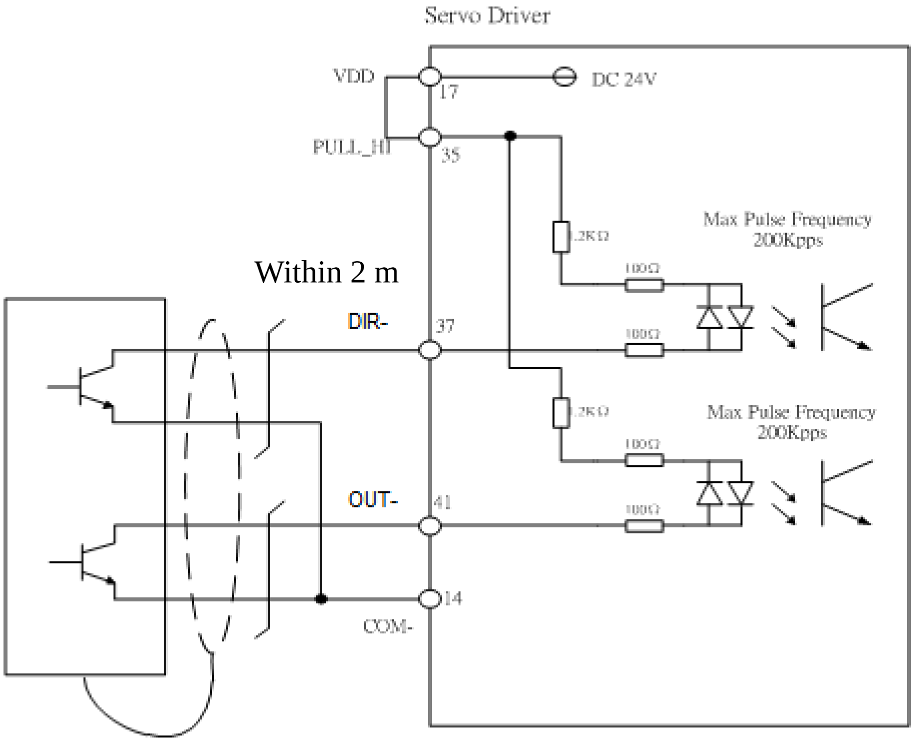



Analog monitoring output MON1, MON2

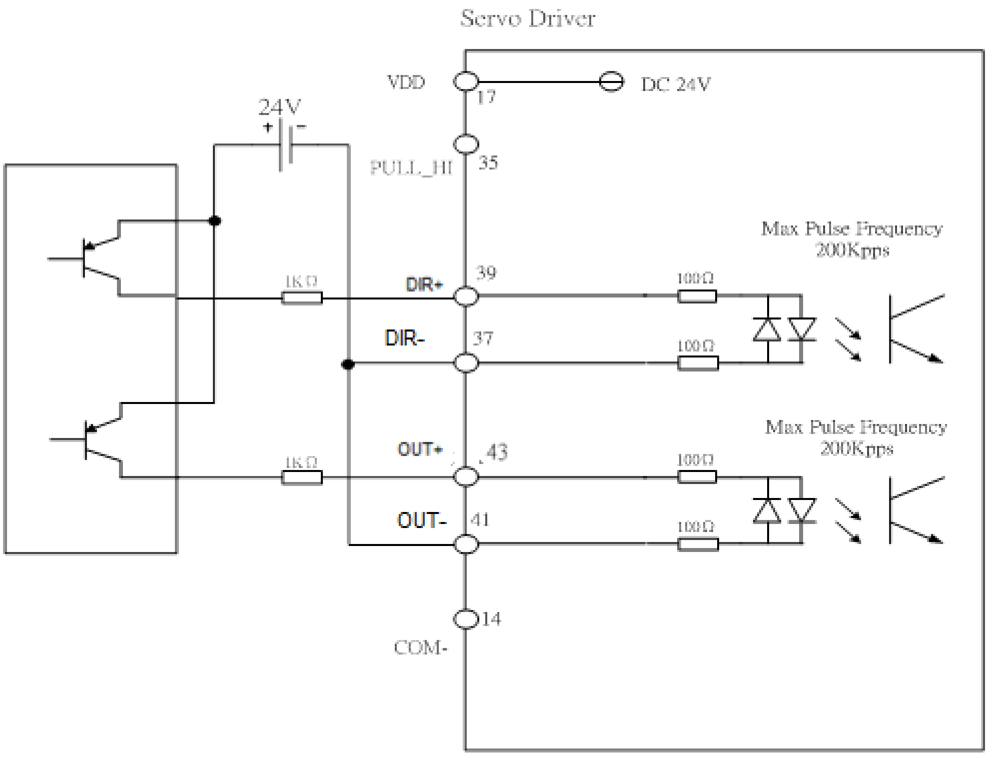


The pulse command can be input via the open collector or line driver. The maximum input pulse for the input via the line driver is 500 Kpps. The maximum input pulse for the open collector is 200 Kpps. The wire length is within 2m.

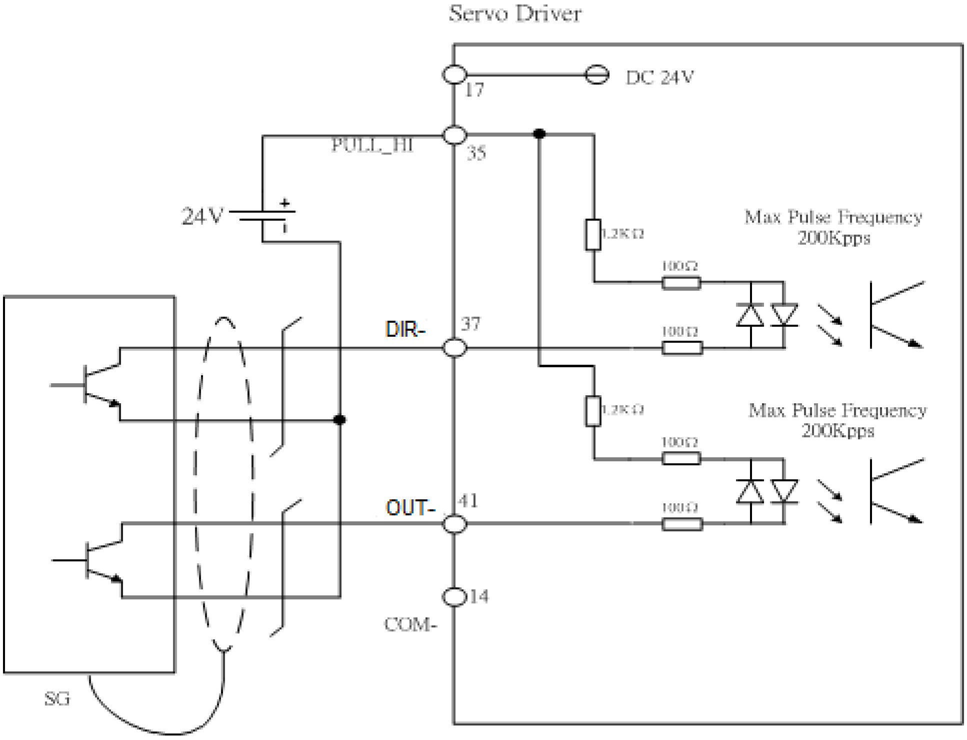
The pulse input source is the NPN type open collector. The power supply in the drive is used.




The pulse input source is the PNP type open collector. The power supply in the drive is used.

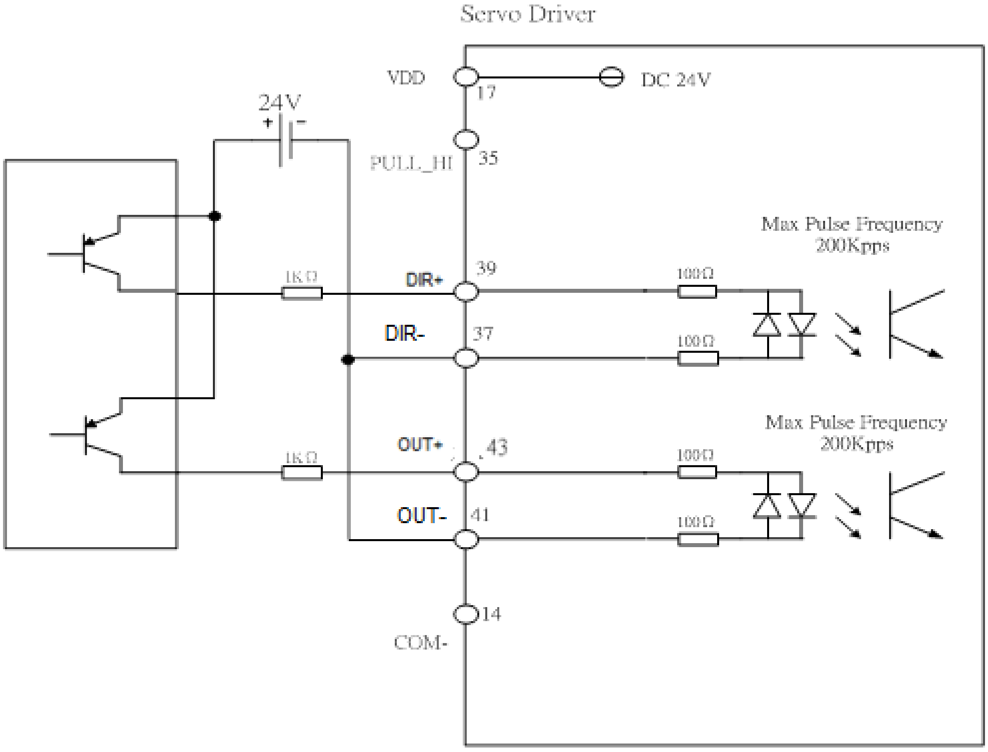


The pulse input source is the NPN type open collector. The external power supply is used.



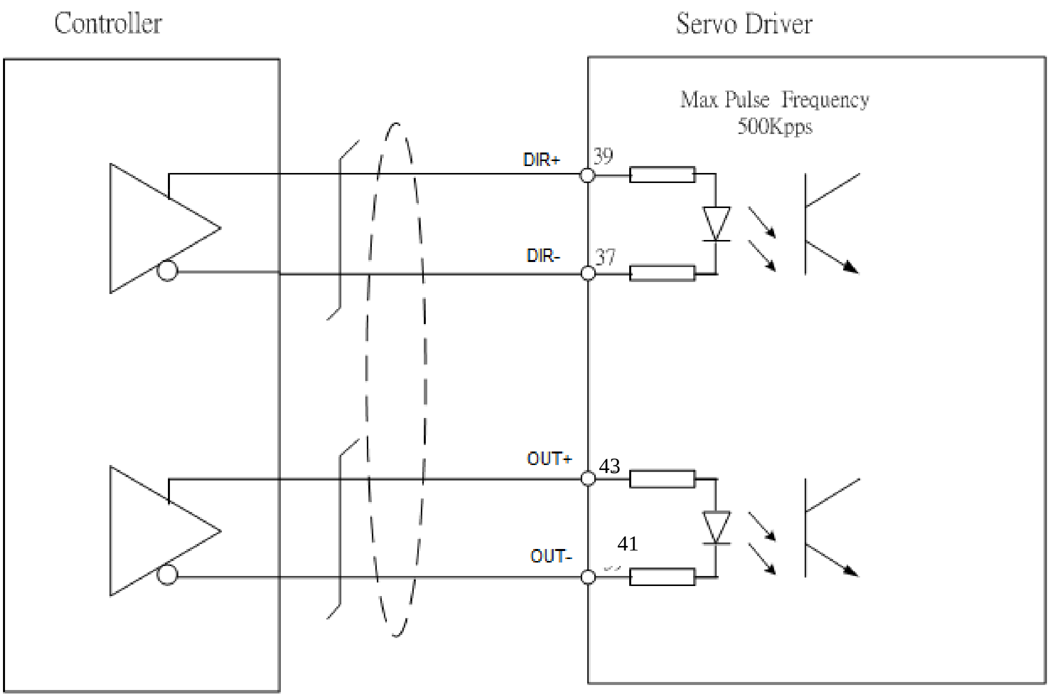

***Note: The double power input is not allowed, otherwise the burning may occur.***

The pulse input source is the PNP type open collector. The external power supply is used.

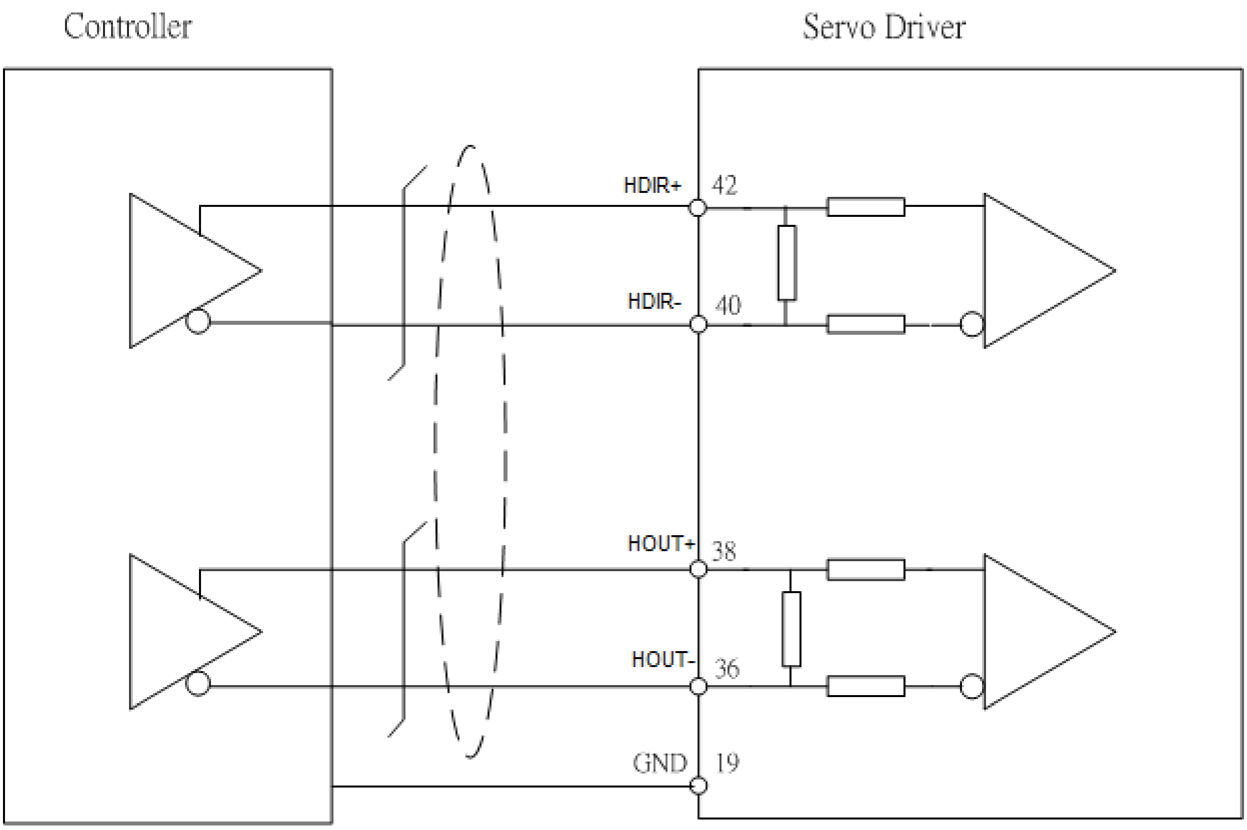



***Note: The double power input is not allowed, otherwise the burning may occur.***

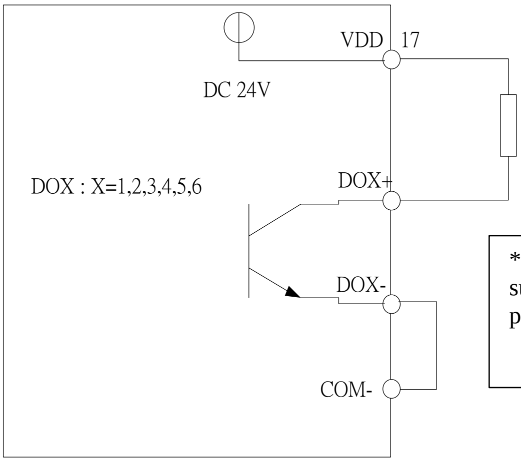
This is the pulse command input (differential input). This is a 5V system. The 24V power supply is not allowed for input.




This is the pulse command input with high speed (differential input). This is a 5V system. The 24V power supply is not allowed for input.

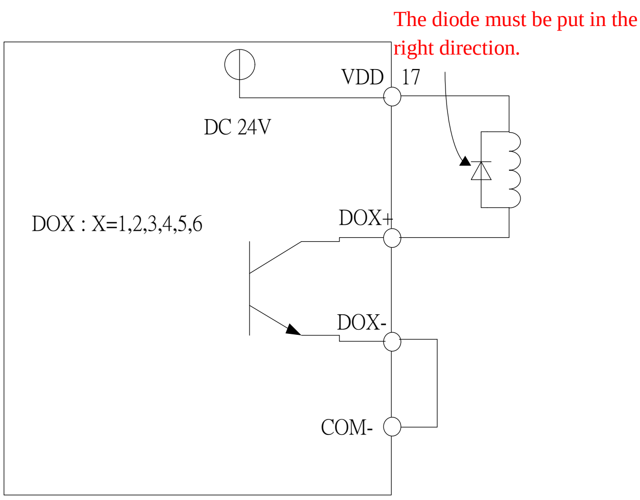


DO wiring, internal power supply, normal load

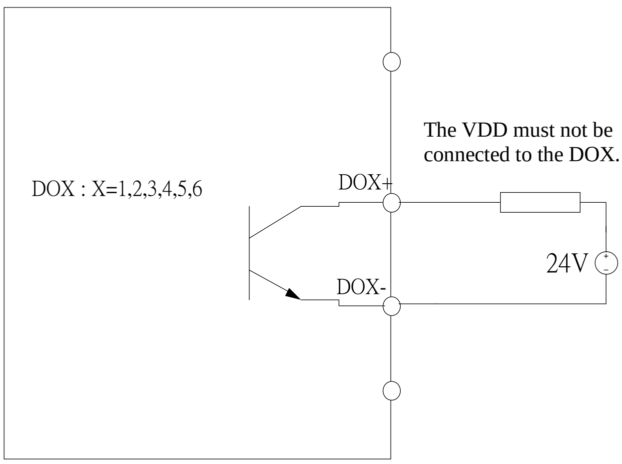



*DO If the output current of the surface is >50mA, overcurrent protection will start.

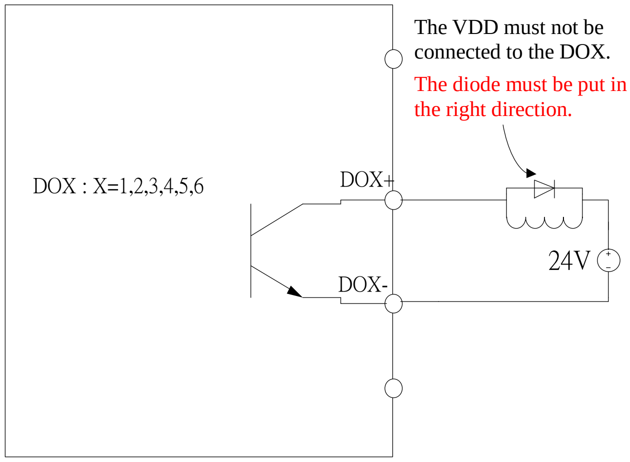
DO wiring, internal power supply, inductive load



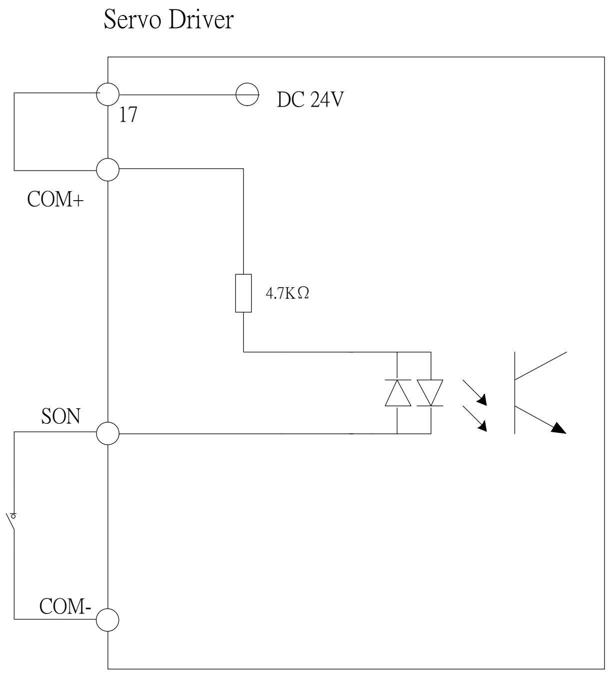

DO wiring, external power supply, normal load



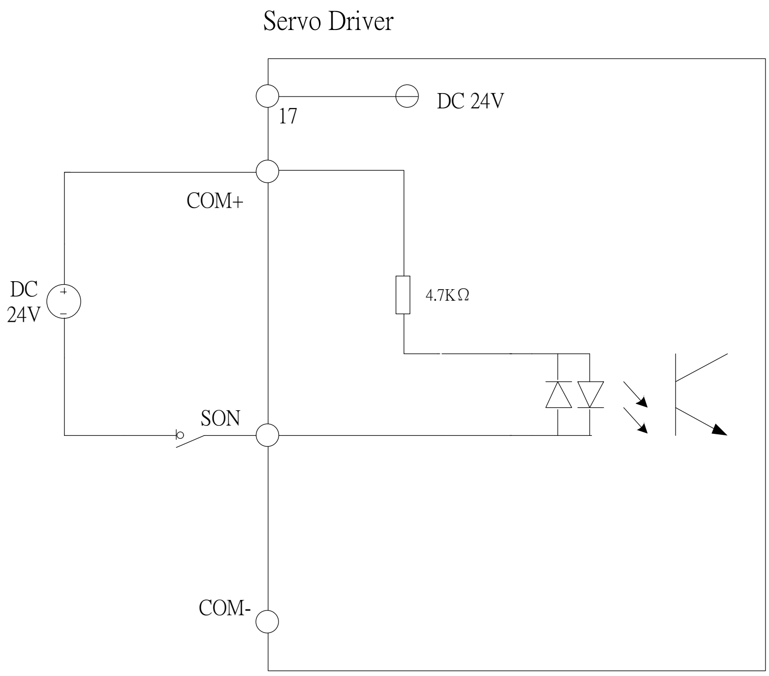
DO wiring, external power supply, inductive load



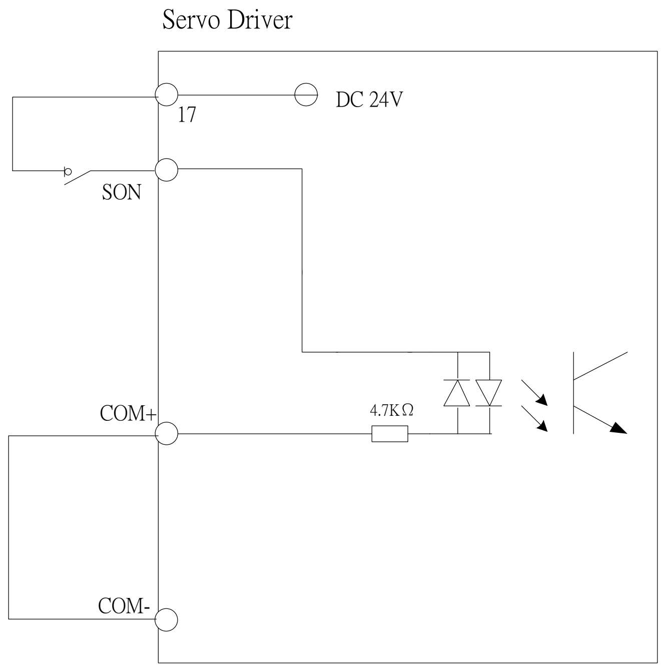

DI wiring, internal power supply, SINK mode



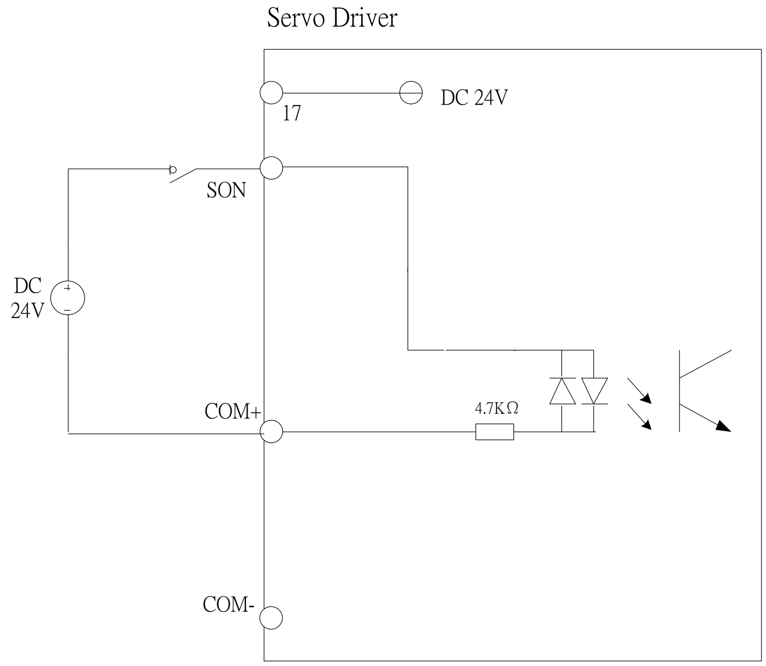
DI wiring, external power supply, SINK mode



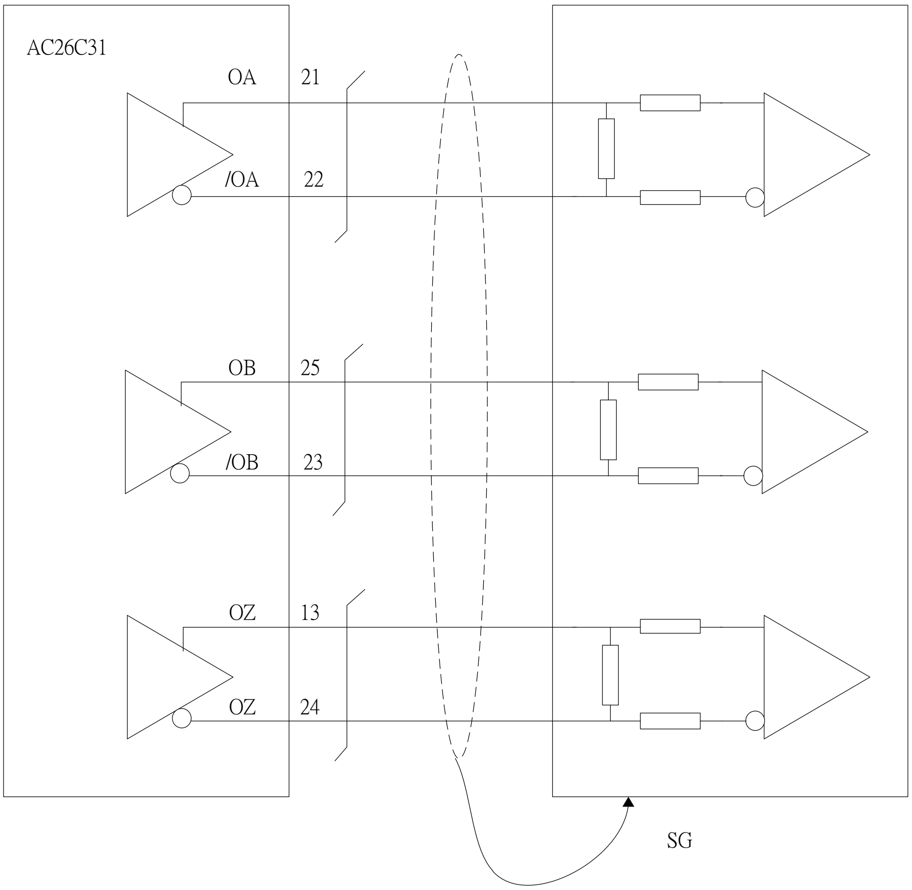

DI wiring, internal power supply, SOURCE mode



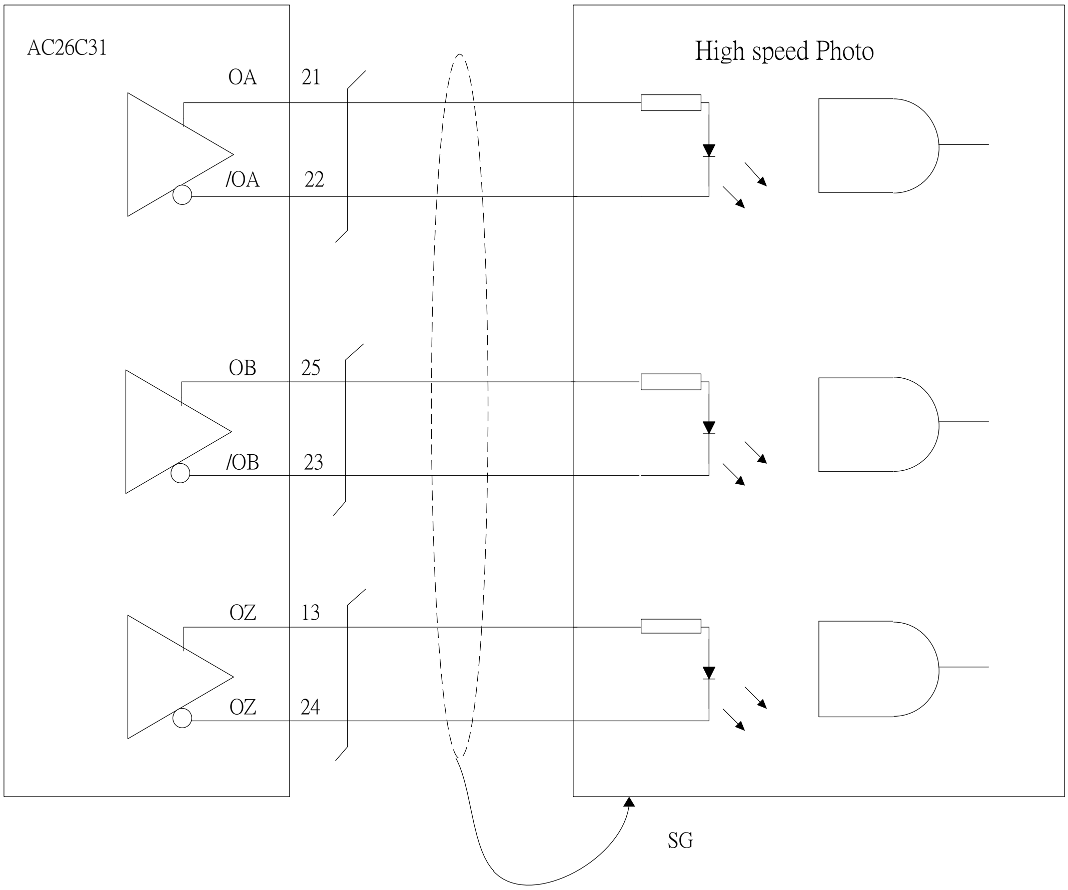
DI wiring, external power supply, SOURCE mode



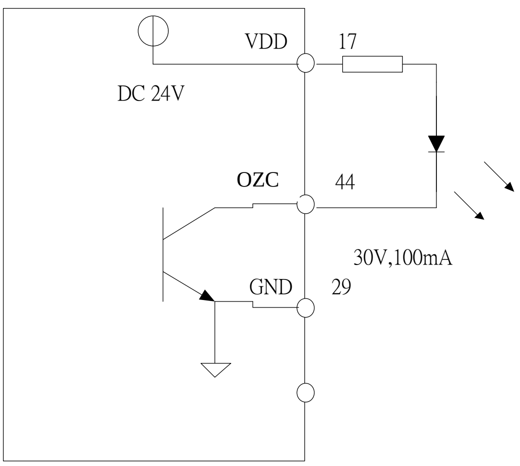

Encoder position output (line driver)



Encoder position output (photo coupler)




Encoder OCZ output (Z pulseoutput for the open collector)



### 3.3.6. User-specified DI and DO signals

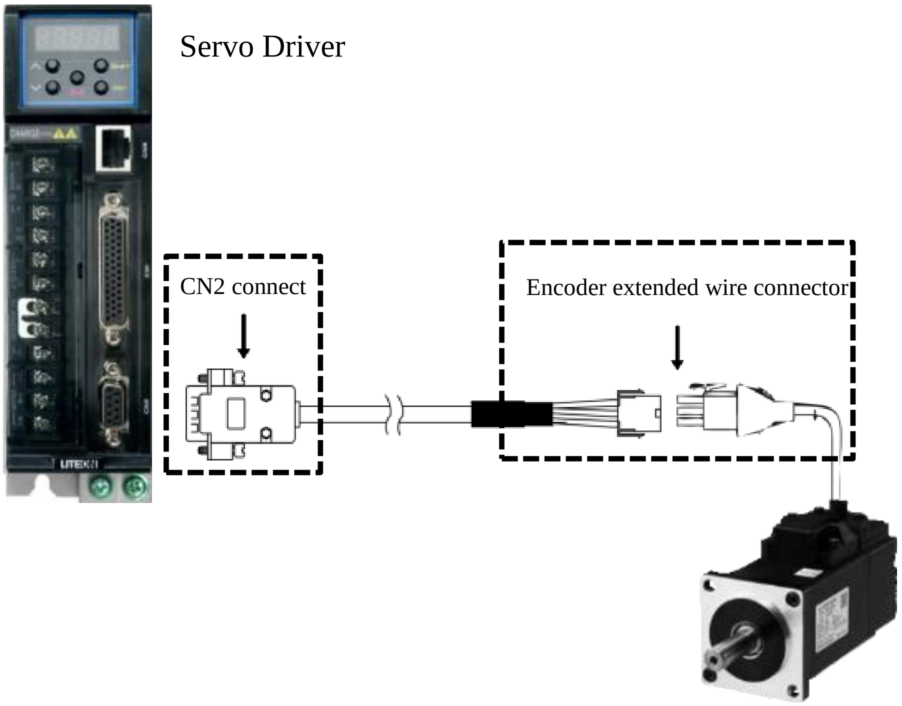
If the desired DI/DO signal can't be found among the default ones, the user may set new DI/DO. The function of the DI1~9 and DO1~6 signals depend on the parameters PC-01~PC-09 and PC-10~PC-15. Refer to the following table. Input the DI or DO code in the corresponding parameter to set the function of this DI/DO.

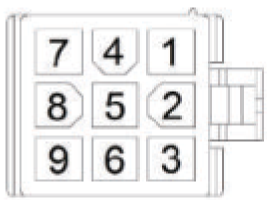
| Signal Name | | Pin No | Corresponding parameter |
|---|---|---|---|
| Standard DI | DI1- | CN1-9 | PC-01 |
| | DI2- | CN1-10 | PC-02 |
| | DI3- | CN1-34 | PC-03 |
| | DI4- | CN1-8 | PC-04 |
| | DI5- | CN1-33 | PC-05 |
| | DI6- | CN1-32 | PC-06 |
| | DI7- | CN1-31 | PC-07 |
| | DI8- | CN1-30 | PC-08 |
| | DI9 | CN1-12 | PC-09 |

| Signal Name | | Pin No | Corresponding parameter |
|---|---|---|---|
| Standard DO | DO1+ | CN1-7 | PC-10 |
| | DO1- | CN1-6 | |
| | DO2+ | CN1-5 | PC-11 |
| | DO2- | CN1-4 | |
| | DO3+ | CN1-3 | PC-12 |
| | DO3- | CN1-2 | |
| | DO4+ | CN1-1 | PC-13 |
| | DO4- | CN1-26 | |
| | DO5+ | CN1-28 | PC-14 |
| | DO5- | CN1-27 | |
| | DO6+ | CN1-16 | PC-15 |
| | DO6- | CN1-15 | |

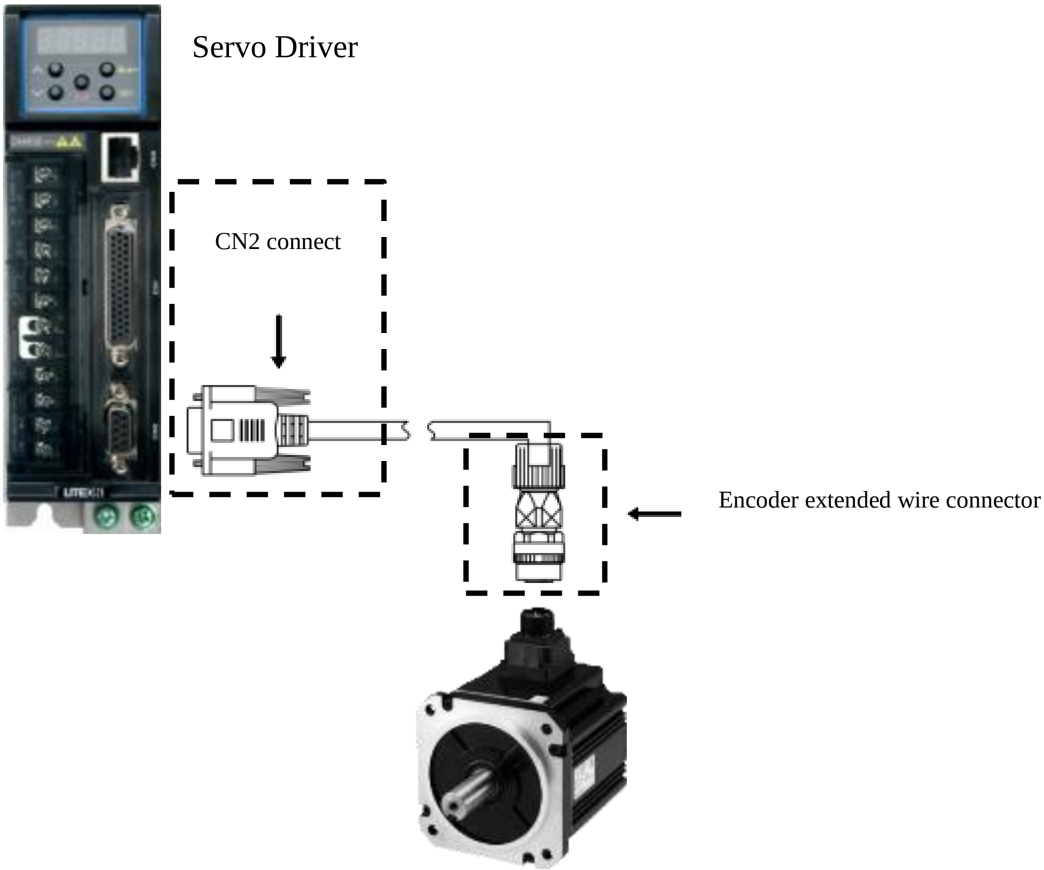
# 3.4. CN2 Wiring of the the encoder signal

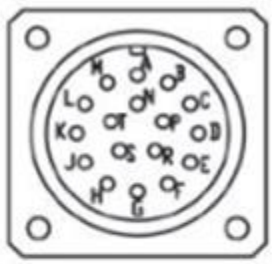
## 3.4.1. Encoder Connector Specifications




<table>
<tr><th>Motor Model</th><th>Encoder Connect</th></tr>
<tr><td>100W~750W<br>IOSMPHA04010M□□□A<br>IOSMPHA06020M□□□A<br>IOSMPHA06040M□□□A<br>IOSMPHA08075M□□□A</td><td>

<table>
<tr><th>Pin</th><th>Signal</th></tr>
<tr><td>1</td><td>DATA+</td></tr>
<tr><td>2</td><td>DATA-</td></tr>
<tr><td>3</td><td>N.C</td></tr>
<tr><td>4</td><td>N.C</td></tr>
<tr><td>5</td><td>N.C</td></tr>
<tr><td>6</td><td>5V</td></tr>
<tr><td>7</td><td>GND</td></tr>
<tr><td>8</td><td>Shield</td></tr>
<tr><td>9</td><td>N.C</td></tr>
</table></td></tr>
</table>



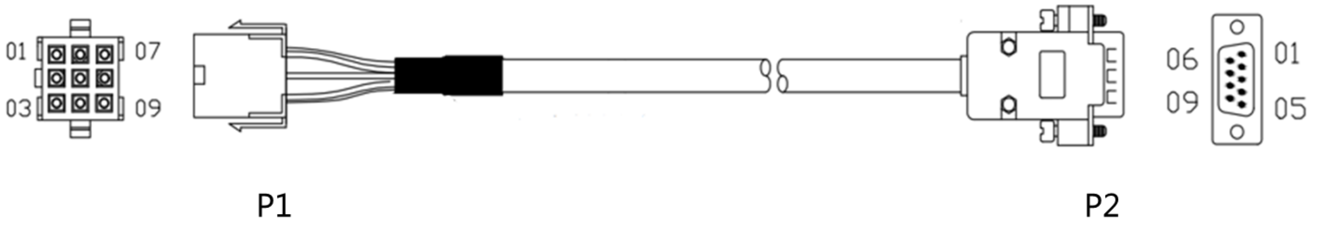

| Motor Model | Encoder Connect |
|---|---|
| 1kW~2kW<br>IOSMPHB131D0M□□□A<br>IOSMPHB131D5M□□□A<br>IOSMPHB132D0M□□□A |  |

| Pin | Signal |
|---|---|
| A、B、C、D | N.C |
| E | DATA+ |
| F | DATA- |
| G | GND |
| H | 5V |
| J | Shield |
| K、L、M、N、R、S、S、T | N.C |

For the wire selection, please use the multi-core cable with the isolated cable, and the isolated cable should be connected to the SHIELD end.

## 3.4.2. Encoder cable wiring diagram

100W~750W Single turn absolute wire：

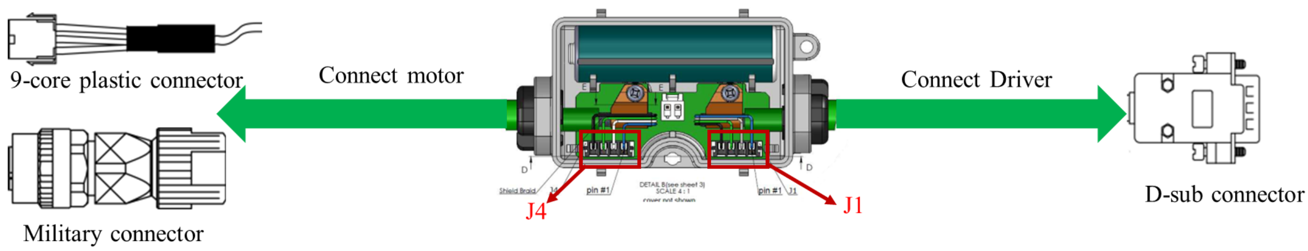



| P1 | Pin Function | P2 |
|---|---|---|
| 9-core plastic connector | | D-sub connector |
| 6 | 5V | 7 |
| 7 | GND | 8 |
| 1 | Data+ | 5 |
| 2 | Data- | 4 |
| 8 | Shield | 外殼 |

1kW~2kW Single turn absolute wire：


| P1 | Pin Function | P2 |
|---|---|---|
| Military connector | | D-sub connector |
| H | 5V | 7 |
| G | GND | 8 |
| E | Data+ | 5 |
| F | Data- | 4 |
| J | Shield | 外殼 |

Multi-turn absolute wire (requires connection of battery case)：




| Military connector | 9-core plastic connector | J4（connect motor） | Pin Function | J1（connect driver） | D-sub connector |
|---|---|---|---|---|---|
| H | 6 | Pin 1 | 5V | Pin 1 | 7 |
| G | 7 | Pin 2 | GND | Pin 2 | 8 |
| E | 1 | Pin 3 | Data+ | Pin 3 | 5 |
| F | 2 | Pin 4 | Data- | Pin 4 | 4 |

### 3.4.3. CN2 Enclosure connector housing connection

(1) The metal isolation mesh and the metal portion of the connector are connected to achieve the effect of a complete metal mask.

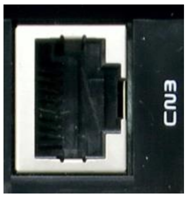
(2) As shown in the fugure, fit into the housing of the connector

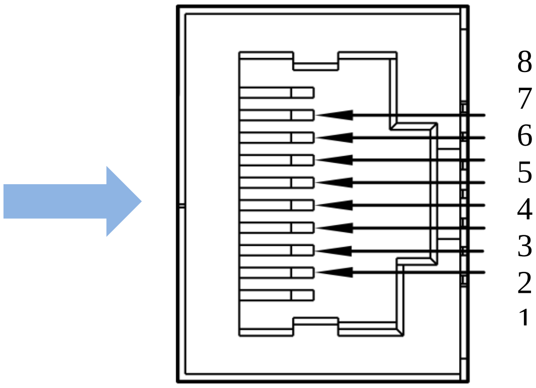
(3) The locking of the housing is complete.

# 3.5. CN3 Wiring for the signal of the communication connector

**CN3 Layout for the terminal of the communication connector**

The drive is connected to the computer via the communication connector. The user uses the MODBUS communication and combines with the assembly language to operate the drive. The user may also use PLC and HMI to operate the drive. We offer two communication interfaces that are commonly used: (1) RS-232 and (2) RS-485. The RS-232 is used more often. The communication distance is about 15 m. If using the RS-485, the transmission distance would be longer. The RS-485 can support simultaneous connections for multiple drives.




CN3 connector (female)

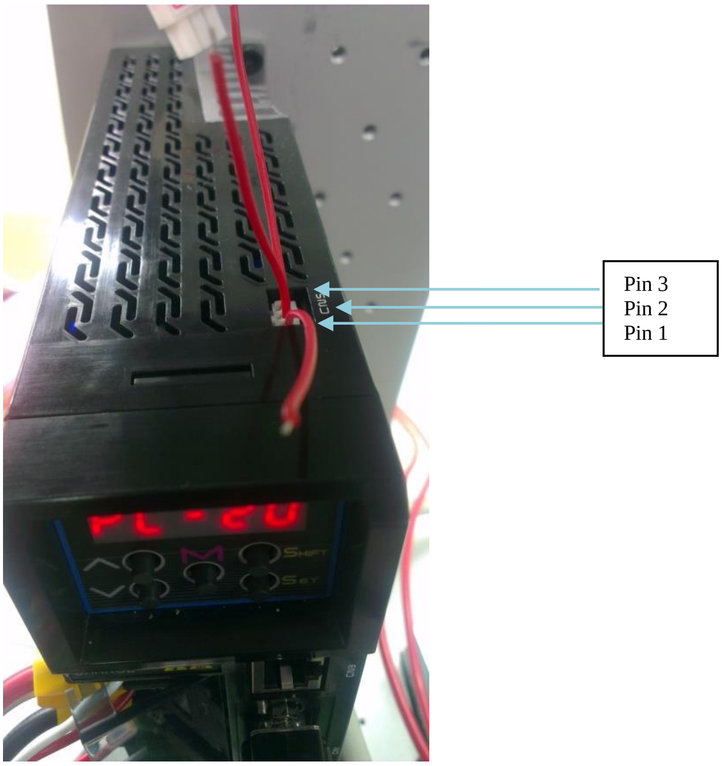
| Pin No | Signal Name | Terminal signal | Function and description |
|---|---|---|---|
| 1 | RS-232 data transmission | RS-232_TX | Data transfer at the drive end<br>Connected to the receiving end RS-232 of the PC |
| 2 | RS-232 data receiving | RS-232_RX | Data receipt at the drive end<br>Connected to the sending end RS-232 of the PC |
| 3 | Signal grounding | GND | +5V ground to the signal end |
| 4 | RS-485 data transmission | RS-485(-) | Differential data transfer at the drive end - |
| 5 | RS-485 data transmission | RS-485(+) | Differential data transfer at the drive end + |
| 6 | Signal grounding | GND | +5V ground to the signal end |
| 7 | - | - | |
| 8 | - | - | |

## 3.6. CN5 Analog voltage output terminal

The CN5 output terminal provides the monitoring analog data. For example, the analog voltage can be used to indicate the rotation speed and current of the motor. ISA-7X provides two channel outputs. The user uses Parameter PD-22 to select the data to be monitored. The signal is based on the grounding (GND) of the power supply.

CN5 output terminal of the drive:

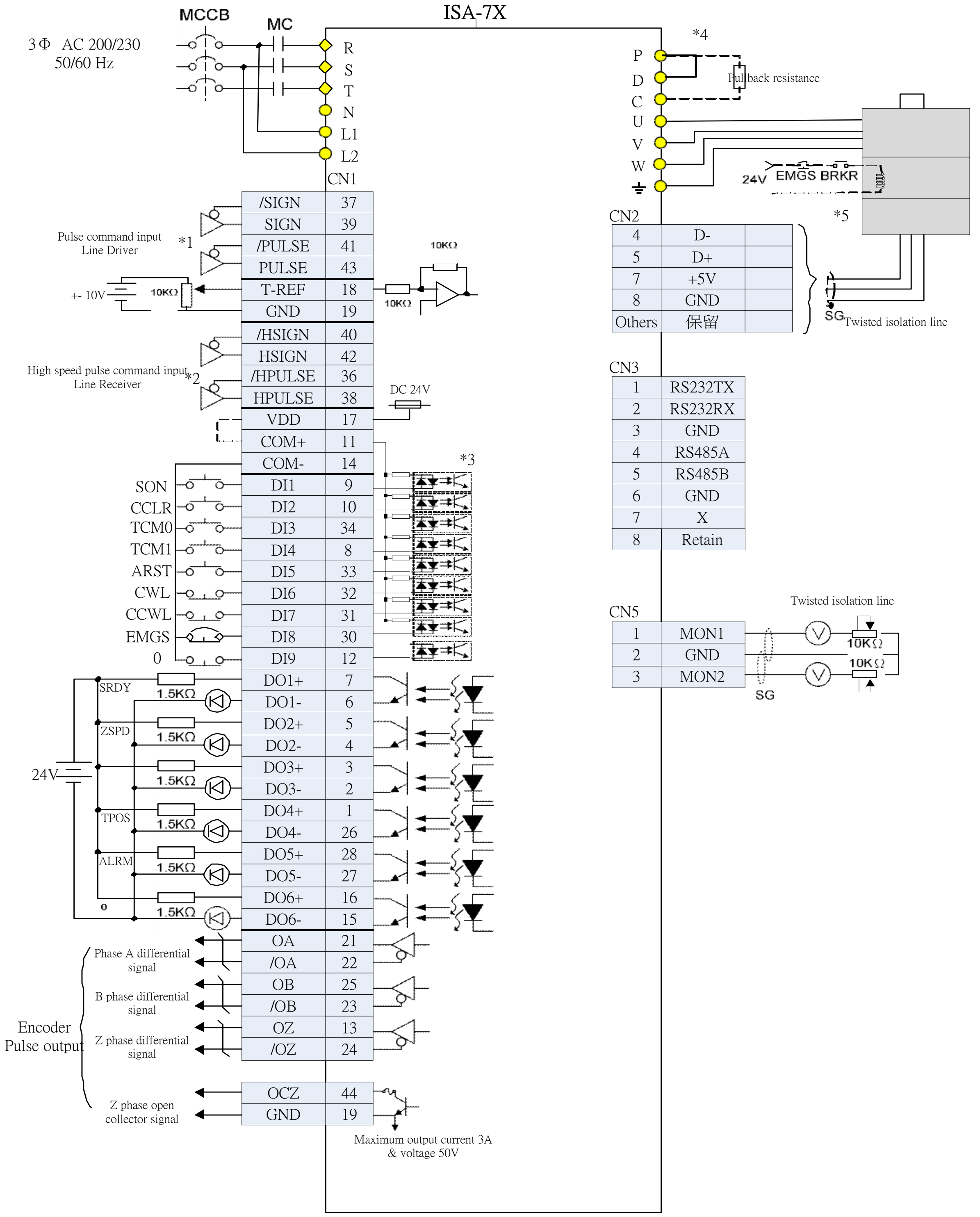
CN5 analog voltage output signal cable:




| Pin No | Signal Name | Function and description | Color | Remark |
|---|---|---|---|---|
| 1 | MON1 | Monitoring analog data 1 | Red | |
| 2 | GND | Earth wire of the power supply | Red | |
| 3 | MON2 | Monitoring analog data 2 | Red | |

# 3.7. Standard wiring

## 3.7.1. Standard wiring for the position mode




Note :

*1 Please refer to section 3.3.3 C3, C4 wiring method

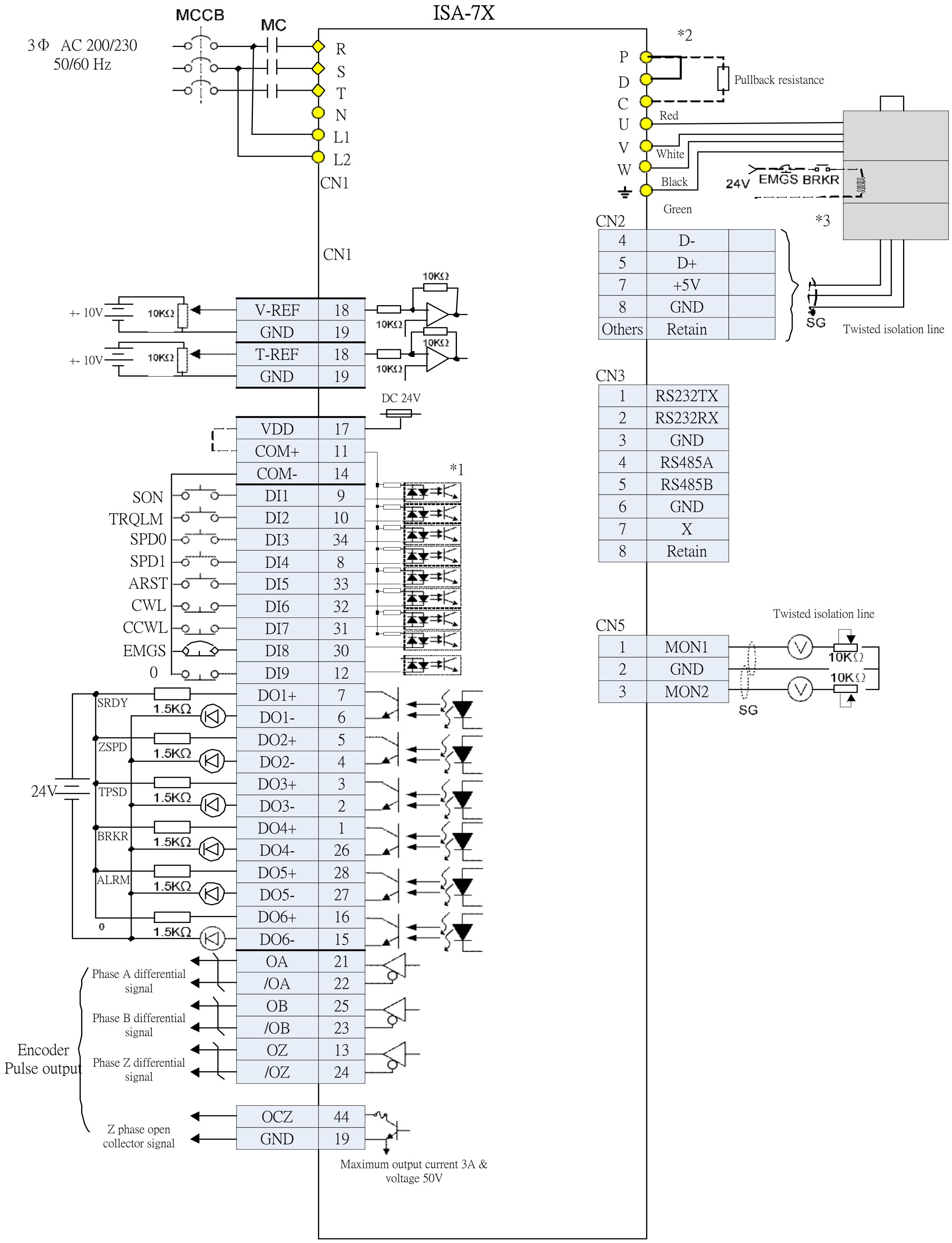
*2 Please refer to section 3.3.3 C3, C4 wiring method

*3 Please refer to Section 3.3.3 C9~C12 SINK/SOURCE Mode Wiring

*4 No built-in rebound resistor below 200W

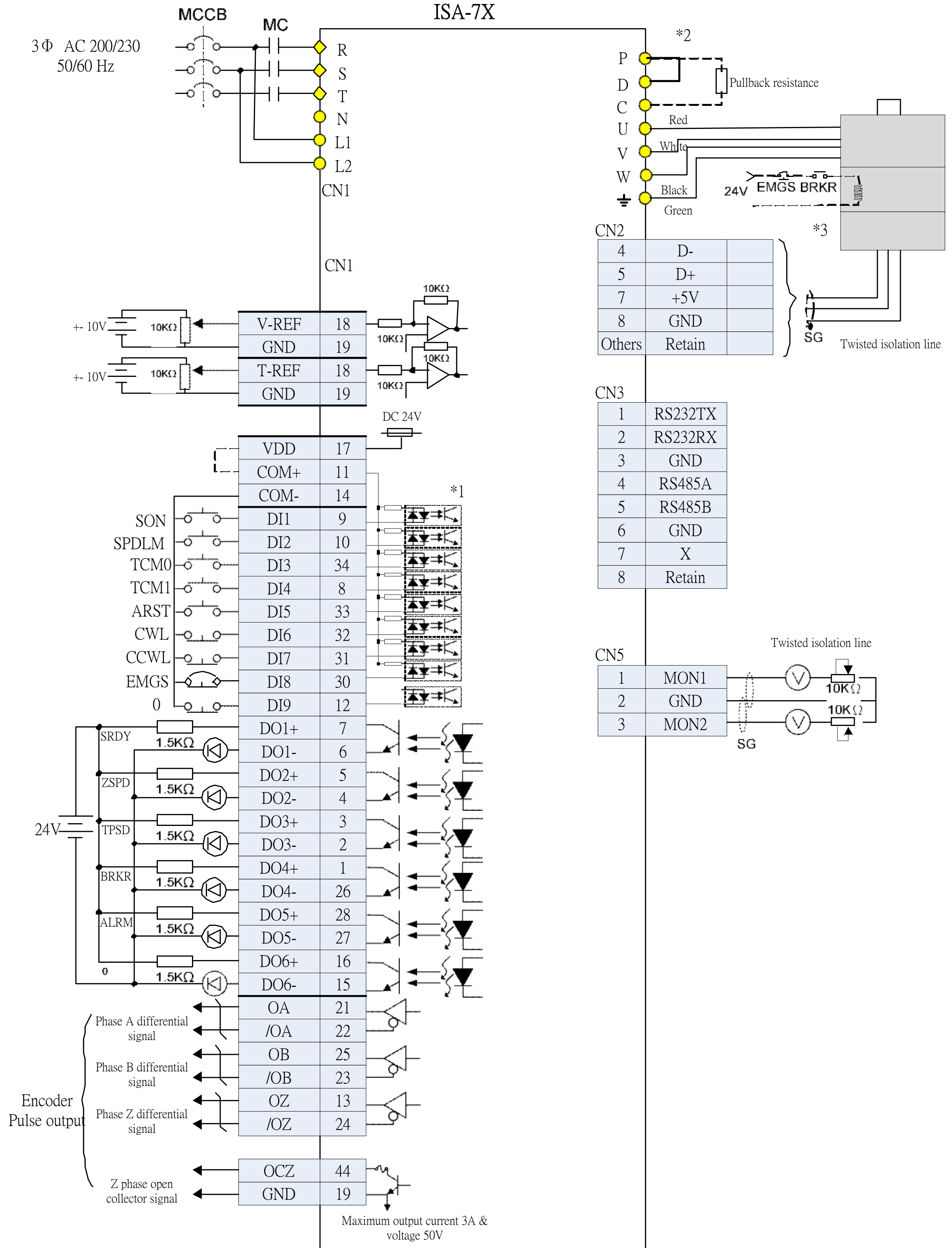
*5 Brake wiring is non-polar

## 3.7.2. Standard wiring for the speed mode




Note :
*1 Please refer to Section 3.3.3 C9~C12 SINK/SOURCE Mode Wiring
*2 No built-in rebound resistor below 200W
*3 Brake wiring is non-polar

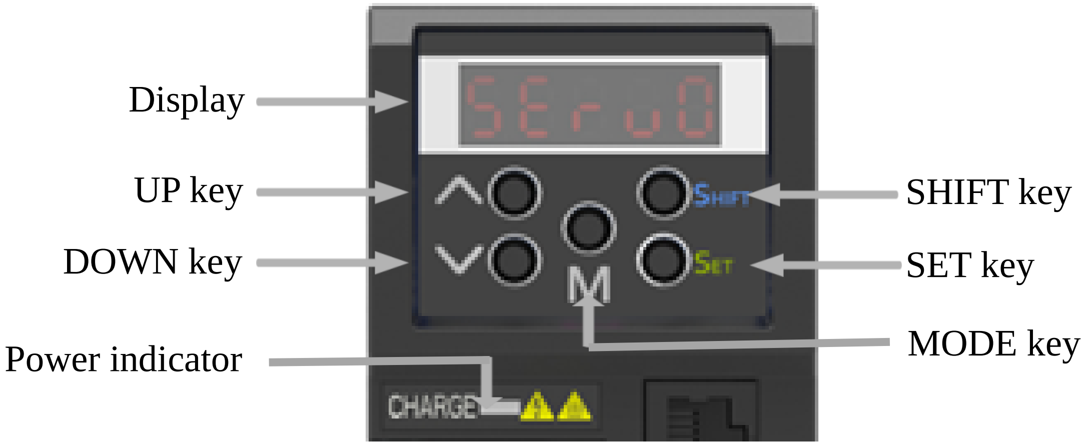
### 3.7.3. Standard wiring for the torque mode




Note :
*1 Please refer to Section 3.3.3 C9~C12 SINK/SOURCE Mode Wiring
*2 No built-in rebound resistor below 200W
*3 Brake wiring is non-polar

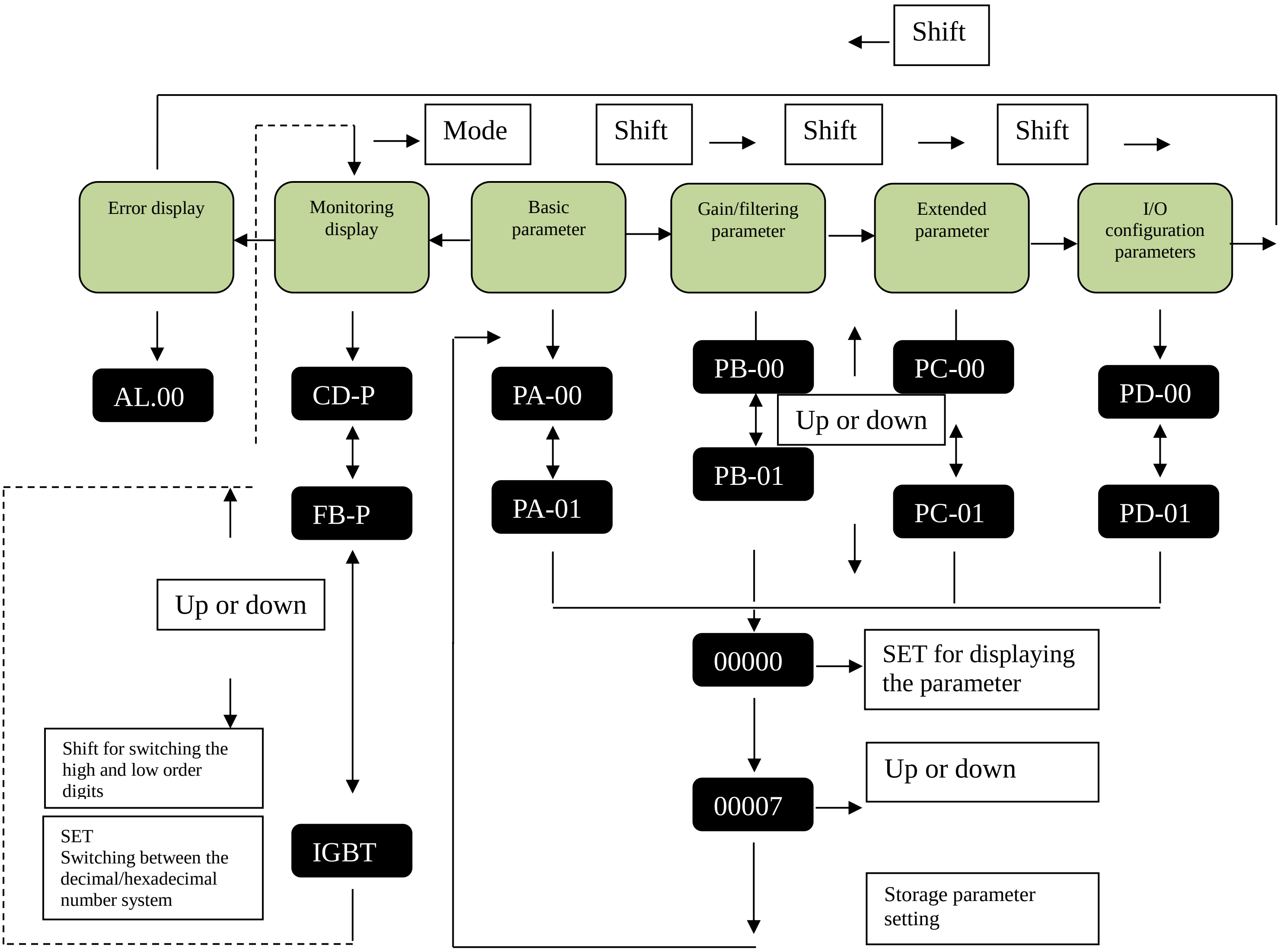
# 4. Panel and Operation

## 4.1. Panel display and key description




| Name | Function |
|---|---|
| Display | Five seven-segment displays are used to show the monitoring, parameter and set values. |
| MODE key | It is used to switch between the monitoring mode, parameter mode and alarm display. When editing the mode, press the MODE key to exit to the parameter mode. |
| SHIFT key | The group code can be changed in the parameter mode. In the editing mode, shift the blinking character to the left would be able to modify the higher character value that is set. In the monitoring mode, the display of the high/low order digit can be switched. |
| UP key | It is used to change the monitoring code, parameter code or set value. |
| DOWN key | It is used to change the monitoring code, parameter code or set value. |
| SET key | It is used to display and store the set value. In the monitoring mode, it is possible to switch to the decimal/hexadecimal number system. In the parameter mode, press the SET key to enter the editing mode. |

## 4.2. Panel operating process




1. When the power supply of the drive is input, the display continues to display the monitoring mode (the monitoring parameter set by the PD-21) first. The alarm code shows up first if there is any alarm.
2. Press the MODE key to switch the parameter display → monitoring display → error display. The alarm mode is omitted if there is no alarm.
3. For any new alarm, it is possible to switch the current mode to the alarm mode instantly. Press the MODE key to switch to other modes.
4. In the monitoring display, switch the monitoring variable to press the UP or DOWN key. After selecting the monitoring variable, press the SET key to confirm to enter the display.
5. In the parameter display, press the SHIFT key to switch the group code. Press the UP/DOWN key to change the last two character parameter codes.
6. In the parameter display, press the SET key to enter the editing setting mode. The display shows the set value of the current parameter. Use the UP/DOWN key to modify the parameter value or press the MODE key to exit the editing setting mode and return to the parameter mode.

7. In the editing setting mode, press the SHIFT key to shift the blinking character to the left and use the UP/DOWN key to amend the high byte quickly.
8. After revising the set value, press the SET key to save the parameter or execute the command.
9. After the parameter setting is finished, the display shows the exit code "SAVED" and returns to the parameter code automatically.

Table4.2.1 Display code

| Display text | LED display | Display text | LED display | Display text | LED display | Display text | LED display |
|---|---|---|---|---|---|---|---|
| 0 | | 9 | | i | | r | |
| 1 | | A | | J | | S | |
| 2 | | b | | K | | t | |
| 3 | | c | | L | | U | |
| 4 | | d | | M | N/A | v | |
| 5 | | E | | n | | W | N/A |
| 6 | | F | | o | | X | N/A |
| 7 | | G | | P | | y | |
| 8 | | H | | q | | Z | |

# 4.3. Status display

## 4.3.1. Description for the display of status value

| Example for the numerical display | Description for the display of status value | |
|---|---|---|
| 01234 (Dec) | Hexadecimal data | If the numerical value is 1234, it displays as 01234 (decimal numerical system). |
| 1234 (Hex) | | If the numerical value is 0x1234, it displays as 1234.<br>(For the hexadecimal numerical system, the first digit does not show.) |
| 1234.5 (Dec high)<br>67890. (Dec low) | 32-bit data | If the numerical value is 1234567890, the high byte displays as 1234.5 and the low byte as 67890 (decimal numerical system). |
| h1234 (Hex high)<br>L5678 (Hex low) | | If the numerical value is 0x12345678, the high byte displays as h1234 and the low byte as L5678 (hexadecimal numerical system). |
| 1.2.345 | This is the way to display negative values. If the numerical value is -12345, it displays as 1.2.345.<br>(Only the decimal numerical system is available. No positive or negative sign shows for the hexadecimal numerical system.) | |

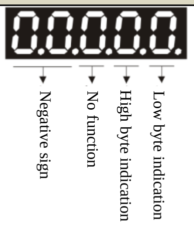
1) Dec indicates the decimal numerical system and Hex the hexadecimal numerical system.
2) The above ways of displaying numerical values are applicable to the monitoring and editing setting modes.
3) The Data format of all monitoring variables is 32-bit. For data display, it is possible to switch between the high/low byte and Dec/Hex. Each parameter only supports one display type and no switchover is allowed.

## 4.3.2. Display of storage setting

After finishing the parameter editing and pressing the SET storage setting key, the panel display continues to show the symbol of setting status for 1 second based on the setting status.

| LED display | Content description |
|---|---|
| Saved | The set value is stored adequately (Saved). |
| R-Only | It is a read-only parameter (Read-Only). |
| Lock | The entered password is wrong or no password is entered (Locked). |
| Err | The set value is wrong or the reserved set value is entered (Write NG). |
| S-off | The servo is activated and no input is allowed (Please Servo off). |
| Re-On | The parameter is effective only after restart (Power On). |

### 4.3.3. Display of decimal point

| Display symbol | Content description |
|---|---|
|  | High/low byte indication: If the data type is 32-bit and the data is in the decimal format, the function indicates whether the numerical value displayed is in the high or low byte format.<br>Negative sign: If the data is in the decimal format, the two decimal points on the left indicate the negative sign, regardless the 16- or 32-bit. The value displayed in the hexadecimal format is always positive. No negative sign is displayed. |

### 4.3.4. Display of the warning message

| Display symbol | Content description |
|---|---|
|  | When the drive generates an error, the warning sign 'AL' and code 'nnn' appear. Refer to the description for the PD-20 parameter in Chapter 7 or Chapter 9 Warning Troubleshooting for the meaning of the sign and code. |

### 4.3.5. Monitoring display

In the monitoring mode, press the UP or DOWN key to select the variable to be monitored and press the SET key for confirmation. Parameter PD-21 can also be modified to designate the monitoring code. For example, "PD-21=4" indicates the motor rotation speed.

