

**AC SERVO SYSTEMS**  
**EPS-B1 SERIES**  
**USER MANUAL**  
(V1.12)



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# How to read the parameters?

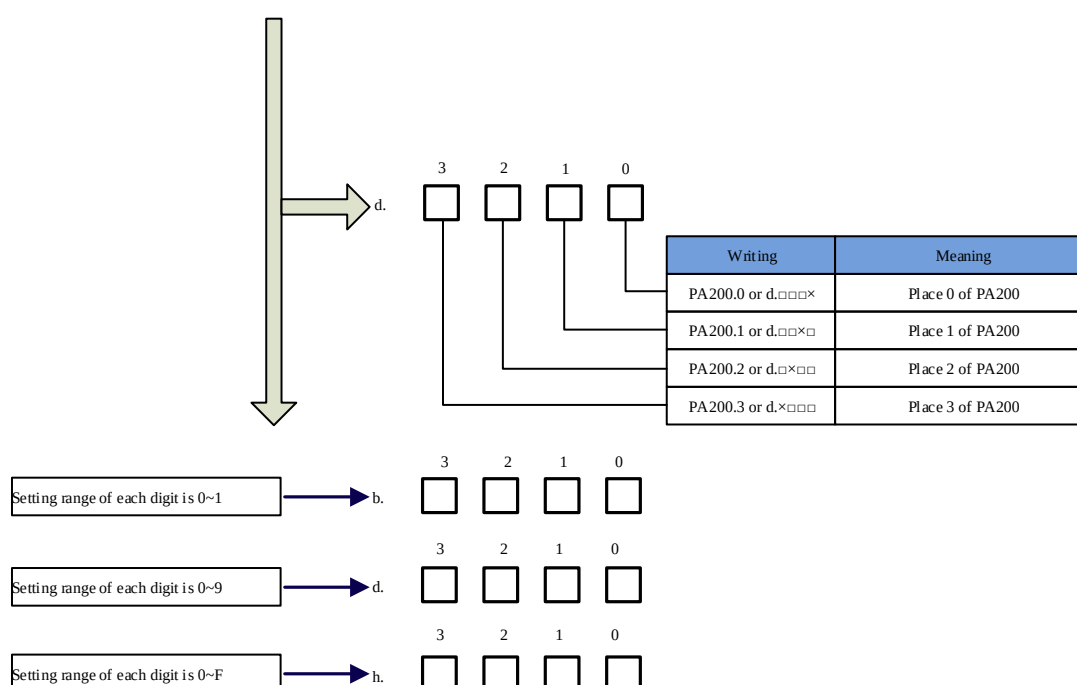
- **High place/Low place explanation**

Sometimes one parameter value is two parameter values combined together. For example, High place is 1234 and low place is 5678, then the combined value is 12345678.

Also for hexadecimal data can be 16-bit or 32-bit. 32-bit data consists of two 16-bit data (two parameters, high/low place) . For example, 0781H data is 0001H and 0782H data is 013AH; then absolute encoder single turn data is 0001013AH.

- **Parameter 1/2/3/4 explanations**

| Parameter | Function                | Range         | Unit | Default | Effective | Remarks |
|-----------|-------------------------|---------------|------|---------|-----------|---------|
| PA200     | Position control switch | d.0000~d.1232 | —    | 0000    | Restart   |         |



# Safety Notice

This section will introduce the main instructions that users shall follow during the receiving, storage, handling, installation, wiring, operation, inspection and disposal of the products.

## DANGER

### ■ Input power

Input power of the servo drive is 220VAC (-15%~+10%) or 380VAC (-15%~+15%) .

### ■ When installed to a machine, the servo motor shall be able to do emergency stop at any moment.

Otherwise, there may be personnel injuries and mechanical failure.

### ■ When the power is on, the power supply terminals must be properly housed.

Otherwise, there may be electric shocks.

### ■ After power off or voltage withstand test, when the charge indication light (CHARGE) is on, do not touch the power supply terminals.

Otherwise, there may be electric shocks caused by residual voltage.

### ■ Please do trial run (JOG) following the procedures and instructions of this user manual.

Otherwise, there may be personnel injuries and mechanical failure.

### ■ Do not make any alterations to this product. Only qualified/designated persons can configure, dismantle or repair this product.

Otherwise, there may be personnel injuries, mechanical failure or fire.

### ■ Please install stop mechanisms on the machine side to ensure safety.

The holding brake of the servo motor is not a device designed to ensure safety.

Otherwise, there may be injuries.

### ■ Please ensure to connect the earth terminal of servo drive with the earth electrode (the earth resistance of servo drive for power input is below 100Ω) .

Otherwise, there may be electric shocks or fire.

## ATTENTION: STORING & TRANSPORTING

### ■ The product shall not be stored or used in below environment:

(Otherwise, there may be fire, electric shocks or machinery breakdown.)

- The place with direct sun light;
- The place where temperature exceeds the limits for storage and using;
- The place where the relative humidity exceeds the limits for storage and using;
- The place with corrosive or flammable gases;
- The place with too much dust, dirt, and too many saline matters and metal powders;
- The place prone to water, oil and chemicals splashes;
- The place where vibrations or shocks may affect the principal parts.

### ■ Please do not transport the product by grasping the cables, motor shafts or encoders.

Otherwise, there may be personnel injuries or machine breakdown.

## ATTENTION: INSTALLATIONS

- **Please do not block the air inlet and outlet, and prevent alien matters entering the product.**  
Otherwise, the inner components may be aged and cause failure or fire.
- **Please install at correct directions.**  
Otherwise, there may be failure.
- **During installation, please ensure there is enough space between the servo drive and internal surface of control cabinet and other electrical parts.**  
Otherwise, there may be fire or machine breakdown.
- **Please do not impose too big impacts.**  
Otherwise, there may be machine breakdown.

## ATTENTION: WIRING

- **Please connect wires correctly and reliably.**  
Otherwise, there may be out-of-control of motor, personnel injuries or machine fault.
- **Please DO NOT connect commercial power supply to the UVW terminals of the servo drive.**  
Otherwise, there may be personnel injuries or fire.
- **Please connect the UVW terminals with the servo motor firmly.**  
Otherwise, there may be a fire.
- **Please do not house the main circuit cables, input-output signal cables and encoder cables with the same bushing, or tie them together. During wiring, the main circuit cables shall be at least 30cm from the input-output signal cable.**
- **Cables for input-output signal and encoder shall be twin strands or multiple-core twinning bulk shielding strands.**
- **Maximum length of input-output signal cable: 3m;  
Maximum length of encoder cable: 30m.**
- **Even when the power is turned off, there may still be residual high voltage inside the servo drive, so when the charge indication light (CHARGE) is on, do not touch the power terminals.**  
Please connect or check wirings after the charge indication light (CHARGE) is off.
- **Please install circuit breakers to prevent external short-circuit.**  
Otherwise, there may be a fire.
- **When used in the following places, please take appropriate measures for shielding:**
  - When there may be interference of static electricity
  - The place with strong electric field or high intensity field
  - The place where there may be radioactive raysOtherwise, there may be machinery breakdown.
- **When connecting to batteries, pay attention to the polarity.**  
Otherwise, it may lead to the damage and explosion of batteries, servo drive and servo motor.



## ATTENTION: OPERATIONS

- **In order to prevent accidents, please conduct trial run (JOG) before connecting to mechanical parts.**  
Otherwise, there may be injuries.
- **Before running, please set the appropriate parameters.**  
Otherwise, the machine may be out of control or have failure.
- **Please do not turn on/off the power supply frequently.**  
Because the power section of servo drive has capacitors, when the power is on, heavy charging current may flow through them. Therefore, if the power is frequently turned on/off, perseverance of the main circuit components inside the servo drive may decline.
- **During JOG operation (AF 02) and manual load inertia detection (AF 15), please note that the emergency stop will become ineffective at over-travel.**  
Otherwise, there may be machinery breakdown.
- **When the servo motor is used on the vertical axis, please set a safety device, in case workpiece drops when there is alarm or over-travel. Besides, please set up zero-position fixation when there is over-travel.**  
Otherwise, the workpiece may drop when there is over-travel.
- **Extreme or alternative parameter settings may cause the servo system to be instable.**  
Otherwise, there may be personnel injuries and machinery breakdown.
- **When there are alarms, please reset the alarm after finding out the causes and ensure operation safety, and then start operation again.**  
Otherwise, there may be machinery breakdown, fire or personnel injuries.
- **The holding brake (optional) of the servo motor is designed for maintaining positions, NOT for servo motor braking at decelerations.**  
Otherwise, there may be machine fault.
- **The servo motor and servo drive shall be used in combinations as specified.**  
Otherwise, there may be fire or machine breakdown.

## ATTENTION: MAINTENANCE

- **Please do not change the wiring when the power is on.**  
Otherwise, there may be electric shocks or personnel injuries.
- **When replacing the servo drive, please copy parameters to the new servo drive, and then start operation again.**  
Otherwise, there may be machinery breakdown.

## ATTENTION: OTHERS

- In order to give explicit explanations, housing or safety protection devices are omitted in some drawings in this user manual. During real operations, please make sure to install the housing or safety protection devices according to the instructions of the user manual.
- Illustrations in this manual are representative graphic symbols, which may be different from the products that you receive.
- During the commissioning and use of servo drive, please install the relevant safety protection devices. Our company will not bear any liability for the special losses, indirect losses and other relevant losses caused by our products.
- This manual is general descriptions or characteristic which may not always be the case in practical use, or may not be completely applicable when the products are further improved.

# Chapter 1 Product Introduction

## 1.1 Product inspections

Please check the items listed in the table below carefully, in case there is negligence during the purchase and transport of the product.

| Items to inspect                                                 | Reference                                                                                                                                                                                          |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Whether the product received is the right one you intend to buy? | Check the product model on the motor and driver nameplate respectively. Please refer to the notes to model in following sections.                                                                  |
| Whether the motor shaft runs smoothly?                           | Rotate the rotor shaft of the motor. If it can rotate smoothly, the rotor shaft is normal.<br><b>Note that the motor with electro-magnetic brake (holding brake) cannot be rotated with hands!</b> |
| Check whether there are any appearance damages?                  | Check visually whether there are any appearance damages.                                                                                                                                           |
| Whether there are loosened screws?                               | Check whether the mounting screws of servo drive is loosened with a screw driver.                                                                                                                  |

Please contact your vendor if anything above occurs.

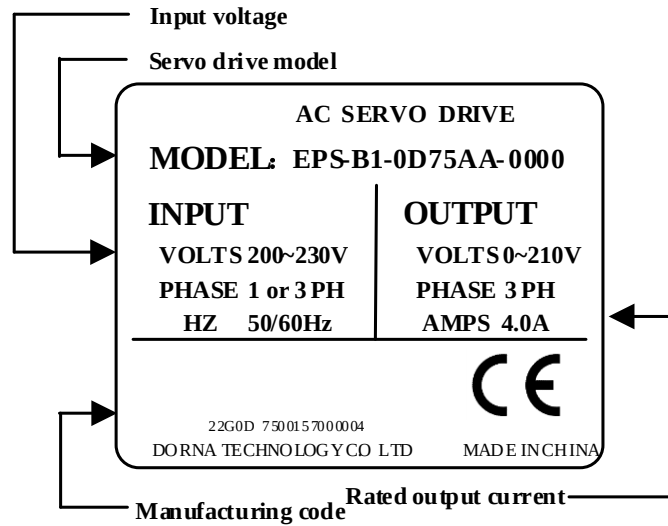
A complete set of servo components shall include the following:

| No. | Reference                                                                                         |
|-----|---------------------------------------------------------------------------------------------------|
| 1   | Servo drive and its matching servo motor.                                                         |
| 2   | Motor power line: supplies power from servo drive to servo motor.                                 |
| 3   | Motor encoder line: transmits signals from motor encoder to servo drive.                          |
| 4   | RJ45 plug for CN1: RS485 communication (optional)                                                 |
| 5   | 50-PIN plug for CN2 (3M simulation product) (optional)                                            |
| 6   | 20-PIN plug for CN3 (A, B type case only) (3M simulation product) (optional)                      |
| 7   | 5-PIN plug for servo drive (A, B type case only) input power supply: L1. L2. L3. L1C. L2C         |
| 8   | 5-PIN plug for external braking resistor and DC reactor (A, B type case only) : (P, D, C, -1, -2) |
| 9   | Two metal pieces for short-circuiting (except E type case)                                        |
| 10  | One copy of user manual                                                                           |

## 1.2 Product model identifications

### 1.2.1 Description of nameplate

- Description of the nameplates of EPS-B1 series servo drives



## 1.2.2 Model identifications

Note: drive and motor models can be updated from time to time. Please contact our after-sales service for updated information.

### ■ Description of the models of EPS-B1 servo drive



1 PRODUCT NAME: EPS

2 PRODUCT SERIES:  
B1 SERIES  
B2 SERIES

3 DRIVE RATED POWER

| SYMBOL | DEFINITION | SYMBOL | DEFINITION |
|--------|------------|--------|------------|
| 0D05   | 0.05KW     | 02D2   | 2.2KW      |
| 0D10   | 0.1KW      | 0003   | 3.0KW      |
| 0D20   | 0.2KW      | 04D5   | 4.5KW      |
| 0D40   | 0.4KW      | 05D5   | 5.5KW      |
| 0D75   | 0.75KW     | 07D5   | 7.5KW      |
| 0001   | 1.0KW      | 0011   | 11KW       |
| 01D2   | 1.2KW      | 0015   | 15KW       |
| 01D5   | 1.5KW      | 0022   | 22KW       |

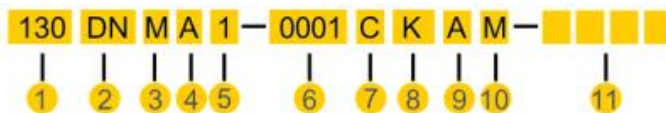
4 INPUT VOLTAGE

| SYMBOL | DEFINITION                |
|--------|---------------------------|
| A      | SINGLE/THREE PHASE 220VAC |
| B      | THREE PHASE 380VAC        |

5 HARDWARE VERSION

6 FACTORY CODE

## ■ Description of the models of DORNA servo motors



1 MOTOR FLANGE (MM)

| SYMBOL | DEFINITION    | SYM BOL | DEFINITION    |
|--------|---------------|---------|---------------|
| 40     | 40 MM FLANGE  | 130     | 130 MM FLANGE |
| 60     | 60 MM FLANGE  | 180     | 180 MM FLANGE |
| 80     | 80 MM FLANGE  | 200     | 200 MM FLANGE |
| 110    | 110 MM FLANGE | 220     | 220 MM FLANGE |

2 PRODUCT NAME: DN

### 3 MOTOR ROTARY INERTIA

| SYMBOL | DEFINITION     |
|--------|----------------|
| M      | MEDIUM INERTIA |
| H      | HIGH INERTIA   |

#### 4 VOLTAGE CLASS

| SYMBOL | DEFINITION         |
|--------|--------------------|
| A      | 220V VOLTAGE CLASS |
| B      | 380V VOLTAGE CLASS |

### 5 MOTOR POLE PAIRS

| SYMBOL | DEFINITION   |
|--------|--------------|
| 1      | 4 POLE PAIRS |
| 2      | 5 POLE PAIRS |

### 6 MOTOR RATED POWER

| SYMBOL | DEFINITION | SYMBOL | DEFINITION |
|--------|------------|--------|------------|
| 0D05   | 0.05KW     | 02D2   | 2.2KW      |
| 0D10   | 0.1KW      | 0003   | 3.0KW      |
| 0D20   | 0.2KW      | 04D5   | 4.5KW      |
| 0D40   | 0.4KW      | 05D5   | 5.5KW      |
| 0D75   | 0.75KW     | 07D5   | 7.5KW      |
| 0001   | 1.0KW      | 0011   | 11KW       |
| 01D2   | 1.2KW      | 0015   | 15KW       |
| 01D5   | 1.5KW      | 0022   | 22KW       |

### 7 MOTOR RATED SPEED

| SYMBOL | DEFINITION | SYMBOL | DEFINITION |
|--------|------------|--------|------------|
| A      | 1000 RPM   | D      | 3000 RPM   |
| B      | 1500 RPM   | E      | 2500 RPM   |
| C      | 2000 RPM   |        |            |

## 8 FEEDBACK DEVICE TYPE

| SYMBOL | DEFINITION                     |
|--------|--------------------------------|
| K      | 5000-LINE (LINE SAVING, GAIN ) |
| J      | 17-BIT SERIAL (ABSOLUTE)       |
| S      | 20-BIT SERIAL (GAIN)           |
| R      | RESOLVER                       |

## 9 MOTOR HOLDING BRAKE SELECTION

| SYMBOL | DEFINITION            |
|--------|-----------------------|
| A      | WITHOUT HOLDING BRAKE |
| B      | WITH HOLDING BRAKE    |

## 10 KEY SLOT/OIL SEAL SELECTION

| SYMBOL | KEY SOLT | OIL SEAL |
|--------|----------|----------|
| K      | YES      | NO       |
| Y      | NO       | YES      |
| M      | YES      | YES      |
| N      | NO       | NO       |

11 FACTORY CODE

## 1.3 Matching servo drives, motors and cables

Please select correct servo drive according to servo motor model, rated voltage, encoder type etc.

5 pole pair motors

**EP-B1, 220V, 5 pole pair**

| CASE TYPE     | Drive model             | Rated current | Motor model                  | Power        | Rated/max speed  | Rated current/torque | Parameter (PA012)   |
|---------------|-------------------------|---------------|------------------------------|--------------|------------------|----------------------|---------------------|
| A type        | EPS-B1-0D20AA           | 2A            | 60DNMA2-0D20D                | 200W         | 3000/6000        | 1.4A/0.64N           | <b>PA012=2</b>      |
| A type        | EPS-B1-0D40AA           | 3A            | 60DNMA2-0D40D                | 400W         | 3000/6000        | 2.5A/1.27N           | <b>PA012=3</b>      |
| B type        | EPS-B1-0D75AA           | 4.5A          | 80DNMA2-0D75D                | 750W         | 3000/4500        | 3.7A/2.4N            | <b>PA012=12</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 80DNMA2-0001D                | 1000W        | 3000/4500        | 4A/3.2N              | <b>PA012=13</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 80DNMA2-0001F                | 1000W        | 2500/3000        | 4A/4N                | <b>PA012=14</b>     |
| B type        | EPS-B1-0D75AA           | 4.5A          | 80DNMA2-0D75C                | 750W         | 2000/4500        | 4.5A/3.5N            | <b>PA012=15</b>     |
| B type        | EPS-B1-0D75AA           | 4.5A          | 90DNMA2-0D75C                | 750W         | 2000/4500        | 4.5A/3.5N            | <b>PA012=15</b>     |
| B type        | EPS-B1-0D75AA           | 4.5A          | 90DNMA2-0D85C                | 850W         | 2000/2300        | 3A/4N                | <b>PA012=16</b>     |
| B type        | EPS-B1-01D5AA           | 6A            | 130DNMA2-0001A               | 1000W        | 1000/1500        | 4.8A/10N             | <b>PA012=37</b>     |
| B type        | EPS-B1-01D5AA           | 7.6A          | 130DNMA2-01D5A               | 1500W        | 1000/1500        | 8A/14.33N            | <b>PA012=38</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 130DNMA2-0D85B               | 1000W        | 1500/3000        | 5.2A/5.4N            | <b>PA012=36</b>     |
| C type        | EPS-B1-01D5AA<br>XXXX-G | 11A           | 130DNMA2-01D3B               | 1500W        | 1500/3000        | 8.4A/8.3N            | <b>PA012=43(39)</b> |
| C type        | EPS-B1-01D5AA-XXXX-G    | 11A           | 130DNMA2-01D5B(20C)          | 1500W        | 1500/2250        | 10.3A/9.55N          | PA012=42            |
| C type        | EPS-B1-02D2AA-XXXX-G    | 16A           | 130DNMA2-0002B(30C)          | 2000W        | 1500/3000        | 13.8A/12.7N          | PA012=45            |
| C type        | EPS-B1-02D2AA-XXXX-G    | 16A           | 130DNMA2-02D3B(30C)          | 2000W        | 1500/3000        | 13.8A/12.7N          | <b>PA012=45</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 130DNMA2-0001C(10C)          | 1000W        | 2000/3000        | <b>4.8A</b> /4.8N    | <b>PA012=33</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 130DNMA2-01D2C(10C)          | 1200W        | 2000/3000        | <b>5.4A</b> /6N      | <b>PA012=34</b>     |
| B type        | EPS-B1-01D5AA           | 7.6A          | 130DNMA2-01D5C(15C)          | 1500W        | 2000/3000        | 8A/7.2N              | <b>PA012=35</b>     |
| C type        | EPS-B1-02D2AA           | 11A           | 130DNMA2- <b>0002C</b> (20C) | 2000W        | 2000/3000        | 10.3A/9.55N          | <b>PA012=42</b>     |
| C type        | EPS-B1-0003AA           | 16A           | 130DNMA2-0003C(30C)          | 3000W        | 2000/3000        | 15.6A/14.3N          | <b>PA012=45</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 130DNMA2-0001D(10C)          | 1000W        | 3000/3200        | 3.6A/3.18N           | <b>PA012=30</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 130DNMA2-01D2D(10C)          | 1200W        | 3000/3200        | 3.7A/3.8N            | <b>PA012=30</b>     |
| B type        | EPS-B1-0001AA           | 6A            | 130DNMA2-01D5D(15C)          | 1500W        | 3000/3200        | 5.3A/4.77N           | <b>PA012=31</b>     |
| B type        | EPS-B1-01D5AA           | 7.6A          | 130DNMA2-01D8D(15C)          | 1800W        | 3000/4000        | 6.7A/5.7N            | <b>PA012=32</b>     |
| <b>C type</b> | <b>EPS-B102D2AA</b>     | <b>7.6A</b>   | <b>130DNMA2-0002D(20C)</b>   | <b>2000W</b> | <b>3000/3200</b> | <b>6.7A/6.36N</b>    | <b>PA012=46</b>     |
| <b>C type</b> | <b>EPS-B1-0003AA</b>    | <b>16A</b>    | <b>130DNMA2-0003D(30C)</b>   | <b>3000W</b> | <b>3000/3200</b> | <b>10.5A/9.55N</b>   | <b>PA012=47</b>     |

| C type                   | EPS-B1-0003AA        | 16A           | 130DNMA2-0003D      | 3000W | 3000/5000       | 16.5A/10N            | PA012=49          |
|--------------------------|----------------------|---------------|---------------------|-------|-----------------|----------------------|-------------------|
| EP-B1, 380V, 5 pole pair |                      |               |                     |       |                 |                      |                   |
| CASE TYPE                | Drive model          | Rated current | Motor model         | Power | Rated/max speed | Rated current/torque | Parameter (PA012) |
| B type                   | EPS-B1-0001BA        | 3.5A          | 80DNMB2-0001D       | 1000W | 3000/4500       | 3A/3.2N              | PA012=13          |
| B type                   | EPS-B1-0001BA        | 3.5A          | 130DNMB2-0001C      | 1000W | 2000/3000       | 3.6A/4.77N           | PA012=33          |
| B type                   | EPS-B1-0001BA        | 3.5A          | 130DNMB2-0001D      | 1000W | 3000/3500       | 2.4A/3.18N           | PA012=36          |
| C type                   | EPS-B1-01D5BA        | 4.5A          | 130DNMB2-0001A      | 1000W | 1000/1500       | 3A/9.55N             | PA012=37          |
| C type                   | EPS-B1-01D5BA-XXXX-G | 6.5A          | 130DNMB2-01D5B(20C) | 1500W | 1500/3000       | 6.1A/9.55N           | PA012=42          |
| C type                   | EPS-B1-02D2BA-XXXX-G | 9A            | 130DNMB2-0002B(30C) | 2000W | 1500/3000       | 7.9A/12.7N           | PA012=45          |
| C type                   | EPS-B1-01D5BA        | 4.5A          | 130DNMB2-01D5C(15C) | 1500W | 2000/3000       | 4.6A/7.2N            | PA012=35          |
| C type                   | EPS-B1-02D2BA        | 6.5A          | 130DNMB2-0002C(20C) | 2000W | 2000/3000       | 6.1A/9.55N           | PA012=42          |
| C type                   | EPS-B1-0003BA        | 9A            | 130DNMB2-0003C(30C) | 2000W | 2000/3000       | 8.8A/14.33N          | PA012=45          |
| C type                   | EPS-B1-01D5BA        | 4.5A          | 130DNMB2-01D5D(15C) | 1500W | 3000/3200       | 3.3A/4.77N           | PA012=31          |
| C type                   | EPS-B1-02D2BA        | 6.5A          | 130DNMB2-0002D(20C) | 2000W | 3000/3200       | 4A/6.36N             | PA012=46          |
| C type                   | EPS-B1-0003BA        | 9A            | 130DNMB2-0003D(30C) | 3000W | 3000/3200       | 6A/9.55N             | PA012=47          |

4 pole pair motors (0.2 to 3KW have already been discontinued as of Jan, 2018)

| Voltage Class | Rated power | Servo drive   |             |           | Servo motor |                |             |              |
|---------------|-------------|---------------|-------------|-----------|-------------|----------------|-------------|--------------|
|               |             | Model         | PA012 Value | Case Type | Flange (mm) | Model          | Rated speed | Rated torque |
| 220V          | 0.2KW       | EPS-B1-0D20AA | 2           | A         | 60          | 60DNMA1-0D20D  | 3000rpm     | 0.64 N·M     |
|               | 0.4KW       | EPS-B1-0D40AA | 3           | A         | 60          | 60DNMA1-0D40D  | 3000rpm     | 1.27 N·M     |
|               | 0.75KW      | EPS-B1-0D75AA | 12          | B         | 80          | 80DNMA1-0D75D  | 3000rpm     | 2.37 N·M     |
|               | 1KW         | EPS-B1-0001AA | 13          | B         | 80          | 80DNMA1-0001D  | 3000rpm     | 3.2 N·M      |
|               | 1KW         | EPS-B1-0001AA | 33          | B         | 130         | 130DNMA1-0001C | 2000rpm     | 5 N·M        |
|               | 1.2KW       | EPS-B1-01D5AA | 25          | B         | 110         | 110DNMA1-01D2D | 3000rpm     | 4 N·M        |
|               | 1.2KW       | EPS-B1-01D5AA | 34          | B         | 130         | 130DNMA1-01D2C | 2000rpm     | 6 N·M        |
|               | 1.5KW       | EPS-B1-01D5AA | 35          | B         | 130         | 130DNMA1-01D5C | 2000rpm     | 7.2 N·M      |
|               | 1.5KW       | EPS-B1-02D2AA | 41          | C         | 130         | 130DNMA1-01D5C | 2000rpm     | 7.2 N·M      |
|               | 1.8KW       | EPS-B1-01D5AA | 29          | B         | 110         | 110DNMA1-01D8D | 3000rpm     | 6 N·M        |
|               | 2.2KW       | EPS-B1-02D2AA | 42          | C         | 130         | 130DNMA1-02D2C | 2000rpm     | 10.5 N·M     |
|               | 3KW         | EPS-B1-0003AA | 45          | C         | 130         | 130DNMA1-0003C | 2000rpm     | 14.33 N·M    |
|               | 3KW         | EPS-B1-0003AA | 70          | C         | 180         | 180DNMA1-0003B | 1500rpm     | 19.1 N·M     |
|               | 4.5KW       | EPS-B1-04D5AA | 72          | D         | 180         | 180DNMA1-04D5B | 1500rpm     | 28.6 N·M     |
| 380V          | 2.2KW       | EPS-B1-02D2BA | 42          | C         | 130         | 130DNMB1-02D2C | 2000rpm     | 10.5 N·M     |
|               | 3KW         | EPS-B1-0003BA | 45          | C         | 130         | 130DNMB1-0003C | 2000rpm     | 14.33 N·M    |
|               | 3KW         | EPS-B1-0003BA | 70          | C         | 180         | 180DNMB1-0003B | 1500rpm     | 19.1 N·M     |
|               | 4.5KW       | EPS-B1-04D5BA | 72          | C         | 180         | 180DNMB1-04D5B | 1500rpm     | 28.6 N·M     |
|               | 5.5KW       | EPS-B1-05D5BA | 73          | D         | 180         | 180DNMB1-05D5B | 1500rpm     | 35 N·M       |
|               | 7.5KW       | EPS-B1-07D5BA | 74          | D         | 180         | 180DNMB1-07D5B | 1500rpm     | 47.7 N·M     |
|               | 11KW        | EPS-B1-0011BA | 109         | E         | 180         | 180DNMB1-0011B | 1500rpm     | 70 N·M       |
|               | 15KW        | EPS-B1-0015BA | 125         | E         | 220         | 200DNMB1-14D7C | 2000rpm     | 70 N·M       |
|               | 22KW        | EPS-B1-0022BA | 135         | E         | 220         | 200DNMB1-0022C | 2000rpm     | 105 N·M      |



## DORNA AC servo motors: 4 pole pairs to 5 pole pairs

(0.2KW to 3KW)

|                            | Before                                                                                                                                                                                                                | After                                      | Remarks                                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Model number</b>        | 60DNMA1-0D20DKAK                                                                                                                                                                                                      | 60DNMA2-0D20DKAK                           | DNMA1 to DNMA2                                                                                                                          |
| <b>Motor design</b>        | 4 pole pairs                                                                                                                                                                                                          | 5 pole pairs                               |                                                                                                                                         |
| <b>Product range</b>       | 60DNMA1<br>80DNMA1<br>130DNMA1<br>130DNMB1                                                                                                                                                                            | 60DNMA2<br>80DNMA2<br>130DNMA2<br>130DNMB2 | All motors from 0.2KW~3KW, both 220V & 380V voltage class will be upgraded.<br><br>For 180/200mm flange, we will not make such changes. |
| <b>Reasons for upgrade</b> | <ul style="list-style-type: none"> <li>Motor length reduced for 130mm flange motors</li> <li>Production process more automated for higher productivity and reliability</li> <li>Enhanced motor performance</li> </ul> |                                            |                                                                                                                                         |
| <b>Cables</b>              | Not changed                                                                                                                                                                                                           |                                            |                                                                                                                                         |
| <b>Servo drives</b>        | Not changed. For parameter changes see below.                                                                                                                                                                         |                                            |                                                                                                                                         |

Additional remarks:

- To use old version drives with new motors (5pp), user should set AF03=315, then PA940=5, PA949=0001 and restart;
- To use new version drives with old motors (4pp), user should set AF03=315, then PA940=4, PA949=0001 and restart;

Regarding the model number of 180mm flange motors:

Theoretically 180mm flange motors should be named as 180DNMA1 or 180DNMA2, but due to historical reasons, they are actually named as 180DNA and DNBB18, as shown below:

|                                   |                |                |
|-----------------------------------|----------------|----------------|
| Servo Motor series                | 180 Series     |                |
| Servo Motor model - new naming    | 180DNMA1-0003B | 180DNMA1-04D5B |
| Servo Motor model - actual naming | 180DNA-30B     | 180DNA-45B     |
| Input voltage                     | 220VAC         |                |

|                                   |                |                |                |                |
|-----------------------------------|----------------|----------------|----------------|----------------|
| Servo Motor series                | 180 Series     |                |                |                |
| Servo Motor model - new naming    | 180DNMB1-0003B | 180DNMB1-04D5B | 180DNMB1-05D5B | 180DNMB1-07D5B |
| Servo Motor model - actual naming | DNBB18-0003B   | DNBB18-04D5B   | DNBB18-05D5B   | DNBB18-07D5B   |
| Input voltage                     | 380VAC         |                |                |                |

EPS-B1 cables:

| Drive      | Power                        | Flange         | Encoder<br>cable(5000-<br>line) | Encoder<br>cable(17-bit) | Encoder<br>cable(17-bit<br>absolute) | Power<br>cable | Brake<br>cable | I/O<br>cable |        |        |        |        |
|------------|------------------------------|----------------|---------------------------------|--------------------------|--------------------------------------|----------------|----------------|--------------|--------|--------|--------|--------|
| B1<br>220V | 0.1KW—0.75KW                 | 60 series      | BE-031                          | BE-030                   | BF-030                               | DA-024         | BG-014         | KE-007       |        |        |        |        |
|            |                              | 80 series      |                                 |                          |                                      |                |                |              |        |        |        |        |
|            |                              | 90 series      |                                 |                          |                                      |                |                |              |        |        |        |        |
|            | 0.8KW—1.0KW                  | 80 series      | BF-031                          | BK-030                   | BH-030                               | DB-024/DC-024  | BC-014         |              |        |        |        |        |
|            |                              | 110 series     |                                 |                          |                                      |                |                |              |        |        |        |        |
|            |                              | 130 series     |                                 |                          |                                      |                |                |              |        |        |        |        |
|            | 1.0KW-1.5KW                  | 110 series     |                                 |                          |                                      |                |                |              |        |        |        |        |
|            |                              | 130 series     |                                 |                          |                                      |                |                |              |        |        |        |        |
|            | 2.1KW-3KW                    | 110 series     |                                 |                          |                                      | DE-002         |                |              |        |        |        |        |
|            |                              | 130 series     |                                 |                          |                                      |                |                |              |        |        |        |        |
|            | 3.1KW-4.5KW                  | 110 series     |                                 |                          |                                      |                |                |              | DF-002 |        |        |        |
|            |                              | 130 series     |                                 |                          |                                      |                |                |              |        |        |        |        |
| B1<br>380V | 1.0KW-1.5KW<br>(C type case) | 130/180 series |                                 |                          |                                      |                |                |              |        | BF-031 | BK-030 | BH-030 |
|            | 1.0KW-1.5KW<br>(B type case) |                |                                 |                          |                                      | DB-024         |                |              |        |        |        |        |
|            | 2.1KW-3.0KW                  | 130/180 series |                                 |                          |                                      | DD-002         |                |              |        |        |        |        |
|            | 3.1KW-4.5KW                  | 130/180 series | DE-002                          |                          |                                      |                |                |              |        |        |        |        |
|            | 4.5KW-7.5KW                  | 130/180 series | DF-002                          |                          |                                      |                |                |              |        |        |        |        |
|            |                              | 200 series     | DM-002                          |                          |                                      |                |                |              |        |        |        |        |
|            |                              | 220 series     | DI-002                          |                          |                                      |                |                |              |        |        |        |        |
|            | 11KW-15KW                    | 200 series     | DK-002                          |                          |                                      |                |                |              |        |        |        |        |
| 220 series |                              | DJ-002         |                                 |                          |                                      |                |                |              |        |        |        |        |
| 22KW       | 200 series                   | DN-002         |                                 |                          |                                      |                |                |              |        |        |        |        |

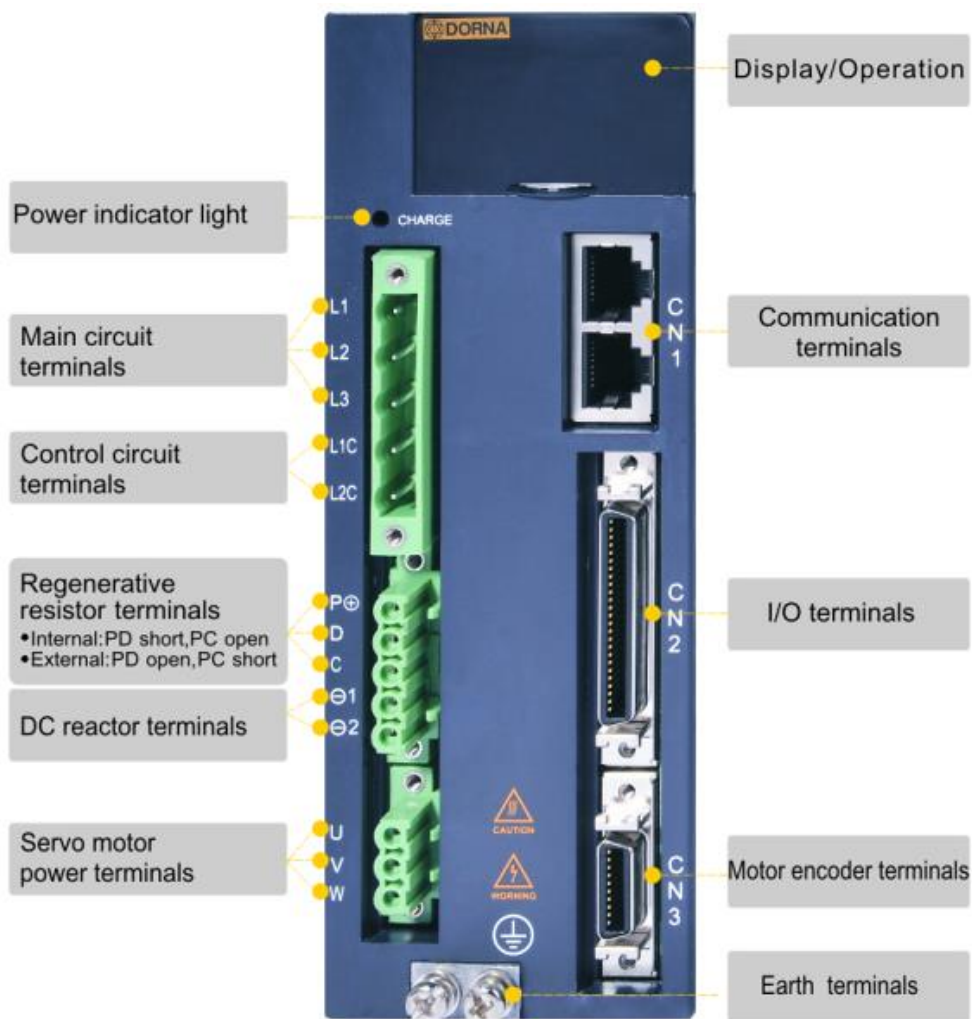
## 1.4 Maintenance and inspections

Please make regular maintenance and inspection of the drive and motor for safe and easy use. Routine and periodical inspections shall be carried out according to the following items

| Type                | Period | Items                                                                                                                                                                                                  |
|---------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Routine inspections | Daily  | <ul style="list-style-type: none"> <li>Whether there are dirt and or substances.</li> <li>Whether there is abnormal vibration and sound</li> <li>Whether the input supply voltage is normal</li> </ul> |

|                        |        |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        |        | <ul style="list-style-type: none"> <li>• Whether there is abnormal smell</li> <li>• Whether there are fiber stubs stuck to the ventilation opening</li> <li>• Whether the front end of driver and the connector are clean</li> <li>• Whether there the connection with control device and equipment motor is loose and whether the core feet deviates</li> <li>• Whether there are foreign matters in the load part</li> </ul> |
| Periodical inspections | Yearly | <ul style="list-style-type: none"> <li>• Whether the fastening parts are loose</li> <li>• Whether it is superheated</li> <li>• Whether the terminal is damaged or loose</li> </ul>                                                                                                                                                                                                                                             |

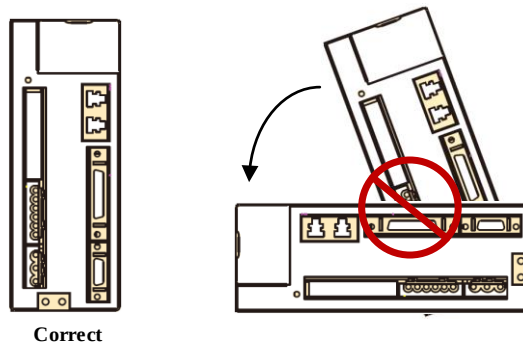
## 1.5 Name of each part of the servo driver



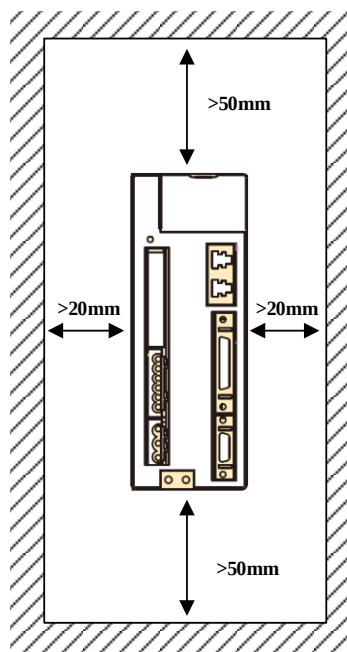
# Chapter 2 Installations

## 2.1 Installation direction and space

The installation direction must be in accordance with the regulations, otherwise it will cause malfunctions. In order to make a good cooling effect, the upper and lower, left and right with the adjacent items and baffle (wall) must have enough space, otherwise it will cause malfunctions. The AC servo drive's suction, exhaust hole cannot be sealed, nor placed upside down, otherwise it will cause malfunctions.



In order to lower the wind resistance to the radiator fan and let heat discharge effectively, users shall follow the recommended installation spacing distance of one or several AC servo drivers (see the figure below) .



## 2.2 Recommended specifications of circuit-breaker and fuse

### ■ 220V class

| Servo drive case type | Circuit-breaker | Fuse (class T) |
|-----------------------|-----------------|----------------|
| <b>A</b>              | 10A             | 20A            |
| <b>B</b>              | 20A             | 40A            |
| <b>C</b>              | 30A             | 80A            |
| <b>D</b>              | 50A             | 120A           |
| <b>E</b>              | 120A            | 300A           |

Note:

1. Strongly recommended: the fuse and circuit-breaker must comply with UL/CSA standards.
2. When an earth leakage circuit breaker (ELCB) is added for leakage protections, please choose ELCB with sensitivity current over 200mA and action time over 0.1s.

## 2.3 Countering noise interference and higher harmonics

The main circuit of servo drive uses a high-speed switching device, so the peripheral wiring and earthing of servo drive may be affected by the noise of the switching device. In order to prevent noise, the following measures can be taken:

- ◆ Please install EMI filter on the main power supply side;
- ◆ Connection of AC/DC reactor for suppression of higher harmonic;
- ◆ Please install the command input equipment (such as PLC) and EMI filter as close as possible to the servo drive;
- ◆ The power line (cable for power supply from servo drive to servo motor) shall be over 30cm from the input-output signal cable. Do not house them in the same bushing or tie them together.
- ◆ Do not use the same power supply with a welding machine or electro spark machine.
- ◆ When there is a high frequency generating device nearby, an EMI filter shall be connected to the input side of the main circuit cable.
- ◆ Ensure the earthing is appropriate.