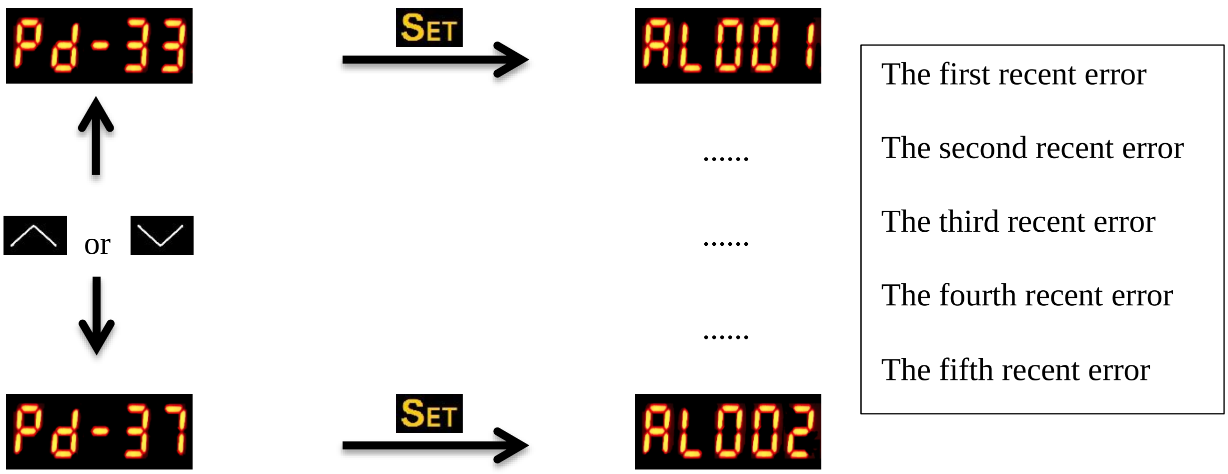
| PD-21 | LED display | Content description | Unit |
|---|---|---|---|
| 0 | Cd-P | The number of pulses entered for the pulse command (the number of pulses for the command entered to the upper controller) | [user unit] |
| 1 | Fb-P | The number of pulses for the motor feedback (the number of pulses fed to the upper controller from the drive) | [user unit] |
| 2 | Err-P | The number of differential pulses for the Cd-P and Fb-P | [user unit] |
| 3 | Efb-P | The number of pulses for the motor feedback (the number of pulses for the encoder feedback) (131072 pulse/rev) | [pulse] |
| 4 | SPEED | Motor rotation speed | [r/min] |
| 5 | ECd.P | The number of pulses for the pulse command input (The number of pulses for the command entered to the upper controller * electronic gear ratio) | [pulse] |
| 6 | Eer-P | The number of differential pulses for the ECd-P and EFb-P | [pulse] |
| 7 | CP-Fr | The pulse command input frequency | [Kpps] |
| 8 | C-SP1 | The speed input command | [Volt] |
| 9 | C-SP2 | The speed input command | [r/min] |
| 10 | C-tq1 | The torque input command | [Volt] |
| 11 | C-tq2 | The torque input command | [%] |
| 12 | PK-L | The peak torque | [%] |
| 13 | AvG-L | The average torque | [%] |
| 14 | U-buS | The voltage of the main circuit | [Volt] |

| | | | |
|---|---|---|---|
| 15 | J-L | The load/motor inertia ratio | [double] |
| 16 | rSn.fr | The resonance frequency (The low byte is the first resonance point and the high byte is the second resonance point.) | [Hz] |
| 17 | diFF.2 | This indicates the number of absolute pulses with respect to the encoder Z-phase. Which means, the numerical value at the origin of the Z-phase is 0. The encoder rotates clockwise or counterclockwise for positive/negative 5000 pulses. | [pulse] |
| 18 | Drv-t | Drive temperature | [°C] |
| 19 | bAtt | Absolute encoder battery voltage | [Volt.] |

## 4.4. Operation of the general function

### 4.4.1. Operation for displaying the record of the abnormal status

After entering the parameter modes PD-33 ~ PD-37, press the SET key to display the corresponding code of the error history.




### 4.4.2. Operation for the jog mode

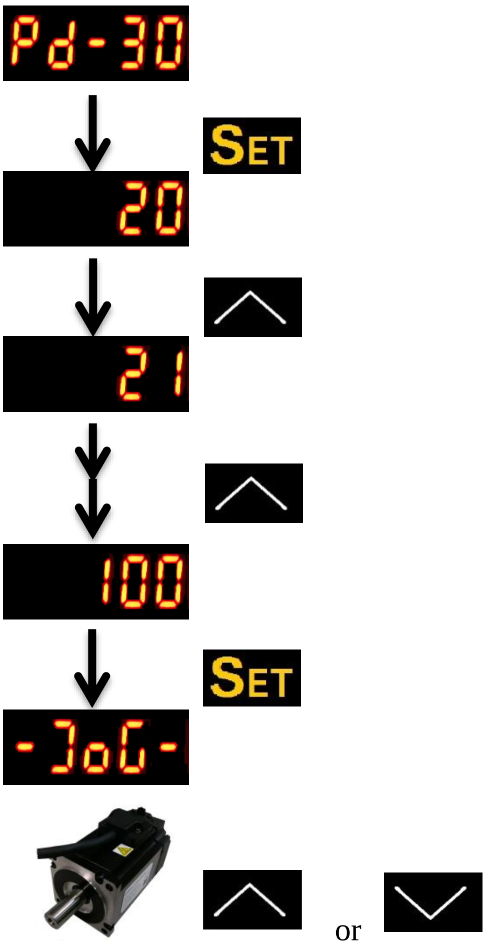
After entering the parameter mode PD-30, execute the jog operating mode according to the following setting methods.

(1) Press the SET key to display the jog speed. The initial value is 20 r/min.

(2) Press the UP or DOWN key to modify the jog speed to the desired value. For the example, the speed is adjusted to 100r/min.

(3)Press the SET key to display JOG and enter the jog mode.

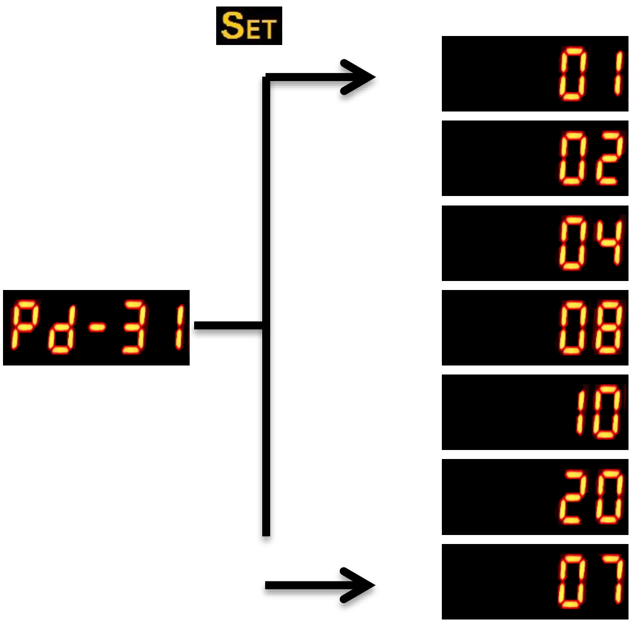
(4) After entering the jog mode, press the UP or DOWN key to make the servo motor to rotate clockwise or counterclockwise. Release the button and the servo motor stops immediately. The jog operation is only effective in the Servo On mode.




Press : The servo motor rotates counterclockwise.
Press : The servo motor rotates clockwise.
Press to return.
Release the key and the motor stops instantly.
If there is no reaction, check the wiring for the motor UVW and encoder.

## 4.4.3. Enforced operation of the digital output

Enter the output diagnosis mode according to the setting method below.
Set "PD-44=006" first and turn on the enforced DO mode. Use the PD-31 to set the enforced DO output via the binary system.
E.g.: DO2 is turned on forcefully when the value is set to 2.
DO1 and DO3 are turned on forcefully when the value is set to 5.
No memory is saved for this mode after power off. The regular DO mode can be resumed after power on or setting "PD-44=106".

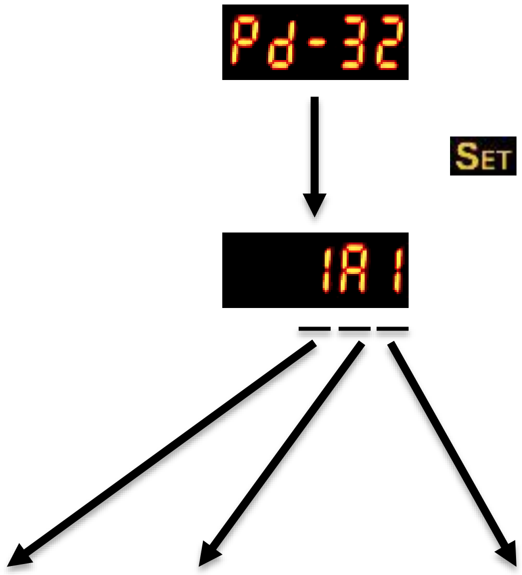



DO1 turned on forcefully
DO2 turned on forcefully
DO3 turned on forcefully
DO4 turned on forcefully
DO5 turned on forcefully
DO6 turned on forcefully
DO1, DO2 and DO3 turned on forcefully

> The PD-31 is in the hexadecimal format. The numerical value 0 at the fifth digit does not appear.

## 4.4.4. Operation for the diagnosis of digital input

Enter the input diagnosis mode according to the setting method below.
When the triggering is executed via the external input signals DI1 ~ DI9 , the panel display shows the corresponding signal. The signal is displayed in the hexadecimal character format.
bit0 corresponds to DI1; bit1 to DI2...etc. The value 1 indicates triggering.
E.g.: If "1A1" shows on the display, the binary value is 110100001b, indicating the triggering for DI1, DI6, DI8 and DI9.




Binary

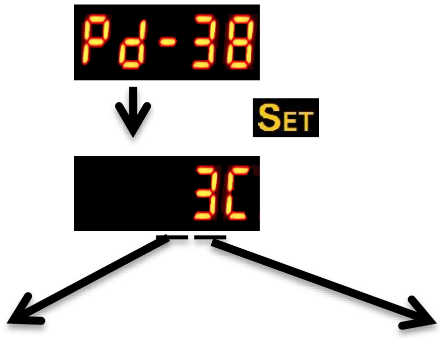
| DI9 | DI8 | DI7 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |

Corresponding DI state

(Hexadecimal display)

## 4.4.5. Operation for the diagnosis of digital output

Enter the output diagnosis mode according to the setting method below.
As for the electrical conductivity of the output signals DO1 ~ DO6, the signal corresponding to these output signals shows on the panel display. The signal is displayed in the hexadecimal format. bit0 corresponds to DO1; bit1 to DO2...etc. The value 1 indicates triggering.
E.g.: If "3C" shows on the display, the binary value is 00111100b, indicating the triggering for DO3, DO4, DO5 and DO6.




| | | | | | | |
|---|---|---|---|---|---|---|
| Binary code | 1 | 1 | 1 | 1 | 0 | 0 |
| Corresponding DI state | DO6 | DO5 | DO4 | DO3 | DO2 | DO1 |

(Hexadecimal display)

# 5. Steps for Commissioning and Tuning

The chapter is divided into two parts for explaining the commissioning operation. The first part is the no-load detection and the second one is the detection for installation in the machine. For safety reasons, the user must conduct the testing for the first part.

## 5.1. No-load detection

To avoid the damage to the servo drive or mechanism, remove the load connected to the servo motor first. (The coupling and relevant accessories on the axle of the servo motor must also be removed. The reason is to avoid the situation that the accessory not removed from the axle of the servo motor flies off, indirectly causing the personal injury or equipment damage.) If the servo motor operates normally according to the normal operating procedure after the removal of the load connected to the servo motor, connect the load back to the servo motor afterwards.

Strongly recommended: Make the servo motor to go into the normal operation under the unloaded condition and connect the motor to the load afterwards to avoid danger.

Check the items listed below one by one to find out problems and solve them before the motor operation to prevent the damage afterwards:

| | |
|---|---|
| Detection before operation<br>(no control power supply provided) | ● Check the servo drive for evident damage.<br>● Insulate the connecting part of the distribution terminal.<br>● Check the wiring for completion and accuracy to prevent damage or abnormality.<br>● Check if there is any conductive object such as the screw or a sheet metal or any flammable object in the servo drive.<br>● Check if the control switch is OFF.<br>● The regenerative resistor of the servo drive or the external regenerative resistor must not be placed on any flammable object. To prevent the electromagnetic actuator from becoming ineffective, check if the circuit causing the immediate termination of operation and cutting the power off operates normally.<br>● If the electronic instrument near the servo drive suffers from the electromagnetic interference, use an instrument for mitigation.<br>● Check if the applied voltage level of the drive is accurate. |

| | |
|---|---|
| Detection before operation (control power supply provided) | ● Excessive stress should be avoided for the cable of the encoder. During motor operation, notice whether the connecting cable contacts the machine part, causing wear or dragging.<br>● For the servo motor, contact the supplier for any vibration or loud noise during operation.<br>● Check the setting of each parameter for accuracy. Unexpected movements might occur due to mechanical characteristics. Do not make excessive adjustments to the parameter.<br>● When resetting the parameter, check if the drive operates while the servo is turned off (Servo Off), otherwise the drive would cause malfunction.<br>● When the relay operates, contact the supplier if no contact sound is heard or there is any abnormal sound is generated.<br>● Check if any abnormality occurs to the power indicator and LED display. |

## 5.2. Power transmission for the drive

The user must follow the steps below.

I. Check the relevant wiring between the motor and drive:

- U, V, W and FG must be connected to red, white, black and green wires, respectively. If the wiring is wrong, the motor operates abnormally. The earth wire FG of the motor must be connected to the grounding protection terminal of the drive.
- The encoder of the motor is connected to the CN2 correctly.

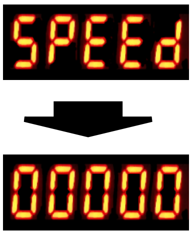
**Warning: Do not connect the power supply end (R, S, T) to the output of the servo drive (U, V, W), otherwise it may result in the damage of the servo drive.**

II. Connection for the power line of the drive: Connect the power supply to the drive. Refer to 3.1.3 for the wiring of the power supply.

III. Power on: For the power supply of the control circuit (L1, L2) and main circuit (R, S,T), the drive shows the following when the power is turned on:


The digital inputs (DI6~DI8) of the factory setting are the CCW-limit (NL), CW-limit (PL) and emergency stop (EMGS) signals. If the digital inputs (DI6~DI8) of the factory setting are not used, the setting of the parameters PC-06~PC-08 of the digital inputs (DI) must be adjusted. Set the parameter to 0 (the function of this DI disabled) or change it to other functional definitions.

If the parameter (PD-21) showed for the status of the drive is set to the motor speed (04) when the last operation ends, the normal screen should look like:




If no text shows on the screen, check if the voltage is too low for L1 and L2.

1) When the screen shows:


Overvoltage warning:
The input voltage of the main circuit exceeds the allowable voltage or the input power supply is inaccurate.
Solution:

- Use the electricity meter to check the input voltage and adjust it to the allowable range.

2) When the screen shows:

Abnormality of the encoder:
The drive does not receive any encoder data or a data error occurs.
Solution:

- Check if the wire distribution for the encoder conforms to the description.
- Check if the connector or line of the encoder is loose.
- Check if the encoder is damaged.

3) When the screen shows:


Emergency stop:
The contact of the digital input is set to emergency stop and it is not conducted.
Solution:

- Make sure that the emergency stop (EMGS) signal is conducted. The default setting is DI8.
- If not using the emergency stop function, set the input to Contact b and the default PC-08 to 115. Another way is to set DI8 (which is PC-08) to other functions.

4) When the screen shows:


Abnormality of the CCW-limit:
The contact of the digital input is set to CCW-limit and it is not conducted.
Solution:

- Make sure that the CCW-limit (NL) signal is conducted. The default setting is DI6.
- If not using the emergency stop function, set the input to Contact b and the default PC-06 to 116. Another way is to set DI6 (which is PC-06) to other functions.

5) When the screen shows:


Abnormality of the CW-limit:
The contact of the digital input is set to CW-limit and it is not conducted.
Solution:

- Make sure that the CW-limit (PL) signal is conducted. The default setting is DI7.
- If not using the emergency stop function, set the input to Contact b and the default PC-07 to 117. Another way is to set DI7 (which is PC-07) to other functions.

6) When the screen shows:


Overcurrent warning:
The output current of the drive is too high.
Solution:

- Check the connection of the motor.
- Check if the lead wire or motor is shorted.

7) When the screen shows:


Low voltage warning:
The input voltage of the main circuit is too low.
The input voltage of the main circuit exceeds the allowable voltage or the input power supply is inaccurate.
Solution:

- Use the electricity meter to check the input voltage and adjust it to the allowable range.

## 5.3. No-load jog test

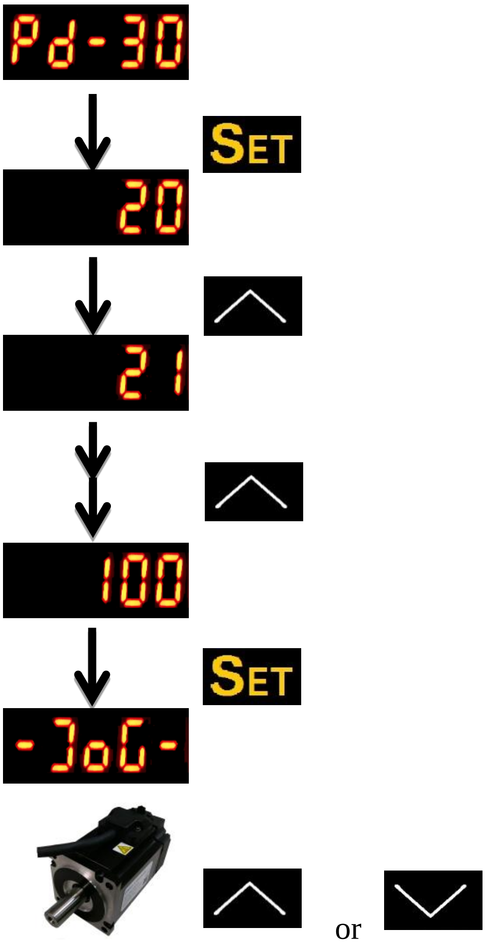
We propose the jog method to trial the motor and drive. The user does not need any extra distribution line, which is really convenient. For safety reasons, it is suggested to jog the motor at low rotation speed. As for the jog mode, the motor is set to move in constant velocity based on the set jog speed. The following is the description we provided.

STEP 1: Set Parameter PD-30. Enter the jog speed (unit: r/min) and press the SET key so that the drive enters JOG mode.

STEP 2: Press the Up key so that the motor turns clockwise. Press the "Down" key so that the motor turns counterclockwise.

STEP 3: Press the MODE key to exit JOG mode.

The following figure demonstrates the operation of the jog mode. Adjust the default initial value 20 rpm to 100rpm.




Press : The servo motor rotates counterclockwise.

Press : The servo motor rotates clockwise.

Press to return:

Release the key and the motor stops instantly.

If there is no reaction, check the wiring for the motor UVW and encoder.

## 5.4. No-load speed test

Before the no-load speed test, secure the motor base as tight as possible to prevent the danger caused by the counter force generated due to the variation in motor rotation speed.

STEP 1： Set the control mode of the drive to the speed mode (PA-00 set to 1). Restart the machine after alteration to update the operating mode.

STEP 2： After restart, modify the setting of the digital input DI as follows:

| Digital Input | Parameter Set value | Description for the Functional Definition | CN1 Pin No |
|---|---|---|---|
| DI1 | PC-01 = 101 | Servo on | Pin9 |
| DI2 | PC-02 = 107 | Torque limit | Pin10 |
| DI3 | PC-03 = 109 | Selection of the speed command | Pin34 |
| DI4 | PC-04 = 10A | Selection of the speed command | Pin8 |
| DI5 | PC-05 = 102 | Error reset | Pin33 |
| DI6 | PC-06 = 0 | No function | Pin32 |
| DI7 | PC-07 = 0 | No function | Pin31 |
| DI8 | PC-08 = 0 | No function | Pin30 |
| DI9 | PC-09 = 0 | No function | Pin12 |

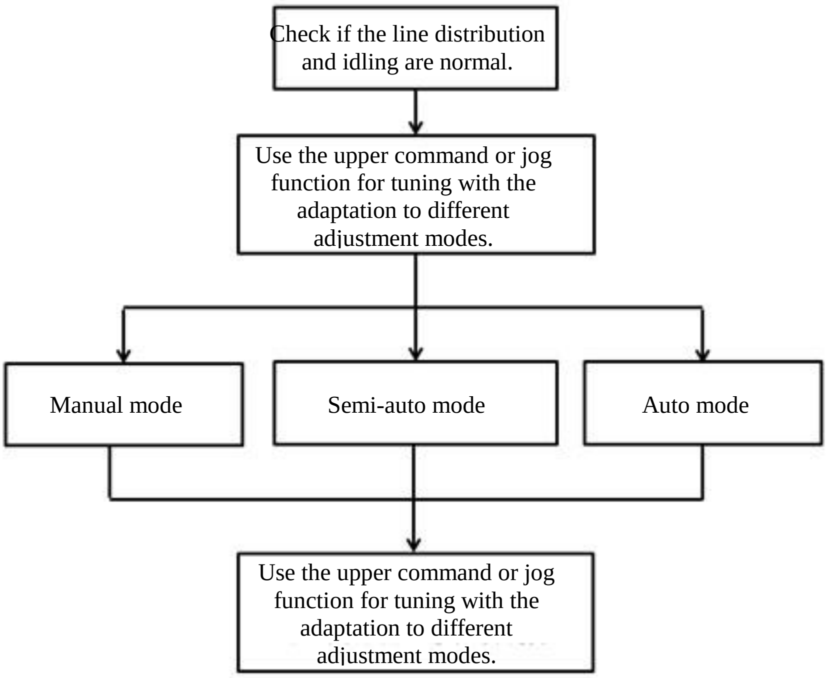
In the table above, the functions of the factory set values CCW-limit (DI6), CW-limit (DI7) and emergency stop (DI8) are canceled. The parameters PC-06~PC-09 are set to 0 (Disabled).
After the setting is complete, the motor must be restarted or the abnormality must be reset if any irregular signal appears for the drive. If the abnormality is reset, the DI5 pin must be conducted to eliminate the abnormality. The restart or reset is required because the factory set value includes the CCW-limit, CW-limit and emergency stop functions.

STEP 3：

1) The user makes the digital input DI1 conducted and the servo activated (Servo On).
2) Open the circuit for the digital inputs DI3 (SPD0) and DI4 (SPD1). The motor operates based on the analog voltage command.
3) Only the digital input DI3 (SPD0) is conducted. The command of the motor rotation speed is the set value of PA-14.
4) Only the digital input DI4 (SPD1) is conducted. The command of the motor rotation speed is the set value of PA-15.
5) The digital input DI3 (SPD0) and DI4 (SPD1) are conducted simultaneously. The command of the motor rotation speed is the set value of PA-16.
6) Steps (3), (4) and (5) may be repeated as wish. The user may also alter the set values of PA-14~PA-16 to change the rotation speed.
7) To stop the drive, open the circuit for the digital input DI1 (Servo Off).

# 5.5. Tuning steps

## 5.5.1. Process of the tuning steps




## 5.5.2. Flowchart of the tuning steps in the semi-auto gain mode

Set PB-32 (response bandwidth of the speed loop in the auto and semi-audit gain adjustment mode). The bandwidth value is 80 (by default).

Set PB-33 to 2 (semi-auto mode, non-persistent adjustment). The adjustment starts after the the revolution speed command is entered manually.(The Jogmode or the upper controller can be used to enter the rotation speed command). LEDwill display the calculated inertia value during the process. After the adjustment is performed for a while, stop the calculation when the the inertia of the system becomes stable and save the calculated load inertia ratio toPB-35. The rigidity and bandwidth settings in PB-32 are referred to during the process of the calculation.

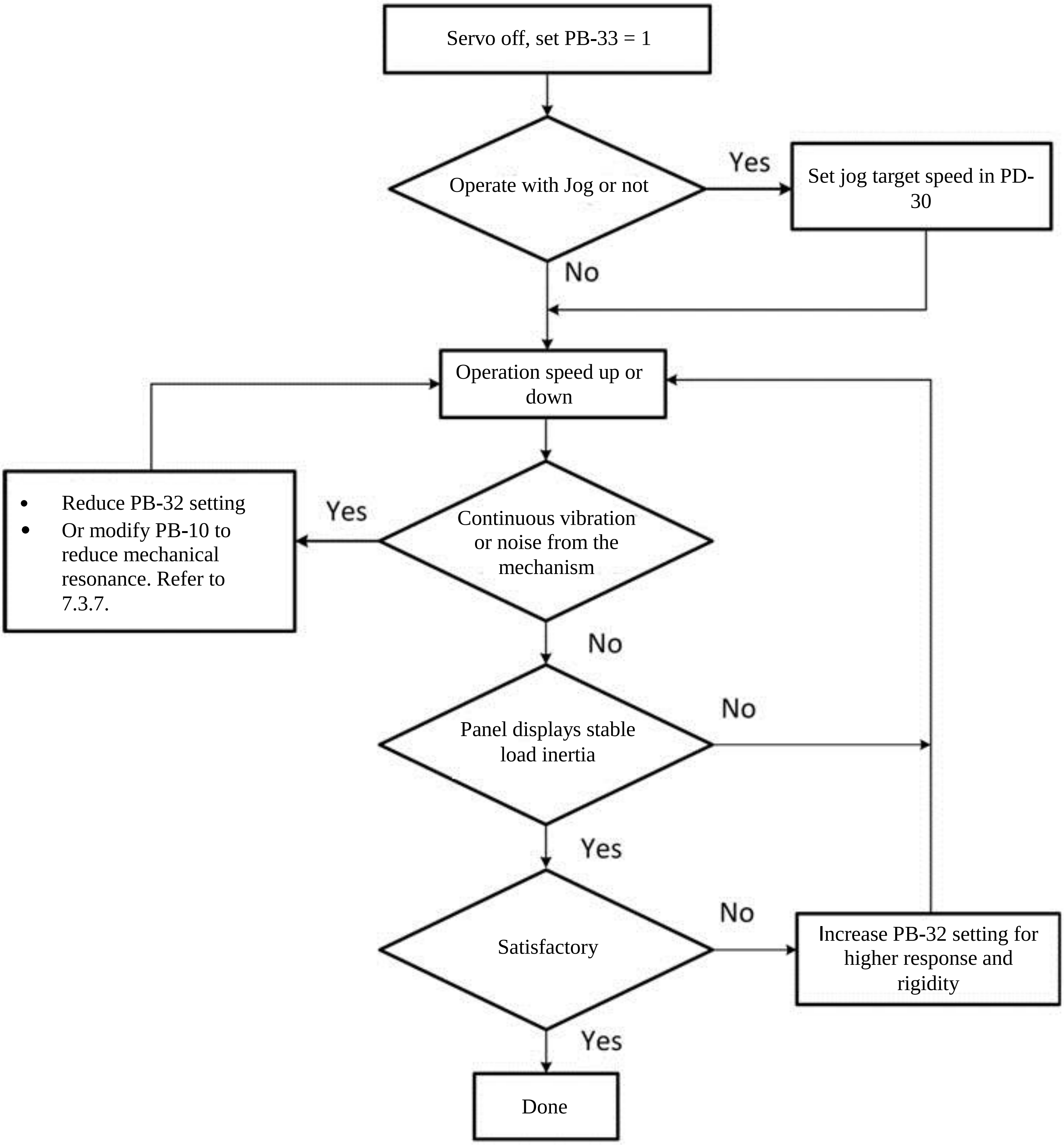
PB-32 is the setting of the response bandwidth for the speed loop in the auto and semi-auto gain adjustment mode:

1~50Hz: Low rigidity, low response.

51~250Hz: Intermediate rigidity, intermediate response.

251~550Hz: High rigidity, high response.

Higher value for faster response


Servo off, set PB-33 = 1
Operate with Jog or not
Yes
Set jog target speed in PD-30
No
Operation speed up or down
Continuous vibration or noise from the mechanism
Yes
• Reduce PB-32 setting
• Or modify PB-10 to reduce mechanical resonance. Refer to 7.3.7.
No
Panel displays stable load inertia
No
Yes
Satisfactory
No
Increase PB-32 setting for higher response and rigidity
Yes
Done

**Use the Jog mode to enter the speed command**

PB-32 sets the target respond bandwidth for the speed loop.

PB-33 is set to 2.

PD-30 sets the jogspeed to enter semi-auto adjustment gain mode.

Press the "Up/ Down" key repeatedly (at least held for 2 seconds) to speed up/down the motor operation.

LED displays the present calculation of the inertia value during the process. Keep pressing until the value becomes stable.

Press MODEto exit from the semi-auto gain adjustment mode.

## 5.5.3. Flowchart of the tuning steps in the automatic gain mode

Set PB-32 (response bandwidth of the speed loop in the auto and semi-audit gain adjustment mode). The bandwidth value is 80 (by default).

Set PB-33 to 1 (semi-auto mode, non-persistent adjustment).

The server system will calculate the load inertia every half an hour and set gain parameters automatically according to the bandwidth settings.

PB-32 is the setting of the response bandwidth for the speed loop in the auto and semi-auto gain adjustment mode:

1~50Hz: Low rigidity, low response.

51~250Hz: Intermediate rigidity, intermediate response.

251~550Hz: High rigidity, high response.

Higher value for faster response


Servo off, set PB-33 = 2
Operate with Jog or not
Yes
Set jog target speed in PD-30
No
Operation speed up or down
Automatic inertia calculation unit
(Calculation every 30 minutes)
Continuous vibration or noise from the mechanism
Yes
Reduce PB-32 setting
Or modify PB-10 to reduce mechanical resonance. Refer to 7.3.7.
No
Satisfactory
No
Increase PB-32 setting for higher response and rigidity
Yes
Done

### 5.5.4. Manual adjustment of gain parameters

In addition to the automatic/semi-auto adjustment mode, the user can enter the control gains for the position and speed loops manually.

Generally, precise machining needs higher rigidity and response frequency, but higher response frequency may cause mechanical resonance easily.

Therefore, the gain must be increased gradually during the tuning process and trial run must be conducted. Reduce the gain value when resonance is generated.

The tuning principles in terms of the gain are described below:

- The proportion gain for position control (KPP,PB-20)

  The KPP parameter determines the characteristic of the position loop response. The higher the numerical value, the faster the position loop response, the lower the command following and tuning errors, and the shorter the tuning duration. However, when the value is set to high, the machine may jitter.

  The calculation method of the position loop response frequency is described below:

  Position loop response frequency (Hz) $= \frac{KPP}{2\pi}$

- Position feed-forward gain(PFG, PB-22)

  Position feed-forward gain can increase the response when the command changes and reduce the command following error and the tuning duration.

  However, vibration may occur if the set value is too high.

- The proportion gain for speed control (KVP, PB-24)

  The KVP parameter determines the feature of the speed loop response. The higher the value, the faster the response and the lower the command following error. However, mechanical resonance if the value is set too high. The speed loop response frequency must be 4~6times the position loop response frequency. The machine may jitter occur if both frequencies are too close.

  The calculation method of the position loop response frequency is described below:

  Position loop response frequency (Hz) $= \frac{KVP}{2\pi}$

- The proportion gain for speed control (KVI, PB-26)

  Higher KVI is better at removing the speed steady-state error, but the machine may jigger if the value is set to high.

  The suggested setting is:

  KVI $\leq$ 1.5 $\times$speed loop response frequency

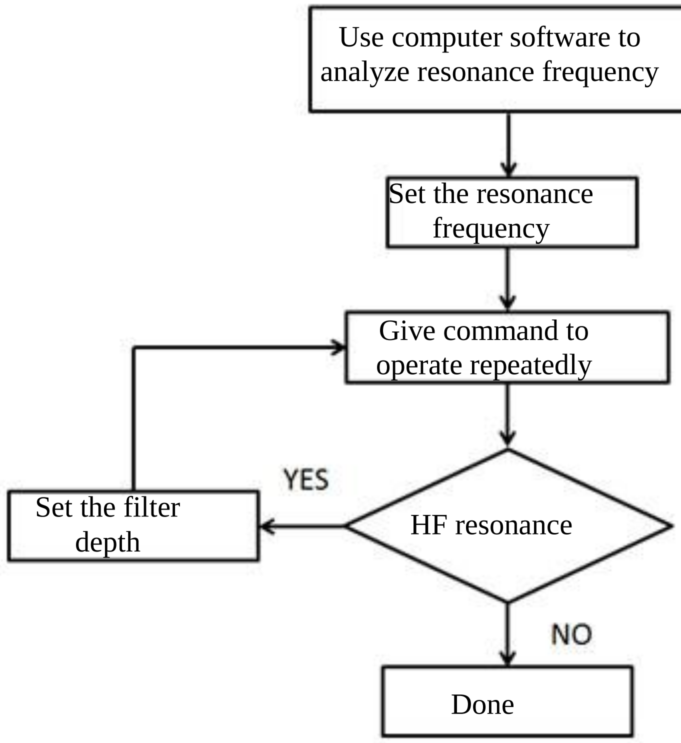
### 5.5.5. Relationship of the gain adjustment mode with the parameters

| Gain adjustment mode | PB-33 | Automatic parameter setting | User-adjusted parameter | Gain state |
|---|---|---|---|---|
| Manual gain adjustment | 0<br>(Default value) | None | PB-35 (Motor load inertia ratio)<br>PB-20 (Position control proportion gain)<br>PB-24 (Speed control proportion gain)<br>PB-26 (Speed control integration compensation)<br>PB-17 (Resonance suppression low-pass filter)<br>PB-28 (External interference resistance gain) | Fixed |
| Automatic gain adjustment<br>(Persistent calculation of the inertia ratio) | 1 | PB-35<br>PB-20<br>PB-22<br>PB-24<br>PB-26<br>PB-17<br>PB-28<br>PB-19 | PB-32 Automatic adjustment mode and responsive setting (Response level) | Persistent adjustment (Adjusted automatically every30 minutes) |
| Semi-auto gain adjustment<br>(Non-persistent inertia calculation) | 2 | PB-35<br>PB-20<br>PB-22<br>PB-24<br>PB-26<br>PB-17<br>PB-28<br>PB-19 | PB-32 Automatic adjustment mode and responsive setting (Response level) | Non-persistent adjustment (The user adjusts after entering the operation command.) |

When the semi-auto mode ( PB-33=2) is changed to the manual mode (PB-33= 0), PB-20, PB-22, PB-24, PB-26, PB-17, PB-28 and PB-19 will be automatically updated to the parameters adjusted in the semi-auto mode.

### 5.5.6. Solutions for mechanical resonance

ISA-7X provides three sets of Notch filters for users to suppress the mechanical HF resonance.
Analyze the resonance frequency using the computer software and enter the frequency value in PB-10, PB-12 or PB-14. Try to keep the machine running repeatedly to test the effect on the resonance suppression. If the resonance remains, use PB-11, PB-13 and PB-15 to increase the filter depth.
Please note that the system will be unstable if the filter depth is excessive and the resonance won't be suppressed efficiently. In this case, it is suggested to reduce the speed bandwidth.



# 6. Parameters and Functions

## 6.1. Definitions of parameters

Definitions of parameters are grouped into four. The first letter behind the initial code of the parameter P is the group character and the two letters after the group character are parameter characters. The communication address is a 16-bit value comprised of the group character and two parameter characters. Definitions of the parameters are described below:

| | |
|---|---|
| GroupA: Basic parameters | (e.g. PA-xx) |
| GroupB: Gain/filter parameters | (e.g. PB-xx) |
| GroupC: I/O configuration parameters | (e.g. PC-xx) |
| GroupD: Expansion parameters | (e.g. PD-xx) |
| GroupG: Msc parameters | (e.g.PG-xx) |
| GroupH: Msc command parameters | (e.g.PH-xx) |
| GroupJ: Msc command parameters | (e.g.PJ-xx) |
| GroupL: E-cam parameters | (e.g.PL-xx) |

Control mode description:

P is the position control mode. (The position command is entered via the CN1 Port.)
S is the speed control mode
T is the torque control mode

Description of the special symbols behind the parameter code:

| | |
|---|---|
| (R-only) | This is a read-only register for the state value, e.g. PD-15, PD-16 etc. |
| (S-off) | Setting is possible only when Servo Off is set to Off, e.g. PA-01, PA-02 etc. |
| (Re-on) | The parameter is valid only after reboot, e.g. PA-00 and PD-00 etc. |
| (N-keep) | This parameter does not memorize the property value of the setting when power is turned off, e.g. PD-06 and PD-20 etc. |

## 6.2. Parameters overview

### 6.2.1. Parameter list

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PA-00 | CTLM | Setting for the input source of the control mode and command | 000h | - | O | O | O | O | (S-off) (Re-on) |
| PA-01 | CMPT | Setting for the input format of the external pulse train | 0002h | - | O | | | O | (S-off) |
| PA-02 | STL | The setting for the speed and torque limit | 00h | - | O | O | O | O | (S-off) |
| PA-03 | ITQ1 | Internal Torque Limit 1/Internal Torque Command 1 | 100 | % | O | O | O | O | |
| PA-04 | ITQ2 | Internal Torque Limit 2/Internal Torque Command 2 | 100 | % | O | O | O | O | |
| PA-05 | ITQ3 | Internal Torque Limit 3/Internal Torque Command 3 | 100 | % | O | O | O | O | |
| PA-06 | EOUT | The setting for the detector output of the pulse value | 8192 | pulse/rev | O | O | O | O | (S-off) |
| PA-07 | MSPL | Maximum speed limit | Based on the model | r/min | O | O | O | O | (S-off) |
| PA-08 | PCLR | Pulse cleaning mode | 00h | - | O | | | O | (S-off) |
| PA-09 | GRM1 | Numerator of the Electronic Gear Ratio (N1) | 1 | pulse | O | | | O | |
| PA-10 | GRD | Denominator of the Electronic Gear Ratio (M) | 1 | pulse | O | | | O | (S-off) |
| PA-11 | GRM2 | Numerator of the Electronic Gear Ratio (N2) | 1 | pulse | O | | | O | |
| PA-12 | GRM3 | Numerator of the Electronic Gear Ratio (N3) | 1 | pulse | O | | | O | |
| PA-13 | GRM4 | Numerator of the Electronic Gear Ratio (N4) | 1 | pulse | O | | | O | |
| PA-14 | ISP1 | Internal Speed Command 1/Internal Speed Limit 1 | Based on the model | 0.1 r/min | | O | O | | |
| PA-15 | ISP2 | Internal Speed Command 2/Internal Speed Limit 2 | Based on the model | 0.1 r/min | | O | O | | |
| PA-16 | ISP3 | Internal Speed Command 3/Internal Speed Limit 3 | Based on the model | 0.1 r/min | | O | O | | |
| PA-17 | CVM | The maximum rotation speed of the analog speed command | Based on the model | r/min | | O | O | | (S-off) |
| PA-18 | CTM | The limited maximum output of the analog torque | 100 | % | O | O | O | O | (S-off) |
| PA-19 | | | - | - | - | - | - | - | |
| PA-20 | INP | Confirmation of the range when the position is reached | 10400 | pulse | O | | | O | |
| PA-21 | ATL | Response level for automatic negotiation | 20 | - | O | O | | O | |
| PB-00 | SFIL | The acceleration-deceleration smoothing constant of the analog speed command | 0 | ms | | O | | | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PB-01 | TFIL | Smoothing constant of the analog torque command | 0 | ms | | | O | | |
| PB-02 | PFIL | Constant of the low-pass filtering for the position command | 0 | 10 ms | O | | | O | |
| PB-03 | STAC | Acceleration constant of the smooth S-curve | 200 | ms | | O | | | |
| PB-04 | STDC | Deceleration constant of the smooth S-curve | 200 | ms | | O | | | |
| PB-05 | STL | Smooth constant of the smooth S-curve | 0 | ms | | O | | | |
| PB-06 | MFIL | The constant of the linear filtering for the analog speed command | 0 | 0.1 ms | | O | | | |
| PB-07 | FRCL | Ratio of friction compensation | 0 | % | O | O | | O | (S-off) |
| PB-08 | FRCT | Smooth constant of friction compensation | 0 | ms | O | O | | O | (S-off) |
| PB-09 | PFLT2 | The constant of the linear filtering for the position command | 0 | ms | O | | | O | (S-off) |
| PB-10 | NCF1 | Notch filter for resonance suppression (1) | 1000 | Hz | O | O | O | O | |
| PB-11 | NCD1 | Notch filter for the attenuation rate of the resonance suppression (1) | 0 | dB | O | O | O | O | |
| PB-12 | NCF2 | Notch filter for resonance suppression (2) | 1000 | Hz | O | O | O | O | |
| PB-13 | NCD2 | Notch filter for the attenuation rate of the resonance suppression (2) | 0 | dB | O | O | O | O | |
| PB-14 | NCF3 | Notch filter for resonance suppression (3) | 1000 | Hz | O | O | O | O | |
| PB-15 | NCD3 | Notch filter for the attenuation rate of the resonance suppression (3) | 0 | dB | O | O | O | O | |
| PB-16 | NCFA | Setting for the suppression mode of auto-resonance | 0 | - | O | O | O | O | |
| PB-17 | NCLA | The setting for the sensitivity suppression of auto-resonance | 100 | % | O | O | O | O | |
| PB-18 | NLP | The low-pass filtering for resonance suppression | 9 | 0.1 ms | O | O | O | O | |
| PB-19 | SCJT | The filter bandwidth for the speed detection | 2500 | Hz | O | O | O | O | |
| PB-20 | KPP | The gain of the position control | 125 | rad/s | O | | | O | |
| PB-21 | PGR | Ratio for the gain variation of the position control | 100 | % | O | | | O | |
| PB-22 | PFG | The feed forward gain for the position control | 50 | % | O | | | O | |
| PB-23 | PFC | The smooth constant of the feed forward gain for the position control | 5 | ms | O | | | O | |
| PB-24 | KVP | The proportional gain for speed control | 502 | rad/s | O | O | O | O | |
| PB-25 | SPR | The ratio for the gain variation of the speed control | 100 | % | O | O | O | O | |
| PB-26 | KVI | The integral compensation for the speed control | 50 | rad/s | O | O | O | O | |
| PB-27 | KVF | The feed forward gain for the speed control | 0 | % | O | O | O | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PB-28 | DSG | The resistance gain for the external interference | 50 | rad/s | O | O | O | O | |
| PB-29 | GCM | Condition of the gain switch and the selection for the switch method | 10 | - | O | O | O | O | |
| PB-30 | GCT | The time constant for the gain switch | 1 | 10 ms | O | O | O | O | |
| PB-31 | GCC | The condition of the gain switch | 0 | Pulse, Kpps, r/min | O | O | O | O | |
| PB-32 | AUTB | The setting for the response bandwidth of the speed loop in the automatic and semi-automatic modes | 80 | Hz | O | O | O | O | |
| PB-33 | AUTM | The method for gain adjustment | 0 | - | O | O | O | O | (S-off) (N-keep) |
| PB-34 | | | - | - | - | - | - | - | |
| PB-35 | GSI | The ratio of load inertia to servo motor inertia | 0 | 0.1 times | O | O | O | O | |
| PB-36 | VSF1 | Frequency for the vibration suppression of low frequency (1) | 1000 | 0.1 Hz | O | | | O | |
| PB-37 | VSG1 | Gain for the vibration suppression of low frequency (1) | 0 | - | O | | | O | |
| PB-38 | VSF2 | Frequency for the vibration suppression of low frequency (2) | 1000 | 0.1 Hz | O | | | O | |
| PB-39 | VSG2 | Gain for the vibration suppression of low frequency (2) | 0 | - | O | | | O | |
| PB-40 | KPI | The integral compensation of the position | 0 | Hz | O | O | O | O | |
| PB-41 | JSL | The level for the stability determination of inertia estimation | 15 | 0.1 times | O | O | O | O | |
| PB-42 | AVSM | | 0 | - | O | | | O | (N-keep) |
| PB-43 | VCL | | 500 | pulse | O | | | O | |
| PB-44 | NCBW1 | | 50 | % | O | O | O | O | |
| PB-45 | NCBW2 | | 50 | % | O | O | O | O | |
| PB-46 | NCBW3 | | 50 | % | O | O | O | O | |
| PC-00 | DIRT | The time for response filtering of the digital input | 2 | 2 ms | O | O | O | O | |
| PC-01 | DI1 | The function planning for Pin DI1 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-02 | DI2 | Function planning for Pin DI2 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-03 | DI3 | Function planning for Pin DI3 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-04 | DI4 | Function planning for Pin DI4 of the digital input | Based on the control model | - | O | O | O | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PC-05 | DI5 | The function planning for Pin DI5 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-06 | DI6 | The function planning for Pin DI6 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-07 | DI7 | The function planning for Pin DI7 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-08 | DI8 | The function planning for Pin DI8 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-09 | DI9 | The function planning for Pin DI9 of the digital input | Based on the control model | - | O | O | O | O | |
| PC-10 | DO1 | Function planning for Pin DO1 of the digital output | Based on the control model | - | O | O | O | O | |
| PC-11 | DO2 | Function planning for Pin DO2 of the digital output | Based on the control model | - | O | O | O | O | |
| PC-12 | DO3 | Function planning for Pin DO3 of the digital output | Based on the control model | - | O | O | O | O | |
| PC-13 | DO4 | Function planning for Pin DO4 of the digital output | Based on the control model | - | O | O | O | O | |
| PC-14 | DO5 | Function planning for Pin DO5 of the digital output | Based on the control model | - | O | O | O | O | |
| PC-15 | DO6 | Function planning for Pin DO6 of the digital output | Based on the control model | - | O | O | O | O | |
| PC-16 | | | - | - | - | - | - | - | |
| PC-17 | | | - | - | - | - | - | - | |
| PC-18 | | | - | - | - | - | - | - | |
| PC-19 | | | - | - | - | - | - | - | |
| PC-20 | ZSPD | The level for zero speed detection | 100 | 0.1 r/min | O | O | O | O | (S-off) |
| PC-21 | BTOD | The turn-on delay time for the electromagnetic brake | 0 | ms | O | O | O | O | |
| PC-22 | BTCD | The turn-off delay time for the electromagnetic brake | 0 | ms | O | O | O | O | |
| PC-23 | SPOK | The level for detection of the speed comparison | 10 | r/min | | O | | | |
| PC-24 | PUUres | Position error in analog monitoring resolution (PUU units) | 10000 | pulse | O | O | O | O | (S-off) |
| PC-25 | POL | The output level for the expected overload | 0 | % | O | O | O | | |
| PD-00 | ADR | The setting of the branch number | 7Fh | - | O | O | O | O | (S-off)<br>(Re-on) |
| PD-01 | BRT | The communication transmission rate | 33h | - | O | O | O | O | (S-off) |
| PD-02 | PTL | The protocol | 6 | - | O | O | O | O | (S-off) |
| PD-03 | CFP | The handling of the communication error | 0 | - | O | O | O | O | (S-off) |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PD-04 | COT | The setting for the communication timeout | 0 | sec | O | O | O | O | (S-off) |
| PD-05 | | | - | - | - | - | - | - | |
| PD-06 | SWDI | Control switch for the source of the input contact (DI) | 0 | - | O | O | O | O | (N-keep) |
| PD-07 | CDT | The time for the delay of the communication response | 0 | 1 ms | O | O | O | O | |
| PD-08 | | | - | - | - | - | - | - | |
| PD-09 | | | - | - | - | - | - | - | |
| PD-10 | | | - | - | - | - | - | - | |
| PD-11 | VER | The firmware version | The factory setting | - | O | O | O | O | (R-only) |
| PD-12 | | | The factory setting | - | O | O | O | O | (R-only) |
| PD-13 | | | - | - | - | - | - | - | |
| PD-14 | | | - | - | - | - | - | - | |
| PD-15 | MON1 | Display for Status Monitoring Register 1 | - | - | O | O | O | O | (R-only) (N-keep) |
| PD-16 | MON2 | Display for Status Monitoring Register 2 | - | - | O | O | O | O | (R-only) (N-keep) |
| PD-17 | MON3 | Display for Status Monitoring Register 3 | - | - | O | O | O | O | (R-only) (N-keep) |
| PD-18 | MON4 | Display for Status Monitoring Register 4 | - | - | O | O | O | O | (R-only) (N-keep) |
| PD-19 | MON5 | Display for Status Monitoring Register 5 | - | - | O | O | O | O | (R-only) (N-keep) |
| PD-20 | ALD | The display for the error status of the drive | - | - | O | O | O | O | (N-keep) |
| PD-21 | SSD | Display for the status of the drive | 0 | - | O | O | O | O | |
| PD-22 | VMON | The analog output monitoring | 01h | - | O | O | O | O | |
| PD-23 | CM1 | The selection for the content of the display for Status Monitoring Register 1 | 0 | - | O | O | O | O | (S-off) |
| PD-24 | CM2 | The selection for the content of the display for Status Monitoring Register 2 | 0 | - | O | O | O | O | (S-off) |
| PD-25 | CM3 | The selection for the content of the display for Status Monitoring Register 3 | 0 | - | O | O | O | O | (S-off) |
| PD-26 | CM4 | The selection for the content of the display for Status Monitoring Register 4 | 0 | - | O | O | O | O | (S-off) |
| PD-27 | CM5 | The selection for the content of the display for Status Monitoring Register 5 | 0 | - | O | O | O | O | (S-off) |
| PD-28 | VMR1 | The ratio for MON1 analog monitoring output | 100 | % | O | O | O | O | (S-off) |
| PD-29 | VMR2 | The ratio for MON2 analog monitoring output | 100 | % | O | O | O | O | (S-off) |
| PD-30 | JOG | The jog control of the servo motor | 20 | r/min | O | O | O | O | |
| PD-31 | FDO | The status and setting of the digital output | Based on the control model | - | O | O | O | O | (S-off) (N-keep) |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PD-32 | DISF | The status and setting of the digital input | Based on the control model | - | O | O | O | O | (N-keep) |
| PD-33 | ALH1 | Record of the Abnormal Status (N) | 0 | - | O | O | O | O | (R-only) |
| PD-34 | ALH2 | The record of the abnormal condition (N-1) | 0 | - | O | O | O | O | (R-only) |
| PD-35 | ALH3 | The record of the abnormal condition (N-2) | 0 | - | O | O | O | O | (R-only) |
| PD-36 | ALH4 | The record of the abnormal condition (N-3) | 0 | - | O | O | O | O | (R-only) |
| PD-37 | ALH5 | The record of the abnormal condition (N-4) | 0 | - | O | O | O | O | (R-only) |
| PD-38 | | | - | - | - | - | - | - | |
| PD-39 | AOUT | The setting for the polarity of the pulse output for the detector | 0 | mV | O | O | O | O | |
| PD-40 | PCM | The status monitoring register (for PC software) | 0 | mV | O | O | O | O | |
| PD-41 | PCMS | The content selection of the status monitoring register (for PC software) | 0 | - | O | O | O | O | |
| PD-42 | MSTP | The function of the motor stop mode | 00h | - | O | O | O | O | (S-off) |
| PD-43 | TSPD | The level for the detection of the target rotation speed | Based on the model | r/min | O | O | O | O | |
| PD-44 | RegMisc1 | The write-in of the special parameter | 0000h | - | O | O | O | O | (S-off) (N-keep) |
| PD-45 | RES | The value of the regenerative resistor | Based on the model | ohm | O | O | O | O | (S-off) |
| PD-46 | RESC | The capacity of the regenerative resistor | Based on the model | watt | O | O | O | O | (S-off) |
| PD-47 | CRSR | The collision protection for the motor (torque percentage) | 0 | % | O | O | O | O | |
| PD-48 | CRST | The collision protection for the motor (protection time) | 1 | ms | O | O | O | O | |
| PD-49 | EXREG | The selection of the external braking unit | 0 | - | O | O | O | O | |
| PD-50 | AUTS | The status of inertia adjustment in the semi-auto mode | 0 | - | O | O | O | O | (S-off) (N-keep) |
| PD-51 | INH | The auxiliary function | - | - | - | - | - | - | |
| PD-52 | PLOSS | The detection of the input phase failure | 0 | - | O | O | O | O | |
| PD-53 | OSPW | The condition for the overspeed warning | Based on the model | rpm | O | O | O | O | |
| PD-54 | PCF | The condition for giving warnings of the excessive error regarding the position control | 6400000 | pulse | O | | | O | |
| PD-55 | LVF | The level for the error of the low voltage | 160 | Vrms | O | O | O | O | |
| PD-56 | ENCType | Encoder type setting | 0 | - | O | O | O | O | (Re-on) |
| PD-57 | INFOS | Message reading selection | 0 | - | O | O | O | O | |
| PD-58 | ABSRST | Absolute position reset | 000h | - | O | O | O | O | (N-keep) |
| PD-59 | AENCSTS | Absolute coordinate system status | 00h | - | O | O | O | O | (R-only) (N-keep) |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PD-60 | APREV | Encoder absolute position - number of turns | 0 | rev | O | O | O | O | (R-only) (N-keep) |
| PD-61 | APREV | Encoder absolute position –Single turn pulse number or PUU | 0 | pulse / PUU | O | O | O | O | (R-only) (N-keep) |
| PD-62 | ZPWID | Z phase width adjustment | 1 | 100 us | O | O | O | O | |
| PG-00 | HmCtrl | Home position return main function setting | 0h | - | | | | O | |
| PG-01 | HmHSpd | Return-to-origin high speed | 7000 | 0.1 r/min | | | | O | |
| PG-02 | HmLSpd | Return-to-origin low speed | 1000 | 0.1 r/min | | | | O | |
| PG-03 | HmHAcc | Return-to-origin high speed acceleration time | 100 | 1 ms | | | | O | |
| PG-04 | HmHDec | Return-to-origin high-speed deceleration time | 100 | 1 ms | | | | O | |
| PG-05 | HmLAcc | Return-to-origin low-speed acceleration time | 100 | 1 ms | | | | O | |
| PG-06 | HmLDec | Return-to-origin low-speed deceleration time | 100 | 1 ms | | | | O | |
| PG-07 | ZpCount | Return-to-origin to find Z times | -1 | - | | | | O | |
| PG-08 | HmDef | Return-to-origin to origin definition | 0 | pulse | | | | O | |
| PG-09 | OrgEnc | Return-to-origin to complete the origin encoder reading | 0h | pulse | | | | O | (R-only) |
| PG-10 | PNLDec | Deceleration time of return-to-origin limit return | 10 | 1 ms | | | | O | |
| PG-11 | SWTrig | Msc software startup trigger | 0 | - | | | | O | (N-keep) |
| PG-12 | AcDe00 | Msc acceleration and deceleration time data group 01 | 1 | 1 ms | | | | O | |
| PG-13 | AcDe01 | Msc acceleration and deceleration time data group 02 | 2 | 1 ms | | | | O | |
| PG-14 | AcDe02 | Msc acceleration and deceleration time data group 03 | 4 | 1 ms | | | | O | |
| PG-15 | AcDe03 | Msc acceleration and deceleration time data group 04 | 6 | 1 ms | | | | O | |
| PG-16 | AcDe04 | Msc acceleration and deceleration time data group 05 | 8 | 1 ms | | | | O | |
| PG-17 | AcDe05 | Msc acceleration and deceleration time data group 06 | 10 | 1 ms | | | | O | |
| PG-18 | AcDe06 | Msc acceleration and deceleration time data group 07 | 20 | 1 ms | | | | O | |
| PG-19 | AcDe07 | Msc acceleration and deceleration time data group 08 | 40 | 1 ms | | | | O | |
| PG-20 | AcDe08 | Msc acceleration and deceleration time data group 09 | 60 | 1 ms | | | | O | |
| PG-21 | AcDe09 | Msc acceleration and deceleration time data group 10 | 80 | 1 ms | | | | O | |
| PG-22 | AcDe0A | Msc acceleration and deceleration time data group 11 | 100 | 1 ms | | | | O | |
| PG-23 | AcDe0B | Msc acceleration and deceleration time data group 12 | 200 | 1 ms | | | | O | |
| PG-24 | AcDe0C | Msc acceleration and deceleration time data group 13 | 400 | 1 ms | | | | O | |
| PG-25 | AcDe0D | Msc acceleration and deceleration time data group 14 | 600 | 1 ms | | | | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PG-26 | AcDe0E | Msc acceleration and deceleration time data group 15 | 800 | 1 ms | | | | O | |
| PG-27 | AcDe0F | Msc acceleration and deceleration time data group 16 | 1000 | 1 ms | | | | O | |
| PG-28 | Dely00 | Msc delay time data group 01 | 0 | 1 ms | | | | O | |
| PG-29 | Dely01 | Msc delay time data group 02 | 5 | 1 ms | | | | O | |
| PG-30 | Dely02 | Msc delay time data group 03 | 10 | 1 ms | | | | O | |
| PG-31 | Dely03 | Msc delay time data group 04 | 20 | 1 ms | | | | O | |
| PG-32 | Dely04 | Msc delay time data group 05 | 30 | 1 ms | | | | O | |
| PG-33 | Dely05 | Msc delay time data group 06 | 50 | 1 ms | | | | O | |
| PG-34 | Dely06 | Msc delay time data group 07 | 70 | 1 ms | | | | O | |
| PG-35 | Dely07 | Msc delay time data group 08 | 100 | 1 ms | | | | O | |
| PG-36 | Dely08 | Msc delay time data group 09 | 200 | 1 ms | | | | O | |
| PG-37 | Dely09 | Msc delay time data group 10 | 300 | 1 ms | | | | O | |
| PG-38 | Dely0A | Msc delay time data group 11 | 500 | 1 ms | | | | O | |
| PG-39 | Dely0B | Msc delay time data group 12 | 700 | 1 ms | | | | O | |
| PG-40 | Dely0C | Msc delay time data group 13 | 1000 | 1 ms | | | | O | |
| PG-41 | Dely0D | Msc delay time data group 14 | 2000 | 1 ms | | | | O | |
| PG-42 | Dely0E | Msc delay time data group 15 | 3000 | 1 ms | | | | O | |
| PG-43 | Dely0F | Msc delay time data group 16 | 5000 | 1 ms | | | | O | |
| PG-44 | Sped00 | Msc target speed data group 01 | 1 | 0.1 r/min | | | | O | |
| PG-45 | Sped01 | Msc target speed data group 02 | 10 | 0.1 r/min | | | | O | |
| PG-46 | Sped02 | Msc target speed data group 03 | 30 | 0.1 r/min | | | | O | |
| PG-47 | Sped03 | Msc target speed data group 04 | 50 | 0.1 r/min | | | | O | |
| PG-48 | Sped04 | Msc target speed data group 05 | 70 | 0.1 r/min | | | | O | |
| PG-49 | Sped05 | Msc target speed data group 06 | 100 | 0.1 r/min | | | | O | |
| PG-50 | Sped06 | Msc target speed data group 07 | 300 | 0.1 r/min | | | | O | |
| PG-51 | Sped07 | Msc target speed data group 08 | 500 | 0.1 r/min | | | | O | |
| PG-52 | Sped08 | Msc target speed data group 09 | 700 | 0.1 r/min | | | | O | |
| PG-53 | Sped09 | Msc target speed data group 10 | 1000 | 0.1 r/min | | | | O | |
| PG-54 | Sped0A | Msc target speed data group 11 | 3000 | 0.1 r/min | | | | O | |
| PG-55 | Sped0B | Msc target speed data group 12 | 5000 | 0.1 r/min | | | | O | |
| PG-56 | Sped0C | Msc target speed data group 13 | 7000 | 0.1 r/min | | | | O | |
| PG-57 | Sped0D | Msc target speed data group 14 | 10000 | 0.1 r/min | | | | O | |
| PG-58 | Sped0E | Msc target speed data group 15 | 20000 | 0.1 r/min | | | | O | |
| PG-59 | Sped0F | Msc target speed data group 16 | 30000 | 0.1 r/min | | | | O | |
| PG-60 | ExIsr | Msc program interrupt settings | 0h | - | | | | O | |
| PG-61 | DiNo01 | Msc command selector - DI number 01 | 1 | - | | | | O | |
| PG-62 | DiNo02 | Msc command selector - DI number 02 | 2 | - | | | | O | |
| PG-63 | DiNo03 | Msc command selector - DI number 03 | 3 | - | | | | O | |
| PG-64 | DiNo04 | Msc command selector - DI number 04 | 4 | - | | | | O | |
| PG-65 | DiNo05 | Msc command selector - DI number 05 | 5 | - | | | | O | |
| PG-66 | DiNo06 | Msc command selector - DI number 06 | 6 | - | | | | O | |
| PG-67 | DiNo07 | Msc command selector - DI number 07 | 7 | - | | | | O | |
| PG-68 | DiNo08 | Msc command selector - DI number 08 | 8 | - | | | | O | |
| PG-69 | DiNo09 | Msc command selector - DI number 09 | 9 | - | | | | O | |
| PG-70 | DiNo0A | Msc command selector - DI number 10 | 10 | - | | | | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PG-71 | DiNo0B | Msc command selector - DI number 11 | 11 | - | | | | O | |
| PG-72 | DiNo0C | Msc command selector - DI number 12 | 12 | - | | | | O | |
| PG-73 | DiNo0D | Msc command selector - DI number 13 | 13 | - | | | | O | |
| PG-74 | DiNo0E | Msc command selector - DI number 14 | 14 | - | | | | O | |
| PG-75 | DiNo0F | Msc command selector - DI number 15 | 15 | - | | | | O | |
| PG-76 | DiEv01 | Msc command trigger - Di-Ev1 | 0 | - | | | | O | |
| PG-77 | DiEv02 | Msc command trigger - Di-Ev2 | 0 | - | | | | O | |
| PG-78 | DiEv03 | Msc command trigger - Di-Ev3 | 0 | - | | | | O | |
| PG-79 | DiEv04 | Msc command trigger - Di-Ev4 | 0 | - | | | | O | |
| PG-80 | InxStrok | Msc indexing total stroke | 109 | PUU | | | | O | |
| PG-81 | FrqRat | Msc mode pulse wave frequency analogy rate denominator | 107 | PUU | | | | O | |
| PG-82 | 1stAbsLat | Position coordinate monitoring parameters when Msc starts | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-83 | AbsCrd | Msc current position coordinate monitoring parameters | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-84 | 1stInxLat | Indexing coordinate monitoring parameters when Msc starts | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-85 | InxCrdPuu | Msc current indexing coordinate monitoring parameters | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-86 | AbsOrgDone | Multi-turn absolute motor origin return state | 0h | - | | | | O | (R-only) |
| PH-00 | MscSet01 | Msc command 01 set value | 0h | - | | | | O | |
| PH-01 | MscDat01 | Msc command 01 data value | 0 | - | | | | O | |
| PH-02 | MscSet02 | Msc command 02 set value | 0h | - | | | | O | |
| PH-03 | MscDat02 | Msc command 02 data value | 0 | - | | | | O | |
| PH-04 | MscSet03 | Msc command 03 set value | 0h | - | | | | O | |
| PH-05 | MscDat03 | Msc command 03 data value | 0 | - | | | | O | |
| PH-06 | MscSet04 | Msc command 04 set value | 0h | - | | | | O | |
| PH-07 | MscDat04 | Msc command 04 data value | 0 | - | | | | O | |
| PH-08 | MscSet05 | Msc command 05 set value | 0h | - | | | | O | |
| PH-09 | MscDat05 | Msc command 05 data value | 0 | - | | | | O | |
| PH-10 | MscSet06 | Msc command 06 set value | 0h | - | | | | O | |
| PH-11 | MscDat06 | Msc command 06 data value | 0 | - | | | | O | |
| PH-12 | MscSet07 | Msc command 07 set value | 0h | - | | | | O | |
| PH-13 | MscDat07 | Msc command 07 data value | 0 | - | | | | O | |
| PH-14 | MscSet08 | Msc command 08 set value | 0h | - | | | | O | |
| PH-15 | MscDat08 | Msc command 08 data value | 0 | - | | | | O | |
| PH-16 | MscSet09 | Msc command 09 set value | 0h | - | | | | O | |
| PH-17 | MscDat09 | Msc command 09 data value | 0 | - | | | | O | |
| PH-18 | MscSet10 | Msc command 10 set value | 0h | - | | | | O | |
| PH-19 | MscDat10 | Msc command 10 data value | 0 | - | | | | O | |
| PH-20 | MscSet11 | Msc command 11 set value | 0h | - | | | | O | |
| PH-21 | MscDat11 | Msc command 11 data value | 0 | - | | | | O | |
| PH-22 | MscSet12 | Msc command 12 set value | 0h | - | | | | O | |
| PH-23 | MscDat12 | Msc command 12 data value | 0 | - | | | | O | |
| PH-24 | MscSet13 | Msc command 13 set value | 0h | - | | | | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PH-25 | MscDat13 | Msc command 13 data value | 0 | - | | | | O | |
| PH-26 | MscSet14 | Msc command 14 set value | 0h | - | | | | O | |
| PH-27 | MscDat14 | Msc command 14 data value | 0 | - | | | | O | |
| PH-28 | MscSet15 | Msc command 15 set value | 0h | - | | | | O | |
| PH-29 | MscDat15 | Msc command 15 data value | 0 | - | | | | O | |
| PH-30 | MscSet16 | Msc command 16 set value | 0h | - | | | | O | |
| PH-31 | MscDat16 | Msc command 16 data value | 0 | - | | | | O | |
| PH-32 | MscSet17 | Msc command 17 set value | 0h | - | | | | O | |
| PH-33 | MscDat17 | Msc command 17 data value | 0 | - | | | | O | |
| PH-34 | MscSet18 | Msc command 18 set value | 0h | - | | | | O | |
| PH-35 | MscDat18 | Msc command 18 data value | 0 | - | | | | O | |
| PH-36 | MscSet19 | Msc command 19 set value | 0h | - | | | | O | |
| PH-37 | MscDat19 | Msc command 19 data value | 0 | - | | | | O | |
| PH-38 | MscSet20 | Msc command 20 set value | 0h | - | | | | O | |
| PH-39 | MscDat20 | Msc command 20 data value | 0 | - | | | | O | |
| PH-40 | MscSet21 | Msc command 21 set value | 0h | - | | | | O | |
| PH-41 | MscDat21 | Msc command 21 data value | 0 | - | | | | O | |
| PH-42 | MscSet22 | Msc command 22 set value | 0h | - | | | | O | |
| PH-43 | MscDat22 | Msc command 22 data value | 0 | - | | | | O | |
| PH-44 | MscSet23 | Msc command 23 set value | 0h | - | | | | O | |
| PH-45 | MscDat23 | Msc command 23 data value | 0 | - | | | | O | |
| PH-46 | MscSet24 | Msc command 24 set value | 0h | - | | | | O | |
| PH-47 | MscDat24 | Msc command 24 data value | 0 | - | | | | O | |
| PH-48 | MscSet25 | Msc command 25 set value | 0h | - | | | | O | |
| PH-49 | MscDat25 | Msc command 25 data value | 0 | - | | | | O | |
| PH-50 | MscSet26 | Msc command 26 set value | 0h | - | | | | O | |
| PH-51 | MscDat26 | Msc command 26 data value | 0 | - | | | | O | |
| PH-52 | MscSet27 | Msc command 27 set value | 0h | - | | | | O | |
| PH-53 | MscDat27 | Msc command 27 data value | 0 | - | | | | O | |
| PH-54 | MscSet28 | Msc command 28 set value | 0h | - | | | | O | |
| PH-55 | MscDat28 | Msc command 28 data value | 0 | - | | | | O | |
| PH-56 | MscSet29 | Msc command 29 set value | 0h | - | | | | O | |
| PH-57 | MscDat29 | Msc command 29 data value | 0 | - | | | | O | |
| PH-58 | MscSet30 | Msc command 30 set value | 0h | - | | | | O | |
| PH-59 | MscDat30 | Msc command 30 data value | 0 | - | | | | O | |
| PH-60 | MscSet31 | Msc command 31 set value | 0h | - | | | | O | |
| PH-61 | MscDat31 | Msc command 31 data value | 0 | - | | | | O | |
| PH-62 | MscSet32 | Msc command 32 set value | 0h | - | | | | O | |
| PH-63 | MscDat32 | Msc command 32 data value | 0 | - | | | | O | |
| PH-64 | MscSet33 | Msc command 33 set value | 0h | - | | | | O | |
| PH-65 | MscDat33 | Msc command 33 data value | 0 | - | | | | O | |
| PH-66 | MscSet34 | Msc command 34 set value | 0h | - | | | | O | |
| PH-67 | MscDat34 | Msc command 34 data value | 0 | - | | | | O | |
| PH-68 | MscSet35 | Msc command 35 set value | 0h | - | | | | O | |
| PH-69 | MscDat35 | Msc command 35 data value | 0 | - | | | | O | |
| PH-70 | MscSet36 | Msc command 36 set value | 0h | - | | | | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PH-71 | MscDat36 | Msc command 36 data value | 0 | - | | | | O | |
| PH-72 | MscSet37 | Msc command 37 set value | 0h | - | | | | O | |
| PH-73 | MscDat37 | Msc command 37 data value | 0 | - | | | | O | |
| PH-74 | MscSet38 | Msc command 38 set value | 0h | - | | | | O | |
| PH-75 | MscDat38 | Msc command 38 data value | 0 | - | | | | O | |
| PH-76 | MscSet39 | Msc command 39 set value | 0h | - | | | | O | |
| PH-77 | MscDat39 | Msc command 39 data value | 0 | - | | | | O | |
| PH-78 | MscSet40 | Msc command 40 set value | 0h | - | | | | O | |
| PH-79 | MscDat40 | Msc command 40 data value | 0 | - | | | | O | |
| PH-80 | MscSet41 | Msc command 41 set value | 0h | - | | | | O | |
| PH-81 | MscDat41 | Msc command 41 data value | 0 | - | | | | O | |
| PH-82 | MscSet42 | Msc command 42 set value | 0h | - | | | | O | |
| PH-83 | MscDat42 | Msc command 42 data value | 0 | - | | | | O | |
| PH-84 | MscSet43 | Msc command 43 set value | 0h | - | | | | O | |
| PH-85 | MscDat43 | Msc command 43 data value | 0 | - | | | | O | |
| PH-86 | MscSet44 | Msc command 44 set value | 0h | - | | | | O | |
| PH-87 | MscDat44 | Msc command 44 data value | 0 | - | | | | O | |
| PH-88 | MscSet45 | Msc command 45 set value | 0h | - | | | | O | |
| PH-89 | MscDat45 | Msc command 45 data value | 0 | - | | | | O | |
| PH-90 | MscSet46 | Msc command 46 set value | 0h | - | | | | O | |
| PH-91 | MscDat46 | Msc command 46 data value | 0 | - | | | | O | |
| PH-92 | MscSet47 | Msc command 47 set value | 0h | - | | | | O | |
| PH-93 | MscDat47 | Msc command 47 data value | 0 | - | | | | O | |
| PH-94 | MscSet48 | Msc command 48 set value | 0h | - | | | | O | |
| PH-95 | MscDat48 | Msc command 48 data value | 0 | - | | | | O | |
| PH-96 | MscSet49 | Msc command 49 set value | 0h | - | | | | O | |
| PH-97 | MscDat49 | Msc command 49 data value | 0 | - | | | | O | |
| PH-98 | MscSet50 | Msc command 50 set value | 0h | - | | | | O | |
| PH-99 | MscDat50 | Msc command 50 data value | 0 | - | | | | O | |
| PJ-00 | MscSet51 | Msc command 51 set value | 0h | - | | | | O | |
| PJ-01 | MscDat51 | Msc command 51 data value | 0 | - | | | | O | |
| PJ-02 | MscSet52 | Msc command 52 set value | 0h | - | | | | O | |
| PJ-03 | MscDat52 | Msc command 52 data value | 0 | - | | | | O | |
| PJ-04 | MscSet53 | Msc command 53 set value | 0h | - | | | | O | |
| PJ-05 | MscDat53 | Msc command 53 data value | 0 | - | | | | O | |
| PJ-06 | MscSet54 | Msc command 54 set value | 0h | - | | | | O | |
| PJ-07 | MscDat54 | Msc command 54 data value | 0 | - | | | | O | |
| PJ-08 | MscSet55 | Msc command 55 set value | 0h | - | | | | O | |
| PJ-09 | MscDat55 | Msc command 55 data value | 0 | - | | | | O | |
| PJ-10 | MscSet56 | Msc command 56 set value | 0h | - | | | | O | |
| PJ-11 | MscDat56 | Msc command 56 data value | 0 | - | | | | O | |
| PJ-12 | MscSet57 | Msc command 57 setting | 0h | - | | | | O | |
| PJ-13 | MscDat57 | Msc command 57 data value | 0 | - | | | | O | |
| PJ-14 | MscSet58 | Msc command 58 set value | 0h | - | | | | O | |
| PJ-15 | MscDat58 | Msc command 58 data value | 0 | - | | | | O | |
| PJ-16 | MscSet59 | Msc command 59 set value | 0h | - | | | | O | |

| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | P | S | T | Msc | |
| PJ-17 | MscDat59 | Msc command 59 data value | 0 | - | | | | O | |
| PJ-18 | MscSet60 | Msc command 60 set value | 0h | - | | | | O | |
| PJ-19 | MscDat60 | Msc command 60 data value | 0 | - | | | | O | |
| PJ-20 | MscSet61 | Msc command 61 set value | 0h | - | | | | O | |
| PJ-21 | MscDat61 | Msc command 61 data value | 0 | - | | | | O | |
| PJ-22 | MscSet62 | Msc command 62 set value | 0h | - | | | | O | |
| PJ-23 | MscDat62 | Msc command 62 data value | 0 | - | | | | O | |
| PJ-24 | MscSet63 | Msc command 63 set value | 0h | - | | | | O | |
| PJ-25 | MscDat63 | Msc command 63 data value | 0 | - | | | | O | |
| PJ-26 | MscSet64 | Msc command 64 set value | 0h | - | | | | O | |
| PJ-27 | MscDat64 | Msc command 64 data value | 0 | - | | | | O | |
| PJ-28 | MscSet65 | Msc command 65 set value | 0h | - | | | | O | |
| PJ-29 | MscDat65 | Msc command 65 data value | 0 | - | | | | O | |
| PJ-30 | MscSet66 | Msc command 66 set value | 0h | - | | | | O | |
| PJ-31 | MscDat66 | Msc command 66 data value | 0 | - | | | | O | |
| PJ-32 | MscSet67 | Msc command 67 set value | 0h | - | | | | O | |
| PJ-33 | MscDat67 | Msc command 67 data value | 0 | - | | | | O | |
| PJ-34 | MscSet68 | Msc command 68 set value | 0h | - | | | | O | |
| PJ-35 | MscDat68 | Msc command 68 data value | 0 | - | | | | O | |
| PL-00 | CamCtrl | Electronic cam main function setting | 0h | - | | | | O | |
| PL-01 | CamSpd | Virtual master axis command – speed command | 0 | 0.1 r/min | | | | O | |
| PL-02 | CamPos | Virtual master axis command – position command | 0 | pulse | | | | O | |
| PL-03 | CamAcc | Virtual master axis command acceleration time | 50 | ms | | | | O | |
| PL-04 | CamDec | Virtual master axis command deceleration time | 50 | ms | | | | O | |
| PL-05 | CamBlk | Main axis command mask amount | 0 | pulse | | | | O | |
| PL-06 | CamRes | Active shaft single turn resolution | 1000 | pulse | | | | O | |
| PL-07 | CamCyl | When the drive shaft turns one week, Number of rotations of the driven shaft | 1 | rev | | | | O | |
| PL-08 | CamPhs | Spindle phase angle adjustment | 0 | 0.1 deg | | | | O | |
| PL-09 | CamOfs | Cam curve table offset | 0 | pulse | | | | O | |
| PL-10 | CamGan | Cam curve magnification | 1000 | 0.001x | | | | O | |
| PL-11 | CamSec | Cam curve original data points | 17 | Number | | | | O | (R-only) |
| PL-12 | CamTyp | Cam curve output command type | 1h | - | | | | O | |
| PL-13 | CamMaMon | Cam drive shaft analog monitor switching | 0h | - | | | | O | |
| PL-14 | CamSvMon | Cam slave axis analog monitor switching | 0h | - | | | | O | |