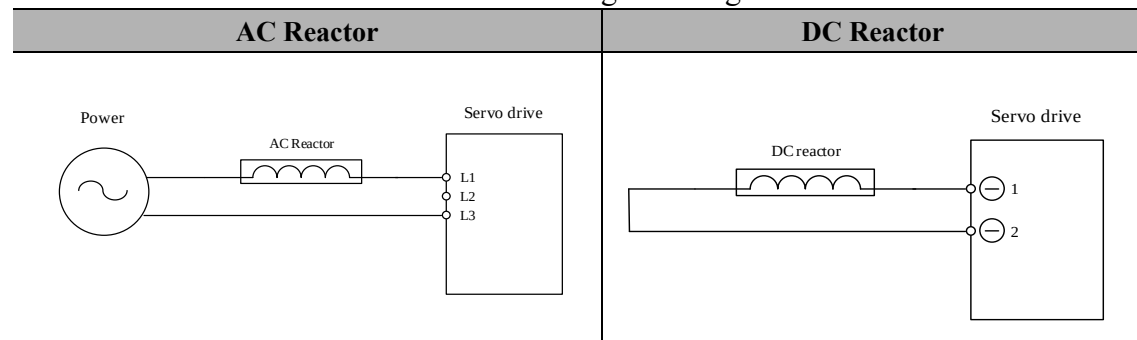
### 2.3.1 Installation of EMI filter

In order to ensure the EMI filter can fully suppress the interference, please note:

| Item | Reference                                                                                                                                                |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Servo drives and EMI filters must be installed on the same metal surface.                                                                                |
| 2    | The wiring has to be as short as possible.                                                                                                               |
| 3    | The metal surface shall be well grounded.                                                                                                                |
| 4    | The metal housing or earthing of both servo drive and EMI filter shall be reliably fixed to the metal surface, with the contact area as big as possible. |
| 5    | The motor power line shall have shielded (double shielding layer is preferred) .                                                                         |
| 6    | Ground shielding copper with the shortest distance and maximum contact.                                                                                  |

### 2.3.2 Connection of AC/DC reactor for suppression of higher harmonic

An AC/DC reactor can be connected to the servo drive for suppression of higher harmonic. Please connect the reactor according to the figure below:



## 2.4 Selection of regenerative resistors

When the motor is outputting torque opposite to the rotating direction, energy is regenerated from the load to the drive. DC bus voltage will rise and at a certain level, the regenerated energy can only be consumed by the regenerative resistor. The drive contains an internal regenerative resistor, and users can also connect an external regenerative resistor. The table below shows the specifications of regenerative resistor contained in EPS-B1 series servo drives.

| Servo drive case type | Internal regenerative resistor specs |                 | Minimum allowable resistance value (Ohm) |
|-----------------------|--------------------------------------|-----------------|------------------------------------------|
|                       | Resistance (Ohm)                     | Capacity (Watt) |                                          |
| A                     | -                                    | -               | 30                                       |
| B                     | 30 (220V)                            | 60              | 20                                       |
| C                     | 30 (220V) \40 (380V)                 | 80              | 13 (220V) \30 (380V)                     |
| D                     | 20 (220V) \40 (380V)                 | 100             | 10 (220V) \20 (380V)                     |
| E                     | -                                    | -               | 10 (380V)                                |

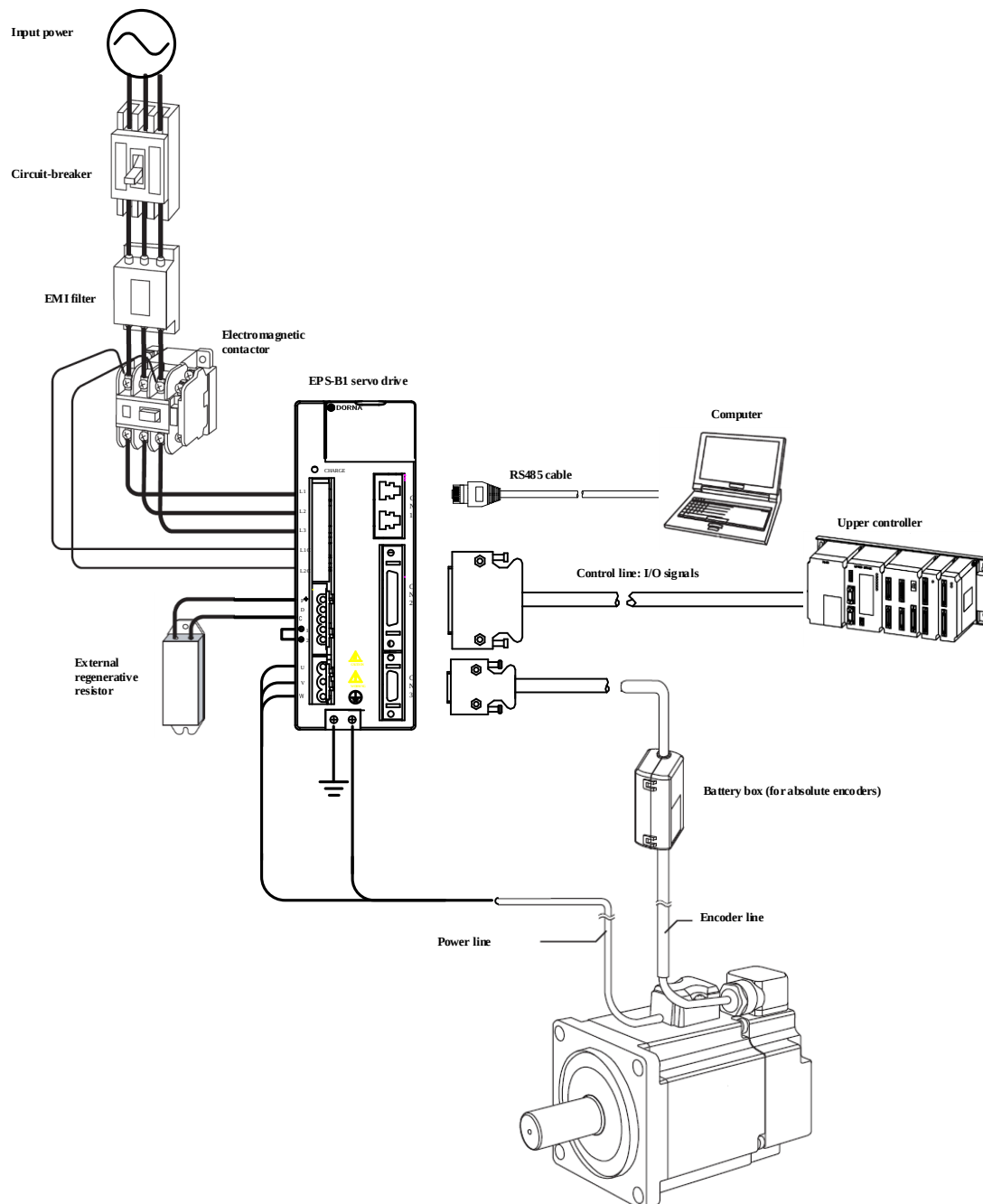
When the regenerative capacity exceeds the disposable capacity of the internal regenerative resistor, an external regenerative resistor shall be connected. Please note:

| Item | Reference                                                                                                                                                                                                                                                                                                                                    |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Please set the external resistor value and capacity correctly.                                                                                                                                                                                                                                                                               |
| 2    | The external resistance value shall not be smaller than the minimum allowable resistance value. If parallel connection is to be used to increase the power, please confirm whether the resistance value satisfies the limiting conditions.                                                                                                   |
| 3    | In natural environment, when the disposable regenerated capacity (mean value) of regenerative resistor is used within the limit of nominal capacity, the temperature of resistor will rise to be above 120°C (under continual regeneration). In order to ensure safety, it is suggested to use a regenerative resistor with a thermo-switch. |
| 4    | When external regenerative resistor is used, the resistor shall be connected to P, C end, and P, D end shall be open. External regenerative resistor shall follow the resistance value suggested in the table above.                                                                                                                         |

# Chapter 3 Wirings

## 3.1 System structure and wiring

### 3.1.1 Servo system structure





### 3.1.2 Servo drive connectors & terminals

| Markings                                                                          | Descriptions                          | Reference                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L1, L2, L3                                                                        | Main circuit input power terminals    | Connect to 1/3 PH AC power supply.<br>(Please choose correctly)                                                                                                                                      |
| L1C, L2C                                                                          | Control circuit input power terminals | Connect 1PH AC power supply.<br>(Please choose correctly)                                                                                                                                            |
| P, D, C                                                                           | Regenerative resistor terminals       | <ul style="list-style-type: none"> <li>Internal regenerative resistor: make PD short circuit, PC open.</li> <li>External regenerative resistor: connect PC to external resistor, PD open.</li> </ul> |
| $\ominus 1, \ominus 2$                                                            | DC Reactor terminals                  | Connect $\ominus 1$ & $\ominus 2$ to DC reactor.                                                                                                                                                     |
| U, V, W                                                                           | Servo motor power supply terminals    | Connect with the servo motor                                                                                                                                                                         |
|  | Earth terminal                        | Connect with input power supply & motor power supply earth terminals for grounding.                                                                                                                  |
| CN1                                                                               | RJ45 jack                             | RS-485 communication                                                                                                                                                                                 |
| CN2                                                                               | I/O connector                         | Connect with upper controller                                                                                                                                                                        |
| CN3                                                                               | Encoder connector                     | Connect with the motor encoder                                                                                                                                                                       |

### 3.1.3 Main circuit wirings

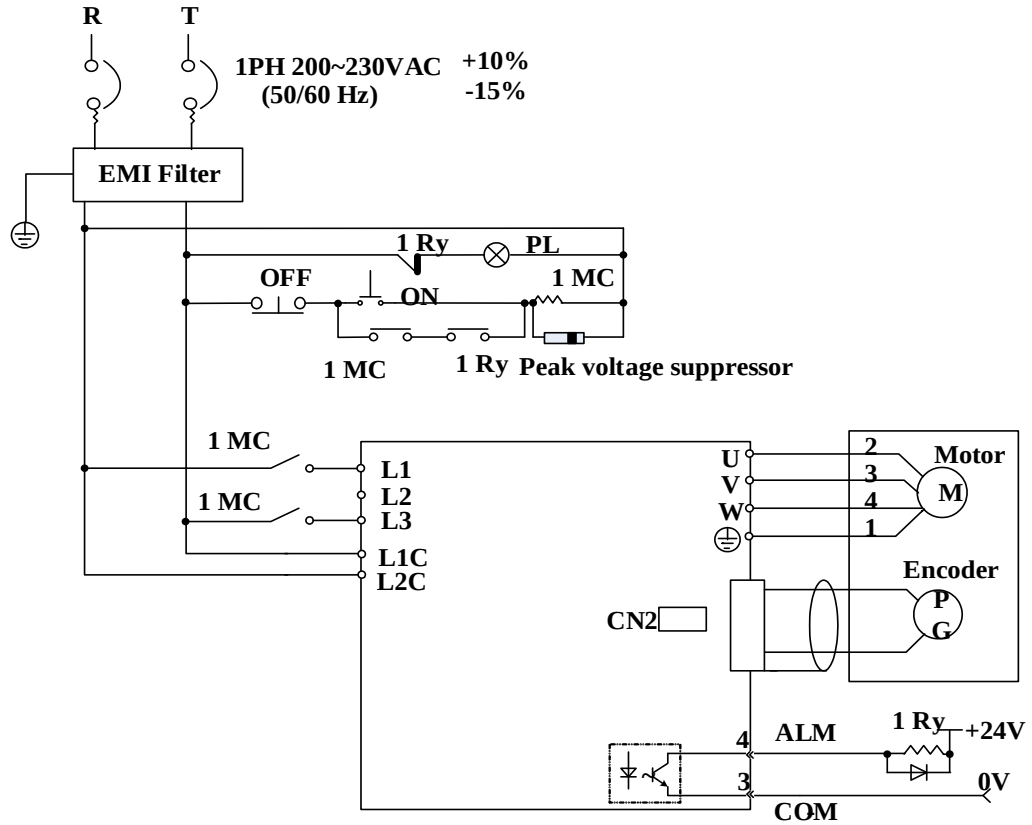
#### 1) Cable diameter requirement

| Mark                                                                                | Name                                  | Cable diameter: mm <sup>2</sup> (AWG) |       |              |       |       |
|-------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|-------|--------------|-------|-------|
|                                                                                     |                                       | EPS-B1-                               |       |              |       |       |
|                                                                                     |                                       | 0D20A                                 | 0D40A | 0D75A        | 0001A | 01D5A |
| L1, L2, L3                                                                          | Main circuit input power terminals    | 1.25 (AWG-16)                         |       | 2.0 (AWG-14) |       |       |
| L1C, L2C                                                                            | Control circuit input power terminals | 1.25 (AWG-16)                         |       |              |       |       |
| U, V, W                                                                             | Servo motor power supply terminals    | 1.25 (AWG-16)                         |       | 2.0 (AWG-14) |       |       |
| P, D, C                                                                             | Regenerative resistor terminals       | 1.25 (AWG-16)                         |       |              |       |       |
|  | Earth wire                            | Above 2.0 (AWG-14)                    |       |              |       |       |

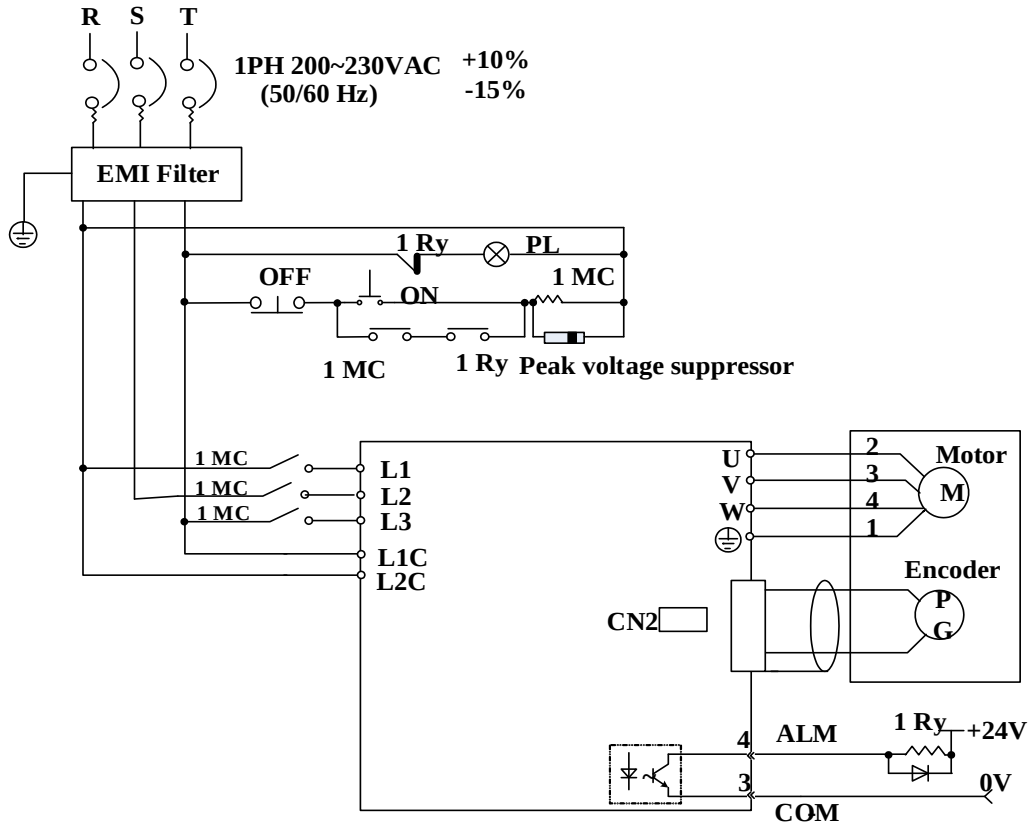
#### 2) Typical main circuit wiring example

- When the signal of ALM is active, power supply of the main circuit shall be OFF.
- Main circuit & control circuit shall be powered on at the same time, or the control circuit first.
- The main circuit shall be powered off before the control circuit.

▪ **1PH 220VAC:**

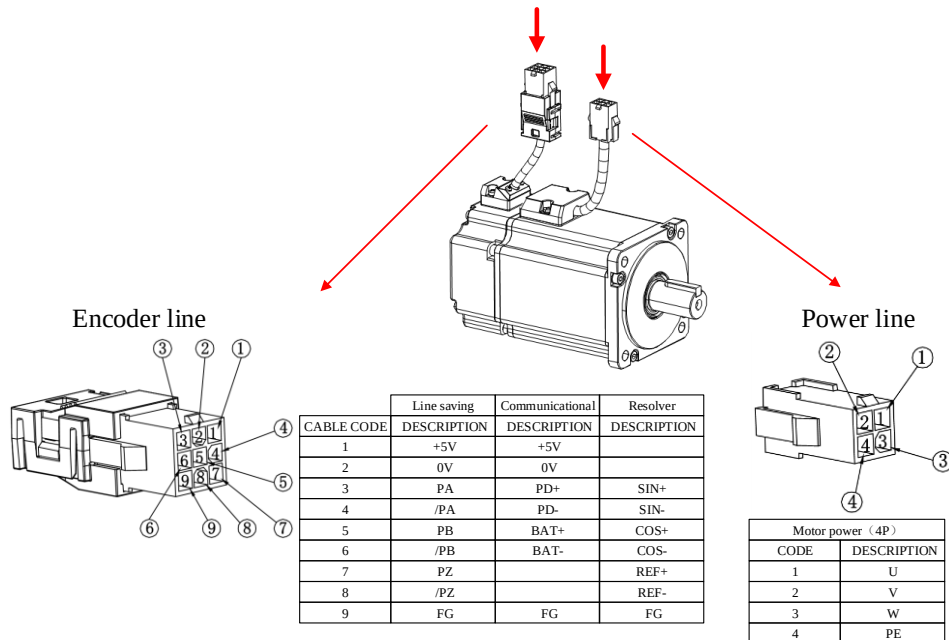


▪ **3PH 220VAC/380VAC:**

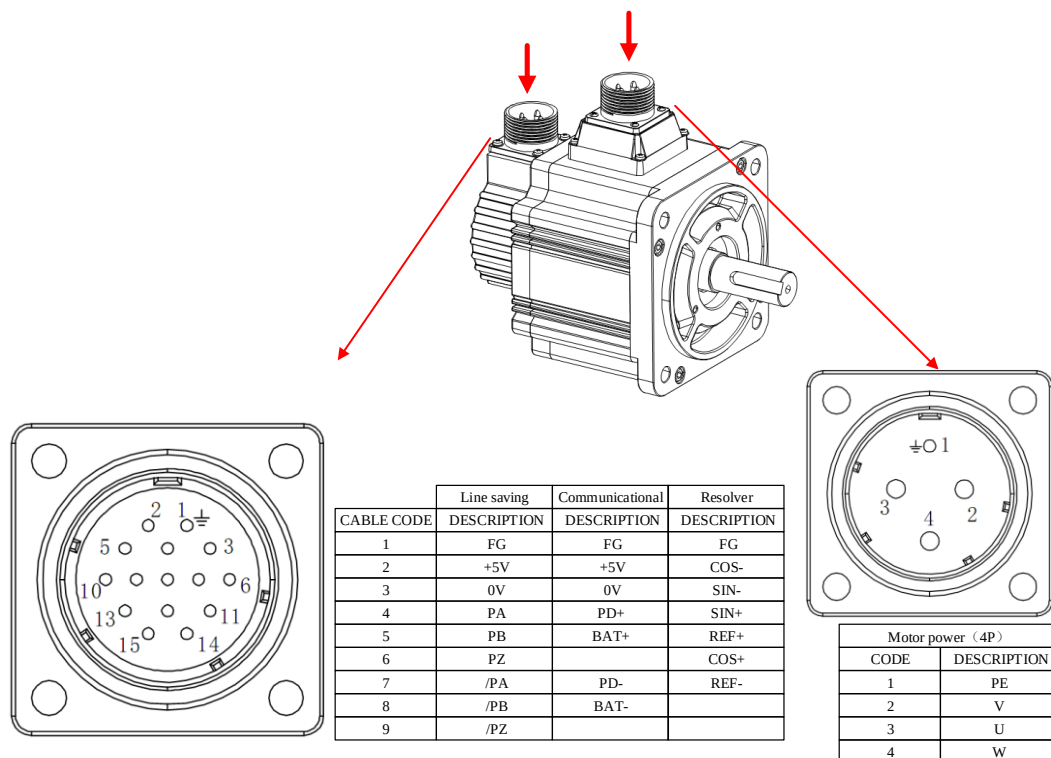


## 3.2 Wirings between servo drive & servo motor

### 3.2.1 Configurations & definitions of quick plug terminals

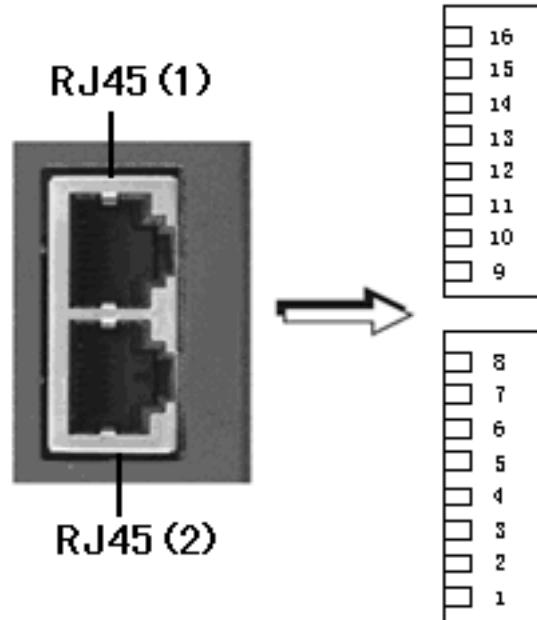


### 3.2.2 Configurations and definitions of aviation plug terminals



### 3.3 Wirings of CN1 (RS485 communication)

#### 1) Terminal appearance

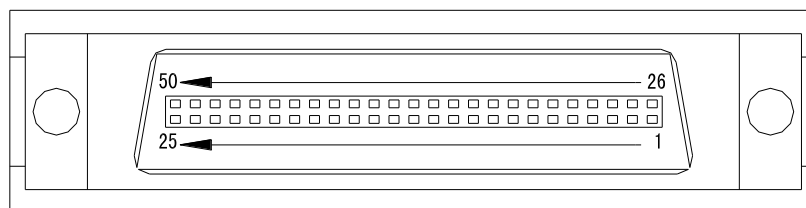


#### 2) Signal definitions

| Mark    | Name   | Function      |
|---------|--------|---------------|
| 1, 9    | RS485+ | RS485+ Signal |
| 2, 10   | RS485- | RS485- Signal |
| 3, 11   | GND    | Ground        |
| 4, 12   | NC     | -             |
| 5, 13   | NC     | -             |
| 6, 14   | GND    | Ground        |
| 7, 15   | CANH   | -             |
| 8, 16   | CANL   | -             |
| Housing | FG     | Shielding     |

### 3.4 Wirings of CN2 (I/O signals)

#### 3.4.1 Pin arrangement of CN2 connector



|    |        |                              |    |         |                              |    |       |                            |    |         |                            |
|----|--------|------------------------------|----|---------|------------------------------|----|-------|----------------------------|----|---------|----------------------------|
| 2  | SG     | GND                          | 1  | SG      | GND                          | 2  | DO    | Digital output 3 (+)       | 2  | DO      | Digital output 4 (-)       |
|    |        |                              |    |         |                              | 7  | 3+    |                            | 6  | 4       |                            |
| 4  | MON    | Analog output                | 3  | PL      | Open collector power input   | 2  | DO    | Digital output 2 (+)       | 2  | DO      | Digital output 3 (-)       |
|    |        |                              |    |         |                              | 9  | 2+    |                            | 8  | 3       |                            |
| 6  | AGN D  | Speed instruction input (-)  | 5  | V-REF   | Speed instruction input (+)  | 3  | DO    | ALM (+)                    | 3  | DO      | Digital output 2 (-)       |
|    |        |                              |    |         |                              | 1  | 1+    |                            | 0  | 2       |                            |
| 8  | /PUL S | Pulse input (-)              | 7  | PULS    | Pulse input (+)              | 3  | PAO   | Encoder A Phase output (+) | 3  | DO      | ALM (-)                    |
|    |        |                              |    |         |                              | 3  |       |                            | 2  | 1       |                            |
| 10 | AGN D  | Torque instruction input (-) | 9  | T-REF   | Torque instruction input (+) | 3  | PB O  | Encoder B Phase output (+) | 3  | /PA O   | Encoder A Phase output (-) |
|    |        |                              |    |         |                              | 5  |       |                            | 4  |         |                            |
| 12 | /SIGN  | Sign input (-)               | 11 | SIGN    | Sign input (+)               | 3  |       |                            | 3  | /PB O   | Encoder B Phase output (-) |
|    |        |                              |    |         |                              | 7  |       |                            | 6  |         |                            |
| 14 |        |                              | 13 |         |                              | 39 |       |                            | 38 |         |                            |
| 16 | HPU LS | High-speed pulse input (+)   | 15 |         |                              | 41 | DI2   | Digital input 2            | 40 | DI1     | Digital input 1            |
| 18 |        |                              | 17 | /HPU LS | High-speed pulse input (-)   | 43 | DI4   | Digital input 4            | 42 | DI3     | Digital input 3            |
| 20 | /PZO   | Encoder Z phase output (-)   | 19 | PZO     | Encoder Z phase output (+)   | 45 | DI6   | Digital input 6            | 44 | DI5     | Digital input 5            |
| 22 |        |                              | 21 |         |                              | 47 | CO M+ | External 24V power input   | 46 | DI7     | Digital input 7            |
| 24 | /HSIGN | High-speed sign input (-)    | 23 | HSIGN   | High-speed sign input (+)    | 49 | +24V  | Internal 24V power supply  | 48 | DI8     | Digital input 8            |
|    |        |                              | 25 | DO4+    | Digital output 4 (+)         |    |       |                            | 50 | 24V GND | Internal 24V GND           |

Notes:

1) do not use vacant terminals.

- 2) Connect the shielding of control line (I/O cable) to the connector housing to achieve FG (frame grounding)
- 3) except for the alarm signal (ALM), all input and output signals can change allocations by parameters.
- 4) Maximum output current of internal 24V is 300mA. If internal 24V is used, internal 5V will lose power very quickly. Therefore, after editing parameters, saving has to be done in a special way. (First set PA006=0000, then edit the parameters, then set PA006=0080, PA006 will change to 0100 automatically)

### 3.4.2 CN2 signal descriptions

#### ■ Name and function of input signals (with default pin allocations)

| Mode             | Signal    | Pin No. | Function                                                         |                                                                     |
|------------------|-----------|---------|------------------------------------------------------------------|---------------------------------------------------------------------|
| Universal        | S-ON      | 40      | Servo ON: The motor is powered on.                               |                                                                     |
|                  | C-MOD     | 41      | Control mode switch: Switch between two control modes.           |                                                                     |
|                  | POT       | 42      | Forward rotation prohibited                                      | Overtravel prohibited: Stop operation of servo motor when it is on. |
|                  | NOT       | 43      | Reverse rotation prohibited                                      |                                                                     |
|                  | CLR       | 44      | Clear position deviation pulses counter during position control. |                                                                     |
|                  | A-RESTART | 45      | Reset alarms                                                     |                                                                     |
|                  | INHIBIT   | 46      | Pulse input inhibited                                            |                                                                     |
|                  | ZEROSPD   | 48      | Zero-speed clamp signal input                                    |                                                                     |
|                  | COM+      | 47      | External 24VDC for I/O signals                                   |                                                                     |
| Position control | HPULS+    | 16      | High-speed channel pulse input                                   |                                                                     |
|                  | HPULS-    | 17      | * Sign+pulse train                                               |                                                                     |
|                  | HSIGN+    | 23      | * CCW+CW Pulse train                                             |                                                                     |
|                  | HSIGN-    | 24      | * A + B Pulse train                                              |                                                                     |
|                  | PULS+     | 7       | Low-speed channel pulse input level:                             |                                                                     |
|                  | PULS-     | 8       | * Sign+pulse train                                               |                                                                     |
|                  | SIGN+     | 11      | * CCW+CW Pulse train                                             |                                                                     |
|                  | SIGN-     | 12      | * A + B Pulse train                                              |                                                                     |
|                  | PL        | 3       | Open collector pulse signal terminal                             |                                                                     |
| Speed control    | V-REF     | 5       | Speed instruction voltage input                                  |                                                                     |
|                  | AGND      | 6       |                                                                  |                                                                     |
| Torque control   | T-REF     | 9       | Torque instruction voltage input                                 |                                                                     |
|                  | AGND      | 10      |                                                                  |                                                                     |

■ Name and function of output signals (with default pin allocations)

| Mode      | Signal | Pin No. | Function                                                                                                              |                                                                                   |
|-----------|--------|---------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Universal | PAO+   | 33      | A phase signal                                                                                                        | Two-phase pulse （A phase and B phase）<br>encoder frequency dividing signal output |
|           | PAO-   | 34      |                                                                                                                       |                                                                                   |
|           | PBO+   | 35      | B phase signal                                                                                                        |                                                                                   |
|           | PBO-   | 36      |                                                                                                                       |                                                                                   |
|           | PZO+   | 19      | Z phase signal                                                                                                        | Original point （Z phase） signal output                                            |
|           | PZO-   | 20      |                                                                                                                       |                                                                                   |
|           | ALM+   | 31      | Servo alarm: <b>OFF when abnormal state is detected.</b>                                                              |                                                                                   |
|           | ALM-   | 32      |                                                                                                                       |                                                                                   |
|           | COIN+  | 29      | Positioning completed: Under position control mode, when deviation pulse is smaller than PA525, the signal is active. |                                                                                   |
|           | COIN-  | 30      |                                                                                                                       |                                                                                   |
|           | CZ+    | 27      | Optocoupler Z phase pulse output                                                                                      |                                                                                   |
|           | CZ-    | 28      |                                                                                                                       |                                                                                   |
|           | BK+    | 25      | External brake signal output                                                                                          |                                                                                   |
|           | BK -   | 26      |                                                                                                                       |                                                                                   |
|           | MON    | 4       | Speed or torque analog output. Voltage range ±8V.                                                                     |                                                                                   |
| SG        | 1      |         |                                                                                                                       |                                                                                   |

### 3.4.3 Allocation of I/O signals

#### 1) Allocation of input signals

- Default input signal allocations

| PA           | Description                                                                          | Range | Unit | Default | Effective |
|--------------|--------------------------------------------------------------------------------------|-------|------|---------|-----------|
| <b>PA500</b> | <b>DI 1 input signal selection</b>                                                   | 0~30  |      | 0       | Immediate |
|              | [0] Servo-on (S-ON)                                                                  |       |      |         |           |
|              | [1] Control mode switch (C-MODE)                                                     |       |      |         |           |
|              | [2] Forward rotation prohibited (POT)                                                |       |      |         |           |
|              | [3] Reverse rotation prohibited (NOT)                                                |       |      |         |           |
|              | [4] Deviation counter clearance (CLR)                                                |       |      |         |           |
|              | [5] Alarm reset (A-RESTART)                                                          |       |      |         |           |
|              | [6] Pulse input inhibited (INHIBIT)                                                  |       |      |         |           |
|              | [7] Zero-speed clamp (ZEROSPD)                                                       |       |      |         |           |
|              | [8] Forward torque limitation (PCL)                                                  |       |      |         |           |
|              | [9] Reverse torque limitation (NCL)                                                  |       |      |         |           |
|              | [10] Gain switch (GAIN)                                                              |       |      |         |           |
|              | [11] Zero switch signal (ZPS)                                                        |       |      |         |           |
|              | [12] Negation signal for internal position control & internal speed control (CMDINV) |       |      |         |           |
|              | [13] Instruction division/ multiplication switch 0 (DIV0)                            |       |      |         |           |
|              | [14] Instruction division/ multiplication switch 1 (DIV1)                            |       |      |         |           |
|              | [15] Internal speed register 0 (INSPD0)                                              |       |      |         |           |
|              | [16] Internal speed register 1 (INSPD1)                                              |       |      |         |           |
|              | [17] Internal speed register 2 (INSPD2)                                              |       |      |         |           |
|              | [18] Internal position register 0 (INPOS0)                                           |       |      |         |           |
|              | [19] Internal position register 1 (INPOS1)                                           |       |      |         |           |
|              | [20] Internal position register 2 (INPOS2)                                           |       |      |         |           |
|              | [21] Internal position register 3 (INPOS3)                                           |       |      |         |           |
|              | [22] Internal position control trigger (PTRG)                                        |       |      |         |           |
|              | [23] Internal position control Forward JOG (P-POS)                                   |       |      |         |           |
|              | [24] Internal position control Reverse JOG (N-POS)                                   |       |      |         |           |
|              | [25] Internal position control homing start (SHOME)                                  |       |      |         |           |
|              | [26] Internal position control stop (PZERO)                                          |       |      |         |           |
|              | [28] Internal torque register 0 (INTor0)                                             |       |      |         |           |



|              |                                                                                                                                  |      |  |   |           |
|--------------|----------------------------------------------------------------------------------------------------------------------------------|------|--|---|-----------|
|              | [29] Internal torque register 1 (INTor1)<br>[30] Incremental/Absolute mode selection in<br>internal position control mode (PAbs) |      |  |   |           |
| <b>PA501</b> | DI 2 input signal selection                                                                                                      | 0~30 |  | 1 | Immediate |
| <b>PA502</b> | DI 3 input signal selection                                                                                                      | 0~30 |  | 2 | Immediate |
| <b>PA503</b> | DI 4 input signal selection                                                                                                      | 0~30 |  | 3 | Immediate |
| <b>PA504</b> | DI 5 input signal selection                                                                                                      | 0~30 |  | 4 | Immediate |
| <b>PA505</b> | DI 6 input signal selection                                                                                                      | 0~30 |  | 5 | Immediate |
| <b>PA506</b> | DI 7 input signal selection                                                                                                      | 0~30 |  | 6 | Immediate |
| <b>PA507</b> | DI 8 input signal selection                                                                                                      | 0~30 |  | 7 | Immediate |

- Default signals and corresponding pins of DI 1~ DI 8:

| Parameter No. | Terminal name | CN2 pin | Default signal |
|---------------|---------------|---------|----------------|
| PA500         | DI 1          | 40      | S-ON           |
| PA501         | DI 2          | 41      | C-MOD          |
| PA502         | DI 3          | 42      | POT            |
| PA503         | DI 4          | 43      | NOT            |
| PA504         | DI 5          | 44      | CLR            |
| PA505         | DI 6          | 45      | A-RESTART      |
| PA506         | DI 7          | 46      | INHIBIT        |
| PA507         | DI 8          | 48      | ZEROSPD        |

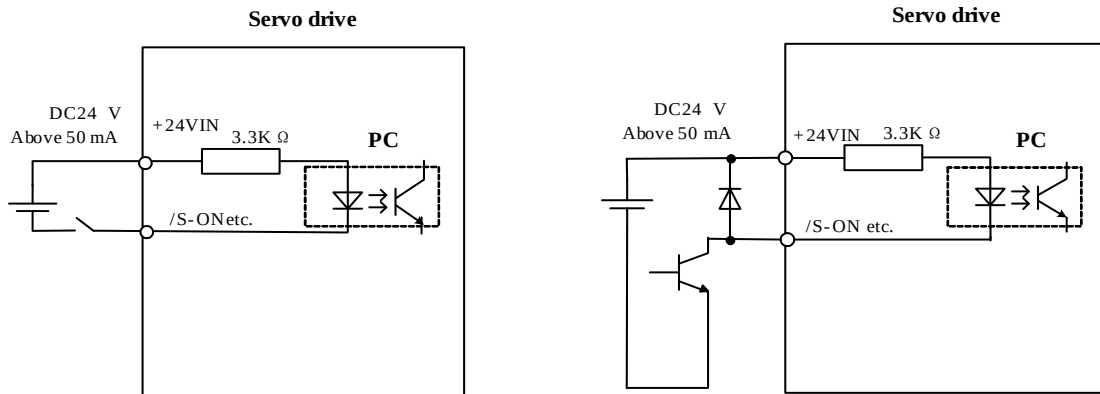
■ Level selection of input signals

| PA    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Range           | Unit | Default | Effective |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|---------|-----------|
| PA508 | <b>Level selection of input signal 0</b><br><b>b.0001: DI 1 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b.0010: DI 2 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b.0100: DI 3 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b. 1000: DI 4 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive) | b.0000<br>~1111 |      | b.0000  | Immediate |
| PA509 | <b>Level selection of input signal 1</b><br><b>b.0001: DI 5 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b.0010: DI 6 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b.0100: DI 7 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b. 1000: DI 8 input signal level selection;</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive) | n.0000<br>~1111 |      | n.0000  | Immediate |

- Change level selection of input signals

When signals like S-ON, POT, NOT are used through "polarity inversion", if there are abnormal states like breakage of signal line, it will cause movement deviating from the safety direction. If such setting has to be adopted, please confirm the action and ensure there are no safety problems.

The typical circuit of input signal is as follows:



Take the above figure as an example. When the optocoupler is conductive, S-ON signal is L level; when the optocoupler is not conductive, S-ON signal is H level. Parameter PA508 decides the active level of S-ON. When PA508.0=0, S-ON signal is L level active; when PA508.0=1, S-ON signal is H level active.

- Confirmation of input signal level selections

The level selection of the input signal can be confirmed by the input signal monitoring (dP012) .

- Multiple pins with same signal allocation

If same signal has been allocated to multiple I/O pins, the highest grade pin prevails. For example, DI 0 and DI 1 are both set to 0 (S-ON) , then S-ON is only determined by DI 1 (highest grade pin) .

## 2) Allocation of output signals

### ▪ Default allocations of output signals

| PA    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Range           | Unit | Default | Effective |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|---------|-----------|
| PA510 | <b>Output signal selection</b><br><b>h.0001: DO 1 output signal selection</b><br>[0] Alarm signal output (ALM)<br>[1] Positioning completed (COIN) : active when position pulse deviation is less than PA525.<br>[2] Z pulse open-collector signal (CZ) : can be negated by PA003.3 and expanded by PA201.3 & PA210.<br>[3] Brake release signal (BK) : can be adjusted by PA518.<br>[4] Servo ready signal (S-RDY) : active when servo is in proper status.<br>[5] Speed instruction reached (VCMP) / (torque threshold) : active when speed deviation is less than PA517.<br>[6] Motor rotation detection (TGON) : active when rotational speed exceeds PA516.<br>[7] Torque limited signal (TLC) : active when load torque reaches PA402/PA403.<br>[8] Zero-speed detection signal (ZSP) : active when rotational speed is less than PA515.<br>[9] Warning output (WARN)<br>[A] Internal position control homing completion signal (HOME)<br>[B] Internal position control position instruction completion signal (CMD-OK)<br>[C] Internal position control positioning & command completion signal (MC-OK)<br>[D] Torque reached (TREACH) : active when forward load torque exceeds PA404 or reverse load torque exceeds PA405.<br><b>h.0010: DO 2 output signal selection</b><br>same as DO 1<br><b>h.0100: DO 3 output signal selection</b><br>same as DO 1<br><b>h.1000: DO 4 output signal selection</b><br>same as DO 1 | h.0000<br>~DDDD |      | h.3210  | Immediate |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |  |        |           |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--|--------|-----------|
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |  |        |           |
| PA511 | <b>Output signal level selection (negation)</b><br><b>b.0001: DO 1 (ALM) output signal level selection</b><br>[0] H level active (optocoupler not conductive)<br>[1] L level active (optocoupler conductive)<br><b>b.0010: DO 2 output signal level selection</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b.0100: DO 3 output signal level selection</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive)<br><b>b.1000: DO 4 output signal level selection</b><br>[0] L level active (optocoupler conductive)<br>[1] H level active (optocoupler not conductive) | h.0000<br>~0011 |  | h.0000 | Immediate |

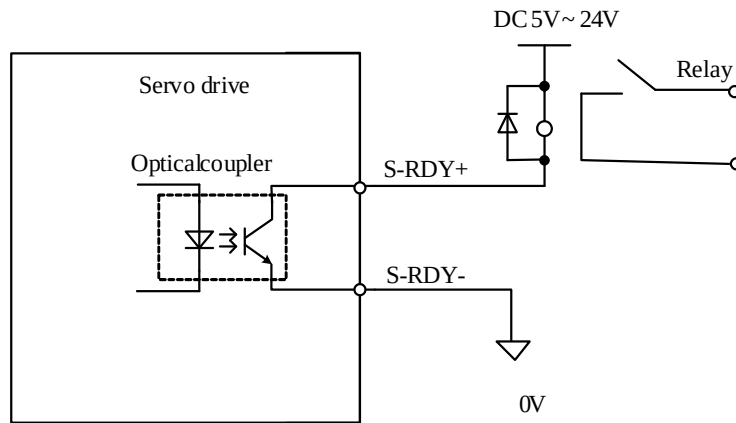
- Default signals and corresponding pins of DO 1 to DO 4

| Parameter No. | Terminal name | CN2 pin | Default signal |
|---------------|---------------|---------|----------------|
| PA510.0       | DO1           | 31, 32  | ALM            |
| PA510.1       | DO2           | 29, 30  | COIN           |
| PA510.2       | DO3           | 27, 28  | CZ             |
| PA510.3       | DO4           | 25, 26  | BK             |

- Change level selection of output signals

If an output signal is not detected, then it is regarded as invalid. For example, COIN is invalid at speed control mode.

Typical output signal circuit is shown in the following diagram:



Maximum allowable voltage: DC 30V  
Maximum allowable current: DC 50mA

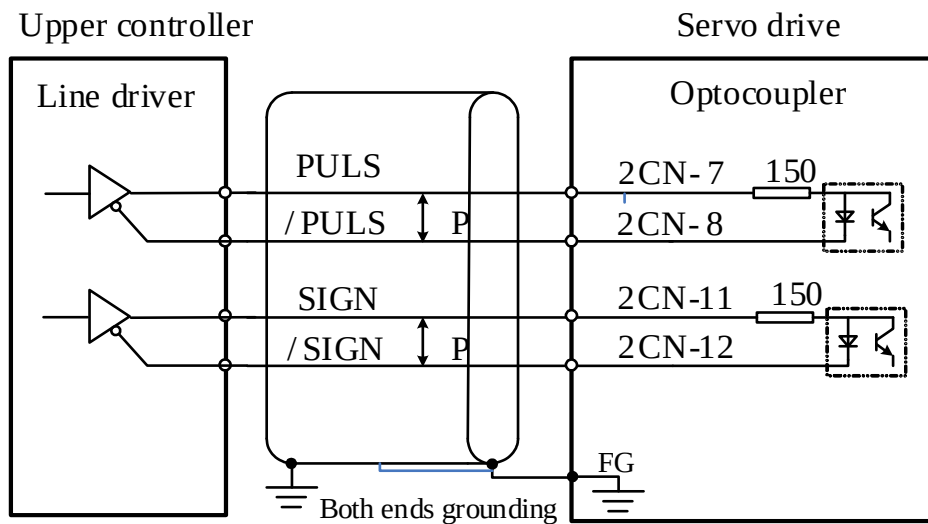
Take above figure as an example, COIN level is determined by PA510. When PA510=0, L level (conductive) is active; when PA510=1, H level (nonconductive) is active.

- Notes:
  - ALM, WARN: active means alarm; inactive means no alarm.
  - CZ level status cannot be modified by PA511;
  - If same signal has been allocated to multiple I/O pins, the highest grade pin prevails. For example, DO 2 and DO 3 are both set to 2 (CZ), then CZ is only determined by DO 3 (highest grade pin).

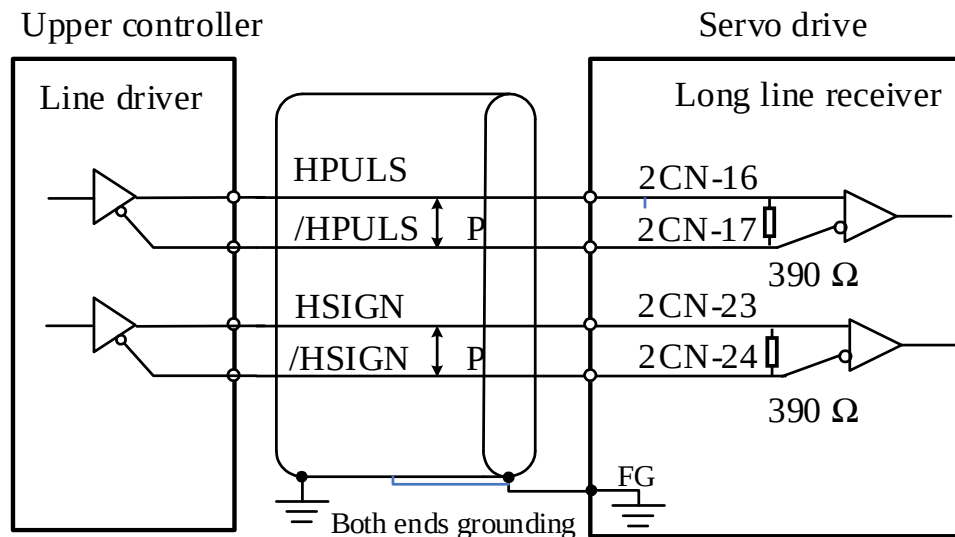
### 3.4.4 Examples of connection with upper controllers

#### 1) Input signal connections

- Line driver, low speed pulse



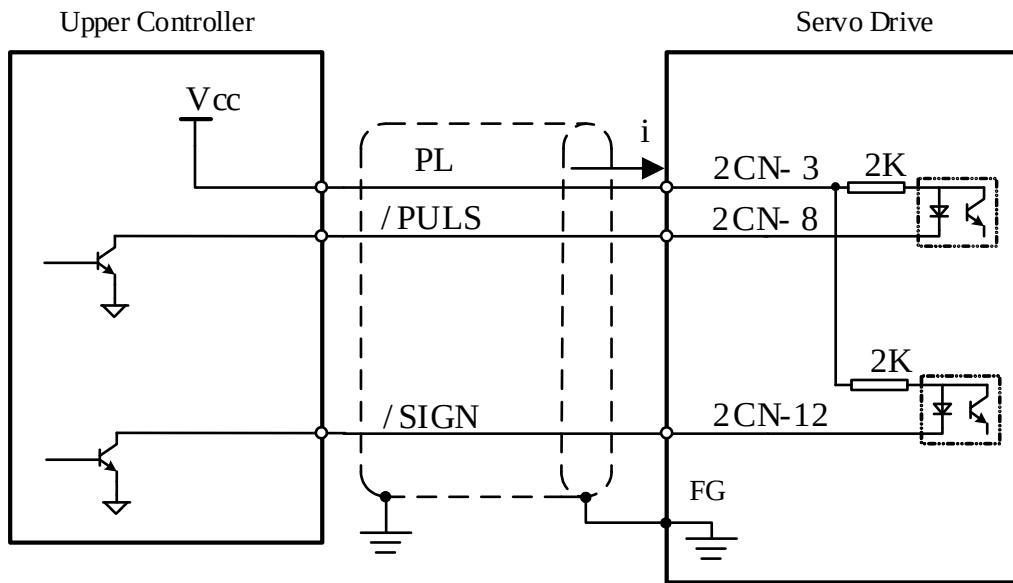
- Line driver, high speed pulse (maximum voltage: 5VDC)



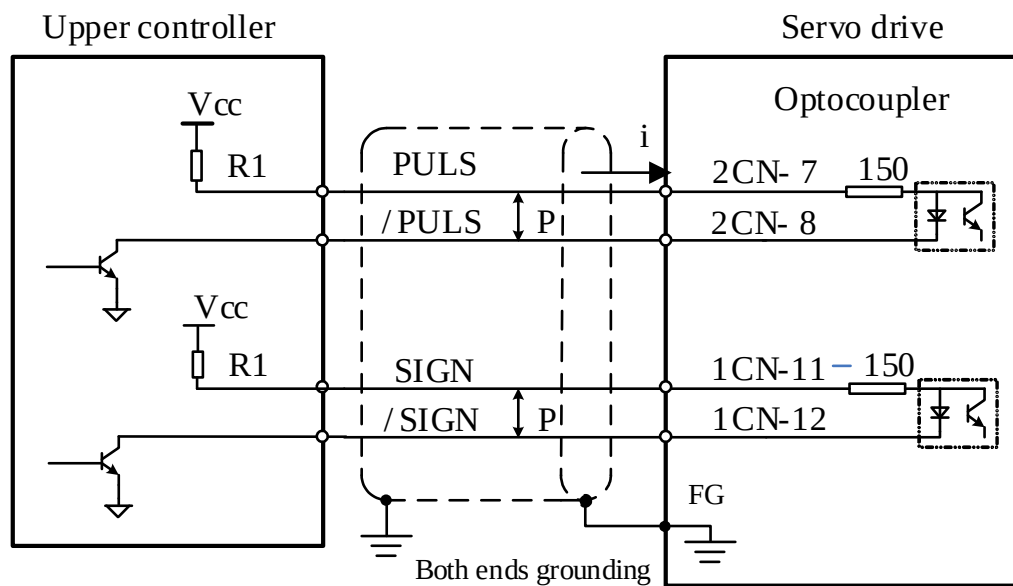
Compatible line driver: AM26LS31 (TI) or equivalent.

Connect the grounding of both controller & servo drive together in order to improve the anti-interference ability of the high speed pulse input interface.

- Open collector, option 1 (external 24VDC)



- Open collector, option 2 (external 5VDC, 12VDC or 24VDC)



Input current  $I = 10 \sim 15\text{mA}$ , thus R1 resistance:

If 24VDC,  $R1=2\text{K } \Omega$ ;

If 12VDC,  $R1=510 \Omega$ ;

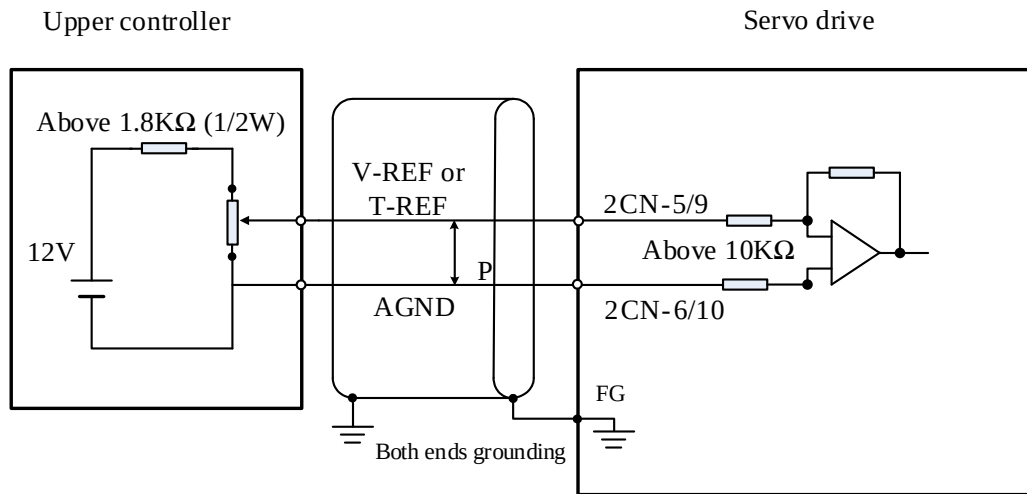
If 5VDC,  $R1=180 \Omega$ ;

Normally, open collector pulses can be easily interfered. To reduce interference:

- Grounding: control line shielding shall connect to ground of upper controller power supply; on the drive side, the shielding shall hang in air;
- Modify PA201.0: the higher PA201.0, the higher filtering effect, the lower input chop frequency.

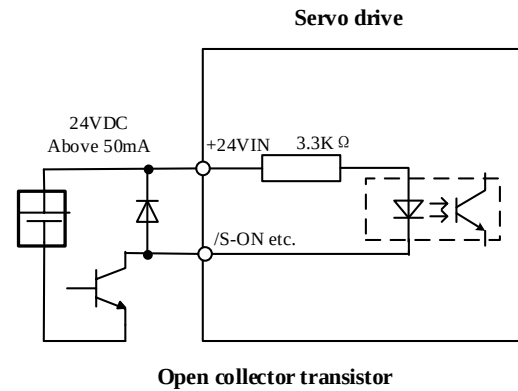
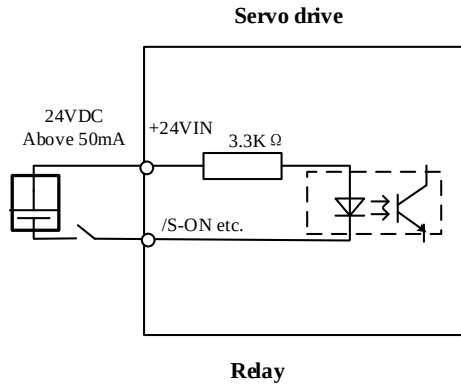


- Analog input



- Sequential control input

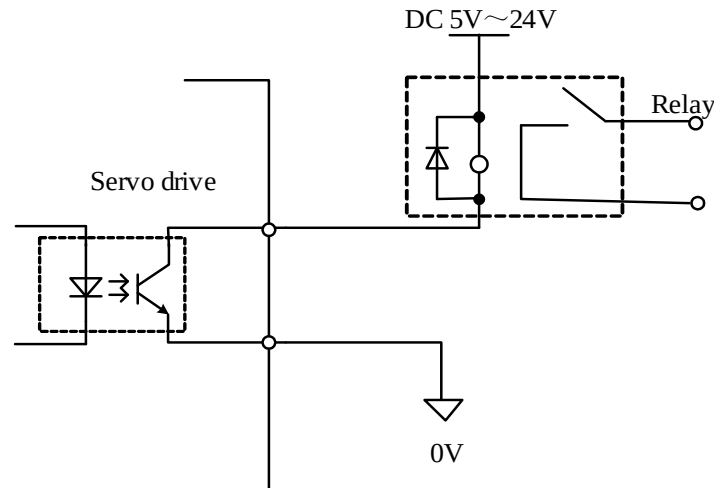
Connected by a relay or an open collector transistor circuit. When using relay connections, select the micro current relay. If you do not use small current relay, it will cause bad contact.