## 6.2.2. Classification of the parameter function

| | Parameters for the monitoring and the general output setting | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode P | S | T | MSC | Remark |
| PD-11 | VER | The firmware version | The factory setting | - | O | O | O | O | (R-only) |
| PD-12 | FPGAVER | FPGA firmware version | The factory setting | | O | O | O | O | (R-only) |
| PD-15 | MON1 | Display for Status Monitoring Register 1 | 0 | - | O | O | O | O | (R-only) (N-keep) |
| PD-16 | MON2 | Display for Status Monitoring Register 2 | 0 | - | O | O | O | O | (R-only) (N-keep) |
| PD-17 | MON3 | Display for Status Monitoring Register 3 | 0 | - | O | O | O | O | (R-only) (N-keep) |
| PD-18 | MON4 | Display for Status Monitoring Register 4 | 0 | - | O | O | O | O | (R-only) (N-keep) |
| PD-19 | MON5 | Display for Status Monitoring Register 5 | 0 | - | O | O | O | O | (R-only) (N-keep) |
| PD-20 | ALD | The display for the error status of the drive (seven-segment display) | - | - | O | O | O | O | (N-keep) |
| PD-21 | SSD | Display for the status of the drive | 0 | - | O | O | O | O | |
| PD-22 | VMON | The analog output monitoring | 01h | - | O | O | O | O | |
| PD-23 | CM1 | The selection for the content of the display for Status Monitoring Register 1 | 0 | - | O | O | O | O | (S-off) |
| PD-24 | CM2 | The selection for the content of the display for Status Monitoring Register 2 | 0 | - | O | O | O | O | (S-off) |
| PD-25 | CM3 | The selection for the content of the display for Status Monitoring Register 3 | 0 | - | O | O | O | O | (S-off) |
| PD-26 | CM4 | The selection for the content of the display for Status Monitoring Register 4 | 0 | - | O | O | O | O | (S-off) |
| PD-27 | CM5 | The selection for the content of the display for Status Monitoring Register 5 | 0 | - | O | O | O | O | (S-off) |
| PD-28 | VMR1 | The ratio for MON1 analog monitoring output | 100 | % | O | O | O | O | (S-off) |
| PD-29 | VMR2 | The ratio for MON2 analog monitoring output | 100 | % | O | O | O | O | (S-off) |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

| Parameters related to the filter smoothness and resonance suppression | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PB-00 | SFIL | The acceleration-deceleration smoothing constant of the analog speed command | 0 | ms | | O | | | |
| PB-01 | TFIL | Smoothing constant of the analog torque command | 0 | ms | | | O | | |
| PB-02 | PFIL | Constant of the low-pass filtering for the position command | 0 | 10 ms | O | | | O | |
| PB-03 | STAC | The acceleration constant of the S-shaped speed curve | 200 | ms | | O | | | |
| PB-04 | STDC | The deceleration constant of the S-shaped speed curve | 200 | ms | | O | | | |
| PB-05 | STL | The smoothing constant of the S-shaped speed curve | 0 | ms | | O | | | |
| PB-06 | MFIL | The constant of the linear filtering for the analog speed command | 0 | 0.1 ms | | O | | | |
| PB-07 | FRCL | The friction compensation | 0 | % | O | O | | O | (S-off) |
| PB-08 | FRCT | The friction compensation | 0 | ms | O | O | | O | (S-off) |
| PB-09 | PFLT2 | The constant of the linear filtering for the position command | 0 | ms | O | | | O | (S-off) |
| PB-10 | NCF1 | Notch filter for resonance suppression (1) | 1000 | Hz | O | O | O | O | |
| PB-11 | NCD1 | Notch filter for the attenuation rate of the resonance suppression (1) | 0 | dB | O | O | O | O | |
| PB-12 | NCF2 | Notch filter for resonance suppression (2) | 1000 | Hz | O | O | O | O | |
| PB-13 | NCD2 | Notch filter for the attenuation rate of the resonance suppression (2) | 0 | dB | O | O | O | O | |
| PB-14 | NCF3 | Notch filter for resonance suppression (3) | 1000 | Hz | O | O | O | O | |
| PB-15 | NCD3 | Notch filter for the attenuation rate of the resonance suppression (3) | 0 | dB | O | O | O | O | |
| PB-16 | NCFA | Setting for the suppression mode of auto-resonance | 0 | - | O | O | O | O | |
| PB-17 | NCLA | The setting for the sensitivity suppression of auto-resonance | 100 | % | O | O | O | O | |
| PB-18 | NLP | The low-pass filtering for resonance suppression | 9 | 0.1 ms | O | O | O | O | |
| PB-19 | SCJT | The filtering for the speed detection and the suppression of micro-vibration | 2500 | Hz | O | O | O | O | |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

| Parameters related to gain and switch | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PA-21 | ATL | Response level for automatic negotiation | 20 | - | O | O | | O | |
| PB-20 | KPP | The gain of the position control | 125 | rad/s | O | | | O | |
| PB-21 | PGR | Ratio for the gain variation of the position control | 100 | % | O | | | O | |
| PB-22 | PFG | The feed-forward gain for location | 50 | % | O | | | O | |
| PB-23 | PFC | The smooth constant of the feed-forward gain for the position | 5 | ms | O | | | O | |
| PB-24 | KVP | The gain of the speed control | 502 | rad/s | O | O | O | O | |
| PB-25 | SPR | The ratio for the gain variation of the speed control | 100 | % | O | O | O | O | |
| PB-26 | KVI | The integral compensation of the speed | 50 | rad/s | O | O | O | O | |
| PB-27 | KVF | The feed-forward gain for speed | 0 | % | O | O | O | O | |
| PB-28 | DSG | The resistance gain for the external interference | 50 | rad/s | O | O | O | O | |
| PB-29 | GCM | Condition of the gain switch and the selection for the switch method | 10 | - | O | O | O | O | |
| PB-30 | GCT | The time constant for the gain switch | 1 | 10 ms | O | O | O | O | |
| PB-31 | GCC | The condition of the gain switch | 0 | pulse Kpps r/min | O | O | O | O | |
| PB-32 | AUTB | The setting for the response bandwidth of the speed loop in the automatic and semi-automatic modes | 80 | Hz | O | O | O | O | |
| PB-33 | AUTM | Gain adjustment mode | 0 | - | O | O | O | O | (S-off) (N-keep) |
| PB-40 | KPI | The integral compensation of the position | 0 | Hz | O | O | O | O | |

| | |
|---|---|
| (R-only) | This indicates the read-only register, which can only be used for reading status values. |
| (S-off) | This indicates Servo Off, which can be set only when the servo is off. |
| (Re-on) | This implies that the parameter is valid when the servo is booted again. |
| (N-keep) | The set content value won't be memorized by the parameter after power off. |

| Parameters related to the position control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PA-00 | CTLM | Setting for the input source of the control mode and command | 000h | - | O | O | O | O | (S-off)<br>(Re-on) |
| PA-01 | CMPT | The setting for the input format of the external pulse | 0002h | - | O | | | O | (S-off) |
| PA-02 | STL | The setting for the speed and torque limit | 00h | - | O | O | O | O | (S-off) |
| PA-03 | ITQ1 | Internal Torque Limit 1 | 100 | % | O | O | O | O | |
| PA-04 | ITQ2 | Internal Torque Limit 2 | 100 | % | O | O | O | O | |
| PA-05 | ITQ3 | Internal Torque Limit 3 | 100 | % | O | O | O | O | |
| PA-06 | EOUT | The setting for the detector output of the pulse value | 8192 | pulse/rev | O | O | O | O | (S-off) |
| PA-07 | MSPL | Maximum speed limit | Based on model | r/min | O | O | O | O | (S-off) |
| PA-09 | GRM1 | Numerator of the Electronic Gear Ratio (N1) | 1 | pulse | O | | | O | |
| PA-10 | GRD | Denominator of the Electronic Gear Ratio (M) | 1 | pulse | O | | | O | (S-off) |
| PA-11 | GRM2 | Numerator of the Electronic Gear Ratio (N2) | 1 | pulse | O | | | O | |
| PA-12 | GRM3 | Numerator of the Electronic Gear Ratio (N3) | 1 | pulse | O | | | O | |
| PA-13 | GRM4 | Numerator of the Electronic Gear Ratio (N4) | 1 | pulse | O | | | O | |
| PA-21 | ATL | Response level for automatic negotiation | 20 | - | O | O | | O | |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

| Parameters related to the speed control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PA-00 | CTLM | Setting for the input source of the control mode and command | 000h | - | O | O | O | O | (S-off) (Re-on) |
| PA-02 | STL | The setting for the speed and torque limit | 00h | - | O | O | O | O | (S-off) |
| PA-03 | ITQ1 | Internal Torque Limit 1 | 100 | % | O | O | O | O | |
| PA-04 | ITQ2 | Internal Torque Limit 2 | 100 | % | O | O | O | O | |
| PA-05 | ITQ3 | Internal Torque Limit 3 | 100 | % | O | O | O | O | |
| PA-06 | EOUT | The setting for the detector output of the pulse value | 8192 | pulse/rev | O | O | O | O | (S-off) |
| PA-07 | MSPL | Maximum speed limit | Based on model | r/min | O | O | O | O | (S-off) |
| PA-14 | ISP1 | Internal Speed Command 1 | Based on model | 0.1 r/min | | O | O | | |
| PA-15 | ISP2 | Internal Speed Command 2 | Based on model | 0.1 r/min | | O | O | | |
| PA-16 | ISP3 | Internal Speed Command 3 | Based on model | 0.1 r/min | | O | O | | |
| PA-17 | CVM | The maximum rotation speed of the analog speed command | Based on model | r/min | | O | O | | (S-off) |
| PA-18 | CTM | The limited maximum output of the analog torque | 100 | % | O | O | O | O | (S-off) |
| PA-21 | ATL | Response level for automatic negotiation | 20 | - | O | O | | O | |

| | |
|---|---|
| (R-only) | This indicates the read-only register, which can only be used for reading status values. |
| (S-off) | This indicates Servo Off, which can be set only when the servo is off. |
| (Re-on) | This implies that the parameter is valid when the servo is booted again. |
| (N-keep) | The set content value won't be memorized by the parameter after power off. |

| Parameters related to the torque control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PA-00 | CTLM | Setting for the input source of the control mode and command | 000h | - | O | O | O | O | (S-off) (Re-on) |
| PA-02 | STL | The setting for the speed and torque limit | 00h | - | O | O | O | O | (S-off) |
| PA-03 | ITQ1 | Internal Torque Limit 1 | 100 | % | O | O | O | O | |
| PA-04 | ITQ2 | Internal Torque Limit 2 | 100 | % | O | O | O | O | |
| PA-05 | ITQ3 | Internal Torque Limit 3 | 100 | % | O | O | O | O | |
| PA-06 | EOUT | The setting for the detector output of the pulse value | 8192 | pulse/rev | O | O | O | O | (S-off) |
| PA-07 | MSPL | Maximum speed limit | Based on model | r/min | O | O | O | O | (S-off) |
| PA-14 | ISP1 | Internal Speed Command 1 | Based on model | 0.1 r/min | | O | O | | |
| PA-15 | ISP2 | Internal Speed Command 2 | Based on model | 0.1 r/min | | O | O | | |
| PA-16 | ISP3 | Internal Speed Command 3 | Based on model | 0.1 r/min | | O | O | | |
| PA-17 | CVM | The maximum rotation speed of the analog speed command | Based on model | r/min | | O | O | | (S-off) |
| PA-18 | CTM | The limited maximum output of the analog torque | 100 | % | O | O | O | O | (S-off) |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Abbr.** | **Function** | **Initial value** | **Unit** | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PA-00 | CTLM | Setting for the input source of the control mode and command | 000h | - | O | O | O | O | (S-off) (Re-on) |
| PA-01 | CMPT | Setting for the input format of the external pulse train | 0002h | - | O | | | O | (S-off) |
| PA-02 | STL | The setting for the speed and torque limit | 00h | - | O | O | O | O | (S-off) |
| PA-03 | ITQ1 | Internal Torque Limit 1/Internal Torque Command 1 | 100 | % | O | O | O | O | |
| PA-04 | ITQ2 | Internal Torque Limit 2/Internal Torque Command 2 | 100 | % | O | O | O | O | |
| PA-05 | ITQ3 | Internal Torque Limit 3/Internal Torque Command 3 | 100 | % | O | O | O | O | |
| PA-06 | EOUT | The setting for the detector output of the pulse value | 8192 | pulse/rev | O | O | O | O | (S-off) |
| PA-07 | MSPL | Maximum speed limit | Based on the model | r/min | O | O | O | O | (S-off) |
| PA-09 | GRM1 | Numerator of the Electronic Gear Ratio (N1) | 1 | pulse | O | | | O | |
| PA-10 | GRD | Denominator of the Electronic Gear Ratio (M) | 1 | pulse | O | | | O | (S-off) |
| PA-11 | GRM2 | Numerator of the Electronic Gear Ratio (N2) | 1 | pulse | O | | | O | |
| PA-12 | GRM3 | Numerator of the Electronic Gear Ratio (N3) | 1 | pulse | O | | | O | |
| PA-13 | GRM4 | Numerator of the Electronic Gear Ratio (N4) | 1 | pulse | O | | | O | |
| PA-21 | ATL | Response level for automatic negotiation | 20 | - | O | O | | O | |
| PG-00 | HmCtrl | Home position return main function setting | 0 | - | | | | O | |
| PG-01 | HmHSpd | Return-to-origin high speed | 7000 | 0.1 r/min | | | | O | |
| PG-02 | HmLSpd | Return-to-origin low speed | 1000 | 0.1 r/min | | | | O | |
| PG-03 | HmHAcc | Return-to-origin high speed acceleration time | 100 | 1 ms | | | | O | |
| PG-04 | HmHDec | Return-to-origin high-speed deceleration time | 100 | 1 ms | | | | O | |
| PG-05 | HmLAcc | Return-to-origin low-speed acceleration time | 100 | 1 ms | | | | O | |
| PG-06 | HmLDec | Return-to-origin low-speed deceleration time | 100 | 1 ms | | | | O | |
| PG-07 | ZpCount | Return-to-origin to find Z times | -1 | - | | | | O | |
| PG-08 | HmDef | Return-to-origin to origin definition | 0 | pulse | | | | O | |
| PG-09 | OrgEnc | Return-to-origin to complete the origin encoder reading | 0 | pulse | | | | O | (R-only) |
| PG-10 | PNLDec | Deceleration time of return-to-origin limit return | 10 | 1 ms | | | | O | |
| PG-11 | SWTrig | Msc software startup trigger | 0 | - | | | | O | (N-keep) |
| PG-12 | AcDe00 | Msc acceleration and deceleration time data group 01 | 1 | 1 ms | | | | O | |
| PG-13 | AcDe01 | Msc acceleration and deceleration time data group 02 | 2 | 1 ms | | | | O | |
| PG-14 | AcDe02 | Msc acceleration and deceleration time data group 03 | 4 | 1 ms | | | | O | |
| PG-15 | AcDe03 | Msc acceleration and deceleration time data group 04 | 6 | 1 ms | | | | O | |
| PG-16 | AcDe04 | Msc acceleration and deceleration time data group 05 | 8 | 1 ms | | | | O | |
| PG-17 | AcDe05 | Msc acceleration and deceleration time data group 06 | 10 | 1 ms | | | | O | |

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PG-18 | AcDe06 | Msc acceleration and deceleration time data group 07 | 20 | 1 ms | | | | O | |
| PG-19 | AcDe07 | Msc acceleration and deceleration time data group 08 | 40 | 1 ms | | | | O | |
| PG-20 | AcDe08 | Msc acceleration and deceleration time data group 09 | 60 | 1 ms | | | | O | |
| PG-21 | AcDe09 | Msc acceleration and deceleration time data group 10 | 80 | 1 ms | | | | O | |
| PG-22 | AcDe0A | Msc acceleration and deceleration time data group 11 | 100 | 1 ms | | | | O | |
| PG-23 | AcDe0B | Msc acceleration and deceleration time data group 12 | 200 | 1 ms | | | | O | |
| PG-24 | AcDe0C | Msc acceleration and deceleration time data group 13 | 400 | 1 ms | | | | O | |
| PG-25 | AcDe0D | Msc acceleration and deceleration time data group 14 | 600 | 1 ms | | | | O | |
| PG-26 | AcDe0E | Msc acceleration and deceleration time data group 15 | 800 | 1 ms | | | | O | |
| PG-27 | AcDe0F | Msc acceleration and deceleration time data group 16 | 1000 | 1 ms | | | | O | |
| PG-28 | Dely00 | Msc delay time data group 01 | 0 | 1 ms | | | | O | |
| PG-29 | Dely01 | Msc delay time data group 02 | 5 | 1 ms | | | | O | |
| PG-30 | Dely02 | Msc delay time data group 03 | 10 | 1 ms | | | | O | |
| PG-31 | Dely03 | Msc delay time data group 04 | 20 | 1 ms | | | | O | |
| PG-32 | Dely04 | Msc delay time data group 05 | 30 | 1 ms | | | | O | |
| PG-33 | Dely05 | Msc delay time data group 06 | 50 | 1 ms | | | | O | |
| PG-34 | Dely06 | Msc delay time data group 07 | 70 | 1 ms | | | | O | |
| PG-35 | Dely07 | Msc delay time data group 08 | 100 | 1 ms | | | | O | |
| PG-36 | Dely08 | Msc delay time data group 09 | 200 | 1 ms | | | | O | |
| PG-37 | Dely09 | Msc delay time data group 10 | 300 | 1 ms | | | | O | |
| PG-38 | Dely0A | Msc delay time data group 11 | 500 | 1 ms | | | | O | |
| PG-39 | Dely0B | Msc delay time data group 12 | 700 | 1 ms | | | | O | |
| PG-40 | Dely0C | Msc delay time data group 13 | 1000 | 1 ms | | | | O | |
| PG-41 | Dely0D | Msc delay time data group 14 | 2000 | 1 ms | | | | O | |
| PG-42 | Dely0E | Msc delay time data group 15 | 3000 | 1 ms | | | | O | |
| PG-43 | Dely0F | Msc delay time data group 16 | 5000 | 1 ms | | | | O | |
| PG-44 | Sped00 | Msc target speed data group 01 | 1 | 0.1 r/min | | | | O | |
| PG-45 | Sped01 | Msc target speed data group 02 | 10 | 0.1 r/min | | | | O | |
| PG-46 | Sped02 | Msc target speed data group 03 | 30 | 0.1 r/min | | | | O | |
| PG-47 | Sped03 | Msc target speed data group 04 | 50 | 0.1 r/min | | | | O | |
| PG-48 | Sped04 | Msc target speed data group 05 | 70 | 0.1 r/min | | | | O | |
| PG-49 | Sped05 | Msc target speed data group 06 | 100 | 0.1 r/min | | | | O | |
| PG-50 | Sped06 | Msc target speed data group 07 | 300 | 0.1 r/min | | | | O | |
| PG-51 | Sped07 | Msc target speed data group 08 | 500 | 0.1 r/min | | | | O | |
| PG-52 | Sped08 | Msc target speed data group 09 | 700 | 0.1 r/min | | | | O | |
| PG-53 | Sped09 | Msc target speed data group 10 | 1000 | 0.1 r/min | | | | O | |
| PG-54 | Sped0A | Msc target speed data group 11 | 3000 | 0.1 r/min | | | | O | |

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PG-55 | Sped0B | Msc target speed data group 12 | 5000 | 0.1 r/min | | | | O | |
| PG-56 | Sped0C | Msc target speed data group 13 | 7000 | 0.1 r/min | | | | O | |
| PG-57 | Sped0D | Msc target speed data group 14 | 10000 | 0.1 r/min | | | | O | |
| PG-58 | Sped0E | Msc target speed data group 15 | 20000 | 0.1 r/min | | | | O | |
| PG-59 | Sped0F | Msc target speed data group 16 | 30000 | 0.1 r/min | | | | O | |
| PG-60 | ExIsr | Msc program interrupt settings | 0 | - | | | | O | |
| PG-61 | DiNo01 | Msc command selector - DI number 01 | 1 | - | | | | O | |
| PG-62 | DiNo02 | Msc command selector - DI number 02 | 2 | - | | | | O | |
| PG-63 | DiNo03 | Msc command selector - DI number 03 | 3 | - | | | | O | |
| PG-64 | DiNo04 | Msc command selector - DI number 04 | 4 | - | | | | O | |
| PG-65 | DiNo05 | Msc command selector - DI number 05 | 5 | - | | | | O | |
| PG-66 | DiNo06 | Msc command selector - DI number 06 | 6 | - | | | | O | |
| PG-67 | DiNo07 | Msc command selector - DI number 07 | 7 | - | | | | O | |
| PG-68 | DiNo08 | Msc command selector - DI number 08 | 8 | - | | | | O | |
| PG-69 | DiNo09 | Msc command selector - DI number 09 | 9 | - | | | | O | |
| PG-70 | DiNo0A | Msc command selector - DI number 10 | 10 | - | | | | O | |
| PG-71 | DiNo0B | Msc command selector - DI number 11 | 11 | - | | | | O | |
| PG-72 | DiNo0C | Msc command selector - DI number 12 | 12 | - | | | | O | |
| PG-73 | DiNo0D | Msc command selector - DI number 13 | 13 | - | | | | O | |
| PG-74 | DiNo0E | Msc command selector - DI number 14 | 14 | - | | | | O | |
| PG-75 | DiNo0F | Msc command selector - DI number 15 | 15 | - | | | | O | |
| PG-76 | DiEv01 | Msc command trigger - Di-Ev1 | 0 | - | | | | O | |
| PG-77 | DiEv02 | Msc command trigger - Di-Ev2 | 0 | - | | | | O | |
| PG-78 | DiEv03 | Msc command trigger - Di-Ev3 | 0 | - | | | | O | |
| PG-79 | DiEv04 | Msc command trigger - Di-Ev4 | 0 | - | | | | O | |
| PG-80 | InxStrok | Msc indexing total stroke | 109 | PUU | | | | O | |
| PG-81 | FrqRat | Msc mode pulse wave frequency analogy rate denominator | 107 | PUU | | | | O | |
| PG-82 | 1stAbsLat | Position coordinate monitoring parameters when Msc starts | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-83 | AbsCrd | Msc current position coordinate monitoring parameters | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-84 | 1stInxLat | Indexing coordinate monitoring parameters when Msc starts | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-85 | InxCrdPuu | Msc current indexing coordinate monitoring parameters | 0 | PUU | | | | O | (R-only) (N-keep) |
| PG-86 | AbsOrgDone | Multi-turn absolute motor origin return state | 0 | - | | | | O | (R-only) |
| PH-00 | MscSet01 | Msc command 01 set value | 0 | - | | | | O | |

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PH-01 | MscDat01 | Msc command 01 data value | 0 | - | | | | O | |
| PH-02 | MscSet02 | Msc command 02 set value | 0 | - | | | | O | |
| PH-03 | MscDat02 | Msc command 02 data value | 0 | - | | | | O | |
| PH-04 | MscSet03 | Msc command 03 set value | 0 | - | | | | O | |
| PH-05 | MscDat03 | Msc command 03 data value | 0 | - | | | | O | |
| PH-06 | MscSet04 | Msc command 04 set value | 0 | - | | | | O | |
| PH-07 | MscDat04 | Msc command 04 data value | 0 | - | | | | O | |
| PH-08 | MscSet05 | Msc command 05 set value | 0 | - | | | | O | |
| PH-09 | MscDat05 | Msc command 05 data value | 0 | - | | | | O | |
| PH-10 | MscSet06 | Msc command 06 set value | 0 | - | | | | O | |
| PH-11 | MscDat06 | Msc command 06 data value | 0 | - | | | | O | |
| PH-12 | MscSet07 | Msc command 07 set value | 0 | - | | | | O | |
| PH-13 | MscDat07 | Msc command 07 data value | 0 | - | | | | O | |
| PH-14 | MscSet08 | Msc command 08 set value | 0 | - | | | | O | |
| PH-15 | MscDat08 | Msc command 08 data value | 0 | - | | | | O | |
| PH-16 | MscSet09 | Msc command 09 set value | 0 | - | | | | O | |
| PH-17 | MscDat09 | Msc command 09 data value | 0 | - | | | | O | |
| PH-18 | MscSet10 | Msc command 10 set value | 0 | - | | | | O | |
| PH-19 | MscDat10 | Msc command 10 data value | 0 | - | | | | O | |
| PH-20 | MscSet11 | Msc command 11 set value | 0 | - | | | | O | |
| PH-21 | MscDat11 | Msc command 11 data value | 0 | - | | | | O | |
| PH-22 | MscSet12 | Msc command 12 set value | 0 | - | | | | O | |
| PH-23 | MscDat12 | Msc command 12 data value | 0 | - | | | | O | |
| PH-24 | MscSet13 | Msc command 13 set value | 0 | - | | | | O | |
| PH-25 | MscDat13 | Msc command 13 data value | 0 | - | | | | O | |
| PH-26 | MscSet14 | Msc command 14 set value | 0 | - | | | | O | |
| PH-27 | MscDat14 | Msc command 14 data value | 0 | - | | | | O | |
| PH-28 | MscSet15 | Msc command 15 set value | 0 | - | | | | O | |
| PH-29 | MscDat15 | Msc command 15 data value | 0 | - | | | | O | |
| PH-30 | MscSet16 | Msc command 16 set value | 0 | - | | | | O | |
| PH-31 | MscDat16 | Msc command 16 data value | 0 | - | | | | O | |
| PH-32 | MscSet17 | Msc command 17 set value | 0 | - | | | | O | |
| PH-33 | MscDat17 | Msc command 17 data value | 0 | - | | | | O | |
| PH-34 | MscSet18 | Msc command 18 set value | 0 | - | | | | O | |
| PH-35 | MscDat18 | Msc command 18 data value | 0 | - | | | | O | |
| PH-36 | MscSet19 | Msc command 19 set value | 0 | - | | | | O | |
| PH-37 | MscDat19 | Msc command 19 data value | 0 | - | | | | O | |
| PH-38 | MscSet20 | Msc command 20 set value | 0 | - | | | | O | |
| PH-39 | MscDat20 | Msc command 20 data value | 0 | - | | | | O | |
| PH-40 | MscSet21 | Msc command 21 set value | 0 | - | | | | O | |
| PH-41 | MscDat21 | Msc command 21 data value | 0 | - | | | | O | |
| PH-42 | MscSet22 | Msc command 22 set value | 0 | - | | | | O | |
| PH-43 | MscDat22 | Msc command 22 data value | 0 | - | | | | O | |
| PH-44 | MscSet23 | Msc command 23 set value | 0 | - | | | | O | |

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PH-45 | MscDat23 | Msc command 23 data value | 0 | - | | | | O | |
| PH-46 | MscSet24 | Msc command 24 set value | 0 | - | | | | O | |
| PH-47 | MscDat24 | Msc command 24 data value | 0 | - | | | | O | |
| PH-48 | MscSet25 | Msc command 25 set value | 0 | - | | | | O | |
| PH-49 | MscDat25 | Msc command 25 data value | 0 | - | | | | O | |
| PH-50 | MscSet26 | Msc command 26 set value | 0 | - | | | | O | |
| PH-51 | MscDat26 | Msc command 26 data value | 0 | - | | | | O | |
| PH-52 | MscSet27 | Msc command 27 set value | 0 | - | | | | O | |
| PH-53 | MscDat27 | Msc command 27 data value | 0 | - | | | | O | |
| PH-54 | MscSet28 | Msc command 28 set value | 0 | - | | | | O | |
| PH-55 | MscDat28 | Msc command 28 data value | 0 | - | | | | O | |
| PH-56 | MscSet29 | Msc command 29 set value | 0 | - | | | | O | |
| PH-57 | MscDat29 | Msc command 29 data value | 0 | - | | | | O | |
| PH-58 | MscSet30 | Msc command 30 set value | 0 | - | | | | O | |
| PH-59 | MscDat30 | Msc command 30 data value | 0 | - | | | | O | |
| PH-60 | MscSet31 | Msc command 31 set value | 0 | - | | | | O | |
| PH-61 | MscDat31 | Msc command 31 data value | 0 | - | | | | O | |
| PH-62 | MscSet32 | Msc command 32 set value | 0 | - | | | | O | |
| PH-63 | MscDat32 | Msc command 32 data value | 0 | - | | | | O | |
| PH-64 | MscSet33 | Msc command 33 set value | 0 | - | | | | O | |
| PH-65 | MscDat33 | Msc command 33 data value | 0 | - | | | | O | |
| PH-66 | MscSet34 | Msc command 34 set value | 0 | - | | | | O | |
| PH-67 | MscDat34 | Msc command 34 data value | 0 | - | | | | O | |
| PH-68 | MscSet35 | Msc command 35 set value | 0 | - | | | | O | |
| PH-69 | MscDat35 | Msc command 35 data value | 0 | - | | | | O | |
| PH-70 | MscSet36 | Msc command 36 set value | 0 | - | | | | O | |
| PH-71 | MscDat36 | Msc command 36 data value | 0 | - | | | | O | |
| PH-72 | MscSet37 | Msc command 37 set value | 0 | - | | | | O | |
| PH-73 | MscDat37 | Msc command 37 data value | 0 | - | | | | O | |
| PH-74 | MscSet38 | Msc command 38 set value | 0 | - | | | | O | |
| PH-75 | MscDat38 | Msc command 38 data value | 0 | - | | | | O | |
| PH-76 | MscSet39 | Msc command 39 set value | 0 | - | | | | O | |
| PH-77 | MscDat39 | Msc command 39 data value | 0 | - | | | | O | |
| PH-78 | MscSet40 | Msc command 40 set value | 0 | - | | | | O | |
| PH-79 | MscDat40 | Msc command 40 data value | 0 | - | | | | O | |
| PH-80 | MscSet41 | Msc command 41 set value | 0 | - | | | | O | |
| PH-81 | MscDat41 | Msc command 41 data value | 0 | - | | | | O | |
| PH-82 | MscSet42 | Msc command 42 set value | 0 | - | | | | O | |
| PH-83 | MscDat42 | Msc command 42 data value | 0 | - | | | | O | |
| PH-84 | MscSet43 | Msc command 43 set value | 0 | - | | | | O | |
| PH-85 | MscDat43 | Msc command 43 data value | 0 | - | | | | O | |
| PH-86 | MscSet44 | Msc command 44 set value | 0 | - | | | | O | |
| PH-87 | MscDat44 | Msc command 44 data value | 0 | - | | | | O | |
| PH-88 | MscSet45 | Msc command 45 set value | 0 | - | | | | O | |

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PH-89 | MscDat45 | Msc command 45 data value | 0 | - | | | | O | |
| PH-90 | MscSet46 | Msc command 46 set value | 0 | - | | | | O | |
| PH-91 | MscDat46 | Msc command 46 data value | 0 | - | | | | O | |
| PH-92 | MscSet47 | Msc command 47 set value | 0 | - | | | | O | |
| PH-93 | MscDat47 | Msc command 47 data value | 0 | - | | | | O | |
| PH-94 | MscSet48 | Msc command 48 set value | 0 | - | | | | O | |
| PH-95 | MscDat48 | Msc command 48 data value | 0 | - | | | | O | |
| PH-96 | MscSet49 | Msc command 49 set value | 0 | - | | | | O | |
| PH-97 | MscDat49 | Msc command 49 data value | 0 | - | | | | O | |
| PH-98 | MscSet50 | Msc command 50 set value | 0 | - | | | | O | |
| PH-99 | MscDat50 | Msc command 50 data value | 0 | - | | | | O | |
| PJ-00 | MscSet51 | Msc command 51 set value | 0 | - | | | | O | |
| PJ-01 | MscDat51 | Msc command 51 data value | 0 | - | | | | O | |
| PJ-02 | MscSet52 | Msc command 52 set value | 0 | - | | | | O | |
| PJ-03 | MscDat52 | Msc command 52 data value | 0 | - | | | | O | |
| PJ-04 | MscSet53 | Msc command 53 set value | 0 | - | | | | O | |
| PJ-05 | MscDat53 | Msc command 53 data value | 0 | - | | | | O | |
| PJ-06 | MscSet54 | Msc command 54 set value | 0 | - | | | | O | |
| PJ-07 | MscDat54 | Msc command 54 data value | 0 | - | | | | O | |
| PJ-08 | MscSet55 | Msc command 55 set value | 0 | - | | | | O | |
| PJ-09 | MscDat55 | Msc command 55 data value | 0 | - | | | | O | |
| PJ-10 | MscSet56 | Msc command 56 set value | 0 | - | | | | O | |
| PJ-11 | MscDat56 | Msc command 56 data value | 0 | - | | | | O | |
| PJ-12 | MscSet57 | Msc command 57 setting | 0 | - | | | | O | |
| PJ-13 | MscDat57 | Msc command 57 data value | 0 | - | | | | O | |
| PJ-14 | MscSet58 | Msc command 58 set value | 0 | - | | | | O | |
| PJ-15 | MscDat58 | Msc command 58 data value | 0 | - | | | | O | |
| PJ-16 | MscSet59 | Msc command 59 set value | 0 | - | | | | O | |
| PJ-17 | MscDat59 | Msc command 59 data value | 0 | - | | | | O | |
| PJ-18 | MscSet60 | Msc command 60 set value | 0 | - | | | | O | |
| PJ-19 | MscDat60 | Msc command 60 data value | 0 | - | | | | O | |
| PJ-20 | MscSet61 | Msc command 61 set value | 0 | - | | | | O | |
| PJ-21 | MscDat61 | Msc command 61 data value | 0 | - | | | | O | |
| PJ-22 | MscSet62 | Msc command 62 set value | 0 | - | | | | O | |
| PJ-23 | MscDat62 | Msc command 62 data value | 0 | - | | | | O | |
| PJ-24 | MscSet63 | Msc command 63 set value | 0 | - | | | | O | |
| PJ-25 | MscDat63 | Msc command 63 data value | 0 | - | | | | O | |
| PJ-26 | MscSet64 | Msc command 64 set value | 0 | - | | | | O | |
| PJ-27 | MscDat64 | Msc command 64 data value | 0 | - | | | | O | |
| PJ-28 | MscSet65 | Msc command 65 set value | 0 | - | | | | O | |
| PJ-29 | MscDat65 | Msc command 65 data value | 0 | - | | | | O | |
| PJ-30 | MscSet66 | Msc command 66 set value | 0 | - | | | | O | |
| PJ-31 | MscDat66 | Msc command 66 data value | 0 | - | | | | O | |
| PJ-32 | MscSet67 | Msc command 67 set value | 0 | - | | | | O | |

| Parameters related to the MSC control | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | Msc | |
| PJ-33 | MscDat67 | Msc command 67 data value | 0 | - | | | | O | |
| PJ-34 | MscSet68 | Msc command 68 set value | 0 | - | | | | O | |
| PJ-35 | MscDat68 | Msc command 68 data value | 0 | - | | | | O | |
| PL-00 | CamCtrl | Electronic cam main function setting | 0 | - | | | | O | |
| PL-01 | CamSpd | Virtual master axis command – speed command | 0 | 0.1 r/min | | | | O | |
| PL-02 | CamPos | Virtual master axis command – position command | 0 | pulse | | | | O | |
| PL-03 | CamAcc | Virtual master axis command acceleration time | 50 | ms | | | | O | |
| PL-04 | CamDec | Virtual master axis command deceleration time | 50 | ms | | | | O | |
| PL-05 | CamBlk | Main axis command mask amount | 0 | pulse | | | | O | |
| PL-06 | CamRes | Active shaft single turn resolution | 1000 | pulse | | | | O | |
| PL-07 | CamCyl | When the drive shaft turns one week, Number of rotations of the driven shaft | 1 | rev | | | | O | |
| PL-08 | CamPhs | Spindle phase angle adjustment | 0 | 0.1 deg | | | | O | |
| PL-09 | CamOfs | Cam curve table offset | 0 | pulse | | | | O | |
| PL-10 | CamGan | Cam curve magnification | 1000 | 0.001x | | | | O | |
| PL-11 | CamSec | Cam curve original data points | 17 | Number | | | | O | (R-only) |
| PL-12 | CamTyp | Cam curve output command type | 1 | - | | | | O | |
| PL-13 | CamMaMon | Cam drive shaft analog monitor switching | 0 | - | | | | O | |
| PL-14 | CamSvMon | Cam slave axis analog monitor switching | 0 | - | | | | O | |

| Parameters for the planning of the digital I/O pin and for the setting related to the output | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PA-20 | INP | Confirmation of the range when the position is reached | 10400 | pulse | O | | | O | |
| PC-00 | DIRT | The time for response filtering of the digital input | 2 | 2 ms | O | O | O | O | |
| PC-01 | DI1 | The function planning for Pin DI1 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-02 | DI2 | Function planning for Pin DI2 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-03 | DI3 | Function planning for Pin DI3 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-04 | DI4 | Function planning for Pin DI4 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-05 | DI5 | Function planning for Pin DI5 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-06 | DI6 | Function planning for Pin DI6 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-07 | DI7 | Function planning for Pin DI7 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-08 | DI8 | Function planning for Pin DI8 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-09 | DI9 | Function planning for Pin DI9 of the digital input | Based on the control mode | - | O | O | O | O | |
| PC-10 | DO1 | Function planning for Pin DO1 of the digital output | Based on the control mode | - | O | O | O | O | |
| PC-11 | DO2 | Function planning for Pin DO2 of the digital output | Based on the control mode | - | O | O | O | O | |
| PC-12 | DO3 | Function planning for Pin DO3 of the digital output | Based on the control mode | - | O | O | O | O | |
| PC-13 | DO4 | Function planning for Pin DO4 of the digital output | Based on the control mode | - | O | O | O | O | |
| PC-14 | DO5 | Function planning for Pin DO5 of the digital output | Based on the control mode | - | O | O | O | O | |
| PC-15 | DO6 | Function planning for Pin DO6 of the digital output | Based on the control mode | - | O | O | O | O | |
| PC-21 | BTOD | The turn-on delay time for the electromagnetic brake | 0 | ms | O | O | O | O | |
| PC-22 | BTCD | The turn-off delay time for the electromagnetic brake | 0 | ms | O | O | O | O | |
| PC-23 | SPOK | The level for detection of the speed comparison | 10 | r/min | | O | | | |
| PC-24 | PUUres | Position error in analog monitoring resolution (PUU units) | 10000 | pulse | O | O | O | O | (S-off) |
| PC-25 | POL | The output level for the expected overload | 0 | % | O | O | O | O | |
| PD-43 | TSPD | The level for the detection of the target rotation speed | Based on model | r/min | O | O | O | O | |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

| Communication parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PD-00 | ADR | The setting of the branch number | 0x7F | - | O | O | O | O | (S-off) (Re-on) |
| PD-01 | BRT | The communication transmission rate | 0x33 | - | O | O | O | O | (S-off) |
| PD-02 | PTL | The protocol | 6 | - | O | O | O | O | (S-off) |
| PD-03 | CFP | The handling of the communication error | 0 | - | O | O | O | O | (S-off) |
| PD-04 | COT | The setting for the communication timeout | 0 | sec | O | O | O | O | (S-off) |
| PD-06 | SWDI | Control switch for the source of the input contact (DI) | 0 | - | O | O | O | O | (N-keep) |
| PD-07 | CDT | The time for the delay of the communication response | 0 | 1 ms | O | O | O | O | |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

| Diagnostic parameters | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Abbr. | Function | Initial value | Unit | Control mode | | | | Remark |
| | | | | | P | S | T | MSC | |
| PD-30 | JOG | The jog control of the servo motor | 20 | r/min | O | O | O | O | |
| PD-31 | FDO | The DO data register of the software (readable and writable) | Based on the control mode | - | O | O | O | O | (S-off) (N-keep) |
| PD-32 | DISF | The multi-function for the contact of the digital input | Based on the control mode | - | O | O | O | O | (N-keep) |
| PD-33 | ALH1 | Record of the Abnormal Status (N) | 0 | - | O | O | O | O | (R-only) |
| PD-34 | ALH2 | The record of the abnormal condition (N-1) | 0 | - | O | O | O | O | (R-only) |
| PD-35 | ALH3 | The record of the abnormal condition (N-2) | 0 | - | O | O | O | O | (R-only) |
| PD-36 | ALH4 | The record of the abnormal condition (N-3) | 0 | - | O | O | O | O | (R-only) |
| PD-37 | ALH5 | The record of the abnormal condition (N-4) | 0 | - | O | O | O | O | (R-only) |

(R-only) This indicates the read-only register, which can only be used for reading status values.
(S-off) This indicates Servo Off, which can be set only when the servo is off.
(Re-on) This implies that the parameter is valid when the servo is booted again.
(N-keep) The set content value won't be memorized by the parameter after power off.

# 6.3. Parameter description

## 6.3.1. PA-XX (Basic parameter)

| PA-00 (Re-on) | CTLM | Setting for the input source of the control mode and command | Communication address: 0000H 0001H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 000h |
| Control mode | ALL |
| Unit | - |
| Configuration range | 000h ~ 109h ( Msc version 000h ~ 10Ah ) |
| Data size | 16 bit |
| Data format | HEX |

□□□■■: The setting of the control mode

□□■□□: The control over the direction of torque output

➢ Setting of the control mode

| Mode | Set value | Description |
|---|---|---|
| P | 0x00 | Single mode |
| S | 0x01 | |
| T | 0x02 | |
| PS | 0x05 | Mixed mode |
| PT | 0x06 | |
| ST | 0x07 | |
| MscP | 0x0B | |
| MscS | 0x0C | |
| Sn | 0x08 | Single mode |
| Tn | 0x09 | |

■ Single mode:

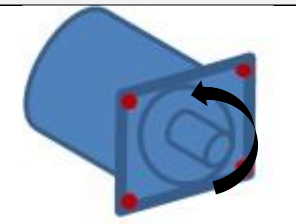
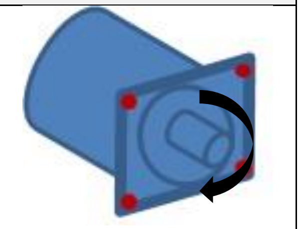
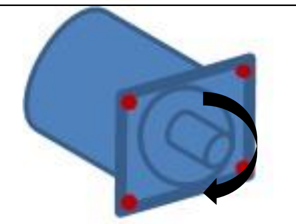
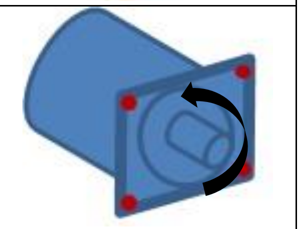
- P: Position control mode
- S: Speed control mode (The command comes from the external analog voltage/internal register, and can be selected with D1: SPD0, SPD1.)
- T: Torque control mode (The command comes from the external analog voltage/ the internal register, and can be selected with D1: TCM0, TCM1.)
- Sn: Speed control mode (The command source comes from the the internal register and can be selected with D1: SPD0, SPD1. If (SPD0,SPD1) = (0,0), the speed command is zero.)
- Tn: Torque control mode (the command source comes from the internal register, and can be chosen with D1: TCM0, TCM 1. If (TCM0,TCM1) = (0,0), the torque command is zero.)

- Msc (motion timing control mode): The source of the command is the internal scratchpad, which can be selected by DI:MscNo1~4, MscEv1~4 or by the electronic cam.

Mixed mode:

Modes can be switched using the external DI (Digital Input). For example, when the PS mode is set (with the control mode setting 05), DI:S-P (Table 7.1 ) can be used to switch between modes.

➢ Control over the direction of the torque output

| | 0 | 1 |
|---|---|---|
| Clockwise direction |  |  |
| Counterclockwise direction |  |  |

| PA-01 (S-off) | CMPT | Setting for the input format of the external pulse train | Communication address: 0002H 0003H |
|---|---|---|---|
| | Initial value | 0002 | |
| | Control mode | T / P | |
| | Unit | N/A | |
| | Configuration range | 0 ~ 0x1142 | |
| | Data size | 16bit | |
| | Data format | Hex | |

□□□□■: Pulse type

□□□■□: Filter width

□□■□□: Logic type

□■□□□: Source of the external pulse input

➢ Pulse type

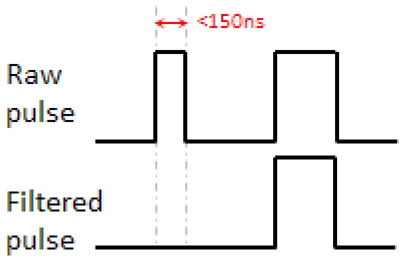
0: AB-phase pulse train (4x)

1: CW-pulse and CCW-pulse trains

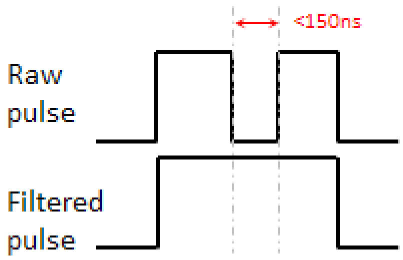
2: Pulse train and symbol

➢ Filter width

| Set value | Low-speed filter width (minimum pulse width *Note 1) | High-speed filter width (minimum pulse width *Note 1) |
|---|---|---|
| 0 | 600 Kpps（600 ns） | 2.8 Mpps（150 ns） |
| 1 | 165 Kpps（2.4 us） | 0.72 Mpps（600 ns） |
| 2 | 85 Kpps（4.8 us） | 360 Kpps（1.2 us） |
| 3 | 42 Kpps（9.6 us） | 170 Kpps（2.4 us） |
| 4 | No filtering | No filtering |



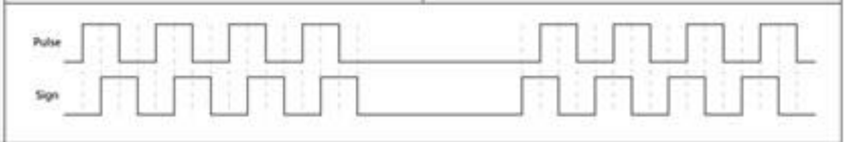

The high-level pulse will be ignored when its width is less than 150 ns.

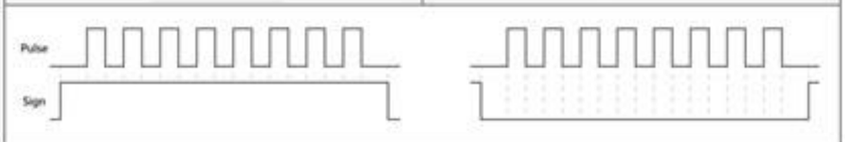


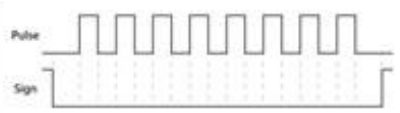
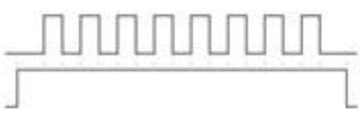

The low-level pulse of the pulse will be ignored when its length is less than 150 ns.

Note 1: The pulse reception can be ensured if the signal comes with the 4Mpps high-speed pulse and the set value of the pulse is 4.

➢ Logic type

| High- and low-speed pulse input | | | | |
|---|---|---|---|---|
| Logic | | Pulse type | Clockwise rotation | Counterclockwise rotation |
| | | | Pulse phase advance | Pulse phase delay |
| 0 | Positive logic | AB-phase pulse train |  | |
| | | CW-pulse and CCW-pulse trains |  | |

| High-speed pulse input | | | | |
|---|---|---|---|---|
| Logic | | Pulse type | Clockwise rotation | Counterclockwise rotation |
| | | | High sign | Low sign |
| 0 | Positive logic | Pulse train + Symbol |  | |

| Low-speed pulse input | | | | |
|---|---|---|---|---|
| Logic | | Pulse type | Clockwise rotation | Counterclockwise rotation |
| | | | Low sign | High sign |
| 0 | Positive logic | Pulse train + Symbol |  |  |

In a digital circuit, 0 and 1 usually represent for the high and low voltage. 1 and 0 represent high and low voltage in "Positive Logic", respectively. On the other hand, 1 and 0 represent low and high voltage in "Negative Logic", respectively.

➢ Source of the external pulse input

0: Low-speed optical coupling (CN1 pin: OUT, DIR)

1: High-speed differential (CN1 pin: HOUT, HDIR)

| PA-02 (S-off) | STL | Setting for the speed and torque limit | Communication address: 0004H 0005H |
|---|---|---|---|
| | Initial value | 00h | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 00h ~ 11h | |
| | Data size | 16 bit | |
| | Data format | HEX | |

□□□□■: Start and stop of the speed limit function (valid only in T mode)

□□□■□: On and off for torque limit function (valid in P / S mode)

➢ On and off for speed limit function(1: on; 0: off)

- Speed limit function can be turned on and off with DI terminal (SPDLM) Parameters and DI (SPDLM) belong to OR operation.
- The speed limit configuration source is determined by DI terminal (SPD0, SPD1) state Can select the speed analog command or the parameter value PA-14 ~ PA-16.

➢ Start and stop of the torque limit function (1: on; 0: off )

- The torque limit function can be turned on and off by DI terminal (TRQLM). Parameters and DI (TRQLM) belong to OR operation.
- The source of the torque limit setting is determined by the state of the DI terminals (TCM0,TCM1). Can select the torque analog command or the parameter value PA-03 ~ PA-05.

| PA-03 | ITQ1 | Internal torque limit1/Internal Torque Command 1 | Communication address: 0006H 0007H |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | -300 ~ +300 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Internal Torque Command 1: The setting of the internal torque command in the first segment (TCM0,TCM1) = (1,0).

Internal Torque Limit 1: The setting of the internal torque limit in the first segment (TCM0,TCM1) = (1,0).

| PA-04 | ITQ2 | Internal torque limit 2/internal torque command 2 | Communication address: 0008H 0009H |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | -300 ~ +300 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Internal Torque Command 2: The setting of the internal torque command in the second segment (TCM0,TCM1) = (0,1).

Internal torque limit 2: The second configuration for the internal torque limit (TCM0,TCM1) = (0,1).

| PA-05 | ITQ3 | Internal torque limit 3/internal torque command 3 | Communication address: 000AH 000BH |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | -300 ~ +300 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Internal torque command 3: The setting of the internal torque command in the third segment (TCM0, TCM1) = (1,1).

Internal torque limit 3: The setting of the internal torque limit in the third segment (TCM0, TCM1) = (1,1).

| PA-06 (S-off) | EOUT | The setting for the detector output of the pulse value | Communication address: 000CH 000DH |
|---|---|---|---|
| | Initial value | 8192 | |
| | Control mode | ALL | |
| | Unit | pulse/rev | |
| | Configuration range | 4 ~ 262144 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

| PA-07 | MSPL | Maximum speed limit | Communication address: 000EH 000FH |
|---|---|---|---|
| | Initial value | By Rated | |
| | Control mode | ALL | |
| | Unit | r/min | |
| | Configuration range | 0 ~ max. Speed | |
| | Data size | 16bit | |
| | Data format | Dec | |

This is the maximum operating speed of the servo motor. The initial value is set to the rated rotation speed.

| PA-08 | PCLR | Pulse cleaning mode | Communication address: 0010H 0011H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 00h |
| | Control mode | P / Msc |
| | Unit | - |
| | Configuration range | 00h ~ 11h |
| | Data size | 16 bit |
| | Data format | HEX |

□□□□■: Trigger method

□□□■□: Function selection

The pulse cleaning function is valid when the control input contact (DI) is set as PCLR.

When the signal of the CCLR is conducted, the accumulated pulse error magnitude of the drive position is cleaned up as 0.

Setting of the trigger method:

0: CCLR trigger method is the positive edge type

1: CCLR trigger method is the level type

Function selection:

0: The accumulated pulse error magnitude of the drive position is cleaned up as 0 when the CCLR is conducted.

1: The Feed Back PUU of the drive is cleaned up to 0 when CCLR is being conducted.

| PA-09 (S-off) | GRM1 | Numerator of the Electronic Gear Ratio (N1) | Communication address: 0012H 0013H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1 |
| | Control mode | P / Msc |
| | Unit | pulse |
| | Configuration range | 1 ~ ( $2^{26}$ - 1 ) |
| | Data size | 32 bit |
| | Data format | DEC |

Multi-step configuration for the numerator of electronic gear ratio

The numerator of the electronic gear ratio can be selected and switched via these two input pins: GNUM0, GNUM1. It is set to PA-09 if they are not defined. Switch the numerator when the machine stops to avoid vibration during switching.

| PA-10 (S-off) | GRD | Denominator of the Electronic Gear Ratio (M) | Communication address: 0014H 0015H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1 |
| | Control mode | P / Msc |
| | Unit | pulse |
| | Configuration range | 1 ~ ( $2^{31}$ - 1 ) |
| | Data size | 32 bit |
| | Data format | DEC |

The servo motor is easy to rotate violently when there is a configuration error. The setting must follow the rules below.

Setting for the input ratio of the command pulse

$$\text{Command pulse input(p1)} \times \frac{N}{M} = \text{Position command(p2)}\text{ ; } (\text{p1}) \times \frac{N}{M} = (\text{p2})$$

Scope for the input ratio of the command pulse: 1/50 $< \frac{N_x}{M} <$ 25600 ($x$ =1, 2, 3, 4)

| PA-11 (S-off) | GRM2 | Numerator of the Electronic Gear Ratio (N2) | Communication address: 0016H 0017H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1 |
| | Control mode | P / Msc |
| | Unit | pulse |
| | Configuration range | 1 ~ （$2^{26}$-1） |
| | Data size | 32bit |
| | Data format | Dec |

Refer to PA-09.

| PA-12 (S-off) | GRM3 | The numerator of the electronic gear ratio (N3 ) | Communication address: 0018H 0019H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1 |
| | Control mode | P / Msc |
| | Unit | pulse |
| | Configuration range | 1 ~ （$2^{26}$-1） |
| | Data size | 32bit |
| | Data format | Dec |

Refer to PA-09.

| PA-13 (S-off) | GRM4 | Numerator of the Electronic Gear Ratio (N4) | Communication address: 001AH 001BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1 |
| | Control mode | P / Msc |
| | Unit | pulse |
| | Configuration range | 1 ~（$2^{26}$-1） |
| | Data size | 32bit |
| | Data format | Dec |

Refer to PA-09.

| PA-14 | ISP1 | Internal Speed Command 1/Internal Speed Limit 1 | Communication address: 001CH 001DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | By rated |
| | Control mode | S / T |
| | Unit | 0.1 r/min |
| | Configuration range | 0 ~ +/-max. Speed |
| | Data size | 32 bit |
| | Data format | DEC |

Internal Speed Command 1: The setting of the internal torque command in the first segment (SPD0,SPD1) = (1,0).

Internal Speed Limit 1: The setting of the internal torque limit in the first segment (SPD0,SPD1) = (1,0).

| PA-15 | ISP2 | Internal Speed Command 2/Internal Speed Limit 2 | Communication address: 001EH 001FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | By rated |
| | Control mode | S / T |
| | Unit | 0.1 r/min |
| | Configuration range | 0 ~ +/-max. Speed |
| | Data size | 32 bit |
| | Data format | DEC |

Internal Speed Command 2: The setting of the internal torque command in the second segment (SPD0,SPD1) = (0,1).

Internal Speed Limit 2: The setting of the internal torque limit in the second segment (SPD0,SPD1) = (0,1).

| PA-16 | ISP3 | Internal Speed Command 3/Internal Speed Limit 3 | Communication address: 0020H 0021H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | By rated |
| | Control mode | S / T |
| | Unit | 0.1 r/min |
| | Configuration range | 0 ~ +/-max. Speed |
| | Data size | 32 bit |
| | Data format | DEC |

Internal Speed Command 3: The setting of the internal torque command in the third segment (SPD0,SPD1) = (1,1).

Internal Speed Limit 3: The setting of the internal torque limit in the third segment (SPD0,SPD1) = (1,1).

| PA-17 (S-off) | CVM | The maximum rotation speed of the analog speed command | Communication address: 0022H 0023H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | By Rated |
| | Control mode | T / S |
| | Unit | r/min |
| | Configuration range | 0 ~ max. Speed |
| | Data size | 16bit |
| | Data format | Dec |

Maximum rotation speed of the analog speed command:

- In the speed mode, this indicates the setting of the rotation speed while the maximum voltage (10V) is input for the analog speed command.

  If the speed is set to 3000 and 10V is input for external voltage, the speed control command is 3000r/min. 5V implies that the speed control command is 1500r/min.

  Speed control command = Input voltage value x Set value/10

- In the torque mode, the parameter represents the command for analog speed limit.

  Speed limit command = Input voltage value x Set value/10

| PA-18 (S-off) | CTM | Limited maximum output of the analog torque | Communication address: 0024H 0025H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 300 |
| | Data size | 16bit |
| | Data format | Dec |

Maximum output of the analog torque command:

- In the torque mode, this indicates the setting of the torque while the maximum voltage (10V) is input for the analog torque command.

  If the initial value is set to 100 and 10 V is input for external voltage, the torque control command is 100% rated torque. 5V implies that the torque control command is 50% rated torque.

  Torque control command = Input voltage value x Set value/10 (%)

- In the speed and position modes, the parameter represents the command for analog torque limit.

  Torque limit command = Input voltage value x Set value/10 (%)

| PA-20 | INP | Confirmation of the range when the position is reached | Communication address: 0028H 0029H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 10400 |
| | Control mode | P / Msc |
| | Unit | Pulse |
| | Configuration range | 0 ~ 1048576 |
| | Data size | 32 bit |
| | Data format | DEC |

In the position mode (P) and the number of differential pulses is below the position range for the set value of the parameter, the signal for position reaching (TPOS) is output.

| PA-21 (S-off) | ATL | Response level for automatic negotiation | Communication address: 002AH 002BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 20 |
| | Control mode | P / S / Msc |
| | Unit | - |
| | Configuration range | 1 ~ 40 |
| | Data size | 16 bit |
| | Data format | DEC |

The parameter is the setting for the response bandwidth.

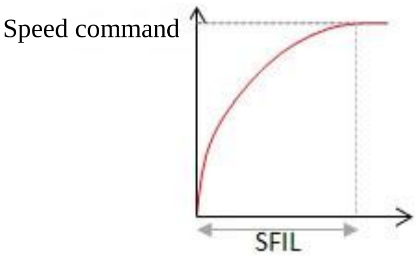
Based on the set value of the parameter and the value of PB-35 (the ratio of load inertia to servo motor inertia), the corresponding gain value is calculated automatically.

The parameters affected are PB-18(NLPF), PB-19(SCJT), PB-20(KPP), PB-24(KVP), PB-26(KVI) and PB-28(DSG). The set value and corresponding bandwidth are shown in the following table.

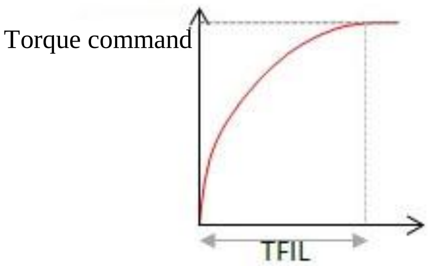
| Set value | Response bandwidth value Hz | Set value | Response bandwidth value Hz |
|---|---|---|---|
| 1 | 5 | 21 | 100 |
| 2 | 6 | 22 | 120 |
| 3 | 8 | 23 | 140 |
| 4 | 10 | 24 | 160 |
| 5 | 13 | 25 | 180 |
| 6 | 15 | 26 | 200 |
| 7 | 18 | 27 | 220 |
| 8 | 21 | 28 | 240 |
| 9 | 24 | 29 | 260 |
| 10 | 27 | 30 | 280 |
| 11 | 30 | 31 | 310 |
| 12 | 33 | 32 | 340 |
| 13 | 36 | 33 | 370 |
| 14 | 40 | 34 | 400 |
| 15 | 45 | 35 | 430 |
| 16 | 50 | 36 | 460 |
| 17 | 55 | 37 | 490 |
| 18 | 60 | 38 | 520 |
| 19 | 70 | 39 | 550 |
| 20 | 80 | 40 | 600 |

## 6.3.2. PB-XX (Gain/filtering parameter)

| PB-00 | SFIL | The acceleration-deceleration smoothing constant of the analog speed command | Communication address: 0100H 0101H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | S | |
| | Unit | ms | |
| | Configuration range | 0 ~ 1000 (0: The function is turned off.) | |
| | Data size | 16bit | |
| | Data format | Dec | |

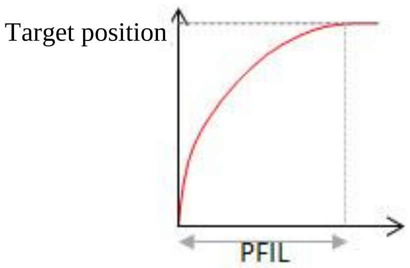



| PB-01 | TFIL | Smoothing constant of the analog torque command | Communication address: 0102H 0103H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | T | |
| | Unit | ms | |
| | Configuration range | 0 ~ 1000 (0: The function is turned off.) | |
| | Data size | 16bit | |
| | Data format | Dec | |



| PB-02 | PFIL | Constant of the low-pass filtering for the position command | Communication address: 0104H 0105H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | P / Msc |
| | Unit | 10ms |
| | Configuration range | 0 ~ 1000 (0: The function is turned off.) |
| | Data size | 16bit |
| | Data format | Dec |




| PB-03 | STAC | Acceleration constant of the smooth S-curve | Communication address: 0106H 0107H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 200 |
| | Control mode | S |
| | Unit | ms |
| | Configuration range | 1 ~ 20000 |
| | Data size | 16bit |
| | Data format | Dec |

Constant for speed acceleration: As for PB-03, PB-04 and PB-05, the time required for acceleration from 0 to 3000r/min can be set separately.

NOTE 1) If the source of the speed command is an analog source or PB-05 is set to 0, turn off the smooth function for S-shaped acceleration-deceleration.

| PB-04 | STDC | Deceleration constant of the smooth S-curve | Communication address: 0108H 0109H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 200 |
| | Control mode | S |
| | Unit | ms |
| | Configuration range | 1 ~ 20000 |
| | Data size | 16bit |
| | Data format | Dec |

Constant for speed acceleration: As for PB-03, PB-04 and PB-05, the time required for acceleration from 0 to 3000r/min can be set separately.

NOTE 1) If the source of the speed command is an analog source or PB-05 is set to 0, turn off the smooth function for S-shaped acceleration-deceleration.

| PB-05 | STL | Smooth constant of the smooth S-curve | Communication address: 010AH 010BH |
|---|---|---|---|

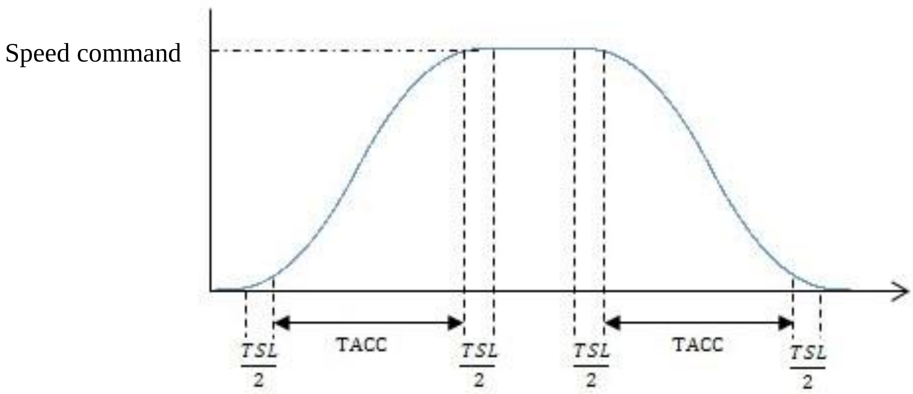
| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | S |
| | Unit | ms |
| | Configuration range | 0 ~ 10000 |
| | Data size | 16bit |
| | Data format | Dec |

PB-03: It is used to set the acceleration time for trapezoidal speed command.

PB-04: It is used to set the deceleration time for trapezoidal speed command.

PB-05: It is used to set the smooth time of the S-shaped acceleration-deceleration.

PB-03, Pb-04 and PB-05 can be configured independently.



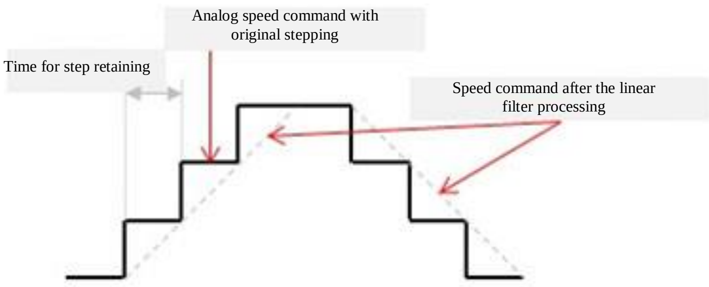

NOTE 1) If the source of the speed command is an analog source or PB-05 is set to 0, turn off the smooth function for S-shaped acceleration-deceleration.

| PB-06 | MFIL | The constant of the linear filtering for the analog speed command | Communication address: 010CH 010DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | S |
| | Unit | 0.1ms |
| | Configuration range | 0 ~ 40 |
| | Data size | 16bit |
| | Data format | Dec |
| | Input example | 10 = 1.0 ms |

The filter is a moving filter. The parameter PB-00 is a low-pass filter. The difference is that the smoothing effect occurs at the beginning and end of the step command for the moving filter. On the other hand, the smoothing effect only occurs at the end of the step command for the low-pass filter.