## 2) Output signal connections

### ▪ Sequential control output

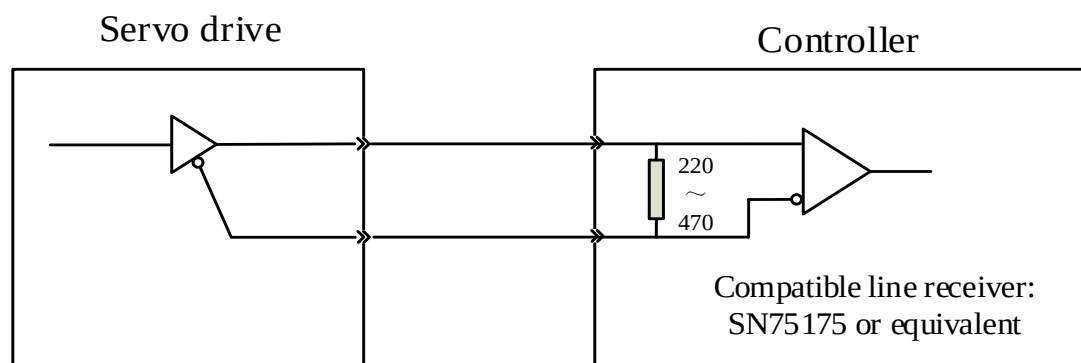
ALM, S-RDY and other sequence of output signals are consisted of optocoupler. Please connect with relays.



Maximum DC voltage: 30VDC  
Maximum DC current: 50mA

### ▪ Line driver output

Encoder serial data are inverted into differential signals. Please use line receiver to process the output signals: PAO, /PAO; PBO, /PBO; PZO, /PZO.



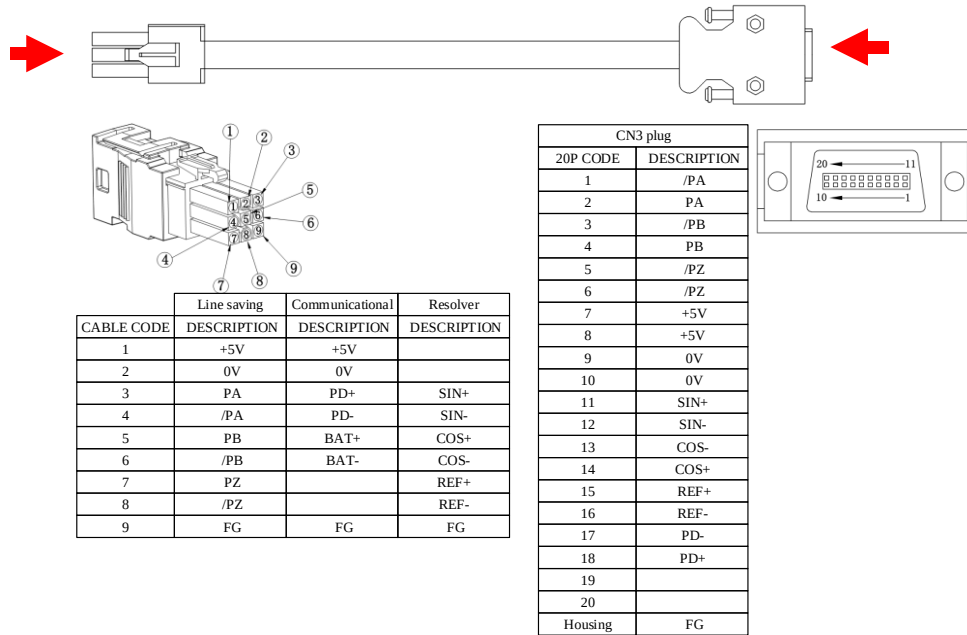
### ▪ Analog output

Pin 4 (MON) & Pin 1 (SG) can be used to provide monitored analog data. For example, motor speed & current can be presented by analogy voltages. The servo drive provides one output channel for the user to monitor the data selected by PA021. This signal is referenced by GND and output voltage range is -8V~+8V.

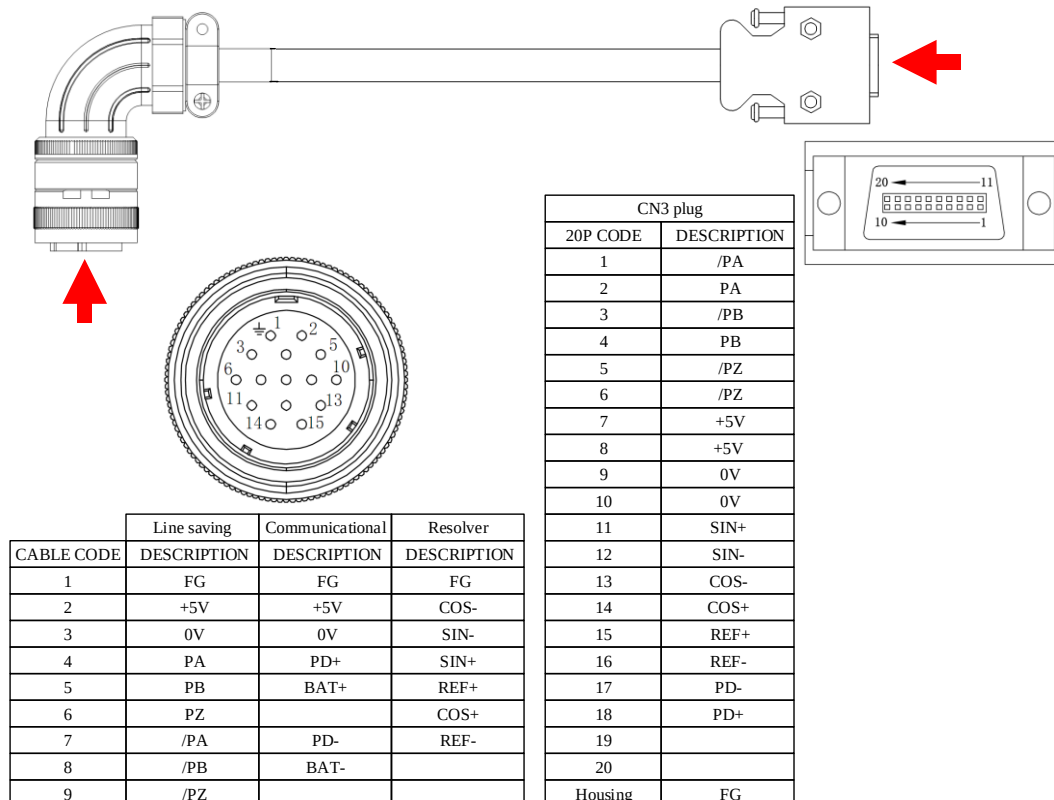
## 3.5 Wirings of CN3 (feedback from encoder to servo drive)

### 3.5.1 Pin arrangement of CN3 connector

#### 1) Quick plug

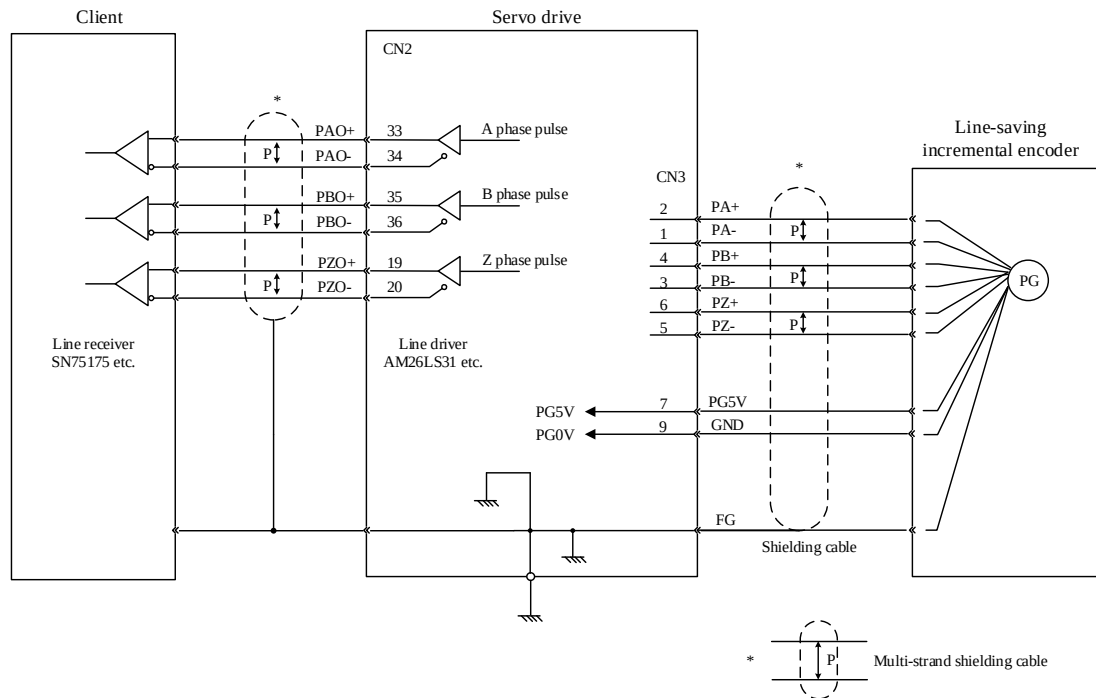


#### 2) Aviation plug

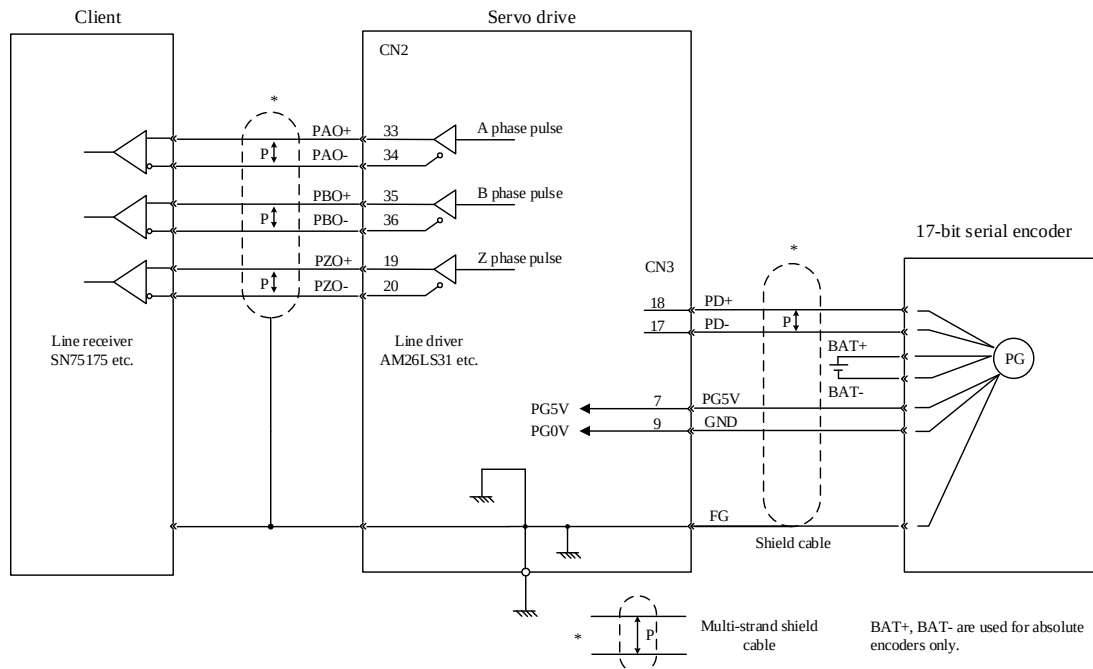


## 3.5.2 Examples of CN3 connections

### ■ Line-saving incremental encoder

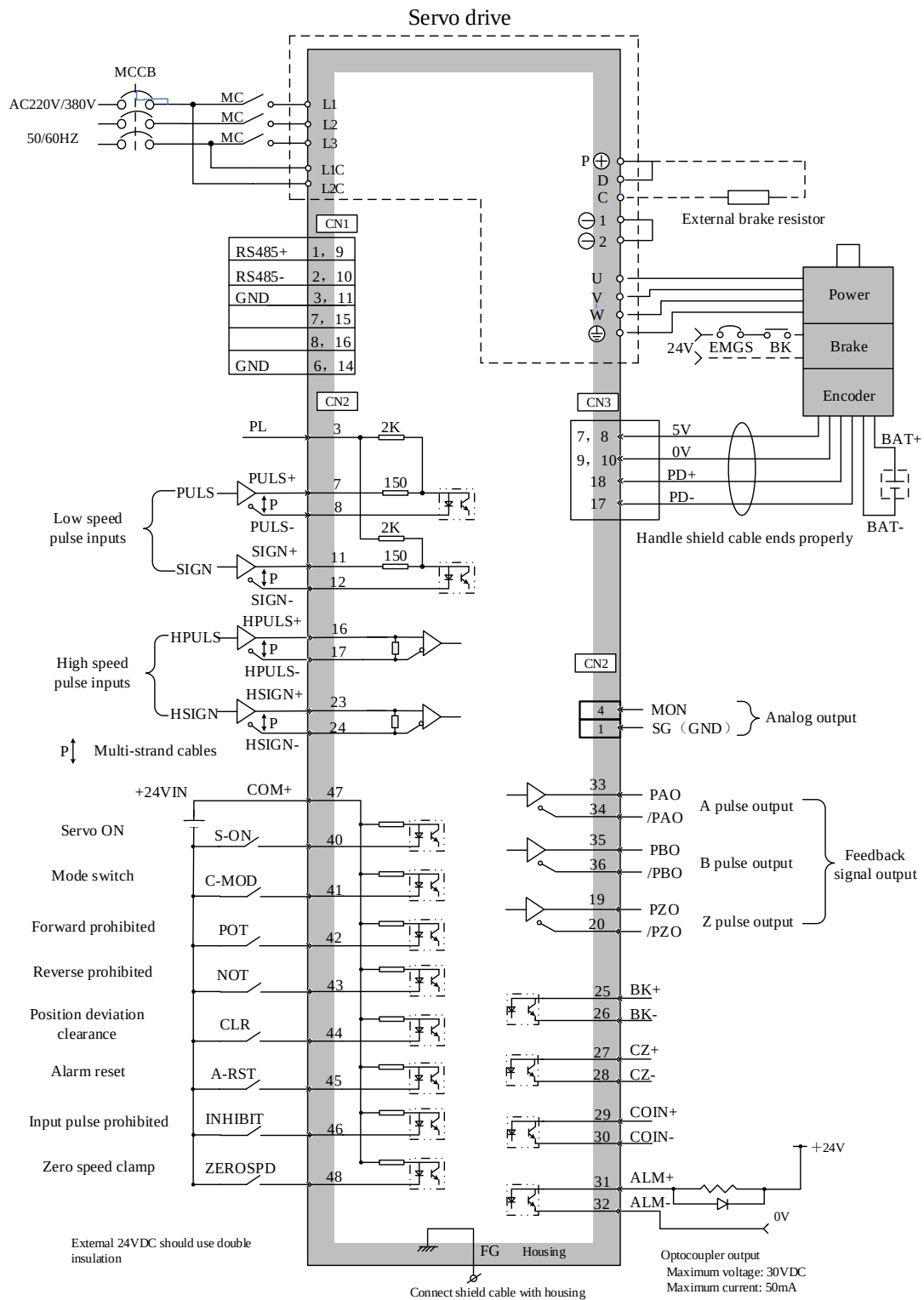


### ■ 17-bit serial encoder

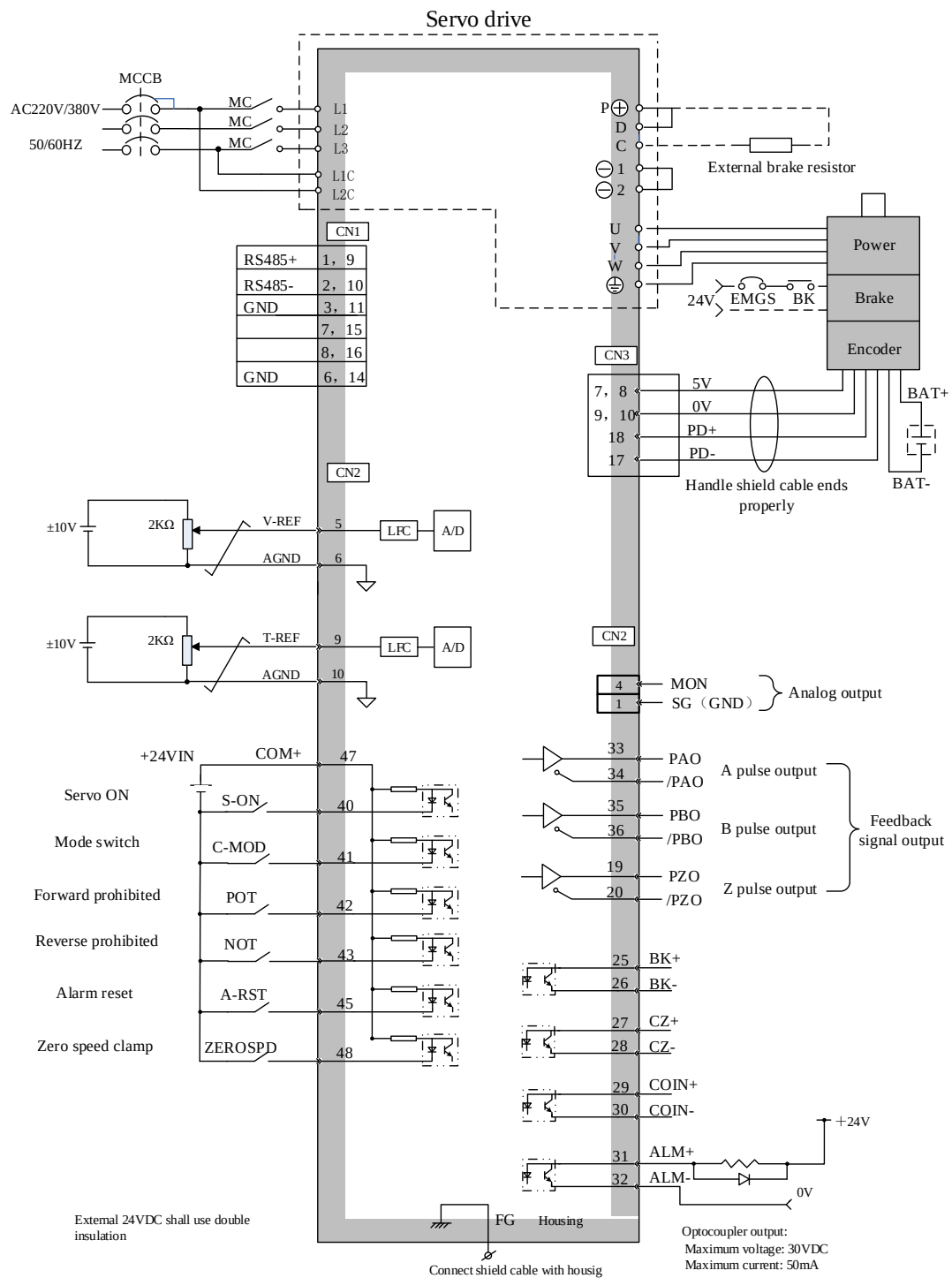


## 3.6 Standard wiring diagrams

### 3.6.1 Position control



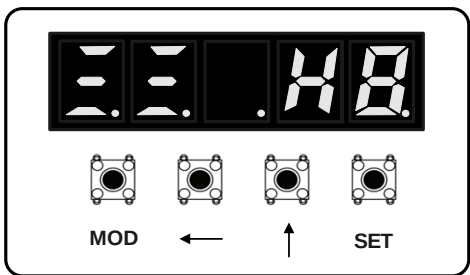
### 3.6.2 Speed/torque control



# Chapter 4 Panel operations

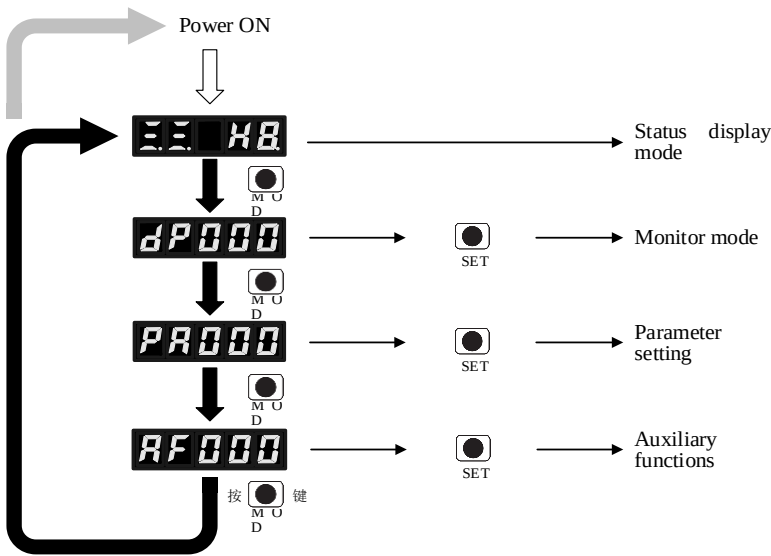
## 4.1 Panel operator

Panel operator consists of a panel display and operating keys. Panel operator is used for displaying status, performing auxiliary functions, setting parameters and monitoring servo drive's movements. **Hold & press ↑ & ← keys together can clear servo drive alarms. BUT please find out the cause of alarms first.**



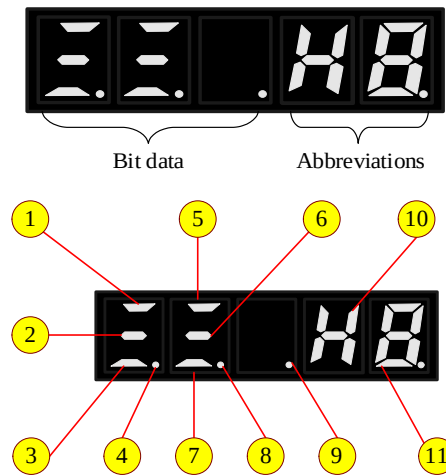
| Key | Function description                     |
|-----|------------------------------------------|
| MOD | Switch between different modes or cancel |
| ←   | Decimal point moves leftwards, in loops  |
| ↑   | Increase or switches between + and–      |
| SET | Equivalent to ENTER                      |

## 4.2 Switch between different functions



## 4.3 Status code display

Status of servo drive is displayed by digits.



| Bit data |                       |                                                                                  |                                                                                  |
|----------|-----------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| No.      | Definition            | Description in position control mode                                             | Description in speed, torque control mode                                        |
| ①        | Power supply ready    | On when the main circuit power is ON;<br>Off when the main circuit power is OFF. | On when the main circuit power is ON;<br>Off when the main circuit power is OFF. |
| ②        | Compatibility         | Positioning completed (COIN)                                                     | Speed instruction reached (VCMP)                                                 |
| ③        | Clear input signals   | On when there is CLR input.<br>Off when there is no CLR input.                   | On when there is CLR input.<br>Off when there is no CLR input.                   |
| ④        | Position control mode | Light on                                                                         | Light off                                                                        |
| ⑤        | Rotation detection    | When speed exceeds the set speed, the light is on (TGON)                         | When speed exceeds the set speed, the light is on (TGON)                         |
| ⑥        | Instruction input     | Pulse input in progress                                                          | Speed/torque control in progress                                                 |
| ⑦        | Torque detection      | Torque instruction exceeds the set value (20% of nominal torque) .               | Torque instruction exceeds the set value (20% of nominal torque) .               |
| ⑧        | Speed control mode    | Light off                                                                        | Light on if speed control is in progress.                                        |
| ⑨        | Torque control mode   | Light off                                                                        | Light on if torque control is in progress.                                       |



|               |       |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |       |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Abbreviations |       |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 10            | Limit |  : left limit.<br> : right limit<br> &  alternately: left & right limits |  : left limit.<br> : right limit<br> &  alternately: left & right limits |
| 11            | Run   |  : motor is excited.                                                                                                                                                                                                                                                                                                        |  : motor is excited.                                                                                                                                                                                                                                                                                                              |

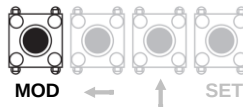
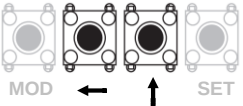
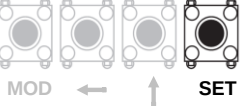
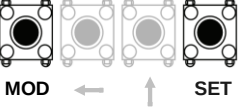
## 4.4 Monitoring display mode (dP □□)

At monitoring display mode, user can monitor the set values, I/O signal status and internal status of the servo drive.

### 4.4.1 Contents of monitoring display mode

Please refer to Chapter 5.1.

### 4.4.2 Example of operations at monitoring display mode (dP 00)

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                            |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1     |  |  | Press MOD key to choose monitoring display function.                  |
| 2     |  |  | If the panel display is not dP 00, press UP & LEFT until it is dP 00. |
| 3     |  |  | Press SET to enter dP 00. This shows motor speed is 1600rpm.          |
| 4     |  |  | Press SET or MOD to return to Step 1.                                 |
| 5     | End of operations                                                                   |                                                                                     |                                                                       |

## 4.5 Parameter mode (PA □□□)

### 4.5.1 Remarks at parameter mode

#### ■ Storage setting status

After parameter editing, press SET to store the setting, and the panel display will constantly display the set state symbol for one second according to the setting state.

| Panel display                                                                     | Remarks                                                               |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------|
|  | Correct setting value, saved (Saved)                                  |
|  | Parameter effective after power off, then power on again (Reset)      |
|  | Wrong setting value or input data out of range (Out of Range)         |
|  | Parameter protected by cryptograph, cannot be modified (No operation) |

#### ■ Data type

| Panel display                                                                       | Remarks                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Left-most digit is blank, meaning setting is on decimal base. When data is unsigned number, the setting range of left-most digit is 0~6, other digits are 0~9; When data is signed number, the left-most digit is the sign digit. |
|  | The left-most digit is "b", meaning that the parameter setting is on a binary base. Scope for each digit is 0 ~ 1.                                                                                                                |
|  | The left-most digit is "d", meaning that the parameter setting is on a decimal base. Scope for each digit is 0 ~ 9.                                                                                                               |
|  | The left-most digit is "h", meaning that the parameter setting is on a hexadecimal base. Scope for each digit is 0 ~ F.                                                                                                           |

## 4.5.2 Example of operations at parameter mode (PA100)

| Steps | Panel display     | Keys | Operations                                                                                                             |
|-------|-------------------|------|------------------------------------------------------------------------------------------------------------------------|
| 1     |                   |      | Press MOD to choose parameter mode.                                                                                    |
| 2     |                   |      | If the panel display is not PA100, press ↑ & ← until it is PA100.                                                      |
| 3     |                   |      | Press SET to enter the parameter editing interface; it will show the left figure which means the current number is 40. |
| 4     |                   |      | Press “←” to make the digit 4 blink.                                                                                   |
| 5     |                   |      | Press “↑” for 6 times and the value becomes “00”.                                                                      |
| 6     |                   |      | Press “←” to move the digit, as shown in the left figure.                                                              |
| 7     |                   |      | Press “↑” for 2 times and the value becomes “200”.                                                                     |
| 8     |                   |      | Press SET to set the value of PA100 to 200. In this case, the value becomes effective immediately.                     |
| 9     |                   |      | After about 1s, the display will return to the parameter editing interface.                                            |
| 10    |                   |      | Press MODE to exit                                                                                                     |
| 11    | End of operations |      |                                                                                                                        |

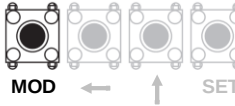
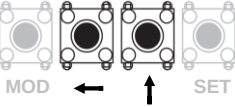
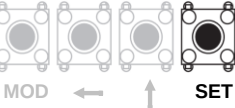
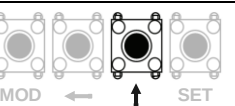
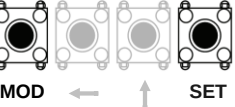
## 4.6 Auxiliary function mode (AF □□)

Auxiliary functions are used to perform some additional setting & tuning of the servo drive.

### 4.6.1 Contents of auxiliary function mode

Please refer to Chapter 6.1

### 4.6.2 Example of operations at auxiliary function mode (AF 05)

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose the auxiliary function.                                                   |
| 2     |   |   | Press “↑” or “←” to show “AF005”.                                                                 |
| 3     |  |  | If the servo is not running, press SET and the panel will display the left figure.                |
|       |  |                                                                                     | If the servo is running or the panel lock (AF 03) is set, the panel will display the left figure. |
| 4     |  |  | Press and hold “↑” to show the left figure.                                                       |
| 5     |  |                                                                                     | Continue pressing it and the left figure means operation is completed.                            |
| 6     |  |                                                                                     | Relieve the key and the panel displays the left figure.                                           |
| 7     |  |  | Press MOD or SET to exit from the auxiliary function and return to the display in step 2.         |
| 8     | End of operations                                                                   |                                                                                     |                                                                                                   |

# Chapter 5 Monitoring display parameters

## 5.1 List of monitoring display parameters

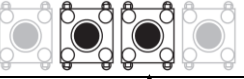
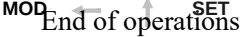
| No.          | Function                                                                                                                                                                                                               | Unit                             |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>dP 00</b> | <b>Motor speed</b><br>Display the motor operating speed                                                                                                                                                                | [rpm]                            |
| <b>dP 01</b> | <b>Motor feedback pulse number (encoder unit, lower 4 digits)</b><br>Display the lower 4 digits of the sum of motor encoder feedback pulse.                                                                            | [1 encoder pulse]                |
| <b>dP 02</b> | <b>Motor feedback pulse number (encoder unit, higher 5 digits)</b><br>Display the higher 5 digits of the sum of motor encoder feedback pulse.                                                                          | [10 <sup>4</sup> encoder pulses] |
| <b>dP 03</b> | <b>Input pulse number before electronic gear (user unit, lower 4 digits)</b><br>Lower 4 digits of the sum of input pulse number in position control mode.                                                              | [1 input pulse]                  |
| <b>dP 04</b> | <b>Input pulse number before electronic gear (user unit, higher 5 digits)</b><br>Higher 5 digits of the sum of input pulse number in position control mode.                                                            | [[10 <sup>4</sup> input pulses]  |
| <b>dP 05</b> | <b>Deviation pulse number (encoder unit, lower 4 digits)</b><br>Lower 4 digits of the sum of deviation pulse number in position control mode.                                                                          | [1 encoder pulse]                |
| <b>dP 06</b> | <b>Deviation pulse number (encoder unit, higher 5 digits)</b><br>Higher 5 digits of the sum of deviation pulse number in position control mode.                                                                        | [10 <sup>4</sup> encoder pulses] |
| <b>dP 07</b> | <b>Speed instruction (analog voltage instruction)</b><br>Voltage value of analog input in speed control mode, after correction of null shift. When the voltage exceeds $\pm 10V$ , it cannot be displayed correctly.   | [0.1V]                           |
| <b>dP 08</b> | <b>Internal speed instruction</b><br>Internal speed instruction under speed control and position control.                                                                                                              | [r/min]                          |
| <b>dP 09</b> | <b>Torque instruction (analog voltage instruction)</b><br>Voltage value of analog input in torque control mode, after correction of null shift. When the voltage exceeds $\pm 10V$ , it cannot be displayed correctly. | [0.1V]                           |
| <b>dP 10</b> | <b>Internal torque instruction (value in relation to the rated torque)</b><br>Internal torque instruction in torque / speed / position control modes.                                                                  | [%]                              |

|              |                                                                                                                                               |                                  |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>dP 11</b> | <b>Torque feedback (value in relation to the rated torque)</b><br>Torque feedback value in torque / speed / position control modes.           | [%]                              |
| <b>dP 12</b> | <b>Input signal monitoring</b><br>Input signal status of CN2 connector                                                                        | -                                |
| <b>dP 13</b> | <b>Output signal monitoring</b><br>Output signal status of CN2 connector                                                                      | -                                |
| <b>dP 14</b> | <b>Instruction pulse frequency</b><br>Instruction pulse frequency of the upper controller in position control.                                | [0.1Khz]                         |
| <b>dP 15</b> | <b>DC bus voltage</b><br>DC bus voltage after rectification                                                                                   | [V]                              |
| <b>dP 16</b> | <b>Total operation time of the servo drive</b><br>If AF05 operation is implemented, the value will be reset.                                  | [Hours]                          |
| <b>dP 17</b> | <b>Rotation angle</b><br>Display the electric rotational angle of the motor.                                                                  | [deg]                            |
| <b>dP 18</b> | <b>Exact position of absolute encoder (single-turn or multi-turn)</b><br>This displays the absolute position data of the encoder in one turn. | [2 Encoder pulse]                |
| <b>dP 19</b> | <b>Number of encoder turns (only for multi-turn absolute encoders)</b><br>This displays the number of turns of multi-turn absolute encoder.   | [1 turn]                         |
| <b>dP 20</b> | <b>Cumulative load factor (take rated cumulative load as 100%)</b><br>Alarm grade during motor overload protection.                           | [%]                              |
| <b>dP 21</b> | <b>Regeneration load factor (take rated regeneration load as 100%)</b><br>Alarm grade during regeneration overload protection                 | [%]                              |
| <b>dP 22</b> | <b>DB load factor (take rated DB load as 100%)</b><br>Alarm grade during DB braking protection                                                | [%]                              |
| <b>dP 23</b> | <b>Load inertial ratio</b><br>Display the ratio between load inertia and motor inertia.                                                       | [%]                              |
| <b>dP 24</b> | <b>Effective gain monitoring</b><br>1: the first group of gains is effective<br>2: the second group of gains is effective                     | -                                |
| <b>dP 30</b> | <b>Subsidiary software version (refer to AF 10 for main software version)</b>                                                                 | -                                |
| <b>dP 34</b> | External linear encoder feedback pulse counts low place                                                                                       | [1 encoder pulse]                |
| <b>dP 35</b> | External linear encoder feedback pulse counts high place                                                                                      | [10 <sup>4</sup> encoder pulses] |
| <b>dP 38</b> | Hybrid deviation low place                                                                                                                    | [1 encoder pulse]                |
| <b>dP 39</b> | Hybrid deviation high place                                                                                                                   | [10 <sup>4</sup> encoder pulses] |
| <b>dP 40</b> | <b>Voltage class (refer to PA000.3 for voltage class setting)</b>                                                                             | -                                |

|       |                  |    |
|-------|------------------|----|
| dP 46 | IGBT temperature | °C |
|-------|------------------|----|

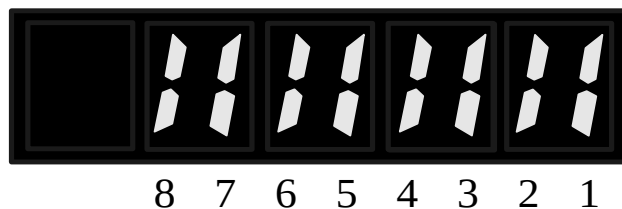
## 5.2 Input signal monitoring (dP 12)

### 5.2.1 Operations of entering dP 12

| Steps | Panel display                                                                                          | Keys                                                                              | Operations                                                        |
|-------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |                       |  | Press MOD key to choose monitoring display function.              |
| 2     |                       |  | If the panel display is not dP 12, press ↑ & ← until it is dP 12. |
| 3     |                       |  | Press SET to enter dP 12.                                         |
| 4     |                       |  | Press SET or MOD to exit to Step 1.                               |
| 5     | <br>End of operations |                                                                                   |                                                                   |

### 5.2.2 Explanations of dP 12 LED displays

Input signal status are shown by the LED displays.



Upper: corresponding signal status  
Lower: level of corresponding signal

DI number

- Corresponding signal status
  - LED off: signal is inactive
  - LED on: signal is active
- Level of corresponding signal
  - LED off: high level (non-conductive)
  - LED on: low level (conductive)

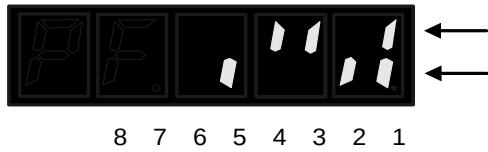
| DI number | Pin (CN2) | Default signal |
|-----------|-----------|----------------|
| 1         | 40        | S-ON           |
| 2         | 41        | C-MOD          |
| 3         | 42        | POT            |
| 4         | 43        | NOT            |
| 5         | 44        | CLR            |
| 6         | 45        | A-RESTART      |
| 7         | 46        | INHIBIT        |
| 8         | 48        | ZEROSPD        |

- Even without external signal inputs, by modifying PA 508 & PA509, user can still make corresponding signal active.

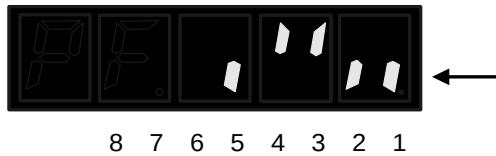


### 5.2.3 Examples of dP 12 LED displays

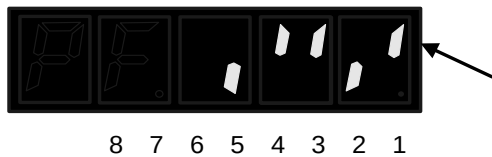
- PA508.0=0: S-ON is active, DI 1 is low level and low level is active.



- PA508.0=1: S-ON is inactive; DI 1 is low level and high level is active.



- PA508.0=1, S-ON is active; DI 1 is high level and high level is active.



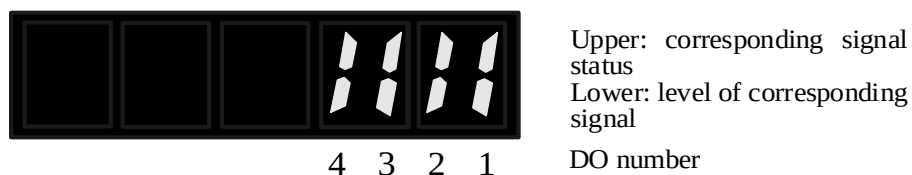
## 5.3 Output signal monitoring (dP 13)

### 5.3.1 Operations of entering dP 13

| Steps | Panel display     | Keys | Operations                                                        |
|-------|-------------------|------|-------------------------------------------------------------------|
| 1     |                   |      | Press MOD key to choose monitoring display function.              |
| 2     |                   |      | If the panel display is not dP 13, press ↑ & ← until it is dP 13. |
| 3     |                   |      | Press SET to enter dP 13.                                         |
| 4     |                   |      | Press SET or MOD to exit to Step 1.                               |
| 5     | End of operations |      |                                                                   |

### 5.3.2 Explanations of dP 13 LED displays

Output signal status are shown by the LED displays.



- Corresponding signal status
  - LED off: signal is inactive
  - LED on: signal is active
- Level of corresponding signal
  - LED off: high level (non-conductive)
  - LED on: low level (conductive)

| DO number | Pin (CN2) | Default signal |
|-----------|-----------|----------------|
| 1         | 31、32     | ALM            |
| 2         | 29、30     | COIN           |
| 3         | 27、28     | CZ             |
| 4         | 25、26     | BK             |

- Even output signal is inactive, by modifying PA 511, user can still make corresponding signal active.
- dP13 is always off if the output signal is CZ.

### 5.3.3 Examples of dP 13 LED displays

- PA511.0=0: ALM is inactive; DO 1 is low level.



- PA511.0=0: ALM is active; DO 1 is high level.



- PA511.0=1: ALM is active; DO 1 is low level.

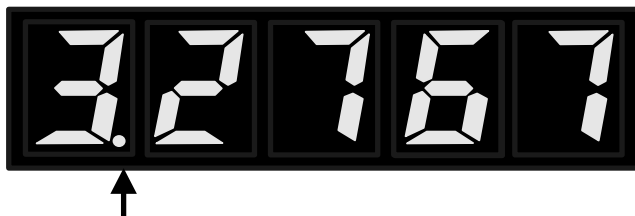


## 5.4 Initial monitoring display at power on

- If PA014 is not 50, then user can set which monitoring display parameter to display at power on.
- If PA014=50 (default), then status codes will be displayed at power on (refer to chapter 4.3)

## 5.5 Display range of dP 01~dP 06

- Display range of dP 01, dP 03 and dP 05 is  $[-32767, 32767]$ .  
A left-most decimal point is used for displaying -32767.



Number is negative.

- When the absolute value of motor feedback pulse number ( $dP\ 02 \times 10^4 + dP\ 01$ ), input pulse number before electronic gear ( $dP\ 04 \times 10^4 + dP\ 03$ ) and deviation pulse number ( $dP\ 06 \times 10^4 + dP\ 05$ ) exceeds 327679999, the monitoring display

will not be updated.

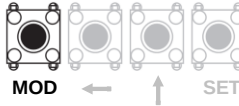
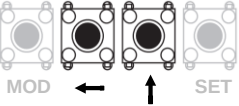
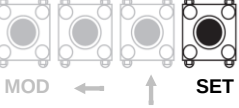
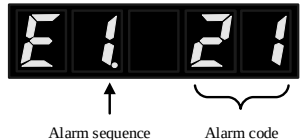
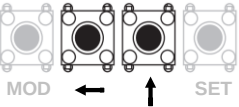
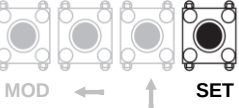
## Chapter 6 Auxiliary functions

### 6.1 List of auxiliary function parameters

| No.   | Function                                                        | Reference |
|-------|-----------------------------------------------------------------|-----------|
| AF 00 | Display of alarm logging                                        | 6.2       |
| AF 01 | Position assignment (only active in position control mode)      | 6.3       |
| AF 02 | JOG run                                                         | 6.4       |
| AF 03 | Panel lock                                                      | 6.5       |
| AF 04 | Clearance of alarm logging                                      | 6.6       |
| AF 05 | Parameter initialization                                        | 6.7       |
| AF 06 | Analog instruction (speed & torque) automatic offset adjustment | 6.8       |
| AF 07 | Speed instruction manual offset adjustment                      | 6.9       |
| AF 08 | Torque instruction manual offset adjustment                     | 6.10      |
| AF 09 | Overview of relevant motor parameters                           | 6.11      |
| AF 10 | Display of main software version of servo drive                 | 6.12      |
| AF 11 | Setting up absolute encoders                                    | 6.13      |
| AF 12 | Clearance of error logging for absolute encoders                | 6.13      |
| AF 15 | Manual detection of load inertia                                | 6.14      |

## 6.2 Display of error logging (AF 00)

Up to 10 most recent alarms can be displayed.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                                                                                                                                    |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                                                                                                                              |
| 2     |    |    | If the panel display is not AF 00, press ↑ & ← until it is AF 00.                                                                                                             |
| 3     |    |    | Press SET to enter AF 00.                                                                                                                                                     |
| 4     |    |    | Press “←” once and it will display one previous alarm. Press “↑” once and it will display a new alarm. The bigger the number on the left side, the older the alarm displayed. |
| 5     |  |  | Press SET to exit to Step 2.                                                                                                                                                  |
| 6     | End of operations.                                                                  |                                                                                     |                                                                                                                                                                               |

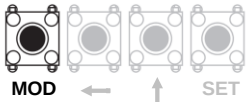
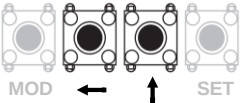
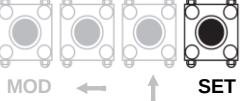
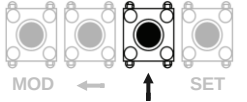
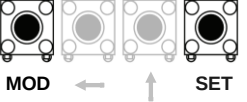
Notes:

- When there have been no alarms, the alarm No. is 0.
- The alarm logging can be deleted through Clearance of Alarm Logging (AF 04) .
- A-RESTART or power off cannot clear the alarm loggings.

## 6.3 Position assignment (AF 01)

With this function, motor feedback position & instruction pulse position is assigned by value of PA766 & PA767.

This parameter will also reset the values in dP 01 ~ dP06.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |    |    | If the panel display is not AF 01, press ↑ & ← until it is AF 01. |
| 3     |    |    | Press SET to enter AF 01.                                         |
| 4     |   |   | Press and hold ↑.                                                 |
| 5     |  |                                                                                     |                                                                   |
| 6     |  |                                                                                     | Release the key.                                                  |
| 7     |  |  | Press MOD or SET to exit to Step 2.                               |
| 8     | End of operations.                                                                  |                                                                                     |                                                                   |

## 6.4 JOG run (AF 02)

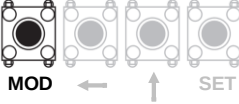
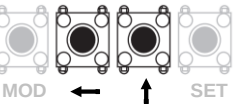
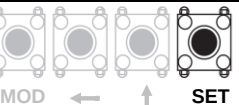
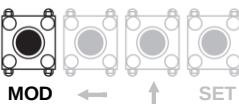
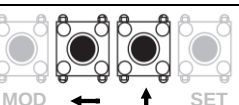
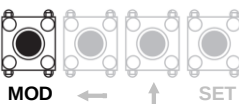
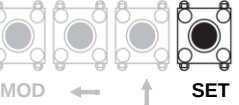
JOG run is the function to confirm the servo motor action through speed control without connecting to the upper controller. During JOG run, the overtravel prevention function (POT, NOT) is inactive. **User shall pay close attention to mechanical movement of the machinery caused by JOG run.**

### 1) Preparing for JOG run

Before JOG run, the following settings are necessary.

- When S-ON input signal is ON, please switch it to OFF.
- Please set the JOG speed after considering mechanical movement of the machinery.  
**JOG speed can be set by PA306.**
- Please take necessary safety measures and ensure it can stop at any emergency.
- In order to ensure safety, a stop device shall be set on the machine side.

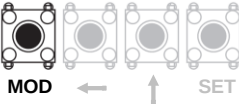
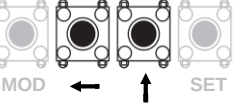
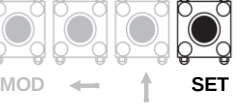
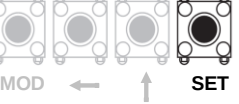
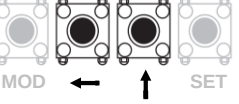
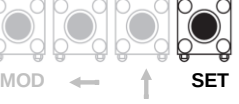
### 2) JOG run procedures

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                                 |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                           |
| 2     |  |   | If the panel display is not AF 02, press ↑ & ← until it is AF 02.          |
| 3     |  |  | Press SET to enter AF 02.                                                  |
| 4     |  |                                                                                     | <i>This will show if the servo is running or panel is locked (AF 03) .</i> |
| 5     |  |  | Press MOD to enable the servo.                                             |
| 6     |  |  | Press ← to JOG forward or ↑ to JOG reversely.                              |
| 7     |  |  | Press MOD (or SET) to stop enabling the servo.                             |
| 8     |  |  | Press SET to exit to Step 2.                                               |
| 9     | End of operations.                                                                  |                                                                                     |                                                                            |

## 6.5 Panel lock (AF 03)

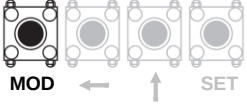
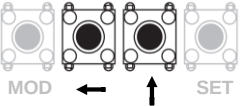
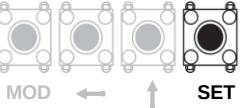
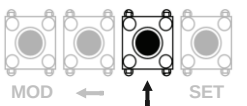
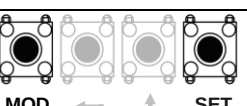
Password settings:

- When it is set to be 58, no parameters or functions can be operated.
- When it is set to be 315, all parameters and functions (even hidden) can be operated.
- When it is set to be any other value, only the parameters and functions listed in the user manual can be operated.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |    |    | If the panel display is not AF 03, press ↑ & ← until it is AF 03. |
| 3     |    |    | Press SET.                                                        |
| 4     |  |  | Press SET to enter AF 03                                          |
| 5     |  |  | Press ↑ or ← to set the password.                                 |
| 6     |  |  | Press SET to finish password setting and exit to Step 2.          |
| 7     | End of operations.                                                                  |                                                                                     |                                                                   |

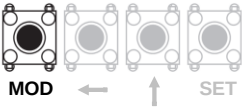
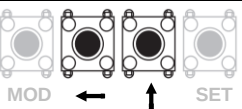
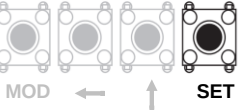
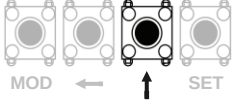
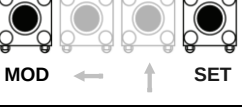


## 6.6 Clearance of alarm logging (AF 04)

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |    |    | If the panel display is not AF 04, press ↑ & ← until it is AF 04. |
| 3     |    |    | Press SET.                                                        |
| 4     |    |    | Press and hold ↑.                                                 |
| 5     |    |                                                                                     | This shows the operation is done.                                 |
| 6     |  |                                                                                     | Release the key.                                                  |
| 7     |  |  | Press MOD or SET to exit to Step 2.                               |
| 8     | End of operations.                                                                  |                                                                                     |                                                                   |

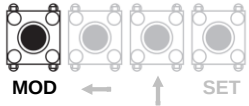
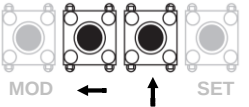
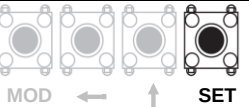
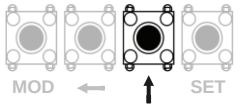
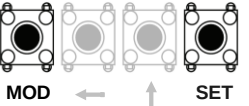
## 6.7 Parameter initialization (AF 05)

To achieve parameter initialization, servo must not be ON. Also, restart afterwards to make initialization effective.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                                 |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                           |
| 2     |    |    | If the panel display is not AF 05, press ↑ & ← until it is AF 05.          |
| 3     |    |    | Press SET if the servo is not ON.                                          |
| 4     |    |                                                                                     | <i>This will show if the servo is running or panel is locked (AF 03) .</i> |
| 5     |  |   | Press and hold ↑.                                                          |
| 6     |  |                                                                                     | This shows the operation is done.                                          |
| 7     |  |                                                                                     | Release the key.                                                           |
| 8     |  |  | Press MOD or SET to exit to Step 2.                                        |
| 9     | Power off, then power on again.                                                     |                                                                                     |                                                                            |
| 10    | End of operations.                                                                  |                                                                                     |                                                                            |

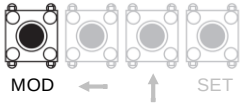
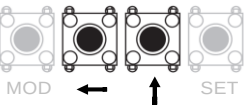
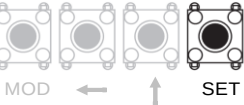
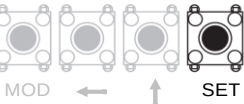
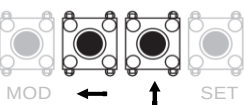
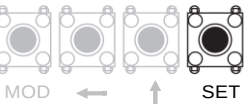
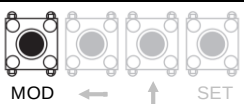
## 6.8 Analog instruction automatic offset adjustment (AF 06)

This is a method for self-regulation of the instruction voltage (speed instruction and torque instruction) after measuring the offset. The measured offset will be saved in the servo drive.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |    |    | If the panel display is not AF 06, press ↑ & ← until it is AF 06. |
| 3     |    |    | Press SET.                                                        |
| 4     |   |   | Press and hold ↑.                                                 |
| 5     |  |                                                                                     | This shows the operation is done.                                 |
| 6     |  |                                                                                     | Release the key.                                                  |
| 7     |  |  | Press MOD or SET to exit to Step 2.                               |
| 8     | End of operations.                                                                  |                                                                                     |                                                                   |

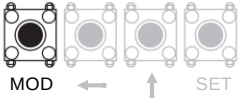
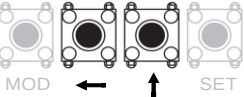
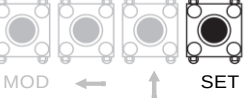
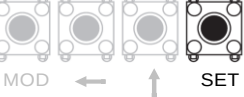
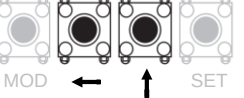
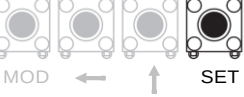
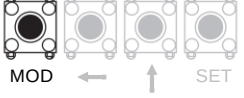
## 6.9 Speed instruction manual offset adjustment (AF 07)

This is the method to input the speed instruction offset directly for regulation.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |    |    | If the panel display is not AF 07, press ↑ & ← until it is AF 07. |
| 3     |    |    | Press SET.                                                        |
| 4     |    |                                                                                     | This will show if the servo is ON.                                |
| 5     |   |   | Press SET to display current offset value.                        |
| 6     |  |  | Press ↑ or ← for adjustment.                                      |
| 7     |  |  | Press SET, 'SAVED' will show and blink, then will exit to Step 2. |
| 8     |  |  | Press MOD to exit to Step 2 without saving.                       |
| 9     | End of operations.                                                                  |                                                                                     |                                                                   |

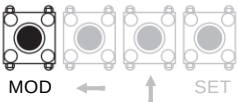
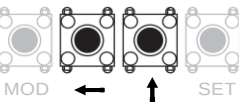
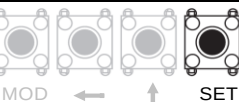
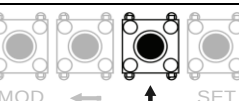
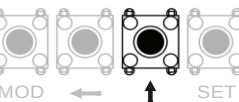
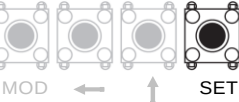
## 6.10 Torque instruction manual offset adjustment (AF 08)

This is the method to input the torque instruction offset directly for regulation.

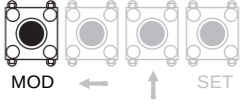
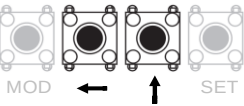
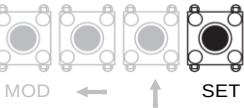
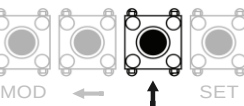
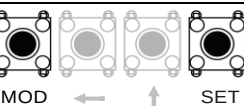
| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |    |    | If the panel display is not AF 08, press ↑ & ← until it is AF 08. |
| 3     |    |    | Press SET.                                                        |
| 4     |    |                                                                                     | This will show if the servo is ON.                                |
| 5     |   |   | Press SET to display current offset value.                        |
| 6     |  |  | Press ↑ or ← for adjustment.                                      |
| 7     |  |  | Press SET, 'SAVED' will show and blink, then will exit to Step 2. |
| 8     |  |  | Press MOD to exit to Step 2 without saving.                       |
| 9     | End of operations.                                                                  |                                                                                     |                                                                   |

## 6.11 Overview of relevant motor parameters (AF 09)

Display the model, encoder type and motor phase of the servo motor connected to the servo drive. If the servo drive has special specifications, its serial number will also be displayed.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                                                                                                                                                                                                              |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                                                                                                                                                                                                        |
| 2     |    |    | If the panel display is not AF 09, press ↑ & ← until it is AF 09.                                                                                                                                                                                       |
| 3     |    |    | Press SET to show the left figure. It means the drive model is 0, and the first letter is identified as "d".                                                                                                                                            |
| 4     |   |   | Press "↑" to show the motor model, and the first letter is identified as "F".                                                                                                                                                                           |
| 5     |  |  | Press "↑" to show the model of encoder. <ul style="list-style-type: none"> <li>0: multi-turn absolute encoder;</li> <li>1: single-turn absolute encoder;</li> <li>2: line-saving incremental encoder.</li> </ul> The first letter is identified as "E". |
| 6     |  |  | Press SET to exit to Step 2.                                                                                                                                                                                                                            |
| 7     | End of operations.                                                                  |                                                                                     |                                                                                                                                                                                                                                                         |

## 6.12 Display of main software version of servo drive (AF 10)

| Steps | Panel display                                                                     | Keys                                                                               | Operations                                                        |
|-------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |  |   | Press MOD key to choose auxiliary function mode.                  |
| 2     |  |   | If the panel display is not AF 10, press ↑ & ← until it is AF 10. |
| 3     |  |   | Press SET.<br>'d 1.00': DSP software version is 1.00.             |
| 4     |  |   | Press ↑.<br>F 1.03: FPGA software version is 1.03.                |
| 5     |  |  | Press MOD or SET to exit to Step 2.                               |
| 6     | End of operations.                                                                |                                                                                    |                                                                   |

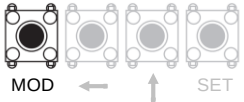
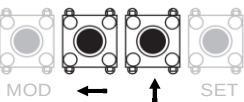
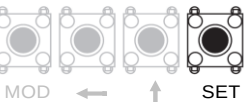
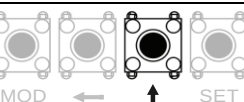
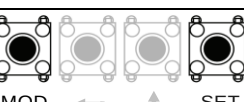
## 6.13 Setting up absolute encoders (AF 11)

This function is used under the following conditions:

- Absolute encoder is used for the first time;
- There are alarms related to absolute encoders;
- User intends to set quantity of turns of a multi-turn encoder to 0.

Notes:

- Servo must be OFF;
- A-RST cannot clear alarms related to absolute encoders;
- Power off and power on again after setting;
- This operation will set quantity of turns of a multi-turn encoder to 0 and clear all alarms related to absolute encoders

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                        |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                  |
| 2     |  |  | If the panel display is not AF 11, press ↑ & ← until it is AF 11. |
| 3     |  |  | Press SET.                                                        |
| 4     |  |  | Press and hold ↑.                                                 |
| 5     |  |                                                                                     | This shows the operation is done.                                 |
| 6     |  |  | Press MOD or SET to exit to Step 2.                               |
| 7     | Power off and power on again.                                                       |                                                                                     |                                                                   |
| 8     | End of operations.                                                                  |                                                                                     |                                                                   |

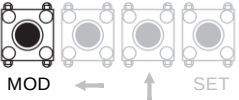
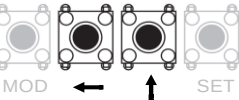
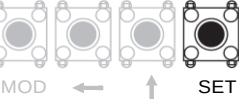
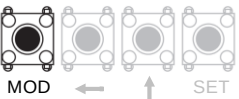
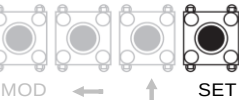
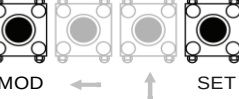


## 6.14 Manual detection of load inertia (AF 15)

Overtravel prevention is inactive during the process of manual detection of load inertia.

### Preparations before operation

- Servo is OFF;
- Please set PA300.2 for running distance of the motor in this operation, after careful study of all related mechanical parts.
- Please take necessary safety measures, e.g. a stop device on the machine side, for emergency stops.

| Steps | Panel display                                                                       | Keys                                                                                | Operations                                                                 |
|-------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 1     |    |    | Press MOD key to choose auxiliary function mode.                           |
| 2     |    |    | If the panel display is not AF 15, press ↑ & ← until it is AF 15.          |
| 3     |   |   | Press SET.                                                                 |
| 4     |  |                                                                                     | <i>This will show if the servo is running or panel is locked (AF 03) .</i> |
| 5     |                                                                                     |  | Press MOD to run manual detection of load inertia.                         |
| 6     |                                                                                     |  | During operation, press SET for emergency stop.                            |
| 7     |  |                                                                                     | Load inertia will display after operation, unit: Kg*cm <sup>2</sup>        |
| 8     |  |  | Press MOD or SET to exit to Step 2.                                        |
| 9     | End of operations.                                                                  |                                                                                     |                                                                            |

# Chapter 7 JOG run

## 7.1 Preparations before JOG run

Please check the following items before JOG run:

| Item         | What to check                                                                                               |
|--------------|-------------------------------------------------------------------------------------------------------------|
| Servo motor  | Whether the motor has been released from load?                                                              |
|              | Whether the wiring and connection are correct?                                                              |
|              | Whether the fastening parts are loose?                                                                      |
|              | If the servo motor has a holding brake, whether the brake has been released (by separate 24VDC) in advance? |
| Servo driver | Whether the wirings and connections are correct?                                                            |
|              | Whether the input voltage to the servo drive is stable?                                                     |

## 7.2 JOG run by panel operations

Please refer to Chapter 6.4

## 7.3 Stand-alone JOG run with upper controllers

Please check the following items before JOG run by instructions from upper controllers:

| Item | What to check                                                                                                             |
|------|---------------------------------------------------------------------------------------------------------------------------|
| 1    | Whether I/O signals are correctly set?                                                                                    |
| 2    | Whether the connections between upper controller and servo drive is correct and whether the polarities are set correctly? |
| 3    | Whether the instructions are correctly set?                                                                               |

### 7.3.1 Wiring & status check of input signal circuit

| Steps | Operations                                                                                                                              | Reference |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1     | Please make sure following signals are connected to CN2: <ul style="list-style-type: none"><li>▪ S-ON</li><li>▪ POT &amp; NOT</li></ul> | 3.3       |
| 2     | Connect servo drive to upper controller.                                                                                                | -         |
| 3     | Power on. Check status of dP 12.                                                                                                        | 4.3       |
| 4     | Input S-ON to enable the servo.                                                                                                         | 4.3       |
| 5     | End of preparations for JOG run.                                                                                                        | -         |

### 7.3.2 JOG run in position control mode

| Steps | Operations                                                                                                                                                                   | Reference      |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1     | Reconfirm the power supply and input signal circuit and then switch on the control power supply of servo drive.                                                              | 3.1            |
| 2     | Use PA200.0 to set the input pulse form.                                                                                                                                     | 8.4.1          |
| 3     | Use PA205 and PA206 to set the electronic gear ratio;<br>Use PA210 to set encoder divided frequency pulse number.                                                            | 8.4.2<br>8.5.7 |
| 4     | Power on again.                                                                                                                                                              | -              |
| 5     | Input S-ON to enable the servo.                                                                                                                                              | -              |
| 6     | Output low speed pulse instruction from the upper controller with easily confirmed motor rotation (such as: 1 turn) .                                                        | -              |
| 7     | Monitor the input pulse number (dP 03 & dP 04) .                                                                                                                             | 5.1            |
| 8     | Monitor feedback pulse number (dP 01 and dP 02) .                                                                                                                            | 5.1            |
| 9     | Confirm whether the servo motor rotates in the direction given by the instruction.                                                                                           | -              |
| 10    | Check whether the number of feedback pulse corresponds with the expected number.<br><b>Feedback pulse number = (dP 01*10<sup>4</sup>+dP 02) *PA210*4/ encoder resolution</b> | 5.1            |
| 11    | Stop the pulse instruction and make the servo OFF.                                                                                                                           | -              |

### 7.3.3 JOG run in speed control mode

| Steps | Operations                                                                                                                         | Reference |
|-------|------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1     | Reconfirm the power supply and input signal circuit and then switch on the control power supply of servo drive.                    | 3.1       |
| 2     | Adjust speed instruction input gain by PA301.                                                                                      | 8.5       |
| 3     | Power on.                                                                                                                          | -         |
| 4     | Confirm the speed instruction input (voltage between V- REF and AGND) is 0 V, and then switch on the servo ON (S-ON) input signal. | -         |
| 5     | Increase speed instruction input voltage (voltage between V-REF and AGND) from 0V slowly.                                          | -         |
| 6     | Confirm the speed instruction value (voltage) through the speed instruction monitoring (dP 07) .                                   | 5.1       |
| 7     | Confirm the motor speed (rotating speed) through motor speed monitoring (dP 00) .                                                  | 5.1       |
| 8     | Confirm the values in procedures 6 and 7 (dP07 and dP00) are consistent according to the conversion relation.                      | 5.1       |
| 9     | Confirm whether the servo motor rotates in the direction given by the instruction.                                                 | -         |
| 10    | Return speed instruction input to 0V, and make the servo OFF. Then the speed test run is finished.                                 | -         |

## 7.4 JOG run with mechanical connections

After stand-alone JOG run, user can then proceed to JOG run with mechanical connections.

| Steps | Items               | Operations                                                                                                                                                                                                                                         | Reference chapter |
|-------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| 1     | Parameter setting 1 | Power on and conduct the setting related to the safety functions, overtravel and brake protection functions.                                                                                                                                       | 3.1<br>8.2        |
| 2     | Parameter setting 2 | Set the necessary parameters according to the control mode used.                                                                                                                                                                                   | -                 |
| 3     | Installation        | Power OFF and connect the servo motor with the mechanical parts.                                                                                                                                                                                   | -                 |
| 4     | Check               | Power on upper controller but keep the servo OFF, and then confirm whether the protection functions set in Step 1 function normally.                                                                                                               | -                 |
| 5     | Operation           | Conduct JOG run same way as Chapter 7.3. Confirm the JOG run result is up to expectations with mechanical connections.                                                                                                                             | 7.3               |
| 6     | Adjustment          | Adjust the servo gains (if necessary) to improve the response characteristic of servo motor.<br>During the JOG run, the servo motor may not adapt to the machine well at the beginning. Please conduct fine tune to make them adapt to each other. | -                 |
| 7     | Finish              | Then, the JOG run is finished.                                                                                                                                                                                                                     | -                 |

## 7.5 JOG run with a holding brake

| Item | Remarks                                                                                                                                                                                                                                                                                  |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | When conducting JOG run of the servo motor with a brake, before confirming the action of brake, measures to prevent the natural fall or vibration due to external force of the machine shall be taken.                                                                                   |
| 2    | When conducting the JOG run of servo motor with a brake, please first of all confirm the action of servo motor and holding brake before connecting the servo motor with the machine. If there are no problems, conduct the JOG run again by connecting the servo motor with the machine. |
| 3    | Please control the action of the holding brake BK signal.                                                                                                                                                                                                                                |

# Chapter 8 Servo operations

## 8.1 Control mode selections

| Parameter | Control mode                                                                                                                                                                                                                                                                                                                | Reference |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| PA000.1   | <b>Position control (pulse train instruction)</b><br>The position of servo motor is controlled through the pulse train position instruction. The position is controlled through the pulse number inputted, and speed is controlled through the frequency of input pulse. It is used when the action needs to be positioned. | 8.4       |
|           | <b>Speed control (analog voltage instruction)</b><br>Use this under the following occasions: <ul style="list-style-type: none"> <li>To control the rotating speed;</li> <li>Use the encoder pulse output of servo drive and establish the position loop through the upper controller for position control.</li> </ul>       | 8.5       |
|           | <b>Torque control (analog voltage instruction)</b><br>Use the analog voltage torque instruction to control the output torque of servo motor.                                                                                                                                                                                | 8.6       |
|           | <b>Internal speed control</b><br>Use 3 input signals, INSPD0, INSPD1 and INSPD2, for speed control through the 8 preset speeds in the servo drive. When this control mode is used, the analog instruction is not needed.                                                                                                    | 8.7       |
|           | <b>Internal speed control ↔ Position control</b>                                                                                                                                                                                                                                                                            | 8.10      |
|           | <b>Internal speed control ↔ Speed control</b>                                                                                                                                                                                                                                                                               | 8.10      |
|           | <b>Internal speed control ↔ Torque control</b>                                                                                                                                                                                                                                                                              | 8.10      |
|           | <b>Position control ↔ Speed control</b>                                                                                                                                                                                                                                                                                     | 8.10      |
|           | <b>Position control ↔ Torque control</b>                                                                                                                                                                                                                                                                                    | 8.10      |
|           | <b>Torque control ↔ Speed control</b>                                                                                                                                                                                                                                                                                       | 8.10      |
|           | <b>Internal position control</b><br>System positions will be controlled without the upper controller.                                                                                                                                                                                                                       | 8.8       |
|           | <b>Internal position control ↔ Position control</b>                                                                                                                                                                                                                                                                         | 8.10      |
|           | <b>Reserved</b>                                                                                                                                                                                                                                                                                                             |           |
|           | <b>Fully closed loop control</b>                                                                                                                                                                                                                                                                                            | 8.11      |

## 8.2 Basic function settings

### 8.2.1 S-ON settings

- S-ON is the instruction for servo motor on/off

| Type  | Signal | Status | Level        | Remarks                             |
|-------|--------|--------|--------------|-------------------------------------|
| Input | S-ON   | ON     | 2CN-40: Low  | Servo is ON & ready for operations. |
|       |        | OFF    | 2CN-40: High | Servo is OFF.                       |

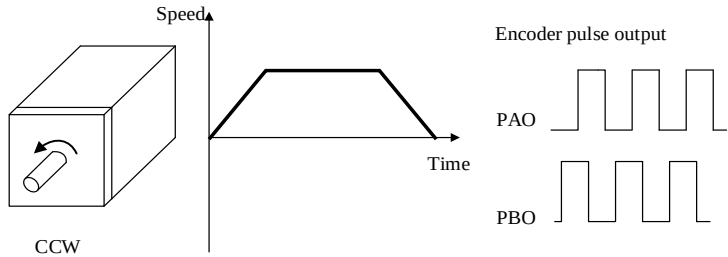
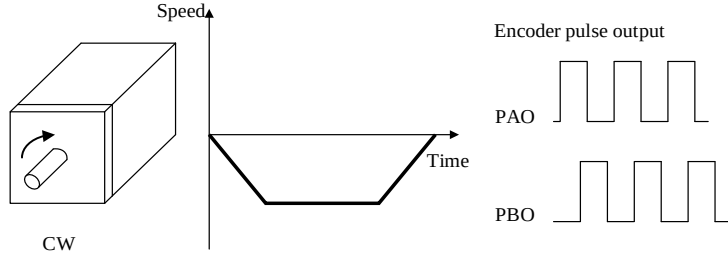
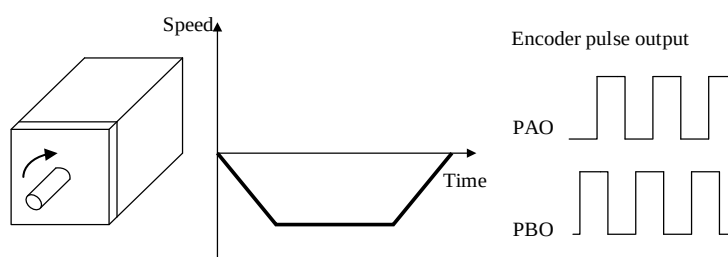
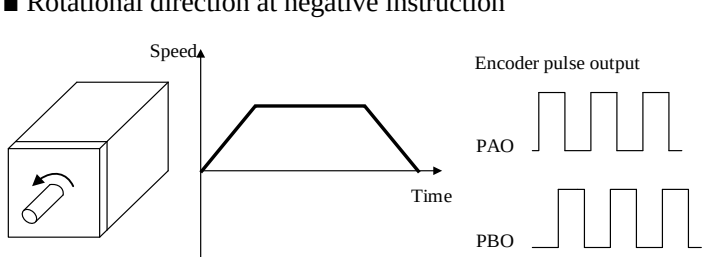
- Selection of S-ON level

| Parameter |        | Remarks                                           |
|-----------|--------|---------------------------------------------------|
| PA508     | b.□□□0 | L level active (optocoupler conductive) (default) |
|           | b.□□□1 | H level active (optocoupler not conductive)       |

## 8.2.2 Switch of motor rotational directions

The servo drive can enable the servo motor to rotate reversely (negative rotation mode) without changing the wiring of servo motor.

The positive direction is counter clockwise rotation (CCW). Negative mode only changes the rotational direction of the motor and positive direction becomes clockwise rotation (CW), and **encoder pulse output polarity remains unchanged**.

| Parameter | Instructions & rotational directions                                                                                                          | Overtravel (OT) |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| PA000     | <b>■ Rotational direction at positive instruction</b><br>   | POT             |
|           | <b>■ Rotational direction at negative instruction</b><br> | NOT             |
|           | <b>■ Rotational direction at positive instruction</b><br> | NOT             |
|           | <b>■ Rotational direction at negative instruction</b><br> | POT             |



### 8.2.3 Overtravel (OT) settings

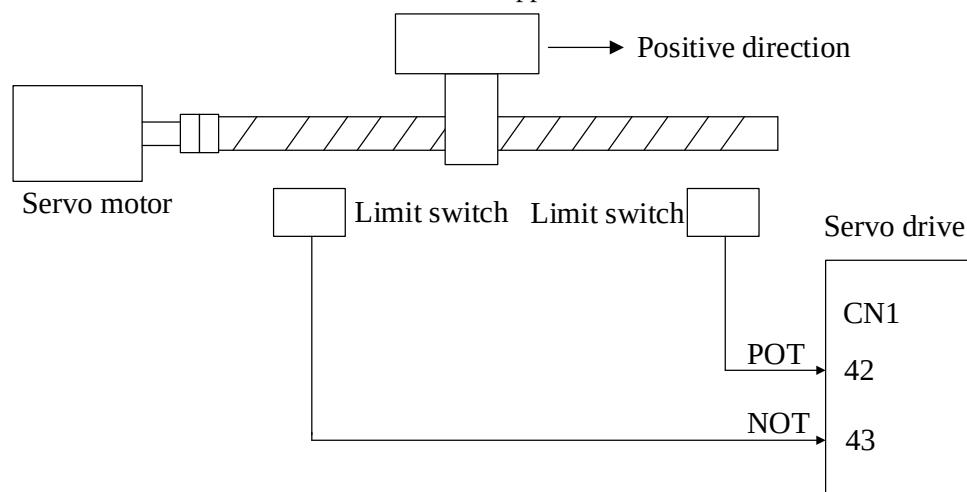
Overtravel refers to the safety function which can make the limit switch function (ON) and force the servo motor to stop when the moving parts of a machine go beyond the movable area.

| Attention                                                                                                                                                                                                                                                 |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Installation of limit switches</b><br>Limit switches must be installed in applications such as linear motions. When the limit switch has bad contacts or broken wires, please use ‘normally closed nodes’ to ensure the motor moves to the safer side. |  |
| <b>Use of servo motors in vertical axis</b><br>Work piece might fall when overtravel. To prevent this, please set the servo into zero-speed clamp when overtravel.                                                                                        |  |

#### (1) Wiring for overtravel

| Type  | Signal | Pin                 | Setting     | Meaning                                      |
|-------|--------|---------------------|-------------|----------------------------------------------|
| Input | POT    | CN2-42<br>(default) | ON=L level  | Can forward run                              |
|       |        |                     | OFF=H level | Forward run prohibited (positive overtravel) |
| Input | NOT    | CN2-43<br>(default) | ON=L level  | Can reverse run                              |
|       |        |                     | OFF=H level | Reverse run prohibited (negative overtravel) |

When in overtravel, servo can still move in the opposite direction.



#### Important

- There might be position deviation pulse residual at overtravel in position control. To clear the residual, use CLR signal.
- POT, NOT can be allocated to other Pins.
- To use POT, NOT, please set PA003.0 & PA003.1 to 0.

## (2) Selection of servo stop patterns at overtravel

| Parameter | During stop      | After stop         | Meaning                                                                                                                |
|-----------|------------------|--------------------|------------------------------------------------------------------------------------------------------------------------|
| PA001     | d.□□0□<br>d.□□□0 | DB to stop         | DB to stop and enter free state (power off) after stop.                                                                |
|           | d.□□0□<br>d.□□□1 |                    | Coast to stop and enter free state (power off) after stop.                                                             |
|           | d.□□0□<br>d.□□□2 | Coast to stop      | Coast to stop and enter free state (power off) after stop.                                                             |
|           | d.□□1□           | Decelerate to stop | Zero-speed clamp state<br>Use emergency stop torque (PA406) to decelerate and enter zero-speed clamp state after stop. |
|           | d.□□2□           | Free state         | Free state<br>Use emergency stop torque (PA406) to decelerate and enter free state (power off) after stop.             |

- Please restart the servo drive after modifying this parameter.
- If the servo receives S-ON signal during coast to stop, the servo motor can only be controlled after the speed has decelerated to 0.
- Definitions:
  - DB: dynamic brake (internal short-circuit of servo drive) . This feature is optional.
  - Coast to stop: stop using natural frictions.
  - Zero-speed clamp: the state when position instruction is 0 and position deviation is cleared.

## (3) Enable overtravel signal

| Parameter | Description                                                  |
|-----------|--------------------------------------------------------------|
| PA003     | b.□□□ 0 Forward rotation prohibited (POT) valid              |
|           | b.□□□ 1 Forward rotation prohibited (POT) invalid (default)  |
|           | b. □□ 0 □ Reverse rotation prohibited (NOT) valid            |
|           | b.□□ 1 □ Reverse rotation prohibited (NOT) invalid (default) |

## (4) Stop torque setting during overtravel

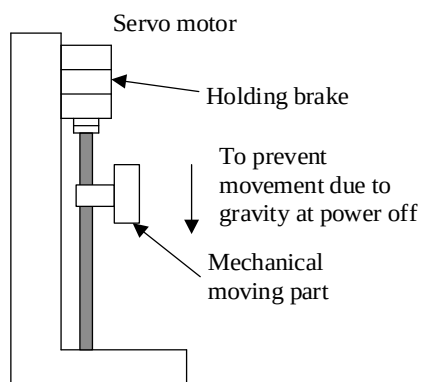
| PA406 | Emergency Stop Torque |      |         |             |
|-------|-----------------------|------|---------|-------------|
|       | Range                 | Unit | Default | Effective   |
|       | 0 ~ 300               | 1%   | 300     | Immediately |

- 
- Set the torque for motor stop when the overtravel signals (POT, NOT) are valid.
  - The setting unit is the % of the rated torque. (the rated torque is 100%)
  - When the emergency stop torque exceeds the maximum running torque of the motor, the actual emergency stop torque output is the motor's maximum running torque; When the emergency stop torque is too small, there may be E.28 alarm during deceleration.
- 

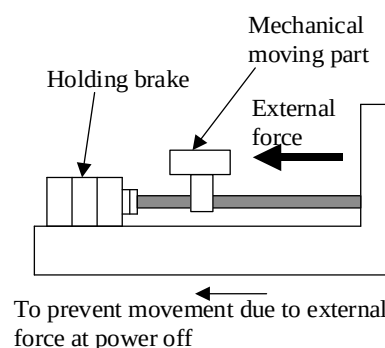
## 8.2.4 Holding brake settings

The holding brake is often used when the motor is used in the vertical axis. When the power of servo drive is OFF, the servo motor with a brake can keep the moving parts from moving due to gravity. (Please refer to Chapter 7.5 JOG run with a holding brake)

### ■ Vertical axis



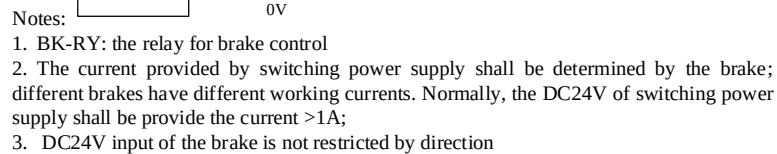
### ■ Horizontal axis



- The holding brake can only be used to maintain the halt state, not braking, of the servo motor. The brake torque is 70% or above of the rated torque of servo motor.
- If only the speed loop is used to activate the servo motor, when the brake functions, set the servo OFF and input instruction to be "0V".
- When setting the position loop, because the servo motor is under servo locked state at stop, the mechanical brake shall not function.

### (1) Example of connection

The sequential output signal of servo drive (BK) and brake power supply forms the ON/OFF of the brake. Standard connection of a circuit is illustrated as follows.



Timing diagram showing the relationship between S-RDY, S-ON, BK, and Holding brake status signals.

- S-RDY**: Signal that is OFF initially, turns ON, and then turns OFF again.
- S-ON**: Signal that is OFF initially, turns ON, and then turns OFF again.
- BK**: Signal that is OFF initially, turns ON when S-ON turns ON, and turns OFF when S-ON turns OFF.
- Holding brake status**: Signal that is 'Holding' (low) initially, transitions to 'Brake release' (high) when S-ON turns ON, and returns to 'Holding' when S-ON turns OFF.

Key timing points:

- \*1**: Time interval from the rising edge of S-ON to the rising edge of BK.
- \*2**: Time interval from the falling edge of S-ON to the falling edge of BK.

\*1. The time from BK signal active to brake release is different for different types of brakes  
\*2. PA518 value

| Type   | Signal name | Pin             | Setting    | Meaning       |
|--------|-------------|-----------------|------------|---------------|
| Output | BK          | Need allocation | ON=L level | Brake release |
|        |             |                 | ON=H level | Brake holding |

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necessary to allocate the output signal (setting of PA510) . Do not connect with it when the motor without a brake is used.

■ Important

When overtravel, even the servo motor is powered off, no BK signal can output.

### (3) Allocation of BK signal

Brake signal (BK) is allocated to DO4 (CN2-25, CN2-26) by default, but can also be allocated freely.

| Parameter |        | Pin    |        | Meaning                              |
|-----------|--------|--------|--------|--------------------------------------|
|           |        | +      | -      |                                      |
| PA510     | h.□□3□ | CN2-29 | CN2-30 | BK signal output from CN2-29, CN2-30 |
|           | h.□3□□ | CN2-27 | CN2-28 | BK signal output from CN2-27, CN2-28 |
|           | h.3□□□ | CN2-25 | CN2-26 | BK signal output from CN2-25, CN2-26 |

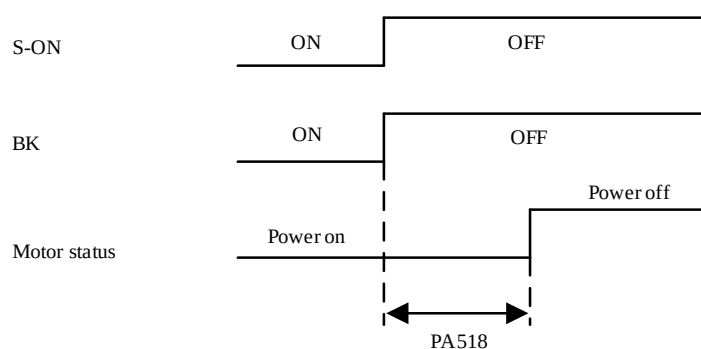
Please refer to Chapter 3.4.3 'Allocation of I/O signals'

### (4) BK signal hysteresis time after Servo-OFF

BK signal is normally OFF when servo OFF, but users can change the BK signal hysteresis time after Servo-OFF.

| PA518 | BK signal hysteresis time after Servo-OFF |      |         |           |
|-------|-------------------------------------------|------|---------|-----------|
|       | Range                                     | Unit | Default | Effective |
|       | 0~500                                     | ms   | 100     | Immed     |

When used on a vertical axis, moving parts of the machine sometimes may move slightly due to deadweight or external force. The slight movement may be eliminated by using the user parameter to delay the actions after the servo OFF.



---

When an alarm is given out, the servo motor will be immediately powered off, and the setting of this parameter becomes irrelevant.

Owing to the deadweight of machine moving parts or the external force, the machine sometimes may move before the brake functions

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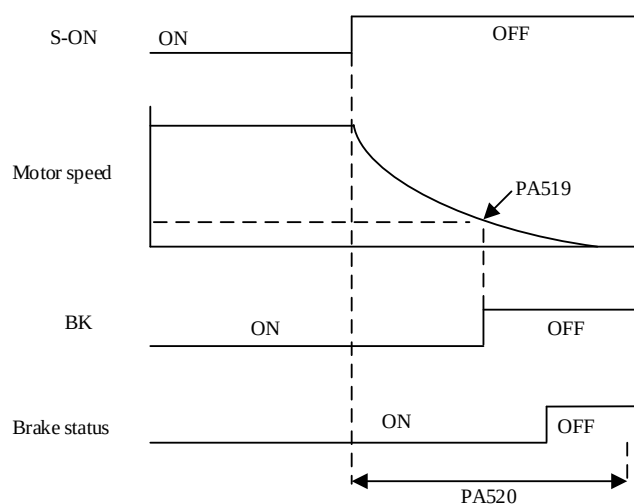
### (5) Setting of BK signal timing during the rotation of servo motor

When a halt instruction is given to the rotating servo motor during servo OFF or an alarm, the output conditions of BK signal can be changed according to the following user parameters.

| PA519 | BK signal speed limit               |      |         |           |
|-------|-------------------------------------|------|---------|-----------|
|       | Range                               | Unit | Default | Effective |
|       | 0~1000                              | rpm  | 100     | Immed     |
| PA520 | BK signal waiting time at Servo-OFF |      |         |           |
|       | Range                               | Unit | Default | Effective |
|       | 100~1000                            | 1ms  | 500     | Immed     |

**BK signal will be OFF (H level, nonconductive) in following situations:**

- The motor speed is below PA519 after servo OFF
- The waiting time exceeds PA520 after servo OFF




---

Even PA519 is set to be above the maximum speed of the servo motor, the servo motor will be restricted by its own maximum speed.

---

## 8.2.5 Selection of servo stop patterns at servo OFF

| Parameter |        | During stop        | After stop | Meaning                                                                         |
|-----------|--------|--------------------|------------|---------------------------------------------------------------------------------|
| PA001     | d.□□□0 | DB to stop         | DB state   | DB to stop and maintain DB state after stop.                                    |
|           | d.□□□1 |                    | Free state | DB to stop and enter free state (power off) after stop.                         |
|           | d.□□□2 | Coast to stop      | Free state | Coast to stop and enter free state (power off) after stop.                      |
|           | d.□□□3 | Decelerate to stop | DB state   | Decelerate at rate of PA522, & stay in DB state when speed is lower than PA523. |
|           | d.□□□4 |                    | Free state | Decelerate at rate of PA522, & coast to stop when speed is lower than PA523.    |

- This parameter is valid in following situations:
  - When S-ON signal is OFF;
  - When there is an alarm output;
  - When main power (L1, L2, L3) is off.
- In the above setting "DB state maintenance after DB stops" of "d.□□□0", if the servo motor stops or rotates at a very low speed, no brake force will be generated.
- Definitions:
  - DB: dynamic brake (internal short-circuit of servo drive) . This feature is optional.
  - Coast to stop: stop using natural frictions.

---

Dynamic brake (DB) can be used for emergency stop.

When the servo motor is frequently started and stopped through the power ON/OFF or servo ON signal (S-ON), DB circuit will also repeat ON and OFF frequently, which is the main cause for the aging of the interior components of the servo drive. Please start and stop the servo motor through the speed input instruction and position control instruction.

## 8.2.6 Instantaneous power off settings

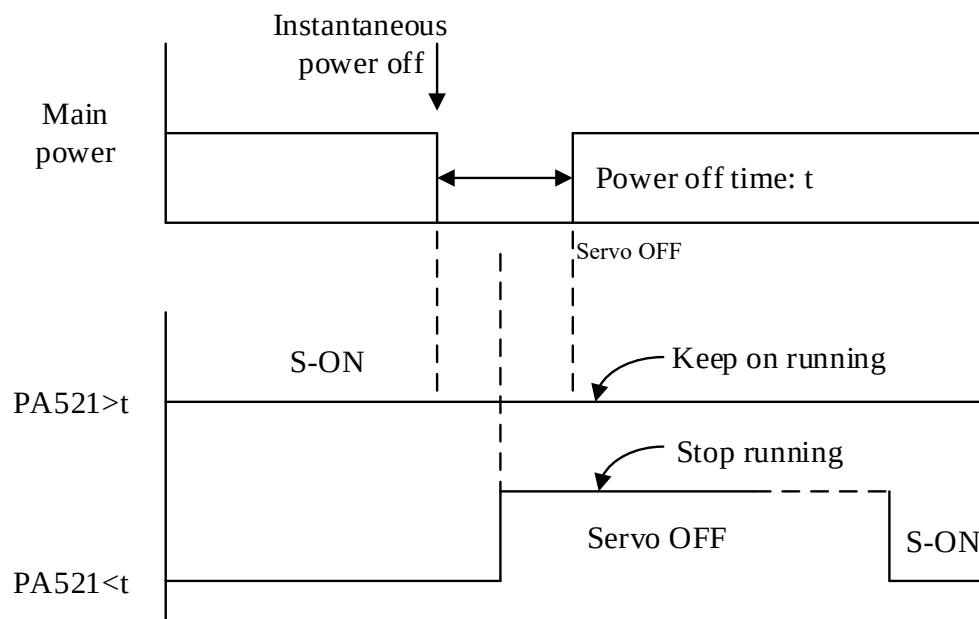
This is to set when the main power supply is OFF instantly, whether the motor shall go on operating or set to be servo OFF

| PA521 | Instantaneous power off holding time |      |         |           |
|-------|--------------------------------------|------|---------|-----------|
|       | Range                                | Unit | Default | Effective |
|       | 40~800                               | 1ms  | 60      | Immed     |

If the OFF→ON resetting time is below the setting value of this parameter, the servo will keep on operating.

But under the following circumstances, the setting of this parameter will not become effective:

- The load of servo motor is too big, which causes " under voltage warning (A.96) " during instantaneous power off;
- When the control power supply is out of control (the same to the usual power OFF operation) during the period of instantaneous power off.



The maximum holding time setting value is 800ms during instantaneous power off, but the holding time of control power supply of the servo motor is about 200ms. The holding time of main power supply varies along with the output of servo drive.

Please use a UPS in order to go on controlling the servo drive if instantaneous power off time is beyond the maximum setting value of this parameter.



## 8.2.7 Analog voltage output

Pin 4 (MON) & Pin 1 (SG) of CN2 provide analog data for monitoring. For example, motor running status. Motor speed and current can also be demonstrated by analog voltage. The range for analog voltage is -8V~+8V.

| Parameter |        | Meaning                                          |
|-----------|--------|--------------------------------------------------|
| PA021     | d.□□□  | Analog output is motor speed feedback. (default) |
|           | d.□□□1 | Analog output is motor torque feedback.          |
|           | d.□□0□ | Output voltage is not negated. (default)         |
|           | d.□□1□ | Output voltage is negated.                       |

|       |                            |      |         |           |
|-------|----------------------------|------|---------|-----------|
| PA023 | Analog voltage output gain |      |         |           |
|       | Range                      | Unit | Default | Effective |
|       | 0~65535                    |      | 0       | Immed     |

The corresponding relations are as below:

| PA023 | Analog output data: speed   | When PA023≠0:                                                     |
|-------|-----------------------------|-------------------------------------------------------------------|
| 0     | 500rpm = 1V, -1000rpm = -2V | $\text{Output voltage} = \frac{\text{motor speed}}{\text{PA023}}$ |
| 500   | 500rpm = 1V                 |                                                                   |
| 1000  | 1000rpm = 1V                |                                                                   |
| 250   | 500rpm = 2V                 |                                                                   |

| PA023 | Analog output data: torque                | When PA023≠0:                                                            |
|-------|-------------------------------------------|--------------------------------------------------------------------------|
| 0     | 100% torque = 3V, -100% torque = -3V      | $\text{Output voltage} = \frac{\text{torque} \times 1000}{\text{PA023}}$ |
| 333   | 100% torque = 3V, -100% torque = -3V      |                                                                          |
| 222   | 100% torque = 4.5V, -50%% torque = -2.25V |                                                                          |
| 666   | 100% torque = 1.5V, -200%% torque = -3V   |                                                                          |

|       |                                        |      |         |           |
|-------|----------------------------------------|------|---------|-----------|
| PA024 | Analog voltage output zero calibration |      |         |           |
|       | Range                                  | Unit | Default | Effective |
|       | -8000~8000                             | mV   | 0       | Immed     |

## 8.3 Using absolute encoders

If the servo motor with an absolute encoder is used, an absolute value detection system can be set in the instruction control unit. Thus after power on again, the motor can directly run without zero reset.

| Encoder type                            | Resolution | Data output range | Action when exceed the limit                                                                                                                                                                                                                                                          |
|-----------------------------------------|------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Absolute encoder with multi-turn memory | 17-bit     | -32768<br>~+32767 | <ul style="list-style-type: none"> <li>When going beyond the upper limit (+32767) of positive rotation direction, the multi-turn data become -32768.</li> <li>When going beyond the lower limit (-32768) of reverse rotation direction, the multi-turn data become +32767.</li> </ul> |

When multi-turn data overflows, E.58 will output. PA007.1 can disable this alarm

| Parameter |        | Meaning                                                |
|-----------|--------|--------------------------------------------------------|
| PA007     | d.□□0□ | Multi-turn data overflows will output E.58 (default) . |
|           | d.□□1□ | Multi-turn data overflows will not output E.58         |

### 8.3.1 Absolute encoder selection

| Parameter |        | Meaning                                                  |
|-----------|--------|----------------------------------------------------------|
| PA002     | d.□0□□ | Use absolute encoders as incremental encoders. (default) |
|           | d.□1□□ | Use absolute encoders as absolute encoders.              |

- When use absolute encoders as incremental encoders, no battery is needed.
- After modifying this parameter, restart the servo to take effect.

### 8.3.2 Using battery for absolute encoder

Even the power is OFF, a battery is needed to back up data, so that the absolute encoder can save the position information.

#### (1) Battery selection

Please make preparations according to the specification of instruction control unit; the battery shall be the product equivalent to ER3V (3.6V, 1000mA TOSHIBA battery) .

#### (2) Battery installation

The battery shall be mounted inside the battery case of the encoder cable; pay close attention not to reverse the polarities.

### 8.3.3 Battery replacement

When the battery voltage drops to be below 3.1V, the servo drive will output "17-bit serial encoder battery warning (A.97)". But this warning only output when the servo drive is ON. If the battery voltage is ultralow when the servo drive is powered on, the servo drive will not give any warning. User can modify warning for ultralow battery voltage.

- **Procedures to replace the battery**

1. Please replace the battery when the control power of servo drive is ON.
2. After replacing the battery, please make the servo drive power OFF, so as to clear "17-bit serial encoder battery warning (A.97)".
3. Restart the power of servo drive; if there is no abnormal action, the battery is successfully replaced.

#### **Important**

When the control power supply of servo drive is OFF and the battery connection has been moved (so has the encoder line), data inside the absolute value encoder will be lost. Therefore, setting of absolute value encoder is necessary. Please refer to Chapter 6.13 Setting up absolute encoders (AF 11).

### 8.3.4 Setting up absolute encoders (AF 11)

Please refer to Chapter 6.13 Setting up absolute encoders (AF 11).

This function is used under the following conditions:

- Absolute encoder is used for the first time;
- There are alarms related to absolute encoders;
- User intends to set quantity of turns of a multi-turn encoder to 0.

Notes:

- Servo must be OFF;
- A-RST cannot clear alarms related to absolute encoders;
- Power off and power on again after setting;
- This operation will set quantity of turns of a multi-turn encoder to 0 and clear all alarms related to absolute encoders

**After AF 11 is done, please restart the servo drive.**

## 8.4 Position control operations

### 8.4.1 Parameter settings

When using pulses for position control, please pay attention to following parameters.