Recommendation: If the speed loop receives the command from the upper computer to form the control of the position loop, the low-pass filter can be used. For simple speed control, the moving filter can be used for better smoothing effects.




| PB-07 | FRCL | Ratio of friction compensation | Communication address: 010EH 010FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | P / S /Msc |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

This indicates the value for friction compensation. (As for the percentage of the rated torque, set 0 to turn off the function for friction compensation and set 1 to turn it on.)

| PB-08 | FRCT | Smooth constant of friction compensation | Communication address: 0110H 0111H |
|---|---|---|---|

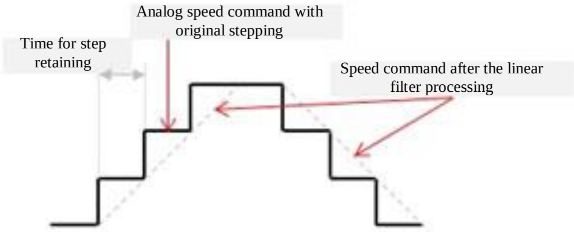
| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | P / S /Msc |
| | Unit | ms |
| | Configuration range | 0 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

This is used to set the smooth constant of friction compensation.

| PB-09 | PFLT2 | The constant of the linear filtering for the position command | Communication address: 0112H 0113H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | P / Msc |
| | Unit | ms |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

For the moving filter, the smoothing effect occurs at the beginning and end of the step command. However, the effect results in the delay of the command.




| PB-10 | NCF1 | Notch filter for resonance suppression (1) | Communication address: 0114H 0115H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1000 |
| | Control mode | ALL |
| | Unit | Hz |
| | Configuration range | 50 ~ 1000 |
| | Data size | 16 bit |
| | Data format | DEC |

| PB-11 | NCD1 | Notch filter for the attenuation rate of the resonance suppression (1) | Communication address: 0116H 0117H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | dB |
| | Configuration range | 0 ~ 32 |
| | Data size | 16 bit |
| | Data format | DEC |

| PB-12 | NCF2 | Notch filter for resonance suppression (2) | Communication Address: 0118H 0119H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1000 |
| | Control mode | ALL |
| | Unit | Hz |
| | Configuration range | 50 ~ 2000 |
| | Data size | 16 bit |
| | Data format | DEC |

| PB-13 | NCD2 | Notch filter for the attenuation rate of the resonance suppression (2) | Communication address: 011AH 011BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | dB |
| | Configuration range | 0 ~ 32 |
| | Data size | 16 bit |
| | Data format | DEC |

| PB-14 | NCF3 | Notch filter for resonance suppression (3) | Communication address: 011CH 011DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1000 |
| | Control mode | ALL |
| | Unit | Hz |
| | Configuration range | 50 ~ 2000 |
| | Data size | 16 bit |
| | Data format | DEC |

| PB-15 | NCD3 | Notch filter for the attenuation rate of the resonance suppression (3) | Communication address: 011EH 011FH |
|---|---|---|---|

| | |
|---|---|
| Initial value | 0 |
| Control mode | ALL |
| Unit | dB |
| Configuration range | 0 ~ 32 |
| Data size | 16 bit |
| Data format | DEC |

| PB-16 | NCFA | Setting for the suppression mode of auto-resonance | Communication address: 0120H 0121H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 0 |
| Control mode | ALL |
| Unit | - |
| Configuration range | 0 ~ 2 |
| Data size | 16 bit |
| Data format | DEC |

| PB-17 | NCLA | The setting for the sensitivity suppression of auto-resonance | Communication address: 0122H 0123H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 100 |
| Control mode | ALL |
| Unit | % |
| Configuration range | 1 ~ 300 |
| Data size | 16 bit |
| Data format | DEC |

| PB-18 | NLPF | The low-pass filtering for resonance suppression | Communication address: 0124H 0125H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 9 |
| Control mode | ALL |
| Unit | 0.1 ms |
| Configuration range | 0 ~ 100 |
| Data size | 16 bit |
| Data format | DEC |

| PB-19 | SCJT | The filter bandwidth for the speed detection | Communication address: 0126H 0127H |
|---|---|---|---|
| | Initial value | 2500 | |
| | Control mode | ALL | |
| | Unit | Hz | |
| | Configuration range | 10 ~ 2500 | |
| | Data size | 16bit | |
| | Data format | Dec | |

This is used to set the filter bandwidth for speed estimation.

| PB-20 | KPP | The gain of the position control | Communication address: 0128H 0129H |
|---|---|---|---|
| | Initial value | 125 | |
| | Control mode | P / Msc | |
| | Unit | rad/s | |
| | Configuration range | 0 ~ 2047 | |
| | Data size | 16bit | |
| | Data format | Dec | |

When the gain of the position control is increased, the position response is increased and the error magnitude of the position control is reduced. Vibration and noise occurs easily if the gain is set to an excessive value.

| PB-21 | PGR | Ratio for the gain variation of the position control | Communication address: 012AH 012BH |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | P / Msc | |
| | Unit | % | |
| | Configuration range | 10 ~ 500 | |
| | Data size | 16bit | |
| | Data format | Dec | |

This is used to switch the change rate regarding the gain of the position control based on the condition of gain switch.

| | | | |
|---|---|---|---|
| PB-22 | PFG | The feed forward gain for the position control | Communication address: 012CH 012DH |

| | | |
|---|---|---|
| | Initial value | 50 |
| | Control mode | P / Msc |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

For smooth change of the position control command, the increase in gain improves the magnitude of the following error for the position. For unsmooth change of the position control command, the decrease in gain mitigates the vibration of the mechanism during operation.

| | | | |
|---|---|---|---|
| PB-23 | PFC | The smooth constant of the feed forward gain for the position control | Communication address: 012EH 012FH |

| | | |
|---|---|---|
| | Initial value | 5 |
| | Control mode | P / Msc |
| | Unit | ms |
| | Configuration range | 2 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

For smooth change of the position control command, the decrease in smooth constant improves the magnitude of the following error for the position. For unsmooth change of the position control command, the increase in smooth constant mitigates the vibration of the mechanism during operation.

| | | | |
|---|---|---|---|
| PB-24 | KVP | The proportional gain for speed control | Communication address: 0130H 0131H |

| | | |
|---|---|---|
| | Initial value | 502 |
| | Control mode | ALL |
| | Unit | rad/s |
| | Configuration range | 0 ~ 8191 |
| | Data size | 16bit |
| | Data format | Dec |

The speed response is increased when the gain of the speed control is increased. Vibration and noise occurs easily if the gain is set to an excessive value.

| PB-25 | SPR | The ratio for the gain variation of the speed control | Communication address: 0132H 0133H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 10 ~ 500 |
| | Data size | 16bit |
| | Data format | Dec |

This is used to switch the change rate regarding the gain of the speed control based on the condition of gain switch.

| PB-26 | KVI | The integral compensation for the speed control | Communication address: 0134H 0135H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 50 |
| | Control mode | ALL |
| | Unit | rad/s |
| | Configuration range | 0 ~ 1023 |
| | Data size | 16bit |
| | Data format | Dec |

When the integral value of the speed control is increased, the position response is increased and the error magnitude of the speed control is reduced. Vibration and noise occurs easily if the gain is set to an excessive value.

| PB-27 | KVF | The feed forward gain for the speed control | Communication address: 0136H 0137H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

For smooth change of the speed control command, the increase in gain improves the magnitude of the following error for the speed. For unsmooth change of the speed control command, the decrease in gain mitigates the vibration of the mechanism during operation.

| | | | |
|---|---|---|---|
| PB-28 | DSG | The resistance gain for the external interference | Communication address: 0138H 0139H |

| | | |
|---|---|---|
| | Initial value | 50 |
| | Control mode | ALL |
| | Unit | rad/s |
| | Configuration range | 0 ~ 1023 |
| | Data size | 16bit |
| | Data format | Dec |

If the parameter is increased, the resistance of the speed circuit increases. It is suggested to set the value of the parameter equal to that of PB-26 (KVI).

It is suggested to refer to the rules below for adjustment:

1. In the speed mode, increase the parameter could reduce the speed overshoot.

2. In the position mode, decrease the parameter could reduce the position overshoot

| | | | |
|---|---|---|---|
| PB-29 | GCM | Condition of the gain switch and the selection for the switch method | Communication address: 013AH 013BH |

| | | |
|---|---|---|
| | Initial value | 10 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 18 |
| | Data size | 16bit |
| | Data format | Dec |

**Condition of the gain switch**:

0: The gain switch function is off.

1: The signal (GAINUP) for gain switch is ON.

2: In the position control mode, the magnitude of the position error is greater than the set value of the parameter PB-31 (GCC).

3: The frequency of the position command is greater than the set value of the parameter PB-31 (GCC).

4: The rotation speed of the servo motor is greater than the set value of the parameter PB-31 (GCC).

5: The signal (GAINUP) for gain switch is OFF.

6: In the position control mode, the magnitude of the position error is less than the set value of the parameter PB-31 (GCC).

7: The frequency of the position command is less than the set value of the parameter PB-31 (GCC).

8: The rotation speed of the servo motor is less than the set value of the parameter PB-31 (GCC).

**Method for gain switching**:

00: Switching of the gain scale

10: Switching of the integrator (P -> PI)

| PB-30 | GCT | The time constant for the gain switch | Communication address: 013CH 013DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1 |
| | Control mode | ALL |
| | Unit | 10ms |
| | Configuration range | 0 ~ 1000 (0: The function is turned off.) |
| | Data size | 16bit |
| | Data format | Dec |

The switch time constant is used for the change of the smooth gain.

| PB-31 | GCC | The condition of the gain switch | Communication address: 013EH 013FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | pulse，Kpps，r/min |
| | Configuration range | 0 ~ 3840000 |
| | Data size | 32bit |
| | Data format | Dec |

The setting of the switching condition (pulse error, Kpps and r/min) depends on the item (PB-29) selected for switching condition.

| PB-32 | AUTB | The setting for the response bandwidth of the speed loop in the automatic and semi-automatic modes | Communication address: 0140H 0141H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 80 |
| | Control mode | ALL |
| | Unit | Hz |
| | Configuration range | 1 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

1~50 Hz: Low rigidity and response

51~250 Hz: Medium rigidity and response

251~550 Hz: High rigidity and response

NOTE 1) The function is turned on through the parameter PB-33. For the bandwidth corresponding to the setting, refer to Secs. 5 and 6 in Chapter 5 for the description of tuning steps.

| PB-33 (S-off) | AUTM | The method for gain adjustment | Communication address: 0142H 0143H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | 0 ~ 2 | |
| | Data size | 16bit | |
| | Data format | Dec | |

0: Manual mode

1: Auto mode (persistent adjustment)

2: Semi-auto mode (non-persistent adjustment)

| PB-35 | GSI | The ratio of load inertia to servo motor inertia | Communication address: 0146H 0147H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | 0.1 times | |
| | Configuration range | 0 ~ 2000 | |
| | Data size | 16bit | |
| | Data format | Dec | |

Ratio of load inertia to servo motor inertia (rotation motor): (J_load/J_motor)

J_motor: The moment of inertia for the servo motor

J_load: The moment of inertia for the overall equivalence of the external mechanical load

| PB-36 | VSF1 | Frequency for the vibration suppression of low frequency (1) | Communication address: 0148H 0149H |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | P | |
| | Unit | 0.1Hz | |
| | Configuration range | 10 ~ 10000 | |
| | Data size | 16bit | |
| | Data format | Dec | |

**This is the parameter for setting the frequency of the first filter for vibration suppression of low frequency. If PB-37 is set to 0, the first filter for vibration suppression of low frequency is turned off.**

| PB-37 | VSG1 | Gain for the vibration suppression of low frequency (1) | Communication address: 014AH 014BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | P / Msc |
| | Unit | - |
| | Configuration range | 0 ~ 9 |
| | Data size | 16 bit |
| | Data format | DEC |

**This is the parameter for setting the gain of the first filter for vibration suppression of low frequency. The greater the gain the better the vibration suppression. The excessive setting may result in uneven operation of the motor. It is suggested to increase the setting gradually.**

| PB-38 | VSF2 | Frequency for the vibration suppression of low frequency (2) | Communication address: 014CH 014DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 1000 |
| | Control mode | P / Msc |
| | Unit | 0.1Hz |
| | Configuration range | 10 ~ 10000 |
| | Data size | 16bit |
| | Data format | Dec |

**This is the parameter for setting the frequency of the second filter for vibration suppression of low frequency. If PB-39 is set to 0, the second filter for vibration suppression of low frequency is turned off.**

| PB-39 | VSG2 | Frequency for the vibration suppression of low frequency (2) | Communication address: 014EH 014FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | P / Msc |
| | Unit | - |
| | Configuration range | 0 ~ 9 |
| | Data size | 16 bit |
| | Data format | DEC |

**This is the parameter for setting the gain of the second filter for vibration suppression of low frequency. The greater the gain the better the vibration suppression. The excessive setting may result in uneven operation of the motor. It is suggested to increase the setting gradually.**

| PB-40 | KPI | The integral compensation of the position | Communication address: 0150H 0151H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | Hz | |
| | Configuration range | 0 ~ 1023 | |
| | Data size | 16bit | |
| | Data format | Dec | |

If the integral value of the position control increases, the magnitude of the steady-state error of the position is reduced. If the setting is excessive, position overshoot and noise may occur.

| PB-41 | JSL | The level for the stability determination of inertia estimation | Communication address: 0152H 0153H |
|---|---|---|---|
| | Initial value | 15 | |
| | Control mode | ALL | |
| | Unit | 0.1times | |
| | Configuration range | 0 ~ 2000 | |
| | Data size | 16bit | |
| | Data format | Dec | |

Parameter function: In the semi-auto mode, the inertia estimated is assumed complete if the scope of the variation in inertia estimation is less than the one for PB-41 for a period of time.

| PB-41 | AVSM | The setting for low frequency automatic suppression mode | Communication address: 0154H 0155H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 15 |
| | Control mode | ALL |
| | Unit | 0.1times |
| | Configuration range | 0 ~ 2000 |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function:

0: Fixed.

1: Automatic suppression.

Automatic suppression mode description:

When set to 1, the vibration is automatically suppressed. When no frequency is found or found, it is automatically set to 0, and the searched frequency is stored to the PB-36.

## 6.3.3. PC-XX (I/O configuration parameters)

| PC-00 | DIRT | The time for response filtering of the digital input | Communication address: 0200H 0201H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 2 |
| Control mode | ALL |
| Unit | 2ms |
| Configuration range | 0 ~ 20 |
| Data size | 16bit |
| Data format | Dec |

For louder ambient noise, the control reliability may be enhanced by the increase in setting. The response time may be affected if the setting is too high.

| PC-01 | DI1 | The function planning for Pin DI1 of the digital input | Communication address: 0202H 0203H |
|---|---|---|---|

| | |
|---|---|
| Initial value | Based on the control mode |
| Control mode | ALL |
| Unit | N/A |
| Configuration range | 000h ~ 125h（Msc version 000h ~ 135h） |
| Data size | 16bit |
| Data format | Hex |

□□□■■: Selection of the input function

□□■□□: Attribute of the input contact

- Selection of the input function: Refer to "Table for definitions of the default DI input" for the function this selection represents.
- Attribute of the input contact: The attribute is Contact a or b.

  0: The input contact is set as NC Contact b.

  1: The input contact is set as NO Contact a.

  After modifying the parameter, restart the power supply to ensure that the function is in normal operation.

  Parameter PD-06 may be used to plan whether DI is controlled by the external terminal or Communication Method PD-32.

| PC-02 | DI2 | Function planning for Pin DI2 of the digital input | Communication address: 0204H 0205H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h ~ 125h ( Msc version 000h ~ 135h ) |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-01.

| PC-03 | DI3 | Function planning for Pin DI3 of the digital input | Communication address: 0206H 0207H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h ~ 125h ( Msc version 000h ~ 135h ) |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-01.

| PC-04 | DI4 | Function planning for Pin DI4 of the digital input | Communication address: 0208H 0209H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h ~ 125h ( Msc version 000h ~ 135h ) |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-01.

| PC-05 | DI5 | The function planning for Pin DI5 of the digital input | Communication address: 020AH 020BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h ~ 125h（Msc version 000h ~ 135h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-01.

| PC-06 | DI6 | The function planning for Pin DI6 of the digital input | Communication address: 020CH 020DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h ~ 125h（Msc version 000h ~ 135h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-01.

| PC-07 | DI7 | The function planning for Pin DI7 of the digital input | Communication address: 020EH 020FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h ~ 125h（Msc version 000h ~ 135h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-01.

| PC-08 | DI8 | The function planning for Pin DI8 of the digital input | Communication address: 0210H 0211H |
|---|---|---|---|
| | Initial value | Based on the control mode | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | 000h ~ 125h（Msc version 000h ~ 135h） | |
| | Data size | 16bit | |
| | Data format | Hex | |

Refer to the description for PC-01.

| PC-09 | DI9 | The function planning for Pin DI9 of the digital input | Communication address: 0212H 0213H |
|---|---|---|---|
| | Initial value | Based on the control mode | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | 000h ~ 125h（Msc version 000h ~ 135h） | |
| | Data size | 16bit | |
| | Data format | Hex | |

Refer to the description for PC-01.

| PC-10 | DO1 | Function planning for Pin DO1 of the digital output | Communication address: 0214H 0215H |
|---|---|---|---|
| | Initial value | Based on the control mode | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | 0 ~ 0x10F （Msc version 000h ~ 116h） | |
| | Data size | 16bit | |
| | Data format | Hex | |

□□□■■: Selection of the input function

□□■□□: Attribute of the input contact

- Selection of the input function: Refer to "Table for definitions of the default DO output" for the function this selection represents.

- Attribute of the input contact: The attribute is Contact a or b.

  0: The input contact is set as NC Contact b.

  1: The input contact is set as NO Contact a.

  After modifying the parameter, restart the power supply to ensure that the function is in normal operation.

  Parameter PD-44 may be used to plan whether DO is controlled by the external terminal or Communication Method PD-31.

| PC-11 | DO2 | Function planning for Pin DO2 of the digital output | Communication address: 0216H 0217H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 0x10F （Msc version 000h ~ 116h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-10.

| PC-12 | DO3 | Function planning for Pin DO3 of the digital output | Communication address: 0218H 0219H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 0x10F （Msc version 000h ~ 116h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-10.

| PC-13 | DO4 | Function planning for Pin DO4 of the digital output | Communication address: 021AH 021BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 0x10F （Msc version 000h ~ 116h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-10.

| PC-14 | DO5 | Function planning for Pin DO5 of the digital output | Communication address: 021CH 021DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 0x10F （Msc version 000h ~ 116h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-10.

| PC-15 | DO6 | Function planning for Pin DO6 of the digital output | Communication address: 021EH 021FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 0x10F （Msc version 000h ~ 116h） |
| | Data size | 16bit |
| | Data format | Hex |

Refer to the description for PC-10.

| PC-16 (Re-on) | Msctime | Msc time delay selector | Communication address：0220H 0221H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc、MscP、MscS | |
| | Unit | - | |
| | Configuration range | 0~1 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the time delay for executing the PR command in milliseconds or seconds. After setting, please power on again to ensure the parameters are set properly.

0: millisecond (ms).

1: second (s).

| PC-18 (Re-on) | DisOrg | Origin return and start selection | Communication address：0224H 0225H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc、MscP、MscS | |
| | Unit | - | |
| | Configuration range | 0~1 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

In the Msc related mode, whether to perform the origin position return, please turn it back on after the setting to ensure the setting is completed.

0: Must be executed.

1: Not executed.

When the selection does not perform the return-to-origin, the system only guarantees that the relative coordinate system is normal, and it does not guarantee the normal positioning of the absolute and indexing coordinate system.

| PC-20 | ZSPD | The level for zero speed detection | Communication address: 0228H 0229H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | 0.1 r/min |
| | Configuration range | 0 ~ 2000 |
| | Data size | 16bit |
| | Data format | Dec |

This is used to set the output range for the zero speed signal (ZSPD). If the clockwise and counterclockwise rotation speed of the motor is below the set value, the zero speed signal is formed and the output pin is enabled.

| PC-21 | BTOD | The turn-on delay time for the electromagnetic brake | Communication address: 022AH 022BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | ms |
| | Configuration range | 0 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: It sets the time delayed from the the time servo is activated to the time that the interlock signal of the electromagnetic brake (DO code 0x07, BREAK) is turned on.

| PC-22 | BTCD | The turn-off delay time for the electromagnetic brake | Communication address: 022CH 022DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | ms |
| | Configuration range | -1000 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: It sets the time delayed from the the time servo is ready and turned off to the time that the interlock signal of the electromagnetic brake (DO code 0x07, BREAK) is turned off. (Refer to 7.5.4 for the use of the electromagnetic brake.)

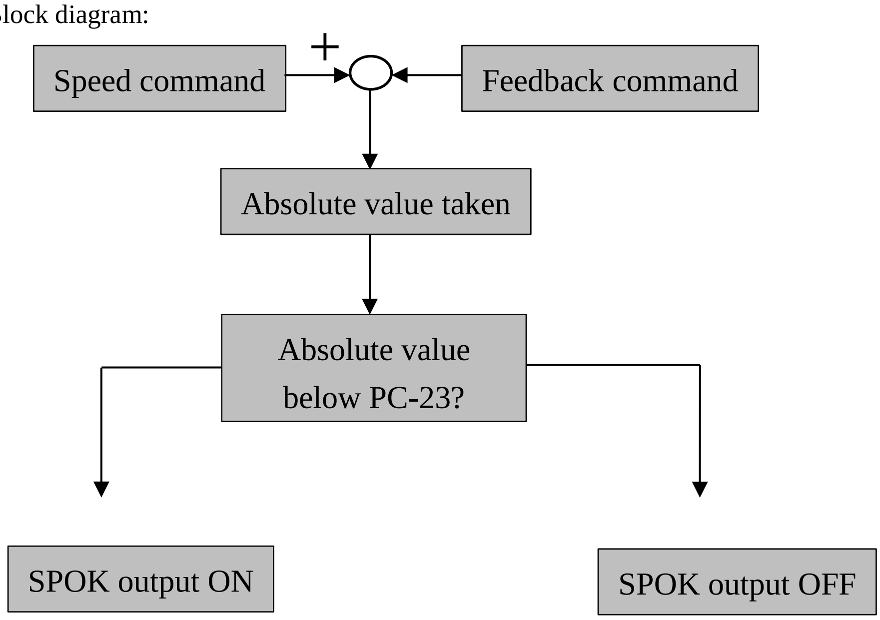
1) When the BTCD delay time is not over and the motor rotation speed is below the one for PC-20, the interlock signal of the electromagnetic brake (BREAK) is turned off.
2) When the BTCD delay time is over and the motor rotation speed is above the one for PC-20, the interlock signal of the electromagnetic brake (BREAK) is turned off.
3) If the alarm or EMGS occurs causes the servo to be turned off, the negative value of BTCD will not become effective if a negative value is assigned to BTCD.
   This is equivalent to the situation that BTCD is set to zero.

| PC-23 | SPOK | The level for detection of the speed comparison | Communication address: 022EH 022FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 10 |
| | Control mode | S |
| | Unit | r/min |
| | Configuration range | 0 ~ 300 |
| | Data size | 16 bit |
| | Data format | DEC |

When the error value between the speed command and motor feedback speed is below the one for this parameter, the digital output DO: SP_OK (DO code 0x0F) is on.

Block diagram:




| PC-24 (S-off) | PUUres | Position error in analog monitoring resolution (PUU units) | Communication address：0230H 0231H |
|---|---|---|---|
| | Initial value | 10000 | |
| | Control mode | P | |
| | Unit | pulse | |
| | Configuration range | 1 ~ ( $2^{26}$ - 1 ) | |
| | Data size | 32 bit | |
| | Data format | DEC | |

The parameter uses the upper control single-turn resolution. It needs to be linked with the electronic gear ratio of PA-09, 10, 11, and 12. When the parameter PD-22 is set to MON1 or MON2 = 8, it will be based on the position error before the electronic gear ratio. The ratio between this set value corresponds to the voltage level.

for example:

If the single-turn resolution of the host controller used is 10000pulse, after setting the electronic gear ratio and setting this parameter to the same resolution as the upper controller, the voltage observed by MON is (+/-8V) corresponding to ( +/- 10000 pulse) error, in order to calculate.

| PC-25 | POL | The output level for the expected overload | Communication address: 0232H 0233H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

If the setting is between 0 and 100 and the continuous output load of the servo motor is above the set ratio (PC-25), the warning signal for expected overload will be output (DO set to 10, OLW). Cancel the function if the set value is above 100.

## 6.3.4. PD-XX (Expansion parameter)

| PD-00<br>(Re-on) | ADR | The setting of the branch number | Communication address:<br>0300H<br>0301H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 7F |
| Control mode | ALL |
| Unit | N/A |
| Configuration range | 01h ~ 7Fh |
| Data size | 16bit |
| Data format | Hex |

When RS-232/RS-485 is used for communication, only one branch number may be set per servo drive. If one branch number is set for multiple drives, the communication would not work properly. The station number implies the absolute address communication network. It is also applicable to RS-232/485.

| PD-01 | BRT | The communication transmission rate | Communication address:<br>0302H<br>0303H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 33 |
| Control mode | ALL |
| Unit | Bps |
| Configuration range | 00h ~ 55h |
| Data size | 16bit |
| Data format | Hex |

□□□□■: RS232

□□□■□: RS485

The following shows the definition of the set value:

0：4800

1：9600

2：19200

3：38400

4：57600

5：115200

| PD-02 | PTL | The protocol | Communication address: 0304H 0305H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 6 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 6 ~ 8 |
| | Data size | 16bit |
| | Data format | Dec |

RS232 and RS485 share the same setting.

The following shows the definition of the set value:

6 = 8, N, 2(MODBUS, RTU)

7 = 8, E, 1(MODBUS, RTU)

8 = 8, O, 1(MODBUS, RUT)

| PD-03 | CFP | The handling of the communication error | Communication address: 0306H 0307H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 1 |
| | Data size | 16bit |
| | Data format | Dec |

The following shows the definition of the set value:

0: A warning is issued and the operation proceeds.

1: A warning is issued and the operation is decelerated to stop. (The termination mode is set in Parameter PD-42.)

| PD-04 | COT | The setting for the communication timeout | Communication address: 0308H 0309H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | Sec |
| | Configuration range | 0 ~ 20 |
| | Data size | 16bit |
| | Data format | Dec |

If the set value is not 0, turn on the communication timeout immediately; otherwise, turn it off.

| PD-06 (N-keep) | SWDI | Control switch for the source of the input contact (DI) | Communication address: 030CH 030DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 1 |
| | Data size | 16bit |
| | Data format | Dec |

0: The DI status is controlled by the external contact.

1: The DI status is controlled by the software. (The DI status can be set via PD-32.)

| PD-07 | CDT | The time for the delay of the communication response | Communication address: 030EH 030FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | 1ms |
| | Configuration range | 0 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

This delays the communication time needed for the drive to respond to the upper controller.

| PD-11 (R-only) | VER | The firmware version | Communication address: 0316H 0317H |
|---|---|---|---|
| | Initial value | The factory setting | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | N/A | |
| | Data size | 16bit | |
| | Data format | Dec | |

| PD-12 (R-only) | FPGAVER | FPGA FW version | 通訊位置：0318H 0319H |
|---|---|---|---|
| | Initial value | The factory setting | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | N/A | |
| | Data size | 16bit | |
| | Data format | Dec | |

| PD-15 (R-only) | MON1 | The display for Condition Monitoring Register 1 | Communication address: 031EH 031FH |
|---|---|---|---|
| | Initial value | - | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | - | |
| | Data size | 32bit | |
| | Data format | Dec | |

The status value to be read by PD-23 can be set via the panel or communication. (Refer to PD-21.) The status data must be read from the communication address through the port.

Example:

If PD-23 is set to 3, the "total pulse numbers for the motor with encoder feedback" is read when PD-15 is read. If the content displayed is read via the MODBUS communication, two sets of 16-bit data from communication addresses 0012H and 0013H is read, respectively. The contents of these two sets form the 32-bit data.

| PD-16 (R-only) | MON2 | The display for Condition Monitoring Register 2 | Communication address: 0320H 0321H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | - |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | - |
| | Data size | 32bit |
| | Data format | Dec |

The status value to be read by PD-24 can be set via the panel or communication. (Refer to PD-21.) The status data must be read from the communication address through the port.

| PD-17 (R-only) | MON3 | The display for Condition Monitoring Register 3 | Communication address: 0322H 0323H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | - |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | - |
| | Data size | 32bit |
| | Data format | Dec |

The status value to be read by PD-25 can be set via the panel or communication. (Refer to PD-21.) The status data must be read from the communication address through the port.

| PD-18 (R-only) | MON4 | The display for Condition Monitoring Register 4 | Communication address: 0324H 0325H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | - |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | - |
| | Data size | 32bit |
| | Data format | Dec |

The status value to be read by PD-26 can be set via the panel or communication. (Refer to PD-21.) The status data must be read from the communication address through the port.

| PD-19 (R-only) | MON5 | The display for Condition Monitoring Register 5 | Communication address: 0326H 0327H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | - |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | - |
| | Data size | 32bit |
| | Data format | Dec |

The status value to be read by PD-27 can be set via the panel or communication. (Refer to PD-21.) The status data must be read from the communication address through the port.

| PD-20 (N-keep) | ALD | The display for the error status of the drive | Communication address: 0328H 0329H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | - |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0~58 (The alarm can be cleared by writing in 0.) |
| | Data size | 16bit |
| | Data format | Dec |

Display of the hexadecimal value: The alarm code is displayed. (Refer to Chapter 9 Warning Troubleshooting for the code definition.)

| PD-21 | SSD | Display for the status of the drive | Communication address: 032AH 032BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 19 |
| | Data size | 16bit |
| | Data format | Dec |

Setting of the default monitoring parameter after power on:

Parameter function:

| | | |
|---|---|---|
| 00 : Cd-P , | The number of pulses entered for the pulse command (the number of pulses for the command entered to the upper controller) | [user unit] |
| 01 : Fb-P , | The number of pulses for the motor feedback (the number of pulses fed to the upper controller from the drive) | [user unit] |
| 02 : Err-P , | The number of differential pulses for the Cd-P and Fb-P | [user unit] |
| 03 : Efb-P , | The number of pulses for the motor feedback (the number of pulses for the encoder feedback) | [pulse] |
| 04 : SPEED , | Motor rotation speed | [r/min] |
| 05 : ECd.P , | The number of pulses entered for the pulse command (the number of pulses for the command entered to the upper controller* the electronic gear ratio) | [pulse] |
| 06 : Eer-P , | The number of differential pulses for the ECd-P and EFb-P | [pulse] |
| 07 : CP-Fr , | The pulse command input frequency | [Kpps] |
| 08 : C-SP1 , | The speed input command | [Volt] |
| 09 : C-SP2 , | The speed input command | [r/min] |
| 10 : C-tq1 , | The torque input command | [Volt] |
| 11 : C-tq2 , | The torque input command | [%] |
| 12 : PK-L , | The peak torque | [%] |
| 13 : AvG-L , | The average torque | [%] |
| 14 : U-buS , | The voltage of the main circuit | [Volt] |
| 15 : J-L , | The load/motor inertia ratio | [double] |
| 16 : rSn.fr, | The resonance frequency (The low byte is the first resonance point and the high byte is the second resonance point.) | [Hz] |
| 17 : diFF.2, | This indicates the number of absolute pulses with respect to the encoder Z-phase. Which means, the numerical value at the origin of the Z-phase is 0. The encoder rotates clockwise or counterclockwise for positive/negative 5000 pulses. | [pulse] |
| 18 : Drv-t , | Drive temperature | [°C] |
| 19 : bAtt | battery voltage | [Volt] |

| PD-22 | VMON | The analog output monitoring | Communication address: 032CH 032DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 01 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 00h ~ 55h ( Msc version 00h ~ 88h ) |
| | Data size | 16bit |
| | Data format | Hex |

□□□□■: MON2

□□□■□: MON1

| Settings of MON1 and MON2 | Description |
|---|---|
| 0 | Motor speed (+/-8 volts/maximum rotation speed) |
| 1 | Motor torque (+/-8 volts/maximum torque) |
| 2 | Pulse command frequency (+8 volts/4.5 Mpps) |
| 3 | Speed command (+/-8 volts/maximum speed command) |
| 4 | Torque command (+/-8 volts/maximum torque command) |
| 5 | VBUS voltage (+/-8 volts/464 V) |
| 6 | Electronic cam drive shaft angular speed monitoring<br>PL-13 = 1: Angle monitoring (+/-8 Volts / 360 degrees)<br>PL-13 = 0: speed monitoring (+/-8 Volts / 6000 rpm) |
| 7 | Electronic cam driven shaft output monitoring<br>PL-14 = 1: Actual output monitoring of the slave axis (+/-8 Volts / PG81)<br>PL-14 = 0: cam curve output monitoring (+/-8 Volts / PG81) |
| 8 | Position error output monitoring (+/-8 Volts / PC24) |

| PD-23 | CM1 | Selection for the content of the display for Status Monitoring Register 1 | Communication address: 032EH 032FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 19 |
| | Data size | 16bit |
| | Data format | Dec |

For the settings, refer to PD-21.

Example:

If PD-23 is set to 04, the "motor rotation speed (r/min)" is read if PD-23 is read.

| | | | |
|---|---|---|---|
| PD-24 | CM2 | Selection for the content of the display for Status Monitoring Register 2 | Communication address: 0330H 0331H |

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 19 |
| | Data size | 16bit |
| | Data format | Dec |

For the settings, refer to PD-21.

| | | | |
|---|---|---|---|
| PD-25 | CM3 | Selection for the content of the display for Status Monitoring Register 3 | Communication address: 0332H 0333H |

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 19 |
| | Data size | 16bit |
| | Data format | Dec |

For the settings, refer to PD-21.

| | | | |
|---|---|---|---|
| PD-26 | CM4 | Selection for the content of the display for Condition Monitoring Register 4 | Communication address: 0334H 0335H |

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0 ~ 19 |
| | Data size | 16bit |
| | Data format | Dec |

For the settings, refer to PD-21.

| PD-27 | CM5 | The display content of Condition Monitoring Register 5 is selected. | Communication address: 0336H 0337H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 0 |
| Control mode | ALL |
| Unit | N/A |
| Configuration range | 0 ~ 19 |
| Data size | 16bit |
| Data format | Dec |

For the settings, refer to PD-21.

| PD-28 | VMR1 | The ratio for MON1 analog monitoring output | Communication address: 0338H 0339H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 100 |
| Control mode | ALL |
| Unit | % |
| Configuration range | 0 ~ 100 |
| Data size | 16bit |
| Data format | Dec |

Example:

PD-22 = 01 (MON1 is the analogue output of motor speed while MON2 is the analogue output of motor torque.)

MON1 output voltage= $8 * \frac{\text{Motor rotation speed}}{\left(\text{Max.speed} * \frac{\text{PD}-28}{100}\right)}$ unit: volts

MON2 output voltage= $8 * \frac{\text{Motor torque}}{\left(\text{Max.torque} * \frac{\text{PD}-29}{100}\right)}$ unit: volts

| PD-29 | VMR2 | The ratio for MON2 analog monitoring output | Communication address: 033AH 033BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

Example:

PD-22 = 01 (MON1 is the analogue output of motor speed while MON2 is the analogue output of motor torque.)

MON1 output voltage= $8 * \frac{\text{Motor rotation speed}}{(\text{Max.speed}*\frac{\text{PD}-28}{100})}$ unit: volts

MON2 output voltage= $8 * \frac{\text{Motor torque}}{(\text{Max.torque}*\frac{\text{PD}-29}{100})}$ : volts

| PD-30 | JOG | The jog control of the servo motor | Communication address: 033CH 033DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 20 |
| | Control mode | ALL |
| | Unit | r/min |
| | Configuration range | 0 ~ max.Speed |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function:

When a jog speed is set for the drive panel control parameter PD-30, the "JOG" icon will display on the panel. Press the "UP" key to control normal jog running. Press the DOWN key to control reverse jog running. Release the key to stop jog running. No running is possible if any error is displayed in this setting. The max. jog speed is the max. servo motor speed.

| PD-31 (S-off) (N-keep) | FDO | The status and setting of the digital output | Communication address: 033EH 033FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 00h ~ 3Fh |
| | Data size | 16bit |
| | Data format | Hex |

For the setting not configured when the software specifies a DO status (PD-44 is not set to 006), this parameter displays the DO status (read-only).

For the setting configured when the software specifies a DO status (PD-44 = 006), this parameter may force to specify the DO status. Bit0 ~Bit5 corresponds to DO1~DO6, respectively.

| PD-32 | DISF | The status and setting of the digital input | Communication address: 0340H 0341H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | Based on the control mode |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 000h~ 1FFh |
| | Data size | 16bit |
| | Data format | Hex |

For the setting not configured when the software specifies a DI status (PD-06 = 0), this parameter displays the DI status (read-only).

For the setting configured when the software specifies a DI status (PD-06 = 1), this parameter may force to specify the DI status. Bit0 ~Bit8 corresponds to DI1~DI9, respectively.

| PD-33 (R-only) | ALH1 | The record of the abnormal condition (N) | Communication address: 0342H 0343H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: The latest abnormal status record

LED displays ALXXX. XXX is an alarm code. Refer to the Drive Alarm List in 9.1.

| PD-34 (R-only) | ALH2 | The record of the abnormal condition (N-1) | Communication address: 0344H 0345H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: The second-last abnormal status record.

LED displays ALXXX. XXX is an alarm code. Refer to the Drive Alarm List in 9.1.

| PD-35 (R-only) | ALH3 | The record of the abnormal condition (N-2) | Communication address: 0346H 0347H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: The third-last abnormal status record.

LED displays ALXXX. XXX is an alarm code. Refer to the Drive Alarm List in 9.1.

| PD-36 (R-only) | ALH4 | The record of the abnormal condition (N-3) | Communication address: 0348H 0349H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | | |
| | Data size | 16bit | |
| | Data format | Dec | |

Parameter function: The fourth-last abnormal status record.

LED displays ALXXX. XXX is an alarm code. Refer to the Drive Alarm List in 9.1.

| PD-37 (R-only) | ALH5 | The record of the abnormal condition (N-4) | Communication address: 034AH 034BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | | |
| | Data size | 16bit | |
| | Data format | Dec | |

Parameter function: The fifth-last abnormal status record.

LED displays ALXXX. XXX is an alarm code. Refer to the Drive Alarm List in 9.1.

| PD-39 ) | VAO | Analog speed input OFFSET | Communication address: 034EH 034FH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: Setting OFFSET amount adjustment.

| PD-40 | PCM | The condition monitoring register (for PC software) | Communication address: 0350H 0351H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | mV |
| | Configuration range | -5000 ~ 5000 |
| | Data size | 16 bit |
| | Data format | DEC |

Parameter function: Setting OFFSET amount adjustment.

| PD-41 | PCMS | The content selection of the condition monitoring register (for PC software) | Communication address: 0352H 0353H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | - |
| | Configuration range | 0 ~ 1 |
| | Data size | 16 bit |
| | Data format | DEC |

| PD-42 | MSTP | The function of the motor stop mode | Communication address: 0354H 0355H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 00h ~ 21h |
| | Data size | 16bit |
| | Data format | Hex |

□□□□■: Motor stop mode

□□□■□: Dynamic brake execution options

- Motor stop mode: When CWL, CCWL, EMGS or communications errors are generated, the motor stop mode functions (no support for the position mode).

  0: Stop immediately

  1: Stop gradually

- Dynamic brake execution options: The stop mode for Servo Off or Alarm.

  0: Execution of dynamic brake

  1: Motor free run

  2: Execution of dynamic brake and then free run when the motor stops thoroughly (motor speed less than PC-20).

| PD-43 | TSPD | The level for the detection of the target rotation speed | Communication address: 0356H 0357H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | The rated value |
| | Control mode | ALL |
| | Unit | r/min |
| | Configuration range | 0 ~ max.Speed |
| | Data size | 16bit |
| | Data format | Dec |

The digital output (TSPD) is enabled when the speed reaches to the preset target speed. If the clockwise and counterclockwise rotation speed of the motor exceeds the set value, the target speed signal is formed and the output pin is enabled.

| PD-44 | RegMisc1 | The write-in of the special parameter | Communication address: 0358H 0359H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 0000h ~ FFFFh |
| | Data size | 16bit |
| | Data format | Hex |

Settings:

| Parameter code | Function |
|---|---|
| 4 | Parameter reset (Power needs to be reconnected after reset.) |
| 6 | Activation of the compulsory DO mode |
| 106 | After the compulsory DO mode is activated, it is possible to switch back to the normal DO mode. |

| PD-45 | RES | The value of the regenerative resistor | Communication address: 035AH 035BH |
|---|---|---|---|

| | Initial value | See the table below. |
|---|---|---|
| | Control mode | ALL |
| | Unit | Ohm |
| | Configuration range | 40 ~ 750 |
| | Data size | 16bit |
| | Data format | Dec |

Settings:

| Model | Initial value |
|---|---|
| 100 W ~ 1 kW | 40Ω |
| 1.5 kW ~ 2 kW | 20Ω |

| PD-46 | RESC | The capacity of the regenerative resistor | Communication address: 035CH 035DH |
|---|---|---|---|

| | Initial value | See the table below. |
|---|---|---|
| | Control mode | ALL |
| | Unit | Watt |
| | Configuration range | 30 ~ 3000 |
| | Data size | 16bit |
| | Data format | Dec |

| Model | Initial value |
|---|---|
| 750W | 40W |
| 1KW ~ 3KW | 40W |

| PD-47 | CRSR | The collision protection for the motor (torque percentage) | Communication address: 035EH 035FH |
|---|---|---|---|

| | Initial value | 0 |
|---|---|---|
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~300 |
| | Data size | 16 bit |
| | Data format | DEC |

Parameter function: Set the level of protection (for the percentage of rated torque, set 0 to off, set 1 or above to open the anti-collision function).

| PD-48 | CRST | The collision protection for the motor (protection time) | Communication address: 0360H 0361H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 1 |
| Control mode | ALL |
| Unit | ms |
| Configuration range | 0 ~1000 |
| Data size | 16 bit |
| Data format | DEC |

Parameter function: Set the protection time When the level setting is reached (PD-47), AL021 (motor collision error) will be displayed after the protected time.

| PD-49 | EXREG | The selection of the external braking unit | Communication address: 0362H 0363H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 0 |
| Control mode | ALL |
| Unit | N/A |
| Configuration range | 0 ~ 1 |
| Data size | 16bit |
| Data format | Dec |

Parameter function: An external braking unit can be used when the capacity of the built-in brake resistor is low. For the information about the connection, refer to Section 3.1.
Set PD-49 to 0 when an internal or external braking resistor is used.
Set PD-49 to 1 when an external braking unit is used.
Erroneous settings will generate AL004 (Regeneration Error).

| PD-50 | AUTS | The status of inertia adjustment in the semi-auto mode | Communication address: 0364H 0365H |
|---|---|---|---|

| | |
|---|---|
| Initial value | 0 |
| Control mode | ALL |
| Unit | N/A |
| Configuration range | 0 ~ 1 |
| Data size | 16bit |
| Data format | Dec |

Semi-auto setting:

1: The inertia estimation in the semi-auto mode is completed. Refer to PB-35 for the load inertia value.

0: When 0 is displayed, the inertia adjustment is still underway.

When 0 is set, the inertia adjustment is still underway.

| PD-52 | PLOSS | The detection of the input phase failure | Communication address: 0368H 0369H |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | 0 ~ 1 (0: Deactivation of the input phase failure detection) | |
| | Data size | 16bit | |
| | Data format | Dec | |

| PD-53 | OSPW | The condition for the overspeed warning | Communication address: 036AH 036BH |
|---|---|---|---|
| | Initial value | Based on model | |
| | Control mode | ALL | |
| | Unit | r/min | |
| | Configuration range | 1 ~ 6500 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

| PD-54 | PCF | The condition for giving warnings of the excessive error regarding the position control | Communication address: 036CH 036DH |
|---|---|---|---|
| | Initial value | 6400000 | |
| | Control mode | P / Msc | |
| | Unit | pulse | |
| | Configuration range | 1 ~ 80000000 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

| PD-55 | LVL | The level for the error of the low voltage | Communication address: 036EH 036FH |
|---|---|---|---|
| | Initial value | 160 | |
| | Control mode | ALL | |
| | Unit | Volt.(rms) | |
| | Configuration range | 140 ~ 190 | |
| | Data size | 16bit | |
| | Data format | Dec | |

This parameter set the low-voltage detection level. The low-voltage alarm is released when the mains supply is lower than this setting. (After the low-voltage error is eliminated, power must be reconnected to the drive to clear the alarm.)

| PD-56 (Re-on) | ENCType | Encoder type setting | Communication address: 0370H 0371H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 0 ~ 1 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

0: Incremental operation, the absolute motor can be used as an incremental motor.

1: Absolute operation, only for absolute motors, if using an incremental motor, it will jump out of AL037.

| PD-57 | INFOS | Message reading selection | Communication address: 0372H 0373H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 0 ~ 7 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Bit0: DI/DO read unit setting. 1: pulse wave; 0: PUU.

Bit1: Communication read unit setting. 1: pulse wave; 0: PUU.

Bit2: Overflow warning setting. 1: Overflow does not warn; 0: Overflow warning AL038 / AL035.

Bit3 ~ bit15: Reserved (0).

| PD-58 (N-keep) | ABSRST | Absolute position reset | Communication address: 0374H 0375H |
|---|---|---|---|
| | Initial value | 000h | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 000h ~ 111h | |
| | Data size | 16 bit | |
| | Data format | HEX | |

Setting 111 will reset the absolute position of the current encoder, which is the same as using DI (AENC_C) to clear the coordinates to zero.

| PD-59 (R-only) (N-keep) | AENCSTS | Absolute coordinate system status | Communication address: 0376H 0377H |
|---|---|---|---|
| | Initial value | 00h | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 00h ~ 1Fh | |
| | Data size | 16 bit | |
| | Data format | HEX | |

Bit0: 1 means absolute position loss; 0 means normal.

Bit 1:1 means the battery low voltage; 0 represents normal.

Bit2: 1 means the absolute lap overflow; 0 represents normal.

Bit3: 1 means the PUU overflow; 0 represents normal.

Bit4: 1 means that the absolute coordinates have not been established yet; 0 means normal.

Bit5 ~ bit15: Reserved (0).

| PD-60 (R-only) (N-keep) | APREV | Encoder absolute position - number of turns | Communication address: 0378H 0379H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | rev | |
| | Configuration range | -32768 ~ 32767 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

When PD-57 bit1 = 1, it is set to read the pulse value, this parameter represents the number of turns of the absolute position of the encoder.

When PD-57 bit1 = 0, this parameter is set to 0 when the PUU value is read.

| PD-61 (R-only) (N-keep) | APPLS | Encoder absolute position –Single turn pulse number or PUU | Communication address: 037AH 037BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | pulse / PUU | |
| | Configuration range | 0 ~ (1048576-1) (pulse number)<br>-2147483648 ~ 2147483647 (PUU) | |
| | Data size | 32 bit | |
| | Data format | DEC | |

When PD-57 bit1 = 1 is set to read the pulse value, this parameter represents the number of pulses in the absolute position of the encoder.

When PD-57 bit1 = 0, set to read the PUU value, this parameter is the absolute position PUU of the horse.

| PD-62 | ZPWID | Z phase width adjustment | Communication address: 037CH 037DH |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | ALL | |
| | Unit | 100 us | |
| | Configuration range | 1 ~ 50 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

After setting PD-62, the system determines the encoder Z-phase output width according to the PD-62 setting value, for example:

PD-62 = 1 ⇨ Z-phase output width = 125 us

PD-62 = 2 ⇨ Z-phase output width = 25 us

PD-62 = 5 ⇨ Z-phase output width = 625 us

PD-62 = 10 ⇨ Z-phase output width = 1250 us = 1.25 ms

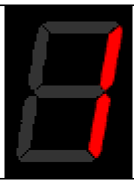
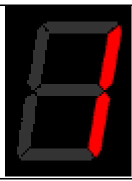
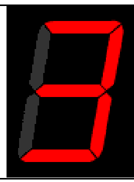
PD-62 = 50 ⇨ Z-phase output width = 6250 us = 6.25 ms

So on and so forth

## 6.3.5. PG-XX（Msc system parameter）

| PG-00 | HmCtrl | Setting for the return-to-origin | Communication address:<br>0600H<br>0601H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 0x113 | |
| | Data size | 16 bit | |
| | Data format | HEX | |

Setting for the return-to-origin :

| Bit | bit08 ~ bit11 | bit04 ~ bit07 | bit00 ~ bit03 |
|---|---|---|---|
| Max. Display word |  |  |  |
| Function | Triggering limit treatment in reset | Setting forOrg origin signal polarity | Setting for the return-to-origin |
| | System control is 0, no input,<br>This function is not available in the limit reference mode. | System control is 0, no input,<br>This function is not available in the limit reference mode. | 0x0: The system is moving forward,<br>The PL limit signal is a reset reference. |
| | | | 0x1: The system is moving backwards,<br>The NL limit signal is a reference for reversion. |
| | Automatic return after 0x0 limit trigger<br>0x1 limit trigger after jumping | 0x0 rising edge<br>0x1 falling edge | 0x2: The system is moving forward,<br>The Org origin signal is a reference for reversion. |
| | | | 0x3: The system is moving forward,<br>The Org origin signal is a reference for reversion. |
| | System control is 0, no input,<br>This feature is not available in the current mode.<br>Jumping after the limit trigger | System control is 0, no input,<br>This feature is not available in the current mode. | 0x4: The system uses the current position as the reset reference. |

For details of the return , please refer to 7.6.1.

| PG-01 | HmHSpd | Return-to-origin high speed | Communication address: 0602H 0603H |
|---|---|---|---|
| | Initial value | 7000 | |
| | Control mode | Msc | |
| | Unit | 0.1 r/min | |
| | Configuration range | 100 ~ 20000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the target speed of the high speed segment during the return-to-origin process.

For details of the return , please refer to 7.6.1.

| PG-02 | HmLSpd | Return-to-origin low speed | Communication address: 0604H 0605H |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | Msc | |
| | Unit | 0.1 r/min | |
| | Configuration range | 10 ~ 4000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the target speed of the low speed segment during the return-to-origin process.

For details of the return , please refer to 7.6.1.

。

| PG-03 | HmHAcc | Return-to-origin high speed acceleration time | Communication address: 0606H 0607H |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 1 ~ 10000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the acceleration time of the high-speed section during the return-to-origin process. The time algorithm is consistent with PB-03. The time required for 0 ➪ 3000 r/min is set, and the slope is used to accelerate the system to the target speed.

Note: This slope is also used for -3000 ➪ 0 r/min.

For details of the return , please refer to 7.6.1.

| PG-04 | HmHDec | Return-to-origin high-speed deceleration time | Communication address: 0608H 0609H |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 1 ~ 10000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the deceleration time of the high-speed section during the return-to-origin process. The time algorithm is the same as that of PB-04. The time required for 3000 ➪ 0 r/min is set, and the slope is pushed to the target speed by this slope.

Note: This slope is also used for 0 ➪ -3000 r/min.

For details of the return , please see 7.6.1.

| PG-05 | HmLAcc | Return-to-origin low-speed acceleration time | Communication address: 060AH 060BH |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 1 ~ 500 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the deceleration time of the low-speed section during the return-to-origin process. The time algorithm is the same as that of PB-04. The time required for 3000 ➪ 0 r/min is set, and the slope is pushed to the target speed by this slope.

Note: This slope is also used for 0 ➪ -3000 r/min.

For details of the return , please see 7.6.1.

| PG-06 | HmLDec | Return-to-origin low-speed deceleration time | Communication address: 060CH 060DH |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 1 ~ 500 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

During the return-to-origin process, the deceleration time of the low-speed section is the same as that of PB-04.

The time required for 3000 ➪ 0 r/min is set, and the slope is pushed to the target speed by this slope.

Note: This slope is also used for 0 ➪ -3000 r/min.

For details of the return , please refer to 7.6.1.

| PG-07 | ZpCount | Return-to-origin to find Z times | Communication address: 060EH 060FH |
|---|---|---|---|
| | Initial value | -1 | |
| | Control mode | Msc | |
| | Unit | times | |
| | Configuration range | -10000 ~ 10000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

When this parameter is not zero, the system will look for the set value of Z times and find the Z later in the return.

The setting value is positive: the watch system looks for the reference signal and then looks forward to Z, so the moving direction is not changed by looking for the Z job.

The setting value is negative: the watch system looks for the reference signal and then looks forward to Z, so the moving direction is not changed by looking for the Z job.

| PG-08 | HmDef | Return-to-origin to origin definition | Communication address: 0610H 0611H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU pulse | |
| | Configuration range | -2147483647 ~ 2147483647 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

After the return of the origin, the system establishes the starting point of the PUU coordinate with this parameter value, and provides the subsequent Msc command.

| PG-09 (R-only) | OrgEnc | Return-to-origin to complete the origin encoder reading | Communication address: 0612H 0613H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | Encoder pulse | |
| | Configuration range | 0 ~ 0x1AFFFFFF | |
| | Data size | 32 bit | |
| | Data format | HEX | |

This parameter is a read-only parameter for monitoring. After the return of the origin, the system writes the encoder reading value +0x1A000000 back to this parameter, so the user reads the highest bit of this parameter belongs to the beginning of 0x1A, and the table system completes the return-to-origin operation.

| PG-10 | PNLDec | Deceleration time of return-to-origin limit return | Communication address: 0614H 0615H |
|---|---|---|---|
| | Initial value | 10 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 1 ~ 50 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

In the process of setting the return-to-origin, if the system encounters the limit signal, whether it is running at high speed or low speed, it will decelerate according to this deceleration time to avoid damage caused by the mechanism collision caused by excessive deceleration. The time algorithm is consistent with PB-04, and the time required for 3000 ➪ 0 r/min is set, and the slope is used to push the system to decelerate to the target speed. Note: This slope is also used for 0 ➪ -3000 r/min.

| PG-11 | SWTrig | Msc software startup trigger | Communication address: 0616H 0617H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 100 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

This parameter belongs to the non-memory parameter, so the power-on is 0. After this parameter is set, the system will trigger the home position return operation or Msc command according to the set value.

| Setting value | Description |
|---|---|
| 0 | Force stop origin return operation or Msc command |
| 1 ~ 68 | Depending on the input value, execute the number 1 ~ 68 Msc command. |
| 100 | Perform the return-to-origin operation |

| PG-12 | AcDe00 | Msc acceleration and deceleration time data group 01 | Communication address: 0618H 0619H |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 1 ~ 65535 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Setting the Msc command to use the acceleration/deceleration time. This parameter is the Msc shared data group. See section 7.6.4 for details.

PG-13 ~ PG-27 are the same with PG-12，they are all Msc acceleration/deceleration time data sets, but the initial values are different from the communication addresses, and are summarized as follows:

| Parametemr | Abbr. | Function | Communication address | | Initial value |
|---|---|---|---|---|---|
| PG-13 | AcDe01 | Msc acceleration and deceleration time data group 02 | 061AH | 061BH | 2 |
| PG-14 | AcDe02 | Msc acceleration and deceleration time data group 03 | 061CH | 061DH | 4 |
| PG-15 | AcDe03 | Msc acceleration and deceleration time data group 04 | 061EH | 061FH | 6 |
| PG-16 | AcDe04 | Msc acceleration and deceleration time data group 05 | 0620H | 0621H | 8 |
| PG-17 | AcDe05 | Msc acceleration and deceleration time data group 06 | 0622H | 0623H | 10 |
| PG-18 | AcDe06 | Msc acceleration and deceleration time data group 07 | 0624H | 0625H | 20 |
| PG-19 | AcDe07 | Msc acceleration and deceleration time data group 08 | 0626H | 0627H | 40 |
| PG-20 | AcDe08 | Msc acceleration and deceleration time data group 09 | 0628H | 0629H | 60 |
| PG-21 | AcDe09 | Msc acceleration and deceleration time data group 10 | 062AH | 062BH | 80 |
| PG-22 | AcDe0A | Msc acceleration and deceleration time data group 11 | 062CH | 062DH | 100 |
| PG-23 | AcDe0B | Msc acceleration and deceleration time data group 12 | 062EH | 062FH | 200 |
| PG-24 | AcDe0C | Msc acceleration and deceleration time data group 13 | 0630H | 0631H | 400 |
| PG-25 | AcDe0D | Msc acceleration and deceleration time data group 14 | 0632H | 0633H | 600 |
| PG-26 | AcDe0E | Msc acceleration and deceleration time data group 15 | 0634H | 0635H | 800 |
| PG-27 | AcDe0F | Msc acceleration and deceleration time data group 16 | 0636H | 0637H | 1000 |

| PG-28 | Dely00 | Msc delay time data group 01 | Communication address: 0638H 0639H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | 1 ms | |
| | Configuration range | 0 ~ 32767 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Setting the delay time for the Msc command. This parameter is the Msc shared data group. See Section 7.6.4 for details.

PG-29 ~ PG-43 are the same with PG-28, they are all Msc delay time data groups, but the initial values are different from the communication addresses, and are summarized as follows:

| Parametemr | Abbr. | Function | Communication address | | Initial value |
|---|---|---|---|---|---|
| PG-29 | Dely01 | Msc delay time data group 02 | 063AH | 063BH | 5 |
| PG-30 | Dely02 | Msc delay time data group 03 | 063CH | 063DH | 10 |
| PG-31 | Dely03 | Msc delay time data group 04 | 063EH | 063FH | 20 |
| PG-32 | Dely04 | Msc delay time data group 05 | 0640H | 0641H | 30 |
| PG-33 | Dely05 | Msc delay time data group 06 | 0642H | 0643H | 50 |
| PG-34 | Dely06 | Msc delay time data group 07 | 0644H | 0645H | 70 |
| PG-35 | Dely07 | Msc delay time data group 08 | 0646H | 0647H | 100 |
| PG-36 | Dely08 | Msc delay time data group 09 | 0648H | 0649H | 200 |
| PG-37 | Dely09 | Msc delay time data group 10 | 064AH | 064BH | 300 |
| PG-38 | Dely0A | Msc delay time data group 11 | 064CH | 064DH | 500 |
| PG-39 | Dely0B | Msc delay time data group 12 | 064EH | 064FH | 700 |
| PG-40 | Dely0C | Msc delay time data group 13 | 0650H | 0651H | 1000 |
| PG-41 | Dely0D | Msc delay time data group 14 | 0652H | 0653H | 2000 |
| PG-42 | Dely0E | Msc delay time data group 15 | 0654H | 0655H | 3000 |
| PG-43 | Dely0F | Msc delay time data group 16 | 0656H | 0657H | 5000 |

<table>
<tr><td>PG-44</td><td>Sped00</td><td>Msc target speed data group 01</td><td>Communication address:<br>0658H<br>0659H</td></tr>
<tr><td rowspan="6"></td><td>Initial value</td><td>1</td><td rowspan="6"></td></tr>
<tr><td>Control mode</td><td>Msc</td></tr>
<tr><td>Unit</td><td>0.1 r/min</td></tr>
<tr><td>Configuration range</td><td>1 ~ max. Speed</td></tr>
<tr><td>Data size</td><td>16 bit</td></tr>
<tr><td>Data format</td><td>DEC</td></tr>
</table>

Setting the target speed of the Msc command. The maximum value is the maximum motor speed *10. Take 400W as an example. The maximum value is 60000. This parameter is the Msc shared data group. See section 7.6.4 for details.

PG-45 ~ PG-59 are the same with PG-44，they are all Msc target speed data groups, but the initial values are different from the communication addresses, and are summarized as follows:

| Parametemr | Abbr. | Function | Communication address | | Initial value |
|---|---|---|---|---|---|
| PG-45 | Sped01 | Msc target speed data group 02 | 065AH | 065BH | 10 |
| PG-46 | Sped02 | Msc target speed data group 03 | 065CH | 065DH | 30 |
| PG-47 | Sped03 | Msc target speed data group 04 | 065EH | 065FH | 50 |
| PG-48 | Sped04 | Msc target speed data group 05 | 0660H | 0661H | 70 |
| PG-49 | Sped05 | Msc target speed data group 06 | 0662H | 0663H | 100 |
| PG-50 | Sped06 | Msc target speed data group 07 | 0664H | 0665H | 300 |
| PG-51 | Sped07 | Msc target speed data group 08 | 0666H | 0667H | 500 |
| PG-52 | Sped08 | Msc target speed data group 09 | 0668H | 0669H | 700 |
| PG-53 | Sped09 | Msc target speed data group 10 | 066AH | 066BH | 1000 |
| PG-54 | Sped0A | Msc target speed data group 11 | 066CH | 066DH | 3000 |
| PG-55 | Sped0B | Msc target speed data group 12 | 066EH | 066FH | 5000 |
| PG-56 | Sped0C | Msc target speed data group 13 | 0670H | 0671H | 7000 |
| PG-57 | Sped0D | Msc target speed data group 14 | 0672H | 0673H | 10000 |
| PG-58 | Sped0E | Msc target speed data group 15 | 0674H | 0675H | 20000 |
| PG-59 | Sped0F | Msc target speed data group 16 | 0676H | 0677H | 30000 |

| PG-60 | ExIsr | Msc program interrupt settings | Communication address: 0678H 0679H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 0x02 | |
| | Data size | 16 bit | |
| | Data format | HEX | |

During the execution of the Msc instruction, the system processes the instruction interrupting operation of the Msc trigger source according to the PG-60 setting value. When the setting is:

0x00: During the execution of the Msc instruction, the system does not provide an instruction interrupt operation.

0x01: During the execution of the Msc instruction, the system will interleave the instruction according to the trigger source after the current instruction is completed.

0x02: During the execution of the Msc instruction, the system immediately interpolates the operation with trigger source.

See section 7.6.6 for details.

| PG-61 | DiNo01 | Msc command selector - DI number 01 | Communication address: 067AH 067BH |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 68 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

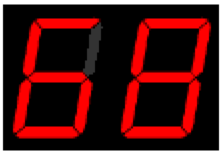
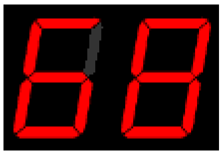
When the DI MscNo1 ~ 4 state and = 1, the Msc command is selected with this parameter setting value. See section 7.6.5 for details.

PG-62 ~ PG-75 are the same with PG-61，All are Msc command selectors, but the communication addresses are different, summarized as follows：

| Parametemr | Abbr. | Initial value | Function | Communication address | |
|---|---|---|---|---|---|
| PG-62 | DiNo02 | 2 | Msc command selector - DI number 02 | 067CH | 067DH |
| PG-63 | DiNo03 | 3 | Msc command selector - DI number 03 | 067EH | 067FH |
| PG-64 | DiNo04 | 4 | Msc command selector - DI number 04 | 0680H | 0681H |
| PG-65 | DiNo05 | 5 | Msc command selector - DI number 05 | 0682H | 0683H |
| PG-66 | DiNo06 | 6 | Msc command selector - DI number 06 | 0684H | 0685H |
| PG-67 | DiNo07 | 7 | Msc command selector - DI number 07 | 0686H | 0687H |
| PG-68 | DiNo08 | 8 | Msc command selector - DI number 08 | 0688H | 0689H |
| PG-69 | DiNo09 | 9 | Msc command selector - DI number 09 | 068AH | 068BH |
| PG-70 | DiNo0A | 10 | Msc command selector - DI number 10 | 068CH | 068DH |
| PG-71 | DiNo0B | 11 | Msc command selector - DI number 11 | 068EH | 068FH |
| PG-72 | DiNo0C | 12 | Msc command selector - DI number 12 | 0690H | 0691H |
| PG-73 | DiNo0D | 13 | Msc command selector - DI number 13 | 0692H | 0693H |
| PG-74 | DiNo0E | 14 | Msc command selector - DI number 14 | 0694H | 0695H |
| PG-75 | DiNo0F | 15 | Msc command selector - DI number 15 | 0696H | 0697H |

| PG-76 | DiEv01 | Msc command trigger - Di-Ev1 | Communication address: 0698H 0699H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 68.68 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

When DI MscEv1 is triggered, the system executes the Msc command according to the trigger type as the rising edge or falling source and the PG-76 set value.

| | Ten digits and Digits | One and two decimal place |
|---|---|---|
| Max. Display word |  |  |
| Function | DI MscEv1 upper edge trigger, The system executes the Msc command according to this field | DI MscEv1 lower edge trigger, The system executes the Msc command according to this field |

See section 7.6.5 for details.

PG-77 ~ PG-79 are the same with PG-61，

All are Msc command selectors, but the communication addresses are different, summarized as follows:

| Parametemr | Abbr. | Function | Communication address | |
|---|---|---|---|---|
| PG-77 | DiEv02 | Msc command trigger - Di-Ev2 | 069AH | 069BH |
| PG-78 | DiEv03 | Msc command trigger - Di-Ev3 | 069CH | 069DH |
| PG-79 | DiEv04 | Msc command trigger - Di-Ev4 | 069EH | 069FH |

| PG-80 | InxStrok | Msc indexing total stroke | Communication address: 06A0H 06A1H |
|---|---|---|---|
| | Initial value | 1,000,000,000 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 10 ~ 1,000,000,000 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

The Msc indexing command will determine the total stroke of the indexing coordinate according to the set value of PG-80, and the command value of the Msc indexing command shall not exceed PG-80. For details, see section 7.6.5.

| PG-81 | FrqRat | Msc mode pulse wave frequency analogy rate denominator | Communication address: 06A2H 06A3H |
|---|---|---|---|
| | Initial value | 80,000,000 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 80,000 ~ 2147483647 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Since the Msc command is a position pulse command generated by the internal calculation of the system, there is no pulse input hardware limit (4 Mbps). In order for the analog monitor output to output the effective position pulse frequency voltage in the Msc mode, the user must cooperate with the Msc command. Enter PG-81 for magnification adjustment to observe the full position pulse frequency waveform.

| PG-82 (R-only) | 1stAbsLat | Position coordinate monitoring parameters when Msc starts | Communication address: 06A4H 06A5H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU pulse | |
| | Configuration range | - | |
| | Data size | 32 bit | |
| | Data format | DEC | |

This parameter is a read-only parameter for monitoring. In Msc mode, when servo off -> On, the system records the absolute position of the Msc coordinate (PUU) at the time of switching to PG-82 for verification of the displacement. 。

| PG-83 (R-only) | AbsCrd | Msc position coordinate monitoring parameters | Communication address: 06A6H 06A7H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU pulse | |
| | Configuration range | - | |
| | Data size | 32 bit | |
| | Data format | DEC | |

This parameter is a read-only parameter for monitoring. In Msc mode, the system records the current Msc coordinate absolute position (PUU) in PG-83 for verification of the current Msc coordinate position.

| PG-84 (R-only) | 1stInxLat | Indexing coordinate monitoring parameters when Msc starts | Communication address: 06A8H 06A9H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU pulse | |
| | Configuration range | - | |
| | Data size | 32 bit | |
| | Data format | DEC | |

This parameter is a read-only parameter for monitoring. In Msc mode, when servo off -> On, the system records the Msc index coordinate absolute position (PUU) at the time of switching to PG-84 for verification of the displacement amount.

| PG-85 (R-only) | InxCrdPuu | Msc current indexing coordinate monitoring parameters | Communication address: 06AAH 06ABH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU pulse | |
| | Configuration range | - | |
| | Data size | 32 bit | |
| | Data format | DEC | |

This parameter is a read-only parameter for monitoring. In Msc mode, the system records the current Msc indexing absolute position (PUU) on the PG-85 for verification of the current Msc indexing coordinate position.

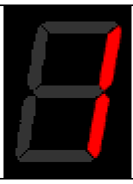
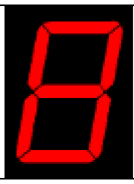
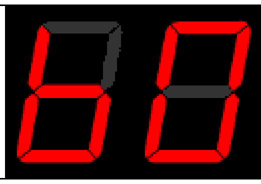
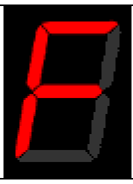
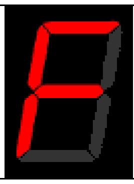
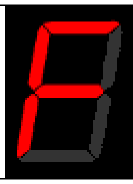
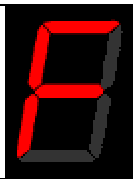
| PG-86 (R-only) | AbsOrgDone | Multi-turn absolute motor origin return state | Communication address: 06ACH 06ADH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | - | |
| | Data size | 16 bit | |
| | Data format | HEX | |

This parameter is a read-only parameter for monitoring. In the Msc mode, it is used to record whether the multi-turn absolute motor completes the return-to-origin operation.

# 6.3.6. PH-XX（Msc command parameter）

| PH-00 | MscSet01 | Msc command 01 set value | Communication address:<br>0700H<br>0701H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0x0 ~ 0x18B0FFFF | |
| | Data size | 32 bit | |
| | Data format | HEX | |

The setting parameters of the mode, function, acceleration/deceleration and delay time of the first group of Msc commands are as follows.

| Bit | bit31 ~ bit28 | bit27 ~ bit24 | bit23 ~ bit16 | |
|---|---|---|---|---|
| Max. Display word |  |  |  | |
| Function | 0x0 can't overlap (delay valid)<br>0x1 can overlap (deferred invalid) | 0x0 no command<br>0x1 fixed speed PPS<br>0x2 fixed speed RPM<br>0x3 absolute positioning<br>0x4 relative positioning<br>0x5 incremental positioning<br>0x6 forward indexing<br>0x7 reverse indexing<br>0x8 shortcut indexing | After you finish jumping to:<br>0x00 stop<br>0xA0 sequential<br>0xB0 step<br>0x01~44 command (No.1~68 command) | |
| 位元 | bit15 ~ bit12 | bit11 ~ bit08 | bit07 ~ bit04 | bit03 ~ bit00 |
| Max. Display word |  |  |  |  |
| Function | Target speed 0x0 ~ 0xF<br>(Set the Msc target speed data group number, and the other commands and fixed speed commands have no function) | Deceleration time 0x0 ~ 0xF<br>(Set the Msc acceleration/deceleration time data group number, and no command command has no function) | Acceleration time 0x0 ~ 0xF<br>(Set the Msc acceleration/deceleration time data group number, and no command command has no function) | Delay time 0x0 ~ 0xF<br>(Set the Msc delay time data group number, and no command command has no function) |

For details of the content , please refer to 7.6.3

| PH-01 | MscDat01 | Msc command 01 data value | Communication address: 0702H 0703H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | See the table below for details | |
| | Data size | 32 bit | |
| | Data format | DEC | |

The command data values of the first group of Msc command are described below.

1. PH-00 is set to constant speed (PPS, RPM) and PH-01 is the speed command value.
2. PH-00 is set to positioning (absolute, relative, incremental), PH-01 is the position command value.
3. PH-00 is set to index (forward, reverse, shortcut), PH-01 is the position value of the index (≤ PG80).
4. PH-00 is set to no command, PH-01 has no effect, but still performs the jump operation according to PH-00 setting.