#### 1) Control mode selection

| Parameter |        | Meaning                        |
|-----------|--------|--------------------------------|
| PA000     | h.□□0□ | Position control (pulse train) |

#### 2) Pulse form selection

| Type  |                                  | Signal | Pin    |
|-------|----------------------------------|--------|--------|
| Input | Low speed channel<br>(<500 Kbps) | PULS+  | CN2-7  |
|       |                                  | PULS-  | CN2-8  |
|       |                                  | SIGN+  | CN2-11 |
|       |                                  | SIGN-  | CN2-12 |
|       | High speed channel<br>(<4 Mbps)  | HPULS+ | CN2-16 |
|       |                                  | HPULS- | CN2-17 |
|       |                                  | HSIGN+ | CN2-23 |
|       |                                  | HSIGN- | CN2-24 |

| Parameter |        | Pulse form              | Forward rotation | Reverse rotation |
|-----------|--------|-------------------------|------------------|------------------|
| PA200     | d.□□00 | PULS+<br>SIGN           |                  |                  |
|           | d.□□01 | CW+<br>CCW              |                  |                  |
|           |        |                         |                  |                  |
|           | d.□□02 | A phase<br>+<br>B phase |                  |                  |

### 3) Position deviation clearance

Besides CLR signal, a timed position deviation clearance can be selected by parameter PA200.2.

| Parameter |         | Meaning                                                                   |
|-----------|---------|---------------------------------------------------------------------------|
| PA200     | d. 0□□□ | Clear position deviation when S-ON is off, power is off or by CLR signal. |
|           | d. 1□□□ | Clear position deviation only by CLR signal.                              |
|           | d. 2□□□ | Clear position deviation only when servo has alarm or by CLR signal.      |

### 4) Input pulse channel selection

User can select input pulse channel by PA200.3.

| Parameter |         | Meaning                                                                                                                                                                                                                                 |
|-----------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PA200     | d. 0□□□ | <b>PULS+SIGN input: low speed pulse channel</b><br>Pulse input in this channel is received by optocoupler. It is suitable for upper controller of collector output and long-line transmitter output, frequency $\leq 500\text{K bps}$ . |
|           | d. 1□□□ | <b>HPULS+HSIGN input: high speed pulse channel</b><br>Pulse input in this channel is received by long-line receiver. It is suitable for upper controller of long-line transmitter output, frequency $\leq 4\text{M bps}$ .              |

## 8.4.2 Electronic gear

### 1) Encoder resolutions

| Parameter | Encoder type | Pulses per revolution | Resolution       |
|-----------|--------------|-----------------------|------------------|
| PA002     | d. 0□□□      | Absolute encoder      | 32768            |
|           | d. 1□□□      | Incremental encoder   | 32768            |
|           | d. 2□□□      | Incremental encoder   | 5000             |
|           | d. 7□□□      | Resolver              | 4096             |
|           | d. 8□□□      | Incremental encoder   | 262144           |
|           |              |                       | 131072 (17-bit)  |
|           |              |                       | 131072 (17-bit)  |
|           |              |                       | 20000            |
|           |              |                       | 16384 (15-bit)   |
|           |              |                       | 1048576 (20-bit) |

Remarks: encoder resolution is 4 times (quadruple frequency) of encoder pulses per revolution.

### 2) Electronic gear ratio

The function of electronic gear is for setting the work-piece moving distance by 1 pulse instruction (1 instruction unit).

| PA206    | PA226    | Instruction processing                                                                                                |                                    |
|----------|----------|-----------------------------------------------------------------------------------------------------------------------|------------------------------------|
| =0       | =0       | Pulse input $\rightarrow$ $\frac{\text{Encoder resolution}}{\text{PA225} \times 10000 + \text{PA205}}$                | Position instruction $\rightarrow$ |
| $\neq 0$ | =0       | Pulse input $\rightarrow$ $\frac{\text{PA225} \times 10000 + \text{PA205}}{\text{PA226} \times 10000 + \text{PA206}}$ | Position instruction $\rightarrow$ |
| =0       | $\neq 0$ |                                                                                                                       |                                    |
| $\neq 0$ | $\neq 0$ |                                                                                                                       |                                    |

**Relevant parameters: PA205~PA210, PA225~PA229.**

### 8.4.3 Position instructions

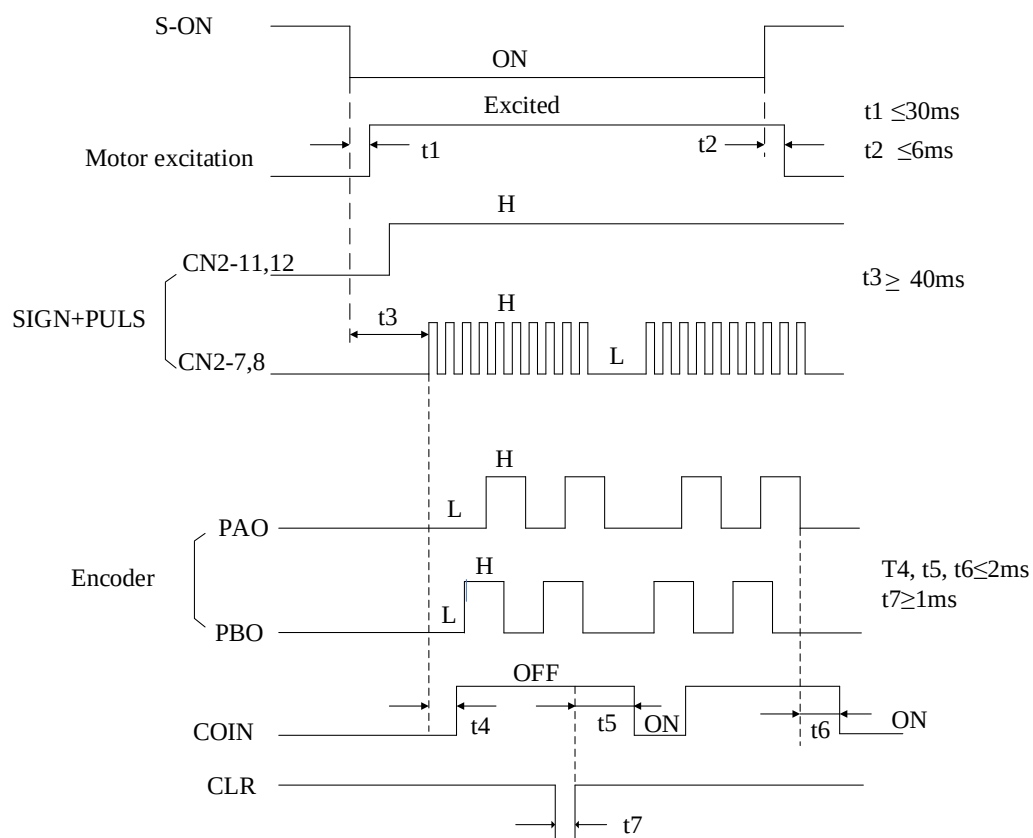
Upper controller's output forms include the following:

- Field-bus output
- +24V open-collector output
- +12V open-collector output
- +5V open-collector output

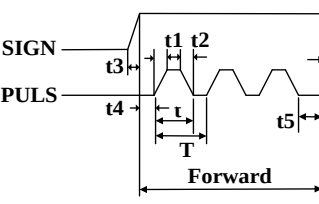
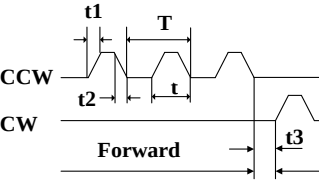
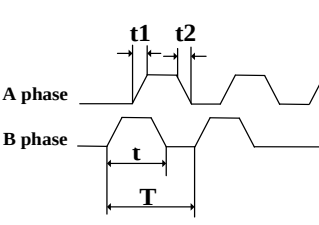
Open-collector output signals can only connect to servo drive's CN2-7, 8, 11, 12, and the parameter should be set to low speed pulse channel, i.e. PA200.3=0 (factory default) .

In case of open-collector pulse input, the interference tolerance for input signal will decrease. In case of deviation due to interference, changes should be made in the following user parameters.

#### 1) Example of I/O signal time sequence

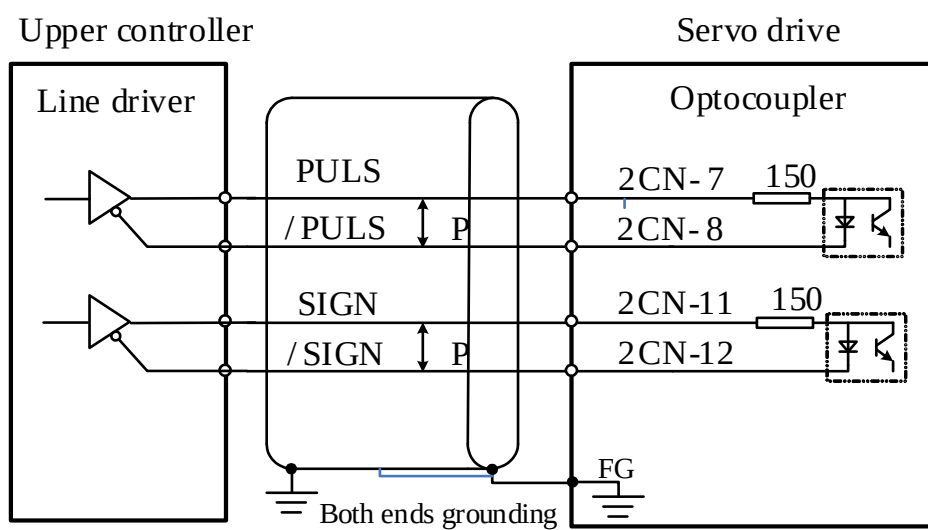


- The interval between S-ON signal and input pulse instructions should be above 40ms. If this interval is less than 40ms, servo drive may fail to receive the pulse instructions.
- Please set CLR signal to be above 20  $\mu\text{s}$ .

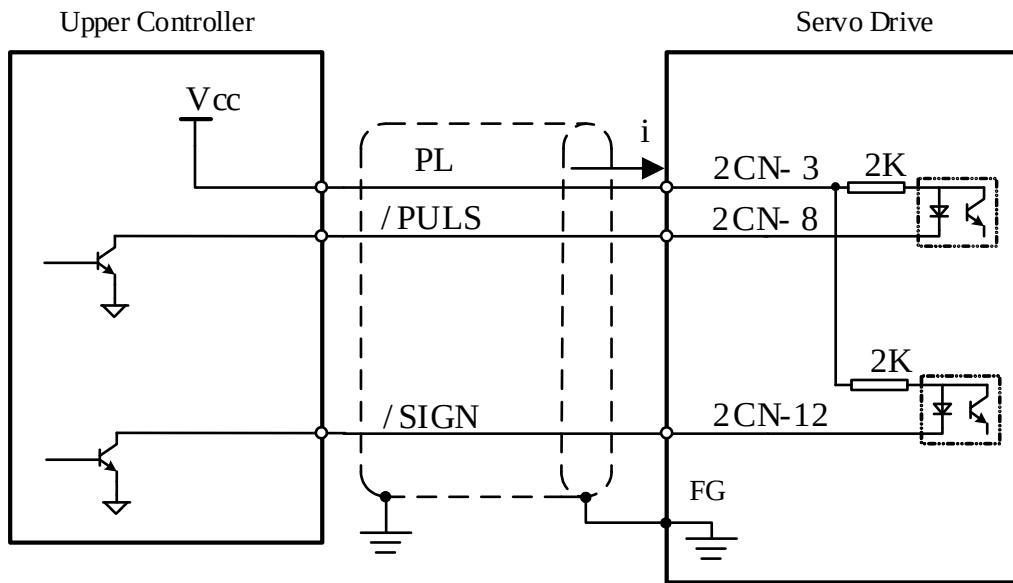
| Pulse forms         | Maximum frequency                      | Specifications                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SIGN+<br>PULS       | 500Kbps.<br>Open-collector:<br>200Kbps |  <p> <math>t1, t2 \leq 0.1\mu s</math><br/> <math>t3, t7 \leq 0.1\mu s</math><br/> <math>t4, t5, t6 &gt; 3\mu s</math><br/> <math>t \geq 1.0\mu s</math><br/> <math>50\% &lt; (t/T) \leq 100\%</math> </p>                                                                    |
| CW+<br>CCW          | 500Kbps.<br>Open-collector:<br>200Kbps |  <p> <math>t1, t2 \leq 0.1\mu s</math><br/> <math>t3 &gt; 3\mu s</math><br/> <math>t \geq 1.0\mu s</math><br/> <math>50\% &lt; (t/T) \leq 100\%</math> </p>                                                                                                                   |
| A phase+<br>B phase | 200Kbps.<br>Open-collector:<br>150Kbps |  <p> <math>t1, t2 \leq 0.1\mu s</math><br/> <math>t \geq 1.0\mu s</math><br/> <math>50\% &lt; (t/T) \leq 100\%</math> </p> <p>           Forward: B phase ahead of A phase by <math>\pi/2</math><br/>           Reverse: A phase ahead of B phase by <math>\pi/2</math> </p> |

## 2) Connection examples

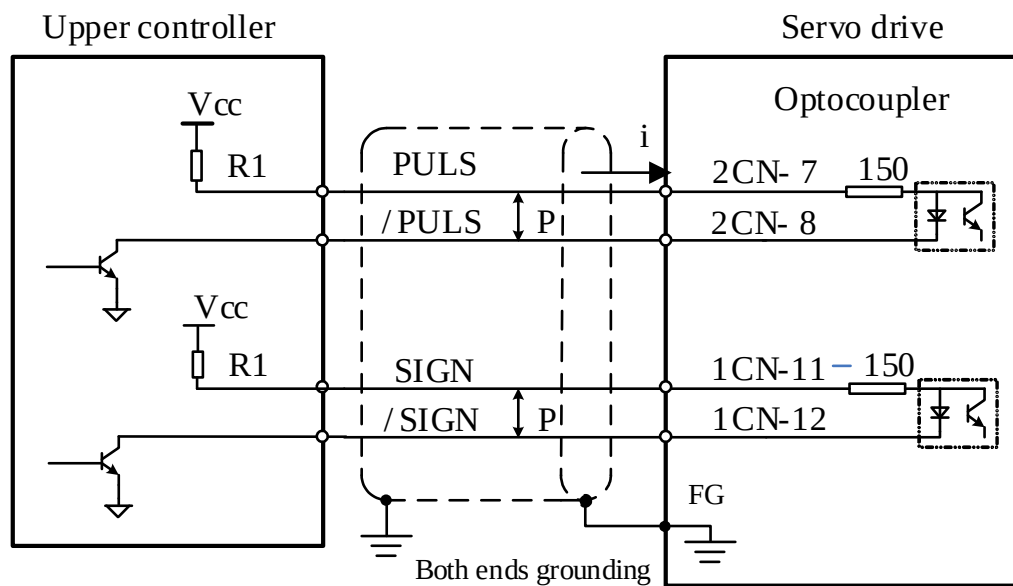
- Line driver, low speed pulse



- Open collector, option 1 (external 24VDC)



- Open collector, option 2 (external 5VDC, 12VDC or 24VDC)



Input current  $I = 10 \sim 15\text{mA}$ , thus R1 resistance:

If 24VDC,  $R1=2\text{K } \Omega$ ;

If 12VDC,  $R1=510 \Omega$ ;

If 5VDC,  $R1=180 \Omega$ ;

Normally, open collector pulses can be easily interfered. To reduce interference:

- Grounding: control line shielding shall connect to ground of upper controller power supply; on the drive side, the shielding shall hang in air;
- Modify PA201.0: the higher PA201.0, the higher filtering effect, the lower input chop frequency.



## 8.4.4 Smoothness

The servo drive can filter pulse instructions within certain frequency ranges.

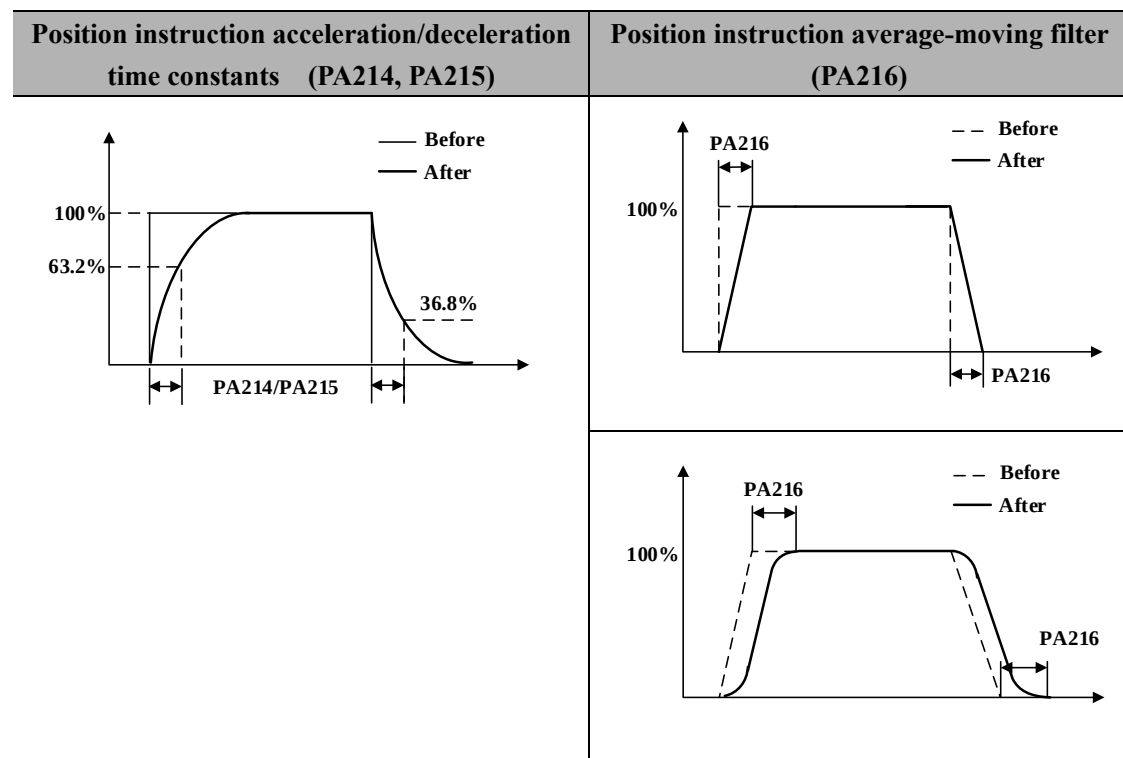
| PA214 | Position instruction acceleration/deceleration time constant 1 |       |         |           |
|-------|----------------------------------------------------------------|-------|---------|-----------|
|       | Range                                                          | Unit  | Default | Effective |
|       | 0~1000                                                         | 0.1ms | 0       | Immed     |
| PA215 | Position instruction acceleration/deceleration time constant 2 |       |         |           |
|       | Range                                                          | Unit  | Default | Effective |
|       | 0~1000                                                         | rpm   | 0       | Immed     |
| PA216 | Position instruction average-moving filter                     |       |         |           |
|       | Range                                                          | Unit  | Default | Effective |
|       | 0~500                                                          | rpm   | 0       | Immed     |

If position instruction acceleration/deceleration time constants (PA214, PA215) are changed, the changed value takes effect only if there's no simultaneous pulse input. In order to truly reflect the set value, please input CLR signal to prohibit pulse instructions.

Even in the following cases, motor can operate smoothly. Also this setting has no effect on movement amount (instruction pulse count) .

- The upper controller that sends the instructions can't accelerate or decelerate.
- The frequency of instruction pulse is low
- The electronic gear ratio is relatively high (more than 10 times)

Effects of PA214, PA215, PA216 are shown as below:



### 8.4.5 Positioning completed signal (COIN)

This signal means that servo motor positioning is completed at position control.

| Type   | Signal | Pin                     | Level       | Name                      |
|--------|--------|-------------------------|-------------|---------------------------|
| Output | COIN   | CN2-29, 30<br>(default) | ON= L level | Positioning completed     |
|        |        |                         | OFF=H level | Positioning not completed |

| PA525 | COIN signal width |        |         |           |
|-------|-------------------|--------|---------|-----------|
|       | Range             | Unit   | Default | Effective |
|       | 0~65535           | 1pulse | 10      | Immed     |

- If the difference between the upper controller's instruction pulse input count and the servo motor's movement amount (deviation pulse) is lower than the set value of this use parameter, then the COIN signal will output; this also depends on the electronic gear setting.
- If the set value of PA525 is too high and servo is running in low speed, COIN signal may still output even though positioning is not completed. Please pay close attention to this.
- Setting of this user parameter does not affect the final positioning precision.
- Please refer to 3.4.3 Allocation of I/O signals.

### 8.4.6 Positioning near signal (NEAR)

The positioning near signal (NEAR) is a signal meaning that the servo motor is near positioning completion. It is usually used in pair with the COIN.

*It is used to receive positioning near signal before the instruction controller's confirmation of the positioning completion signal to make action sequence preparations after positioning is completed to shorten the time needed for the action when positioning is completed.*

| Type   | Signal | Pin                | Level       | Name                            |
|--------|--------|--------------------|-------------|---------------------------------|
| Output | NEAR   | To be<br>allocated | ON=L level  | Near positioning completion     |
|        |        |                    | OFF=H level | Not near positioning completion |

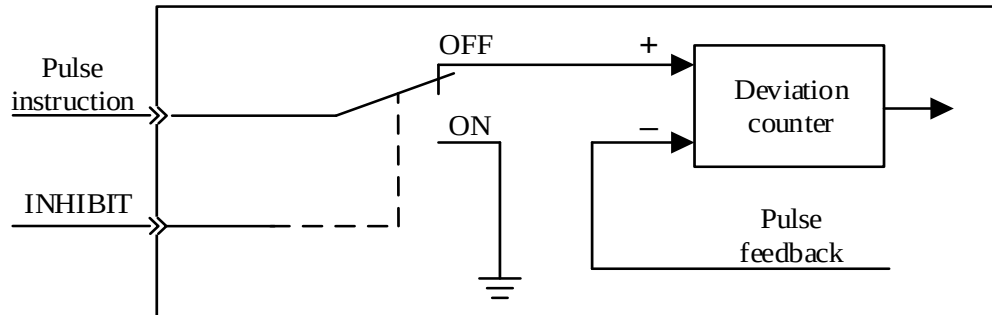
| PA526 | NEAR signal width |        |         |           |
|-------|-------------------|--------|---------|-----------|
|       | Range             | Unit   | Default | Effective |
|       | 0~65535           | 4pulse | 100     | Immed     |

- If the difference between the upper controller's instruction pulse input count and the servo motor's movement amount (deviation) is lower than the set value of this use parameter PA526, then the positioning near signal (NEAR) will output. this also depends on the electronic gear setting.
- Value of PA526 should be greater than value of PA525.
- **This signal is temporarily unavailable.**

### 8.4.7 Pulse input inhibited (INHIBIT)

This is a function that stops (inhibits) instruction pulse input counting in case of position control.

It is in servo locking (clamping) state when this function is used.



| Type  | Signal  | Pin                 | Level       | Name           |
|-------|---------|---------------------|-------------|----------------|
| Input | INHIBIT | CN2-46<br>(default) | ON=L level  | INHIBIT is ON  |
|       |         |                     | OFF=H level | INHIBIT is OFF |

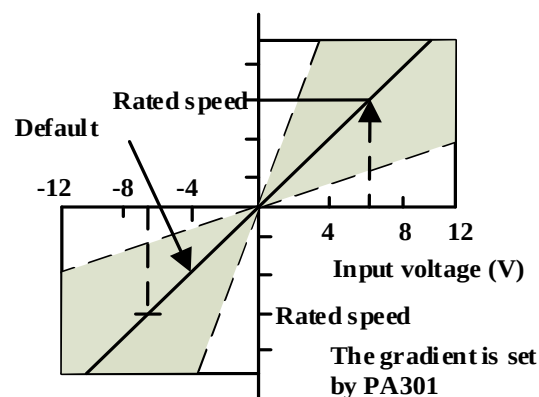
INHIBIT is only valid in position control mode.

## 8.5 Speed control operations

### 8.5.1 Parameter settings

| Parameter                                               |                        | Meaning                               |         |           |
|---------------------------------------------------------|------------------------|---------------------------------------|---------|-----------|
| PA000                                                   | h.□□1□                 | Control mode selection: speed control |         |           |
| When PA000.1 = 1, 5, 7, 9, speed control is being used. |                        |                                       |         |           |
| PA301                                                   | Speed instruction gain |                                       |         |           |
|                                                         | Range                  | Unit                                  | Default | Effective |
|                                                         | 150~3000               | 0.01V/ rated speed                    | 600     | -         |

This parameter is for setting the instruction voltage (V-REF) at motor rated speed.



**Input voltage range: DC  $\pm 2V \sim \pm 10V$  / rated speed**

Examples:

- PA301=600 means that with 6V input, the motor will at the rated speed (default);
- PA301=1000 means that with 10V input, the motor will at the rated speed.

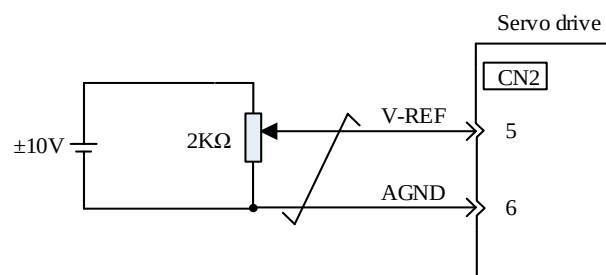
### 8.5.2 Input signals

#### 1) Speed instruction input

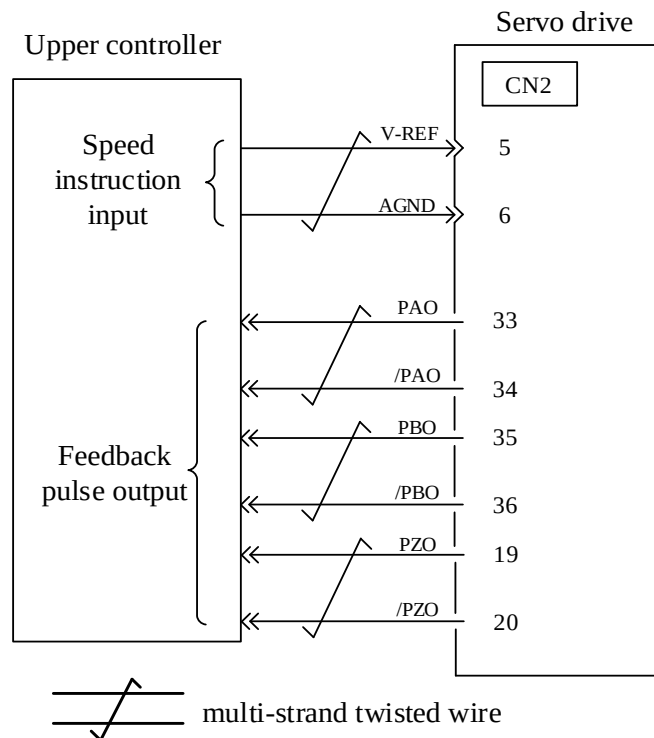
If speed instruction is sent to the servo drive, servo motor will run at a speed proportional to input voltage.

| Type  | Signal | Pin   | Name                            |
|-------|--------|-------|---------------------------------|
| Input | V-REF  | CN2-5 | Speed instruction input         |
|       | AGND   | CN2-6 | GND for speed instruction input |

Please use multi-strand twisted wire to prevent interferences.



Programmable controller and so on are used for connection with the instruction controller's speed instruction output terminal in case of position control by



## 2) Proportional action instruction signal (P-CON)

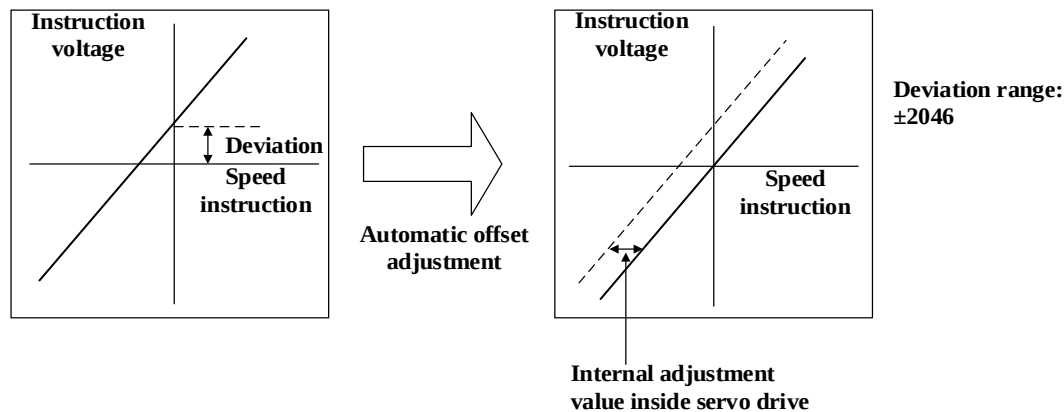
| Type  | Signal | Pin             | Level       | Name                                                         |
|-------|--------|-----------------|-------------|--------------------------------------------------------------|
| Input | P-CON  | To be allocated | ON=L level  | Operate the servo drive in proportional (P) mode;            |
|       |        |                 | OFF=H level | Operate the servo drive in proportional & integral (PI) mode |

- P-CON signal is a signal in respect of which speed control mode is selected from PI (proportional and integral) or P (proportional) control.
- If it's set to P, then control can relieve motor rotation and slight vibration caused by speed instruction input drifting.
- Input instruction: It can progressively reduce servo motor rotation caused by drifting at 0V, but servo rigidity (support strength) decreases at stop.
- **This signal is temporarily unavailable.**

### 8.5.3 Instruction offset adjustment

When in speed control mode, even with 0V instruction, the motor may still rotate at a slight speed. This happens when instruction voltage of upper controller or external circuit has slight (mV unit) deviation (offset). In this case, instruction offset can be adjusted automatically or manually by using the panel operator. Please use automatic or manual offset adjust by referring to Chapter 6.8 & 6.9.

Automatic offset adjustment is the function of offset measuring and automatic voltage adjustment. When the voltage instruction of upper controller and external circuit is deviated, the servo drive will adjust the offset automatically as follows:



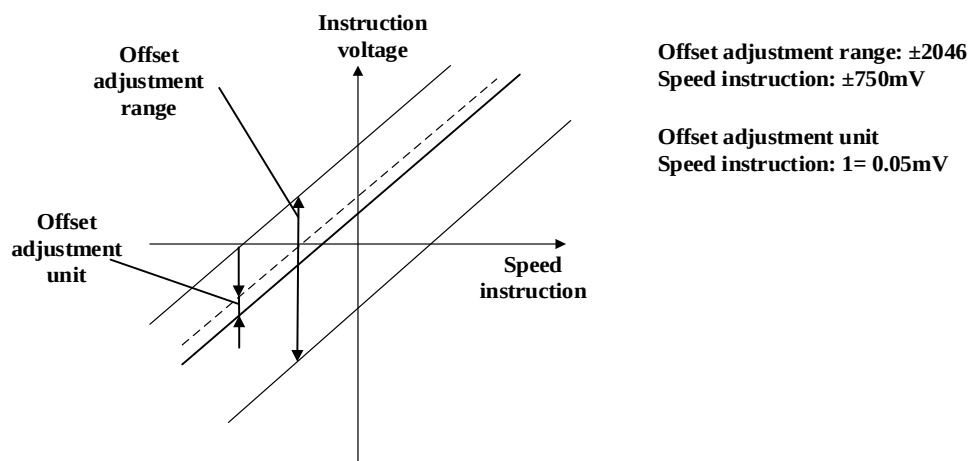
#### 1) Analog instruction automatic offset adjustment (AF 06)

Please refer to Chapter 6.8.

#### 2) Speed instruction manual offset adjustment (AF 07)

Use AF 07 in following situations (Please refer to Chapter 6.9) :

- When servo is locked and deviation pulse is set to 0, AF 06 can't be used.
- When user wants to set offset to a certain value;
- When the offset value is confirmed by AF 06.

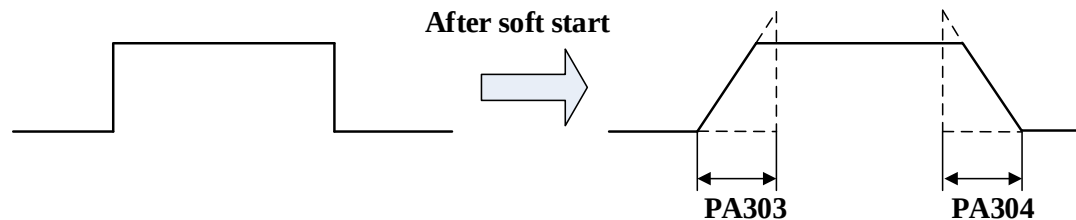


## 8.5.4 Soft start

Soft start is the function that phase step speed instruction input is transformed to instruction with certain acceleration and deceleration curves inside servo drive, thus to achieve smooth operations.

| PA303 | Soft start acceleration time |      |         |           |
|-------|------------------------------|------|---------|-----------|
|       | Range                        | Unit | Default | Effective |
|       | 0~5000                       | 1ms  | 0       | Immed     |
| PA304 | Soft start deceleration time |      |         |           |
|       | Range                        | Unit | Default | Effective |
|       | 0~5000                       | 1ms  | 0       | Immed     |

- PA303: Acceleration time from 0rpm to 1000rpm;
- PA304: Deceleration time from 1000rpm to 0rpm.



## 8.5.5 Speed instruction filter time constant

| PA302 | Speed instruction filter time constant |        |         |           |
|-------|----------------------------------------|--------|---------|-----------|
|       | Range                                  | Unit   | Default | Effective |
|       | 0~1000                                 | 0.01ms | 40      | Immed     |

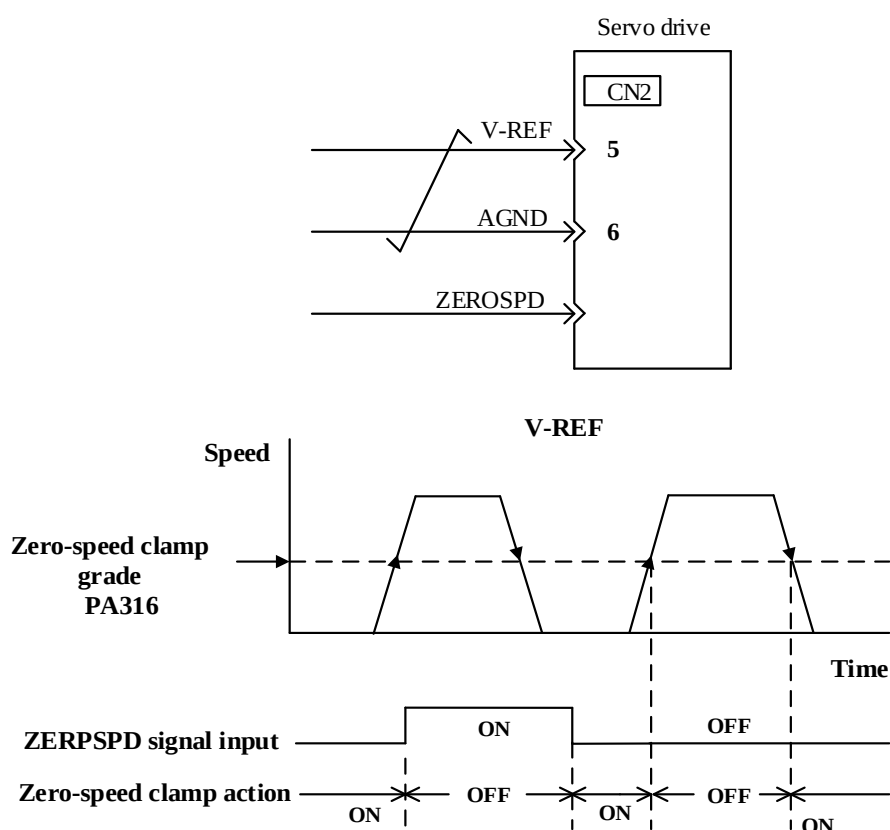
Analog speed instruction (V-REF) is input through 1-time relay filter to smooth speed instruction. The responsiveness will be reduced if the set value is too large.

## 8.5.6 Zero-speed clamp function

This is a function used when upper controller is not configured with position loop in case of speed control.

If zero-speed clamp (ZEROSPD) (PA300.3=0) signal is set to be ON, or input voltage of speed instruction (V-REF) (PA300.3 = 1) is below PA316 (zero-speed clamp grade), servo drive is configured with position loop inside, and speed instruction is ignored and servo motor is stopped in the servo locking state. The servo motor is clamped to within  $\pm 1$  pulse at the position where zero-speed clamp is effective, and it will return to the zero-speed clamp position even if turned by external force.

| Parameter | Meaning                                                |
|-----------|--------------------------------------------------------|
| PA300     | <b>Speed control switch 1: speed dead zone control</b> |
|           | PA300.3=0: use input signal ZEROSPD                    |
|           | PA300.3=1: automatic, use PA316 setting                |



| PA316 | Zero-speed clamp grade |      |         |           |
|-------|------------------------|------|---------|-----------|
|       | Range                  | Unit | Default | Effective |
|       | 1~2000                 | 1rpm | 30      | Immed     |

This is to set the motor into automatic zero-speed clamp state when speed is lower than PA316 setting. PA316 should be lower than maximum motor speed.

| Type  | Signal  | Pin   | Level      | Name                         |
|-------|---------|-------|------------|------------------------------|
| Input | ZERPSPD | To be | ON=L level | Zero-speed clamp function ON |

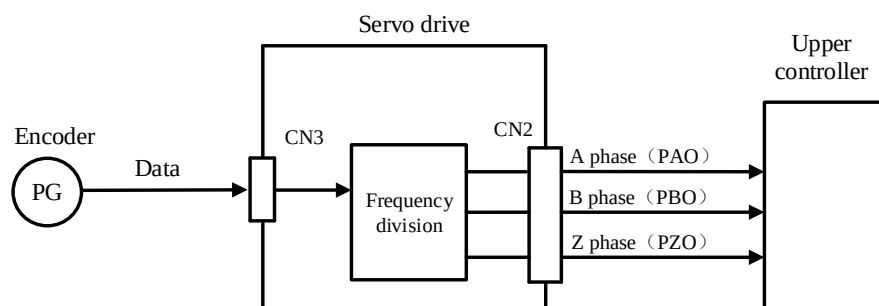


|                                                  |  |           |             |                               |
|--------------------------------------------------|--|-----------|-------------|-------------------------------|
|                                                  |  | allocated | OFF=H level | Zero-speed clamp function OFF |
| Please refer to 3.4.3 Allocation of I/O signals. |  |           |             |                               |

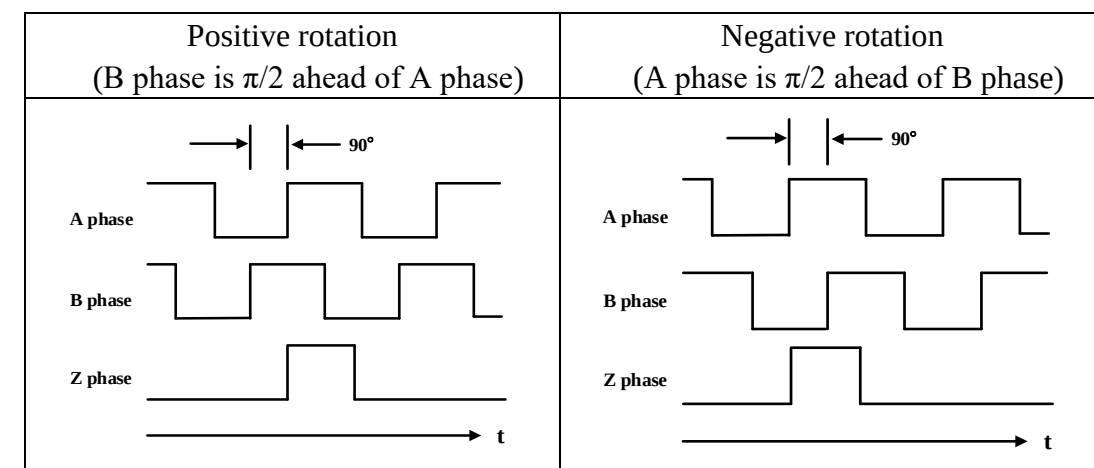
## 8.5.7 Encoder signal output

Pulse feedbacks from the encoder are processed inside the servo drive before outputting to the upper controller.

| Type   | Signal | Pin    | Name                                      |
|--------|--------|--------|-------------------------------------------|
| Output | PAO    | CN2-33 | Encoder Output A Phase                    |
|        | /PAO   | CN2-34 | Encoder Output /A Phase                   |
| Output | PBO    | CN2-35 | Encoder Output B Phase                    |
|        | /PBO   | CN2-36 | Encoder Output /B Phase                   |
| Output | PZO    | CN2-19 | Encoder Output Z Phase (reference point)  |
|        | /PZO   | CN2-20 | Encoder Output /Z Phase (reference point) |



### ▪ Output phase status



Please make servo drive rotate by two turns before using servo drive's Z phase pulse output for mechanical reference point reset action. If this can't be done due to the structure of the mechanical system, please implement reference point reset action at speed below 600rpm (calculated according to servo motor's rotating speed) .

### ▪ Frequency division

This is a transformation process of the encoder pulse feedbacks by changing the density of pulses. The parameter is PA210.

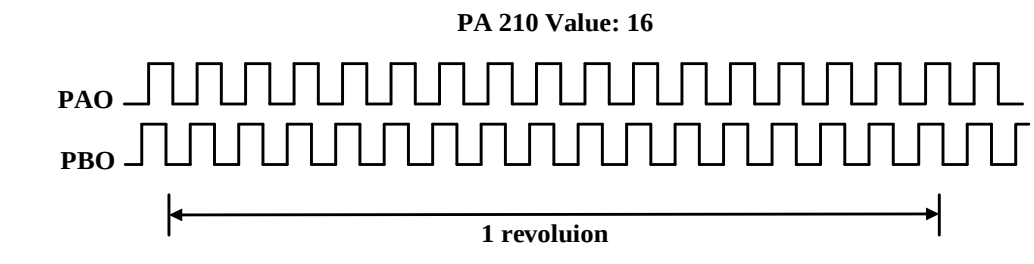
### ▪ Encoder resolution (frequency-division) setting

| PA210 | Encoder resolution (frequency-division) setting |             |         |           |
|-------|-------------------------------------------------|-------------|---------|-----------|
|       | Range                                           | Unit        | Default | Effective |
|       | 16~16384                                        | 1Pulse/ rev | 16384   | Immed     |

The setting range is dependent on the encoder resolution.

| Encoder specification | Resolution | Pulse per revolution | Range    |
|-----------------------|------------|----------------------|----------|
| Line-saving encoder   | 20000      | 5000ppr              | 16~5000  |
| 17-bit                | 131072     | 32768ppr             | 16~16384 |

### ▪ Example: PA210=16



### 8.5.8 Speed instruction reached (VCMP)

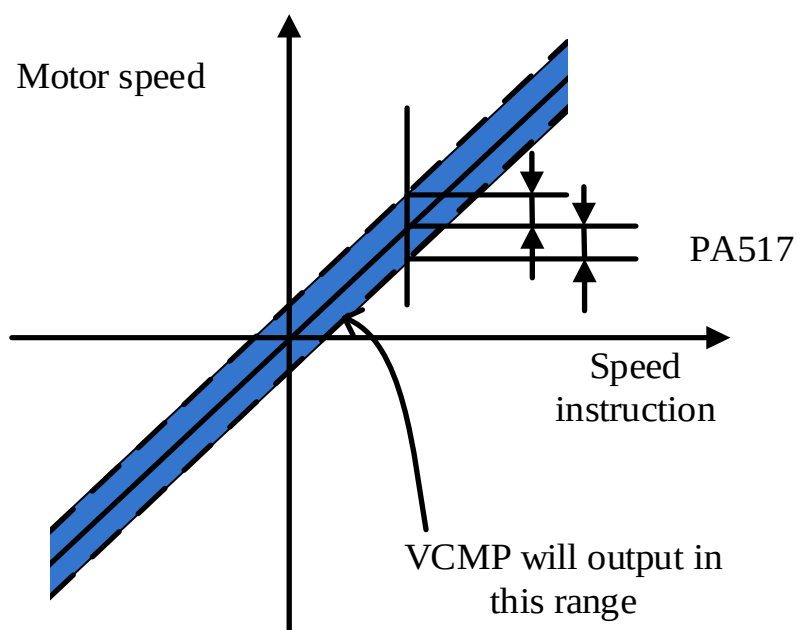
When motor rotation speed is same as speed instruction, VCMP will output

| Type   | Signal | Pin             | Level       | Name           |
|--------|--------|-----------------|-------------|----------------|
| Output | VCMP   | To be allocated | ON=L level  | Same speed     |
|        |        |                 | OFF=H level | Not same speed |

VCMP needs to be allocated by PA510. Please refer to 3.4.3 Allocation of I/O signals.

| PA517 | VCMP signal detection width |      |         |           |
|-------|-----------------------------|------|---------|-----------|
|       | Range                       | Unit | Default | Effective |
|       | 0~100                       | rpm  | 10      | Immed     |

If the difference between motor speed and instruction speed is less than PA517 value, VCMP will output.



For example, PA517=100, speed instruction is 200rpm, if motor speed is within 1900rpm to 2100rpm, VCMP will be ON.

## 8.6 Torque control operations

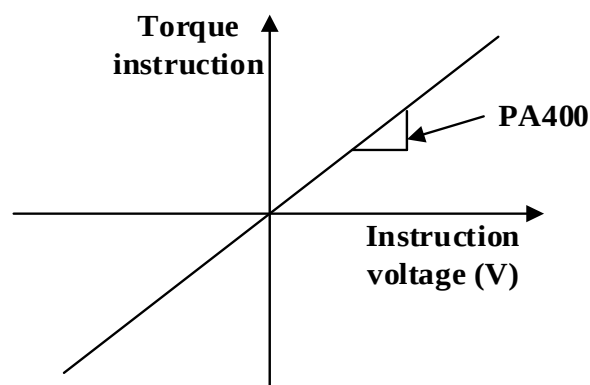
### 8.6.1 Parameter settings

When using analog instructions for torque control, following parameters need to be set:

| Parameter |        | Meaning                                |
|-----------|--------|----------------------------------------|
| PA000     | h.□□2□ | Control mode selection: torque control |

| PA400 | Torque instruction gain |                    |         |           |
|-------|-------------------------|--------------------|---------|-----------|
|       | Range                   | Unit               | Default | Effective |
|       | 10~100                  | 0.1V/ rated torque | 30      | Immed     |

This parameter is for setting the instruction voltage (T-REF) at motor rated torque.



#### ▪ Examples

PA400=30: Input 3VDC will output rated torque (Default)

PA400=100: Input 10VDC will output rated torque

PA400= 20: Input 2VDC will output rated torque

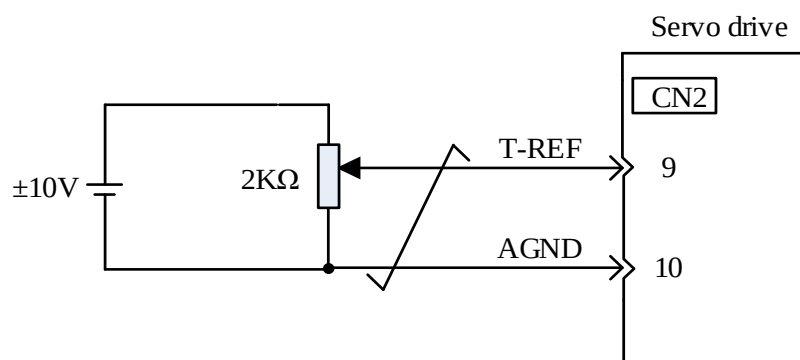
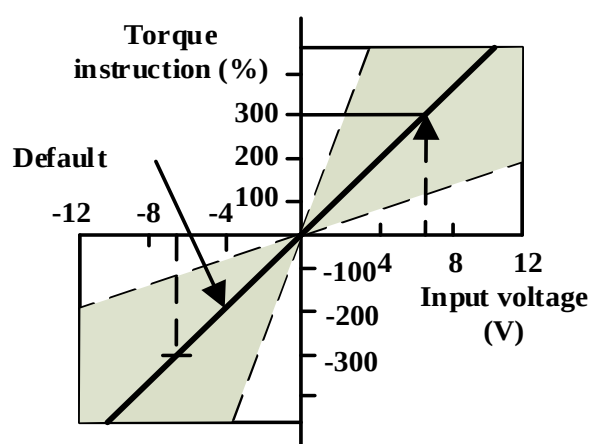
## 8.6.2 Input signals

If speed instruction is sent to the servo drive, servo motor will run at a speed proportional to input voltage.

| Type  | Signal | Pin    | Name                             |
|-------|--------|--------|----------------------------------|
| Input | T-REF  | CN2-9  | Torque instruction input         |
|       | AGND   | CN2-10 | GND for torque instruction input |

When PA000.1 = 2, 6, 8, 9, torque control is being used.