The setting range of each type of command is as follows:

| Command type | Setting range |
|---|---|
| PH-00 is set to fixed speed PPS | ±2147483647 |
| PH-00 is set to fixed speed RPM | ±60000<br>（≦750W Motor maximum speed, other wattages see motor specifications） |
| PH-00 is set to position (absolute, relative, incremental) | ±2147483647 |
| PH-00 is set to index (forward, reverse, shortcut) | ≤ PG80 |

For details of the content , please refer to 7.6.3。

PH-02 ~ PH-99 are the same with PH-00 and PH-01. They are all Msc command settings and command data values, but the communication addresses are different. The summary is as follows:

| Parameter | Abbr. | Function | Setting | Communication address | |
|---|---|---|---|---|---|
| PH-02 | MscSet02 | Msc command 02 set value | Same as PH-00 | 0704H | 0705H |
| PH-03 | MscDat02 | Msc command 02 data value | Same as PH-01 | 0706H | 0707H |
| PH-04 | MscSet03 | Msc command 03 set value | Same as PH-00 | 0708H | 0709H |
| PH-05 | MscDat03 | Msc command 03 data value | Same as PH-01 | 070AH | 070BH |
| PH-06 | MscSet04 | Msc command 04 set value | Same as PH-00 | 070CH | 070DH |
| PH-07 | MscDat04 | Msc command 04 data value | Same as PH-01 | 070EH | 070FH |
| PH-08 | MscSet05 | Msc command 05 set value | Same as PH-00 | 0710H | 0711H |
| PH-09 | MscDat05 | Msc command 05 data value | Same as PH-01 | 0712H | 0713H |
| PH-10 | MscSet06 | Msc command 06 set value | Same as PH-00 | 0714H | 0715H |
| PH-11 | MscDat06 | Msc command 06 data value | Same as PH-01 | 0716H | 0717H |
| PH-12 | MscSet07 | Msc command 07 set value | Same as PH-00 | 0718H | 0719H |
| PH-13 | MscDat07 | Msc command 07 data value | Same as PH-01 | 071AH | 071BH |

| Parameter | Abbr. | Function | Setting | Communication address | |
|---|---|---|---|---|---|
| PH-14 | MscSet08 | Msc command 08 set value | Same as PH-00 | 071CH | 071DH |
| PH-15 | MscDat08 | Msc command 08 data value | Same as PH-01 | 071EH | 071FH |
| PH-16 | MscSet09 | Msc command 09 set value | Same as PH-00 | 0720H | 0721H |
| PH-17 | MscDat09 | Msc command 09 data value | Same as PH-01 | 0722H | 0723H |
| PH-18 | MscSet10 | Msc command 10 set value | Same as PH-00 | 0724H | 0725H |
| PH-19 | MscDat10 | Msc command 10 data value | Same as PH-01 | 0726H | 0727H |
| PH-20 | MscSet11 | Msc command 11 set value | Same as PH-00 | 0728H | 0729H |
| PH-21 | MscDat11 | Msc command 11 data value | Same as PH-01 | 072AH | 072BH |
| PH-22 | MscSet12 | Msc command 12 set value | Same as PH-00 | 072CH | 072DH |
| PH-23 | MscDat12 | Msc command 12 data value | Same as PH-01 | 072EH | 072FH |
| PH-24 | MscSet13 | Msc command 13 set value | Same as PH-00 | 0730H | 0731H |
| PH-25 | MscDat13 | Msc command 13 data value | Same as PH-01 | 0732H | 0733H |
| PH-26 | MscSet14 | Msc command 14 set value | Same as PH-00 | 0734H | 0735H |
| PH-27 | MscDat14 | Msc command 14 data value | Same as PH-01 | 0736H | 0737H |
| PH-28 | MscSet15 | Msc command 15 set value | Same as PH-00 | 0738H | 0739H |
| PH-29 | MscDat15 | Msc command 15 data value | Same as PH-01 | 073AH | 073BH |
| PH-30 | MscSet16 | Msc command 16 set value | Same as PH-00 | 073CH | 073DH |
| PH-31 | MscDat16 | Msc command 16 data value | Same as PH-01 | 073EH | 073FH |
| PH-32 | MscSet17 | Msc command 17 set value | Same as PH-00 | 0740H | 0741H |
| PH-33 | MscDat17 | Msc command 17 data value | Same as PH-01 | 0742H | 0743H |
| PH-34 | MscSet18 | Msc command 18 set value | Same as PH-00 | 0744H | 0745H |
| PH-35 | MscDat18 | Msc command 18 data value | Same as PH-01 | 0746H | 0747H |
| PH-36 | MscSet19 | Msc command 19 set value | Same as PH-00 | 0748H | 0749H |
| PH-37 | MscDat19 | Msc command 19 data value | Same as PH-01 | 074AH | 074BH |
| PH-38 | MscSet20 | Msc command 20 set value | Same as PH-00 | 074CH | 074DH |
| PH-39 | MscDat20 | Msc command 20 data value | Same as PH-01 | 074EH | 074FH |
| PH-40 | MscSet21 | Msc command 21 set value | Same as PH-00 | 0750H | 0751H |
| PH-41 | MscDat21 | Msc command 21 data value | Same as PH-01 | 0752H | 0753H |
| PH-42 | MscSet22 | Msc command 22 set value | Same as PH-00 | 0754H | 0755H |
| PH-43 | MscDat22 | Msc command 22 data value | Same as PH-01 | 0756H | 0757H |
| PH-44 | MscSet23 | Msc command 23 set value | Same as PH-00 | 0758H | 0759H |
| PH-45 | MscDat23 | Msc command 23 data value | Same as PH-01 | 075AH | 075BH |
| PH-46 | MscSet24 | Msc command 24 set value | Same as PH-00 | 075CH | 075DH |
| PH-47 | MscDat24 | Msc command 24 data value | Same as PH-01 | 075EH | 075FH |
| PH-48 | MscSet25 | Msc command 25 set value | Same as PH-00 | 0760H | 0761H |
| PH-49 | MscDat25 | Msc command 25 data value | Same as PH-01 | 0762H | 0763H |
| PH-50 | MscSet26 | Msc command 26 set value | Same as PH-00 | 0764H | 0765H |
| PH-51 | MscDat26 | Msc command 26 data value | Same as PH-01 | 0766H | 0767H |

| Parameter | Abbr. | Function | Setting | Communication address | |
|---|---|---|---|---|---|
| PH-52 | MscSet27 | Msc command 27 set value | Same as PH-00 | 0768H | 0769H |
| PH-53 | MscDat27 | Msc command 27 data value | Same as PH-01 | 076AH | 076BH |
| PH-54 | MscSet28 | Msc command 28 set value | Same as PH-00 | 076CH | 076DH |
| PH-55 | MscDat28 | Msc command 28 data value | Same as PH-01 | 076EH | 076FH |
| PH-56 | MscSet29 | Msc command 29 set value | Same as PH-00 | 0770H | 0771H |
| PH-57 | MscDat29 | Msc command 29 data value | Same as PH-01 | 0772H | 0773H |
| PH-58 | MscSet30 | Msc command 30 set value | Same as PH-00 | 0774H | 0775H |
| PH-59 | MscDat30 | Msc command 30 data value | Same as PH-01 | 0776H | 0777H |
| PH-60 | MscSet31 | Msc command 31 set value | Same as PH-00 | 0778H | 0779H |
| PH-61 | MscDat31 | Msc command 31 data value | Same as PH-01 | 077AH | 077BH |
| PH-62 | MscSet32 | Msc command 32 set value | Same as PH-00 | 077CH | 077DH |
| PH-63 | MscDat32 | Msc command 32 data value | Same as PH-01 | 077EH | 077FH |
| PH-64 | MscSet33 | Msc command 33 set value | Same as PH-00 | 0780H | 0781H |
| PH-65 | MscDat33 | Msc command 33 data value | Same as PH-01 | 0782H | 0783H |
| PH-66 | MscSet34 | Msc command 34 setting value | Same as PH-00 | 0784H | 0785H |
| PH-67 | MscDat34 | Msc command 34 data value | Same as PH-01 | 0786H | 0787H |
| PH-68 | MscSet35 | Msc command 35 set value | Same as PH-00 | 0788H | 0789H |
| PH-69 | MscDat35 | Msc command 35 data value | Same as PH-01 | 078AH | 078BH |
| PH-70 | MscSet36 | Msc command 36 setting value | Same as PH-00 | 078CH | 078DH |
| PH-71 | MscDat36 | Msc command 36 data value | Same as PH-01 | 078EH | 078FH |
| PH-72 | MscSet37 | Msc command 37 set value | Same as PH-00 | 0790H | 0791H |
| PH-73 | MscDat37 | Msc command 37 data value | Same as PH-01 | 0792H | 0793H |
| PH-74 | MscSet38 | Msc command 38 set value | Same as PH-00 | 0794H | 0795H |
| PH-75 | MscDat38 | Msc command 38 data value | Same as PH-01 | 0796H | 0797H |
| PH-76 | MscSet39 | Msc command 39 setting value | Same as PH-00 | 0798H | 0799H |
| PH-77 | MscDat39 | Msc command 39 data value | Same as PH-01 | 079AH | 079BH |
| PH-78 | MscSet40 | Msc command 40 set value | Same as PH-00 | 079CH | 079DH |
| PH-79 | MscDat40 | Msc command 40 data value | Same as PH-01 | 079EH | 079FH |
| PH-80 | MscSet41 | Msc command 41 set value | Same as PH-00 | 07A0H | 07A1H |
| PH-81 | MscDat41 | Msc command 41 data value | Same as PH-01 | 07A2H | 07A3H |
| PH-82 | MscSet42 | Msc command 42 set value | Same as PH-00 | 07A4H | 07A5H |
| PH-83 | MscDat42 | Msc command 42 data value | Same as PH-01 | 07A6H | 07A7H |
| PH-84 | MscSet43 | Msc command 43 setting value | Same as PH-00 | 07A8H | 07A9H |
| PH-85 | MscDat43 | Msc command 43 data value | Same as PH-01 | 07AAH | 07ABH |
| PH-86 | MscSet44 | Msc command 44 set value | Same as PH-00 | 07ACH | 07ADH |
| PH-87 | MscDat44 | Msc command 44 data value | Same as PH-01 | 07AEH | 07AFH |
| PH-88 | MscSet45 | Msc command 45 set value | Same as PH-00 | 07B0H | 07B1H |
| PH-89 | MscDat45 | Msc command 45 data value | Same as PH-01 | 07B2H | 07B3H |

| Parameter | Abbr. | Function | Setting | Communication address | |
|---|---|---|---|---|---|
| PH-90 | MscSet46 | Msc command 46 set value | Same as PH-00 | 07B4H | 07B5H |
| PH-91 | MscDat46 | Msc command 46 data value | Same as PH-01 | 07B6H | 07B7H |
| PH-92 | MscSet47 | Msc command 47 set value | Same as PH-00 | 07B8H | 07B9H |
| PH-93 | MscDat47 | Msc command 47 data value | Same as PH-01 | 07BAH | 07BBH |
| PH-94 | MscSet48 | Msc command 48 set value | Same as PH-00 | 07BCH | 07BDH |
| PH-95 | MscDat48 | Msc command 48 data value | Same as PH-01 | 07BEH | 07BFH |
| PH-96 | MscSet49 | Msc command 49 set value | Same as PH-00 | 07C0H | 07C1H |
| PH-97 | MscDat49 | Msc command 49 data value | Same as PH-01 | 07C2H | 07C3H |
| PH-98 | MscSet50 | Msc command 50 set value | Same as PH-00 | 07C4H | 07C5H |
| PH-99 | MscDat50 | Msc command 50 data value | Same as PH-01 | 07C6H | 07C7H |

## 6.3.7. PJ-XX ( Msc command parameter )

| PJ-00 | MscSet51 | Msc command 51 setting value | Communication address: 0800H 0801H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0x0 ~ 0x18B0FFFF | |
| | Data size | 32 bit | |
| | Data format | HEX | |

The 51st group Msc command mode, function, acceleration and deceleration and delay time and other setting parameters, the specific settings are the same as PH-00, please refer to PH-00 description. See section 7.6.3 for details of the specific

| PJ-01 | MscDat51 | Msc command 51 data value | Communication address: 0802H 0803H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | See PH-01 for details. | |
| | Data size | 32 bit | |
| | Data format | DEC | |

The 51st group command data value of the Msc command is the same as PH-01. Please refer to the PH-01 description. See section 7.6.3 for details of the specific

PJ-02 ~ PJ-35 are the same with PJ-00 及 PJ-01. All are Msc command settings and command data values, but the communication addresses are different, summarized as follows:

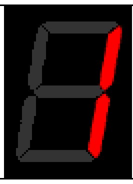
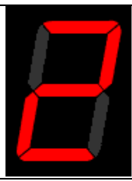
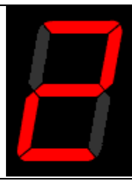
| Parameter | Abbr. | Function | Setting | Communication address | |
|---|---|---|---|---|---|
| PJ-02 | MscSet52 | Msc command 52 set value | Same as PJ-00 | 0804H | 0805H |
| PJ-03 | MscDat52 | Msc command 52 data value | Same as PJ-01 | 0806H | 0807H |
| PJ-04 | MscSet53 | Msc command 53 setting value | Same as PJ-00 | 0808H | 0809H |
| PJ-05 | MscDat53 | Msc command 53 data value | Same as PJ-01 | 080AH | 080BH |
| PJ-06 | MscSet54 | Msc command 54 setting value | Same as PJ-00 | 080CH | 080DH |
| PJ-07 | MscDat54 | Msc command 54 data value | Same as PJ-01 | 080EH | 080FH |
| PJ-08 | MscSet55 | Msc command 55 set value | Same as PJ-00 | 0810H | 0811H |
| PJ-09 | MscDat55 | Msc command 55 data value | Same as PJ-01 | 0812H | 0813H |
| PJ-10 | MscSet56 | Msc command 56 set value | Same as PJ-00 | 0814H | 0815H |
| PJ-11 | MscDat56 | Msc command 56 data value | Same as PJ-01 | 0816H | 0817H |
| PJ-12 | MscSet57 | Msc command 57 setting | Same as PJ-00 | 0818H | 0819H |
| PJ-13 | MscDat57 | Msc command 57 data value | Same as PJ-01 | 081AH | 081BH |

| Parameter | Abbr. | Function | Setting | Communication address | |
|---|---|---|---|---|---|
| PJ-14 | MscSet58 | Msc command 58 set value | Same as PJ-00 | 081CH | 081DH |
| PJ-15 | MscDat58 | Msc command 58 data value | Same as PJ-01 | 081EH | 081FH |
| PJ-16 | MscSet59 | Msc command 59 setting value | Same as PJ-00 | 0820H | 0821H |
| PJ-17 | MscDat59 | Msc command 59 data value | Same as PJ-01 | 0822H | 0823H |
| PJ-18 | MscSet60 | Msc command 60 set value | Same as PJ-00 | 0824H | 0825H |
| PJ-19 | MscDat60 | Msc command 60 data value | Same as PJ-01 | 0826H | 0827H |
| PJ-20 | MscSet61 | Msc command 61 set value | Same as PJ-00 | 0828H | 0829H |
| PJ-21 | MscDat61 | Msc command 61 data value | Same as PJ-01 | 082AH | 082BH |
| PJ-22 | MscSet62 | Msc command 62 set value | Same as PJ-00 | 082CH | 082DH |
| PJ-23 | MscDat62 | Msc command 62 data value | Same as PJ-01 | 082EH | 082FH |
| PJ-24 | MscSet63 | Msc command 63 set value | Same as PJ-00 | 0830H | 0831H |
| PJ-25 | MscDat63 | Msc command 63 data value | Same as PJ-01 | 0832H | 0833H |
| PJ-26 | MscSet64 | Msc command 64 set value | Same as PJ-00 | 0834H | 0835H |
| PJ-27 | MscDat64 | Msc command 64 data value | Same as PJ-01 | 0836H | 0837H |
| PJ-28 | MscSet65 | Msc command 65 set value | Same as PJ-00 | 0838H | 0839H |
| PJ-29 | MscDat65 | Msc command 65 data value | Same as PJ-01 | 083AH | 083BH |
| PJ-30 | MscSet66 | Msc command 66 set value | Same as PJ-00 | 083CH | 083DH |
| PJ-31 | MscDat66 | Msc command 66 data value | Same as PJ-01 | 083EH | 083FH |
| PJ-32 | MscSet67 | Msc command 67 set value | Same as PJ-00 | 0840H | 0841H |
| PJ-33 | MscDat67 | Msc command 67 data value | Same as PJ-01 | 0842H | 0843H |
| PJ-34 | MscSet68 | Msc command 68 set value | Same as PJ-00 | 0844H | 0845H |
| PJ-35 | MscDat68 | Msc command 68 data value | Same as PJ-01 | 0846H | 0847H |

## 6.3.8. PL-XX ( Msc Electronic cam parameter )

| PL-00 | CamCtrl | Electronic cam main function setting | Communication address:<br>0900H<br>0901H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0x0 ~ 0x0122 | |
| | Data size | 16 bit | |
| | Data format | HEX | |

Electronic cam main function setting

| Bit | bit08 ~ bit11 | bit04 ~ bit07 | bit00 ~ bit03 |
|---|---|---|---|
| Max. Display Bit |  |  |  |
| Function | Whether to disable the electronic cam after the master axis is single turn (>=1 turns) | Active axis source | E-cam enable setting |
| | 0x00:<br>The master axis input is continued after the master axis is completed in a single cycle.<br>0x01:<br>The electronic cam is deactivated after the master axis is completed in a single cycle. | 0x00:<br>The external pulse wave is set according to PA-01.<br>0x01:<br>Virtual master axis - speed command.<br>0x02:<br>Virtual master axis - position command。 | 0x00:<br>The electronic cam is deactivated.<br>0x01:<br>DI Cam En enables electronic cams for On.<br>0x02:<br>Enable the electronic cam immediately. |

| PL-01 | CamSpd | Virtual master axis command − speed command | Communication address:<br>0902H<br>0903H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | 0.1 r/min | |
| | Configuration range | -60000 ~ 60000 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Set the virtual master axis speed command value, which is 0.1 r/min.

If the PL-00 master axis source is a virtual master axis-speed command, the system will determine the direction of the master axis rotation with the PL-01 polarity.

Please refer to 7.6.9 for specific description.

| PL-02 | CamPos | Virtual master axis command – position command | Communication address: 0904H 0905H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU | |
| | Configuration range | -2147483647 ~ 2147483647 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Set the virtual master axis position command value and take the PUU unit (Pulse of User Unit).

If the source of the PL-00 master axis is the virtual master axis-position command, the system will determine the direction of rotation of the master axis with the polarity of PL-02.

Please refer to 7.6.9 for specific description

| PL-03 | CamAcc | Virtual master axis command acceleration time | Communication address: 0906H 0907H |
|---|---|---|---|
| | Initial value | 50 | |
| | Control mode | Msc | |
| | Unit | ms | |
| | Configuration range | 1 ~ 65535 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the virtual master axis speed command acceleration time. The acceleration time calculation is different from the other module's fixed slope mode. The calculation of 0→PL-01 requires PL-03 ms.

Please refer to 7.6.9 for specific description

| PL-04 | CamDec | Virtual master axis command deceleration time | Communication address: 0908H 0909H |
|---|---|---|---|
| | Initial value | 50 | |
| | Control mode | Msc | |
| | Unit | ms | |
| | Configuration range | 1 ~ 65535 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Set the virtual master axis speed command deceleration time. The deceleration time calculation is different from the other module's fixed slope mode. PL-01→0 needs PL-04 ms calculation.

Please refer to 7.6.9 for specific description

| PL-05 | CamBlk | Main axis command mask amount | Communication address: 090AH 090BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU | |
| | Configuration range | 0 ~ 500000000 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Set the active axis pulse wave command mask amount. When the active axis pulse wave>mask amount, the active axis pulse wave is input into the electronic cam module to generate the driven shaft displacement stroke.

Please refer to 7.6.9 for specific description

| PL-06 | CamRes | Active shaft single turn resolution | Communication address: 090CH 090DH |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | Msc | |
| | Unit | PUU | |
| | Configuration range | 10 ~ 2147483647 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Set the active axis pulse wave map to map the active axis angle of the slave axis cam curve.

In addition, if the AB type pulse input, because the system uses 4 times frequency to calculate the input pulse wave, the single-turn resolution needs to be 4 times the original resolution of the active axis.

Pulse wave number→0 ~ 360 degrees: number of active axis pulse wave × PL-07÷PL-06×360

Please refer to 7.6.9 for specific description

| PL-07 | CamCyl | Number of rotations of the driven shaft | Communication address: 090EH 090FH |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | Msc | |
| | Unit | rev | |
| | Configuration range | 1 ~ 99999 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

When the drive axis reaches the single-turn resolution, set the number of rotations of the slave axis.

Pulse wave number→0 ~ 360 degrees: number of active axis pulse wave × PL-07÷PL-06×360

Please refer to 7.6.9 for specific description

| PL-08 | CamPhs | Spindle phase angle adjustment | Communication address: 0910H 0911H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | 0.1 度 | |
| | Configuration range | 0 ~ 3600 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

The spindle phase angle is adjusted from 0 to 360.0 degrees.

Please refer to 7.6.9 for specific description

| PL-09 | CamOfs | Cam curve table offset | Communication address: 0912H 0913H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | PUU | |
| | Configuration range | -2147483647 ~ 2147483647 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Set the offset of the driven axis travel output.

Please refer to 7.6.9 for specific description

| PL-10 | CamGan | Cam curve magnification | Communication address: 0914H 0915H |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | Msc | |
| | Unit | 0.001 times | |
| | Configuration range | -10000000 ~ 10000000 | |
| | Data size | 32 bit | |
| | Data format | DEC | |

Set the times of the driven axis travel output.

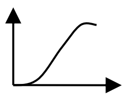
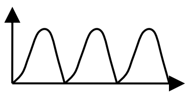
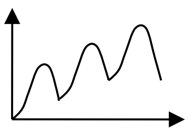
Please refer to 7.6.9 for specific description

| PL-11 (R-only) | CamSec | Cam curve original data points | Communication address: 0916H 0917H |
|---|---|---|---|
| | Initial value | 17 | |
| | Control mode | Msc | |
| | Unit | Number | |
| | Configuration range | 3 ~ 720 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

The number of raw data points of the cam curve input by the user is displayed, and a set of 17-point cam curves is default, but this parameter is not reset with the PD-44.

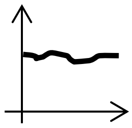
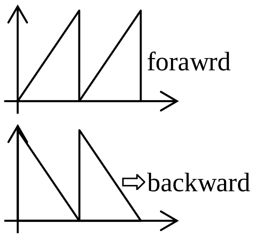
| PL-12 | CamTyp | Cam curve output command type | Communication address: 0918H 0919H |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 2 | |
| | Data size | 16 bit | |
| | Data format | Hex | |

Cam curve output command type.

| Setting | Output command type. | |
|---|---|---|
| 0 |  | In this mode, the curve output command will incrementally accumulate each cam curve output command, so as shown in the left figure, as the X axis (drive axis angle) gradually increases, the Y axis (output stroke) also gradually increases. |
| 1 |  | In this mode, the curve output command will process each cam curve output command in absolute mode, so as shown on the left, when the X axis (drive axis angle) is gradually increased, the Y axis (output stroke) will change according to the curve height. |
| 2 |  | In this mode, the curve output mode is the same as the set value = 1 mode. The difference is that if the cam curve is set at the 360 degree set value ≠ 0 degrees, in the PL-12 = 1 mode, when the drive axis angle is > 360 degrees, Forced to return to the coordinate travel after 0 degrees, but in PL-12 = 2 mode, when the drive shaft angle is >360 degrees, the system automatically raises the subsequent coordinate stroke according to the 360 degree set value, as shown in the left figure. |

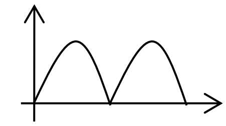
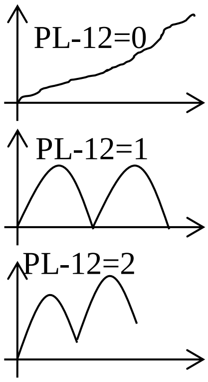
Please refer to 7.6.9 for specific description

| PL-13 | CamMon | Cam drive shaft analog monitor switching | Communication address:<br>091AH<br>091BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 1 | |
| | Data size | 16 bit | |
| | Data format | Hex | |

| Setting | Output command type. | |
|---|---|---|
| 0 |  | In this mode, the system will output the active shaft speed analog voltage, the voltage multiplier is 6000 r/min corresponding to 8 volts, and if the active shaft is fixed speed, the output is as shown on the left. |
| 1 |  | In this mode, the system will output the drive shaft angle change, the voltage multiplier is 360 degrees corresponding to 8 volts, and if the drive shaft is fixed speed, the output waveform is as shown on the left. |

Please refer to 7.6.9 for specific description

| PL-14 | CamMon | Cam slave axis analog monitor switching | Communication address:<br>091CH<br>091DH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 1 | |
| | Data size | 16 bit | |
| | Data format | Hex | |

| Setting | Output command type. | |
|---|---|---|
| 0 |  | In this mode, the system will output the cam curve (small interpolated data) pulse wave according to the active axis angle. The voltage magnification is 8 volts for PG-81, and the waveform output is shown on the left. |
| 1 |  | In this mode, the system will output the actual cam stroke according to the master axis angle and PL-12 setting. The voltage multiplier is 8 volts for PG-81, and the waveform output is shown on the left. |

Please refer to 7.6.9 for specific description

# 7. Control Function

## 7.1. Selection of operating mode

ISA drive provides three basic operating modes, position, speed and torque modes. You can use a single control mode or the mixed mode for control. The following table lists all the operating modes and relevant description:

| Mode name | | Mode code | Mode number | Description |
|---|---|---|---|---|
| Single mode | Position mode (Terminal input) | P | 0x0 | The drive receives the position command and controls the motor to move to the target position. The position command is input from the terminal block. The signal type is pulse. |
| | Speed mode | S | 0x1 | The drive receives the speed command and controls the motor to reach the target rotational speed.<br>The internal register provides the speed command (three registers available) or the external terminal block inputs the analog voltage (-10V ~ +10V). The command selection is based on the DI signal. |
| | Torque mode | T | 0x2 | The drive receives the torque command and controls the motor to reach the target torque.<br>The internal register provides the torque command (three registers available) or the external terminal block inputs the analog voltage (-10V ~ +10V). The command selection is based on the DI signal. |
| | Speed mode (no analog input) | Sn | 0x8 | The drive receives the speed command and controls the motor to reach the target rotational speed.<br>The speed command can only be provided by the internal register (three registers available). It cannot be provided by the external terminal block. The command selection is based on the DI signal. |
| | Torque mode (no analog input) | Tn | 0x9 | The drive receives the torque command and controls the motor to reach the target torque.<br>The torque command can only be provided by the internal register (three registers available). It cannot be provided by the external terminal block. The command selection is based on the DI signal. |
| | Msc mode | Msc | 0xA | The user inputs the motion sequence data into the driver in advance, and the driver receives the trigger signal, activates the origin return and the Msc command, and controls the motor displacement according to the user motion timing data. |
| Mixed mode | Position-Speed | PS | 0x5 | P and S is switched via the DI signal. |
| | Position-Torque | PT | 0x6 | P and T is switched via the DI signal. |
| | Speed-Torque | ST | 0x7 | S and T is switched via the DI signal. |

The steps for mode change are as follows:

1. Switch the drive to Servo Off by turning the SON signal of DI off.
2. Fill the mode number from the table above into the setting of the control mode in Parameter PA-00. Refer to the description from Chapter 6.

3. After finish setting, disconnect the drive and connect the power to the drive.

# 7.2. Position mode

The position mode for control is used for the device requiring precise positioning, such as the industrial machinery. The directional input of the command pulse operates the rotation angle of the motor through the external pulse. The device accepts the pulse input up to 4Mpps. The closed-loop system of the position focuses on the speed mode. The gain position controller and lead compensation are added externally. Two operating modes (manual and auto) are available for the user, just like the speed mode. The section explains the gain position controller, lead compensation and processing of position command.

## 7.2.1. Command of position mode

The command of the position mode for control (P) comes from the input pulse of the terminal block. Three types are available for the pulse and each type is divided into positive and negative logic. The pulse is set in Parameter PA-01. Refer to the table below:

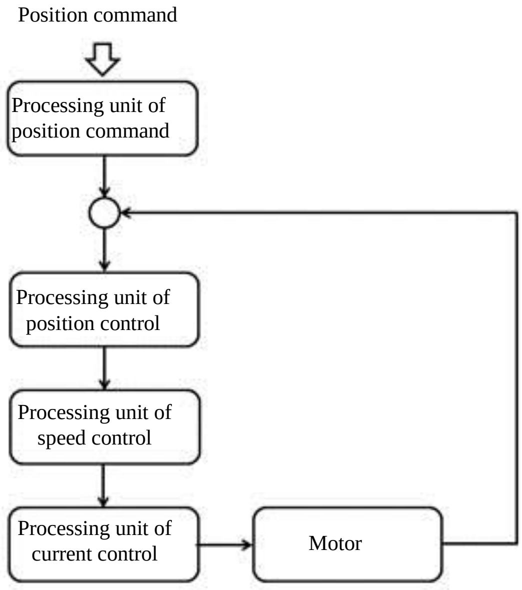
| PA-01 (S-off) | CMPT | Setting for the input format of the external pulse train | Communication address: 0002H 0003H |
|---|---|---|---|
| | Initial value | 0002 | |
| | Control mode | T / P | |
| | Unit | N/A | |
| | Configuration range | 0 ~ 0x1142 | |
| | Data size | 16bit | |
| | Data format | Hex | |

□□□□■: Pulse type
□□□■□: Filter width
□□■□□: Logic type
□■□□□: Source of the external pulse input

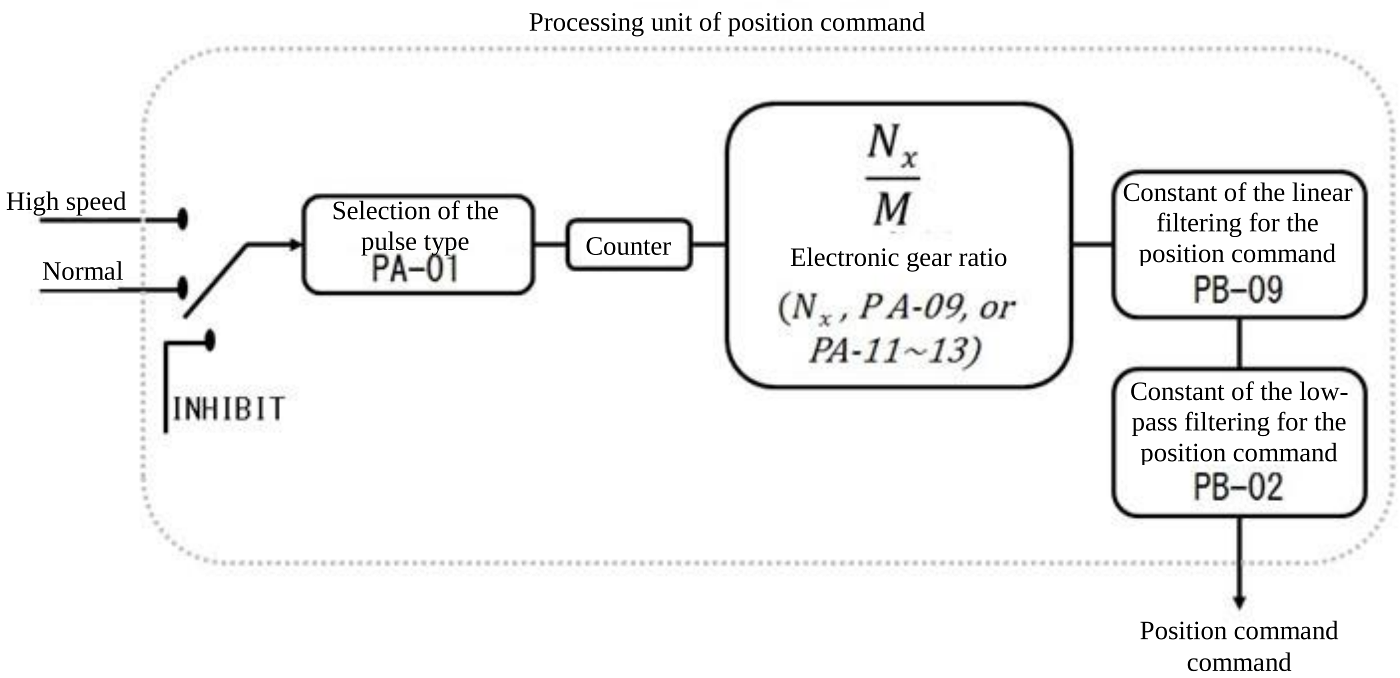
Refer to Chapter 6 for setting in details.

## 7.2.2. Control structure of the position mode

The diagram below shows the basic control structure:




For better control, the pulse signal is processed and modified through the processing unit of the position command. The following diagram shows the structure:




The graph shows P Mode. The selection is made by using PA-00. The electronic gear ratio can set in P

Mode to set proper positioning resolution. The command smoothing can be achieved via the low-pass filter.

Inhibit input (INHP)

INHP must be selected through DI before the function is used. (Refer to PC-01~09.) The function won't be used if it is not selected in DI. After selection, the calculation of the pulse command signal in the position mode for control is terminated after the INHP input is on. The motor remains locked.

### 7.2.3. Electronic gear ratio

The change of travel ratio can be conducted simply and easily via the electronic gear. Higher electronic gear ratio usually leads to stepping of the position command. The condition can be improved by smoothing the ratio through the low-pass filter. If the electronic gear ratio equals 0.5, the ratio of each two pulses from the command end to the pulse of the motor rotation is 1 pulse.

Relevant parameters:

| PA-09 | GRM1 | Numerator of the Electronic Gear Ratio (N1) | Communication address: 0012H 0013H |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | P | |
| | Unit | pulse | |
| | Configuration range | 1 ~ ( $2^{26}$-1 ) | |
| | Data size | 32bit | |
| | Data format | Dec | |

Multi-step configuration for the numerator of electronic gear ratio.
The numerator of the electronic gear ratio can be selected and switched via these two input pins: GNUM0, GNUM1. It will be set to PA-09 as default if the two input pins are not defined. Switch the numerator when the machine stops to avoid vibration during switching.

| PA-10 (S-off) | GRD | Denominator of the Electronic Gear Ratio (M) | Communication address: 0014H 0015H |
|---|---|---|---|
| | Initial value | 1 | |
| | Control mode | P | |
| | Unit | pulse | |
| | Configuration range | 1 ~ ( $2^{31}$-1 ) | |
| | Data size | 32bit | |
| | Data format | Dec | |

The servo motor is easy to rotate violently when there is a configuration error. The setting must follow the rules below.
Setting for the input ratio of the command pulse

Command for pulse input $(\mathrm{p1}) \times \frac{N}{M}$ = Command position $(\mathrm{p2})$ ; $(\mathrm{p1}) \times \frac{N}{M} = (\mathrm{p2})$

Scope for the input ratio of the command pulse: $1/50 < \frac{N_x}{M} < 25600$ ( $x$ =1、2、3、4)

### 7.2.4. Adjustment for the gain of position circuit

Before setting the position control unit, the user must select the operating mode for gain adjustment first manually (PB-33) for the speed control unit. As a result, the setting of speed control unit is complete. The speed control unit must be set before the setting of the position control unit because the speed circuit is included in the internal circuit of the position circuit.
Parameter PB-33 allows the user to select the operating mode for gain adjustment. If the user decides to adjust the gain manually, the gain of the speed circuit must be adjusted before setting the proportional gain (PB-20) and feed-forward gain (PB-22) of the position circuit.
Proportional gain(PB-20) : The gain increase would expand the response bandwidth of the position circuit.
Feed-forward gain (PB-22): This reduces the phase-lag error.
The bandwidth of the position circuit must not exceed that of the speed circuit. It is suggested that response bandwidth of position circuit (Hz) ≤ response bandwidth of speed circuit.(Hz)
Fp: Response bandwidth of position (Hz)
Fv: Response bandwidth of speed (Hz)

$$Fp \leq \frac{Fv}{4}$$

E.g.: For setting the response bandwidth of position to 10Hz, Parameter KPP( PB-20) is designed as
$KPP = 2 \times \pi \times Fp = 2 \times \pi \times 10 = 62.8$

Relevant parameters:

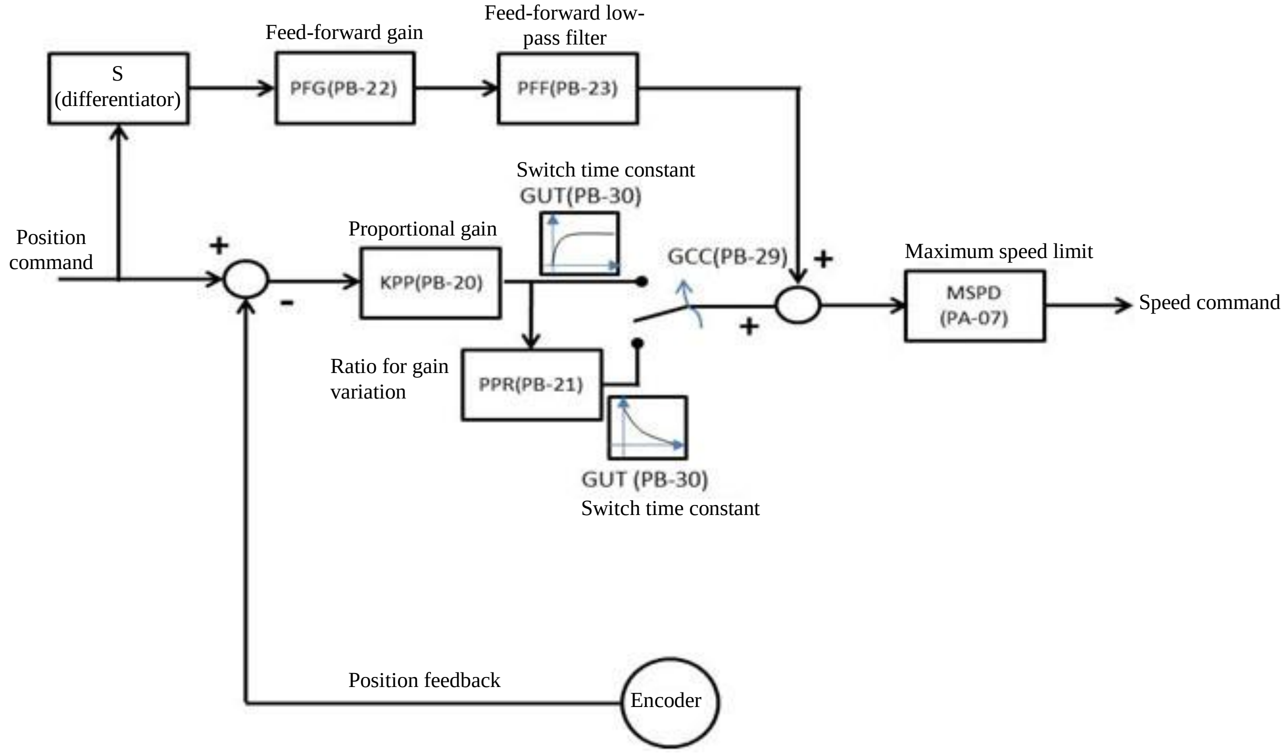
| PB-20 | KPP | Gain of the position control | Communication address: 0128H 0129H |
|---|---|---|---|
| | Initial value | 125 | |
| | Control mode | P | |
| | Unit | rad/s | |
| | Configuration range | 0 ~ 2047 | |
| | Data size | 16bit | |
| | Data format | Dec | |

When the gain of the position control is increased, the position response is increased and the error magnitude of the position control is reduced. Vibration and noise occurs easily if the gain is set to an excessive value.

<table>
<tr><td>PB-22</td><td>PFG</td><td>Feed-forward gain for the position control</td><td>Communication address:<br>012CH<br>012DH</td></tr>
<tr><td rowspan="6"></td><td>Initial value</td><td>50</td><td rowspan="6"></td></tr>
<tr><td>Control mode</td><td>P</td></tr>
<tr><td>Unit</td><td>%</td></tr>
<tr><td>Configuration range</td><td>0 ~ 100</td></tr>
<tr><td>Data size</td><td>16bit</td></tr>
<tr><td>Data format</td><td>Dec</td></tr>
</table>

For smooth change of the position control command, the increase in gain improves the magnitude of the following error for the position. For unsmooth change of the position control command, the decrease in gain mitigates the vibration of the mechanism during operation.

Position control unit:




If the KPP of proportional gain is adjusted to an excessive degree, the open-loop bandwidth of the position is expanded, which results in the reduction of phase margin and the motor vibration. The KPP must be lowered until the motor rotor no longer vibrates. With the interference of the external torque, excessively low KPP cannot meet reasonable requirements of the following error for the position. By adjusting the PFG of the feed-forward gain properly, the dynamic following error of position can be reduced effectively.

## 7.3. Speed mode

The speed mode for control (S or Sn) is used for the device requiring precise speed control, such as the CNC processing machine. Two modes for command input are available for the drive, which are the analog and register input.

- The input of analog command is used to manipulate the rotation speed of motor through the external voltage.
- Two application methods are available for the input of command register:
  - For the first method, the user sets different values of speed command to three command registers (PA-14~PA-16) before activation and switches them through SP0 and SP1 of DI in CN1.
  - As for the second one, the content value of the command register is changed through communication. For the incoherence generated due to the switching in command register, the device provides complete S-curve planning.

In the closed-loop control system for speed, two gain adjustment modes (PB-33, manual and auto) are available for the user.

- Manual gain mode: The user sets all parameters for speed loop and all auto or auxiliary functions are turned off.
- Automatic gain mode: The estimation of load inertia is provided. The parameter of the drive is adjusted simultaneously. The parameter set by the user is regarded as the initial value.

### 7.3.1. Selection of speed command

The source of the speed command can be divided into the analog voltage input externally and the internal parameter. The selection depends on the DI signal of CN1. The correspondence between the speed command and signal is shown in the following table:

<table>
<tr><th rowspan="2">Speed command no.</th><th colspan="2">DI signal of CN1</th><th rowspan="2" colspan="3">Command Source</th><th rowspan="2">Contents</th><th rowspan="2">Scope</th></tr>
<tr><th>SPD1</th><th>SPD0</th></tr>
<tr><td rowspan="2">S1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">Mode</td><td>S</td><td>External analog command</td><td>Voltage difference between V-REF and GND</td><td>-10 V ~ +10V</td></tr>
<tr><td>Sn</td><td>None</td><td>The speed command is 0.</td><td>0</td></tr>
<tr><td>S2</td><td>0</td><td>1</td><td rowspan="3" colspan="3">Parameter of internal register</td><td>PA-14</td><td>-5000.0 ~ 5000.0</td></tr>
<tr><td>S3</td><td>1</td><td>0</td><td>PA-15</td><td>-5000.0 ~ 5000.0</td></tr>
<tr><td>S4</td><td>1</td><td>1</td><td>PA-16</td><td>-5000.0 ~ 5000.0</td></tr>
</table>

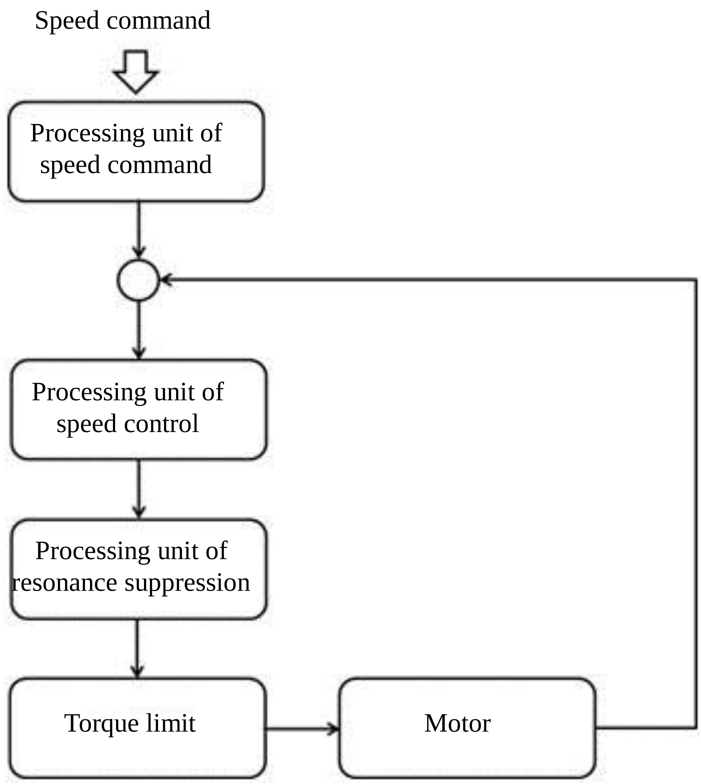
- PD0 ~ SPD1 status: 0 represents open circuit (Open) and 1 represents close circuit (Close).
- In the situation that SPD0=SPD1=0, the command is 0 if the mode is Sn. If the user does not need to use the analog voltage as the speed command, he or she may adopt Sn Mode to make sure that the analog voltage is without zero drift. For S Mode, the command is the analog voltage difference

between V-REF and GND. The voltage range input is -10V ~ +10V. The rotation speed corresponding to the voltage is adjustable (PA-17).

- If either SPD0 or SPD1 is not 0, the speed command is the internal parameter. The command becomes effective right after the change between SPD0 and SPD1.
- The setting for the parameter of the internal register is between -50000 and 50000. Set value = Setting range x unit (0.1r/min)
  E.g.: PA-14 = +30000. Set value of rotation speed = +30000 x 0.1r/min = +3000r/min

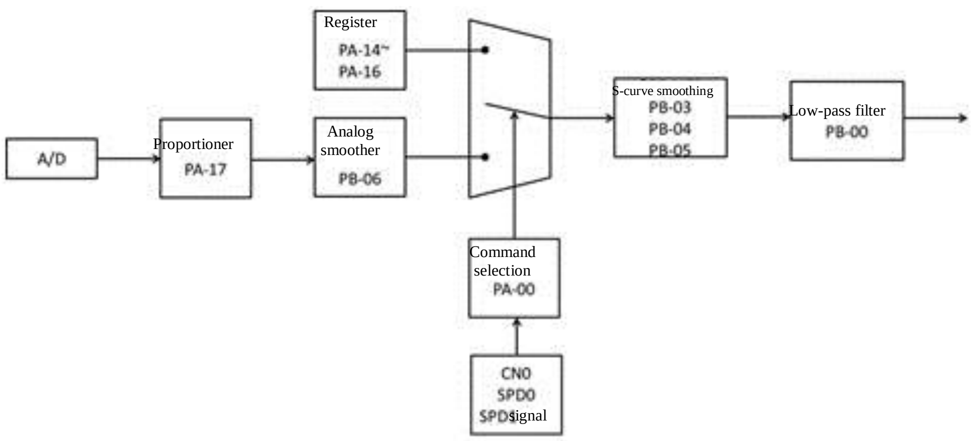
The speed command discussed in this section can be treated as the speed command under the speed mode (S or Sn). It can also be input as the command of speed limit under the torque mode (T or Tn).

## 7.3.2. Control structure of the speed mode




The processing unit of speed command selects the source of speed command based on 7.3.1. The selection includes the size of command represented by the analog voltage set by the proportioner (PA-17), as well as the S-curve used for smoothing the speed command. The speed control unit manages the gain parameter of the drive and computes the command of the current supplied to the motor promptly. The resonance suppression unit is used to suppress the resonance of machinery structure. The units are explained as follows:

First, the functions regarding the Processing unit of speed command are introduced. The structure diagram is as below:



### 7.3.3. Smoothing of speed command

Smoothing of S-curve command

The command generator of S-curve smoothing for the speed adopts the planning of the three-phase acceleration curve during acceleration and deceleration. It enables smoothing of the motion control and generates continuous acceleration to avoid excessive jerk (acceleration differentiation) due to rapid change of the command entered. The jerk may stimulate the vibration and noise of the machinery structure. The user may use the speed constant of S-curve acceleration (PB-03) to adjust the slope of speed change during acceleration. The speed constant of S-curve deceleration (PB-04) is used to adjust the slope of speed change during deceleration. The smoothing constant of S-curve acceleration and deceleration (PB-05) is used to improve the stability during start and stop of motor. The device provides the calculation for the time required for the completion of command. T (ms) indicates the operating time. S (r/min) represents the command of absolute speed, which is the absolute value calculated by subtracting the final speed from the initial speed. When PB-05 is set to 0, the command generator of S-curve smoothing is turned off. No smoothing effect is available for the speed command at this moment.

Relevant parameters:

| PB-03 | STAC | Acceleration constant of the smooth S-curve | Communication address: 0106H 0107H |
|---|---|---|---|
| | Initial value | 200 | |
| | Control mode | S | |
| | Unit | ms | |
| | Configuration range | 1 ~ 20000 | |
| | Data size | 16bit | |
| | Data format | Dec | |

Constant for speed acceleration: As for PB-03, PB-04 and PB-05, the time required for acceleration from 0 to 3000r/min can be set separately.

NOTE 1) If the source of the speed command is an analog source or PB-05 is set to 0, turn off the smooth function for S-shaped acceleration-deceleration.

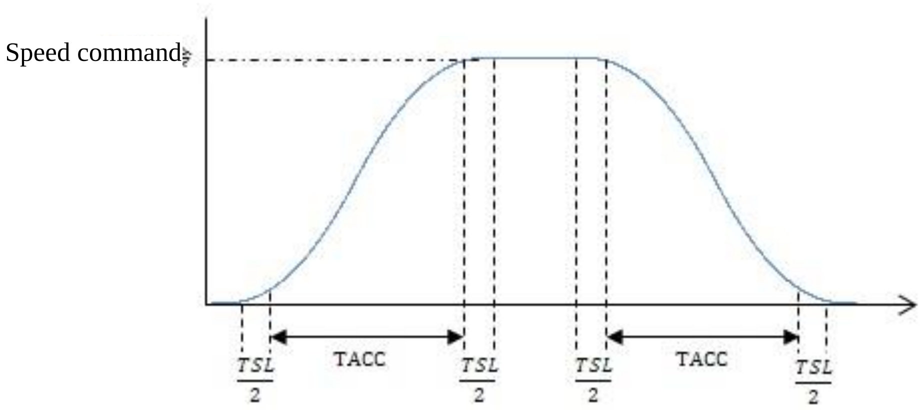
| PB-04 | STDC | Deceleration constant of the smooth S-curve | Communication address: 0108H 0109H |
|---|---|---|---|
| | Initial value | 200 | |
| | Control mode | S | |
| | Unit | ms | |
| | Configuration range | 1 ~ 20000 | |
| | Data size | 16bit | |
| | Data format | Dec | |

Constant for speed acceleration: As for PB-03, PB-04 and PB-05, the time required for acceleration from 0 to 3000r/min can be set separately.

NOTE 1) If the source of the speed command is an analog source or PB-05 is set to 0, turn off the smooth function for S-shaped acceleration-deceleration.

| PB-05 | STL | Smooth constant of the smooth S-curve | Communication address: 010AH 010BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | S | |
| | Unit | ms | |
| | Configuration range | 0 ~ 10000 | |
| | Data size | 16bit | |
| | Data format | Dec | |

PB-03: It is used to set the acceleration time for trapezoidal speed command.
PB-04: It is used to set the deceleration time for trapezoidal speed command.
PB-05: It is used to set the smooth time of the S-shaped acceleration-deceleration.
PB-03, PB-04 and PB-05 can be set separately.




NOTE 1) If the source of the speed command is an analog source or PB-05 is set to 0, turn off the smooth function for S-shaped acceleration-deceleration.

- **Analog command smoother**

The analog command smoother is provided primary to offer the buffering when the analog input signal changes too fast.

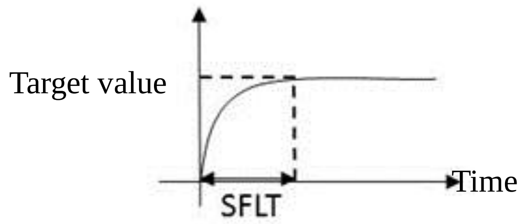
The S-curve generator for analog speed allows the smoothing of the analog input command. Its time planning is the same as the one for the S-curve of general speed. The speed and acceleration curves are continuous. The graph above illustrates the schematic diagram for the S-curve generator for analog speed. The slopes of the rotation speed command referred during acceleration and deceleration are different. It is evident that how the command is followed. The poor following property shows in the graph. The user may
adjust the time setting (PB-03, PB-04 and PB-05) based on the actual situation for improvement.

- **Low-pass filter at the command end**

The low-pass filter at the command end is usually used to attenuate unneeded high-frequency response or noise while smoothing the command.

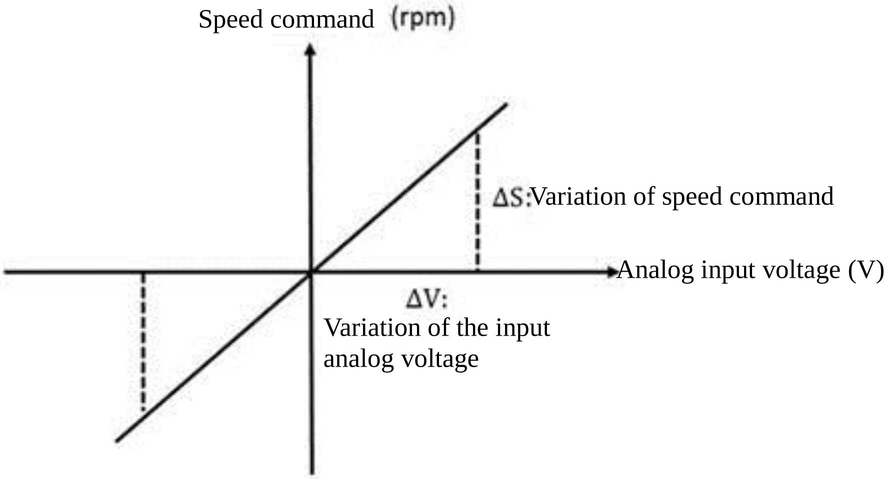
Relevant parameters:

| PB-00 | SFIL | Acceleration-deceleration smoothing constant of the analog speed command | Communication address: 0100H 0101H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | S | |
| | Unit | ms | |
| | Configuration range | 0 ~ 1000 (0: The function is turned off.) | |
| | Data size | 16bit | |
| | Data format | Dec | |



### 7.3.4. Proportioner at the analog command end

The speed command of motor is controlled by the analog voltage difference between V_REF and VGND. The slope and range of speed control is adjusted by adapting to the proportioner of Internal Parameter PA-17.




Relevant parameters:

| | | | |
|---|---|---|---|
| PA-17 (S-off) | CVM | Maximum rotation speed of the analog speed command | Communication address: 0022H 0023H |

| | | |
|---|---|---|
| | Initial value | By Rated |
| | Control mode | T / S |
| | Unit | r/min |
| | Configuration range | 0 ~ max. Speed |
| | Data size | 16bit |
| | Data format | Dec |

Maximum rotation speed of the analog speed command:

- In the speed mode, this indicates the setting of the rotation speed while the maximum voltage (10V) is input for the analog speed command.

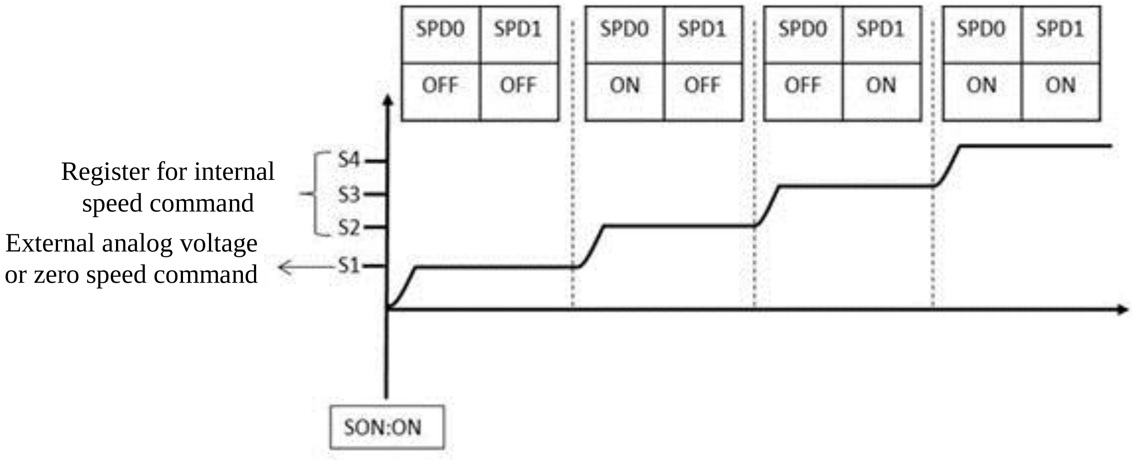
If the speed is set to 3000 and 10V is input for external voltage, the speed control command is 3000r/min. 5V implies that the speed control command is 1500r/min.

Speed control command = Input voltage value x Set value/10

- In the torque mode, the parameter represents the command for analog speed limit.

Speed limit command = Input voltage value x Set value/10

### 7.3.5. Timing diagram of speed mode



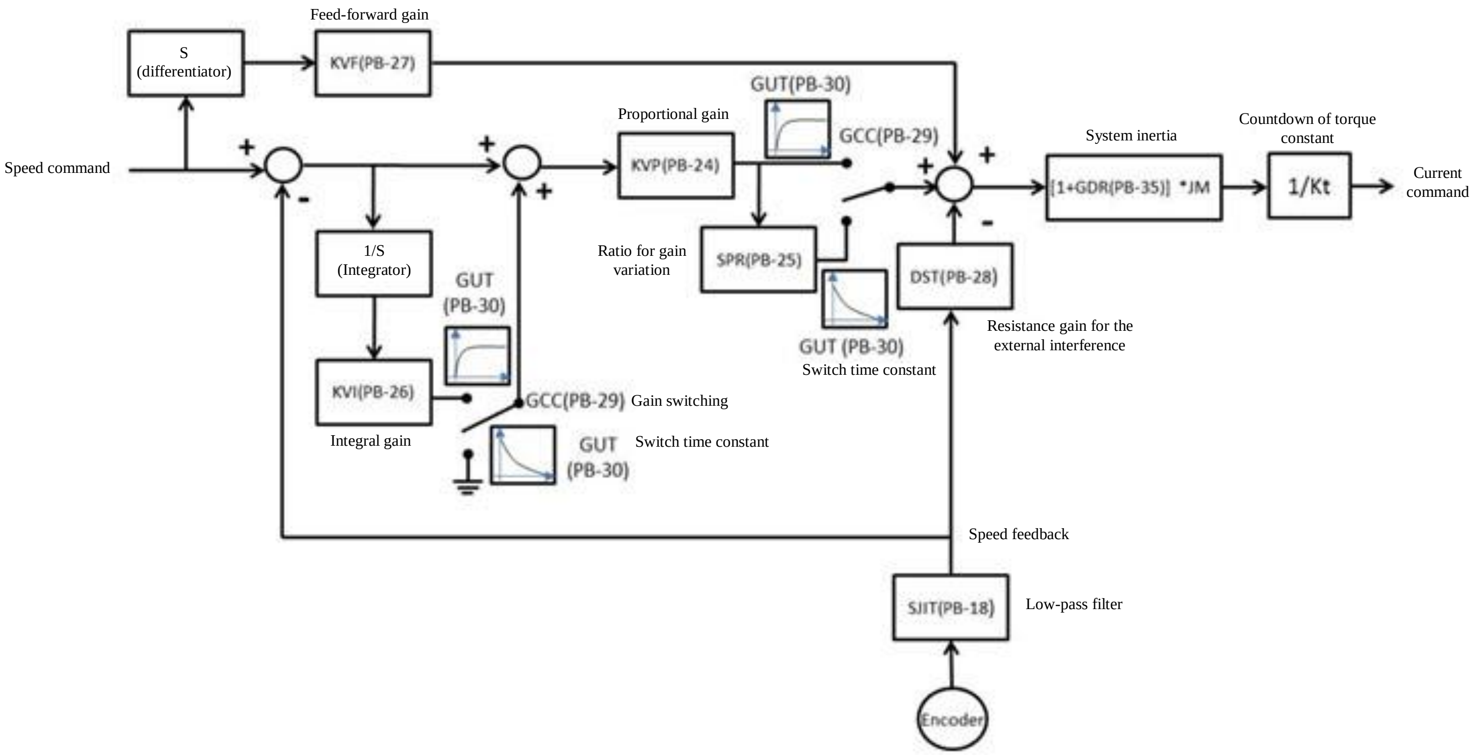

1) OFF represents open circuit (Open) and ON represents close circuit (Close).

2) For Sn Mode, Speed Command S1=0. For S Mode, Speed Command S1 is the analog voltage of external input.

3) After Servo On, the command is selected based on the status of SPD0~SPD1.

## 7.3.6. Adjustment for the gain of speed circuit

The following is the structure diagram for the speed control unit:




Select the way to adjust the gain through Parameter PB-33.

| PB-33 (S-off) | AUTM | Method for gain adjustment | Communication address: 0141H 0142H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | N/A | |
| | Configuration range | 0 ~ 2 | |
| | Data size | 16bit | |
| | Data format | Dec | |

0: Manual Mode

1: Auto Mode (persistent adjustment)

2: Semi-auto Mode (non-persistent adjustment)

0: Description for Manual Mode

- If PB-33 is set to 0, the user is allowed to set all parameters related to control gain. The parameters are PB-20, PB-23, PB-24, PB-26, PB-27, PB-17 and PB-28.
- Relevant parameters are updated automatically when Auto or Semi-auto Mode is switched to the manual mode.

1: Description for Auto Mode

- The system inertia is estimated continuously. The load inertia ratio estimated is stored automatically to PB-35 every 30 minutes. Refer to the rigidity and bandwidth setting of PB-32.
- When switching from Auto Mode 1 or Semi-auto Mode 2 to Manual Mode 0, the system stores the measured load inertia ratio automatically to PB-35 and sets corresponding control parameter based on the load inertia ratio.
- When switching from Manual Mode 0 directly to Semi-auto Mode 1 or Auto Mode 2, enter the proper load inertia ratio in PB-35.
- When switching from Auto Mode 1 to Manual Mode 0, the values of PB-20, PB-24 and PB-26 are altered to the corresponding parameter value in Auto Mode.
- When switching from Semi-Auto Mode 2 to Manual Mode 0, the values of PB-20, PB-24, PB-26, PB-17 and PB-28 are altered to the corresponding parameter value in Semi-auto Mode.

2: Description for Semi-auto Mode

- When the system inertia is stabilized, the estimation stops after PB-50 shows 1. The load inertia ratio estimated is stored in PB-35. The adjustment continues when switching from other modes (Manual or Auto Mode) to Semi-auto Mode.
- If the range of system inertia is too large, PB-50 shows 0 and the adjustment continues.

**Manual mode**

When PB-33 is set to 0, the proportional gain (PB-24), integral gain (PB-26) and feed-forward gain (PB-27) are set by the user. The impacts caused by each parameter in general are as follows:
Proportional gain (PB-24): The gain increase would expand the response bandwidth of the position circuit.
Feed-forward gain (PB-27): This reduces the phase-lag error.
Integral gain (PB-26): The gain increase would enhance the low-frequency rigidity of the speed-loop and reduce the steady-state error. In the meantime, the phase margin value is sacrificed. Excessive integral gain may result in system instability.

Relevant parameters:

| | | | |
|---|---|---|---|
| PB-24 | KVP | Proportional gain for speed control | Communication address: 0130H 0131H |

| | | |
|---|---|---|
| | Initial value | 502 |
| | Control mode | ALL |
| | Unit | rad/s |
| | Configuration range | 0 ~ 8191 |
| | Data size | 16bit |
| | Data format | Dec |

The speed response is increased when the gain of the speed control is increased. Vibration and noise occurs easily if the gain is set to an excessive value.

| | | | |
|---|---|---|---|
| PB-26 | KVI | Integral compensation for the speed control | Communication address: 0134H 0135H |

| | | |
|---|---|---|
| | Initial value | 50 |
| | Control mode | ALL |
| | Unit | rad/s |
| | Configuration range | 0 ~ 1023 |
| | Data size | 16bit |
| | Data format | Dec |

When the integral value of the speed control is increased, the position response is increased and the error magnitude of the speed control is reduced. Vibration and noise occurs easily if the gain is set to an excessive value.

| | | | |
|---|---|---|---|
| PB-27 | KVF | Feed-forward gain for the speed control | Communication address: 0136H 0137H |

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

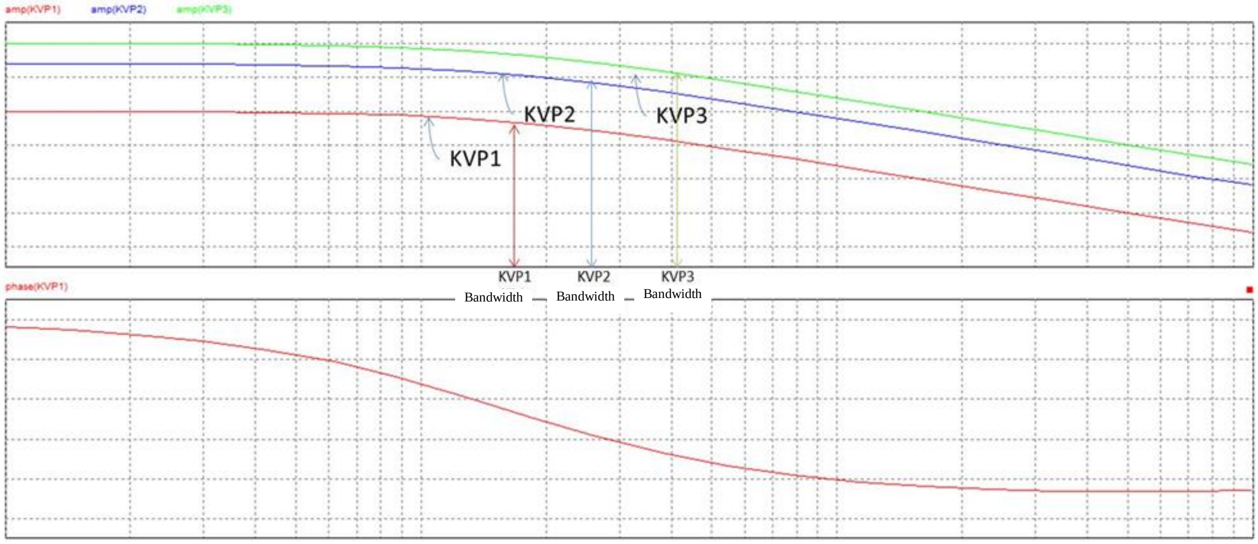
For smooth change of the speed control command, the increase in gain improves the magnitude of the following error for the speed. For unsmooth change of the speed control command, the decrease in gain mitigates the vibration of the mechanism during operation.

For academic principles, the step response can be used to interpret the proportional gain (KVP), integral gain (KVI) and feed-forward gain (KVF).

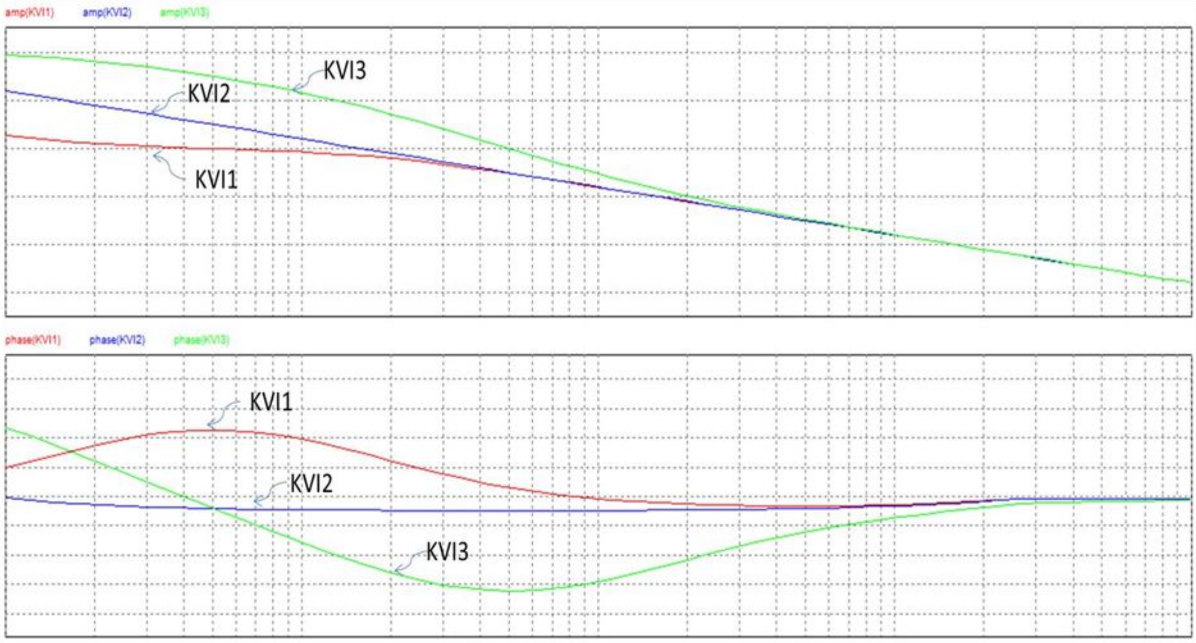
We explain the basic principles based on frequency and time domain.

- **Principle of frequency domain**

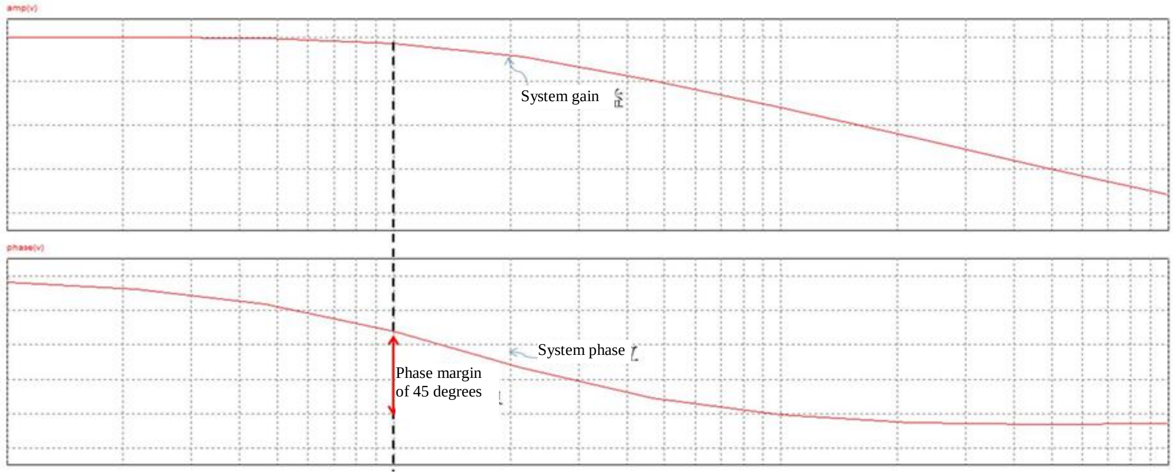
1. STEP 1: KVI =KVF=0. Make an adjustment so that KVP3>KVP2>KVP1. The higher the KVP the wider the bandwidth and the lower the phase margin.




2. STEP 2: Fix the KVP and adjust the KVI (KVI3>KVI2>KVI1).

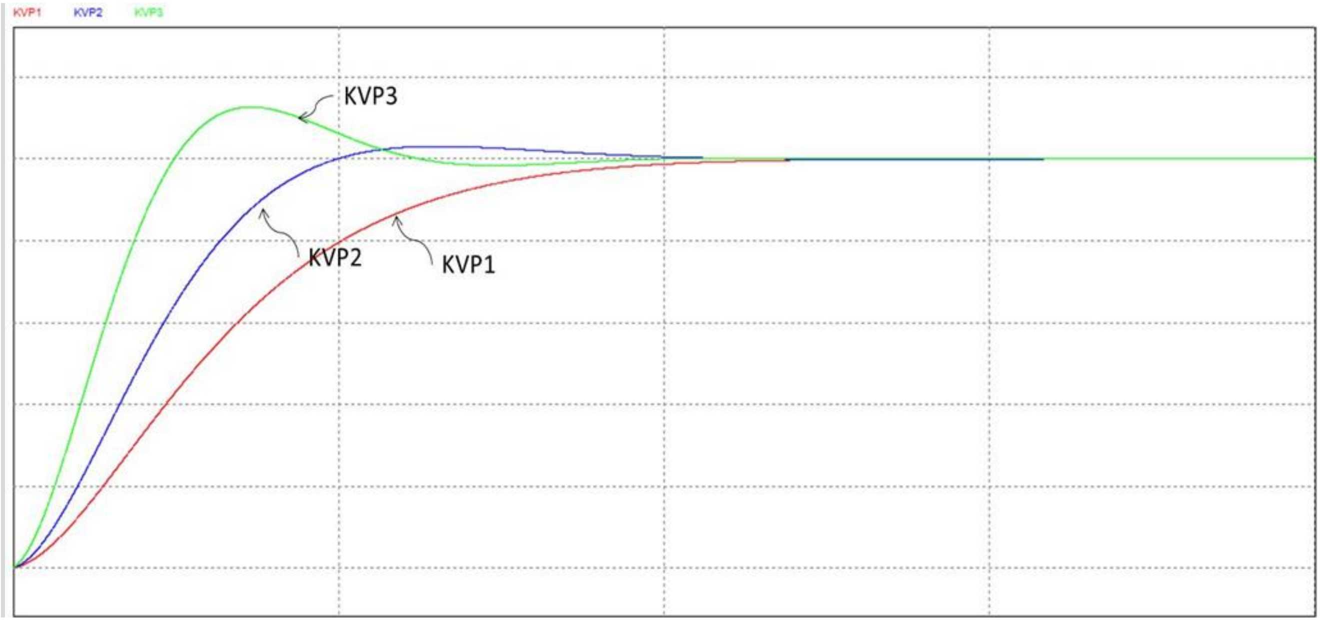



3. STEP 3: Select the KVI. If the phase margin is too low (relatively unstable), adjust the KVP again so that the phase margin reaches 45 degrees.

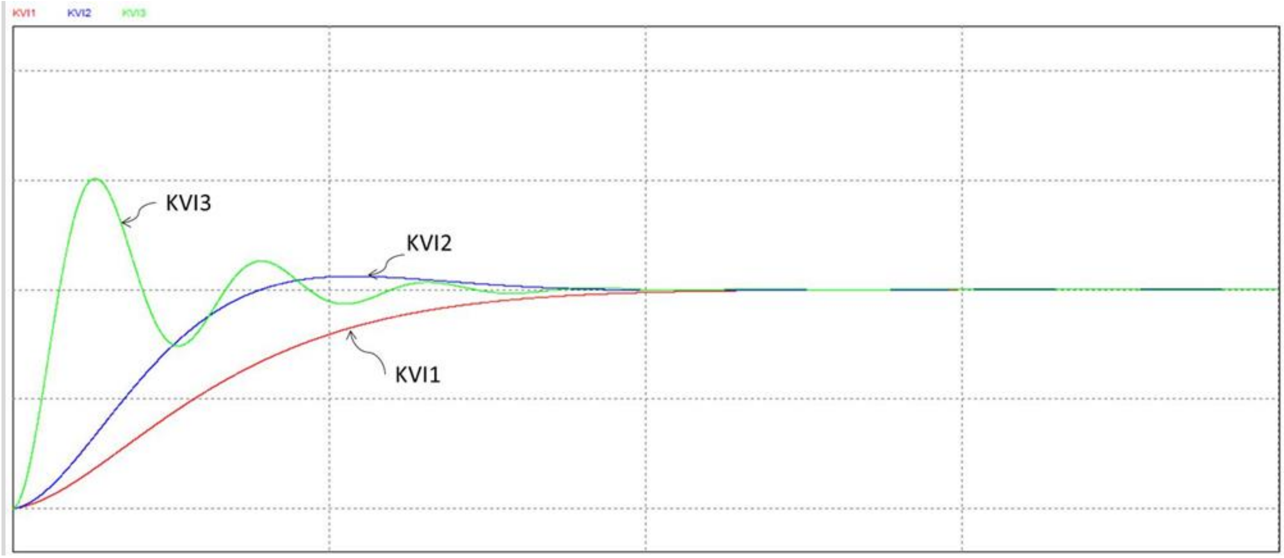



- **Principle of time domain**

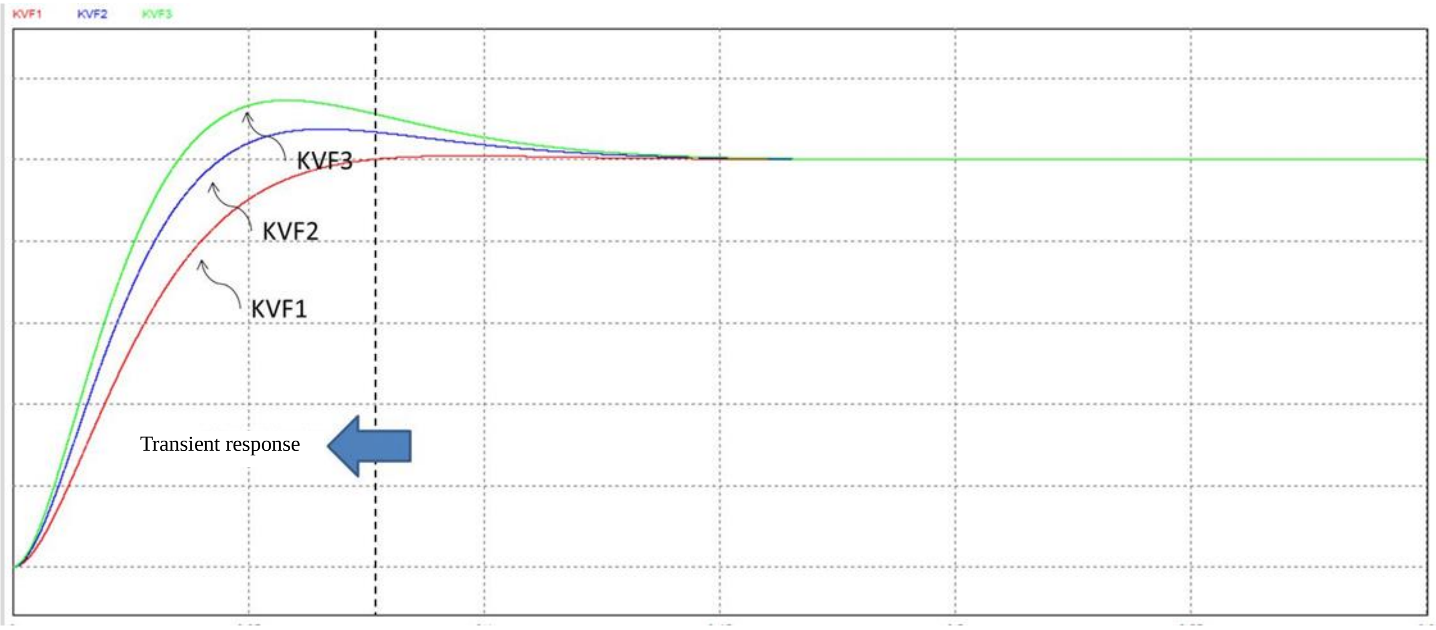
1. The higher the KVP is, the broader the bandwidth and the shorter time required for rising. If the KVP is too high, the phase margin of the system is low and the relevant stability would also be low. For fixing the steady-state following error, this is not more evidently helpful than the KVI. Refer to the following illustration (KVP3>KVP2>KVP1).




2. The higher the KVI is, the faster the steady-state error can be eliminated. It is obviously helpful for the steady-state error of KVI. If the KVI is too high, the phase margin of system would be too low. Refer to the following diagram (KVI3> KVI 2> KVI 1).



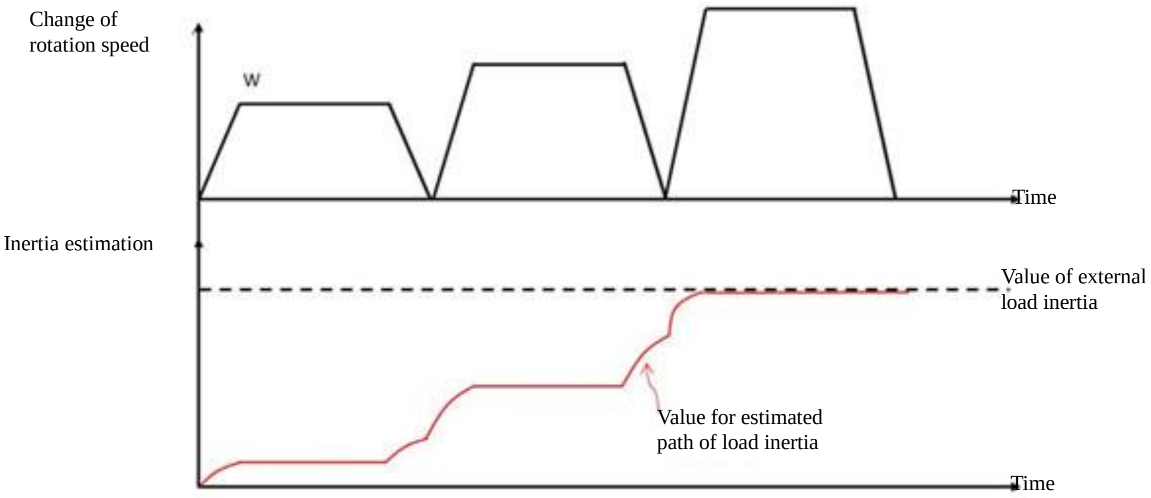

**3.** The higher the KVF is, the higher the feed-forward compensation. The dynamic following error during the transient state can be reduced. If the KVF is too high, it may result in system swing. Refer to the diagram below (KVF3>KVF2>KVF1).




Generally the measurement requires the use of instrument if the frequency domain method is used. The user must have the relevant measurement equipment at hand. The time domain method only requires one oscilloscope. By using the analog input and output terminals provided by the drive in the meantime, the user can utilize the time domain method conveniently to adjust the parameter of PI controller.

**Auto mode**

The self-adaptive learning rule is used for the automatic gain adjustment. The internal parameter of the control unit is adapted automatically to the variation in external load inertia. Certain convergence time is required for adaptive learning. If the load changes too fast, it is not applicable to the auto mode. It is suggested that the variation in external load inertia should be stable or slow. The convergence time tuned in the auto mode varies by the speed of the change in motor rotation speed.




## 7.3.7. Resonance suppression unit

The excessive rigidity (system bandwidth set too high) of the drive control system could result in the mechanical resonance generated by the drive combined with the machinery structure. The drive provides the low-pass filter (PB-17), Notch Filter 1 (PB-10) and (PB-11), Notch Filter 2 (PB-12) and (PB-13), as well as Notch Filter 3 (PB-10) and (PB-11). The resonance suppression is achieved without affecting the original control parameter.

Relevant parameters:

| PB-10 | NCF1 | Notch filter for resonance suppression (1) | Communication address: 0114H 0115H |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | ALL | |
| | Unit | Hz | |
| | Configuration range | 50 ~ 1000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

| PB-11 | NCD1 | Notch filter for the attenuation rate of the resonance suppression (1) | Communication address: 0116H 0117H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | dB | |
| | Configuration range | 0 ~ 32 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The first group of resonance suppresses the Notch filter attenuation rate. When set to 0, the Notch filter is turned off.

| PB-12 | NCF2 | Notch filter for resonance suppression (2) | Communication address: 0118H 0119H |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | ALL | |
| | Unit | Hz | |
| | Configuration range | 50 ~ 2000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The second set of mechanical resonance frequency settings.

| PB-13 | NCD2 | Notch filter for the attenuation rate of the resonance suppression (2) | Communication address: 011AH 011BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | dB | |
| | Configuration range | 0 ~ 32 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The second group of resonance suppresses the Notch filter attenuation rate. When set to 0, the Notch filter is turned off.

| PB-14 | NCF3 | Notch filter for resonance suppression (3) | Communication address: 011CH 011DH |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | ALL | |
| | Unit | Hz | |
| | Configuration range | 50 ~ 2000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The third set of mechanical resonance frequency settings.

| PB-15 | NCD3 | Notch filter for the attenuation rate of the resonance suppression (3) | Communication address: 011EH 011FH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | dB | |
| | Configuration range | 0 ~ 32 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The third group of resonance suppresses the Notch filter attenuation rate. When set to 0, the Notch filter is turned off.

| PB-16 | NCFA | Setting for the suppression mode of auto-resonance | Communication address: 0120H 0121H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 0 ~ 2 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function:

0: Manual resonance suppression.

1: Automatically fixed after resonance suppression.

2: Continuous automatic resonance suppression.

| PB-17 | NCLA | The setting for the sensitivity suppression of auto-resonance | Communication address: 0122H 0123H |
|---|---|---|---|
| | Initial value | 100 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | 1 ~ 300 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The set value is related to the sensitivity of the resonance suppression detection.

When the PB-17 setting is higher: the resonance sensitivity is lowered.

When the PB-17 setting is lower : the resonance sensitivity rises.

| PB-18 | NLP | The low-pass filtering for resonance suppression | Communication address: 0124H 0125H |
|---|---|---|---|
| | Initial value | 9 | |
| | Control mode | ALL | |
| | Unit | 0.1 ms | |
| | Configuration range | 0 ~ 100 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: Resonance suppression low-pass filter time constant. When set to 0, the low-pass filtering function is turned off.

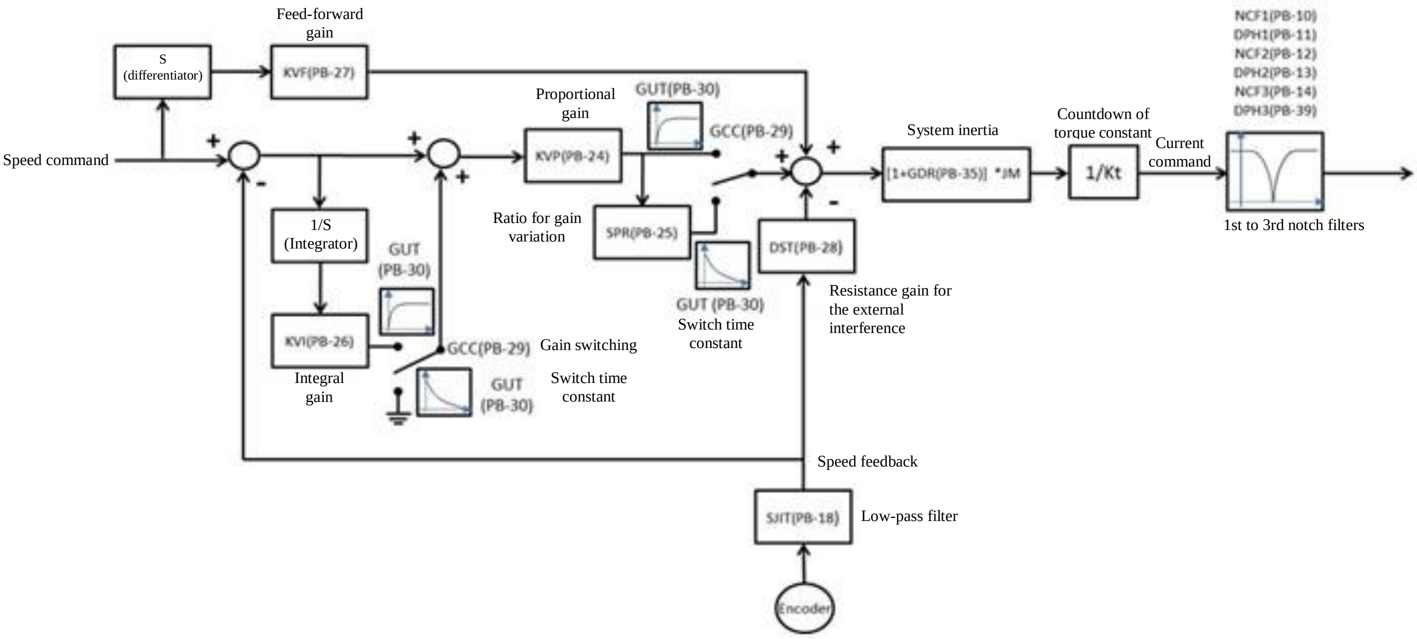
Note: The PB-18 setting value varies with the PA-21 setting. It can also be set to 0 to disable the low-pass filtering function.

| PB-44 | NCBW1 | Resonance suppression Notch filter 1 width | Communication address: 0158H 0159H |
|---|---|---|---|
| | Initial value | 50 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | 1 ~ 100 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

| PB-45 | NCBW2 | Resonance suppression Notch filter 2 width | Communication address: 015AH 015BH |
|---|---|---|---|
| | Initial value | 50 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | 1 ~ 100 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

| PB-46 | NCBW3 | Resonance suppression Notch filter 3 width | Communication address: 015CH 015DH |
|---|---|---|---|
| | Initial value | 50 | |
| | Control mode | ALL | |
| | Unit | % | |
| | Configuration range | 1 ~ 100 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

➢ Resonance suppression unit

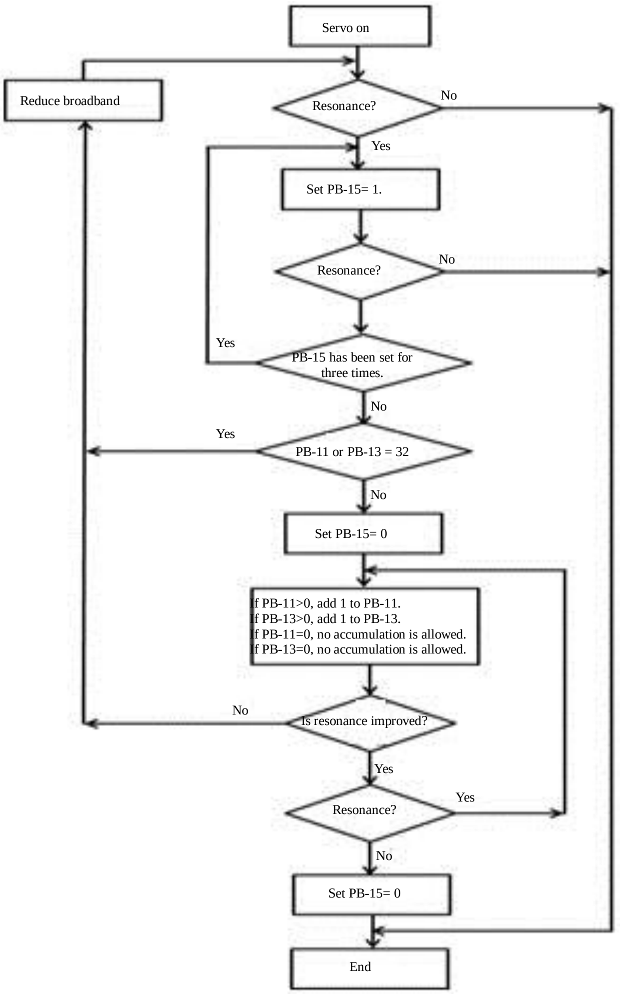



The drive is equipped with two notch filters with automatic resonance suppression, which can be turned on by setting PB-15 to 1 or 2. The drive searches for and suppresses the resonance point automatically. The found frequency point and attenuation rate will be filled in Resonance Filter 1 (PB-10) and (PB-11) and

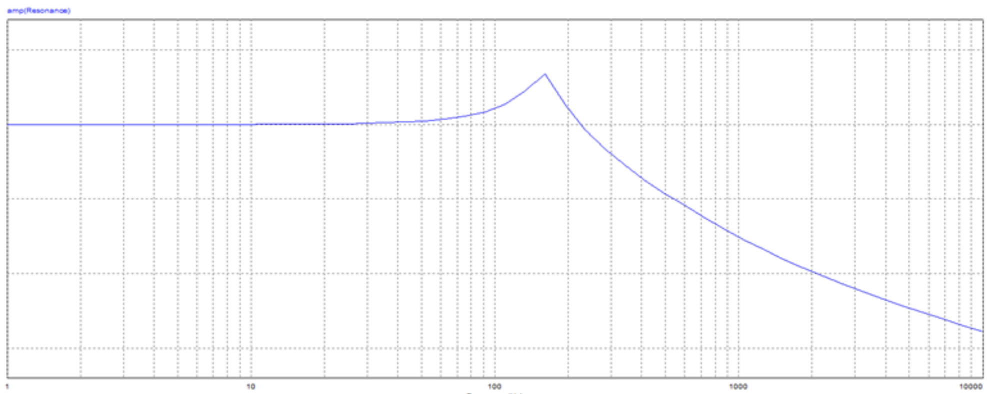
Resonance Filter 2 (PB-12) and (PB-13) sequentially.
When PB-15 is set to 1, it is set to 0 (auto resonance suppression turned off) automatically after system suppression. When PB-15 is set to 2, the search of resonance point continues.
The resonance exists if PB-15 is set to 1 or 2. If either the value of PB-11 or PB13 is 32, it is suggested to reduce the speed bandwidth and reactivate the auto resonance suppression.
If values of both PB-11 and PB-13 are below 32 but resonance still exists, set PB-15 to 0 (auto resonance suppression turned off) and adjust PB-11 and PB-13 manually to higher values. If the resonance still cannot be suppressed, it is suggested to reduce the speed bandwidth and reuse the auto resonance suppression.
Before the manual adjustment of PB-11 and PB-13, check if the values of PB-11 and PB-13 are greater than 0. If these equal to 0, the resonance frequency point is not found. Do not increase the values of PB-11 and PB-13 manually; otherwise the system deterioration might occur.

| PB-15 Function Table | | |
|---|---|---|
| PB-15 Current value | PB-15 Value to be modified | Function |
| 0 | 1 | Clear the values of PB-12~ PB-1x to activate the auto resonance suppression. |
| 0 | 2 | Clear the values of PB-12~ PB-1x to activate the auto resonance suppression. |
| 1 | 0 | Store the current values of PB-12~ PB-1x to deactivate the auto resonance suppression. |
| 1 | 1 | Clear the values of PB-12~ PB-1x to activate the auto resonance suppression. |
| 1 | 2 | Do not clear the values of PB-12~ PB-1x and keep the auto resonance suppression active. |
| 2 | 0 | Store the current values of PB-12~ PB-1x to deactivate the auto resonance suppression. |
| 2 | 1 | Clear the values of PB-12~ PB-1x to activate the auto resonance suppression. |
| 2 | 2 | Do not clear the values of PB-12~ PB-1x and keep the auto resonance suppression active. |

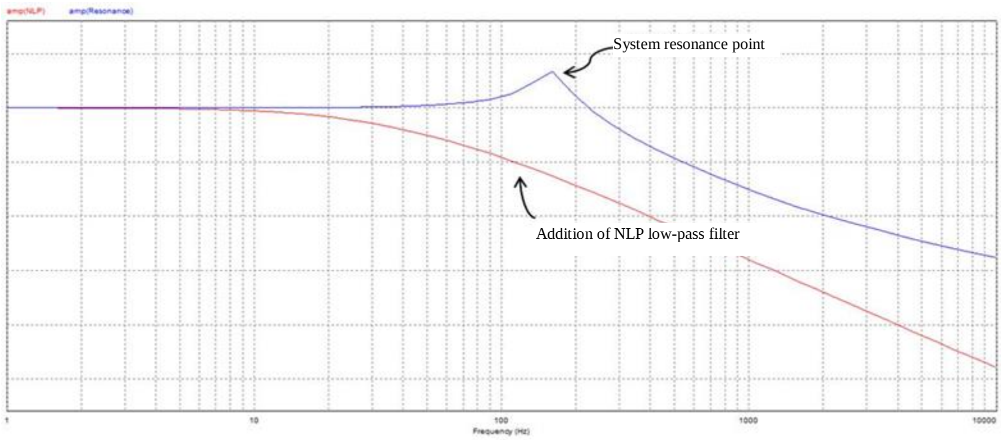
➢ Flow Chart for Resonance Suppression




The low-pass filter NLP (PB-17) is used to describe the resonance suppression. The Bode plot of the system for resonance is as below.

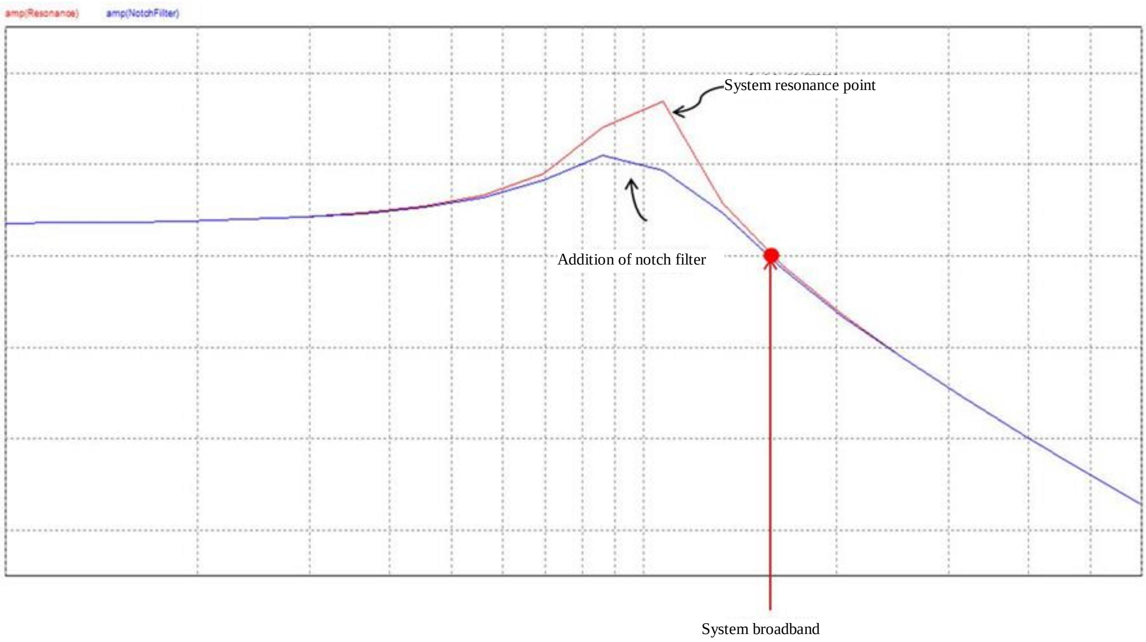


When NLP starts to increase, the effect is illustrated in the Bode plot below. The resonance point will be filtered by the resonant low-pass filter.

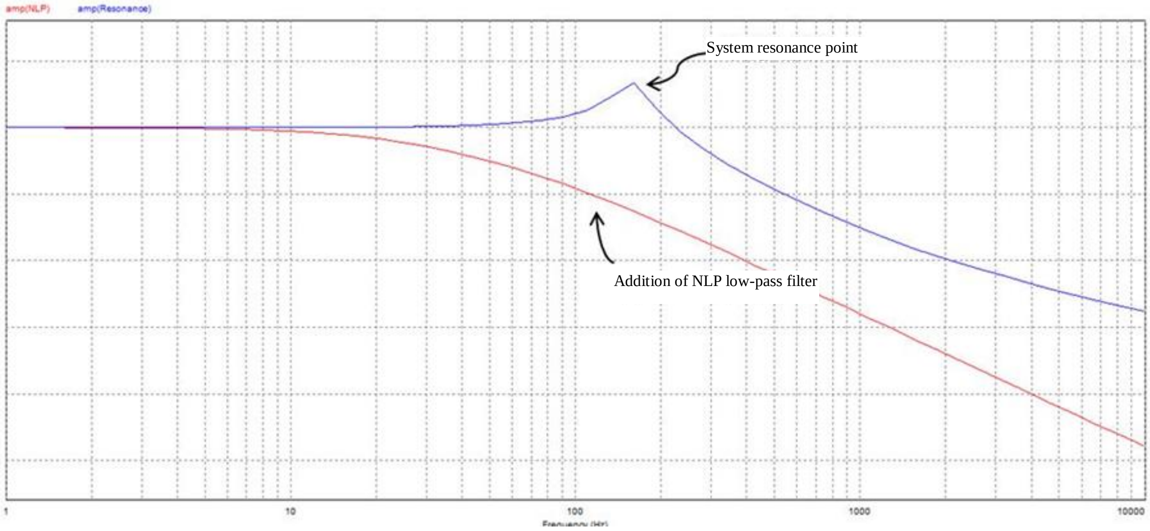



If the user knows the resonance frequency, set the notch filter parameter directly for resonance suppression. Set the frequency of the notch filter to 50~1000Hz. If the resonance frequency falls out of this range, it is suggested to use the resonant low-pass filter (PB-17) to reduce the resonance effect.

Next, we want to find out effect of the notch and low-pass filters in the resonance system.
First, let's explore the effect created by applying the notch filter to the resonance system. In the following Bode plot, the resonance system suppresses the resonance point effectively after the notch filter is added to the system. The system bandwidth is not much affected.




Next, we can see that the system broadband is smaller when using the resonant low-pass filter to increase the NLP (PB-17). According to the graph below, the resonant low-pass filter can solve the resonance problem but the phase margin of system is lower, as well as the system stability.

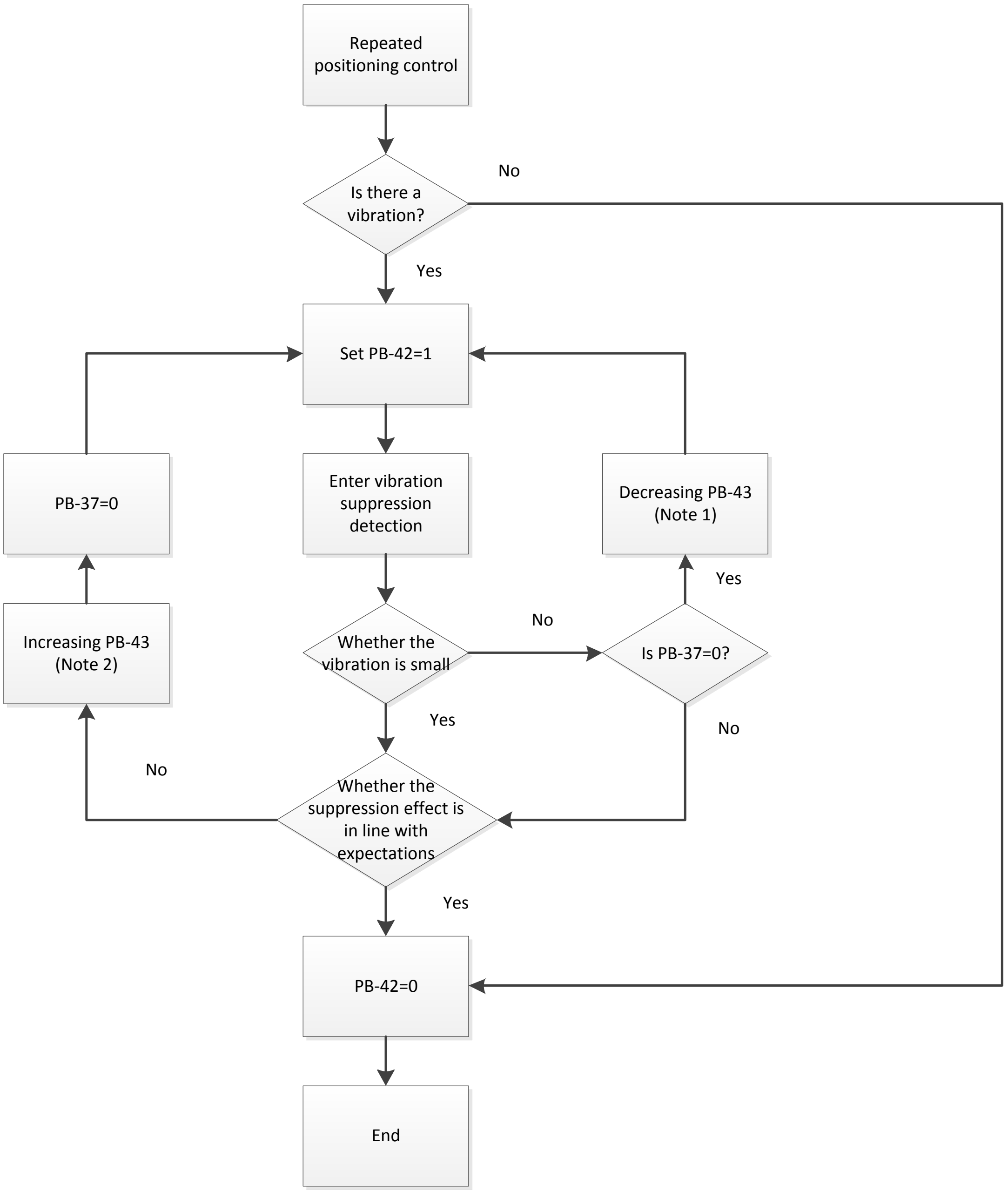

amp(NLP)
amp(Resonance)
System resonance point
Addition of NLP low-pass filter
1
10
100
1000
10000

### 7.3.8. Low frequency vibration suppression of position mode

If the rigidity of the system is too low, at the end of the position command, although the motor itself is close to static, the mechanical load end will still have continuous vibration, and the low frequency vibration suppression function can be used to reduce the phenomenon of mechanical load end swing. The low frequency vibration suppression range is 1.0 Hz to 100.0 Hz. This function provides manual setting and automatic setting.

Automatic setting function:
When the system vibration frequency is unknown, the automatic low frequency vibration suppression function can be turned on. This function will automatically find the frequency of low frequency swing. First, turn off the low frequency suppression filter PB-37 and PB-39 are 0. When PB-42 is set to 1, the system will automatically find the low frequency vibration frequency when automatic detection. When the frequency is fixed, the PB-42 will automatically set back to 0, and the vibration frequency will be set to PB-36 and PB-37 will be set to 1. If the low frequency swing still exists after the PB-42 is automatically set back to zero, please check if the low frequency vibration suppression gain PB-37 has been automatically turned on. If the PB-37 is zero, it means that no frequency is detected, please reduce the low frequency vibration. Check the level PB-43, and set PB-42 = 1, and then look for the low frequency swing frequency. It should be noted that the detection level setting is too small, and it is easy to misjudge other non-primary low frequency vibration frequencies.

Low frequency automatic suppression flow chart: ：




Note 1: When PB-37 is 0, the representative frequency cannot be found. It may be because the detection level is too high, and the frequency of low frequency swing is not detected.

Note 2: When the PB-37 has a value, it still cannot slow down the swing. It may be because the detection level is too low, and the noise is misjudged as the low frequency swing frequency or other non-primary low frequency vibration frequency.

Note 3: When the vibration suppression effect is still not achieved after the automatic vibration suppression process, if there is a way to know the frequency of the low frequency vibration, you can manually set the PB-37 to achieve the vibration suppression effect.

Automatic suppression parameters:

| PB-42 (N-keep) | AVSM | Low frequency automatic suppression mode setting | Communication address: 0154H 0155H |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | P / Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 1 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function:

0: Fixed.

1: Automatic suppression.

Automatic suppression mode description:

When set to 1, the vibration is automatically suppressed. When no frequency is found or found, it is automatically set to 0, and the searched frequency is stored to the PB-36.

| PB-43 | VCL | Low frequency vibration detection level | Communication address: 0156H 0157H |
|---|---|---|---|
| | Initial value | 500 | |
| | Control mode | P / Msc | |
| | Unit | pulse | |
| | Configuration range | 1 ~ 8000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function:

When the automatic suppression mode is on (PB-42 = 1), the vibration is judged according to the vibration detection level. The lower the value, the more sensitive it is to the vibration frequency search, which is easy to cause misjudgment into other non-primary low frequency vibration frequencies. The higher the value, the lower the false positive, but when the vibration amplitude of the mechanism is small, it is difficult to find the vibration frequency.

PB-43 is the range of vibration frequency of low frequency vibration frequency. When the frequency is not detected, it may be that PB-43 is set too high. It is recommended to adjust PB-43 to be small, but the adjustment is too small. It may be due to noise or non-primary low frequency. Vibration causes a misjudgment of the vibration frequency. If there is an external instrument, such as an oscilloscope, you can observe the position error (pulse) to set PB-43.

Manual setting method:

There are two sets of low frequency suppression filters for low frequency suppression. The first group is the parameters PB-36 ~ PB-37, and the second group is the parameters PB-38 ~ PB-39. These two sets of filters can be utilized to mitigate low frequency vibrations at two different frequencies. The parameters PB-36 and PB-38 are used to set the frequency of the low-frequency swing. The low-frequency suppression function suppresses the vibration of the low-frequency mechanical load only when the low-frequency vibration suppression frequency parameter is set close to the vibration frequency. Parameter PB-37 and PB-39 is used to set the response after filtering. The larger the PB-37 and PB-39 settings, the better the response, but it is too easy to make the motor run poorly. The PB-37 and PB-39 factory default values are zero, indicating that the functions of both sets of filters are turned off. The relevant parameters are as follows:

| PB-36 | VSF1 | Low frequency vibration suppression frequency (1) | Communication address: 0148H 0149H |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | P / Msc | |
| | Unit | 0.1 Hz | |
| | Configuration range | 10 ~ 1000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

The first set of low frequency vibration suppression filter frequency setting parameters, if PB-37 is set to 0, the first group of low frequency vibration suppression filters is turned off.

| PB-37 | VSG1 | Low frequency vibration suppression gain (1) | Communication address: 014AH 014BH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | P / Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 9 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

The first set of low-frequency vibration suppression filter gain setting parameters, the larger the gain value, the better the effect of suppressing vibration, but the excessive setting value tends to make the motor run poorly. It is recommended that the set value be gradually increased from small to small.

| PB-38 | VSF2 | Low frequency vibration suppression frequency (2) | Communication address: 014CH 014DH |
|---|---|---|---|
| | Initial value | 1000 | |
| | Control mode | P / Msc | |
| | Unit | 0.1 Hz | |
| | Configuration range | 10 ~ 1000 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

The second set of low frequency vibration suppression filter frequency setting parameters, if PB-39 is set to 0, the second group of low frequency vibration suppression filters is turned off.

| PB-39 | VSG2 | Low frequency vibration suppression gain (2) | Communication address: 014EH 014FH |
|---|---|---|---|
| | Initial value | 0 | |
| | Control mode | P / Msc | |
| | Unit | - | |
| | Configuration range | 0 ~ 9 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

The second set of low-frequency vibration suppression filter gain setting parameters, the larger the gain value, the better the effect of suppressing vibration, but the excessive setting value tends to make the motor run poorly. It is recommended that the set value be gradually increased from small to small.

# 7.4. Torque mode

The torque mode for control (T or Tn) is used for the device requiring torque control, such as the printing machine and coil winding machine...etc. Two modes for command input are available for the drive, which are the analog and register input.

The input of analog command is used to manipulate the torque performance of motor through the external voltage. As for the register input, the data of the internal parameter (PA-03~PA-05) is treated as the torque command.

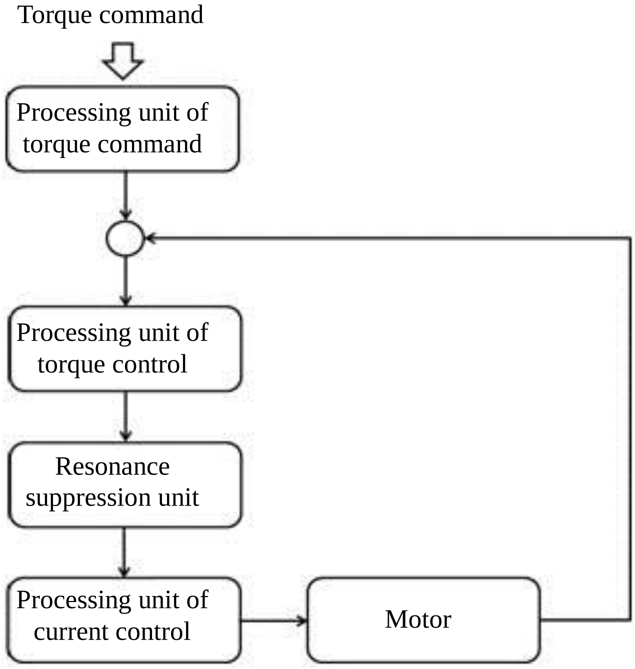
## 7.4.1. Selection of torque command

The source of the torque command can be divided into the analog voltage input externally and the internal parameter. The selection depends on the DI signal of CN1. Refer to the table below:

<table>
<tr><th rowspan="2">Torque command no.</th><th colspan="2">DI signal of CN1</th><th rowspan="2" colspan="3">Command Source</th><th rowspan="2">Contents</th><th rowspan="2">Scope</th></tr>
<tr><th>TCM1</th><th>TCM0</th></tr>
<tr><td rowspan="2">T1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">Mode</td><td>T</td><td>External analog command</td><td>Voltage difference between T-REF and GND</td><td>-10 V ~ +10V</td></tr>
<tr><td>Tn</td><td>None</td><td>The torque command is 0.</td><td>0</td></tr>
<tr><td>T2</td><td>0</td><td>1</td><td rowspan="3" colspan="3">Parameter of internal register</td><td>PA-03</td><td>-300.0% ~ 300.0%</td></tr>
<tr><td>T3</td><td>1</td><td>0</td><td>PA-04</td><td>-300.0% ~ 300.0%</td></tr>
<tr><td>T4</td><td>1</td><td>1</td><td>PA-05</td><td>-300.0% ~ 300.0%</td></tr>
</table>

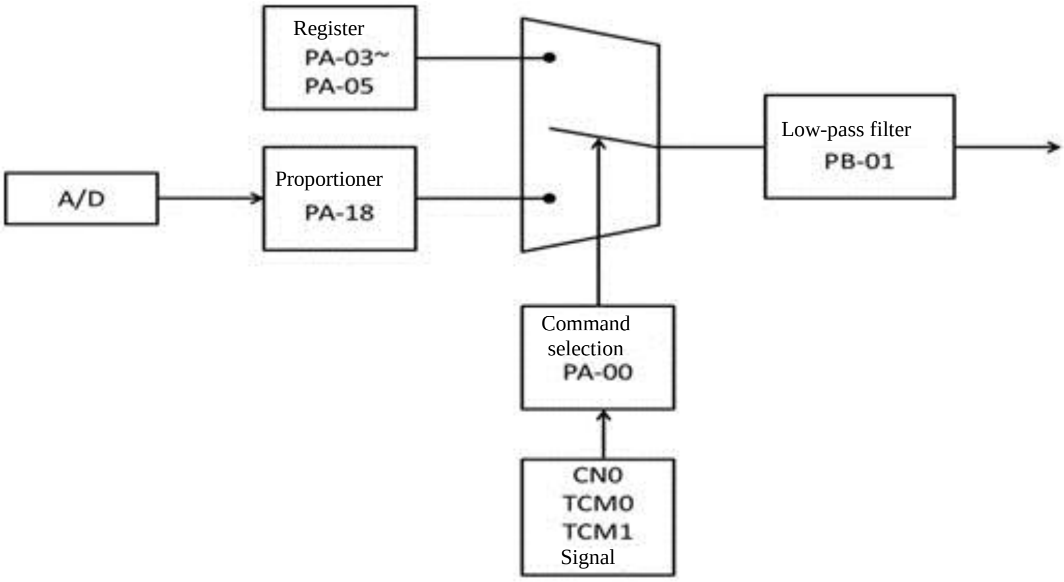
- TCM0 ~ TCM1 status: 0 represents open circuit (Open) and 1 represents close circuit (Close).
- In the situation that TCM0=TCM1=0, the command is 0 if the mode is Tn. Therefore, if the user does not need to use the analog voltage as the torque command, he or she may adopt Tn Mode to make sure that the analog voltage is without zero drift. For T Mode, the command is the analog voltage difference between T-REF and GND. The voltage range input is -10V ~ +10V. The torque corresponding to the voltage is adjustable (PA-18).
- If either TCM0 or TCM1 is not 0, the torque command is the internal parameter. The command is effective right after the change of TCM0 ~ TCM1 and CTRG is not needed for triggering. The torque command discussed in this section can be treated as the torque command under the torque mode (T or Tn). It can also be input as the command of torque limit under the speed mode (S or Sn).

## 7.4.2. Control structure of the torque mode




The diagram above illustrates the basic control structure of torque. The processing unit of torque command selects the source of torque command based on 7.4.1. The selection includes the size of command represented by the analog voltage set by the proportioner (PA-18), as well as the smoothing of the torque command. The torque control unit manages the gain parameter of the drive and computes the magnitude of the current supplied to the motor promptly.

The following chart shows the structure diagram regarding the processing unit of torque command.



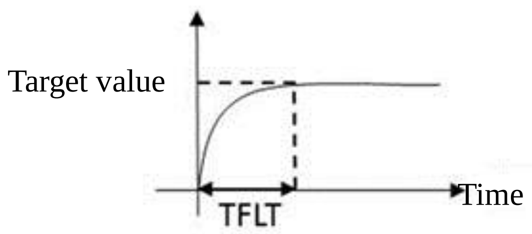
The path above is the command of internal register and the one below is the external analog command. The selection is based on the TCM0 and TCM1 statuses and PA-00 (T or Tn). The proportioner can be used to adjust the torque size represented by the analog voltage command. The low-pass filter may be applied to ensure smooth response of the command signal.

### 7.4.3. Smoothing of torque command

Relevant parameters:

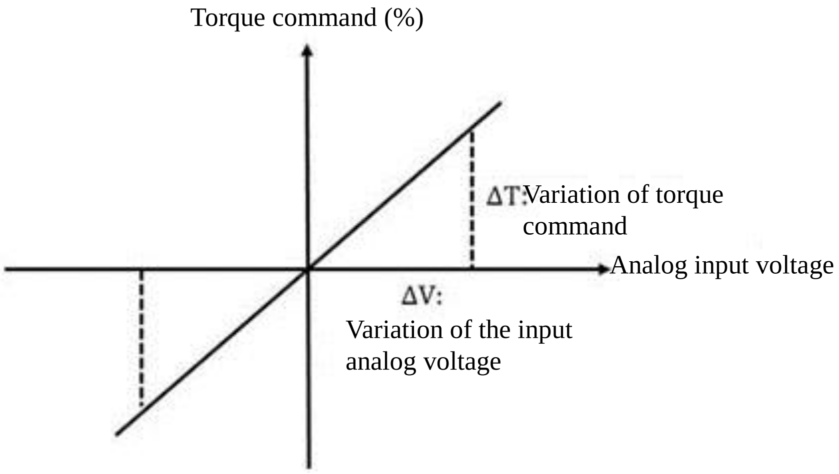
| PB-01 | TFIL | Smoothing constant of the analog torque command | Communication address: 0102H 0103H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | T |
| | Unit | ms |
| | Configuration range | 0 ~ 1000 (0: The function is turned off.) |
| | Data size | 16bit |
| | Data format | Dec |




### 7.4.4. Proportioner at the analog command end

The torque command of motor is controlled by the analog voltage difference between T_REF and GND. The slope and range of torque control is adjusted by adapting to the proportioner of Internal Parameter PA-18.



| PA-18 (S-off) | CTM | Limited maximum output of the analog torque | Communication address: 0024H 0025H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 300 |
| | Data size | 16bit |
| | Data format | Dec |

Maximum output of the analog torque command:

In the torque mode, this indicates the setting of the torque while the maximum voltage (10V) is input for the analog torque command.

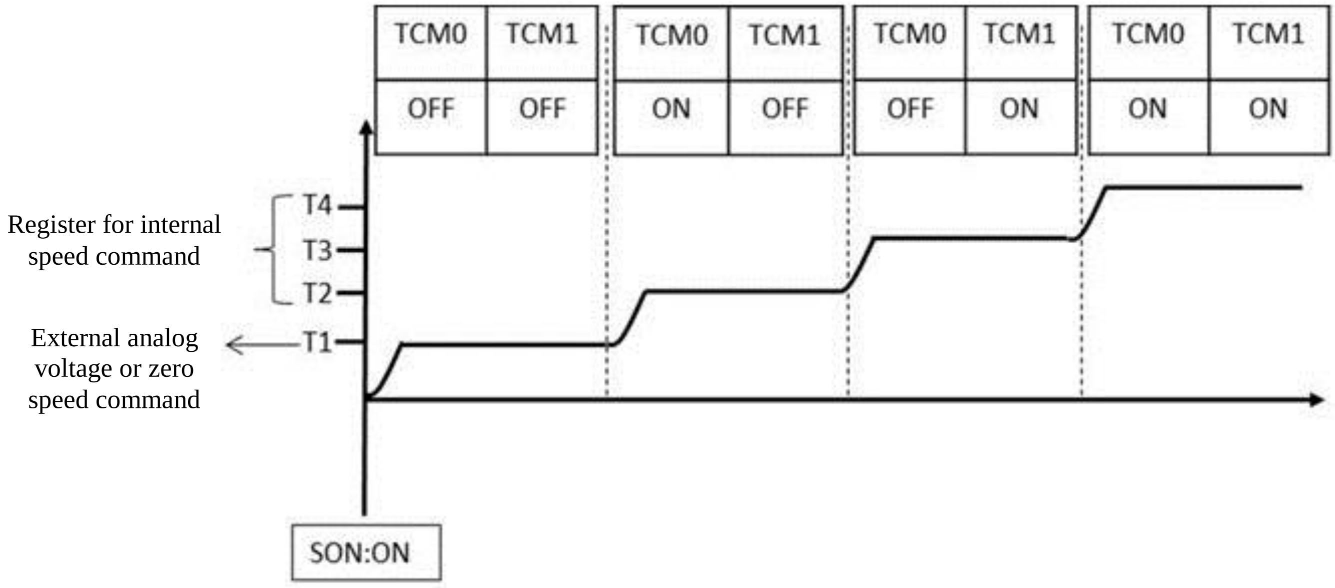
If the initial value is set to 100 and 10 V is input for external voltage, the torque control command is 100% rated torque. 5V implies that the torque control command is 50% rated torque.

Torque control command = Input voltage value x Set value/10 (%)

In the speed and position modes, the parameter represents the command for analog torque limit.

Torque limit command = Input voltage value x Set value/10 (%)

### 7.4.5. Timing diagram of torque mode




- OFF represents open circuit (Open) and ON represents close circuit (Close).
- For Tn Mode, Torque Command T1=0. For T Mode, Torque Command T1 is the analog voltage of external input.
- After Servo On, the command is selected based on the status of TCM0~TCM1.

### 7.4.6. Mixed mode

Besides the single operating mode, the drive also provides the mixed mode.

1) Speed/position mixed mode (P-S)
2) Speed/torque mixed mode (S-T)
3) Torque/position mixed mode (P-T)

| Mode name | Mode code | Mode number | Description |
|---|---|---|---|
| Mixed mode | P-S | 05 | P and S can be switched via the DI signal S_P. |
| | P-T | 06 | P and T can be switched via the DI signal T_P. |
| | S-T | 07 | S and T can be switched via the DI signal S_T. |

The mixed mode consisting of Sn and Tn is not available. To prevent the mixed mode from occupying DI input points, the signal for external analog voltage can be used as the command under the speed and torque modes. Therefore, the use of DI (SPD0 and SPD1 or TCM0 and TCM1) can be reduced.

The default DI/DO signal indicates the relationship between the DI/DO signal and pin right after the mode selection.

### 7.4.7. Position/speed mixed mode

P-S position command comes from the pulse input externally. The speed command can be the external analog voltage or internal parameter (PA-14 ~ PA-15) setting. The S-P signal controls the switching of the speed/position mode.

### 7.4.8. Position/torque mixed mode

P-T position command comes from the pulse input externally. The torque command can be the external analog voltage or internal parameter (PA-03 ~ PA-05) data. The T-P signal controls the switching of the torque/position mode.

### 7.4.9. Speed/torque mixed mode

The only mode available is S-T Mode. The speed command can come from the external analog voltage or internal parameter (PA-14～PA-16) data. The mode is selected through SPD0~SPD1. Similarly, the torque command can come from the external analog voltage or internal parameter (PA-03～PA-05) data. The mode is selected through TCM0~TCM1. The S-T signal controls the switching of the speed/torque mode.

In the torque mode (S-T set to ON), the torque command is selected via TCM0 and TCM1. The torque command is selected via SPD0 and SPD1 after switchover to the speed mode (S-T set to OFF). The motor rotates by following the rotation speed in the command immediately. After S-T is turned on, the speed mode returns to the torque instantly. For the relationship between the DI signal in each mode and the selected command, refer to the description in the chapter for each single mode.

### 7.4.10 MSC/Position mixed mode

The Msc-P position command can come from the external pulse wave and the internal Msc command. In this mode, the home position return can be used in the position mode. If you do not choose to perform the home position return first or use the DisOrg parameter setting, the home position return will not be performed (PC- 18=1), the MSC command cannot be used. The MSC/Position mode switching is controlled by the MSC-P signal.

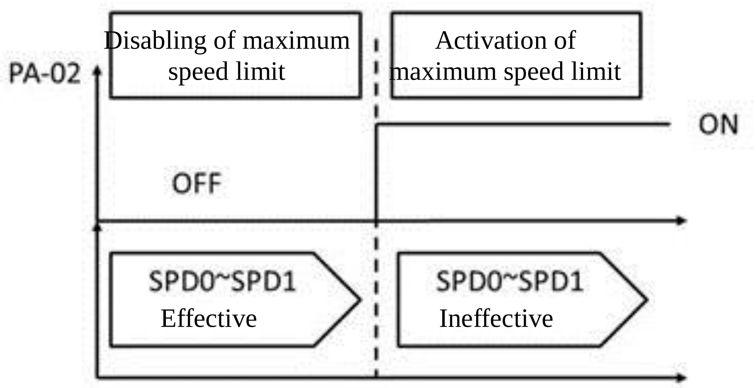
### 7.4.11 MSC/Speed mixed mode

The Msc-S position command comes from the internal Msc command. The speed command can be the external analog voltage or the internal parameter (PA-14 ~ PA-15). In this mode, the return-to-origin can only be used when the DI is switched to the MSC mode. Use, if you do not choose to perform home position return first or use the DisOrg parameter setting to not perform home position return (PC-18=1), the MSC command cannot be used. The MSC/speed mode switching is controlled by the MSC-S signal.

# 7.5. Others

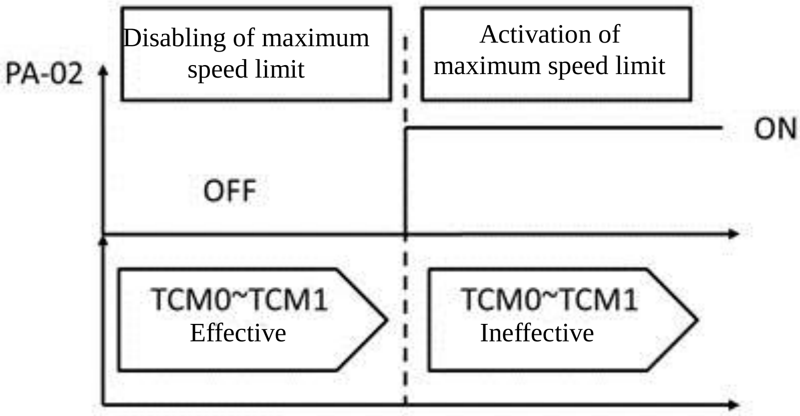
## 7.5.1. Use of the speed limit

In the position, speed, torque and other modes (if available), the maximum speed limit is restricted by the internal parameter PA-07. The speed limit and command can be passed down in the same way, which is through the external analog voltage or internal parameter (PA-14~PA-16). Refer to 7.3.1. The speed limit is only allowed in the torque mode and it is used to restrict the motor rotation speed. If the external analog voltage is adopted for the torque command, extra DI signals are available. These signals can be regarded as SPD0~SPD1 and utilized to select the speed limit command. If number of DI signals is insufficient, the speed limit command can also be input via the analog voltage. The speed limit is activated when PA-02 us set to 1. The following shows the diagram:




## 7.5.2. Use of the torque limit

The speed limit and command can be passed down in the same way, which is through the external analog voltage or internal parameter (PA-03~PA-05). Refer to 7.4.1. The speed limit is effective in the position or speed mode and it is used to restrict the motor torque output. If the external pulse is adopted for the position command or the external analog voltage is adopted for the speed mode, extra DI signals are available. These signals can be regarded as TCM0~TCM1 and utilized to select the torque limit command. If number of DI signals is insufficient, the torque limit command can also be input via the analog voltage. The speed limit is activated when PA-02 us set to 1. The following shows the diagram:




### 7.5.3. Analog monitoring

The drive provides two analog channels. The user observes the drive status needed through analog monitoring.

| PD-22 | VMON | Analog output monitoring | Communication address: 032CH 032DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 01 |
| | Control mode | ALL |
| | Unit | N/A |
| | Configuration range | 00 ~ 0x55 |
| | Data size | 16bit |
| | Data format | Hex |

| PD-28 | VMR1 | Ratio for MON1 analog monitoring output | Communication address: 0338H 0339H |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

| PD-29 | VMR2 | Ratio for MON2 analog monitoring output | Communication address: 033AH 033BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 100 |
| | Control mode | ALL |
| | Unit | % |
| | Configuration range | 0 ~ 100 |
| | Data size | 16bit |
| | Data format | Dec |

| PD-39 | AOUT | Setting for the polarity of the pulse output for the detector | Communication address: 034AH 034BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | |
| | Control mode | |
| | Unit | |
| | Configuration range | |
| | Data size | |
| | Data format | |

### 7.5.4. Use of the electromagnetic brake

| PC-21 | BTOD | Turn-on delay time for the electromagnetic brake | Communication address: 022AH 022BH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | ms |
| | Configuration range | 0 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

Parameter function: It sets the time delayed from the the time servo is activated to the time that the interlock signal of the electromagnetic brake (DO code 0x07, BREAK) is turned on.

| PC-22 | BTCD | Turn-off delay time for the electromagnetic brake | Communication address: 022CH 022DH |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 0 |
| | Control mode | ALL |
| | Unit | ms |
| | Configuration range | -1000 ~ 1000 |
| | Data size | 16bit |
| | Data format | Dec |

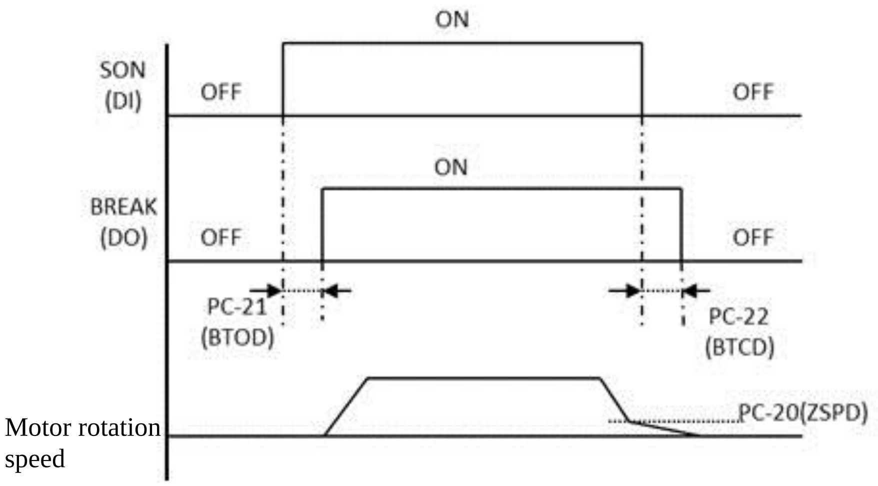
Parameter function: It sets the time delayed from the the time servo is ready and turned off to the time that the interlock signal of the electromagnetic brake (DO code 0x07, BREAK) is turned off. (Refer to 7.5.4 for the use of the electromagnetic brake.)

1) When the BTCD delay time is not over and the motor rotation speed is below the one for PC-20, the interlock signal of the electromagnetic brake (BREAK) is turned off.
2) When the BTCD delay time is over and the motor rotation speed is above the one for PC-20, the interlock signal of the electromagnetic brake (BREAK) is turned off.
3) If the Alarm or EMGS occurs causes the servo to be turned off, the negative value of BTCD will not become effective if a negative value is assigned to BTCD. This is equivalent to the situation that BVCD is set to zero.

### 7.5.5. Use of the electromagnetic brake

For the electromagnetic brake by the drive, (1) BREAK is set to OFF. In this case, the electromagnetic brake is inoperative and the motor is under the machinery lockout condition. (2) BREAK is set to ON. In that case, the electromagnetic brake is in operation and the motor rotates freely. The operation of electromagnetic brake can be divided into two types below. The user uses the parameter BTOD (PC-21) and BTCD (PC-22) to set relevant delay. Usually the electromagnetic brake is used for Z-axis direction to prevent high quantity of heat generated by high resistance created continuously by the servo motor. Such heat would cause the shortening of motor lifetime. For this device, the electromagnetic motor can only be activated after the servo is off to avoid malfunctions. In the situation that the electromagnetic brake is manipulated by the user, it can only be activated during braking. Therefore the braking force of the electromagnetic brake and the motor would be in the same direction. The drive operation becomes normal because it is less likely to require the intervention from the braking force of the electromagnetic brake. During acceleration or deceleration, the drive generates higher current to overcome the braking force of the electromagnetic brake. The alarm for overload protection could be triggered.

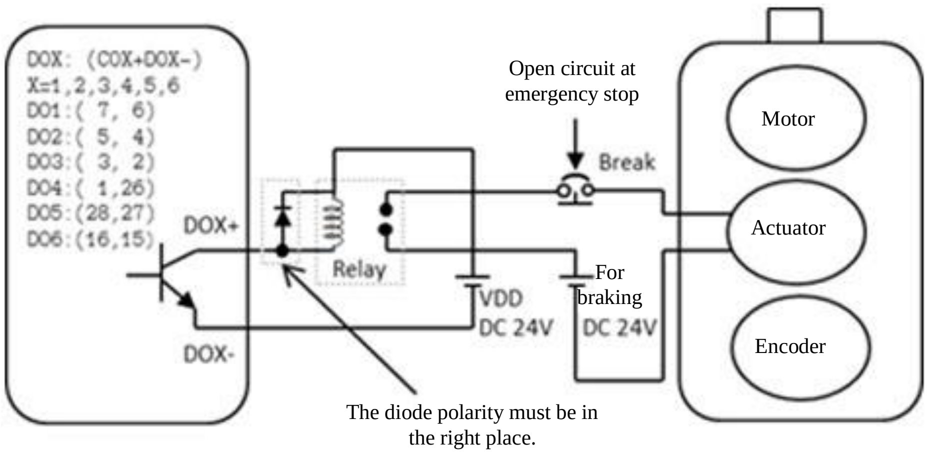
Time diagram of the control on electromagnetic brake:




Explanation regarding the timing for BREAK output:

1. After the servo is off, the motor rotation speed might be still over the one set in PC-20 after the time set the in PC-22 has elapsed. In this case, BREAK is OFF (electromagnetic brake lockout).

2. After the servo is off, the motor rotation speed might go below the one set in PC-20 even before the time set the in PC-22 has elapsed. In this case, BREAK is OFF (electromagnetic brake lockout).

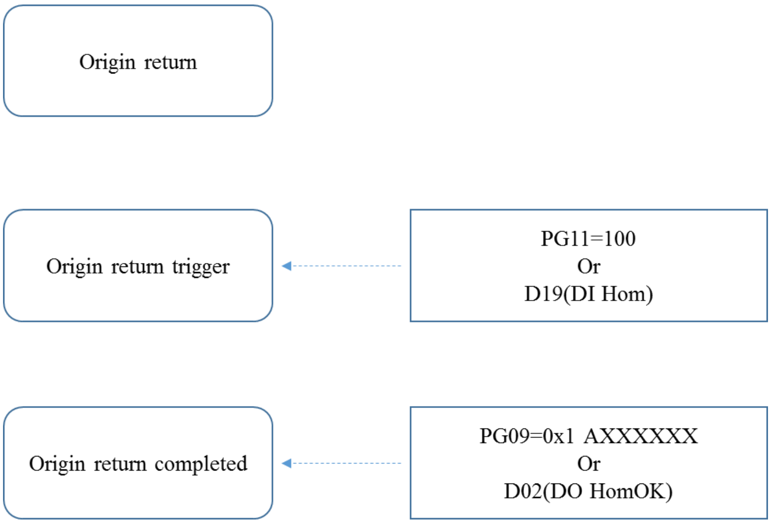


## 7.6. Msc mode

Motion Sequency Control provides simple motion trajectory planning and timing control to reduce the burden on the PLC and the host computer, thereby reducing system integration cost and complexity. Msc main functions can be divided into three categories: origin return, Msc motion planning instructions and electronic cam. The following are the various function settings and behaviors.