**Input voltage range: DC  $\pm 2V \sim \pm 10V$  / rated torque**

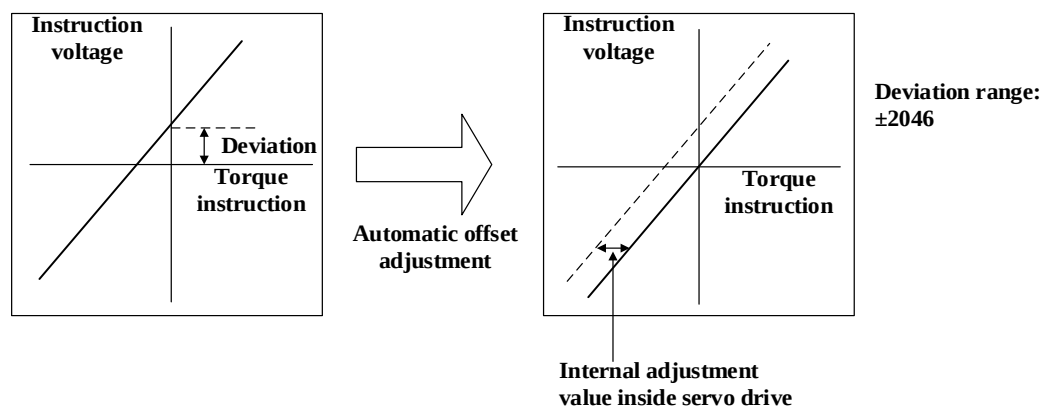


dP 10 is for Internal torque instruction (value in relation to the rated torque) display in internal torque instruction in torque / speed / position control modes.

### 8.6.3 Instruction offset adjustment

When in torque control mode, even with 0V instruction, the motor may still output at a slight torque. This happens when instruction voltage of upper controller or external circuit has slight (mV unit) deviation (offset). In this case, instruction offset can be adjusted automatically or manually by using the panel operator. Please use automatic or manual offset adjust by referring to Chapter 6.8 & 6.10.

Automatic offset adjustment is the function of offset measuring and automatic voltage adjustment. When the voltage instruction of upper controller and external circuit is deviated, the servo drive will adjust the offset automatically as follows:



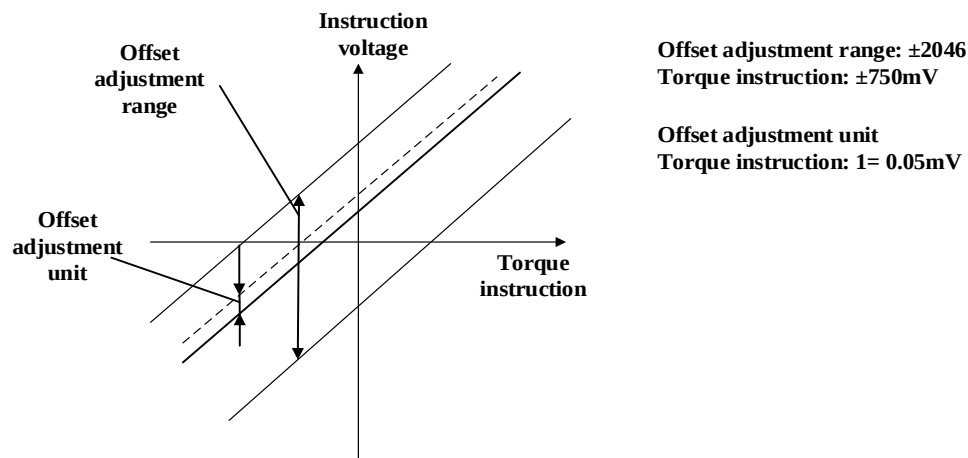
#### 1) Analog instruction automatic offset adjustment (AF 06)

Please refer to Chapter 6.8.

#### 2) Torque instruction manual offset adjustment (AF 08)

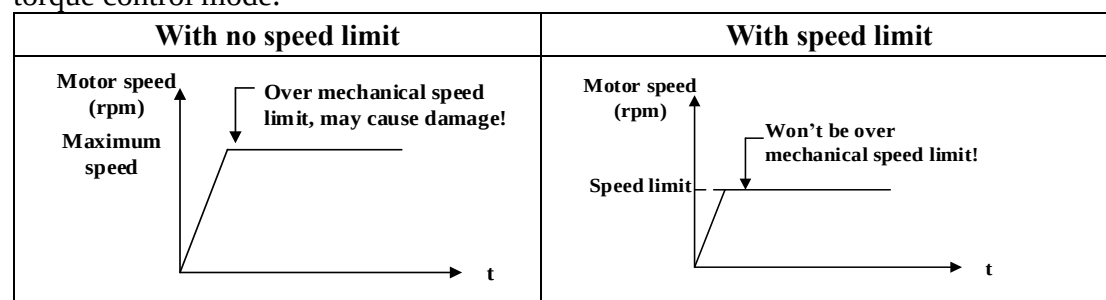
Use AF 08 in following situations (Please refer to Chapter 6.10) :

- When servo is locked and deviation pulse is set to 0, AF 06 can't be used.
- When user wants to set offset to a certain value;
- When the offset value is confirmed by AF 06.



## 8.6.4 Speed limit in torque control mode

When servo motor needs to be output torque following torque instructions, motor's rotating speed is not controlled. If instruction torque is too large due to the load torque at mechanical side, motor's rotating speed may increase too much. As a protection measure at mechanical side, servo motor's rotating speed needs to have limits in torque control mode.



### ▪ Speed limit in torque control mode selection

| Parameter |        | Meaning                                                         |
|-----------|--------|-----------------------------------------------------------------|
| PA002     | d.□□0□ | Use PA407 as speed limit (internal speed limit)                 |
|           | d.□□1□ | Use V-REF & PA301 setting as speed limit (external speed limit) |

### ▪ Speed limit in torque control mode

| PA407 | Speed limit in torque control mode |      |         |           |
|-------|------------------------------------|------|---------|-----------|
|       | Range                              | Unit | Default | Effective |
|       | 0~5000                             | rpm  | 1500    | Immed     |

When PA002.1=0, settings of this parameter is effective.

Value of PA407 shall not exceed maximum motor speed.

### ▪ External speed limit

| Type  | Signal | Pin   | Name                         |
|-------|--------|-------|------------------------------|
| Input | V-REF  | CN2-5 | External speed limit         |
|       | AGND   | CN2-6 | GND for external speed limit |

PA301 setting has no polarity.

| PA301 | Speed instruction gain |                    |         |           |
|-------|------------------------|--------------------|---------|-----------|
|       | Range                  | Unit               | Default | Effective |
|       | 150~3000               | 0.01 V/rated speed | 600     | Immed     |

### ▪ Output signal when speed is in limit

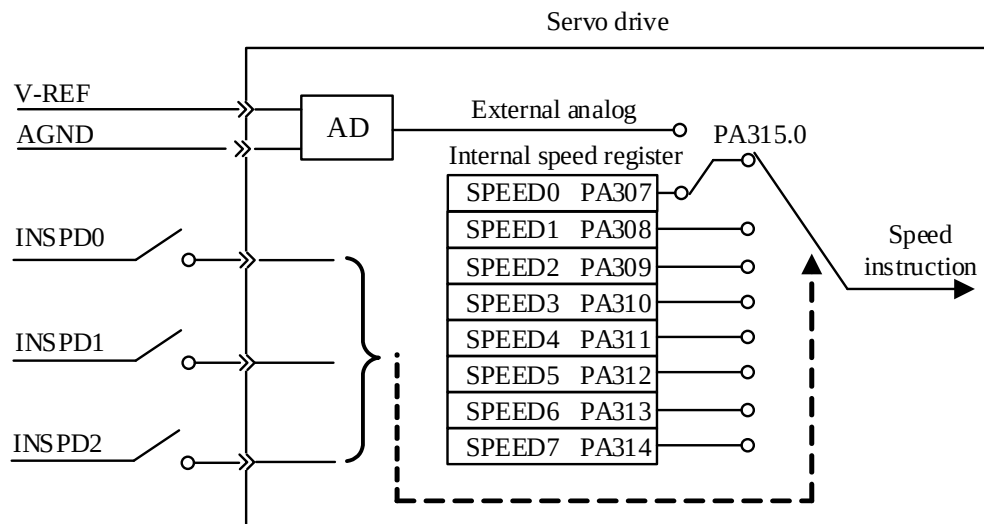
| Type   | Signal | Pin             | Level       | Name                      |
|--------|--------|-----------------|-------------|---------------------------|
| Output | VLT+   | To be allocated | ON=L level  | In speed limit status     |
|        | VLT—   | To be allocated | OFF=H level | Not in speed limit status |

***This signal is temporarily unavailable.***

## 8.7 Internal speed control

Internal speed control is to set 8 speeds beforehand through parameters inside servo drive and to select among them by using external input signals INSPD2, INSPD1 and INSPD0.

It's unnecessary to configure speed generator or pulse generator outside.



| INSPD2      | INSPD1      | INSPD0      | Internal speed selection |
|-------------|-------------|-------------|--------------------------|
| 0 (Invalid) | 0 (Invalid) | 0 (Invalid) | Internal speed 0 (PA307) |
| 0 (Invalid) | 0 (Invalid) | 1 (Valid)   | Internal speed 1 (PA308) |
| 0 (Invalid) | 1 (Valid)   | 0 (Invalid) | Internal speed 2 (PA309) |
| 0 (Invalid) | 1 (Valid)   | 1 (Valid)   | Internal speed 3 (PA310) |
| 1 (Valid)   | 0 (Invalid) | 0 (Invalid) | Internal speed 4 (PA311) |
| 1 (Valid)   | 0 (Invalid) | 1 (Valid)   | Internal speed 5 (PA312) |
| 1 (Valid)   | 1 (Valid)   | 0 (Invalid) | Internal speed 6 (PA313) |
| 1 (Valid)   | 1 (Valid)   | 1 (Valid)   | Internal speed 7 (PA314) |



## 8.7.1 Parameter settings

| Parameter |                  | Meaning                                        |         |           |
|-----------|------------------|------------------------------------------------|---------|-----------|
| PA000     | h. □□3□          | Control mode selection: internal speed control |         |           |
| PA307     | Internal speed 0 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 100     | Immed     |
| PA308     | Internal speed 1 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 200     | Immed     |
| PA309     | Internal speed 2 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 300     | Immed     |
| PA310     | Internal speed 3 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 400     | Immed     |
| PA311     | Internal speed 4 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 500     | Immed     |
| PA312     | Internal speed 5 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 600     | Immed     |
| PA313     | Internal speed 6 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 700     | Immed     |
| PA314     | Internal speed 7 |                                                |         |           |
|           | Range            | Unit                                           | Default | Effective |
|           | —5000~5000       | rpm                                            | 800     | Immed     |

PA307~PA314 settings should not exceed maximum motor speed.

## 8.7.2 Input signals

| Type  | Signal | Pin             | 名称                        |
|-------|--------|-----------------|---------------------------|
| Input | INSPD0 | To be allocated | Internal speed register 0 |
|       | INSPD1 | To be allocated | Internal speed register 1 |
|       | INSPD2 | To be allocated | Internal speed register 2 |

Please refer to 3.4.3 Allocation of I/O signals.

## 8.8 Internal position control

When **PA000.1=A**, servo drive is in internal position mode and can perform simple single-axis motions without upper controllers.

Up to 16 positions can be set. Each position can set its own distance, speed, acceleration/deceleration time, stop (dead zone) time etc. This internal position control mode also has homing function (look for zero point) .

### ■ Internal position control switches & selections (PA700, PA770)

- 1) Use external INPOS0, INPOS1, INPOS2, INPOS3 to choose certain positions. Triggers can be set by PA770.1: external I/O (PTRG) or INPOS0, INPOS1, INPOS2, INPOS3.
- 2) Use external I/O (PTRG) to trigger cycle run. Cycle begins with PA700.2 and ends with PA700.3.
- 3) Internal position runs in cycles at internal timing. Cycle begins with PA700.2 and ends with PA700.3.

### ■ Internal position distance settings (PA701 to PA732)

Each distance is set by two parameters in pairs, for example, PA701 & PA702, PA703 & PA704 etc. Values in these paired parameters are hexadecimal, with symbols and combine to a 32-bit position data.

For example, PA702 is 0x 0007, PA701 is 0x A120, then position data is 0x0007A120, means 500000 pulses. For a 5000-line encoder, each turn creates 20,000 pulses. Thus the position data means 25 turns.

Notes:

- 1) Setting range is [0x0000, 0xFFFF].
- 2) Electronic gear ratio settings will have counter-effect on distance.
- 3) These parameters can also be set by communications. (Refer to Chapter 10)

### ■ Internal position speeds (PA733 to PA748)

Electronic gear ratio will have counter-effect on speeds.

### ■ Internal position acceleration/deceleration time (PA749 to PA764)

For settings please refer to Chapter 8.4.4.

### ■ Internal position stop (dead zone) time (PA765)

This parameter is only valid when PA700.0=2. (Internal position runs in cycles at internal timing)

This is time between CMD\_OK (internal position control position instruction completion signal output) and the execution of next action.

## 8.8.1 Parameter settings

| Parameter |                                                     | Meaning                                              |         |           |  |
|-----------|-----------------------------------------------------|------------------------------------------------------|---------|-----------|--|
| PA000     | h.□□A□                                              | Control mode selection: internal position control    |         |           |  |
|           |                                                     |                                                      |         |           |  |
| Parameter |                                                     | Meaning                                              |         |           |  |
| PA700     | h.□□□0                                              | INPOS selects internal position section.             |         |           |  |
|           | h.□□□1                                              | PTRG triggers internal position run and in cycle.    |         |           |  |
|           | h.□□□2                                              | Internal position runs in cycles at internal timing. |         |           |  |
|           | h.□□0□                                              | Incremental position                                 |         |           |  |
|           | h.□□1□                                              | Absolute position                                    |         |           |  |
|           | h.□X□□                                              | Cycle run starting position                          |         |           |  |
|           | h.X□□□                                              | Cycle run ending position                            |         |           |  |
| PA701     | Internal position 0 distance low place              |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0x0000~0xFFFF                                       | pulse                                                | 0x4E20  | Immed     |  |
| PA702     | Internal position 0 distance high place             |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0x0000~0xFFFF                                       | pulse                                                | 0x0000  | Immed     |  |
| ~~        |                                                     |                                                      |         |           |  |
| PA731     | Internal position 15 distance low place             |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0x0000~0xFFFF                                       | pulse                                                | 0xE200  | Immed     |  |
| PA732     | Internal position 15 distance high place            |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0x0000~0xFFFF                                       | pulse                                                | 0x0004  | Immed     |  |
| PA733     | Internal position 0 speed                           |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0~5000                                              | rpm                                                  | 100     | Immed     |  |
| ~~        |                                                     |                                                      |         |           |  |
| PA748     | Internal position 15 speed                          |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0~5000                                              | rpm                                                  | 100     | Immed     |  |
| PA749     | Internal position 0 acceleration/deceleration time  |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0~500                                               | ms                                                   | 0       | Immed     |  |
| ~~        |                                                     |                                                      |         |           |  |
| PA764     | Internal position 15 acceleration/deceleration time |                                                      |         |           |  |
|           | Range                                               | Unit                                                 | Default | Effective |  |
|           | 0~500                                               | ms                                                   | 0       | Immed     |  |

|       |                                                    |      |         |           |
|-------|----------------------------------------------------|------|---------|-----------|
| PA765 | <b>Internal position dead zone time</b>            |      |         |           |
|       | Range                                              | Unit | Default | Effective |
|       | 0~5000                                             | rpm  | 100     | Immed     |
| PA768 | <b>JOG speed in internal position control mode</b> |      |         |           |
|       | Range                                              | Unit | Default | Effective |
|       | 0~5000                                             | rpm  | 100     | Immed     |

Value of PA733~PA748 shall not exceed maximum motor speed.

| Parameter | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|---|----------------------------------------------------------------------|---|-----------------------------------------------------------------------------|---|-----------------------------------------------------------------------|---|-------|---|--------|---|--------------|---|---------------------------------------------------------------------------------|
| PA770     | <b>Internal position control switch 2</b> <div style="margin-top: 10px;"> <p>b. <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-right: 5px;"></span><sup>3</sup> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-right: 5px;"></span><sup>2</sup> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-right: 5px;"></span><sup>1</sup> <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black;"></span><sup>0</sup></p> <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="width: 30%;"> <p>Trigger signal selection</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30px; text-align: center;">0</td><td>Use PTRG</td></tr> <tr><td style="text-align: center;">1</td><td>Use internal position selection signals: INPOS0、INPOS1、INPOS2、INPOS3</td></tr> </table> <p>Trigger time sequence selection</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30px; text-align: center;">0</td><td>Only receive new trigger signal when current position is completed (CMD-OK)</td></tr> <tr><td style="text-align: center;">1</td><td>Can receive new trigger even though current position is not completed</td></tr> </table> <p>PZERO function selection</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30px; text-align: center;">0</td><td>Stop.</td></tr> <tr><td style="text-align: center;">1</td><td>Pause.</td></tr> </table> <p>Software position limit enabling</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 30px; text-align: center;">0</td><td>No enabling.</td></tr> <tr><td style="text-align: center;">1</td><td>Can enable. PA756, PA757 are positive limits; PA758, PA759 are negative limits.</td></tr> </table> </div> <div style="width: 65%;"> <p>3</p> <p>2</p> <p>1</p> <p>0</p> </div> </div> </div> | 0 | Use PTRG | 1 | Use internal position selection signals: INPOS0、INPOS1、INPOS2、INPOS3 | 0 | Only receive new trigger signal when current position is completed (CMD-OK) | 1 | Can receive new trigger even though current position is not completed | 0 | Stop. | 1 | Pause. | 0 | No enabling. | 1 | Can enable. PA756, PA757 are positive limits; PA758, PA759 are negative limits. |
| 0         | Use PTRG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 1         | Use internal position selection signals: INPOS0、INPOS1、INPOS2、INPOS3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 0         | Only receive new trigger signal when current position is completed (CMD-OK)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 1         | Can receive new trigger even though current position is not completed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 0         | Stop.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 1         | Pause.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 0         | No enabling.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |
| 1         | Can enable. PA756, PA757 are positive limits; PA758, PA759 are negative limits.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |          |   |                                                                      |   |                                                                             |   |                                                                       |   |       |   |        |   |              |   |                                                                                 |

## 8.8.2 Input signals

| Type  | Signal | Pin             | Level                         | Meaning                                  |
|-------|--------|-----------------|-------------------------------|------------------------------------------|
| Input | ZPS    | To be allocated | ON=L level                    | External zero switch signal ON           |
|       |        |                 | OFF=H level                   | External zero switch signal OFF          |
|       | PZERO  | To be allocated | ON=L level                    | Internal position control stops: valid   |
|       |        |                 | OFF=H level                   | Internal position control stops: invalid |
|       | INPOS0 | To be allocated | ON=L level                    | INPOS0 signal valid                      |
|       |        |                 | OFF=H level                   | INPOS0 signal invalid                    |
|       | INPOS1 | To be allocated | ON=L level                    | INPOS1 signal valid                      |
|       |        |                 | OFF=H level                   | INPOS1 signal invalid                    |
|       | INPOS2 | To be allocated | ON=L level                    | INPOS2 signal valid                      |
|       |        |                 | OFF=H level                   | INPOS2 signal invalid                    |
|       | INPOS3 | To be allocated | ON=L level                    | INPOS3 signal valid                      |
|       |        |                 | OFF=H level                   | INPOS3 signal invalid                    |
|       | PTRG   | To be allocated | OFF (H level) to ON (L level) | PTRG signal valid                        |
|       | P-POS  | To be allocated | ON=L level                    | P-POS signal valid                       |
|       |        |                 | OFF=H level                   | P-POS signal invalid                     |
|       | N-POS  | To be allocated | ON=L level                    | N-POS signal valid                       |
|       |        |                 | OFF=H level                   | N-POS signal invalid                     |
|       | SHOME  | To be allocated | OFF (H level) to ON (L level) | SHOME signal valid                       |

Please refer to 3.4.3 Allocation of I/O signals.

### ■ External zero switch signal (ZPS)

Used for homing functions only. Please refer to Chapter 8.9.

### ■ Internal position control stops (PZERO)

When PZERO is valid in internal position control, the motor stops and stays in clamping status. PA770.2 can select whether this is a stop or pause.

If PA770.2=0 (stop), homing process needs to restart after PZERO becomes invalid again.

If PA770.2=1 (pause), homing process will continue after PZERO becomes invalid again.

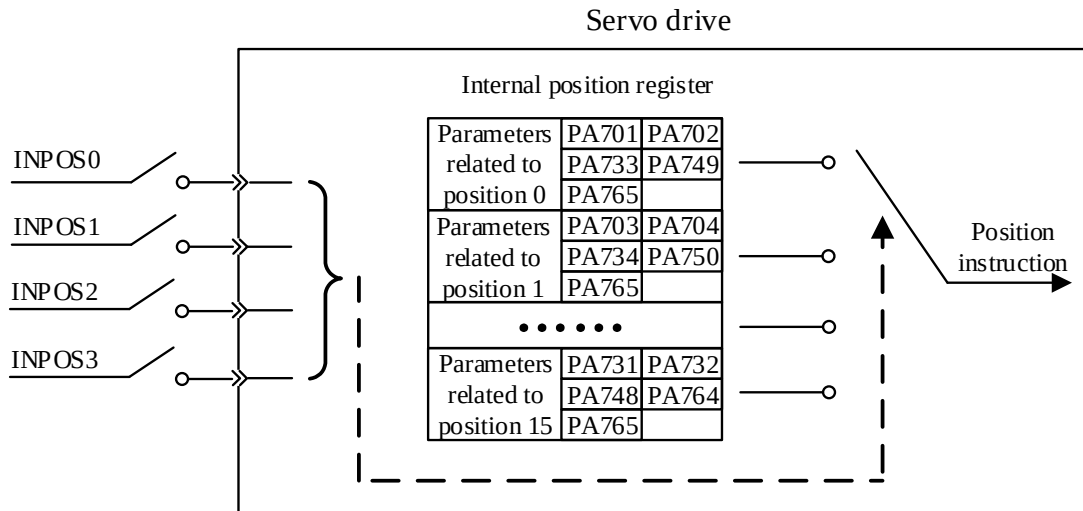


## ■ Internal position register (INPOS0、INPOS1、INPOS2、INPOS3)

INPOS0, INPOS1, INPOS2, INPOS3 combines to achieve 16-position control

| INPOS3      | INPOS2      | INPOS1      | INPOS0      | Internal position selection |
|-------------|-------------|-------------|-------------|-----------------------------|
| 0 (invalid) | 0 (invalid) | 0 (invalid) | 0 (invalid) | Position 0 (PA702&PA701)    |
| 0 (invalid) | 0 (invalid) | 0 (invalid) | 1 (valid)   | Position 1 (PA704&PA703)    |
| 0 (invalid) | 0 (invalid) | 1 (valid)   | 0 (invalid) | Position 2 (PA706&PA705)    |
| 0 (invalid) | 0 (invalid) | 1 (valid)   | 1 (valid)   | Position 3 (PA708&PA707)    |
| 0 (valid)   | 1 (valid)   | 0 (invalid) | 0 (invalid) | Position 4 (PA710&PA709)    |
| 0 (valid)   | 1 (valid)   | 0 (invalid) | 1 (valid)   | Position 5 (PA712&PA711)    |
| 0 (valid)   | 1 (valid)   | 1 (valid)   | 0 (invalid) | Position 6 (PA714&PA713)    |
| 0 (valid)   | 1 (valid)   | 1 (valid)   | 1 (valid)   | Position 7 (PA716&PA715)    |
| 1 (valid)   | 0 (invalid) | 0 (invalid) | 0 (invalid) | Position 8 (PA718&PA717)    |
| 1 (valid)   | 0 (invalid) | 0 (invalid) | 1 (valid)   | Position 9 (PA720&PA719)    |
| 1 (valid)   | 0 (invalid) | 1 (valid)   | 0 (invalid) | Position 10 (PA722&PA721)   |
| 1 (valid)   | 0 (invalid) | 1 (valid)   | 1 (valid)   | Position 11 (PA724&PA723)   |
| 1 (valid)   | 1 (valid)   | 0 (invalid) | 0 (invalid) | Position 12 (PA726&PA725)   |
| 1 (valid)   | 1 (valid)   | 0 (invalid) | 1 (valid)   | Position 13 (PA728&PA727)   |
| 1 (valid)   | 1 (valid)   | 1 (valid)   | 0 (invalid) | Position 14 (PA730&PA729)   |
| 1 (valid)   | 1 (valid)   | 1 (valid)   | 1 (valid)   | Position 15 (PA732&PA731)   |

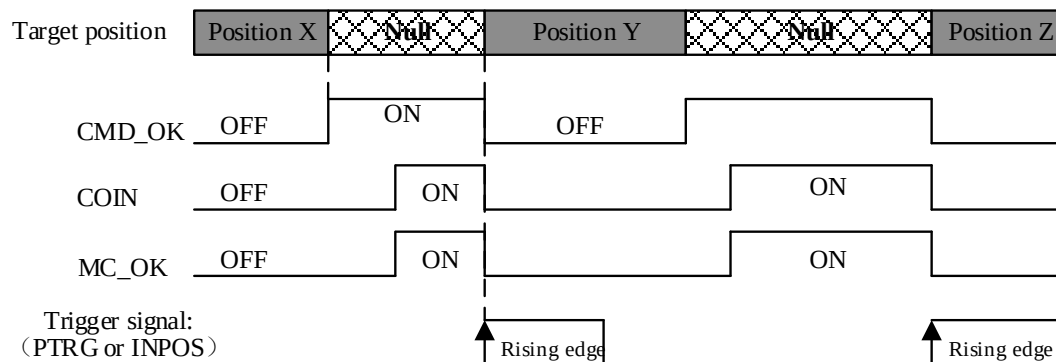
This is illustrated as below:



### ■ Internal position control trigger (PTRG)

When PA700.0=0 or 1, and PA770.1=0 in internal position control mode, the rising edge is valid.

Time sequence of PTRG is illustrated below:



### ■ Internal position control Forward JOG (P-POS)

In internal position control mode, even during homing or internal position sections, when P-POS signal becomes valid, position instruction will cut to forward JOG immediately and all current running instructions will be canceled and the cycle run will restart to starting point. PA768 is JOG speed in internal position control mode.

### ■ Internal position control Reverse JOG (N-POS)

### ■ Internal position control homing start (SHOME)

In internal position control mode, when SHOME signal becomes valid, all current running instructions will be canceled to cut into homing operations. The rising edge of this signal is valid.



### 8.8.3 Output signals

| Type   | Signal | Pin             | Status  | Meaning                                                       |
|--------|--------|-----------------|---------|---------------------------------------------------------------|
| Output | HOME   | To be allocated | Valid   | Internal position control homing completed                    |
|        |        |                 | Invalid | Internal position control homing not completed                |
|        | CMD-OK | To be allocated | Valid   | Internal position control instruction completed               |
|        |        |                 | Invalid | Internal position control instruction not completed           |
|        | MC-OK  | To be allocated | Valid   | Internal position control positioning & command completed     |
|        |        |                 | Invalid | Internal position control positioning & command not completed |

Please refer to 3.4.3 Allocation of I/O signals.

#### ■ Internal position control homing completion signal (HOME)

When homing is completed, and position coordinates are valid, and position counter is valid, this signal is ON.

- This signal is OFF at power on;
- When homing is completed, this signal is ON;
- After running one position section, this signal is OFF;
- When SHOME triggers, this signal is OFF;
- When homing is completed again, this signal is ON;
- When inputting PZERO to stop homing, this signal is OFF.

#### ■ Internal position control instruction completion signal (CMD-OK)

- When entering internal position control mode, this signal is ON;
- When during instruction executing, this signal is OFF;
- When position instructions finish executing, this signal is ON.

**This signal only means the completion of instructions, not necessarily actual motor positioning.**

#### ■ Internal position control positioning & command completion (MC-OK)

This signal means both the completion of positioning & commands.

When CMD-OK & COIN are both ON, this signal is ON; otherwise OFF.

## 8.9 Homing function

Normally there should be a reference point (zero) switch on working tables and is used to determine coordinate system zero position for point-to-point controls. Homing is needed when power-on or after each processing for next movement. In internal position control mode, upper controller gives homing start (SHOME) signal and the servo drive will execute homing functions automatically. Homing modes, homing speeds and offset can all be set through PA771, PA775, PA776, PA777, and PA778.

### ■ Homing mode selections

| Parameter                   | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--|---|------------------|---|------------------|--------------------------|--|---|---------------------------------------------------------------------|---|--------------------------------------------------------------------|---|---------------------------------------------------------------------|---|--------------------------------------------------------------------------|-----------------------------|--|---|-------------------------|---|-----------------------------|-------------------------|--|---|---------|---|-------------|
| PA771                       | <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;">           d. <span style="margin-right: 10px;">3</span><span style="margin-right: 10px;">2</span><span style="margin-right: 10px;">1</span><span>0</span><br/> <div style="display: flex; justify-content: space-around; width: 100px;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> </div> <div> <table border="1" style="margin-bottom: 10px;"> <thead> <tr><th colspan="2">Homing rotational direction</th></tr> </thead> <tbody> <tr><td>0</td><td>Forward rotation</td></tr> <tr><td>1</td><td>Reverse rotation</td></tr> </tbody> </table> <table border="1" style="margin-bottom: 10px;"> <thead> <tr><th colspan="2">Homing pattern selection</th></tr> </thead> <tbody> <tr><td>0</td><td>After contacting zero switch, look for Z pulse by rotating backward</td></tr> <tr><td>1</td><td>After contacting zero switch, look for Z pulse by rotating forward</td></tr> <tr><td>2</td><td>After contacting zero switch, rotate backward, not look for Z pulse</td></tr> <tr><td>3</td><td>After contacting zero point switch, rotate forward, not look for Z pulse</td></tr> </tbody> </table> <table border="1" style="margin-bottom: 10px;"> <thead> <tr><th colspan="2">Homing completion operation</th></tr> </thead> <tbody> <tr><td>0</td><td>Clear all position data</td></tr> <tr><td>1</td><td>Not clear all position data</td></tr> </tbody> </table> <table border="1"> <thead> <tr><th colspan="2">Homing signal selection</th></tr> </thead> <tbody> <tr><td>0</td><td>Use ZPS</td></tr> <tr><td>1</td><td>Use Z pulse</td></tr> </tbody> </table> </div> </div> | Homing rotational direction |  | 0 | Forward rotation | 1 | Reverse rotation | Homing pattern selection |  | 0 | After contacting zero switch, look for Z pulse by rotating backward | 1 | After contacting zero switch, look for Z pulse by rotating forward | 2 | After contacting zero switch, rotate backward, not look for Z pulse | 3 | After contacting zero point switch, rotate forward, not look for Z pulse | Homing completion operation |  | 0 | Clear all position data | 1 | Not clear all position data | Homing signal selection |  | 0 | Use ZPS | 1 | Use Z pulse |
| Homing rotational direction |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 0                           | Forward rotation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 1                           | Reverse rotation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| Homing pattern selection    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 0                           | After contacting zero switch, look for Z pulse by rotating backward                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 1                           | After contacting zero switch, look for Z pulse by rotating forward                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 2                           | After contacting zero switch, rotate backward, not look for Z pulse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 3                           | After contacting zero point switch, rotate forward, not look for Z pulse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| Homing completion operation |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 0                           | Clear all position data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 1                           | Not clear all position data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| Homing signal selection     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 0                           | Use ZPS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |
| 1                           | Use Z pulse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |  |   |                  |   |                  |                          |  |   |                                                                     |   |                                                                    |   |                                                                     |   |                                                                          |                             |  |   |                         |   |                             |                         |  |   |         |   |             |

### ■ Other homing parameters

|       |                                                   |       |         |           |
|-------|---------------------------------------------------|-------|---------|-----------|
| PA775 | <b>Homing speed before contacting zero signal</b> |       |         |           |
|       | Range                                             | Unit  | Default | Effective |
|       | 0~3000                                            | rpm   | 500     | Immed     |
| PA776 | <b>Homing speed after contacting zero signal</b>  |       |         |           |
|       | Range                                             | Unit  | Default | Effective |
|       | 0~500                                             | rpm   | 30      | Immed     |
| PA777 | <b>Zero switch offset low place</b>               |       |         |           |
|       | Range                                             | Unit  | Default | Effective |
|       | 0x0000~0xFFFF                                     | pulse | 0       | Immed     |
| PA778 | <b>Zero switch offset high place</b>              |       |         |           |
|       | Range                                             | Unit  | Default | Effective |
|       | 0x0000~0x1FFF                                     | pulse | 0       | Immed     |

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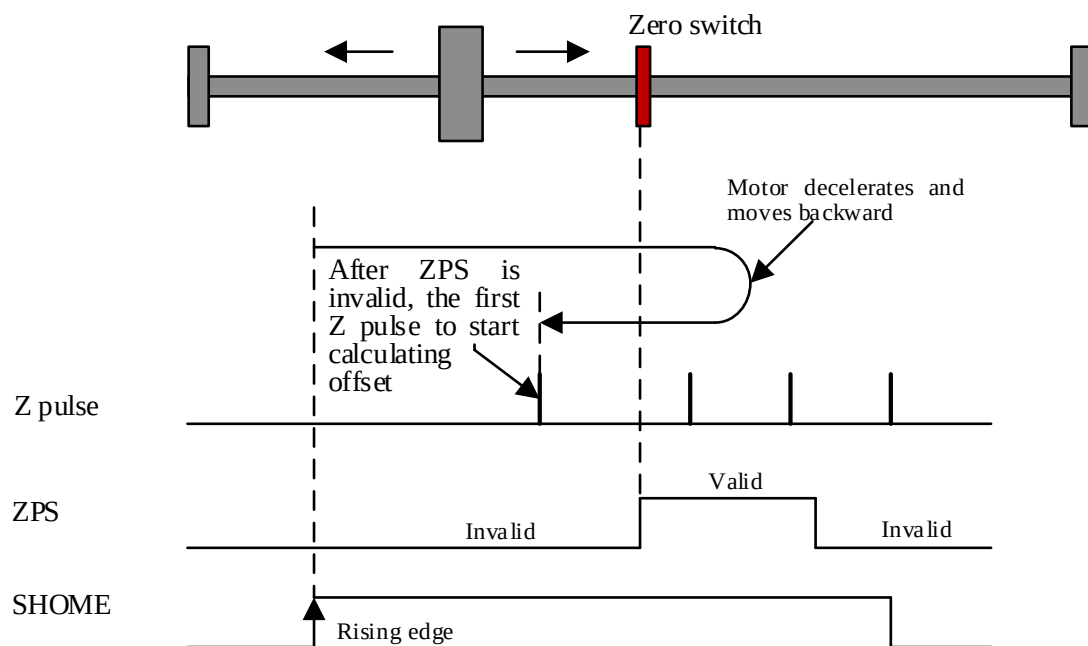
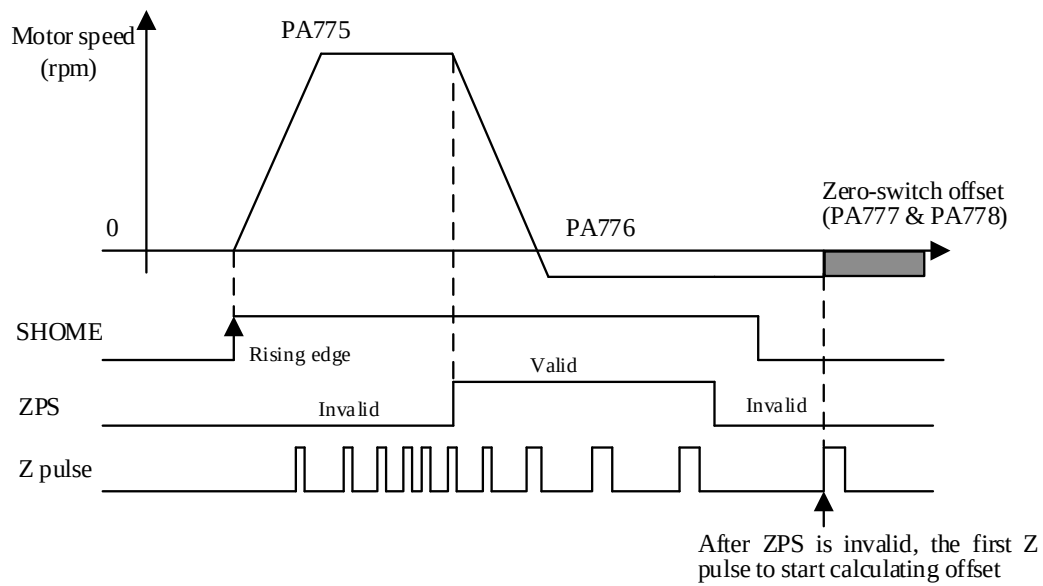
**Important**

- When PA775, PA776 settings exceed maximum speed of the servo motor, actual value is still restricted as servo motor's maximum speed.
  - Zero position offset directions are determined by homing directions.
  - Homing functions are suitable for internal position control (junction instruction) and position control (pulse instruction) .
  - During homing, servo drive does not receive pulse commands.
- 

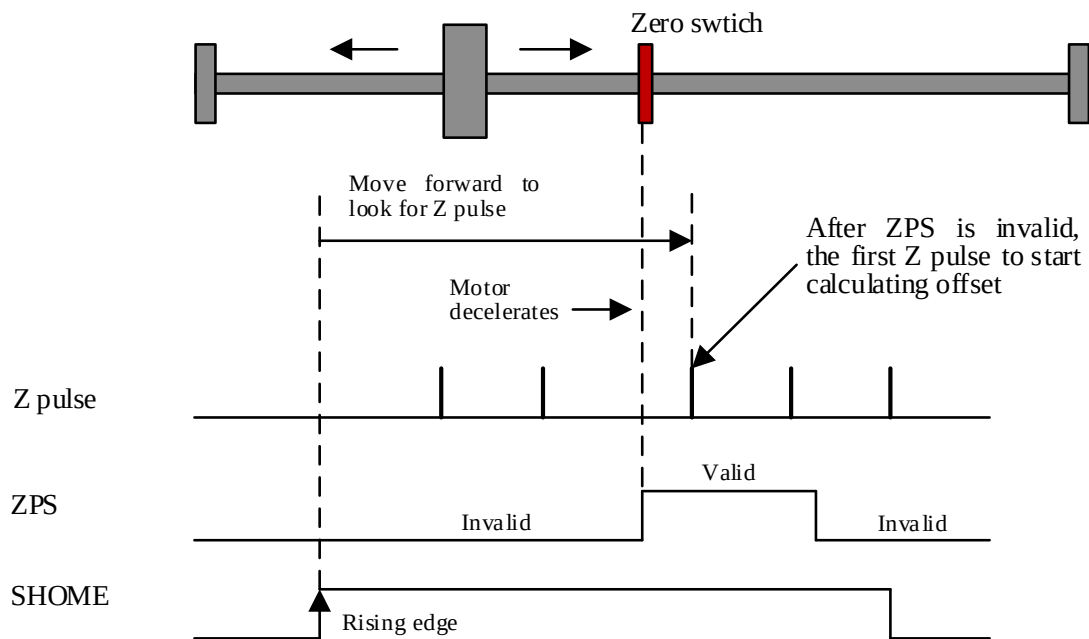
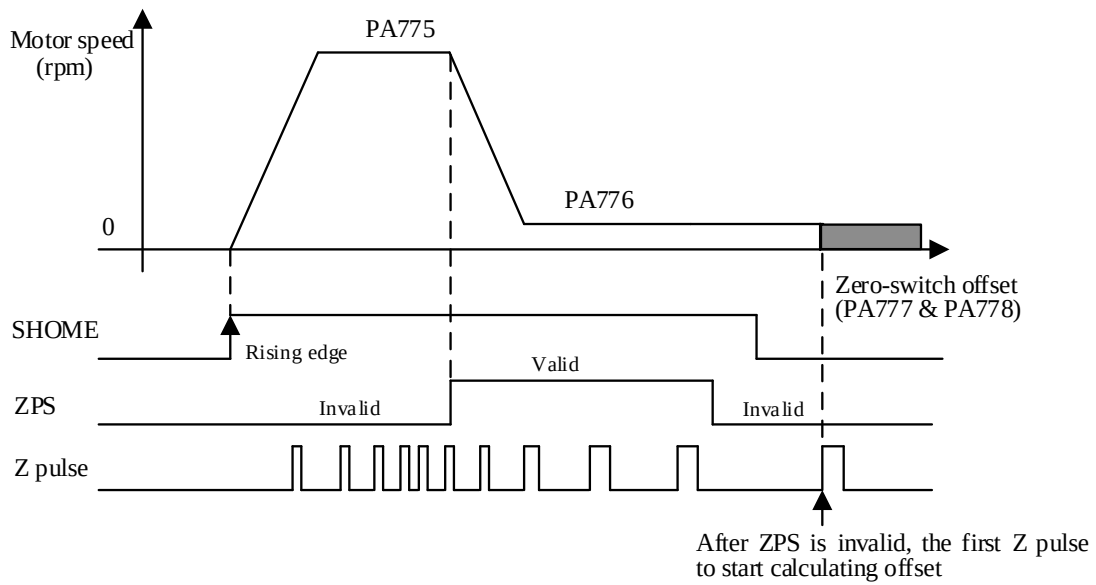
**■ Description of the homing process**

- When SHOME rising edge is detected, motor runs at direction set by PA771.0 and speed set by PA772.
- When zero switch (reference point) signal ZPS is detected active, motor runs at speed set by PA775 after finding Z pulse according to PA771.1 setting.
- When ZPS is inactive, also after detected Z pulse, motor runs at speed set by PA776 and starts calculating zero switch offset pulse numbers.
- When zero switch offset pulse number is reached, motor stops and outputs HOME signal.
- Normally set PA775 at high speed and PA776 at low speed. Note that if PA776 is set too high, homing accuracy will be affected.

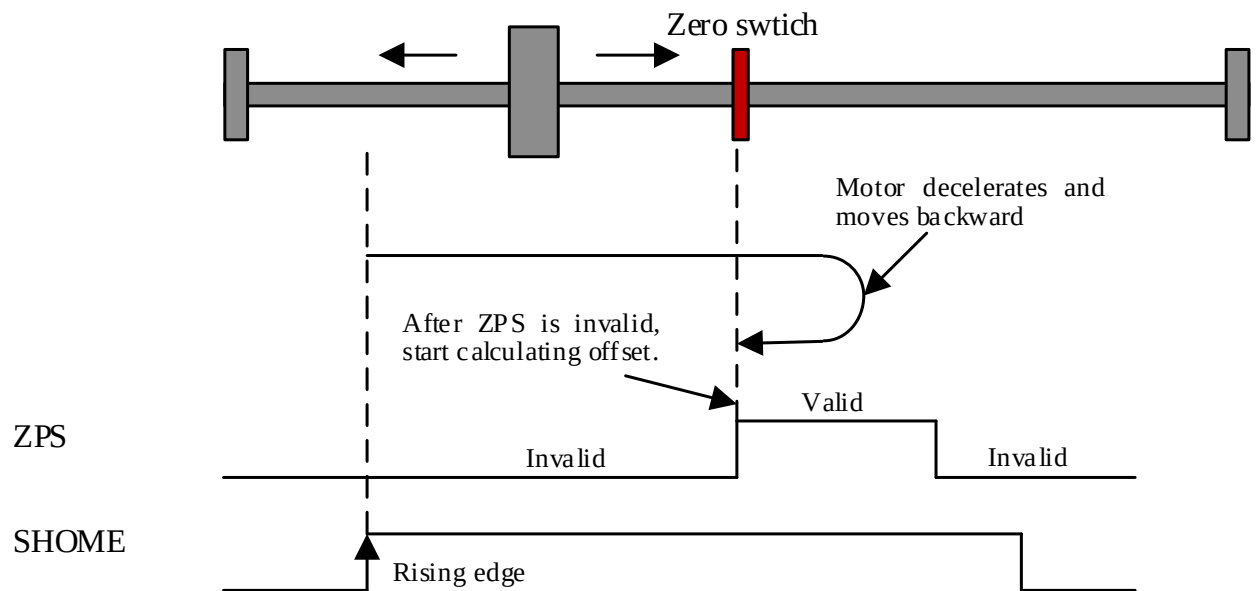
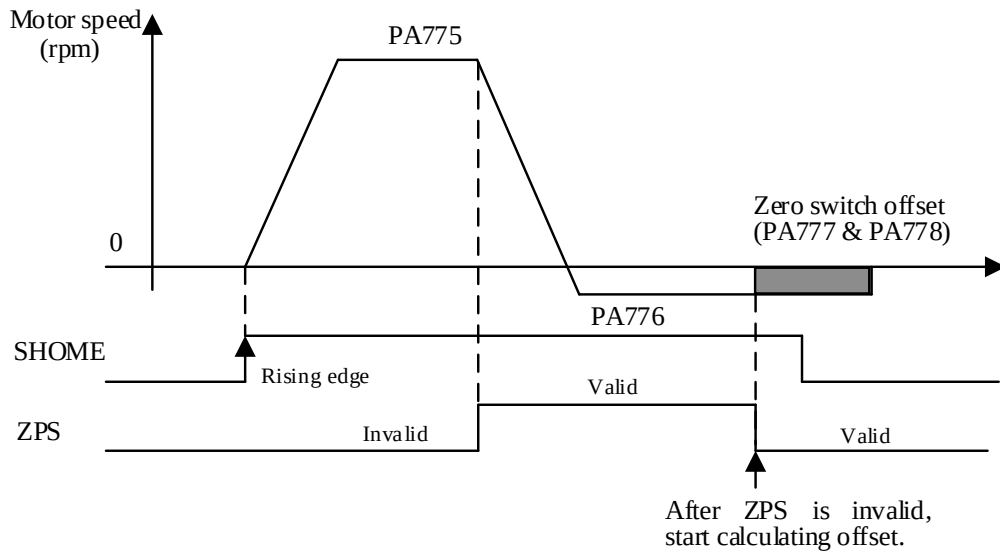
- **PA771.1=0:** After contacting zero switch, look for Z pulse by rotating backward.