### 7.6.1. Return to origin

The origin return provides the user to quickly establish the Msc motion coordinate system to facilitate the path planning of the Msc command. Therefore, the user must first use the origin return to establish the starting point of the motion, as shown in the following figure, the driver controls and if the origin return is not completed. The Msc command cannot be executed. The main function of the return-to-origin is set as shown in the following table:




| | | | |
|---|---|---|---|
| PG-00 | bit00 ~ bit03 mode:<br>Forward PL limit, reverse NL limit, positive origin Org, reverse origin, current position<br>bit04 ~ bit07 trigger:<br>Rising edge/falling edge trigger<br>bit08 ~ bit11 limit:<br>Jump after the limit trigger ALM / automatic carriage return (only for the origin and current position as the origin reference) | | |
| PG-01 | High speed setting（10 ~ 2000 rpm） | PG-06 | Low speed deceleration time（1 ~ 500 ms） |
| PG-02 | Low speed setting（1 ~ 400 rpm） | PG-07 | Find the Z direction and the number of times:<br>1. 0 does not find Z<br>2. positive value to find Z<br>3. Negative value carriage return to find Z (±10000) |
| PG-03 | High speed acceleration time（1 ~ 10000 ms） | PG-08 | Origin definition（±2147483647） |
| PG-04 | High speed deceleration time（1 ~ 10000 ms） | PG-09 | Encoder reading and reset status after reset (read only) |
| PG-05 | Low speed acceleration time（1 ~ 500 | PG-10 | Emergency stop deceleration time after limit trigger (1 ~ 50 ms) |

| | | | |
|---|---|---|---|
| | ms ) | | |

According to the original point of use, refer to the left and right limit signals, the origin signal and the current position, and find the system origin according to the Z setting. For the convenience of description, the definition behavior is as follows:

Case01: The starting position is in front of the reference signal

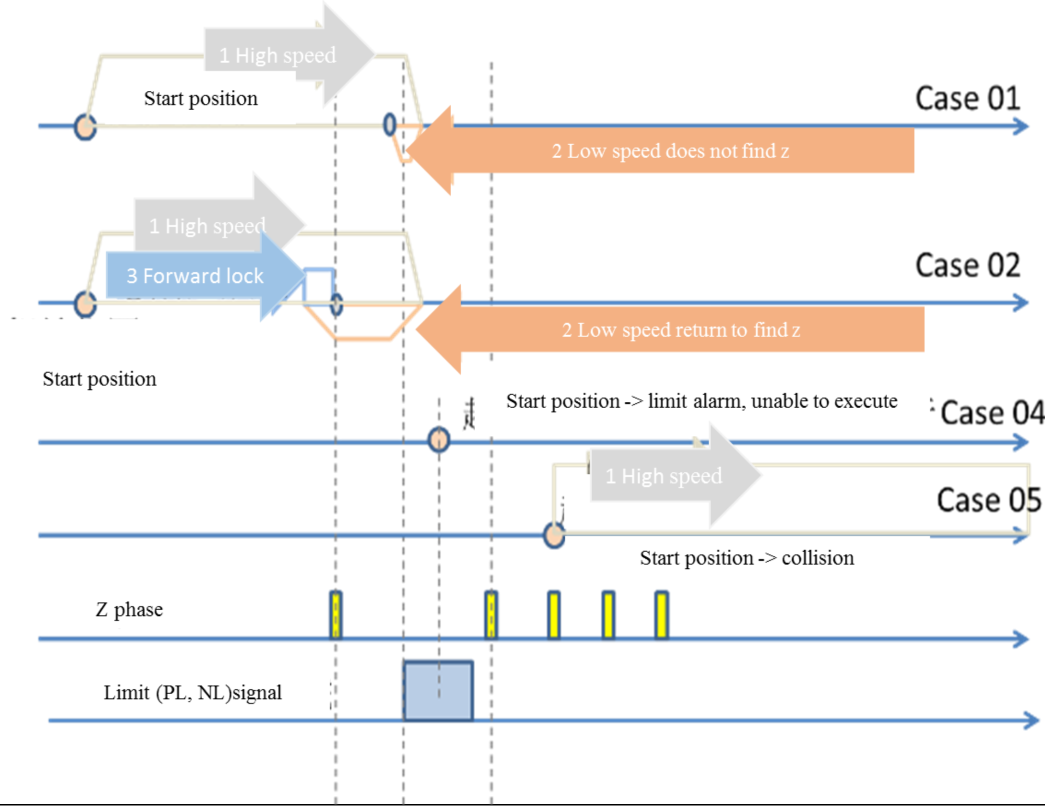
Case02: Start position in front of the reference signal and press Enter to find Z phase

Case03: Start position in front of the reference signal and proceed to find Z phase

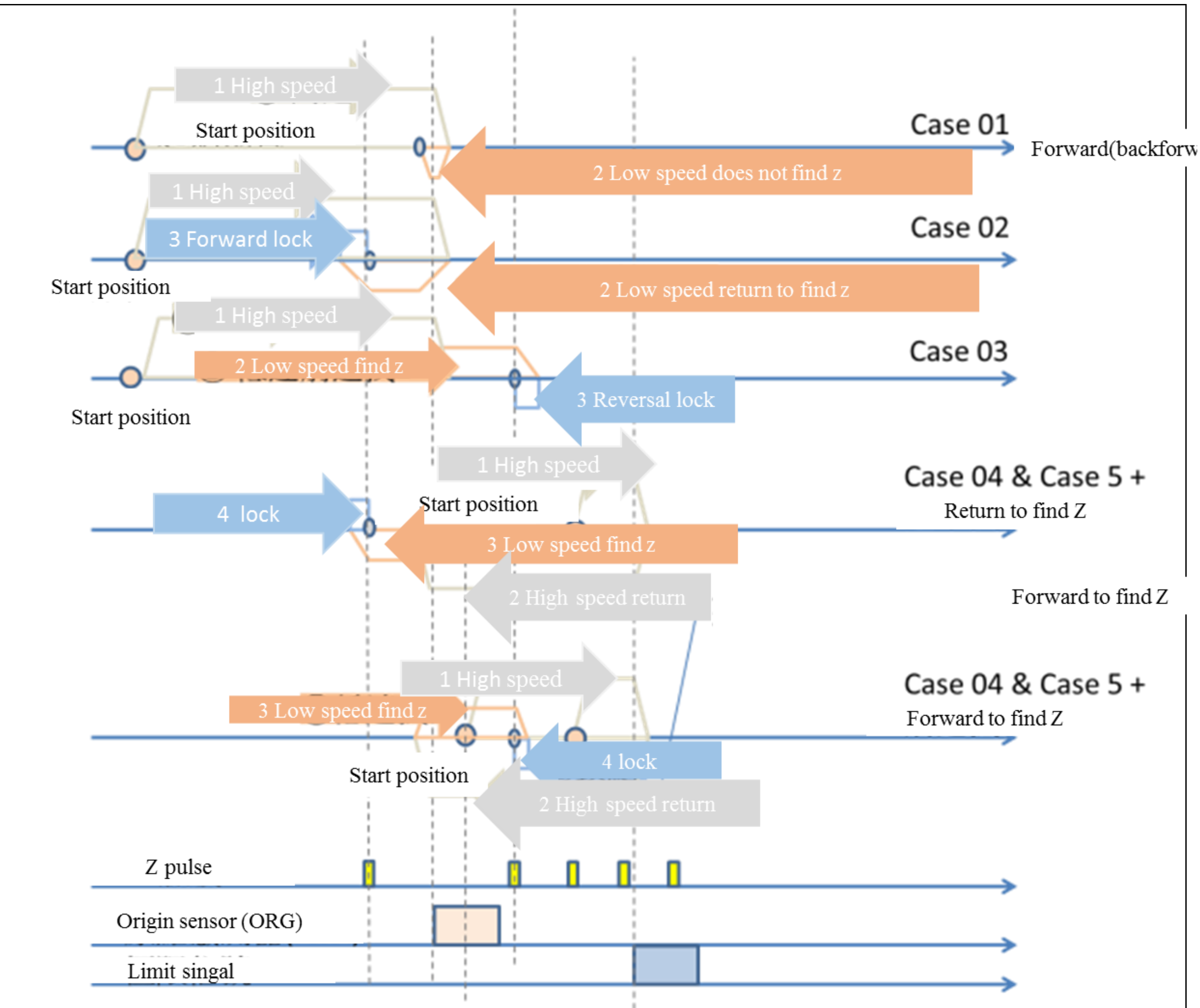
Case04: The starting position is in the reference signal

Case05: The starting position is behind the reference signal

The reset process can be summarized in several steps: 1 high-speed collision reference signal 2 low speed find Z, no Z, low speed search signal edge 3 find Z and error correction lock point, the specific behavior is as follows:

<table>
<tr><td rowspan="2">Limit (PL, NL) as the origin</td><td>
</td></tr>
<tr><td>When using the limit signal for reversion reference, the system control must not perform the forward looking Z phase (case03). The system first moves to the limit signal at the high speed speed, hits the reference signal and then cuts the low speed, and looks for the Z mode to advance or enter. During the acceleration/deceleration setting, the deceleration is performed according to the acceleration/deceleration settings of each segment. It should be noted that when the starting point is case05, it will cause a collision. In addition, when the limit signal is used as the origin reference, the deceleration time of the high and low speed sections is decelerated with the set value of PG-10 to reduce the deceleration time and lead to collision.<br><br>In addition, when the system is reset, the system will do the limit wiring check. If the NL alarm is triggered in the forward direction, the system will stop and display the limit alarm.</td></tr>
</table>

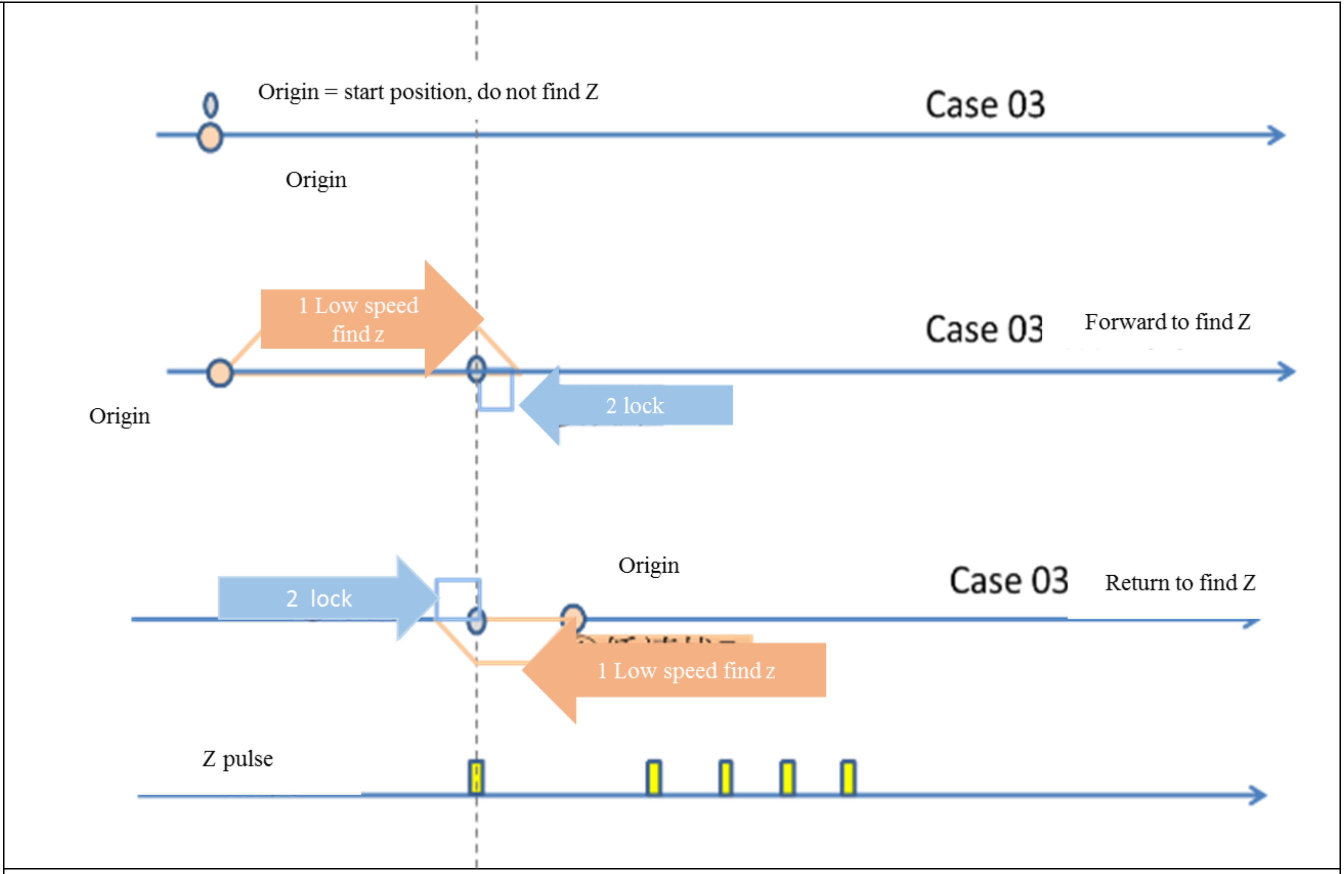
Origin signal




When using the reset reference, the system first moves to the origin signal at the high speed speed, hits the reference signal and then cuts the low speed, and seeks Z to advance or enter. During the acceleration and deceleration, the acceleration and deceleration settings are performed according to the acceleration and deceleration settings. slow down. When the starting position is at the origin signal or behind (case04, 05), and the PG-00 limit is set to 0, the automatic carriage return is started, and the PG-00 reverse setting is used to find the edge of the origin signal. The figure above is PG- The behavior of 00 reversal = 0, originally looking for the origin signal and the carriage return to find Z, after the impact limit, become the origin of the origin signal and forward to find Z, the advantage of this method is in the origin signal regardless of the starting position Before or after, the same location will be found as the system origin. For example, case02 and case 04~05 + carriage return to find Z, the two sets of settings are the same, but the starting position is in front of, before and after the origin signal, but the same position is locked as the system origin.

In addition, when the system is reset, the system will do the limit wiring check. If the NL alarm is triggered in the forward direction, the system will stop and display the limit alarm.

Current position as origin




When using the current position for the origin return reference, if you do not find Z, you will use the current position as the origin. If you find Z, you will find Z operation at low speed. If you hit the limit signal when you find Z, you will jump directly. Limit alarm, this mode does not provide the limit automatic carriage return function.

### 7.6.2. Return to origin - Execution trigger

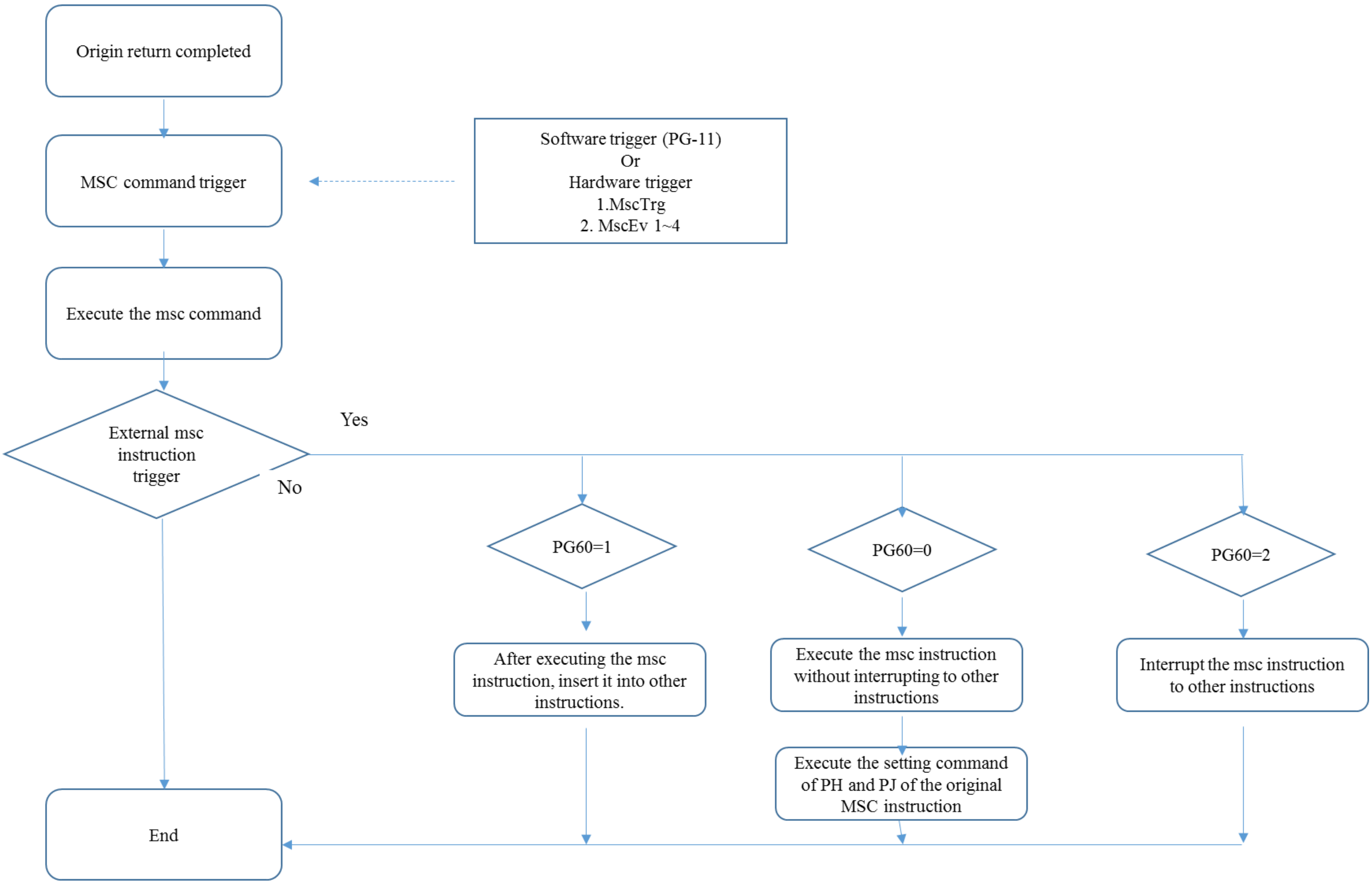
The home position return currently provides two ways for the user to trigger the program. When the input PG-11 = 100 and DI Hom, the priority is triggered by the first trigger. When the return-to-origin is completed, the system provides the following two ways to inform the user:

Monitoring parameter PG-09: The highest meta-area value shows 0x1A as the beginning. Example: If the motor encoder reads 2 pulses after the return of the origin, PG-09 = 0x1A000002.

DO HomOK: When the return-to-origin is completed, DO HomOK is ON (the specific output level is mainly set by PC parameters).

### 7.6.3. Msc Motion Planning - Command Description

After the return of the origin is completed, the user inputs the Msc command according to the motion track requirement by using the PH and PJ parameters, and uses the PG parameter to set the command source and the trigger mode. The flow chart is as shown in the following figure. The main parameter setting contents are organized as follows:


Origin return completed
MSC command trigger
Software trigger (PG-11)
Or
Hardware trigger
1.MscTrg
2. MscEv 1~4
Execute the msc command
External msc instruction trigger
Yes
No
PG60=1
PG60=0
PG60=2
After executing the msc instruction, insert it into other instructions.
Execute the msc instruction without interrupting to other instructions
Interrupt the msc instruction to other instructions
Execute the setting command of PH and PJ of the original MSC instruction
End

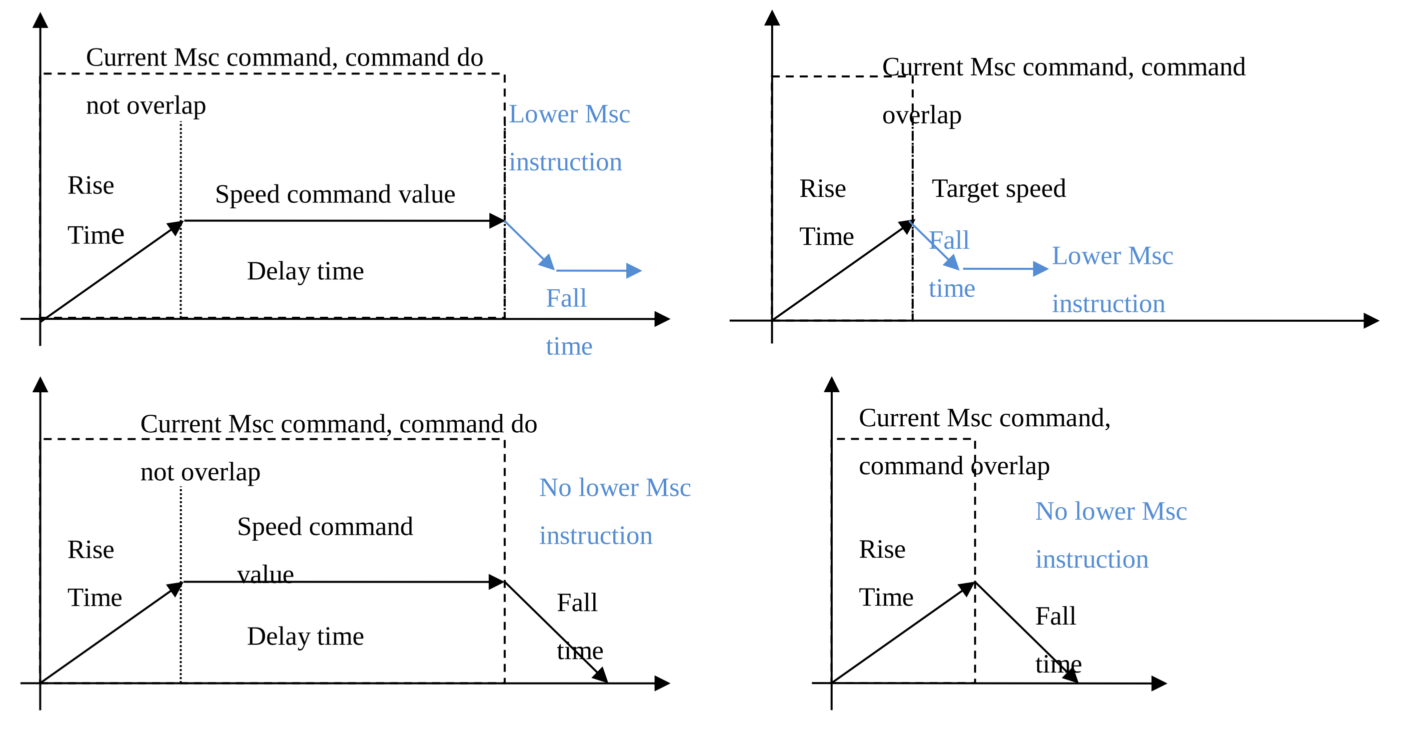
<table>
<tr><td>16 bit parameter</td><td colspan="8">bit15 ~ bit00</td></tr>
<tr><td>PG-60</td><td colspan="8">Set the external interrupt mode: 0x00 is not interrupted, 0x01 is not interrupted, 0x02 is immediately interrupted</td></tr>
<tr><td>PG-61 ~ 75</td><td colspan="8">Set the instruction number of the DI MscNo1 ~ 4 status map (setting 1 ~ 68, 0 = no trigger)</td></tr>
<tr><td>PG-76 ~ 79</td><td colspan="8">When the upper edge and the lower edge of DI Ev1 ~ Ev4 are triggered, the instruction number is executed (1~68.1 ~ 68, 0 = no trigger)</td></tr>
<tr><td>PG-80</td><td colspan="8">Total travel of the indexing coordinates (PUU)</td></tr>
<tr><td>32 bit parameter</td><td>bit31~ bit28</td><td>bit27~ bit24</td><td>bit23~ bit20</td><td>bit19~ bit16</td><td>bit15~ bit12</td><td>bit11~ bit08</td><td>bit07~ bit04</td><td>bit03~ bit00</td></tr>
<tr><td rowspan="9">PH-even<br>PJ-even<br>Such as PH-00</td><td rowspan="9">0x00 does not overlap<br>(delay effective)<br><br>0x01 can overlap<br>(Starting at the fixed speed and deceleration)</td><td>00<br>No command</td><td colspan="2" rowspan="9">Finished jump<br>↓ i0x00 stop<br>0xA0 sequential<br>0xB0 step<br>0x01~44 instruction<br>(No.1~68 instructions)</td><td rowspan="3">No function</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td>01<br>Constant speed PPS</td><td rowspan="8">Deceleration time<br>0x0~ 0xF</td><td rowspan="8">Acceleration time<br>0x0~ 0xF</td><td rowspan="8">Delay time<br>0x0~ 0xF</td></tr>
<tr><td>02<br>Constant speed RPM</td></tr>
<tr><td>03<br>Absolute Positioning</td><td rowspan="6">Target speed<br>0x0~ 0xF</td></tr>
<tr><td>04<br>Relatively Positioning</td></tr>
<tr><td>05<br>Increment Positioning</td></tr>
<tr><td>06<br>Forward Indexing</td></tr>
<tr><td>07<br>Reverse Indexing</td></tr>
<tr><td>08<br>shortcut Indexing</td></tr>
<tr><td>PH-odd<br>PJ-odd<br>Such as PH-01</td><td colspan="8">Actual command value<br>1. PH-00 is set to constant speed (PPS, RPM) and PH-01 is the speed command value.<br>2. PH-00 is set to positioning (absolute, relative, incremental), PH-01 is the position command value.<br>3. PH-00 is set to index (forward, reverse, shortcut), PH-01 is the position value in the index (≤ PG80).<br>4. PH-00 is set to no command, PH-01 has no effect, but still performs the jump operation according to PH-00 setting.</td></tr>
</table>

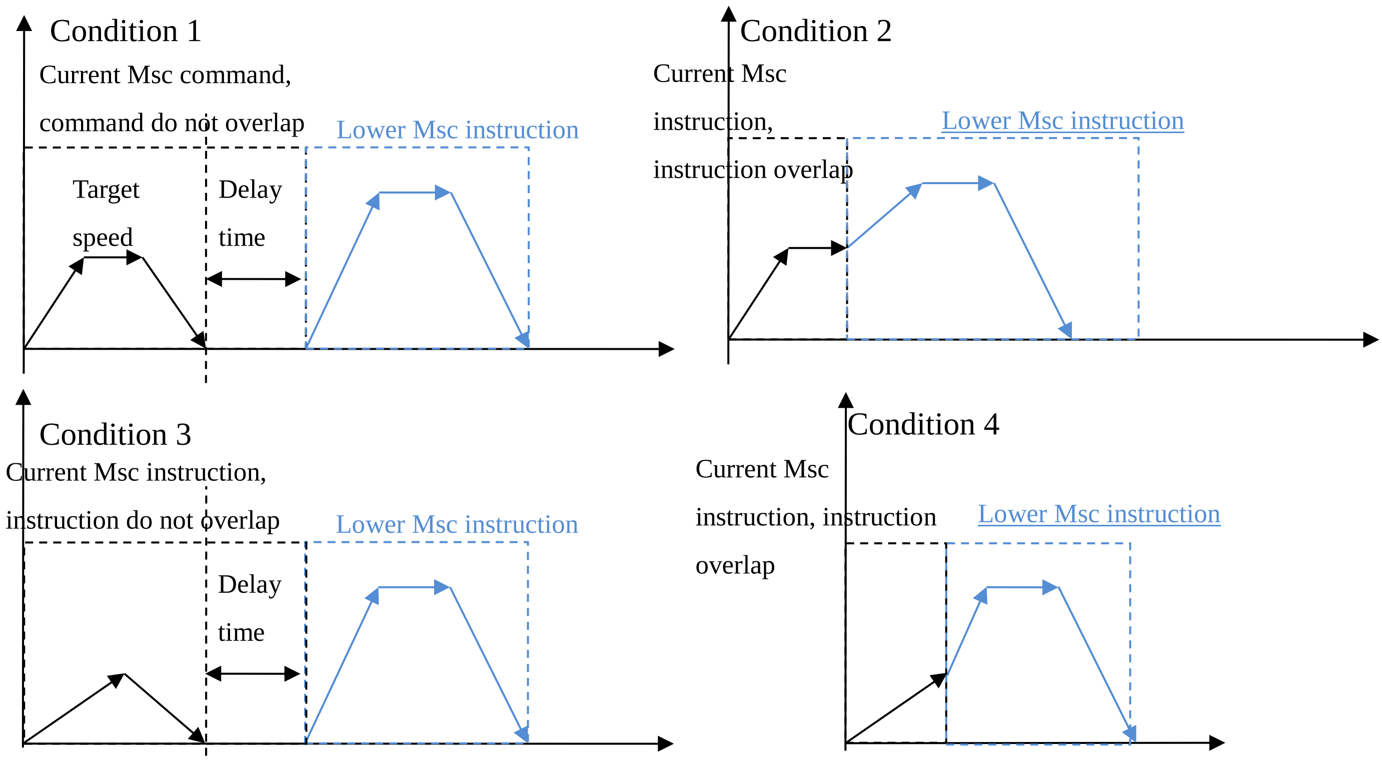
The Msc command configures two 32-bit meta-parameters to describe the command. The correspondence between the command number and the actual parameters is shown in the following table. There are a total of 68 commands:

| Msc command NO. | Mode setting | Actual command value |
|---|---|---|
| Msc No. 01 | PH-00 | PH-01 |
| Msc No. 02 | PH-02 | PH-03 |
| Msc No. 03~68 | PH, PJ-even | PH, PJ-odd |

The Msc command is mainly divided into four categories: no command, fixed speed, positioning and indexing, and can be mixed with unregulated conditions. In addition, all Msc commands are built in the PUU (user unit) system. Therefore, after Servo On, the system will force the lockdown ratio to be locked. Therefore, when the speed reduction ratio is not available in the Serc On mode, the DI can be switched to avoid the coordinate system being More action, it is recommended to determine the system reduction ratio before the return of the origin, improve the Msc stroke predictability. The specific behavior of each Msc instruction is described as follows:

Msc fixed speed command

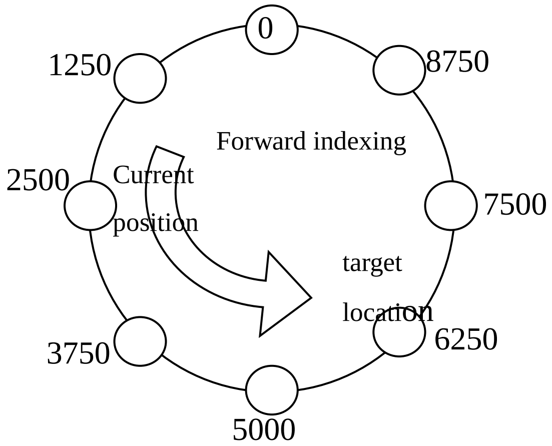


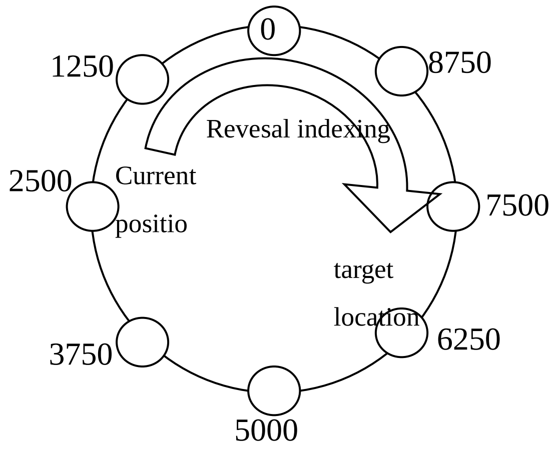
| | |
|---|---|
| | The Msc fixed speed command has two units: PPS and RPM. The former corresponds to the command value up to ±2147483647, and the latter is ±max speed (such as ±60000). Regardless of the unit description of the fixed speed command, the system converts to Servo On. The PUU is used to provide a rear position controller. In the fixed speed command, the instruction overlap and the delay time behavior are different as shown in the above figure. When the fixed speed command reaches the speed command value, the delay time is calculated (such as the upper left figure), but if the instruction content has the overlap function enabled, The next Msc command is switched immediately when the speed command value is reached (as in the upper right figure).<br><br>If the current Msc fixed speed command does not set the subsequent Msc command, the system uses the deceleration time defined by the current Msc command to decelerate (as shown in the lower left figure). In this case, if the overlap function is enabled, the delay time is canceled, and the system starts to decelerate after reaching the speed command value ( As shown in the lower right figure). |
| Msc 定位指令 |  |

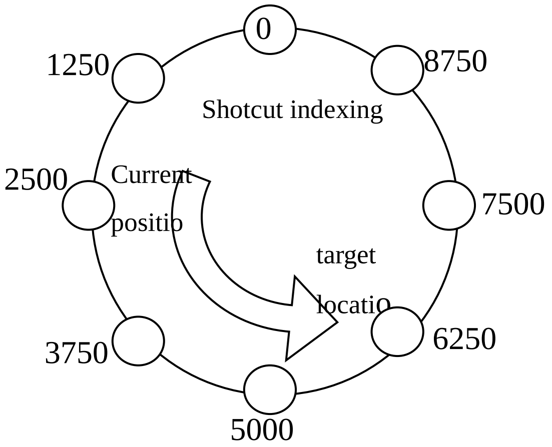
There are three types of Msc positioning instructions: absolute positioning instructions, relative positioning instructions and incremental positioning instructions. The command values can reach ±2147483647. The execution paths of each type of instructions are as follows:
Absolute positioning command: Calculate the difference between the absolute command and the current absolute position of the motor based on the origin coordinates established after the return of the origin. The displacement is executed as the command unit, unit PUU (user unit). Example: If the current absolute motor position = 2000, absolute command = 4000, the system displacement = 4000 - 2000 = +2000, motor target position = 4000.
Relative positioning command: The relative type command directly adds the command command value to the current position, so the relative type command value is equal to the system displacement of the command. Example: If the current absolute motor position = 2000, relative command = 4000, the system displacement = +4000, the motor target position = 6000.
Incremental positioning command: the target position of the previous Msc command, plus the incremental command command value, as the new motor target position, and calculate the required displacement amount from the current motor position. If the previous Msc command is a fixed speed command, the previous target position is forcibly set to 0. Therefore, it is recommended that the previous command of the incremental command be a positioning type command or no command. Example: If the current absolute motor position = 2000, the previous positioning command target position = 4000, the current incremental command = 4000, the motor target position = 4000 + 4000 = 8000, system displacement = 8000 – 2000 = +6000.
The system calculates the required displacement amount of the current positioning command according to the above principle, and performs motion planning with the set value of acceleration and deceleration, etc. (as shown in the above figure). According to the overlap of the command and the amount of displacement, the four main conditions of the above figure appear. When the displacement is enough to supply the path planning of the command (such as condition 1 and condition 2), the system controls the motor motion curve according to the set acceleration/deceleration time, delay time and overlap setting. When the overlap is enabled, the system will decelerate soon. Node, load the next Msc instruction (as in the case of the above situation), otherwise the next time the delay time is completed, the next Msc instruction is loaded (see situation 1 above). If the displacement is insufficient for the path planning of the command (such as situation 3 and condition 4), the system will determine the deceleration node according to the path residual amount and the required distance for deceleration, and use the overlap enable or not to determine whether or not to decelerate the node. Load the next Msc instruction (enable the overlap as shown in the third case above, disable the overlap as shown in Figure 4 above).

**Msc indexing command**

Indexing total stroke PG80=10000⇨




There are three types of Msc indexing commands: forward indexing, reverse indexing, and shortcut indexing. Each indexing instruction is limited by the total stroke (PG-84) when inputting, and the command attribute is absolute. Type, if the current position is 2500, the current Msc command target position is 6250, and the total division travel is 10000, then the execution path of each type of instruction is:

Forward indexing: The difference between the current position and the target is 6250 – 2500 = +3750, which is a positive value that matches the positive rotation index and defines the forward direction of motion. Therefore, the actual displacement of the system is +3750, and its behavior is as shown in the above figure. degree.

Reverse indexing: The current position and target difference is 6250 – 2500 = +3750, which is positive but the reverse direction is required to move in the reverse direction, so the actual displacement of the system is +3750 – 10000 = −6250, Its behavior is reversed as shown above.

Shortcut indexing: the current position and target forward deviation is 6250 – 2500 = +3750, and the reverse phase difference is 3750 – 10000 = −6250. Therefore, the system uses the shortest displacement of +3750 to move to the target position, and its behavior is as shown in the above figure. Indexing.

In addition to the difference between the calculation method of the indexing and the positioning type, the indexing command has the acceleration/deceleration time, the delay time and the overlap of the commands. In this respect, the behavior is consistent with the positioning line command, and this column is not described here.

### 7.6.4. Msc Motion Planning - Shared Information Group Description

In each type of Msc command mode setting parameter (PH, PJ-even number parameter), the data content of the lower 16-bit is mainly the shared data group number, and is mapped to the actual physical quantity by the number, and the relationship is as shown in the following table.

| Msc command setting NO. | Target speed | | | Deceleration time | | | Acceleration time | | | Delay time | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mapping | default | unit | mapping | default | unit | mapping | default | unit | mapping | default | unit |
| 0x0 | PG-44 | 1 | 0.1RPM | PG-12 | 1 | 1ms | PG-12 | 1 | 1ms | PG-28 | 0 | 1ms |
| 0x1 | PG-45 | 10 | 0.1RPM | PG-13 | 2 | 1ms | PG-13 | 2 | 1ms | PG-29 | 5 | 1ms |
| 0x2 | PG-46 | 30 | 0.1RPM | PG-14 | 4 | 1ms | PG-14 | 4 | 1ms | PG-30 | 10 | 1ms |
| 0x3 | PG-47 | 50 | 0.1RPM | PG-15 | 6 | 1ms | PG-15 | 6 | 1ms | PG-31 | 20 | 1ms |
| 0x4 | PG-48 | 70 | 0.1RPM | PG-16 | 8 | 1ms | PG-16 | 8 | 1ms | PG-32 | 30 | 1ms |
| 0x5 | PG-49 | 100 | 0.1RPM | PG-17 | 10 | 1ms | PG-17 | 10 | 1ms | PG-33 | 50 | 1ms |
| 0x6 | PG-50 | 300 | 0.1RPM | PG-18 | 20 | 1ms | PG-18 | 20 | 1ms | PG-34 | 70 | 1ms |
| 0x7 | PG-51 | 500 | 0.1RPM | PG-19 | 40 | 1ms | PG-19 | 40 | 1ms | PG-35 | 100 | 1ms |
| 0x8 | PG-52 | 700 | 0.1RPM | PG-20 | 60 | 1ms | PG-20 | 60 | 1ms | PG-36 | 200 | 1ms |
| 0x9 | PG-53 | 1000 | 0.1RPM | PG-21 | 80 | 1ms | PG-21 | 80 | 1ms | PG-37 | 300 | 1ms |
| 0xA | PG-54 | 3000 | 0.1RPM | PG-22 | 100 | 1ms | PG-22 | 100 | 1ms | PG-38 | 500 | 1ms |
| 0xB | PG-55 | 5000 | 0.1RPM | PG-23 | 200 | 1ms | PG-23 | 200 | 1ms | PG-39 | 700 | 1ms |
| 0xC | PG-56 | 7000 | 0.1RPM | PG-24 | 400 | 1ms | PG-24 | 400 | 1ms | PG-40 | 1000 | 1ms |
| 0xD | PG-57 | 10000 | 0.1RPM | PG-25 | 600 | 1ms | PG-25 | 600 | 1ms | PG-41 | 2000 | 1ms |
| 0xE | PG-58 | 20000 | 0.1RPM | PG-26 | 800 | 1ms | PG-26 | 800 | 1ms | PG-42 | 3000 | 1ms |
| 0xF | PG-59 | 30000 | 0.1RPM | PG-27 | 1000 | 1ms | PG-27 | 1000 | 1ms | PG-43 | 5000 | 1ms |

### 7.6.5. Msc Motion Planning - command selection and triggering

When the system does not perform the return-to-origin, the control prohibits the execution of each type of Msc command. Therefore, before the Msc command is triggered, please perform the return-to-origin return to facilitate the system to establish the coordinate system. In principle, the incremental (or single-turn absolute) motor needs After each power-on, the origin is restored to establish coordinates. Multi-turn absolute motor because the encoder has the battery position after the battery memory is turned off, so after the first Msc command is executed, the original point is reset. If the machine structure and the encoder remanufacturing are not changed, the subsequent power transmission is completed. The Msc command can be directly triggered, and the user can observe the PG-86 status to see if the multi-turn absolute motor has completed the return-to-origin operation.

In the case of a multi-turn absolute motor, if the AL033 absolute position is lost, the AL035 absolute position lap overflow and the AL038 position (PUU unit) counter overflow occur, the system cannot maintain the coordinate integrity. Therefore, the Msc module will not be executed. If these alarms occur,

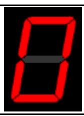
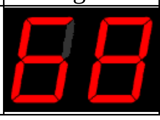
perform the home position return operation to rebuild the coordinate system.
The system provides software trigger (PG-11) and DI hardware trigger (MscTrg, MscEv1~4) for the user to trigger the Msc command to be executed. The specific trigger mode and command selection are as follows:
Software trigger (PG-11): When PG-11 = 1 ~ 68 input, the system starts triggering the corresponding Msc number command with the input value. For example, input 1 triggers the Msc number 1 command, and input 2 triggers the Msc number 2 command.
DI MscTrg hardware trigger: When DI MscTrg turns ON, the system triggers the selected Msc number command according to the 4 DI (MscNo1~4) state and the corresponding PG-61 ~ PG-75 setting value, DI MscNo and selected Msc number. The correspondence is described in the following table:

| DI function name | | | | | | DI state total value | PG parameters | MSC NO. |
|---|---|---|---|---|---|---|---|---|
| MscNo6 | MscNo5 | MscNo4 | MscNo3 | MscNo2 | MscNo1 | | | |
| OFF | OFF | OFF | OFF | OFF | OFF | 0 | No | No |
| OFF | OFF | OFF | OFF | OFF | ON | 1 | PG-61 | PG-61 setting · default = 1 |
| OFF | OFF | OFF | OFF | ON | OFF | 2 | PG-62 | PG-62 setting · default = 2 |
| OFF | OFF | OFF | OFF | ON | ON | 3 | PG-63 | PG-63 setting · default = 3 |
| OFF | OFF | OFF | ON | OFF | OFF | 4 | PG-64 | PG-64 setting · default = 4 |
| OFF | OFF | OFF | ON | OFF | ON | 5 | PG-65 | PG-65 setting · default = 5 |
| OFF | OFF | OFF | ON | ON | OFF | 6 | PG-66 | PG-66 setting · default = 6 |
| OFF | OFF | OFF | ON | ON | ON | 7 | PG-67 | PG-67 setting · default = 7 |
| OFF | OFF | ON | OFF | OFF | OFF | 8 | PG-68 | PG-68 setting · default = 8 |
| OFF | OFF | ON | OFF | OFF | ON | 9 | PG-69 | PG-69 setting · default = 9 |
| OFF | OFF | ON | OFF | ON | OFF | 10 | PG-70 | PG-70 setting · default = 10 |
| OFF | OFF | ON | OFF | ON | ON | 11 | PG-71 | PG-71 setting · default =11 |
| OFF | OFF | ON | ON | OFF | OFF | 12 | PG-72 | PG-72 setting · default =12 |
| OFF | OFF | ON | ON | OFF | ON | 13 | PG-73 | PG-73 setting · default = 13 |
| OFF | OFF | ON | ON | ON | OFF | 14 | PG-74 | PG-74 setting · default = 14 |
| OFF | OFF | ON | ON | ON | ON | 15 | PG-75 | PG-75 setting · default = 15 |
| OFF | ON | OFF | OFF | OFF | OFF | 16 | No | 16 |
| OFF | ON | OFF | OFF | OFF | ON | 17 | No | 17 |
| OFF | ON | OFF | OFF | ON | OFF | 18 | No | 18 |
| OFF | ON | OFF | OFF | ON | ON | 19 | No | 19 |
| OFF | ON | OFF | ON | OFF | OFF | 20 | No | 20 |
| OFF | ON | OFF | ON | OFF | ON | 21 | No | 21 |
| OFF | ON | OFF | ON | ON | OFF | 22 | No | 22 |
| OFF | ON | OFF | ON | ON | ON | 23 | No | 23 |

| DI function name | | | | | | DI state total value | PG parameters | MSC NO. |
|---|---|---|---|---|---|---|---|---|
| MscNo6 | MscNo5 | MscNo4 | MscNo3 | MscNo2 | MscNo1 | | | |
| OFF | ON | ON | OFF | OFF | OFF | 24 | No | 24 |
| OFF | ON | ON | OFF | OFF | ON | 25 | No | 25 |
| OFF | ON | ON | OFF | ON | OFF | 26 | No | 26 |
| OFF | ON | ON | OFF | ON | ON | 27 | No | 27 |
| OFF | ON | ON | ON | OFF | OFF | 28 | No | 28 |
| OFF | ON | ON | ON | OFF | ON | 29 | No | 29 |
| OFF | ON | ON | ON | ON | OFF | 30 | No | 30 |
| OFF | ON | ON | ON | ON | ON | 31 | No | 31 |
| ON | OFF | OFF | OFF | OFF | OFF | 32 | No | 32 |
| ON | OFF | OFF | OFF | OFF | ON | 33 | No | 33 |
| ON | OFF | OFF | OFF | ON | OFF | 34 | No | 34 |
| ON | OFF | OFF | OFF | ON | ON | 35 | No | 35 |
| ON | OFF | OFF | ON | OFF | OFF | 36 | No | 36 |
| ON | OFF | OFF | ON | OFF | ON | 37 | No | 37 |
| ON | OFF | OFF | ON | ON | OFF | 38 | No | 38 |
| ON | OFF | OFF | ON | ON | ON | 39 | No | 39 |
| ON | OFF | ON | OFF | OFF | OFF | 40 | No | 40 |
| ON | OFF | ON | OFF | OFF | ON | 41 | No | 41 |
| ON | OFF | ON | OFF | ON | OFF | 42 | No | 42 |
| ON | OFF | ON | OFF | ON | ON | 43 | No | 43 |
| ON | OFF | ON | ON | OFF | OFF | 44 | No | 44 |
| ON | OFF | ON | ON | OFF | ON | 45 | No | 45 |
| ON | OFF | ON | ON | ON | OFF | 46 | No | 46 |
| ON | OFF | ON | ON | ON | ON | 47 | No | 47 |
| ON | ON | OFF | OFF | OFF | OFF | 48 | No | 48 |
| ON | ON | OFF | OFF | OFF | ON | 49 | No | 49 |
| ON | ON | OFF | OFF | ON | OFF | 50 | No | 50 |
| ON | ON | OFF | OFF | ON | ON | 51 | No | 51 |
| ON | ON | OFF | ON | OFF | OFF | 52 | No | 52 |
| ON | ON | OFF | ON | OFF | ON | 53 | No | 53 |
| ON | ON | OFF | ON | ON | OFF | 54 | No | 54 |
| ON | ON | OFF | ON | ON | ON | 55 | No | 55 |
| ON | ON | ON | OFF | OFF | OFF | 56 | No | 56 |
| ON | ON | ON | OFF | OFF | ON | 57 | No | 57 |
| ON | ON | ON | OFF | ON | OFF | 58 | No | 58 |
| ON | ON | ON | OFF | ON | ON | 59 | No | 59 |
| ON | ON | ON | ON | OFF | OFF | 60 | No | 60 |

| DI function name | | | | | | DI state total value | PG parameters | MSC NO. |
|---|---|---|---|---|---|---|---|---|
| MscNo6 | MscNo5 | MscNo4 | MscNo3 | MscNo2 | MscNo1 | | | |
| ON | ON | ON | ON | OFF | ON | 61 | No | 61 |
| ON | ON | ON | ON | ON | OFF | 62 | No | 62 |
| ON | ON | ON | ON | ON | ON | 63 | No | 63 |

DI MscEv1~4 hardware trigger: When the MscEv1~4 status changes, the system triggers the selected Msc number command according to the corresponding PG-76~79 setting value. The correspondence between MscEv1~4 and the selected Msc number is described as follows:

| DI name | trigger | PG parameters | MSC NO. |
|---|---|---|---|
| MscEv1 | Rising edge | PG-76 | The two digits of the PG-76 higher set value (as shown below) |
| | Falling edge | PG-76 | The lower two digits of the PG-76 set value (as shown below) |
| MscEv2 | Rising edge | PG-77 | The two digits of the PG-77 higher set value (as shown below) |
| | Falling edge | PG-77 | The lower two digits of the PG-77 set value (as shown below) |
| MscEv3 | Rising edge | PG-78 | The two digits of the PG-78 higher set value (as shown below) |
| | Falling edge | PG-78 | The lower two digits of the PG-78 set value (as shown below) |
| MscEv4 | Rising edge | PG-79 | The two digits of the PG-79 higher set value (as shown below) |
| | Falling edge | PG-79 | The lower two digits of the PG-79 set value (as shown below) |
| | Useless digits | high two digits | low two digits |
| Display |  |  |  |

Trigger priority order: PG-11 software trigger, MscTrg and MscEv1~4 hardware trigger, etc. The priority of the three types of triggers is as follows:

| Trigger type | Priority (the smaller the number, the higher) |
|---|---|
| MscEv1 rising edge hardware trigger | 1 |
| MscEv1 falling edge hardware trigger | 2 |
| MscEv2 rising edge hardware trigger | 3 |
| MscEv2 falling edge hardware trigger | 4 |
| MscEv3 rising edge hardware trigger | 5 |
| MscEv3 falling edge hardware trigger | 6 |
| MscEv4 rising edge hardware trigger | 7 |
| MscEv4 falling edge hardware trigger | 8 |

| | |
|---|---|
| MscTrg hardware trigger | 9 |
| PG-11 software trigger | 10 |

If all kinds of trigger sources occur at the same time, the system selects the trigger source to be executed as described above, and the unselected trigger source is masked by the system. Therefore, when multiple trigger sources occur at the same time, the system only selects the trigger source with the highest priority.

## 7.6.6. Msc Motion Planning – command jump and interrupt

The jump operation after the Msc command is interrupted and the command is completed is determined by the setting values of bit 16 to bit 23 in the PG-60 and Msc command mode settings, as follows:

Instruction Interruption: The PG-60 setting determines the interpolating behavior of all Msc commands in the system. The specific behavior is as follows:

| PG-60 setting | Function | Desctiption |
|---|---|---|
| 0x0 | Not interrupted | When the Msc instruction is executed, if other trigger sources require execution of other Msc instructions, the system directly ignores the requirement and does not interrupt the current instruction. After the system completes all Msc instructions, it is open to accept the trigger source request. |
| 0x1 | Only after the completion | When the Msc instruction is executed, if other trigger sources require execution of other Msc instructions, the system immediately continues the required Msc instruction after the current instruction is completed. The jump setting of the original execution instruction plan is ignored. The specific instruction connection mode is still set according to the overlap of the original execution instructions, and the Msc instruction is executed in succession.<br>If multiple sets of trigger sources require interrupting the current Msc instruction, still follow the contents of 7.6.5, and continue the high priority Msc instruction after the current instruction is completed. |
| 0x2 | Immediate interruption | When the Msc instruction is executed, if other trigger sources require execution of other Msc instructions, the system immediately aborts the current instruction and directly connects the required Msc instruction. |

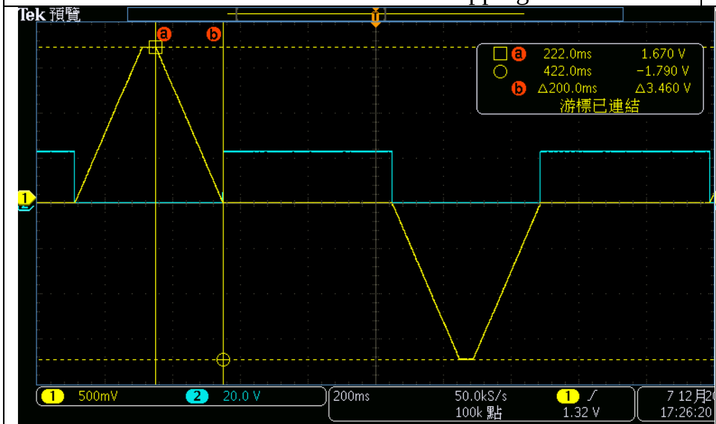
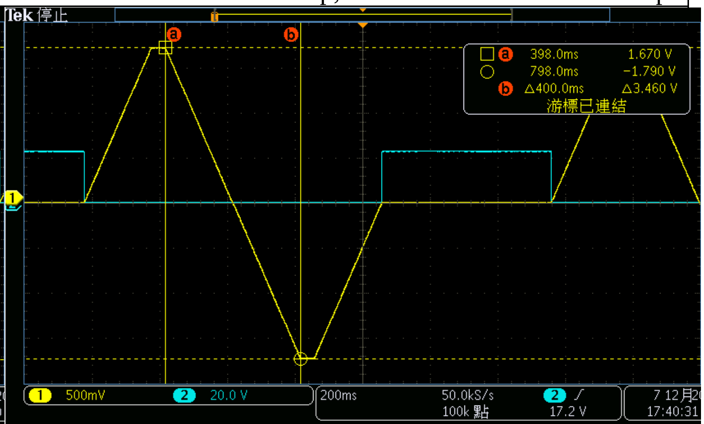
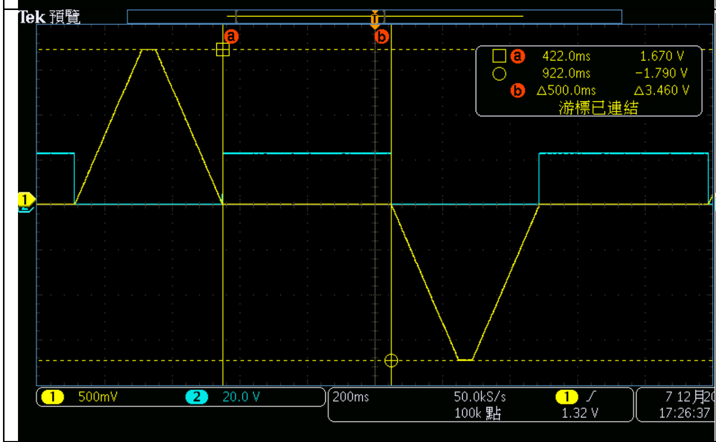
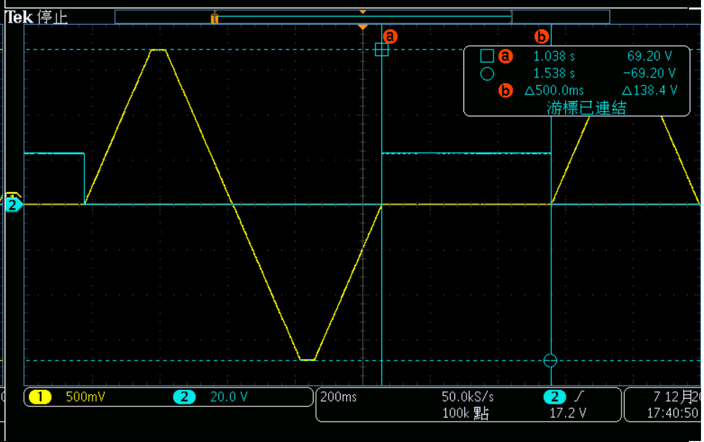
Command jump: The setting value of bit16~bit23 in the Msc command mode setting determines whether the other Msc commands are connected after the current command is completed. The specific behavior is as follows:

| PH, PJ-even bit16 ~bit23 | Function | Desctiption |
|---|---|---|
| 0x00 | Stop continuously | After the current instruction is completed, the system stops the Msc instruction. When the trigger source starts and starts again, DO MscBusy will be OFF. |
| 0xA0 | Sequential connection | After the current instruction is completed, the system will take the next Msc command. For example, the Msc number 1 command is currently executed. In this mode, the number 1 command will be automatically followed by the number 2 command, and DO MscBusy will be ON. |
| 0xB0 | Step up command | After the current instruction is completed, the system will take the previous Msc command. For example, the current execution of the Msc number 1 command is immediately interrupted to the number 3 command. If the number 3 is set to this mode, the number 1 command is automatically connected after the number 3 is completed. MscBusy will be ON. |
| 0x01 | Number 1 command | After the current command is completed, the system automatically connects the Msc number 1 command, and DO MscBusy will be ON. |
| 0x02 | Number 2 command | After the current command is completed, the system automatically connects the Msc number 2 command, and DO MscBusy will be ON. |
| 0x03 ~ 0x44 | Connect the number 3~68 command | After the current command is completed, the system automatically connects the Msc number 3 ~ 68 commands (depending on the set value), DO MscBusy will be ON. |

## 7.6.7. Msc Motion Planning – command monitoring

When the Msc command is executed, the user can use the PD-22 to set the analog pulse command frequency output to observe the actual speed curve. However, in the Msc mode, the analog pulse frequency is changed by the PG-81 (other modes remain fixed). Magnification: 4.5 Mbps output 8V) to observe the full speed curve.

Example: If you execute the following command
Absolute positioning command 01 = 524288, next step, target speed, deceleration, acceleration and delay time code is 0xDDDA
Absolute positioning command 02 = 0, connected to the previous step, the target speed, deceleration, acceleration and delay time code is 0xDDDA
The two commands turn off the overlap and turn on the overlap function, and the waveforms are monitored by the analog monitor pulse command and DO MscDelay as follows:

| Two command close overlapping | Command 01 turns on overlap, command 02 turns off overlap |
|---|---|
|  |  |
|  |  |
| CH01: Pulse frequency analog output<br>CH02: DO MscDelay<br>From the waveform, the triangle of the positive voltage is the motion curve of the command 01, and the triangle of the negative voltage is the motion curve of the command 02, and both curves have a delay of 500 ms. | CH01: Pulse frequency analog output<br>CH02: DO MscDelay<br>From the waveform, the triangle of positive voltage is the motion curve of command 01, and the triangle of negative voltage is the motion curve of command 02. When the command 01 starts decelerating, the overlap function is enabled immediately, so the speed is directly decelerated and the command 02 is connected, and the command 02 After the completion, perform a 500ms delay time. |

In addition to using the pulse wave command frequency to observe the dynamic speed curve, the system also provides four sets of monitoring parameters for the user to observe before and after the execution, the specific displacement and the actual PUU coordinate value, in addition to the original CD-P, FB-P and other system position monitoring The parameter still has an effect in Msc mode.

| Monitoring parameter | Function | Descriotion |
|---|---|---|

| | | |
|---|---|---|
| PG-82 | When Msc starts<br>Position coordinate monitoring parameter | In Msc mode, when Serv Off -> On, the system records the absolute position of the Msc coordinate (PUU) at the time of switching to PG-82 for verification of the displacement. |
| PG-83 | Msc current<br>Position coordinate monitoring parameter | In Msc mode, the system records the current Msc coordinate absolute position (PUU) in PG-83 for verification of the current Msc coordinate position. |
| PG-84 | When Msc starts<br>Indexing coordinate monitoring parameters | In Msc mode, when Serv Off -> On, the system records the Msc index coordinate absolute position (PUU) at the time of switching to PG-84 for verification of the displacement amount. |
| PG-85 | Msc current<br>Indexing coordinate monitoring parameters | In Msc mode, the system records the current Msc indexing absolute position (PUU) on the PG-85 for verification of the current Msc indexing coordinate position. |

Example: If the origin is reset, the system origin is defined as 0, the Msc command is the absolute positioning command 10000 PUU, the total division stroke (PG-80) = 4000, acceleration and deceleration and delay time 100 ms, gear ratio = 1, After Servo Off is switched to On, the motor encoder reads = 100. After the execution of the Msc command, the parameters of PG-82 ~ PG-85, CD-P, FB-P are as follows:

| Parameter | Function | Value | Description |
|---|---|---|---|
| PG-82 | When Msc starts<br>Position coordinate monitoring parameter | 100 | After the servo Off is switched to On, the system memorizes the encoder reading value and converts the gear ratio to PG-82. |
| PG-83 | Msc current<br>Position coordinate monitoring parameter | 10000 | After the absolute positioning command is executed, the motor Msc coordinates are located. |
| PG-84 | When Msc starts<br>Indexing coordinate monitoring parameters | 100 | After the servo Off is switched to On, the system memorizes the encoder reading value and converts the PG-84 with the gear ratio and the total indexing stroke (PG-80). P-G84 = PG-82 divided by the remainder of PG-80 |
| PG-85 | Msc current<br>Indexing coordinate monitoring parameters | 2000 | After the absolute positioning command is executed, the motor Msc coordinates the position, and then divides the total stroke (PG-80 PG-85. PG-85 = PG-83 divided by the remainder of PG-80) |
| CD-P | Pulse wave command input pulse wave number | 9900 | Actual displacement = PG-83 – PG-82 |
| FB-P | Motor feedback pulse number | 10000 | Servo Off switches to the value after On + the actual amount of displacement. |

# 8. Communication Mechanism

## 8.1. RS-485/RS-232 Communication hardware interface

For communication, the servo drive supports two serial communication functions RS-485 and RS-232 to access and alter the parameter in the servo system. The communication functions RS-485 and RS-232 cannot be used simultaneously. The description is as follows:

**Definition of the CN3 interface pin for servo motor:**

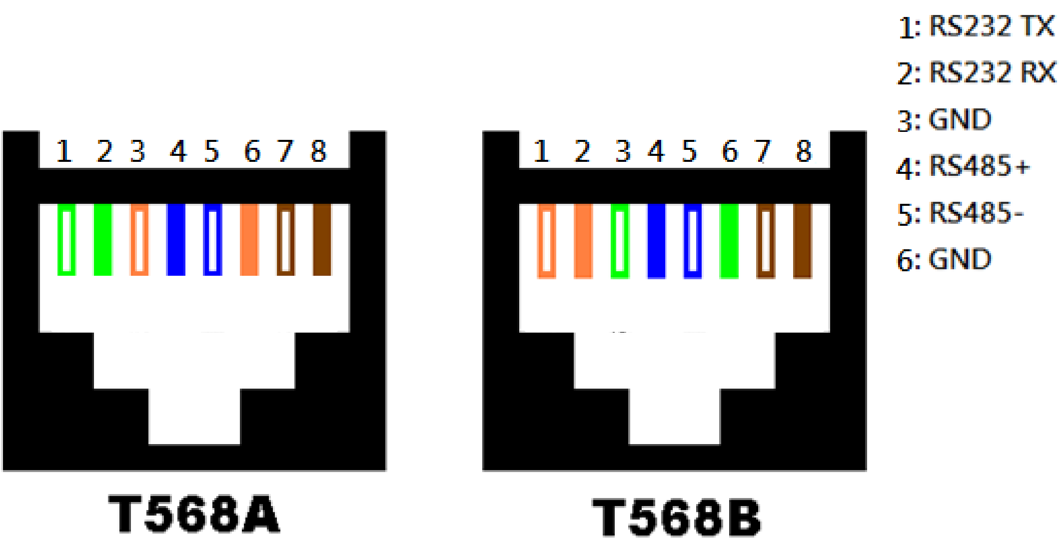



Fig. 8.1 Definition for the communication Interface CN3 of servo motor

For RS232 communication, use Pin 1 (TX), Pin 2 (RX) and Pin 3(GND) of Interface CN3. For RS485 communication, use Pin 4 (+) and Pin 5 (-) of CN3 Interface.

Note: The definition of RS232TX and RS232RX defined in Interface CN3 is the one for the signal at the servo drive end. If the servo motor is the slave for communication, dock TX of the master end for communication to RS232RX at the slave end. Dock RX at the master end to RS232TX at the slave end.

### Description for the use of RS232:

1) 15 m is required for the environment with less noise. For the transmission speed above 38400bps, use the communication line with the length below 3 m to ensure the transmission accuracy.

2) For the definition of the wiring regarding RS232 connector, refer to Fig. 8.1 Definition for the communication Interface CN3 of servo motor.

Description for the use of **RS-485**:

1) It is suggested to use the line with the length below 15 m to ensure the transmission accuracy.

2) For the definition of the wiring regarding RS-485 connector, refer to Fig. 8.1 Definition for the communication Interface CN3 of servo motor.

3) When using RS-485, 32 drives can be connected simultaneously. For connecting more servo drives or increase the communication distance, a repeater must be installed for expansion. Up to

254 servo drives can be connected to.

## 8.2. RS-485/RS-232 Communication parameter setting

PD-00 Setting of the branch number, PD-01 Communication transmission rate and PD-02 Protocol are the parameters must be set and confirmed before a servo drive is connected to the communication network. Rest of the settings are optional, including PD-03 Handling of the communication error, PD-04 Setting for the communication timeout, PD-06 Control switch for the source of the input contact (DI), PD-07 Time for the delay of the communication response and PD-08 Monitoring Mode. Refer to Chapter 7 in the manual for details.

The following is the setting for the communication group of Parameter PD:

**Communication address for rate of ADR communication transmission: 0300H~0301H**

| PD-00 | **ADR** | **Setting of the communication office number** | Communication address: **0300H** **0301H** |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 7Fh |
| | Control mode | ALL |
| | Unit | - |
| | Configuration range | 01h ~ 7Fh |
| | Data size | 16 bit |
| | Data format | HEX |

When RS-232/RS-485 is used for communication, only one branch number may be set per servo drive.
If one branch number is set for multiple drives in the communication network, the communication would not work properly.
The station number implies the address of the drive in the communication network. It is also applicable to RS-232/485.

**Communication address for rate of BRT communication transmission: 0302H~0303H**

Operation interface: Index related to the panel/software communication: Sec. 8.2

| PD-1 | **BRT** | **Setting of communication transmission rate** | Communication address: **0302H** **0303H** |
|---|---|---|---|

| | | |
|---|---|---|
| | Initial value | 33h |
| | Control mode | ALL |
| | Unit | Bps |
| | Configuration range | 00h ~ 55h |
| | Data size | 16 bit |
| | Data format | HEX |

□□□□■ : RS232

□□□■□ : RS485

The following shows the definition of the set value for communication transmission rate for A and B:

0：4800

1：9600

2：19200

3：38400

4：57600

5：115200

**Communication address for PTL protocol: 0304H~0305H**

| PD-02 | **PTL** | **Protocol setting** | Communication address: **0304H** **0305H** |
|---|---|---|---|
| | Initial value | 6 | |
| | Control mode | ALL | |
| | Unit | - | |
| | Configuration range | 6 ~ 8 | |
| | Data size | 16 bit | |
| | Data format | DEC | |

Parameter function: The protocol shared by RS-485 and RS-232 is set to the lowest bit A (4-bit, 16 bit).

| | 0 | 0 | 0 | A | |
|---|---|---|---|---|---|
| Communication method | - | - | - | RS-485 | RS-232 |
| Configuration range | 0 | 0 | 0 | 6~8 | |

The following is the definition for the set value of protocol shared by RS-485 and RS-232:

6:8, N, 2(MODBUS, RTU)

7:8, E, 1(MODBUS, RTU)

8:8, O, 1(MODBUS, RUT)

## 8.3. MODBUS protocol

For the RTU (Remote Terminal Unit) mode, the user sets the required protocol in Parameter PD-02. As for functions supported by the drive, 03H Multiple Word Reading, 06H Single Word Writing and 10H Multiple Word Writing. Refer to the description below.

### Data structure of communication

The following is the definition for the data frame in the RTU communication mode:

**RTU mode:**

| | |
|---|---|
| Start | Standstill period over 10 ms |
| Slave address (communication address) | Slave address (communication address): 1-byte |
| Function code: | Function code: 1-byte |
| Data (n-1) | Data (n-1) |
| ……. | Data content: n-word =2n-byte, n<=10 |
| Data (0) | Data (0) |
| CRC error check: | CRC error check: 1-byte |
| End 1 | Standstill period over 10 ms |

The RTU (Remote Terminal Unit) communication mode begins from a static signal and ends with another static signal. The communication position, function code, data content, check for Cyclical Redundancy Check (CRC) error...etc. are between the beginning and end.

**Example 1, Function Code 03H Multiple Word Reading:**

For the example below, the master passes down the command to No. 127 (7FH) Slave for reading the data from two words in a row starting from the home address 0200H. The data content replied by the slave is Location 0200H = > Content 1122H and Location 0201H=> Content 3344H. Up to 10 entries allowed to be read at once.

**RTU mode:**

**Request command: Response command:**

Request command:

| | |
|---|---|
| Slave Address (1 Bytes) | 7FH |
| Function (1 Bytes) | 03H |
| Initial data location (2 bytes) | 02H (high bit set)<br>00H (low bit set) |

| | |
|---|---|
| Number of data entries (Unit: word) (2 bytes) | 00H (high bit set)<br>02H (low bit set) |
| CRC Check Low (1 Bytes) | CFH (low bit set) |
| CRC Check High (1 Bytes) | ADH (high bit set) |

**Response command**:

| | |
|---|---|
| Slave Address (1 Bytes) | 7FH |
| Function (1 Bytes) | 03H |
| Number of data entries (Unit: byte) (1 byte) | 04H |
| Initial data address Contents of 0200H (2 bytes) | 11H (high bit set)<br>22H (low bit set) |
| Address of the second data Contents of 0201H (2 bytes) | 33H (high bit set)<br>44H (low bit set) |
| CRC Check Low (1 Bytes) | D5H (low bit set) |
| CRC Check High (1 Bytes) | C1H (high bit set) |

Note: A standstill period for 10 ms is required before and after transmission.

**Example 2, Function Code 06H Single Word Writing:**

For the following example, the master passes down the writing command to No. 127 (7FH) Slave for writing the data 1234H to the address 0200H. The slave replies the master after writing is complete.

**RTU mode:**

**Request command: Response command:**

Request command:

| | |
|---|---|
| Slave Address (1 Bytes) | 7FH |
| Function (1 Bytes) | 06H |
| Initial data location (2 bytes) | 02H (high bit set)<br>00H (low bit set) |
| Data content (2 bytes) | 12H (high bit set)<br>34H (low bit set) |
| CRC Check Low (1 Bytes) | 8FH (low bit set) |

| | |
|---|---|
| CRC Check High (1 Bytes) | 1BH (high bit set) |

**Response command**:

| | |
|---|---|
| Slave Address (1 Bytes) | 7FH |
| Function (1 Bytes) | 06H |
| Initial data location (2 bytes) | 02H (high bit set)<br>00H (low bit set) |
| Data content (2 bytes) | 12H (high bit set)<br>34H (low bit set) |
| CRC Check Low (1 Bytes) | 8FH (low bit set) |
| CRC Check High (1 Bytes) | 1BH (high bit set) |

Note: In the RTU mode, a standstill period for 10 ms is required before and after transmission.

**Example 3, Function Code 10H, Multiple Word Writing:**

For the example below, the master passes down the writing command to Slave No. 127 (7FH) for writing two words EF01H and 2345H to the home address 0012H. In other words, Location 0012H is written to EF01H and Location 0013H is written to 2345H. Up to 10 entries allowed to be read at once. The slave replies the master after writing is complete.

**Request command: Response command:**

Request command:

| | |
|---|---|
| Slave Address (1 Bytes) | 7FH |
| Function (1 Bytes) | 10H |
| Initial data location (2 bytes) | 00H (high bit set)<br>12H (low bit set) |
| Number of data entries (Unit: word) (2 bytes) | 00H (high bit set)<br>02H (low bit set) |
| Number of data entries (Unit: byte) (1 byte) | 04H |
| First data written to Location 0012H | EF01H |
| Second data written to Location 0013H | 2345H |
| CRC Check Low (1 Bytes) | 50H (low bit set) |

| | |
|---|---|
| CRC Check High (1 Bytes) | 84H (high bit set) |

**Response command**:

| | |
|---|---|
| Slave Address (1 Bytes) | 7FH |
| Function (1 Bytes) | 10H |
| Initial data location (2 bytes) | 00H (high bit set)<br>12H (low bit set) |
| Number of data entries (Unit: word) (2 bytes) | 00H (high bit set)<br>02H (low bit set) |
| CRC Check Low (1 Bytes) | EBH (low bit set) |
| CRC Check High (1 Bytes) | D3H (high bit set) |

**The following must be noted:**

For PD-01, the new transmission rate must be used to transfer data for writing the next data after the new set value of transmission speed is written when the communication speed is altered.

For PD-02, the new protocol value must be used to transfer data for writing the next data after the new set value of protocol is written when the protocol is altered.

PD-31 relates to the control of forced output contact. With this parameter, the user tests the functioning of DO (Digit Output) more easily. The user writes in 1, 2, 4, 8 and 16 to test DO1, DO2, DO3, DO4 and DO5, respectively. After testing complete, 0 must be written to this parameter and the servo drive shall be notified for test completion.