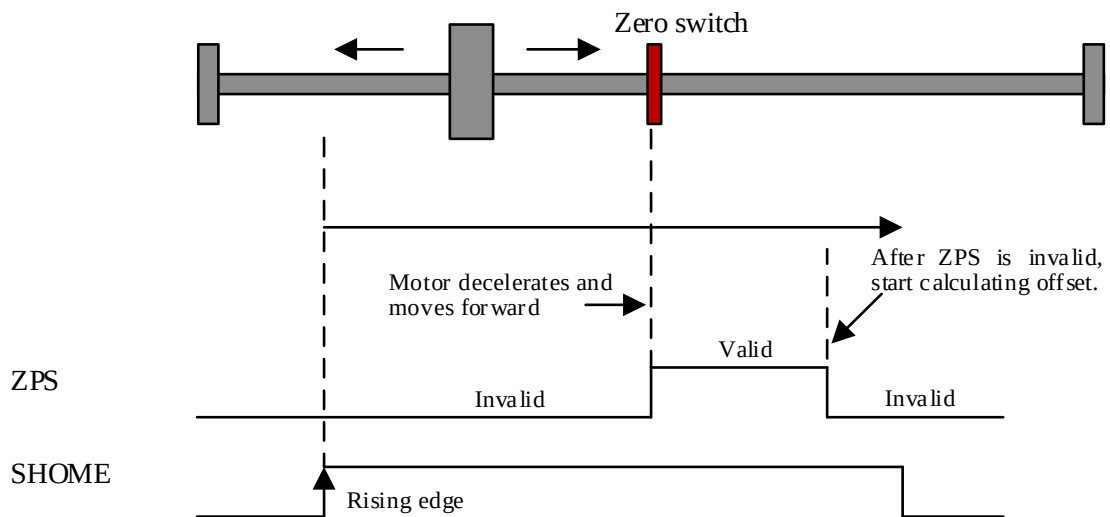
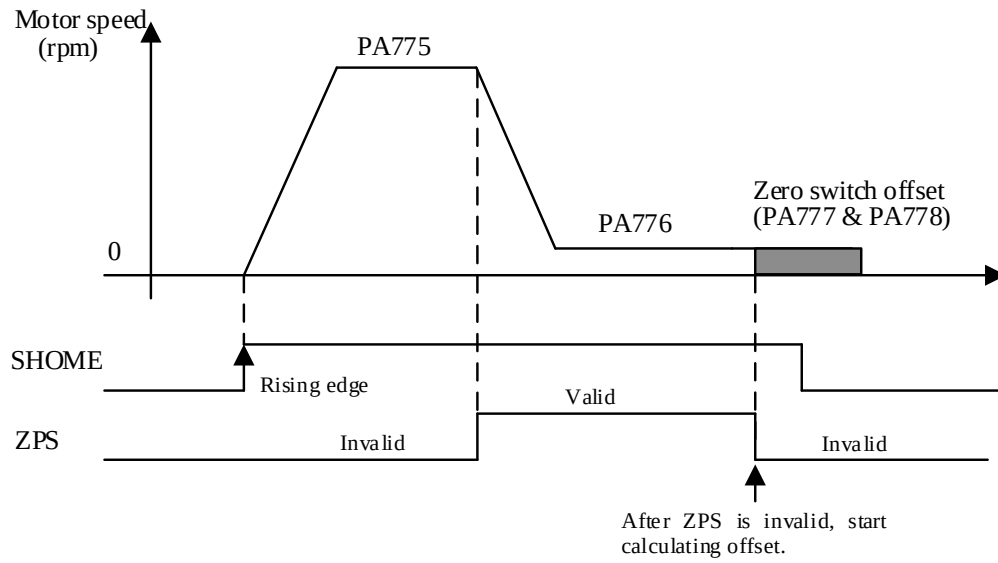
- **PA771.1=1: After contacting zero switch, look for Z pulse by rotating forward.**



- **PA771.1=2: After contacting zero switch, rotate backward, not look for Z pulse.**



- **PA771.1=3: After contacting zero switch, rotate forward, not look for Z pulse.**



## 8.10 Combination of different control modes

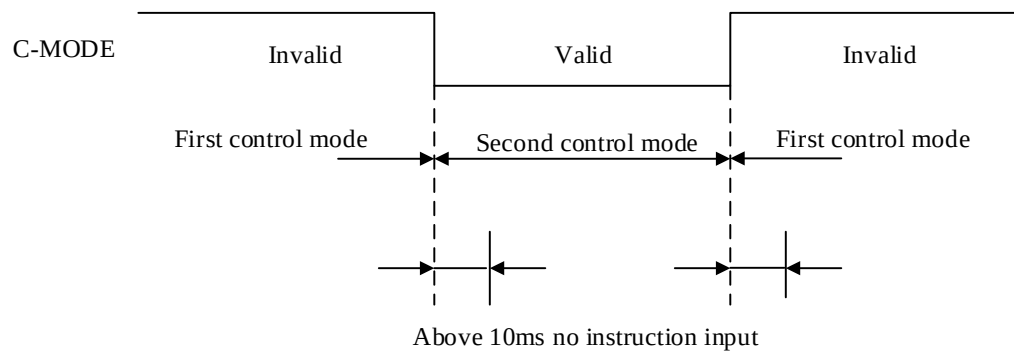
The servo can select two control modes and switch between them. Settings are as below:

### 8.10.1 Parameter settings

| Parameter | Control mode combinations                           |
|-----------|-----------------------------------------------------|
| PA000     | h.□□4□ Internal speed control ↔ Position control    |
|           | h.□□5□ Internal speed control ↔ Speed control       |
|           | h.□□6□ Internal speed control ↔ Torque control      |
|           | h.□□7□ Position control ↔ Speed control             |
|           | h.□□8□ Position control ↔ Torque control            |
|           | h.□□9□ Torque control ↔ Speed control               |
|           | h.□□B□ Internal position control ↔ Position control |

### 8.10.2 Input signal

- When C-MODE is invalid, first control mode is selected;
- When C-MODE is valid, second control mode is selected





## 8.11 Fully close loop control

### 8.11.1 Parameter settings

| Parameter |        | Meaning                                           |
|-----------|--------|---------------------------------------------------|
| PA000     | h.□□d□ | Control mode selection: fully closed loop control |

| Parameter |        | Meaning                                    |
|-----------|--------|--------------------------------------------|
| PA202     | d.□□0□ | External linear encoder signals not negate |
|           | d.□□1□ | External linear encoder signals negate     |

| Parameter |        | Meaning                                                                                                                                    |
|-----------|--------|--------------------------------------------------------------------------------------------------------------------------------------------|
| PA202     | d.□0□□ | Use C-MOD signal to switch between internal & external loops (0: external; 1: internal)                                                    |
|           | d.□1□□ | Switch between internal & external loops when electronic gear ratio switches (electronic gear ratio setting 1: external; others: internal) |

| Parameter |     | Meaning                                                                             |
|-----------|-----|-------------------------------------------------------------------------------------|
| PA202.3   | 0~9 | When pulse residual is less than this value, fully closed loop control is finished. |

|       |                                                                                                                                                                                  |      |         |           |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|-----------|
| PA211 | <b>External (linear) encoder numerator</b>                                                                                                                                       |      |         |           |
|       | Range                                                                                                                                                                            | Unit | Default | Effective |
|       | 1~65535                                                                                                                                                                          | —    | 0       | Immed     |
|       | When PA211=0, the servo motor encoder resolution will become this numerator and user only need to set PA212 to the feedback pulse count from external encoder in one revolution. |      |         |           |
| PA212 | <b>External (linear) encoder denominator</b>                                                                                                                                     |      |         |           |
|       | Range                                                                                                                                                                            | Unit | Default | Effective |
|       | 1~65535                                                                                                                                                                          | —    | 1       | Immed     |

Motor encoder resolutions:

- 5000-line incremental: 20,000ppr;
- 17-bit encoder: 131,072 ppr;
- 20-bit encoder: 1,048,576ppr.

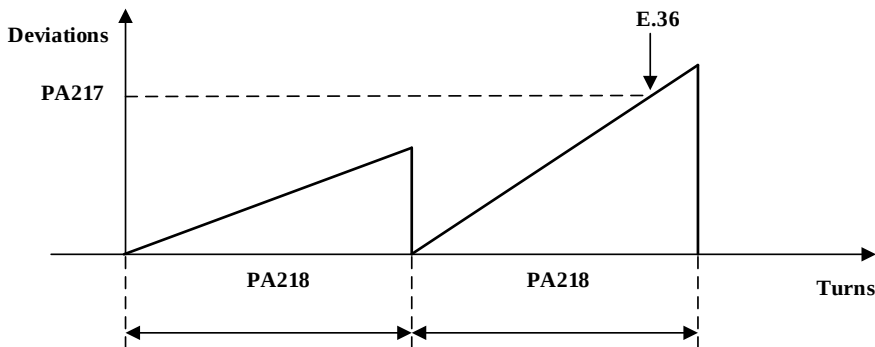
External encoder gear ratio:

$$\frac{PA[211]}{PA[212]} = \frac{\text{Motor encoder resolution (pulse)}}{\text{External encoder resolution (pulse)}}$$

Notes:

If this gear ratio is wrong, the calculated position based on motor encoder feedback pulses will be different from the calculated position based on external encoder feedback pulses. This deviation will accumulate and will result in E.36 if the deviation exceeds PA217.

| PA217                                                                                                                                                    | Fully closed loop position deviation threshold |       |         |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------|---------|-----------|
|                                                                                                                                                          | Range                                          | Unit  | Default | Effective |
|                                                                                                                                                          | 0~65535                                        | pulse | 2000    | Immed     |
| This is to set the hybrid deviations between motor encoder feedback & external linear encoder.<br>If PA217=0, the servo drive will not judge deviations. |                                                |       |         |           |

| PA218                                                                                                                                                                           | Fully closed loop hybrid deviation clearance |      |         |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------|---------|-----------|
|                                                                                                                                                                                 | Range                                        | Unit | Default | Effective |
|                                                                                                                                                                                 | Turn                                         | turn | 100     | Immed     |
| After the incremental moving distance is over PA218, the servo drive will clear the accumulated hybrid deviations. If PA218=0, this clearance function is disabled.             |                                              |      |         |           |
|  <p>Please set PA218 properly based on mechanical structure and position limit sensors.</p> |                                              |      |         |           |

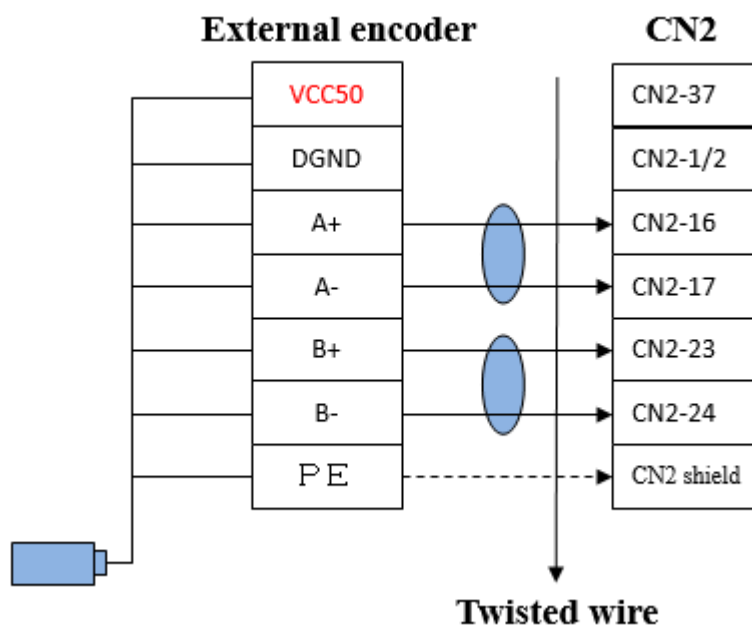
| No.   | Contents                                                 | Unit                             |
|-------|----------------------------------------------------------|----------------------------------|
| dP 34 | External linear encoder feedback pulse counts low place  | [1 encoder pulse]                |
| dP 35 | External linear encoder feedback pulse counts high place | [10 <sup>4</sup> encoder pulses] |
| dP 38 | Hybrid deviation low place                               | [1 encoder pulse]                |
| dP 39 | Hybrid deviation high place                              | [10 <sup>4</sup> encoder pulses] |

### 8.11.2 Wirings

#### 1) CN2 pin allocations

| Pin        | Definition          | Meaning                       |
|------------|---------------------|-------------------------------|
| CN2-37     | VCC50<br>(external) | 5V power for external encoder |
| CN2-1      | DGND<br>(external)  | 5V ground                     |
| CN2-2      | DGND<br>(external)  | 5V ground                     |
| CN2-16     | EHS_PLS+            | Linear encoder A+ input       |
| CN2-17     | EHS_PLS-            | Linear encoder A- input       |
| CN2-23     | EHS_DIR+            | Linear encoder B+ input       |
| CN2-24     | EHS_DIR-            | Linear encoder B- input       |
| CN2 Shield | PE                  | Shielding wire                |

#### 2) Wirings



#### ■ Notes:

- (1) Please use shielded double-twisted wire diameter over 0.18mm<sup>2</sup> & less than 20 meters;
- (2) Connect PE of external encoder to shielding layer of wire as well as CN2 case;

- (3) Wires shall be far away from R, S, T, U, V, W;  
 (4) Please use external encoder with A/B outputs & range of 1~9999.

## Chapter 9 Fault diagnosis

### 9.1 Alarms

| Code | Symptom/Cause                                            | Clear | Solutions                                                                                                                                                                  |
|------|----------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E.03 | Wrong parameters & verifications                         | No    | AF 05: parameter initialization.                                                                                                                                           |
| E.04 | Wrong parameter data format                              | No    | AF 05: parameter initialization.                                                                                                                                           |
| E.05 | Abnormal internal circuit of current detection channel 1 | No    | Power off, then power on again after 1 minute.                                                                                                                             |
| E.06 | Abnormal internal circuit of current detection channel 2 | No    | Power off, then power on again after 1 minute.                                                                                                                             |
| E.08 | Servo drive internal communication error                 | No    | 1) Power off, then power on again after 1 minute;<br>2) Check motor earthing and whether next to interference source.                                                      |
| E.10 | Broken encode line                                       | No    | 1) Check encoder line;<br>2) Check if PA002.3 matches encoder type.                                                                                                        |
| E.11 | Encoder A/B pulse loss                                   | No    | 1) Check encoder line;<br>2) Check grounding of both servo drive and motor;<br>3) Check shielding cable connections;<br>4) Separate encoder line from power supply cables. |
| E.12 | Encoder Z pulse loss                                     | No    | Check encoder line.                                                                                                                                                        |
| E.13 | Encoder UVW error                                        | No    | Check encoder line.                                                                                                                                                        |
| E.14 | Encoder status error                                     | No    | Check encoder line.                                                                                                                                                        |
| E.15 | Main power supply wiring error                           | No    | 1) Check if there is input phase loss;<br>2) Check if input voltage is correct;<br>3) Set PA001.2=1.                                                                       |
| E.16 | Regenerative circuit error                               | No    | 1) Check if input voltage is too low;<br>2) Set PA009.0=1 to disable this alarm.                                                                                           |
| E.17 | Regenerative resistor error                              | No    | 1) Check if input voltage is too low;<br>2) Set PA009.0=1 to disable this alarm;<br>3) Check if regenerative resistor is already connector or if has error.                |
| E.18 | (Main circuit DC bus)                                    | No    | 1) Check if input voltage is correct;                                                                                                                                      |

|      |                                                   |     |                                                                                                                                                                                                                                                                                      |
|------|---------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | under-voltage                                     |     | 2) Check if the relay works properly (should have sound when power on) ;<br>3) Increase value of PA512.                                                                                                                                                                              |
| E.19 | (Main circuit DC bus) over-voltage                | No  | 1) Check if input voltage is correct;<br>2) Check regenerative resistor;<br>3) Reduce the value of PA512.                                                                                                                                                                            |
| E.20 | IGBT alarm                                        | No  | 1) Check if drive matches motor (PA012) ;<br>2) Reduce the value of PA402 & PA403;<br>3) Increase the value of PA104.                                                                                                                                                                |
| E.21 | Motor overload                                    | Yes | 1) Increase the value of PA010.3;<br>2) Increase acceleration/deceleration time (Position control: reduce PA100, increase PA214, PA215, PA216. Speed control: increase PA302, PA303, PA304) ;<br>3) Reduce the value of PA402 & PA403;<br>4) Change to a higher power servo.         |
| E.22 | Regenerative overload                             | Yes | 1) Increase acceleration/deceleration time (Position control: reduce PA100, increase PA214, PA215, PA216. Speed control: increase PA302, PA303, PA304) ;<br>2) Increase PA010.2 if the resistor can withstand;<br>3) Increase value of PA512.                                        |
| E.23 | DB overload                                       | Yes |                                                                                                                                                                                                                                                                                      |
| E.25 | Deviation counter overflow (exceeds 256*65536)    | Yes | 1) Check if motor can JOG properly;<br>2) Check electronic gear ratio settings;<br>3) Check if torque limit is correct;<br>4) Check if there is limit switch.                                                                                                                        |
| E.26 | Position deviation exceeds setting value of PA528 | Yes | 1) Check if motor can JOG properly;<br>2) Check electronic gear ratio settings;<br>3) Increase PA528;<br>4) Check if there is limit switch.                                                                                                                                          |
| E.27 | Motor speed exceeds maximum speed*1.2             | Yes | 1) Check if motor UVW wirings are correct;<br>2) Check if the PID parameters are correct or if load inertia is too high;<br>3) Increase acceleration/deceleration time (Position control: reduce PA100, increase PA214, PA215, PA216. Speed control: increase PA302, PA303, PA304) . |
| E.28 | Motor speed out of control                        | Yes | 1) Check if motor UVW wirings are correct;<br>2) Check PID settings for responsiveness;<br>3) Increase PA530 (if too high will disable the protection function) .                                                                                                                    |
| E.29 | Motor out of control                              | Yes | 1) Check if motor UVW wirings are correct;<br>2) Check if encoder type is correct (PA002.3) ;                                                                                                                                                                                        |

|      |                                                                     |     |                                                                                                                                                       |
|------|---------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                                                                     |     | 3) Check if drive matches motor (PA012) ;<br>4) Reduce servo gains properly, such as increase filter (PA215, PA216) .                                 |
| E.30 | Electronic gear ratio value too high                                | Yes | 1) Check electronic gear ratio settings;<br>2) Check input pulse frequency.                                                                           |
| E.31 | Internal data value too high: calculation is over 32-bit            | Yes | 1) Check electronic gear ratio settings;<br>2) Check input pulse frequency.                                                                           |
| E.35 | Input inhabitation                                                  | Yes | 1) Check if there is limit switch signal input;<br>2) Set PA003.2=1 to disable this alarm.                                                            |
| E.36 | Fully closed loop deviation too large                               | Yes |                                                                                                                                                       |
| E.44 | Servo drive reset error                                             | No  | 1) Time interval between power off & power on again shall be greater than 5 seconds;<br>2) Check if there is any interference source nearby.          |
| E.45 | Servo drive internal error 1                                        | No  |                                                                                                                                                       |
| E.46 | Servo drive internal error 2                                        | No  |                                                                                                                                                       |
| E.47 | Servo drive internal error 3                                        | No  |                                                                                                                                                       |
| E.50 | 17-bit serial encoder communicational error                         | No  | 1) Check if PA002.3 matches encoder type;<br>2) Check encoder line;<br>3) Replace the servo motor.                                                    |
| E.51 | 17-bit serial encoder ODD/EVEN place, stop place verification error | Yes | 1) Check encoder line;<br>2) Check if there is any interference source nearby;<br>3) Check shielding wire connections;<br>4) Replace the servo motor; |
| E.52 | 17-bit serial encoder data verification error                       | Yes | Same as above.                                                                                                                                        |
| E.53 | 17-bit serial encoder status domain stop place error                | Yes | Same as above.                                                                                                                                        |
| E.54 | 17-bit serial encoder SFOME stop place error                        | Yes | Same as above.                                                                                                                                        |
| E.55 | 17-bit serial encoder over-speed                                    | Yes | 1) Check if motor axis displaced during power off;<br>2) Execute AF 12;<br>3) Check if absolute encoder has battery.                                  |
| E.56 | 17-bit serial encoder absolute status error                         | Yes | 1) Check if there is any interference source nearby;<br>2) Execute AF 11.                                                                             |
| E.57 | 17-bit serial encoder counter error                                 | Yes | 1) Check if there is any interference source nearby;<br>2) Execute AF 11.                                                                             |
| E.58 | 17-bit serial encoder multi-                                        | Yes | 1) Check if there is any interference source                                                                                                          |

|      |                                                      |     |                                                                                                                                                       |
|------|------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | turn data overflow<br>(exceeds 65535 turns)          |     | nearby;<br>2) Execute AF 11.                                                                                                                          |
| E.59 | 17-bit serial encoder over-heat                      | Yes | 1) Check motor temperature;<br>2) Execute AF 12.                                                                                                      |
| E.60 | 17-bit serial encoder multi-turn data error          | Yes | 1) Check battery voltage;<br>2) Execute AF 11.                                                                                                        |
| E.61 | 17-bit serial encoder battery voltage less than 3.1V | Yes | 1) Replace battery;<br>2) Execute AF 12                                                                                                               |
| E.62 | 17-bit serial encoder battery voltage less than 2.5V | No  | Same as above                                                                                                                                         |
| E.63 | 17-bit serial encoder data not initialized           | Yes | 1) Check if PA002.3 matches encoder type;<br>2) Initialize 17-bit serial encoder.                                                                     |
| E.64 | 17-bit serial encoder data & verification error      | Yes | Same as above                                                                                                                                         |
| E.67 | Servo drive does not match the servo motor           | Yes | 1) Modify PA012 setting;<br>2) Disable this alarm by PA007.3 but may degrade motor performance or cause E.29;<br>3) Replace the servo drive or motor. |
| E.68 | Same as above                                        | Yes | Same as above                                                                                                                                         |
| E.69 | Same as above                                        | Yes | Same as above                                                                                                                                         |
| E.70 | Absolute encoder data error                          | Yes |                                                                                                                                                       |
| E.76 | IGBT over-heat                                       | Yes | 1) Check servo drive fan;<br>2) Check ventilation;<br>3) Set PA009.2=0 to disable this alarm.                                                         |
| E.77 | Software limit switch alarm                          | Yes | 1) Check if PA779~PA782 are correct;<br>2) Set PA770.3=0 to disable this alarm.                                                                       |

## 9.2 Warnings

| Code | Symptom/Cause                                        | Solutions                                                                                                                                                                                                                                         |
|------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A.90 | Position deviation (residual pulse) too much         | <ol style="list-style-type: none"> <li>1) Check electronic gear ratio settings;</li> <li>2) Increase PA527;</li> <li>3) Check if there is limit switch.</li> </ol>                                                                                |
| A.91 | Overload                                             | <ol style="list-style-type: none"> <li>1) Increase acceleration/deceleration time;</li> <li>2) Increase stop/start times;</li> <li>3) Increase PA010.3;</li> <li>4) Reduce load;</li> <li>5) Replace with a higher power servo.</li> </ol>        |
| A.92 | Regenerative overload                                | <ol style="list-style-type: none"> <li>1) Increase acceleration/deceleration time;</li> <li>2) Increase stop/start times;</li> <li>3) Increase PA010.2;</li> <li>4) Use a regenerative resistor with higher power but lower resistance</li> </ol> |
| A.95 | Over-voltage warning                                 | <ol style="list-style-type: none"> <li>1) Increase acceleration/deceleration time;</li> <li>2) Increase stop/start times;</li> <li>3) Reduce regenerative resistance;</li> <li>4) Reduce PA512.</li> </ol>                                        |
| A.96 | Under-voltage warning                                | <ol style="list-style-type: none"> <li>1) Check input voltage;</li> <li>2) Increase PA512.</li> </ol>                                                                                                                                             |
| A.97 | 17-bit serial encoder battery voltage less than 3.1V | <ol style="list-style-type: none"> <li>1) Check battery voltage and wiring;</li> <li>2) Replace battery.</li> </ol>                                                                                                                               |



# Chapter 10 Communications

## 10.1 Communication terminals

Please refer to chapter 3.3 for wirings of CN1.

- 1) If upper controller only connects to one servo drive, connect RJ45 (1) to upper controller and RJ45 (2) to a 120Ω resistor.
- 2) If upper controller connects to multiple servo drives, connect RJ45 (1) of first servo drive to upper controller and RJ45 (2) of first servo drive to RJ45 (1) of second servo drive. Connect all servo drives in this way and connect RJ45 (2) of last servo drive to a 120Ω resistor.
- 3) Do not connect pin 4 or pin 5 of RJ45.

## 10.2 Communication parameters

| Parameter | Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Range       | Unit | Default | Effective |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|---------|-----------|
| PA015     | RS485 communication address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1~31        |      | 1       | Immed     |
|           | RS485 communication function selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | d.0000~0095 |      | d.0095  | Immed     |
| PA016     | <div><div>d.</div><div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>RS485 bit rate</div><div><div>02400bps</div><div>14800bps</div><div>29600bps</div><div>319200bps</div><div>438400bps</div><div>557600bps</div><div>6115200bps</div></div></div><div><div>Communicational protocol</div><div><div>08, N, 1 (Modbus protocol, RTU mode)</div><div>18, N, 2 (Modbus protocol, RTU mode)</div><div>28, E, 1 (Modbus protocol, RTU mode)</div><div>38, O, 1 (Modbus protocol, RTU mode)</div><div>47, N, 2 (Modbus protocol, ASCII mode)</div><div>57, E, 1 (Modbus protocol, ASCII mode)</div><div>67, O, 1 (Modbus protocol, ASCII mode)</div><div>78, N, 2 (Modbus protocol, ASCII mode)</div><div>88, E, 1 (Modbus protocol, ASCII mode)</div><div>98, O, 1 (Modbus protocol, ASCII mode)</div></div></div><div><div>Reserved</div></div><div><div>Communicational data equivalent</div><div><div>0Internal speed: 1rpm; internal torque: 1% rated torque.</div><div>1Internal speed: 0.1rpm; internal torque: 0.1% rated torque.</div></div></div></div></div></div></div> |             |      |         |           |

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## 10.3 Communication protocol

When using RS-485 for serial communications, each servo drive must set its own axis number (PA015). There are two MODBUS modes: ASCII (American Standard Code for Information Interchange) or RTU (Remote Terminal Unit).

### 10.3.1 Encoding definitions

◆ **ASCII mode:**

Every 8-bit data consists of two ASCII bytes.

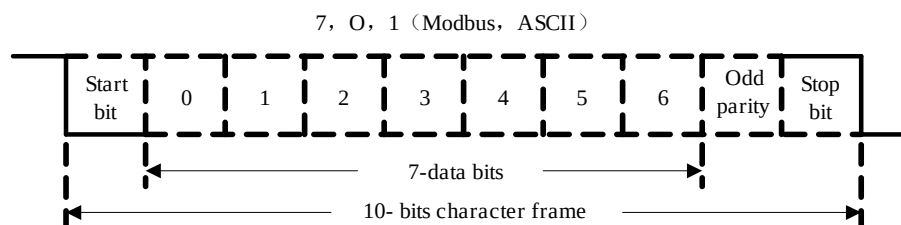
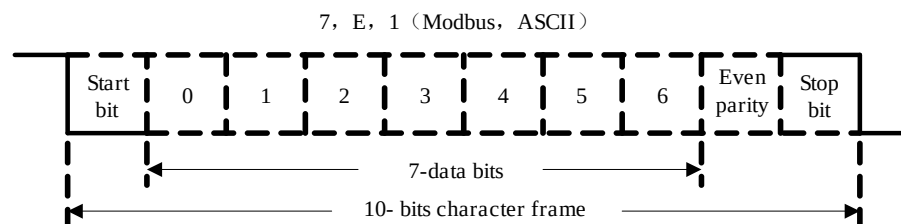
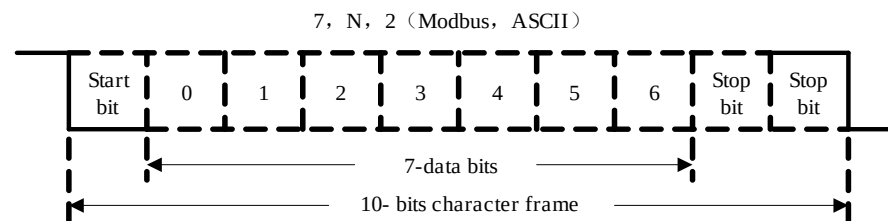
| Byte symbol | '0' | '1' | '2' | '3' | '4' | '5' | '6' | '7' |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|
| ASCII code  | 30H | 31H | 32H | 33H | 34H | 35H | 36H | 37H |
| Byte symbol | '8' | '9' | 'A' | 'B' | 'C' | 'D' | 'E' | 'F' |
| ASCII code  | 38H | 39H | 41H | 42H | 43H | 44H | 45H | 46H |

◆ **RTU mode:**

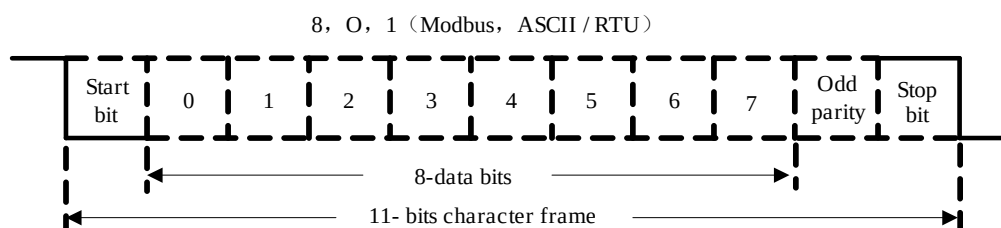
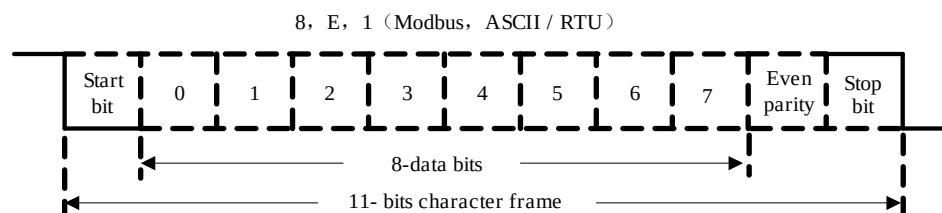
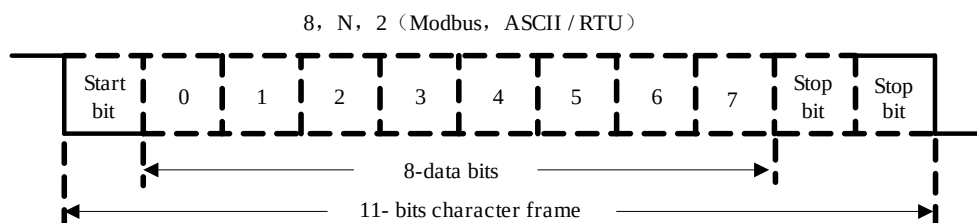
Every 8-bits data consists of two 4-bits hexadecimal bytes.

### 10.3.2 Byte structure

#### ◆ 10-bits byte box (used for 7-bits data)



#### ◆ 11-bits byte box (used for 8-bits data)



### 10.3.3 Communication data structure

#### ◆ ASCII mode:

|                   |                                                      |
|-------------------|------------------------------------------------------|
| <b>STX</b>        | Communication starting byte: ':' (3AH)               |
| <b>ADR</b>        | Communication address: 1-byte contains 2 ASCII codes |
| <b>CMD</b>        | Command code: 1-byte contains 2 ASCII codes          |
| <b>DATA (n-1)</b> | Data content (n≤12) :                                |
| .....             | Word number=n;                                       |
| <b>DATA (0)</b>   | Byte number=2n;<br>ASCII code number=4n;             |
| <b>LRC</b>        | Command code: 1-byte contains 2 ASCII codes          |
| <b>End 1</b>      | End code 1: (0DH) (CR)                               |
| <b>End 0</b>      | End code 0: (0AH) (LF)                               |

#### RTU mode

|                   |                                 |
|-------------------|---------------------------------|
| <b>STX</b>        | Static time exceeding 3.5 bytes |
| <b>ADR</b>        | Communication address: 1-byte   |
| <b>CMD</b>        | Command code: 1-byte            |
| <b>DATA (n-1)</b> | Data content (n≤12) :           |
| .....             | Word number=n;                  |
| <b>DATA (0)</b>   | Byte number=2n;                 |
| <b>CRC</b>        | Command code: 1-byte            |
| <b>End 1</b>      | Static time exceeding 3.5 bytes |

Detailed explanations are as below:

#### ➤ **STX (Communication starting)**

ASCII mode: ':' byte (3AH) .

RTU mode: Static time exceeding 3.5 bytes under current communication speed.

#### ➤ **ADR (communication address)**

Valid communication address is between 1 and 127. For example: to communicate with servo drive of Axis 16 (hexadecimal: 10H) :

ASCII mode: ADR='1', '0'=> '1'=31H, '0'=30H

RTU mode: ADR = 10H

#### ➤ **CMD (command code) & DATA (data content)**

DATA format is determined by CMD. Common CMD listed below:

| Command | Meaning             | Remarks             |
|---------|---------------------|---------------------|
| 03H     | Read N words, N≤29  | Standard command 03 |
| 06H     | Write 1 word        | Standard command 06 |
| 10H     | Write N words, N≤29 | Standard command 10 |

### 1) CMD: 03H (Read N words, $N \leq 29$ )

For example, to continuously read 2 words from starting address 0200H of servo drive Axis 01H:

ASCII mode:

| Command                        |       | Response                             |               |
|--------------------------------|-------|--------------------------------------|---------------|
| STX                            | ‘:’   | STX                                  | ‘:’           |
| ADR                            | ‘0’   | ADR                                  | ‘0’           |
|                                | ‘1’   |                                      | ‘1’           |
| CMD                            | ‘0’   | CMD                                  | ‘0’           |
|                                | ‘3’   |                                      | ‘3’           |
| Starting address (high to low) | ‘0’   | Data quantity (bytes)                | ‘0’           |
|                                | ‘2’   |                                      | ‘4’           |
|                                | ‘0’   | Starting address 0200H (high to low) | ‘0’           |
|                                | ‘0’   |                                      | ‘0’           |
| Data quantity (WORD)           | ‘0’   |                                      | ‘B’           |
|                                | ‘0’   |                                      | ‘1’           |
|                                | ‘0’   | Second address 0200H (high to low)   | ‘1’           |
|                                | ‘2’   |                                      | ‘F’           |
| LRC Check (high to low)        | ‘F’   |                                      | ‘4’           |
|                                | ‘8’   |                                      | ‘0’           |
| End 1                          | (0DH) | LRC Check (high to low)              | ‘E’           |
| End 0                          | (0AH) |                                      | ‘8’           |
|                                |       | End 1                                | (0DH)<br>(CR) |
|                                |       | End 0                                | (0AH)<br>(LF) |

RTU mode:

| Command                        |     | Response                             |     |
|--------------------------------|-----|--------------------------------------|-----|
| ADR                            | 01H | ADR                                  | 01H |
| CMD                            | 03H | CMD                                  | 03H |
| Starting address (high to low) | 02H | Data quantity (bytes)                | 04H |
|                                | 00H |                                      | 00H |
| Data byte number (high to low) | 00H | Starting address 0200H (high to low) | B1H |
|                                | 02H |                                      | 1FH |
| CRC check low                  | C5H | Second address 0200H (high to low)   | 40H |
| CRC check high                 | B3H |                                      | A3H |
|                                |     | CRC check low                        | A3H |
|                                |     | CRC check high                       | D4H |

---

## 2) CMD: 06H (write one word)

For example, write 100 (0064H) to starting address 0200H of servo drive Axis 01H:

ASCII mode:

| Command                        |               | Response                             |               |
|--------------------------------|---------------|--------------------------------------|---------------|
| STX                            | ‘.’           | STX                                  | ‘.’           |
| ADR                            | ‘0’           | ADR                                  | ‘0’           |
|                                | ‘1’           |                                      | ‘1’           |
| CMD                            | ‘0’           | CMD                                  | ‘0’           |
|                                | ‘6’           |                                      | ‘6’           |
| Starting address (high to low) | ‘0’           | Starting address 0200H (high to low) | ‘0’           |
|                                | ‘2’           |                                      | ‘2’           |
|                                | ‘0’           |                                      | ‘0’           |
|                                | ‘0’           |                                      | ‘0’           |
| Data content (high to low)     | ‘0’           | Data content (high to low)           | ‘0’           |
|                                | ‘0’           |                                      | ‘0’           |
|                                | ‘6’           |                                      | ‘6’           |
|                                | ‘4’           |                                      | ‘4’           |
| LRC Check (high to low)        | ‘9’           | LRC Check (high to low)              | ‘9’           |
|                                | ‘3’           |                                      | ‘3’           |
| End 1                          | (0DH)<br>(CR) | End 1                                | (0DH)<br>(CR) |
| End 0                          | (0AH)<br>(LF) | End 0                                | (0AH)<br>(LF) |

RTU mode:

| Command                        |     | Response                       |     |
|--------------------------------|-----|--------------------------------|-----|
| ADR                            | 01H | ADR                            | 01H |
| CMD                            | 06H | CMD                            | 06H |
| Starting address (high to low) | 02H | Starting address (high to low) | 02H |
|                                | 00H |                                | 00H |
| Data content (high to low)     | 00H | Data content (high to low)     | 00H |
|                                | 64H |                                | 64H |
| CRC check low                  | 89H | CRC check low                  | 89H |
| CRC check high                 | 99H | CRC check high                 | 99H |

---

### 3) CMD: 10H (write N words, $N \leq 29$ )

For example, write 100 (0064H) , 102 (0066H) to starting address 0200H of servo drive Axis 01H:

**ASCII mode:**

| Command                        |               | Response                       |               |
|--------------------------------|---------------|--------------------------------|---------------|
| STX                            | ‘.’           | STX                            | ‘.’           |
| ADR                            | ‘0’           | ADR                            | ‘0’           |
|                                | ‘1’           |                                | ‘1’           |
| CMD                            | ‘1’           | CMD                            | ‘1’           |
|                                | ‘0’           |                                | ‘0’           |
| Starting address (high to low) | ‘0’           | Starting address (high to low) | ‘0’           |
|                                | ‘2’           |                                | ‘2’           |
|                                | ‘0’           |                                | ‘0’           |
|                                | ‘0’           |                                | ‘0’           |
| Data word number (high place)  | ‘0’           | Data word number (high to low) | ‘0’           |
|                                | ‘0’           |                                | ‘0’           |
| Data word number (low place)   | ‘0’           |                                | ‘0’           |
|                                | ‘2’           |                                | ‘2’           |
| Data byte number               | ‘0’           | LRC Check (high to low)        | ‘9’           |
|                                | ‘4’           |                                | ‘3’           |
| Data 1 content (high to low)   | ‘0’           | End 1                          | (0DH)<br>(CR) |
|                                | ‘0’           | End 0                          | (0AH)<br>(LF) |
|                                | ‘6’           |                                |               |
|                                | ‘4’           |                                |               |
| Data 2 content (high to low)   | ‘0’           |                                |               |
|                                | ‘0’           |                                |               |
|                                | ‘6’           |                                |               |
|                                | ‘6’           |                                |               |
| LRC Check (high to low)        | ‘1’           |                                |               |
|                                | ‘D’           |                                |               |
| End 1                          | (0DH)<br>(CR) |                                |               |
| End 0                          | (0AH)<br>(LF) |                                |               |



---

**RTU mode:**

**Command**

|                                       |            |
|---------------------------------------|------------|
| <b>ADR</b>                            | <b>01H</b> |
| <b>CMD</b>                            | <b>10H</b> |
| <b>Starting address (high to low)</b> | <b>02H</b> |
|                                       | <b>00H</b> |
| <b>Data word number (high to low)</b> | <b>00H</b> |
|                                       | <b>02H</b> |
| <b>Data byte number</b>               | <b>04H</b> |
| <b>Data 1 content</b>                 | <b>00H</b> |
|                                       | <b>64H</b> |
| <b>Data 2 content</b>                 | <b>00H</b> |
|                                       | <b>66H</b> |
| <b>CRC check low</b>                  | <b>50H</b> |
| <b>CRC check high</b>                 | <b>11H</b> |

**Response**

|                                       |            |
|---------------------------------------|------------|
| <b>ADR</b>                            | <b>01H</b> |
| <b>CMD</b>                            | <b>10H</b> |
| <b>Starting address (high to low)</b> | <b>02H</b> |
|                                       | <b>00H</b> |
| <b>Data word number (high to low)</b> | <b>00H</b> |
|                                       | <b>02H</b> |
| <b>CRC check low</b>                  | <b>40H</b> |
| <b>CRC check high</b>                 | <b>70H</b> |

---

➤ **LRC (ASCII mode) & CRC (RTU mode) detected error value calculation**

**ASCII mode:**

ASCII mode uses LRC (Longitudinal Redundancy Check) to detect error value. LRC detected error value is the sum from ADR to last data content and use 256 as unit to remove excess part (for example: sum is 128H, then only use 28H), and then calculate supplement number of 2.

**RTU mode:**

RTU mode uses CRC (Cyclical Redundancy Check) detected error value.

Step 1: CRC register is a 16-bits register whose content is FFFFH;

Step 2: **Exclusive OR** compute first byte of command & low place byte of 16-bits CRC register and store the result back to CRC register.

Step 3: Check lowest place (LSB) of CRC register. If this place is 0, then move to the right by 1 place; If this place is 1, then CRC register value move to the right by 1 place and **Exclusive OR** compute with A001H.

Step 4: Go back to Step 3 until Step 3 has been executed 8 times; then to Step 5.

Step 5: Repeat Step 2 to Step 4 for next byte of the CMD until all bytes have been processed.

At this point, CRC register content is CRC detected error value.

Notes:

After calculated CRC detected error value, in command, shall first fill in CRC low place, then CRC high place.

**3) End1、End0 (communication end)**

**ASCII mode:**

(0DH) i.e. byte as '\r' (carriage return) & (0AH) i.e. byte as '\n' (new line), means communication end.

**RTU mode:**

Static time exceeding 3.5 bytes in current communication speed.

---

### 10.3.4 Communication troubleshooting

Common error causes are:

- When reading-writing parameters, data address is wrong;
- When writing parameters, data exceeds upper/lower limit of this parameter;
- Communication is interfered, data transmission error or verification error.

When above communication error occurs, the servo drive will continue running, meanwhile will send back an error frame.

Error frame format:

#### Upper controller data frame:

| Start | Slave address | Command | Data address | Verification |
|-------|---------------|---------|--------------|--------------|
|       |               |         |              |              |

#### Servo drive feedback error frame:

| Start | Slave address | Response code | Error code | Verification |
|-------|---------------|---------------|------------|--------------|
|       |               |               |            |              |

Error frame response code = command + 80H

Error code=00H: communication normal;

=01H: servo drive cannot recognize the request;

=02H: data address of the request does not exist in the servo drive;

=03H: data of the request is not allowed (exceeding upper/lower limit) ;

=04H: servo drive started to execute the request but failed;

For example: servo drive Axis number is 03H, write data 06H to parameter PA004. As both upper/lower limit of PA004 is 0, data cannot be written. Servo drive will send back an error frame; error code is 03H (exceeding upper/lower limit) . Structure is as below.

#### Upper controller data frame:

| Start | Slave address | Command | Data address | Verification |
|-------|---------------|---------|--------------|--------------|
|       | 03H           | 06H     | 0004H, 0006H |              |

#### Servo drive feedback error frame:

| Start | Slave address | Response code | Error code | Verification |
|-------|---------------|---------------|------------|--------------|
|       | 03H           | 86H           | 03H        |              |

If slave address is 00H, this is broadcast data and the servo drive will send no feedback.

## 10.4 Communication address

**Notes: W/R: writable/readable (R: readable only; W: writable only)**

| Address                                    | Meaning                                                                                  | Unit     | Data type                                                         | W/R |
|--------------------------------------------|------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------|-----|
| 0000~03E7H                                 | Parameters in Chapter 12.3.<br>Examples:<br>PA005: 0005H<br>PA101: 0065H<br>PA307: 0133H |          | Unassigned hexadecimal<br>Assigned hexadecimal<br>Assigned 32-bit | W/R |
| 0600~0628H: Monitoring display parameters. |                                                                                          |          |                                                                   |     |
| 0600H                                      | Motor speed (dP 00)                                                                      | rpm      | Assigned hexadecimal                                              | R   |
| 0601H                                      | Motor feedback pulse number (encoder unit, lower 4 digits) (dP 01)                       | pulse    | Assigned hexadecimal                                              | R   |
| 0602H                                      | Motor feedback pulse number (encoder unit, higher 5 digits) (dP 02)                      | pulse    | Assigned hexadecimal                                              | R   |
| 0603H                                      | Input pulse number before electronic gear (user unit, lower 4 digits) (dP 03)            | pulse    | Assigned hexadecimal                                              | R   |
| 0604H                                      | Input pulse number before electronic gear (user unit, higher 5 digits) (dP 04)           | pulse    | Assigned hexadecimal                                              | R   |
| 0605H                                      | Deviation pulse number (encoder unit, lower 4 digits) (dP 05)                            | pulse    | Assigned hexadecimal                                              | R   |
| 0606H                                      | Deviation pulse number (encoder unit, higher 5 digits) (dP 06)                           | pulse    | Assigned hexadecimal                                              | R   |
| 0607H                                      | Speed instruction (analog voltage instruction) (dP 07)                                   | 0.01V    | Unassigned hexadecimal                                            | R   |
| 0608H                                      | Internal speed instruction (dP 08)                                                       | rpm      | Assigned hexadecimal                                              | R   |
| 0609H                                      | Torque instruction (analog voltage instruction) (dP 09)                                  | 0.01V    | Unassigned hexadecimal                                            | R   |
| 060AH                                      | Internal torque instruction (value in relation to the rated torque) (dP 10)              | %        | Assigned hexadecimal                                              | R   |
| 060BH                                      | Torque feedback (value in relation to the rated torque) (dP 11)                          | %        | Assigned hexadecimal                                              | R   |
| 060CH                                      | Input signal monitoring (dP 12)                                                          |          | Unassigned hexadecimal                                            | R   |
| 060DH                                      | Output signal monitoring (dP 13)                                                         |          | Unassigned hexadecimal                                            | R   |
| 060EH                                      | Instruction pulse frequency (dP 14)                                                      | 0.1Khz   | Assigned hexadecimal                                              | R   |
| 060FH                                      | DC bus voltage (dP 15)                                                                   | V        | Unassigned hexadecimal                                            | R   |
| 0610H                                      | Total operation time (dP 16)                                                             | H        | Unassigned hexadecimal                                            | R   |
| 0611H                                      | Rotation angle (dP 17)                                                                   |          | Unassigned hexadecimal                                            | R   |
| 0612H                                      | Exact position of absolute encoder (single-turn or multi-turn) (dP 18)                   | 2 pulses | Unassigned hexadecimal                                            | R   |
| 0613H                                      | Number of encoder turns (only effective for multi-turn absolute encoders) (dP 19)        | turn     | Unassigned hexadecimal                                            | R   |

|       |                                                                         |       |                        |   |
|-------|-------------------------------------------------------------------------|-------|------------------------|---|
|       | 19)                                                                     |       |                        |   |
| 0614H | Cumulative load factor (take the rated cumulative load as 100%) (dP 20) | %     | Unassigned hexadecimal | R |
| 0617H | Load inertial ratio (dP 23)                                             | %     | Unassigned hexadecimal | R |
| 0618H | Effective gain monitoring (dP 24)                                       |       | Unassigned hexadecimal | R |
|       |                                                                         |       |                        |   |
| 0630H | Current alarm code                                                      |       | Unassigned hexadecimal | R |
| 0631H | Current warning code                                                    |       | Unassigned hexadecimal | R |
|       |                                                                         |       |                        |   |
| 0780H | Absolute encoder multi-turn data                                        | turn  | Unassigned hexadecimal | R |
| 0781H | Absolute encoder single turn data high place                            | pulse | Unassigned 32-bit      | R |
| 0782H | Absolute encoder single turn data low place                             | pulse |                        | R |
|       |                                                                         |       |                        |   |
| 0783H | Motor feedback position low place                                       | pulse | Assigned 32-bit        | R |
| 0784H | Motor feedback position high place                                      | pulse |                        | R |
| 0785H | Motor reference position low place                                      | pulse | Assigned 32-bit        | R |
| 0786H | Motor reference position high place                                     | pulse |                        | R |

**Notes:**

All data is displayed in hexadecimal (16-bit or 32-bit) . 32-bit data consists of two 16-bit data. For example, 0781H data is 0001H and 0782H data is 013AH; then absolute encoder single turn data is 0001013AH.