**Communication read parameter:**

The parameter read by the servo drive via the communication method include:

PA-00~PA-21

PB-00~PB-41

PC-00~PC-25

PD-00~PD-55

# 9. Warning Troubleshooting

## 9.1. Drive Alarm List

| Alarm indication | Alarm name | Description for alarm activation | Indication DO | Switching of servo state |
|---|---|---|---|---|
| AL001 | Overvoltage | It is activated when the voltage of main circuit is above the specified value. | ALM | Servo Off |
| AL002 | Overcurrent | It is activated when the instantaneous current of the main circuit is above the current tolerance level of IGBT hardware. | ALM | Servo Off |
| AL003 | Error with motor coupling | The drive does not match the corresponding motor. | ALM | Servo Off |
| AL004 | Regeneration error | It is activated if any regeneration error occurs. | ALM | Servo Off |
| AL005 | Overload | It is activated when the output of the drive is above the load curve. | ALM | Servo Off |
| AL006 | Overspeed | It is activated when the motor speed is above the normal speed. | ALM | Servo Off |
| AL007 | Abnormality in the pulse command | It is activated when the pulse command input frequency is above the specified value. | ALM | Servo Off |
| AL008 | Excessive location error | It is activated when the value of location error is above the set value. | ALM | Servo Off |
| AL009 | Abnormality in the encoder | The communication error regarding the data of the encoder occurs. | ALM | Servo Off |
| AL010 | Abnormality in the calibration | | ALM | Servo Off |
| AL011 | The IGBT is overheated. | The IGBT of drive is overheated. | ALM | Servo Off |
| AL012 | Abnormality in the EEPROM | It is activated due to abnormality in the memory access. | ALM | Servo Off |
| AL013 | Abnormality in the output signal of the detector | | ALM | Servo Off |
| AL014 | Serial communication error | | ALM | Servo Off |
| AL015 | Overheated environment | The ambient temperature is too high. | ALM | Servo Off |
| AL016 | Internal error in the encoder | | ALM | Servo Off |
| AL017 | Error in the data reliability of the encoder | An abnormality occurs in the internal data of the encoder three times in a row. | ALM | Servo Off |
| AL018 | Overheated motor | The motor is overheated. | WRN | Servo On |
| AL019 | Error in the CRC communication | It is activated when an abnormality occurs in RS-232/485 communication. | ALM | Servo Off |
| AL020 | Timeout of the serial communication | It is activated when a timeout occurs in RS-232/485 communication. | ALM | Servo Off |

| Alarm indication | Alarm name | Description for alarm activation | Indication DO | Switching of servo state |
|---|---|---|---|---|
| AL021 | Error in the motor collision | | ALM | Servo Off |
| AL022 | Exceeding the upper limit for the motor temperature | The motor temperature exceeds the tolerance range. | ALM | Servo Off |
| AL023 | Exceeding the upper limit for the encoder temperature | The encoder temperature exceeds the tolerance range. | ALM | Servo Off |
| AL024 | Abnormality in the encoder output | | ALM | Servo Off |
| AL025 | Overheated encoder | The encoder is overheated. | ALM | Servo On |
| AL027 | Retrogradation overload | The retrogradation of the drive exceeds the capacity of retrogradation resistance. | ALM | Servo Off |
| AL029 | RST input voltage below level | The RST input voltage is too low. | ALM | Servo Off |
| AL030 | Encoder high voltage error or Encoder internal error | The driver charging circuit is not removed, causing the battery voltage to be higher than the specification (> 3.8V), or the encoder signal is incorrect. | ALM | Servo Off |
| AL033 | Absolute position loss | Absolute coordinate initialization is not performed.The absolute encoder loses the number of turns recorded internally due to low battery voltage or power interruption. | WRN | Servo On |
| AL034 | Encoder low voltage error | Absolute encoders have a lower battery voltage than the specification or a battery voltage error. | WRN | Servo On |
| AL035 | Absolute position circle overflow (PD-57, bit2 can be turned off, Msc mode is forced to enable) | The number of absolute position turns exceeds the maximum range (-32768~+32767). Absolute coordinate initialization must be performed again. | WRN | Servo On |
| AL036 | Absolute data I/O transmission error | Timing error in reading absolute position with DI/DO | WRN | Servo On |
| AL037 | Motor type error | Incremental motors do not support absolute functions. | ALM | Servo Off |
| AL038 | Position counter overflow (PD-57, bit2 can be turned off, Msc mode is forced to enable) | The position counter overflows. The pulse wave number in PUU mode exceeds -2147483648 ~ 2147483647 Absolute coordinate initialization must be performed again. | WRN | Servo On |
| AL050 | Low voltage | The voltage of the main circuit is too low. | WRN | Servo Off |
| AL051 | Emergency stop | It is activated when the emergency stop button is pressed. | WRN | Servo Off |
| AL052 | Abnormality in the CCW-limit | It is activated when the CCW-limit switch is pressed. | WRN | Servo On |
| AL053 | Abnormality in the CW-limit | It is activated when the CW-limit switch is pressed. | WRN | Servo On |

| Alarm indication | Alarm name | Description for alarm activation | Indication DO | Switching of servo state |
|---|---|---|---|---|
| AL054 | Timeout of the serial communication | | ALM | Servo Off |
| AL055 | Phase failure for the power of the main circuit | The power of the main circuit is input in one way only. | WRN | Servo Off |
| AL056 | Warning of the expected overload | | WRN | Servo Off |
| AL057 | Abnormality in the fan | It is activated when the fan operates abnormally. | ALM | Servo Off |
| AL058 | Abnormality in the DSP | It is activated when the DSP operates abnormally. | WRN | Servo Off |

## 9.2. Reason for and handling of the alarm

### AL001 : Overvoltage

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The input voltage of the main circuit exceeds the allowance. | Measure the input power by the voltmeter to see if it is consistent with the specified value. | Use the adequate power supply or cascade the voltage stabilizer. |
| Malfunction of the drive hardware | An alarm occurs despite that the input power is consistent with the specified value. | Return it to the dealer or factory for repair. |
| Abnormality in the regeneration system | The regeneration system fails or the regeneration voltage is too high. | Check the regeneration system or mechanism. |

### AL002 : Overcurrent

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The output of the drive is open. | Check the connection of the motor and drive. | The open circuit issue is solved to prevent the exposure of conductor. |
| Abnormality in the motor wiring | Check the wiring order for the motor. | The wiring must be conducted again based on specifications. |
| Abnormality in the IGBT | Breakdown and abnormality in the IGBT module | Return it to the dealer or factory for repair. |
| Abnormality in the setting of the control parameter | The control or gain value is set too high. | The value is reset to the initial value. It will be set and calibrated again. |
| Abnormality in the control command | Check if the input command is in a state of high severity. | Modify the input command or turn on the filter function. |

### AL003 : Error with motor coupling

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Encoder damage | An abnormality occurs in the encoder. | Replace the motor. |
| Loose encoder connector | The encoder wire is loose. | It is reattached. |
| Error with motor coupling | The motor does not match the drive. | Replace the motor. |

### AL004 : Regeneration error

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Wrong selection of the regenerative resistor or no external regenerative resistor connected | Check the condition of the regenerative resistor. | Reset the parameter value. Send the resistor back to the factory if the abnormality is unsolved. |
| The parameter for resistor capacity not returned to zero when the regenerative resistor not in use | Check the parameter for the resistor capacity. | The parameter for resistor capacity must be returned to zero when the regenerative resistor is not in use. |
| | | |

## AL005 : Overload

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Continuous use while exceeding the rated load of the drive | Check if the motor operates in the condition that the rated load is above 100% for a long time through the monitoring state AVG-L. | Replace the old motor with the one with higher watts or reduce the load. |
| Inadequate setting of the system parameter | 1. Check if the mechanical system sways.<br>2. The acceleration and deceleration constant is set too short. | Reset the value of switch parameter. |
| Wrong wiring of the motor and encoder | Check the UVW and encoder wiring. | Install the wire correctly. |

## AL006 : Overspeed

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Excessive variation of speed command | Check if the speed command of the upper input is abnormal. | Modify the command or turn on the filter function. |
| Inadequate setting of the system parameter | Check if the condition for the overspeed warning (PD-53) is insufficient. | Set the parameter value correctly. |

## AL007 : Abnormality in the pulse command

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Frequency in the pulse command above the rated input frequency | Check the pulse frequency sent by the upper controller. | Set the upper controller correctly. |

## AL008 : Excessive location error

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The set value of parameter for position control error set too low | Check the set value of parameter for position control error (PD-54). | Increase the set value of parameter for position control error (PD-54). |
| Control gain set too low | Check if the position and speed gains are appropriate. | Calibrate the control gain again. |
| Torque limit too low | Check the torque limit value. | Set the torque limit correctly. |
| Excessive external load | Check the state of external load. | Reduce the load or replace the old motor with the one with higher watts. |

## AL009 : Abnormality in the encoder

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Loose encoder wire | Check if the encode wire is loose. | Reattach the encoder wire. |
| Wrong wiring of the encoder | Check if the encode wire is consistent with the specifications and definition. | Reattach the encoder wire. |
| Malfunction of encoder | An abnormality occurs in the motor. | Replace the motor. |

### AL010 : Abnormality in the calibration

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Analog Input contact not returned to zero | Measure if the voltage level of the analog input contact is equivalent to the ground potential. | The analog input contact is grounded correctly. |
| Damage of the detecting element | Detection of power reset | If any abnormality still occurs, return the element to the factory for repair. |

### AL011 : IGBTOverheated module

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Overheated drive | Check if the drive temperature is too high. | Lower the drive temperature. |

### AL012 : Abnormality in the EEPROM

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Memory damage | | Return it to the dealer or factory for repair. |

### AL015 : Ambient temperature too high

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Ambient temperature of the drive too high | Check if the drive temperature is too high. | Lower the drive temperature. |

### AL017 : Error in the data reliability of the encoder

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Abnormality in three data entries of the encoder data received by the drive in a row. | 1. Check if the motor is grounded normally.<br>2. Check if the signal cable of the encoder is entangled with the line with the power or high current. If not, the interference source can be avoided.<br>3. Check if the mesh is used for the filament of the encoder. | 1. Make sure that the ground end of the UVW connector is connected to the heat dissipation of the drive.<br>2. Check the wiring for the signal cable of the encoder to prevent it from entangling with other lines.<br>3. Use the filament with mesh.<br>4. If the situation is not improved, return the drive the factory for repair. |

### AL018 : Overheated motor

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The motor temperature is over 75℃. | Check if the motor temperature is too high. | Reduce the motor temperature. |

### AL019 : Error in the CRC communication

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Error in RS-232/485 communication | Check if the signal cable is interfered with. | Check the wiring for the signal cable to prevent it from entangling with other lines. |

### AL020 : Timeout of the serial communication

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Inadequate setting of the timeout parameter | Check the setting of timeout parameter. | Set the parameter correctly. |
| Communication | Check if the wire is loose. | Connect the wire correctly. |

| | | |
|---|---|---|
| interruption | | |

### AL021 : Error in the motor collision

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Inadequate setting of the timeout parameter | Check the setting of timeout parameter. | Set the parameter correctly. |
| Communication interruption | Check if the wire is loose. | Connect the wire correctly. |

### AL022 : Exceeding the upper limit for the motor temperature

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The motor temperature is over 90℃. | Check if the motor temperature is too high. | Reduce the motor temperature. |

### AL023 : Exceeding the upper limit for the encoder temperature

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Encoder temperature exceeding 85℃ | Check if the encoder temperature is too high. | Lower the encoder temperature. |

### AL025 : Overheated encoder

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Encoder temperature exceeding 65℃ | Check if the encoder temperature is too high. | Lower the encoder temperature. |

### AL026 : Overcurrent output by the servo

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Abnormality in the setting of the control parameter | The control or gain value is set too high. | The value is reset to the initial value. It will be set and calibrated again. |
| Abnormality in the control command | Check if the input command is in a state of high severity. | Modify the input command or turn on the filter function. |

### AL027 : Regeneration overload

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Error in the parameter setting | Check the parameter for the resistor capacity and the resistor parameter. | Reset the parameter value. |
| The capacity of regenerative resistor is insufficient. | Check if the deceleration time is too short or if the capacity of the regenerative resistor is too low. | Increase the deceleration time or attach the regenerative resistor with higher watts. |

### AL030：Encoder high voltage error or encoder internal error

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Battery voltage is too high | Check if the battery installation is abnormal<br>(Voltage is high > 3.8V). | If the battery voltage is too high, check or replace the battery. |
| Encoder internal error | 1. Check if it is an absolute encoder.<br>2. Is the motor ground ground properly grounded.<br>3. The encoder signal line is separated from the power supply or high current line to | 1. After checking and excluding the above abnormal causes, there is still no improvement, please return it to the dealer or the original factory for repair. |

| | | |
|---|---|---|
| | avoid the generation of interference sources.<br>4. Is the wire of the position detector used to use the isolation net? | 2. Connect the ground (green) of the UVW connector to the heat sink of the drive.<br>3. Separate the encoder signal line from the power or high current line.<br>4. Please use wire with isolation net. If there is still no improvement, please return it to the dealer or the original factory for repair. |

## AL033：Absolute position loss

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The battery voltage is too low or the battery is replaced under low voltage conditions. | Check if the battery voltage is lower than 1.2V or replace the battery with the drive control power OFF. | After replacing the battery, re-execute the system initialization program and perform absolute coordinate initialization as described in sections 11.3.4 to 11.3.5. |
| Absolute position coordinate initialization has not been completed after the absolute function is activated | 1. Install the battery.<br>2. Check the battery power wiring of the battery's external box and the drive.<br>3. Check the encoder wiring. | Re-execute the system initialization program and refer to the instructions in sections 11.3.4 to 11.3.5 for absolute coordinate initialization. |
| Poor battery contact or disconnection | 1. Check the encoder wiring.<br>2. Check the wiring of the battery's external box and the drive. | Connect or repair the wiring so that the battery power can be supplied to the encoder normally. Re-execute the system initialization program. Refer to Section 11.3.4 ~ 11.3.5 for absolute coordinate initialization. |

## AL034：Encoder low voltage error

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Battery voltage is too low | 1. Check if the panel battery voltage is lower than 3.1 V.<br>2. Measure if the battery voltage is lower than 3.1 V. | Replace the battery with the drive control power ON. AL034 will automatically disappear after replacing the new battery. |

## AL035：Absolute position circle overflow

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| The number of turns is out of range | Check if the number of motor turns is -1048576 ~ 1048575 laps. | 1. Re-run the coordinate initialization program and refer to the instructions in 11.3.1 for absolute coordinate initialization.<br>2. If you do not need to accept the lap time overflow warning message, set PD-57, bit2 to 1, to turn off this warning function. The Msc mode will force this warning function to be triggered. In the Msc mode, this alarm occurs. Please refer to the origin return program 7.6.1 to reconstruct the coordinate system. |

## AL036：Absolute data I/O transmission error

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Read time expired | Check that the On-> Off and Off-> On switching times of DO (AENC_D) match the settings required by Tq or Tout. | 1. The DI (AENC_E) must be reset to the low level to clear the alarm and re-arm.<br>2. Perform absolute position information for DI/DO reading in accordance with the timing instructions in 11.3.6. |

## AL037：Motor type error

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Incremental motor set to absolute function | 1. Check that the motor is an incremental or absolute encoder.<br>2. Check parameter PD-56. | To use the absolute function, use an absolute motor. If the absolute function is not used, set parameter PD-56 to 0. |

## AL038：Position counter overflow

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Position counter overflow | Check that the stroke exceeds the maximum count range, or set the appropriate gear ratio to avoid feedback calculation overflow. | If you do not need to accept the overflow warning message, set PD-57, bit3 to 1, to turn off this warning function. Msc mode will force this warning function, please refer to the origin return program 7.6.1 to reconstruct the coordinate system. |

## AL050 ：Low voltage

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Input voltage of the main | Measure the input power by the | Use the adequate power supply or |

| | | |
|---|---|---|
| circuit below the allowance | voltmeter to see if it is consistent with the specified value. | cascade the voltage stabilizer. |

### AL051 : Emergency stop

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Emergency stop switch pressed | Check the switch status. | Turn on the emergency stop switch. |

### AL052 : Abnormality in the CCW-limit

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| CCW-limit switch pressed | Check the switch status. | Turn on the CCW-limit switch. |

### AL053 : Abnormality in the CW-limit

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| CW-limit switch pressed | Check the switch status. | Turn on the CW-limit switch. |

### AL055 : Phase failure for the power of the main circuit

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Phase failure for the power of the main circuit with only single phase input available | 1. Check if the power connection is loose.<br>2. Check if the power input is normal. | Make sure that the three-way power supply is connected. Return the power supply to the factory for repair if there is still any abnormality. |

### AL056 : Warning of the expected overload

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Warning of the expected overload | 1. Check for the use during continuous overloading.<br>2. | 1. Refer to AL005 for handling.<br>2. |

### AL057 : Abnormality in the fan

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Abnormality in the fan | Check the condition of the fan. | Return it to the dealer or factory for repair. |

### AL058 : Abnormalityin the DSP

| Reason for abnormality | Check for abnormality | Handling of abnormality |
|---|---|---|
| Abnormality in the DSP | Check whether the drive operates normally. | Return it to the dealer or factory for repair. |

## 9.3. Alarm troubleshooting

| Alarm indication | Alarm name | Action for recovery after alarm |
|---|---|---|
| AL001 | Overvoltage | DI: ARST clear |
| AL002 | Overcurrent | DI: ARST clear |
| AL003 | Error with motor coupling | DI: ARST clear |
| AL004 | Regeneration error | DI: ARST clear |
| AL005 | Overload | DI: ARST clear |
| AL006 | Overspeed | DI: ARST clear |
| AL007 | Abnormality in the pulse command | DI: ARST clear |
| AL008 | Excessive location error | DI: ARST clear |
| AL009 | Abnormality in the encoder | DI: ARST clear |
| AL010 | Abnormality in calibration | DI: ARST clear |
| AL011 | Overheated IGBT | DI: ARST clear |
| AL012 | Abnormality in EEPROM | DI: ARST clear |
| AL013 | Abnormality in the output signal of the detector | DI: ARST clear |
| AL014 | Serial communication error | DI: ARST clear |
| AL015 | Overheated environment | It is cleared automatically after temperature recovery. |
| AL016 | Internal error in the encoder | DI: ARST clear |
| AL017 | Error in the data reliability of the encoder | DI: ARST clear |
| AL018 | Overheated motor | It is cleared automatically after temperature recovery. |
| AL019 | Error in the CRC communication | DI: ARST clear |
| AL020 | Timeout of the serial communication | DI: ARST clear |
| AL021 | Error in the motor collision | DI: ARST clear |
| AL022 | Exceeding the upper limit for the motor temperature | It is cleared automatically after temperature recovery. |
| AL023 | Exceeding the upper limit for the encoder temperature | It is cleared automatically after temperature recovery. |
| AL024 | Abnormality in the encoder output | DI: ARST clear |
| AL025 | Overheated encoder | It is cleared automatically after temperature recovery. |
| AL026 | Overcurrent output by the servo | DI: ARST clear |
| AL027 | Abnormality in the regeneration | DI: ARST clear |
| AL030 | Encoder high voltage error or Encoder internal error | |
| AL033 | Absolute position loss | |
| AL034 | Encoder low voltage error | |

| Alarm indication | Alarm name | Action for recovery after alarm |
|---|---|---|
| AL035 | Absolute position circle overflow (PD-57, bit2 can be turned off, Msc mode is forced to enable) | |
| AL036 | Absolute data I/O transmission error | |
| AL037 | Motor type error | |
| AL038 | Position counter overflow (PD-57, bit2 can be turned off, Msc mode is forced to enable) | |
| AL050 | Low voltage | It is cleared automatically after the voltage returns to normal. |
| AL051 | Emergency stop | DI: It is cleared automatically after EMG is clear. |
| AL052 | Abnormality in the CCW-limit | DI: ARST clear |
| AL053 | Abnormality in the CW-limit | DI: ARST clear |
| AL054 | Timeout of the serial communication | DI: ARST clear |
| AL055 | Phase failure for the power of the main circuit | DI: ARST clear |
| AL056 | Warning of the expected overload | DI: ARST clear |
| AL057 | Abnormality in the fan | DI: ARST clear |
| AL058 | Abnormality in the DSP | Return it to the dealer or factory for repair. |

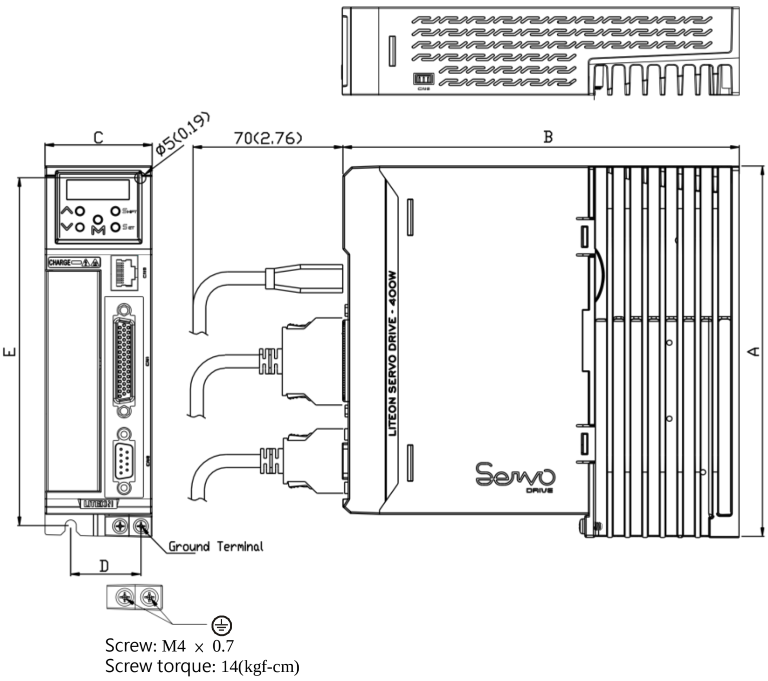
# 10. Specifications

## 10.1. Standard specification for the servo drive

<table>
<tr><th colspan="2" rowspan="2">Model name of servo drive: ISA-7X</th><th>100W</th><th>200W</th><th>400W</th><th>750W</th><th>1kW</th><th>1.5kW</th><th>2.0kW</th></tr>
<tr><th>010</th><th>020</th><th>040</th><th>075</th><th>100</th><th>150</th><th>200</th></tr>
<tr><td rowspan="2">Output power</td><td>Rated voltage (Note 1)</td><td colspan="7">Three phase 170VAC</td></tr>
<tr><td>Rated current [A] (Note 1)</td><td>0.9</td><td>1.7</td><td>2.8</td><td>5.8</td><td>6.0</td><td>10.0</td><td>11.0</td></tr>
<tr><td rowspan="4">Power supply input of the main circuit</td><td>Voltage/frequency</td><td colspan="5">Three phase AC 200 ~ 230V/50, 60Hz<br>Single phase AC 230V/50, 60Hz</td><td colspan="2">Three phase 200VAC-230VAC, 50/60Hz</td></tr>
<tr><td>Rated current [A] (Note 1)</td><td>0.7</td><td>1.5</td><td>2.6</td><td>3.8</td><td>5.0</td><td>8.0</td><td>10.5</td></tr>
<tr><td>Allowable voltage variation</td><td colspan="5">Three phase: 170 ~ 255 VAC<br>Single phase: 200 ~ 255 VAC</td><td colspan="2">Three phase: 170 ~ 255 VAC</td></tr>
<tr><td>Allowable frequency variation</td><td colspan="7">Maximum ±5%</td></tr>
<tr><td rowspan="5">Power supply input of the control circuit</td><td>Voltage/frequency</td><td colspan="7">Single phase 200VAC-240VAC, 50/60Hz</td></tr>
<tr><td>Rated current [A]</td><td colspan="7">0.2</td></tr>
<tr><td>Allowable voltage variation</td><td colspan="7">Single phase 170VAC-255VAC</td></tr>
<tr><td>Allowable frequency variation</td><td colspan="7">Maximum ±5%</td></tr>
<tr><td>Power consumption [W]</td><td colspan="7">30</td></tr>
<tr><td colspan="2">Power supply for interface</td><td colspan="7">24VDC ±10% (required current capacity: 0.5A)</td></tr>
<tr><td colspan="2">Method for control of main circuit</td><td colspan="7">Space-vector PWM control/current control method</td></tr>
<tr><td colspan="2">Built-in regenerative resistor<br>Allowable regenerative power [W]</td><td>--</td><td>--</td><td>60</td><td>60</td><td>60</td><td>100</td><td>100</td></tr>
<tr><td colspan="2">Dynamic brake</td><td colspan="7">Built-in</td></tr>
<tr><td colspan="2">Communication function</td><td colspan="7">RS232/RS485</td></tr>
<tr><td colspan="2">Output pulse of encoder</td><td colspan="7">Compatible (A/B/Z-phase pulse)</td></tr>
<tr><td colspan="2">Analog monitoring</td><td colspan="7">Two channels are available. Use the parameter to set the monitoring signal (range of output voltage: ±8V).</td></tr>
<tr><td colspan="2">External control method</td><td colspan="7">Pulse and analog signals</td></tr>
<tr><td rowspan="10">Position control mode</td><td>Pulse frequency of maximum output</td><td colspan="7">500k/4Mpulses/s (if the differential receiver is used) and 200kpulse/s (if the open collector is used)</td></tr>
<tr><td>Command pulse mode</td><td colspan="7">Pulse +symbol; A phase + B phase; CCW pulse + CW pulse</td></tr>
<tr><td>Command control method</td><td colspan="7">External pulse control</td></tr>
<tr><td>Command smoothing method</td><td colspan="7">Low-pass and P-curve smoothing filter</td></tr>
<tr><td>Position feedback pulse</td><td colspan="7">Encoder resolution: 20 bits</td></tr>
<tr><td>Command pulse rate</td><td colspan="7">A/B rate of electronic gear, A: 1-16777215, B: 1-16777215, 1/10 < A/B < 4000</td></tr>
<tr><td>Width setting for positioning completion</td><td colspan="7">0-±65535 pulses (command pulse unit)</td></tr>
<tr><td>Excessive error</td><td colspan="7">± 10 rotation</td></tr>
<tr><td>Torque limit</td><td colspan="7">Via the parameter or external analog input (0- +10 VDC/maximum torque)</td></tr>
<tr><td>Feed-forward compensation</td><td colspan="7">Parameter setting method</td></tr>
<tr><td rowspan="7">Speed control mode</td><td>Speed control range</td><td colspan="7">Analog speed command 1:2000, internal speed command 1:5000</td></tr>
<tr><td>Bandwidth</td><td colspan="7">Maximum 550Hz</td></tr>
<tr><td>Command control method</td><td colspan="7">Control of external analog command/control of internal register</td></tr>
<tr><td>Command smoothing method</td><td colspan="7">Low-pass smoothing filter; S-curve smoothing filter</td></tr>
<tr><td>Input of analog speed command</td><td colspan="7">0- ±10VDC/rated speed (may be changed via the parameter at 10V speed) (Input resistance: 10kΩ-12 kΩ)</td></tr>
<tr><td>Speed variation ratio</td><td colspan="7">Maximum ±0.01% (load variation ratio: 0-100%), 0% (power variation ratio: ±10%)<br>Maximum ±0.2% (ambient temperature: 25°C ±10°C); then the analog speed command is used</td></tr>
<tr><td>Torque limit</td><td colspan="7">Via the parameter or external analog input (0- +10 VDC/maximum torque)</td></tr>
<tr><td>Torque control</td><td>Command control</td><td colspan="7">Control of external analog command</td></tr>
</table>

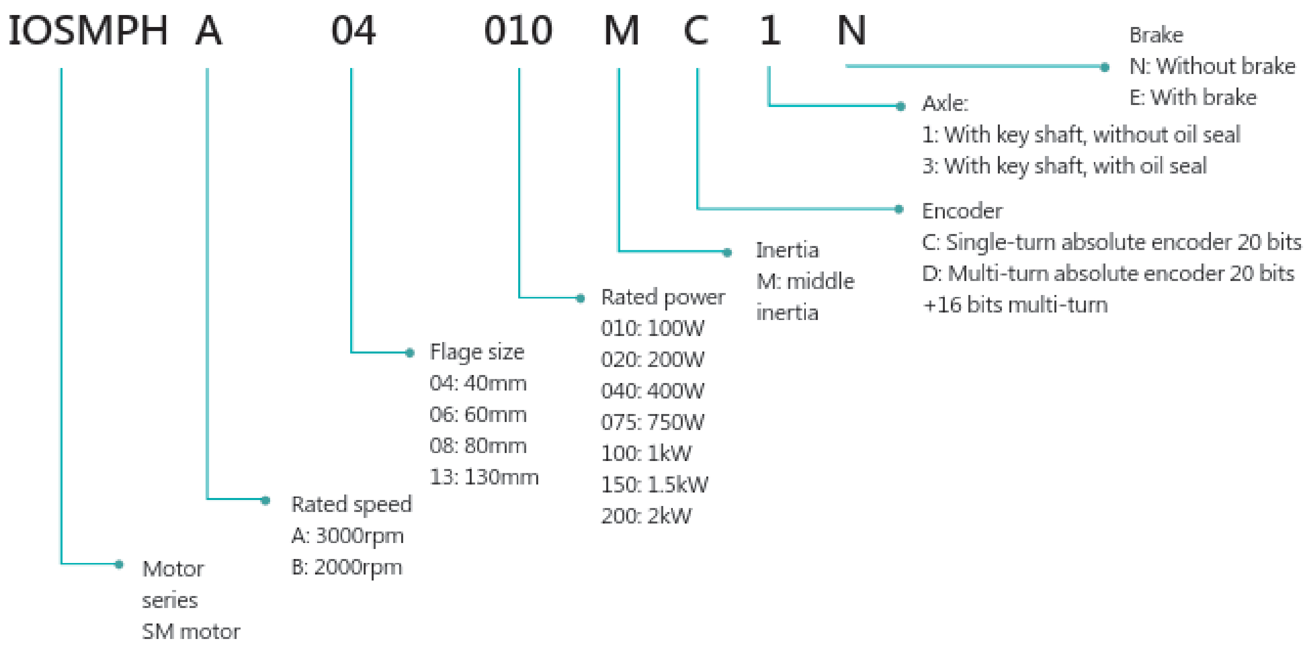
| | | | |
|---|---|---|---|
| mode | method | | |
| | Command smoothing method | Low-pass smoothing filter | |
| | Input of analog torque command | 0- ±10VDC/maximum torque (input resistance: 10kΩ-12 kΩ) | |
| | Speed limit | Via the parameter or external analog input (0- +10VDC/rated speed) | |
| Digital I/O | Input | Servo start, error reset, gain switch, pulse clear, zero speed clamping, command input reverse control, torque limit, speed limit, motor stop, speed command selection, selection and switching of command for the speed/position mixed mode, selection and switching of command for the speed/torque mixed mode, selection and switching of command for the torque/position mixed mode, emergency stop, CW- /CCW-limit, CW- /CCW-limit torque limit, forward/reverse jog input, selection of ratio for the numerator of the electronic gear ratio and the pulse input inhibited. | |
| | Output | A/B/Z line driver input | |
| | | Servo ready, servo start, zero speed detection, command speed arrival, command position arrival, torque limiting, servo alarm, electromagnetic brake, overload alert, servo warning, software limit (reverse direction), software limit (forward direction) and servo procedure complete. | |
| Protection function | | Overcurrent protection, regenerative overvoltage protection, overload protection (electronic thermal relay), servo motor overheat protection, encoder error protection, regeneration error protection, low voltage protection, transient power failure protection, overspeed protection, excessive error protection, magnetic pole detection protection, as well as the malfunction protection of linear servo control malfunction. | |
| Safety authentication | | IEC/EN 61800-5-1, UL508C (planned) | |
| Structure (IP level) | | Natural cooling, open type (IP20) | Forced cooling, open type (IP20) |
| Close fitting | | Allowed (Note 2) | |
| Environment | Ambient temperature | 0-55°C (non-frozen), storage: -20°C-65°C (non-frozen)<br>(If the ambient temperature is above 45°C, enforce the peripheral air cycling.) | |
| | Ambient humidity | Maximum 90% RH (non-condensing), storage: maximum 90% RH (non-condensing) | |
| | Installation location | It must be installed indoor without direct sunlight, corrosive gas, flammable gas, oil mist or dust. | |
| | Height | Height above sea level - below 1000 m | |
| | Vibration resistance | $5.9 m/s^2$ at 10-55Hz (X, Y and Z directions) | |

## 10.1.1. Outline dimension drawing (drive)




| Power | A | B | C | D | E | Weight |
|---|---|---|---|---|---|---|
| 200W~400W | 173(6.81) | 185(7.28) | 50(1.97) | 32.5(1.28) | 162.5(6.40) | 1.05(2.31) |
| 750W~1kW | 173(6.81) | 195(7.68) | 70(2.76) | 52.5(2.07) | 163(6.42) | 1.64(3.61) |
| 1.5kW~2kW | 212.4( 8.36 ) | 209.2( 8.24 ) | 108( 4.25 ) | 95 ( 3.74 ) | 200 ( 7.87 ) | 3.4 ( 7.5 ) |

## 10.2. Standard specification for the servo motor



# 10.2.1. Size of the motor fixed screw

| Item | | | Unit | Specifications |
|---|---|---|---|---|
| Voltage | | | V | AC200V ~ 240V |
| Model of the electric machinery ( IOSMPHA04010M□□□A ) | | | - | IOSMPHA04010M□□□A<br>Medium inertia |
| Size of mounted flange | | | mm | □40 |
| Schematic weight | | No actuator | kg | 0.55 |
| | | With actuator | | 0.75 |
| Basic specifications | Rated output | | W | 100 |
| | Rated torque | | N·m | 0.318 |
| | Maximum transient torque | | N·m | 0.96 |
| | Rated current | | Arms | 0.9 |
| | Maximum transient current | | Arms | 2.7 |
| | Rated rotation speed | | r /min | 3000 |
| | Max. speed | | r /min | 6000 |
| | Torque constant | | N · m/Arms | 0.37 |
| | Induced voltage constant for each phase | | mV/(r/min) | 23.7 |
| | Rated power | No actuator | kW/s | Maximum power per second |
| | | With actuator | | 12.3 |
| | Machinery constant | No actuator | ms | Mechanical constant |
| | | With actuator | | 1.87 |
| | Electric constant | | | 0.55 |
| | Rotor inertia | No actuator | $\times10^{-4}$ | Rotor inertia |
| | | With actuator | kg · m² | 0.082 |
| | Encoder | | | 20bit serial communication (RS-422) |
| Actuator specifications | Purpose | | | Holding brake (not for braking) |
| | Power supply | | - | Use SELV power supply / power supply that is reinforced with hazardous voltages |
| | Rated voltage | | V | DC24V±10 % |
| | Rated current | | A | 0.25 |
| | Static friction torque | | N·m | >0.32 |
| | Pull-in time | | ms | <40 |
| | Release time | | ms | <20 |
| | Release voltage | | V | >DC1.2V |
| Condition of application environment | Rated time | | | continous |
| | Temperature of application environment | | | 0℃ ~ 40℃ |
| | Humidity of application environment | | | 20 to 85% RH (no condensation) |
| | Temperature of storage environment | | | -20 ° C ~ 65 ° C (no condensation) Maximum temperature: 80 ° C, 72 hours |
| | Humidity of storage environment | | | 20 to 85% RH (no condensation) |
| | Use of the air in the storage environment | | | Indoor (no direct sunlight) non-corrosive gas, flammable gas, oil mist, dust, combustibles, abrasives, etc. |
| | Thermal resistance level | | | Class B |
| | Insulation resistance | | | DC1000V megohmmeter 5MΩ or more |
| | Insulation voltage resistance | | | AC1500V 1 minute |
| | Altitude for operation | | | Above 1000m above sea level |
| | Vibration level | | | V15 (JEC2121) |
| | Endurance vibration | | | 49m/s2 (5G) |
| | Endurance shock | | | 98m/s2 (10G) |
| | Protective structure | | | IP65 (IP67 can be used) |
| Notes | | | | · Regified to be grounded, ClassI grade |
| | | | | · Overvoltage Category II "Overvoltage category II" grade |
| | | | | · Pollution degree 2 "Pollution degree 2" grade product |
| | | | | · The value indicated by the rated torque is the value when it is mounted on the L-flange of approximately 2 times the flange size. |
| | | | | · The brake cable has polarity. Connect the wire yellow (BRK+) to +24V and wire the wire Blue (BRK-) is connected to GND. |

| Item | | | Unit | Specifications | |
|---|---|---|---|---|---|
| Voltage | | | V | AC200V ~ 240V | |
| Model of the electric machinery（IOSMPHA060□□M□□□A） | | | - | IOSMPHA06020M□□□A<br>Medium inertia | IOSMPHA06040M□□□A<br>Medium inertia |
| Size of mounted flange | | | mm | □60 | |
| Schematic weight | | No actuator | kg | 1.1 | 1.6 |
| | | With actuator | | 1.5 | 2.1 |
| Basic specifications | Rated output | | W | 200 | 400 |
| | Rated torque | | N·m | 0.64 | 1.27 |
| | Maximum transient torque | | N·m | 1.9 | 3.8 |
| | Rated current | | Arms | 1.7 | 2.8 |
| | Maximum transient current | | Arms | 5.1 | 8.4 |
| | Rated rotation speed | | r /min | 3000 | |
| | Max. speed | | r /min | 6000 | |
| | Torque constant | | N · m/Arms | 0.38 | 0.454 |
| | Induced voltage constant for each phase | | mV/(r/min) | 25 | 29.86 |
| | Rated power | No actuator | kW/s | 15.1 | 58.7 |
| | | With actuator | | 14.1 | 51.9 |
| | Machinery constant | No actuator | ms | 0.60 | 0.67 |
| | | With actuator | | 0.65 | 0.75 |
| | Electric constant | | ms | 2.16 | 2.37 |
| | Rotor inertia | No actuator | $\times 10^{-4}$ | 0.27 | 0.49 |
| | | With actuator | kg · m² | 0.29 | 0.51 |
| | Encoder | | 20bit serial communication (RS-422) | | |
| Actuator specifications | Purpose | | Holding brake (not for braking) | | |
| | Power supply | | - | Use SELV power supply / power supply that is reinforced with hazardous voltages | |
| | Rated voltage | | V | DC24V±10 % | |
| | Rated current | | A | 0.3 | |
| | Static friction torque | | N·m | >1.27 | |
| | Pull-in time | | ms | <50 | |
| | Release time | | ms | <20 | |
| | Release voltage | | V | >DC1.2V | |
| Condition of application environment | Rated time | | Continuous | | |
| | Temperature of application environment | | 0℃～40℃ | | |
| | Humidity of application environment | | 20～85%RH (non-condensing) | | |
| | Temperature of storage environment | | -20℃～65℃ (non-condensing) Highest temperature: 80℃ with 72 hours | | |
| | Humidity of storage environment | | 20～85%RH (non-condensing) | | |
| | Use of the air in the storage environment | | It must be installed indoor without direct sunlight, corrosive gas, flammable gas, oil mist, dust, combustible material or grinding compound. | | |
| | Thermal resistance level | | Class B | | |
| | Insulation resistance | | DC1000V above 5MΩ | | |
| | Insulation voltage resistance | | AC1500V 1 minute | | |
| | Altitude for operation | | Altitude below 1000m | | |
| | Vibration level | | V15 (JEC2121) | | |
| | Endurance vibration | | 49m/s2 (5G) | | |
| | Endurance shock | | 98m/s2 (10G) | | |
| | Protective structure | | IP65 (corresponding to IP67) | | |
| Notes | | | • Regified to be grounded, ClassI grade | | |
| | | | • Overvoltage Category II "Overvoltage category II" grade | | |
| | | | • Pollution degree 2 "Pollution degree 2" grade product | | |
| | | | • The value indicated by the rated torque is the value when it is mounted on the L-flange of approximately 2 times the flange size. | | |
| | | | · The brake cable has polarity. Connect the wire yellow (BRK+) to +24V and wire the wire Blue (BRK-) is connected to GND. | | |

| Item | | | Unit | Specifications |
|---|---|---|---|---|
| Voltage | | | V | AC200V ~ 240V |
| Model of the electric machinery ( IOSMPHA08075M□□□A ) | | | - | IOSMPHA08075M□□□A<br>Medium inertia |
| Size of mounted flange | | | mm | □80 |
| Schematic weight | | No actuator | kg | 2.7 |
| | | With actuator | | 3.3 |
| Basic specifications | Rated output | | Rated output | 750 |
| | Rated torque | | Rated torque | 2.39 |
| | Maximum transient torque | | Maximum transient torque | 7.2 |
| | Rated current | | Rated current | 5.0 |
| | Maximum transient current | | Maximum transient current | 15 |
| | Rated rotation speed | | Rated rotation speed | 3000 |
| | Max. speed | | Max. speed | 6000 |
| | Torque constant | | Torque constant | 0.48 |
| | Induced voltage constant for each phase | | Induced voltage constant for each phase | 31.25 |
| | Rated power | No actuator | kW/s | 64.1 |
| | | With actuator | | 52.8 |
| | Machinery constant | No actuator | ms | 0.53 |
| | | With actuator | | 0.64 |
| | Electric constant | | Electric constant | 3.47 |
| | Rotor inertia | No actuator | $\times 10^{-4}$ kg · m² | 1.61 |
| | | With actuator | | 1.65 |
| | Encoder | | 20bit serial communication (RS-422) | |
| Actuator specifications | Purpose | | Holding brake (not for braking) | |
| | Power supply | | - | Use SELV power supply / power supply that is reinforced with hazardous voltages |
| | Rated voltage | | V | DC24V±10 % |
| | Rated current | | A | 0.33 |
| | Static friction torque | | N · m | >2.39 |
| | Pull-in time | | ms | 60 |
| | Release time | | ms | 20 |
| | Release voltage | | V | >DC1.2V |
| Condition of application environment | Rated time | | Continuous | |
| | Temperature of application environment | | 0℃～40℃ | |
| | Humidity of application environment | | 20～85%RH (non-condensing) | |
| | Temperature of storage environment | | -20℃～65℃(non-condensing) Highest temperature: 80℃ with 72 hours | |
| | Humidity of storage environment | | 20～85%RH (non-condensing) | |
| | Use of the air in the storage environment | | It must be installed indoor without direct sunlight, corrosive gas, flammable gas, oil mist, dust, combustible material or grinding compound. | |
| | Thermal resistance level | | Class B | |
| | Insulation resistance | | DC1000V above 5MΩ | |
| | Insulation voltage resistance | | AC1500V 1 minute | |
| | Altitude for operation | | Altitude below 1000m | |
| | Vibration level | | V15 (JEC2121) | |
| | Endurance vibration | | 49m/s2 (5G) | |
| | Endurance shock | | 98m/s2 (10G) | |
| | Protective structure | | IP65 (corresponding to IP67) | |
| Notes | | | • Regified to be grounded, ClassI grade | |
| | | | • Overvoltage Category II "Overvoltage category II" grade | |
| | | | • Pollution degree 2 "Pollution degree 2" grade product | |
| | | | • The value indicated by the rated torque is the value when it is mounted on the L-flange of approximately 2 times the flange size. | |
| | | | · The brake cable has polarity. Connect the wire yellow (BRK+) to +24V and wire the wire Blue (BRK-) is connected to GND. | |

| Item | | | Unit | Specifications | | |
|---|---|---|---|---|---|---|
| Voltage | | | V | AC200V ~ 240V | | |
| Model of the electric machinery ( IOSMPHB13□□□M□□□A ) | | | - | IOSMPHB131D0M□□□A Medium inertia | IOSMPHB131D5M□□□A Medium inertia | IOSMPHB132D0M □□□A Medium inertia |
| Size of mounted flange | | | mm | □130 | | |
| Schematic weight | | No actuator | kg | 6.1 | 7.6 | 9.3 |
| | | With actuator | | 8.1 | 9.7 | 11.4 |
| Basic specifications | Rated output | | Basic specifications | 1000 | 1500 | 2000 |
| | Rated torque | | N· m | 4.77 | 7.16 | 9.55 |
| | Maximum transient torque | | N· m | 14.3 | 21.5 | 28.65 |
| | Rated current | | Arms | 5.8 | 8.6 | 11.7 |
| | Maximum transient current | | Arms | 18.6 | 28.8 | 37.8 |
| | Rated rotation speed | | r /min | 2000 | 2000 | 2000 |
| | Max. speed | | r /min | 3000 | 3000 | 3000 |
| | Torque constant | | N · m/Arms | 0.856 | 0.86 | 0.829 |
| | Induced voltage constant for each phase | | mV/(r/min) | 53.8 | 53.5 | 52 |
| | Rated power | No actuator | kW/s | 18.2 | 27.7 | 37.7 |
| | | With actuator | | 15.7 | 25.0 | 34.8 |
| | Machinery constant | No actuator | ms | 0.99 | 0.92 | 0.84 |
| | | With actuator | | 1.15 | 1.02 | 0.91 |
| | Electric constant | | ms | 7.53 | 7.87 | 8.06 |
| | Rotor inertia | No actuator | $\times 10^{-4}$ kg · m² | 12.5 | 18.5 | 24.2 |
| | | With actuator | | 14.5 | 20.5 | 26.2 |
| | Encoder | | 20bit serial communication (RS-422) | | | |
| Actuator specifications | Purpose | | Holding brake (not for braking) | | | |
| | Power supply | | - | Use SELV power supply / power supply that is reinforced with hazardous voltages | | |
| | Rated voltage | | V | DC24V±10 % | | |
| | Rated current | | A | 0.82 | | |
| | Static friction torque | | N· m | >9.55 | | |
| | Pull-in time | | ms | 120 | | |
| | Release time | | ms | 80 | | |
| | Release voltage | | V | >DC1.2V | | |
| Condition of application environment | Rated time | | Continuous | | | |
| | Temperature of application environment | | 0℃～40℃ | | | |
| | Humidity of application environment | | 20～85%RH (non-condensing) | | | |
| | Temperature of storage environment | | -20℃～65℃(non-condensing) Highest temperature: 80℃ with 72 hours | | | |
| | Humidity of storage environment | | 20～85%RH (non-condensing) | | | |
| | Use of the air in the storage environment | | It must be installed indoor without direct sunlight, corrosive gas, flammable gas, oil mist, dust, combustible material or grinding compound. | | | |
| | Thermal resistance level | | Class B | | | |
| | Insulation resistance | | DC1000V above 5MΩ | | | |
| | Insulation voltage resistance | | AC1500V 1 minute | | | |
| | Altitude for operation | | Altitude below 1000m | | | |
| | Vibration level | | V15 (JEC2121) | | | |
| | Endurance vibration | | 49m/s2 (5G) | | | |
| | Endurance shock | | 98m/s2 (10G) | | | |
| | Protective structure | | IP65 (corresponding to IP67) | | | |
| Notes | | | ・Regified to be grounded, ClassI grade | | | |
| | | | ・Overvoltage Category II "Overvoltage category II" grade | | | |
| | | | ・Pollution degree 2 "Pollution degree 2" grade product | | | |
| | | | ・The value indicated by the rated torque is the value when it is mounted on the L-flange of approximately 2 times the flange size. | | | |
| | | | · The brake cable has polarity. Connect the wire yellow (BRK+) to +24V and wire the wire Blue (BRK-) is connected to GND. | | | |

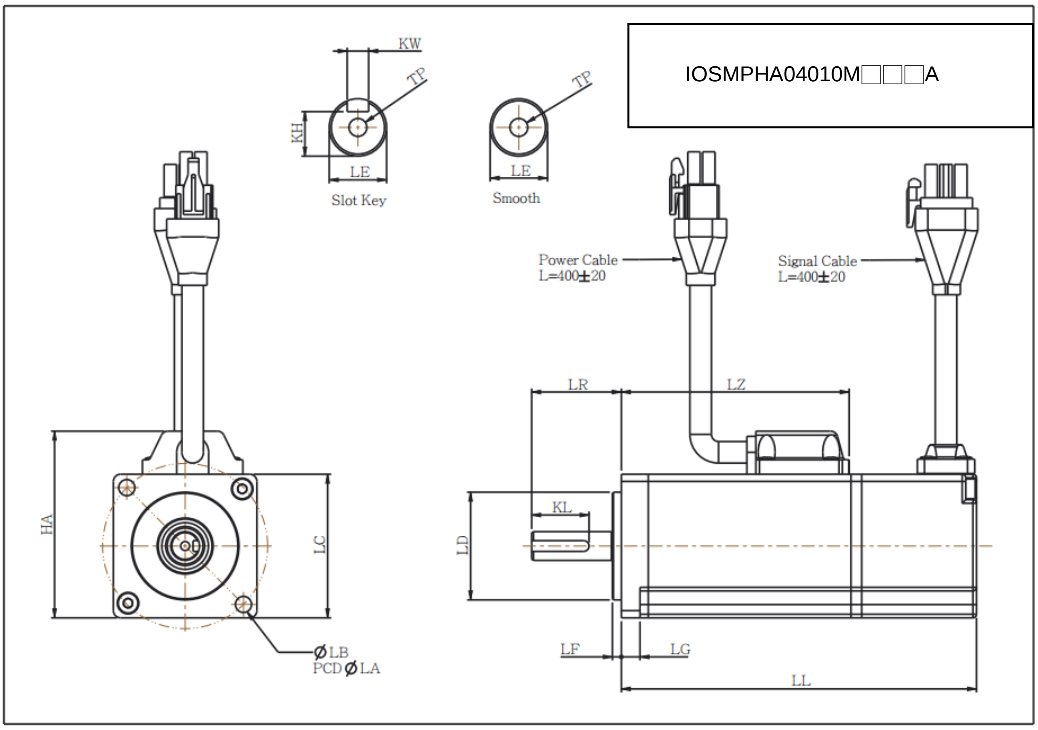
## 10.2.2. Motor fixing screw size

| | | |
|---|---|---|
| ! | The motor should be secured with the recommended size screws. | Otherwise, the motor life will be shortened and<br>Unable to play the original function. |

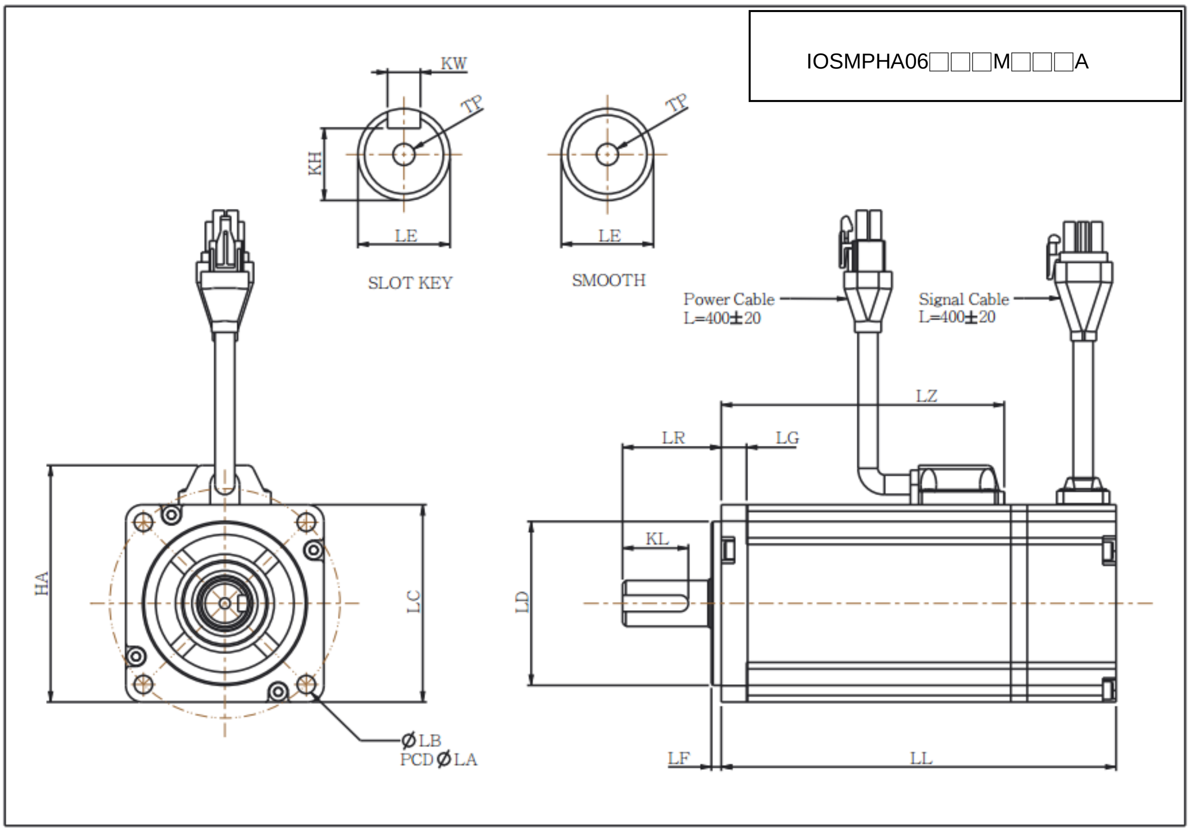
| Motor fixing screw | | |
|---|---|---|
| Servo motor model | Fixed hole | Recommended |
| IOSMPHA04010M | 2-φ4.5 | Over M4 X 12mm |
| IOSMPHA06020M | 4-φ5.5 | Over M5 X 12mm |
| IOSMPHA06040M | 4-φ5.5 | Over M5 X 12mm |
| IOSMPHA08075M | 4-φ7 | Over M6 X 14mm |
| IOSMPHB131D0M<br>IOSMPHB131D5M<br>IOSMPHB132D0M | 4-φ9 | Over M8 X 18mm |

| | | |
|---|---|---|
| ! | In combination with a reducer, the oil may enter the inside of the motor from the output shaft. It is necessary to specify an oil seal on the motor. | Doing so will shorten the life of the motor and will not function properly. |

## 10.2.3. Outline dimension drawing (Motor)

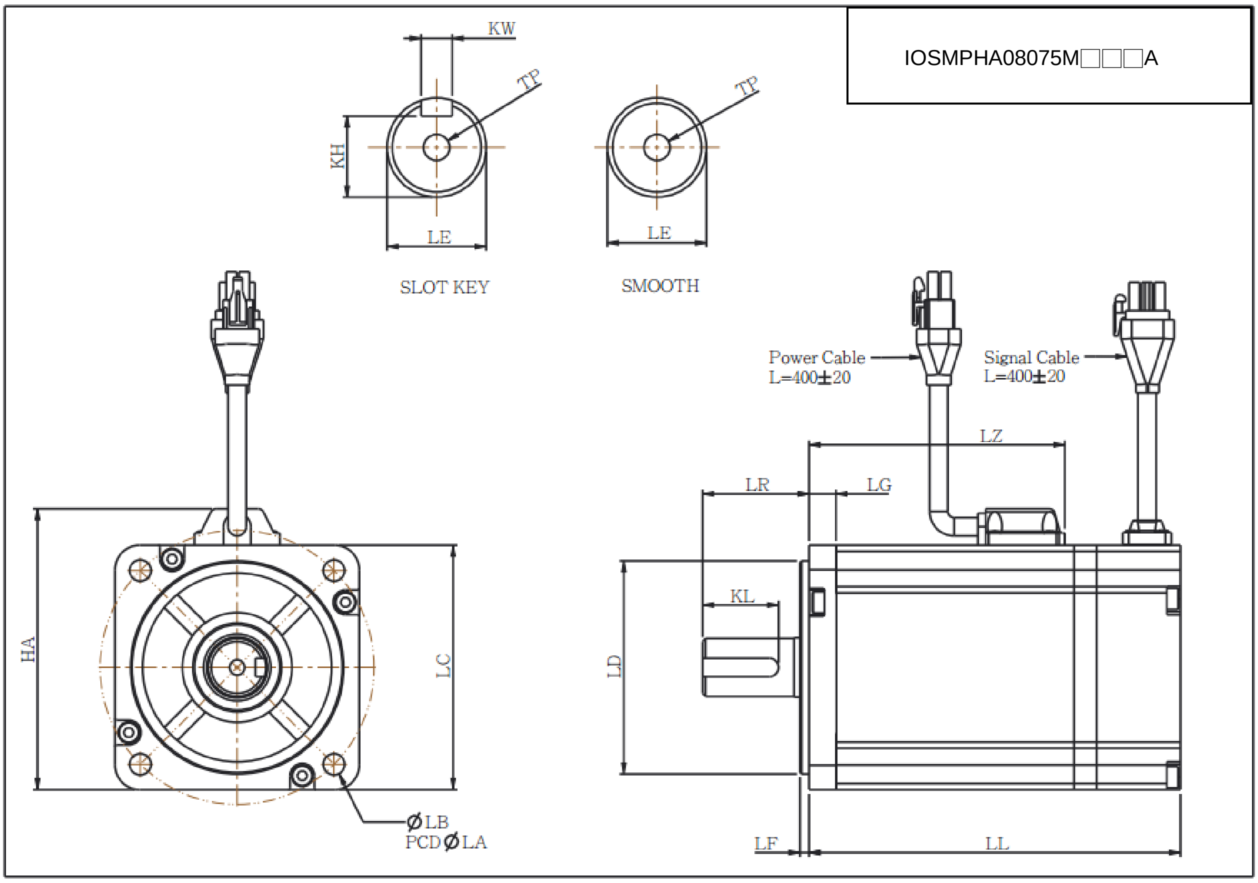



| Power | 100W | |
|---|---|---|
| Model Name | IOSMPHA04010M□□NA | IOSMPHA04010M□□EA |
| LL | 99 | 127.5 |
| LZ | 63.5 | |
| LA | Φ46 | |
| LB | 2-Φ4.5 | |
| LC | 40 | |
| LD | Φ30 h7 | |
| LE | Φ8 h6 | |
| LF | 2.5 | |
| LG | 5.2 | |
| LR | 25 | |
| KL | 16 | |
| KW | 3 N9 | |
| KH | 6.2 | |
| TP | M3 Depth 8 | |
| HA | 52 | |

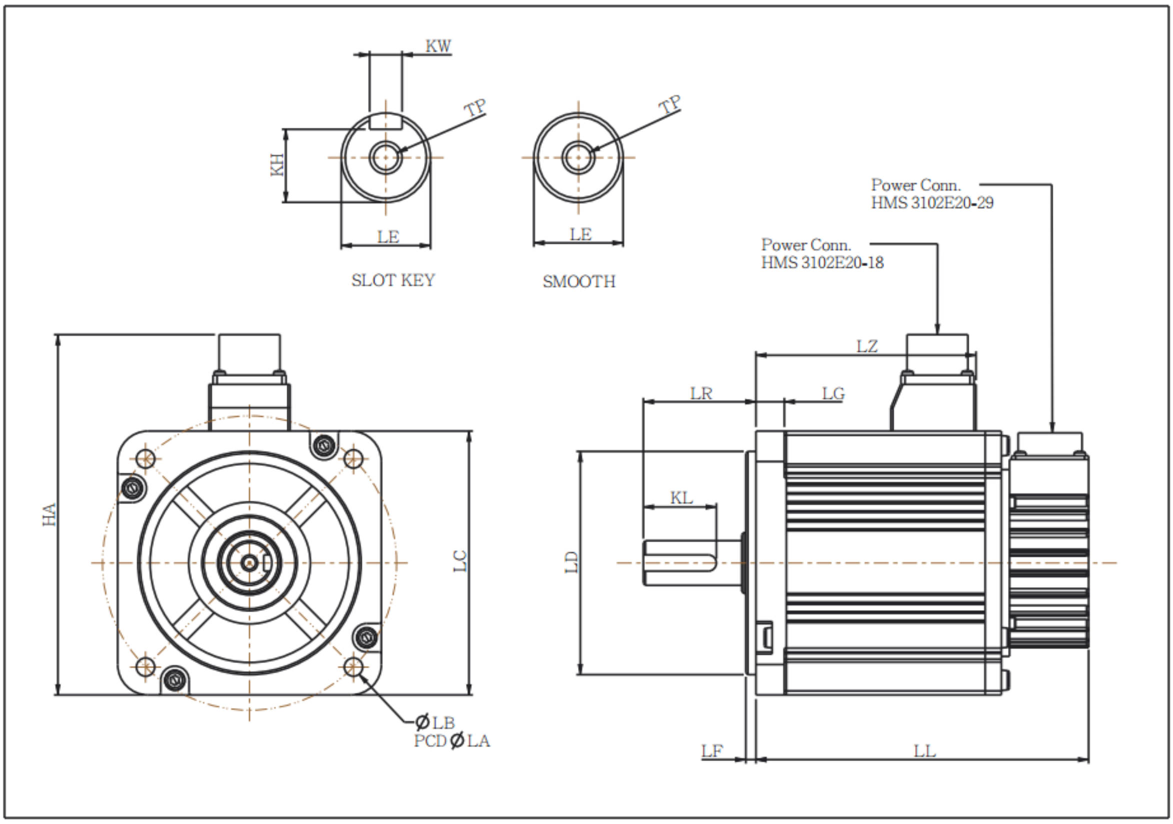



| Power | 200W | |
|---|---|---|
| Model Name | IOSMPHA06020M□□NA | IOSMPHA06020M□□EA |
| LL | 97 | 131 |
| LZ | 62 | |
| LA | Φ70 | |
| LB | 4-Φ5.5 | |
| LC | 60 | |
| LD | Φ50 h7 | |
| LE | Φ14 h6 | |
| LF | 3 | |
| LG | 7.7 | |
| LR | 30 | |
| KL | 20 | |
| KW | 5 N9 | |
| KH | 11 | |
| TP | M4 Depth 15 | |
| HA | 72 | |

| Power | 400W | |
|---|---|---|
| Model Name | IOSMPHA06040M□□NA | IOSMPHA06040M□□EA |
| LL | 120 | 154 |
| LZ | 86 | |
| LA | Φ70 | |
| LB | 4-Φ5.5 | |
| LC | 60 | |
| LD | Φ50 h7 | |
| LE | Φ14 h6 | |
| LF | 3 | |
| LG | 7.7 | |
| LR | 30 | |
| KL | 20 | |
| KW | 5 N9 | |
| KH | 11 | |
| TP | M4 Depth 15 | |
| HA | 72 | |




| Power | 750W | |
|---|---|---|
| Model Name | IOSMPHA08075M□□NA | IOSMPHA08075M□□EA |
| LL | 122 | 155 |
| LZ | 84 | |
| LA | Φ90 | |
| LB | 4-Φ7 | |
| LC | 80 | |
| LD | Φ70 h7 | |
| LE | Φ19 h6 | |
| LF | 3 | |
| LG | 8.8 | |
| LR | 35 | |
| KL | 25 | |
| KW | 6 N9 | |
| KH | 15.5 | |
| TP | M6 Depth 15 | |
| HA | 92 | |



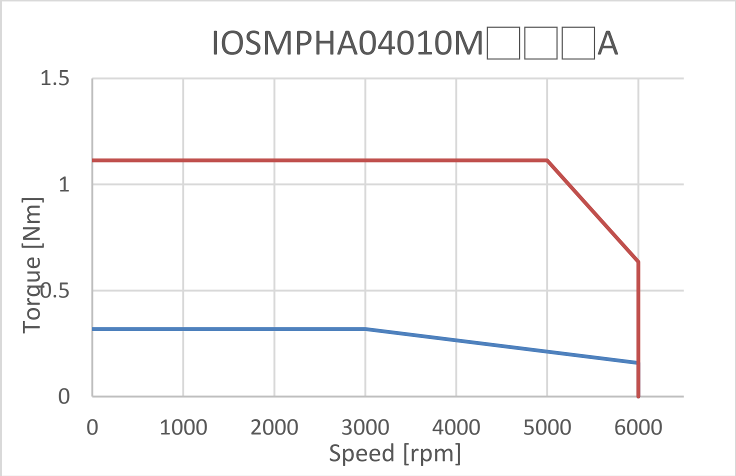

| Power | 1kW | |
|---|---|---|
| Model Name | IOSMPHB131D0M□□NA | IOSMPHB131D0M□□EA |
| LL | 140 | 191 |
| LZ | 85.5 | |
| LA | Φ145 | |
| LB | 4-Φ9 | |
| LC | 130 | |
| LD | Φ110 h7 | |
| LE | Φ24 h6 | |
| LF | 5 | |
| LG | 14 | |
| LR | 55 | |
| KL | 36 | |
| KW | 6 N9 | |
| KH | 19.5 | |
| TP | M6 Depth 15 | |
| HA | 179 | |

| Power | 1.5kW | |
|---|---|---|
| Model Name | IOSMPHB131D5M□□NA | IOSMPHB131D5M□□EA |
| LL | 160 | 209 |
| LZ | 105.5 | |
| LA | Φ145 | |
| LB | 4-Φ9 | |
| LC | 130 | |
| LD | Φ110 h7 | |
| LE | Φ24 h6 | |
| LF | 5 | |
| LG | 14 | |
| LR | 55 | |
| KL | 36 | |
| KW | 6 N9 | |
| KH | 19.5 | |
| TP | M6 Depth 15 | |
| HA | 179 | |

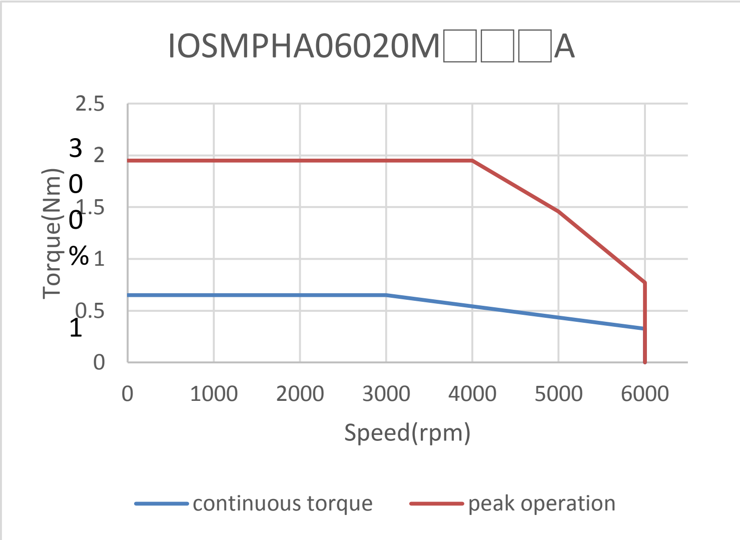
| Power | 2kW | |
|---|---|---|
| Model Name | IOSMPHB132D0M□□NA | IOSMPHB132D0M□□EA |
| LL | 179 | 229 |
| LZ | 124.5 | |
| LA | Φ145 | |
| LB | 4-Φ9 | |
| LC | 130 | |
| LD | Φ110 h7 | |
| LE | Φ24 h6 | |
| LF | 5 | |
| LG | 14 | |
| LR | 55 | |
| KL | 36 | |
| KW | 6 N9 | |
| KH | 19.5 | |
| TP | M6 Depth 15 | |
| HA | 179 | |

### 10.2.4. T-N Characteristic figure

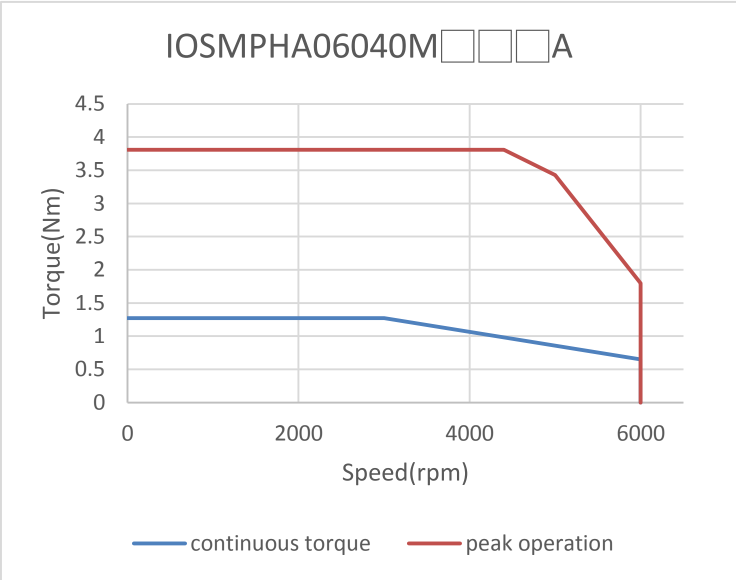
100W



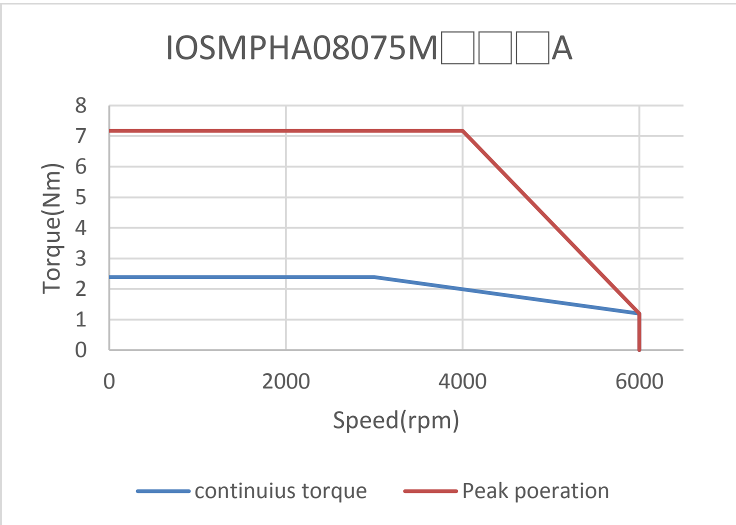

200W



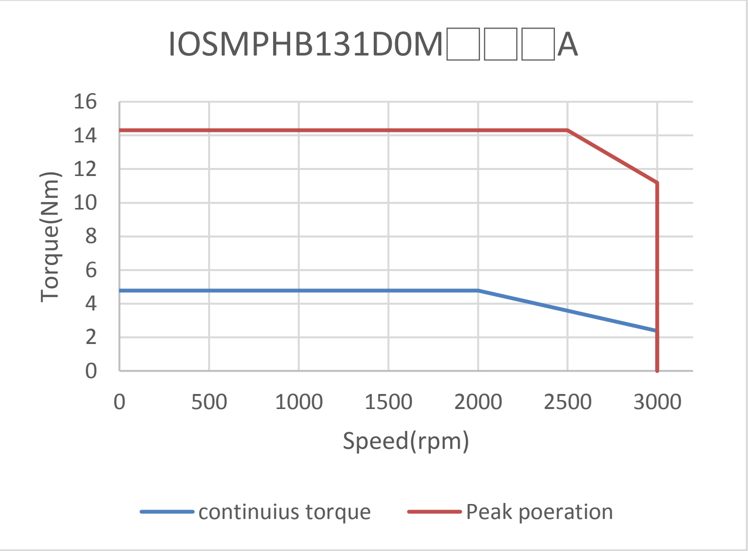
400W


IOSMPHA06040M□□□A
Torque(Nm)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
2000
4000
6000
Speed(rpm)
continuous torque
peak operation

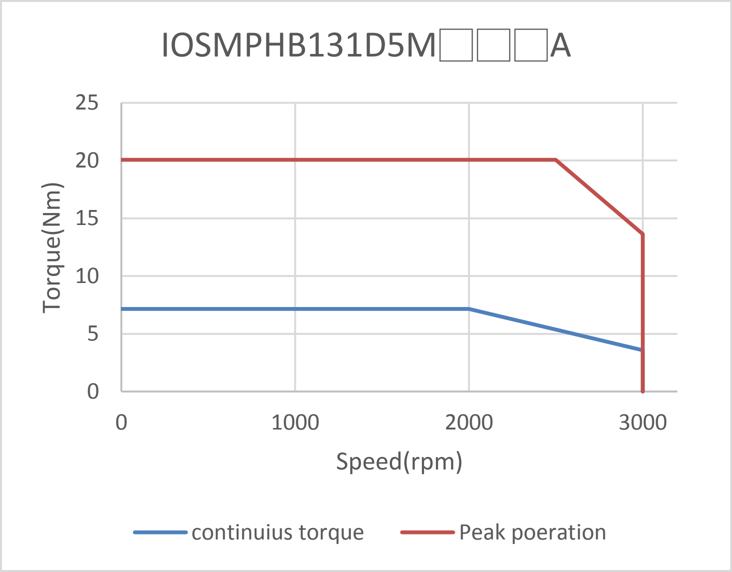
750W


IOSMPHA08075M□□□A
Torque(Nm)
8
7
6
5
4
3
2
1
0
0
2000
4000
6000
Speed(rpm)
continuius torque
Peak poeration

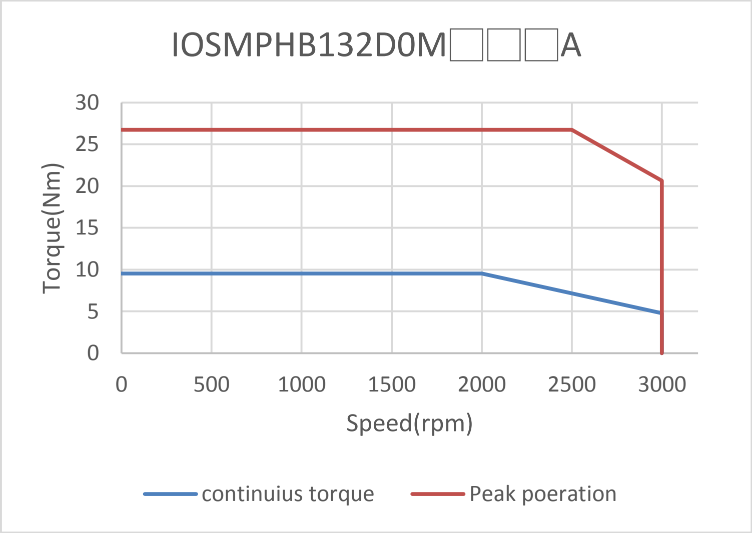
1kW


IOSMPHB131D0M□□□A
Torque(Nm)
16
14
12
10
8
6
4
2
0
0
500
1000
1500
2000
2500
3000
Speed(rpm)
continiuius torque
Peak poeration

1.5kW


IOSMPHB131D5M□□□A
Torque(Nm)
25
20
15
10
5
0
0
1000
2000
3000
Speed(rpm)
continuius torque
Peak poeration

2kW


IOSMPHB132D0M□□□A
Torque(Nm)
30
25
20
15
10
5
0
0
500
1000
1500
2000
2500
3000
Speed(rpm)
continuius torque
Peak poeration