# Chapter 11 Product specifications

## 11.1 Servo drive specifications

### 11.1.1 Basic specifications

|                      |  |                                                  |                         |                                                                                                                                                                                                                                                    |                              |
|----------------------|--|--------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Input voltage        |  | 220VAC                                           |                         | Singe/Three Phase 220VAC -15%~+10%, 50/60Hz                                                                                                                                                                                                        |                              |
|                      |  | 380VAC                                           |                         | Three Phase 380VAC -15%~+15%, 50/60Hz                                                                                                                                                                                                              |                              |
| Control mechanism    |  |                                                  |                         | <div><div></div>Single/Three phase full wave rectification</div> <div><div></div>IGBT PWM control, sine-wave current control</div>                                                                                                                 |                              |
| Feedback devices     |  |                                                  |                         | <div><div></div>5000-LINE LINE-SAVING (GAIN)</div> <div><div></div>17-BIT SERIAL (ABSOLUTE)</div> <div><div></div>20-BIT SERIAL (GAIN)</div> <div><div></div>RESOLVER</div>                                                                        |                              |
| Use conditions       |  | Ambient temperature                              |                         | <div><div></div>Use temperature: 0~+45℃</div> <div><div></div>Storage temperature: -20~55℃</div>                                                                                                                                                   |                              |
|                      |  | Humidity                                         |                         | Below 90%RH (no freezing or condensing)                                                                                                                                                                                                            |                              |
|                      |  | Vibration                                        |                         | 4.9 m/s <sup>2</sup> ~19.6 m/s <sup>2</sup>                                                                                                                                                                                                        |                              |
|                      |  | Protection class/cleanness                       |                         | Protection class: IP10; Cleanness: 2. But should be: <div><div></div>·With no corrosive or combustible gas</div> <div><div></div>·With no water, oil or drug splashing</div> <div><div></div>·With little dust, ash, salt or metallic powder</div> |                              |
|                      |  | Altitude                                         |                         | Below 1000m                                                                                                                                                                                                                                        |                              |
| Performance          |  | Speed control precision                          |                         | 1:5000                                                                                                                                                                                                                                             |                              |
|                      |  | Speed fluctuation rate                           | Load fluctuation        | 0 ~100% load: below ±0.01% (at rated speed)                                                                                                                                                                                                        |                              |
|                      |  |                                                  | Voltage fluctuation     | Rated voltage ±10%: 0.001% (at rated speed)                                                                                                                                                                                                        |                              |
|                      |  |                                                  | Temperature fluctuation | 25 ±25℃: below ±0.1% (at rated speed)                                                                                                                                                                                                              |                              |
|                      |  | Torque control precision                         |                         | ±3% (repeatable)                                                                                                                                                                                                                                   |                              |
|                      |  | Soft start time                                  |                         | 0~5s (acceleration or deceleration)                                                                                                                                                                                                                |                              |
| Input/output signals |  | Encoder pulse output (A phase, B phase, Z phase) |                         | <div><div></div>5000 line-saving encoder: 16~5000;</div> <div><div></div>17-bit serial encoder:16~16384;</div> <div><div></div>20-bit serial encoder: 16~1,048,576.</div>                                                                          |                              |
|                      |  | Sequential input signals                         |                         | Pin number                                                                                                                                                                                                                                         | 8                            |
|                      |  |                                                  |                         | Functions                                                                                                                                                                                                                                          | S-ON, C-MODE, POT, NOT, etc. |

|                               |                           |         |                                                                                        |                                    |
|-------------------------------|---------------------------|---------|----------------------------------------------------------------------------------------|------------------------------------|
|                               | Sequential output signals |         | Pin number                                                                             | 4                                  |
|                               |                           |         | Functions                                                                              | ALM, COIN, CZ, BK-OFF, S-RDY, etc. |
| Communication functions       | RS485                     | 1: N    | With relay, maximum N=31                                                               |                                    |
|                               |                           | Address | By parameter setting                                                                   |                                    |
|                               |                           | Devices | PC, upper controller                                                                   |                                    |
| Display/keypad                |                           |         | 7 LED X 5 bit, 4 buttons                                                               |                                    |
| Dynamic brake (DB) (optional) |                           |         | At Servo OFF, forward/backward rotation inhibition, power OFF, or stop due to failure. |                                    |
| Regenerative functions        |                           |         | Internal or external                                                                   |                                    |
| Over-travel (OT) protections  |                           |         | POT, NOT. DB, deceleration to stop, coast to stop.                                     |                                    |
| Protection functions          |                           |         | Over-current, over-voltage, under-voltage, over-load, regenerative fault, etc.         |                                    |

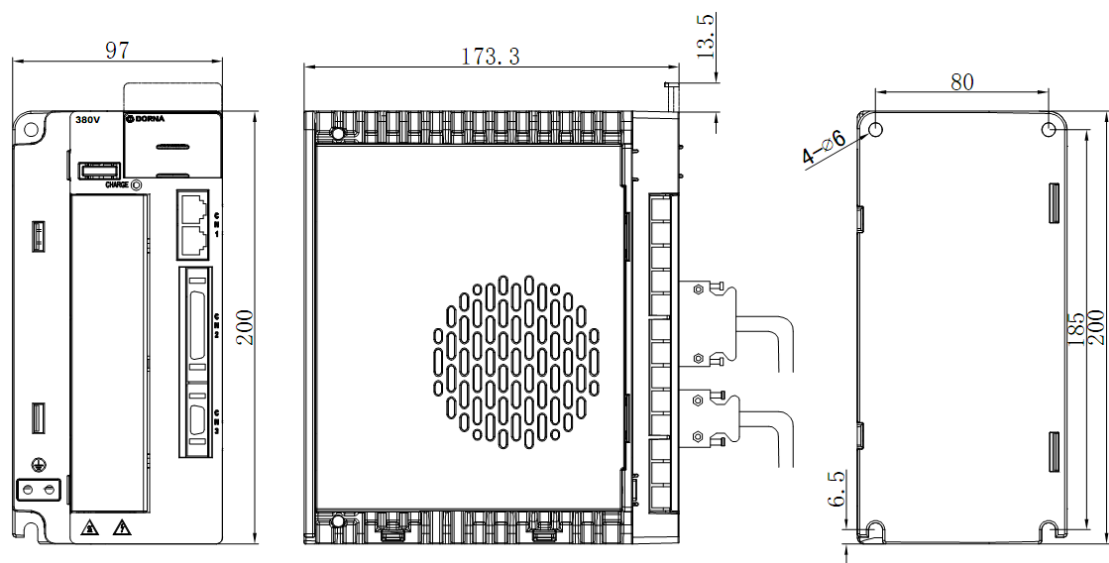
### 11.1.2 Position/speed/torque control specifications

|                  |                           |                               |                                     |           |         |         |
|------------------|---------------------------|-------------------------------|-------------------------------------|-----------|---------|---------|
| Position control | Feedforward compensation  |                               | 0~100% (Unit: 1%)                   |           |         |         |
|                  | Position completion width |                               | 0~65535 Encoder unit                |           |         |         |
|                  | Input signals             | Pulse form                    | PULS+SIGN, CW+CCW, A+B              |           |         |         |
|                  |                           | Pulse status                  | Support line-driver, open collector |           |         |         |
|                  |                           | Maximum input pulse frequency |                                     | PULS+SIGN | CW+CCW  | A+B     |
|                  |                           |                               | Long line-driver                    | 4Mbps     | 4 Mpps  | 1 Mpps  |
|                  |                           |                               | Line-driver                         | 500Kpps   | 500Kpps | 125Kpps |
|                  |                           |                               | Open-collector                      | 200Kpps   | 200Kpps | 200Kpps |
|                  |                           | Clearance                     | Clear deviation pulses              |           |         |         |
|                  | Internal position         | Position selection            | External input signals              |           |         |         |
| Speed control    | Soft start time           |                               | 0~5s                                |           |         |         |
|                  | Input signals             | Instruction voltage           | $\pm 10$ V                          |           |         |         |
|                  |                           | Input resistance              | Approximately 9k $\Omega$           |           |         |         |
|                  | Internal speed            | Speed selection               | External input signals              |           |         |         |
| Torque control   | Input signals             | Instruction voltage           | $\pm 10$ V                          |           |         |         |
|                  |                           | Input resistance              | Approximately 9k $\Omega$           |           |         |         |

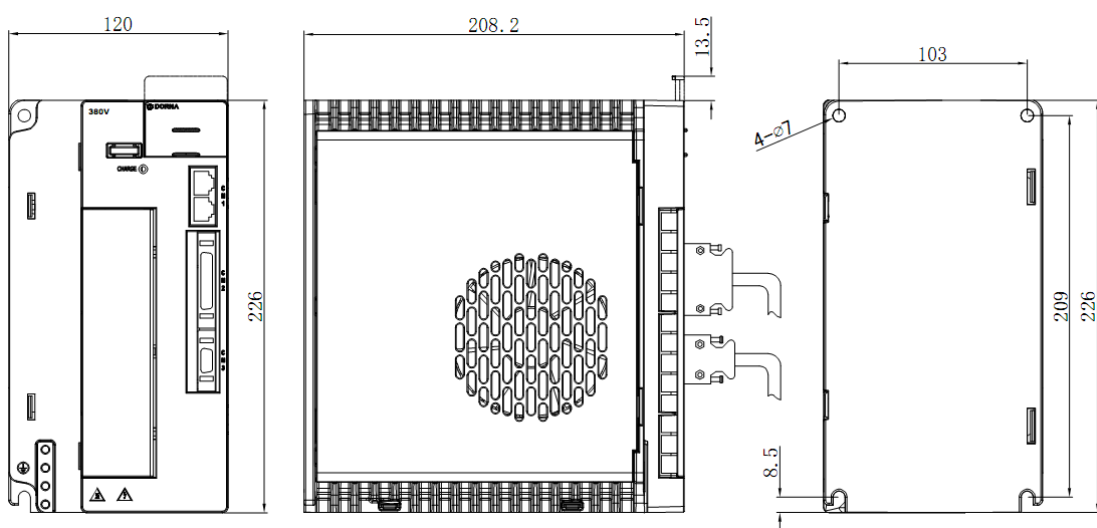




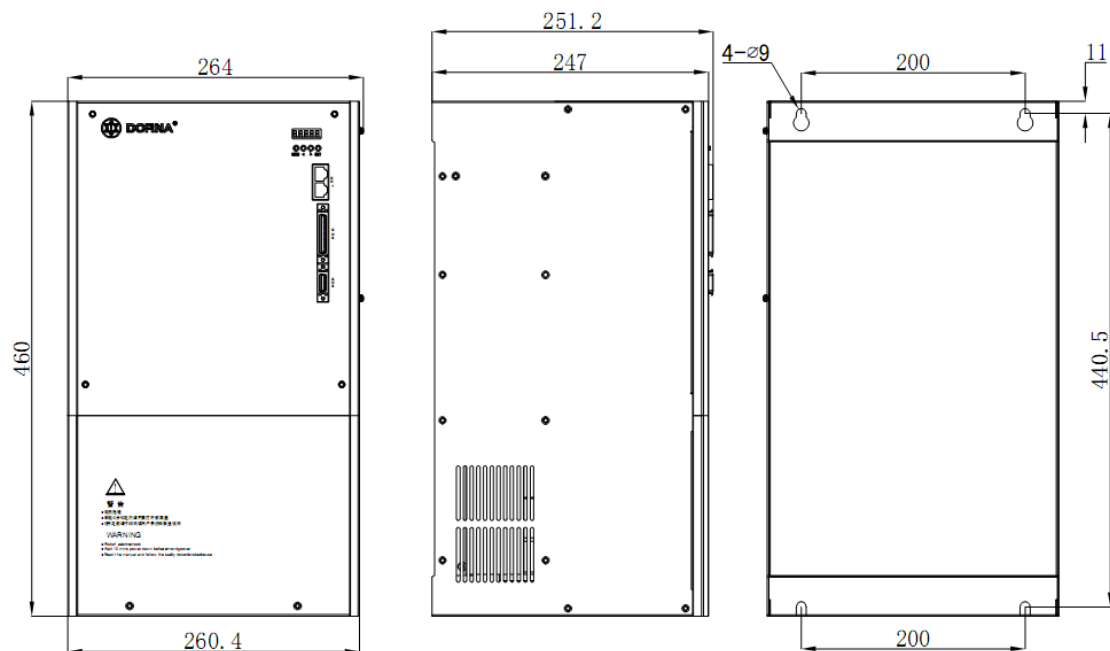
### C type case:



### D type case:



## E type case:



### Notes:

- Unit is mm.
- Dimensions are subject to changes without prior notice.

## 11.2 Servo motor specifications & dimensions

### General specifications

Working system: S1 continuous

Heat resistance class: B

Vibration: 5G

Insulation voltage class: AC1500V, 1 minute

Insulation resistance: DC500V, above 10MΩ

Installation mode: Flange

Working temperature: 0~40℃ (no freezing)

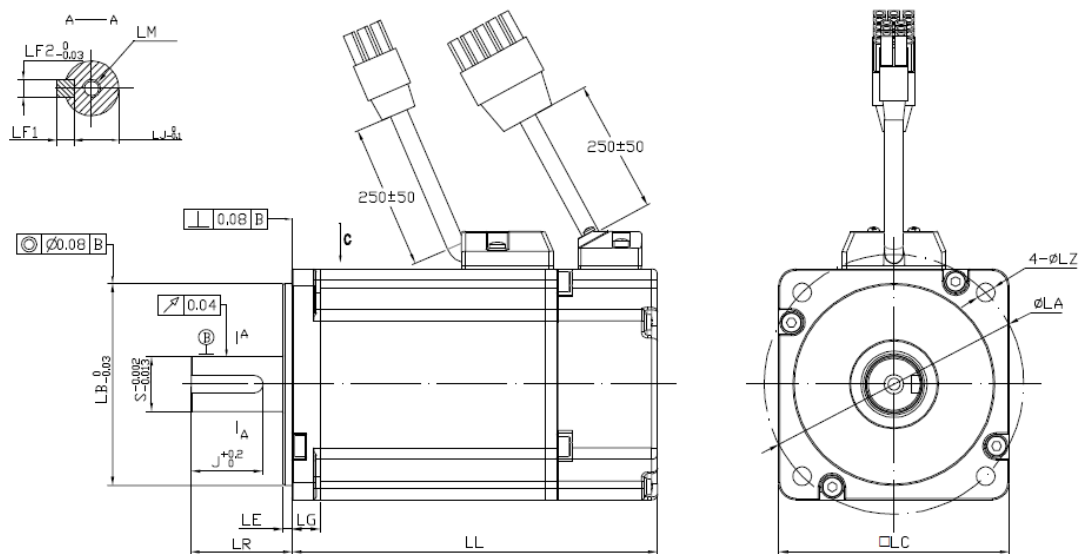
Operating humidity: 20%~80% (no dewing)

Altitude: Below 1000m

Protections: Full-enclosed IP65 (except the shaft-through part)

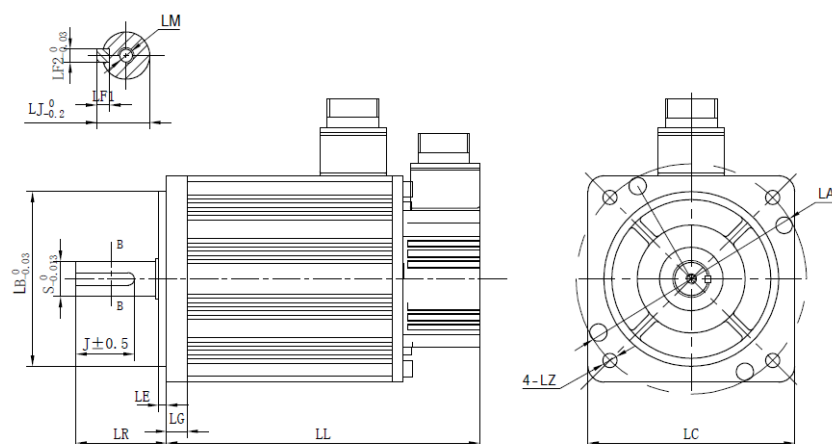
## 60/80 Series

| Servo Motor series                      | 60 series    |              | 80 Series    |              |
|-----------------------------------------|--------------|--------------|--------------|--------------|
| Servo Motor model                       | 60DNMA2-0D20 | 60DNMA2-0D40 | 80DNMA2-0D75 | 80DNMA2-0001 |
| Input voltage                           | 220VAC       |              |              |              |
| Inertia                                 | High         | High         | High         | Medium       |
| Rated power (W)                         | 200          | 400          | 750          | 1000         |
| Rated torque (N*m)                      | 0.64         | 1.27         | 2.39         | 3.18         |
| Rated current (A)                       | 1.4          | 2.5          | 3.7          | 5.1          |
| Maximum current (A)                     | 4.2          | 7.5          | 11.1         | 15.3         |
| Rated speed (rpm)                       | 3000         | 3000         | 3000         | 3000         |
| Maximum speed (rpm)                     | 5000         | 5000         | 5000         | 5000         |
| Torque constant (N*m/Amp)               | 0.45         | 0.508        | 0.64         | 0.62         |
| Back EMF constant (V/Krpm)              | 29           | 33           | 43           | 41           |
| Rotary inertia (with brake) (10-4Kg*m2) | 0.14 (0.16)  | 0.67 (0.68)  | 1.5 (1.53)   | 1.12 (1.15)  |
| Resistance (line-line) ( $\Omega$ )     | 8.4          | 4.28         | 1.5          | 1.2          |
| Inductance (line-line) (mH)             | 26.5         | 15.4         | 7.9          | 6.1          |
| Mass (with brake) (kg)                  | 1.03 (1.53)  | 1.59 (2.05)  | 2.93 (4.03)  | 3.12 (4.12)  |
| LL (with brake) (mm)                    | 105(140)     | 140(175)     | 144.7(183.9) | 144.7(183.9) |
| LR (mm)                                 | 30           | 30           | 35           | 35           |
| LE (mm)                                 | 3            | 3            | 3            | 3            |
| LG (mm)                                 | 8            | 8            | 8            | 8            |
| S (mm)                                  | 14           | 14           | 19           | 19           |
| LJ1 (mm)                                | 0            | 0            | 0            | 0            |
| LJ (mm)                                 | 11           | 11           | 15.5         | 15.5         |
| J (mm)                                  | 20           | 20           | 25           | 25           |
| LF1 (mm)                                | 5            | 5            | 6            | 6            |
| LF2 (mm)                                | 5            | 5            | 6            | 6            |
| LM (mm)                                 | M4 deep 15   | M4 deep 15   | M5 deep 20   | M5 deep 20   |
| LA (mm)                                 | 70           | 70           | 90           | 90           |
| LB (mm)                                 | 50           | 50           | 70           | 70           |
| LC (mm)                                 | 60           | 60           | 80           | 80           |
| LZ (mm)                                 | 5.5          | 5.5          | 6.5          | 6.5          |



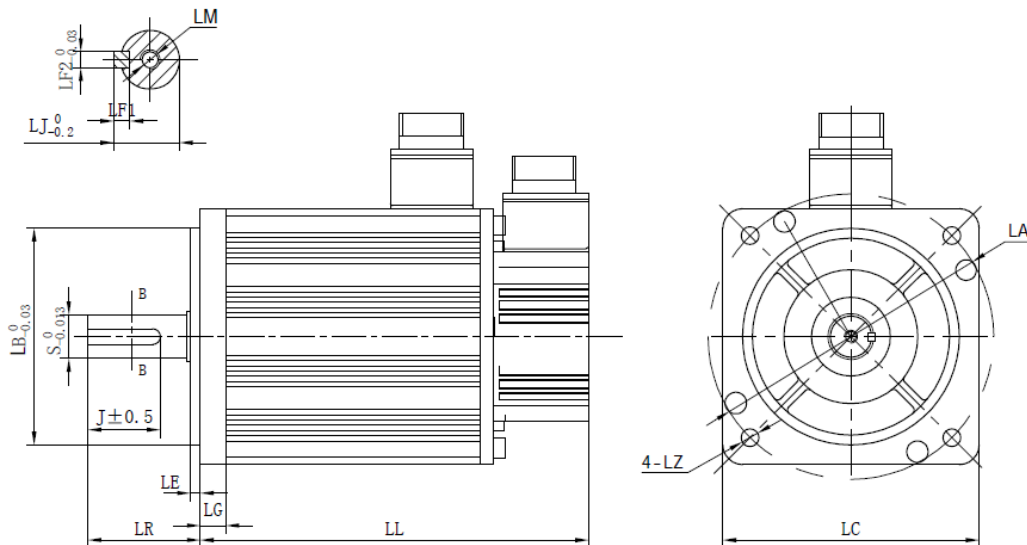
## 130 Series (220V class)

| Servo Motor series                                                | 130 Series     |                |                |                |
|-------------------------------------------------------------------|----------------|----------------|----------------|----------------|
| Servo Motor model                                                 | 130DNMA2-0001C | 130DNMA2-01D5C | 130DNMA2-0002C | 130DNMA2-0003C |
| Input voltage                                                     | 220VAC         | 220VAC         | 220VAC         | 220VAC         |
| Inertia                                                           | Medium         |                |                |                |
| Rated power (W)                                                   | 1000           | 1500           | 2000           | 3000           |
| Rated torque (N*m)                                                | 4.77           | 7.16           | 9.55           | 14.33          |
| Rated current (A)                                                 | 5              | 8.4            | 10.3           | 13.5           |
| Maximum current (A)                                               | 15             | 25.2           | 30.1           | 40.5           |
| Rated speed (rpm)                                                 | 2000           | 2000           | 2000           | 2000           |
| Maximum speed (rpm)                                               | 3000           | 3000           | 3000           | 3000           |
| Torque constant (N*m/Amp)                                         | 0.95N. m/Arms  | 0.85N. m/Arms  | 0.93N. m/Arms  | 1.07N. m/Arms  |
| Back EMF constant (V/Krpm)                                        | 66V/Krpm       | 59.8V/Krpm     | 72.6V/Krpm     | 76V/Krpm       |
| Rotary inertia (with brake) ( $10^{-4}\text{Kg}\cdot\text{m}^2$ ) | 7.1 (7.5)      | 10.6 (11.1)    | 13.8 (14.3)    | 20.4 (20.9)    |
| Resistance (line-line) ( $\Omega$ )                               | 1.08           | 0.543          | 0.52           | 0.32           |
| Inductance (line-line) (mH)                                       | 12.8           | 6.3            | 6.8            | 4.7            |
| Mass (with brake) (kg)                                            | 6.5 (8.8)      | 8 (10.5)       | 9.6 (11.9)     | 12.6 (14.9)    |
| LL (with brake) (mm)                                              | 154 (198)      | 173 (217)      | 192 (236)      | 230 (274)      |
| LR (mm)                                                           | 58             | 58             | 58             | 58             |
| LE (mm)                                                           | 6              | 6              | 6              | 6              |
| LG (mm)                                                           | 12             | 12             | 12             | 12             |
| S (mm)                                                            | 22             | 22             | 22             | 22             |
| LJ1 (mm)                                                          | 0              | 0              | 0              | 0              |
| LJ (mm)                                                           | 18             | 18             | 18             | 18             |
| J (mm)                                                            | 36             | 36             | 36             | 36             |
| LF1 (mm)                                                          | 7              | 7              | 7              | 7              |
| LF2 (mm)                                                          | 8              | 8              | 8              | 8              |
| LM (mm)                                                           | M6 deep 15     | M6 deep 15     | M6 deep 15     | M6 deep 15     |
| LA (mm)                                                           | 145            | 145            | 145            | 145            |
| LB (mm)                                                           | 110            | 110            | 110            | 110            |
| LC (mm)                                                           | 130            | 130            | 130            | 130            |
| LZ (mm)                                                           | 9.5            | 9.5            | 9.5            | 9.5            |



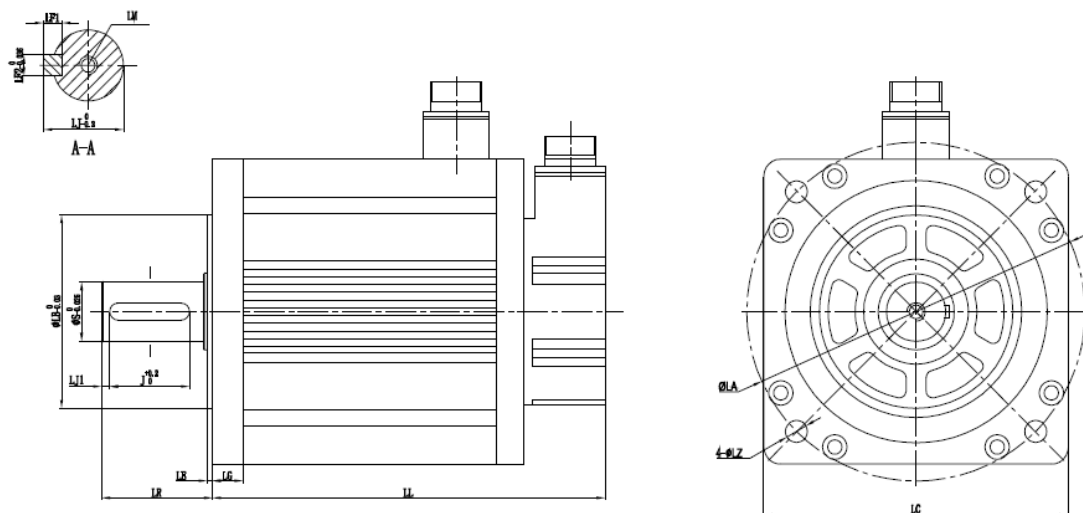
**130 Series (380V class): motors listed in this table already replaced by DNMB2**

| Servo Motor series                   | 130 Series     |                |                |                |
|--------------------------------------|----------------|----------------|----------------|----------------|
| Servo Motor model                    | 130DNMB1-0001C | 130DNMB1-01D5C | 130DNMB1-02D2C | 130DNMB1-0003C |
| Input voltage                        | 380VAC         |                |                |                |
| Rated power (KW)                     | 1              | 1.5            | 2.2            | 3              |
| Rated torque (N*m)                   | 4.77           | 7.16           | 10.5           | 14.33          |
| Maximum torque (N*m)                 | 14.31          | 21.48          | 31.5           | 42.99          |
| Rated current (A)                    | 3.2            | 4.5            | 6.2            | 8.7            |
| Maximum current (A)                  | 9.6            | 13.5           | 18.6           | 26.1           |
| Rated speed (rpm)                    | 2000           | 2000           | 2000           | 2000           |
| Maximum speed (rpm)                  | 3000           | 3000           | 3000           | 3000           |
| Torque constant (N*m/Amp)            | 1.49           | 1.59           | 1.69           | 1.64           |
| Back EMF constant (V/Krpm)           | 113            | 120            | 120            | 117            |
| Rotary inertia (w/brake) (10-4Kg*m2) | 8.3 (8.6)      | 10.4 (10.7)    | 15.6 (15.9)    | 22.9 (23.2)    |
| Resistance (line-line) ( $\Omega$ )  | 3.9            | 2.02           | 1.45           | 0.78           |
| Inductance (line-line) (mH)          | 25             | 14             | 11             | 7              |
| Mass (with brake) (kg)               | 7.5 (10.3)     | 9.6 (12.4)     | 11.5 (13.3)    | 16 (18.8)      |
| LL (with brake) (mm)                 | 172 (231)      | 197 (256)      | 219 (278)      | 267 (326)      |
| LR (mm)                              | 57             | 57             | 57             | 57             |
| LE (mm)                              | 5              | 5              | 5              | 5              |
| LG (mm)                              | 13             | 13             | 13             | 13             |
| S (mm)                               | 22             | 22             | 22             | 22             |
| LJ1 (mm)                             | 0              | 0              | 0              | 0              |
| LJ (mm)                              | 24.5           | 24.5           | 24.5           | 24.5           |
| J (mm)                               | 36             | 36             | 36             | 36             |
| LF1 (mm)                             | 6              | 6              | 6              | 6              |
| LF2 (mm)                             | 6              | 6              | 6              | 6              |
| LM (mm)                              | M6 deep 15     | M6 deep 15     | M6 deep 15     | M6 deep 15     |
| LA (mm)                              | 145            | 145            | 145            | 145            |
| LB (mm)                              | 110            | 110            | 110            | 110            |
| LC (mm)                              | 130            | 130            | 130            | 130            |
| LZ (mm)                              | 9              | 9              | 9              | 9              |



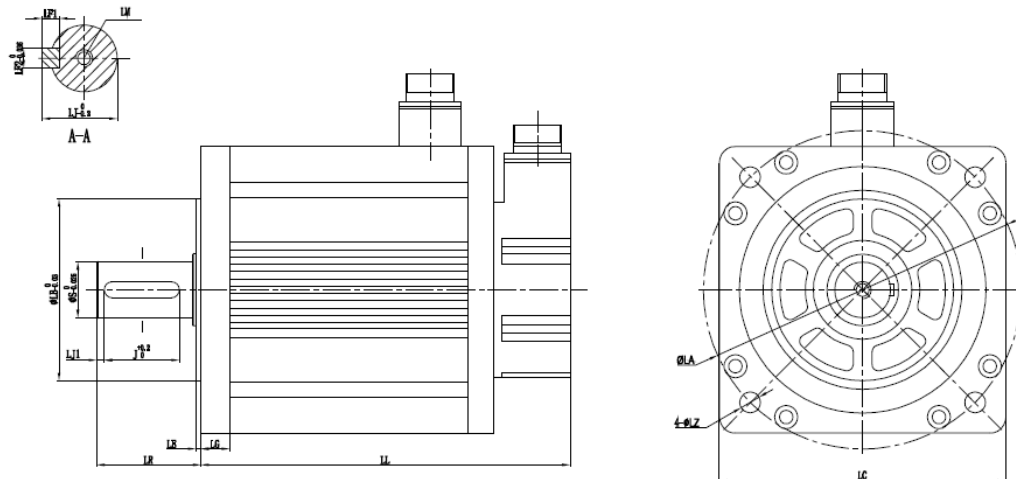
## 180 Series (220V class)

| Servo Motor series                      | 180 Series     |                |
|-----------------------------------------|----------------|----------------|
| Servo Motor model - new                 | 180DNMA1-0003B | 180DNMA1-04D5B |
| Servo Motor model - old                 | 180DNA-30B     | 180DNA-45B     |
| Input voltage                           | 220VAC         |                |
| Rated power (KW)                        | 3              | 4.5            |
| Rated torque (N*m)                      | 19.1           | 28.6           |
| Maximum torque (N*m)                    | 57.3           | 85.8           |
| Rated current (A)                       | 12             | 18.4           |
| Maximum current (A)                     | 36             | 55.2           |
| Rated speed (rpm)                       | 1500           | 1500           |
| Maximum speed (rpm)                     | 2000           | 2000           |
| Torque constant (N*m/Amp)               | 1.59           | 1.55           |
| Back EMF constant (V/Krpm)              | 107            | 112            |
| Rotary inertia (with brake) (10-4Kg*m2) | 47.7 (48.2)    | 69 (69.5)      |
| Resistance (line-line) ( $\Omega$ )     | 0.67           | 0.32           |
| Inductance (line-line) (mH)             | 4.65           | 3.3            |
| Mass (with brake) (kg)                  | 19.5 (24.5)    | 23.5 (28.5)    |
| LL (with brake) (mm)                    | 212 (287)      | 252 (327)      |
| LR (mm)                                 | 65             | 65             |
| LE (mm)                                 | 3.2            | 3.2            |
| LG (mm)                                 | 18             | 18             |
| S (mm)                                  | 35             | 35             |
| LJ1 (mm)                                | 3              | 3              |
| LJ (mm)                                 | 38             | 38             |
| J (mm)                                  | 51             | 51             |
| LF1 (mm)                                | 8              | 8              |
| LF2 (mm)                                | 10             | 10             |
| LM (mm)                                 | M8 deep 20     | M8 deep 20     |
| LA (mm)                                 | 200            | 200            |
| LB (mm)                                 | 114.3          | 114.3          |
| LC (mm)                                 | 180            | 180            |
| LZ (mm)                                 | 13             | 13             |



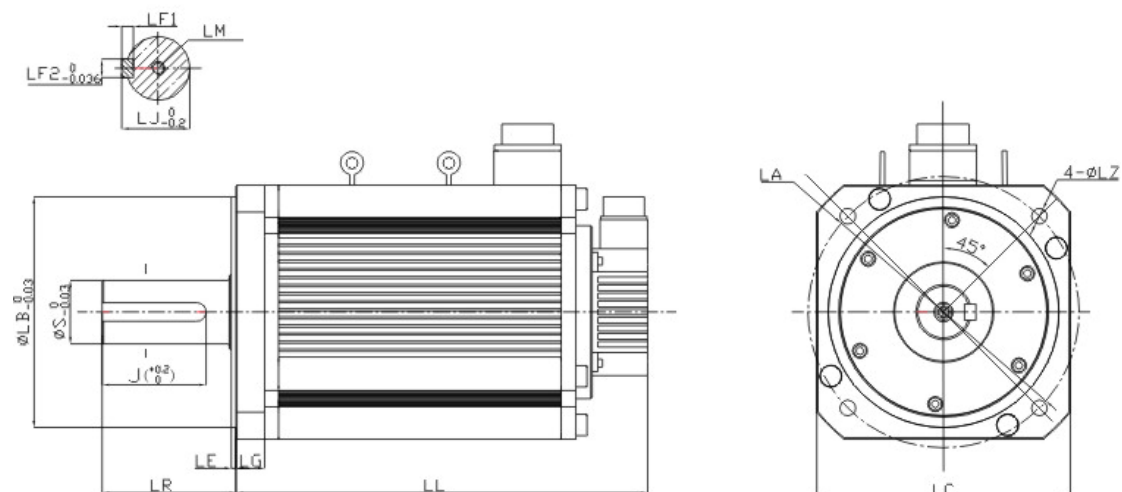
## 180 series (380V class)

| Servo Motor series                      | 180 Series     |                |                |                |
|-----------------------------------------|----------------|----------------|----------------|----------------|
| Servo Motor model - new                 | 180DNMB1-0003B | 180DNMB1-04D5B | 180DNMB1-05D5B | 180DNMB1-07D5B |
| Servo Motor model - old                 | DNBB18-0003B   | DNBB18-04D5B   | DNBB18-05D5B   | DNBB18-07D5B   |
| Input voltage                           | 380VAC         |                |                |                |
| Rated power (KW)                        | 3              | 4.5            | 5.5            | 7.5            |
| Rated torque (N*m)                      | 19.1           | 28.6           | 35             | 47.7           |
| Maximum torque (N*m)                    | 57.3           | 85.8           | 105            | 143.1          |
| Rated current (A)                       | 6.8            | 10.3           | 12.5           | 17.5           |
| Maximum current (A)                     | 20.4           | 30.9           | 37.5           | 52.5           |
| Rated speed (rpm)                       | 1500           | 1500           | 1500           | 1500           |
| Maximum speed (rpm)                     | 2000           | 2000           | 2000           | 2000           |
| Torque constant (N*m/Amp)               | 2.81           | 2.78           | 2.80           | 2.73           |
| Back EMF constant (V/Krpm)              | 225            | 210            | 200            | 142            |
| Rotary inertia (with brake) (10-4Kg*m2) | 47.7 (48.2)    | 69 (69.5)      | 77.5 (78)      | 121 (121.5)    |
| Resistance (line-line) ( $\Omega$ )     | 2.9            | 1.18           | 0.88           | 0.24           |
| Inductance (line-line)                  | 21             | 10             | 9.4            | 2.45           |
| Mass (with brake) (kg)                  | 20 (25)        | 24 (29)        | 31.5 (36.5)    | 37 (42)        |
| LL (with brake) (mm)                    | 212 (287)      | 252 (327)      | 272 (347)      | 332 (407)      |
| LR (mm)                                 | 65             | 65             | 65             | 65             |
| LE (mm)                                 | 3.2            | 3.2            | 3.2            | 3.2            |
| LG (mm)                                 | 18             | 18             | 18             | 18             |
| S (mm)                                  | 35             | 35             | 35             | 35             |
| LJ1 (mm)                                | 3              | 3              | 3              | 3              |
| LJ (mm)                                 | 38             | 38             | 38             | 38             |
| J (mm)                                  | 51             | 51             | 51             | 51             |
| LF1 (mm)                                | 8              | 8              | 8              | 8              |
| LF2 (mm)                                | 10             | 10             | 10             | 10             |
| LM (mm)                                 | M8 deep 20     | M8 deep 20     | M8 deep 20     | M8 deep 20     |
| LA (mm)                                 | 200            | 200            | 200            | 200            |
| LB (mm)                                 | 114.3          | 114.3          | 114.3          | 114.3          |
| LC (mm)                                 | 180            | 180            | 180            | 180            |
| LZ (mm)                                 | 13             | 13             | 13             | 13             |



## 200 Series

| Servo Motor series                              | 200 Series     |                |                |                |
|-------------------------------------------------|----------------|----------------|----------------|----------------|
| Servo Motor model                               | 200DNMB1-07D3C | 200DNMB1-14D7C | 200DNMB1-0022C | 200DNMB1-29D3C |
| Rated power (KW)                                | 7.3            | 14.7           | 22.0           | 29.0           |
| Input voltage                                   | 380VAC         |                |                |                |
| Rated torque (N*m)                              | 35             | 70             | 105            | 140            |
| Maximum torque (N*m)                            | 105            | 210            | 315            | 420            |
| Rated current (A)                               | 13             | 25             | 37             | 55             |
| Maximum current (A)                             | 39.8           | 76.5           | 113.2          | 168.3          |
| Rated speed (rpm)                               | 2000           | 2000           | 2000           | 2000           |
| Maximum speed (rpm)                             | 2400           | 2400           | 2400           | 2400           |
| Torque constant (N*m/Amp)                       | 2.69           | 2.80           | 2.84           | 2.55           |
| Back EMF constant (V/Krpm)                      | 1.5            | 1.5            | 1.5            | 1.5            |
| Rotary inertia (with brake) (10 <sup>-3</sup> ) | 5.5            | 10             | 14             | 17.5           |
| Resistance (line-line) ( $\Omega$ )             | 1.2            | 0.48           | 0.3            | 0.18           |
| Inductance (line-line) (mH)                     | 13             | 6.08           | 4.5            | 2.7            |
| Mass (with brake) (kg)                          | 35             | 47             | 60             | 72             |
| LL (with brake) (mm)                            | 363            | 433            | 503            | 573            |
| LR (mm)                                         | 82             | 82             | 82             | 82             |
| LE (mm)                                         | 4              | 4              | 4              | 4              |
| LG (mm)                                         | 16.5           | 16.5           | 16.5           | 16.5           |
| S (mm)                                          | 42             | 42             | 42             | 42             |
| LJ1 (mm)                                        | 0              | 0              | 0              | 0              |
| LJ (mm)                                         | 37             | 37             | 37             | 37             |
| J (mm)                                          | 66             | 66             | 66             | 66             |
| LF1 (mm)                                        | 8              | 8              | 8              | 8              |
| LF2 (mm)                                        | 12             | 12             | 12             | 12             |
| LM (mm)                                         | M12 deep 30    | M12 deep 30    | M12 deep 30    | M12 deep 30    |
| LA (mm)                                         | 215            | 215            | 215            | 215            |
| LB (mm)                                         | 180            | 180            | 180            | 180            |
| LC (mm)                                         | 200            | 200            | 200            | 200            |
| LZ (mm)                                         | 13.5           | 13.5           | 13.5           | 13.5           |





# Chapter 12 Appendix

## 12.1 List of monitoring display functions

| No.   | Function                                                                                                                                                                                                               | Unit                             |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| dP 00 | <b>Motor speed</b><br>Display the motor operating speed                                                                                                                                                                | [rpm]                            |
| dP 01 | <b>Motor feedback pulse number (encoder unit, lower 4 digits)</b><br>Display the lower 4 digits of the sum of motor encoder feedback pulse.                                                                            | [1 encoder pulse]                |
| dP 02 | <b>Motor feedback pulse number (encoder unit, higher 5 digits)</b><br>Display the higher 5 digits of the sum of motor encoder feedback pulse.                                                                          | [10 <sup>4</sup> encoder pulses] |
| dP 03 | <b>Input pulse number before electronic gear (user unit, lower 4 digits)</b><br>Lower 4 digits of the sum of input pulse number in position control mode.                                                              | [1 input pulse]                  |
| dP 04 | <b>Input pulse number before electronic gear (user unit, higher 5 digits)</b><br>Higher 5 digits of the sum of input pulse number in position control mode.                                                            | [[10 <sup>4</sup> input pulses]  |
| dP 05 | <b>Deviation pulse number (encoder unit, lower 4 digits)</b><br>Lower 4 digits of the sum of deviation pulse number in position control mode.                                                                          | [1 encoder pulse]                |
| dP 06 | <b>Deviation pulse number (encoder unit, higher 5 digits)</b><br>Higher 5 digits of the sum of deviation pulse number in position control mode.                                                                        | [10 <sup>4</sup> encoder pulses] |
| dP 07 | <b>Speed instruction (analog voltage instruction)</b><br>Voltage value of analog input in speed control mode, after correction of null shift. When the voltage exceeds $\pm 10V$ , it cannot be displayed correctly.   | [0.1V]                           |
| dP 08 | <b>Internal speed instruction</b><br>Internal speed instruction under speed control and position control.                                                                                                              | [r/min]                          |
| dP 09 | <b>Torque instruction (analog voltage instruction)</b><br>Voltage value of analog input in torque control mode, after correction of null shift. When the voltage exceeds $\pm 10V$ , it cannot be displayed correctly. | [0.1V]                           |
| dP 10 | <b>Internal torque instruction (value in relation to the rated torque)</b><br>Internal torque instruction in torque / speed / position control modes.                                                                  | [%]                              |
| dP 11 | <b>Torque feedback (value in relation to the rated torque)</b><br>Torque feedback value in torque / speed / position control modes.                                                                                    | [%]                              |

|       |                                                                                                                                               |                                  |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| dP 12 | <b>Input signal monitoring</b><br>Input signal status of CN2 connector                                                                        | -                                |
| dP 13 | <b>Output signal monitoring</b><br>Output signal status of CN2 connector                                                                      | -                                |
| dP 14 | <b>Instruction pulse frequency</b><br>Instruction pulse frequency of the upper controller in position control.                                | [0.1Khz]                         |
| dP 15 | <b>DC bus voltage</b><br>DC bus voltage after rectification                                                                                   | [V]                              |
| dP 16 | <b>Total operation time of the servo drive</b><br>If AF05 operation is implemented, the value will be reset.                                  | [Hours]                          |
| dP 17 | <b>Rotation angle</b><br>Display the electric rotational angle of the motor.                                                                  | [deg]                            |
| dP 18 | <b>Exact position of absolute encoder (single-turn or multi-turn)</b><br>This displays the absolute position data of the encoder in one turn. | [2 Encoder pulse]                |
| dP 19 | <b>Number of encoder turns (only for multi-turn absolute encoders)</b><br>This displays the number of turns of multi-turn absolute encoder.   | [1 turn]                         |
| dP 20 | <b>Cumulative load factor (take rated cumulative load as 100%)</b><br>Alarm grade during motor overload protection.                           | [%]                              |
| dP 21 | <b>Regeneration load factor (take rated regeneration load as 100%)</b><br>Alarm grade during regeneration overload protection                 | [%]                              |
| dP 22 | <b>DB load factor (take rated DB load as 100%)</b><br>Alarm grade during DB braking protection                                                | [%]                              |
| dP 23 | <b>Load inertial ratio</b><br>Display the ratio between load inertia and motor inertia.                                                       | [%]                              |
| dP 24 | <b>Effective gain monitoring</b><br>1: the first group of gains is effective<br>2: the second group of gains is effective                     | -                                |
| dP 30 | <b>Subsidiary software version (refer to AF 10 for main software version)</b>                                                                 | -                                |
| dP 34 | <b>External linear encoder feedback pulse counts low place</b>                                                                                | [1 encoder pulse]                |
| dP 35 | <b>External linear encoder feedback pulse counts high place</b>                                                                               | [10 <sup>4</sup> encoder pulses] |
| dP 38 | <b>Hybrid deviation low place</b>                                                                                                             | [1 encoder pulse]                |
| dP 39 | <b>Hybrid deviation high place</b>                                                                                                            | [10 <sup>4</sup> encoder pulses] |
| dP 40 | <b>Voltage class (refer to PA000.3 for voltage class setting)</b>                                                                             | -                                |
| dP 46 | <b>IGBT temperature</b>                                                                                                                       | °C                               |

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## 12.2 List of auxiliary function parameters

| No.   | Function                                                        | Reference |
|-------|-----------------------------------------------------------------|-----------|
| AF 00 | Display of alarm logging                                        | 6.2       |
| AF 01 | Position assignment (only active in position control mode)      | 6.3       |
| AF 02 | JOG run                                                         | 6.4       |
| AF 03 | Panel lock                                                      | 6.5       |
| AF 04 | Clearance of alarm logging                                      | 6.6       |
| AF 05 | Parameter initialization                                        | 6.7       |
| AF 06 | Analog instruction (speed & torque) automatic offset adjustment | 6.8       |
| AF 07 | Speed instruction manual offset adjustment                      | 6.9       |
| AF 08 | Torque instruction manual offset adjustment                     | 6.10      |
| AF 09 | Overview of relevant motor parameters                           | 6.11      |
| AF 10 | Display of main software version of servo drive                 | 6.12      |
| AF 11 | Setting up absolute encoders                                    | 6.13      |
| AF 12 | Clearance of error logging for absolute encoders                | 6.13      |
| AF 15 | Manual detection of load inertia                                | 6.14      |

## 12.3 List of parameters

### Legends:

- P: Parameter number.
- Descriptions: Parameter detailed descriptions.
- Range: Parameter setting range.
- Unit: Parameter unit.
- Defau: Parameter factory default setting value.
- Effective: Parameter effective time.
  - Immed: Parameter to be effective immediately.
  - Restart: Parameter to be effective after restart the servo drive.
- R: Remarks

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Range       | Unit | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|--------|-----------|---|
| PA000 | Basic function selection 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | h.0000~01D1 |      | h.0000 | Restart   |   |
|       | <div><div><div>h.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div></div><div><div><div>Direction selection</div><div><div>0</div><div>Positive mode</div></div><div><div>1</div><div>Negative mode</div></div></div><div><div><div>Control mode selection</div><div><div>0</div><div>Position control (pulse train)</div></div><div><div>1</div><div>Speed control (analog instruction)</div></div><div><div>2</div><div>Torque control (analog instruction)</div></div><div><div>3</div><div>Internal speed control</div></div><div><div>4</div><div>Internal speed control ↔ Position control</div></div><div><div>5</div><div>Internal speed control ↔ Speed control</div></div><div><div>6</div><div>Internal speed control ↔ Torque control</div></div><div><div>7</div><div>Position control ↔ Speed control</div></div><div><div>8</div><div>Position control ↔ Torque control</div></div><div><div>9</div><div>Torque control ↔ Speed control</div></div><div><div>A</div><div>Internal position control</div></div><div><div>B</div><div>Internal position control ↔ Position control</div></div><div><div>C</div><div>Reserved</div></div><div><div>D</div><div>Fully closed loop control</div></div></div><div><div><div>Reserved</div></div><div><div><div>Input voltage of servo drive</div><div><div>0</div><div>220V class</div></div><div><div>1</div><div>380V class</div></div></div></div></div></div></div></div> |             |      |        |           |   |
|       | Notes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |      |        |           |   |
|       | ▪ 220V class: PA000.3=0;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |      |        |           |   |
|       | ▪ 380V class: PA000.3=1;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |      |        |           |   |
|       | ▪ Execute AF 05 (parameter initialization) after modifying PA000.3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |      |        |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Range                                       | Unit | Defau  | Effective | R |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------|--------|-----------|---|---|----------------------------|---|---------------------------------------------|---|----------------------------|---|--------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------|---|--------------------------------------------|---|----------------------------------------------------|---|-------------------------------------------------|---|-----------------------------------------------------------------------|---|---------------------------------------------------------------------------------|---|------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------|---|------------------------------------------------|---|-----------------------------------------------|---|----------------------------------|---|-------------------------------------------|---|-----------------|
| PA001 | Basic function selection 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | d.0000~0264                                 |      | d.0000 | Restart   |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
|       | <div><div>d.</div><div><div>3</div><div>2</div><div>1</div><div>0</div><div><div><div></div></div><div><div></div></div><div><div></div></div><div><div></div></div></div></div><div><div>Servo stop patterns at servo OFF or alarms</div><table><tr><td>0</td><td>DB (dynamic brake) to stop</td></tr><tr><td>1</td><td>DB (dynamic brake) to stop, then release DB</td></tr><tr><td>2</td><td>Coast to stop, DB not used</td></tr><tr><td>3</td><td>Decelerate at rate of PA522, &amp; stay in DB state when speed is lower than PA523</td></tr><tr><td>4</td><td>Decelerate at rate of PA522, &amp; coast to stop when speed is lower than PA523</td></tr></table></div><div><div>Servo stop patterns at OT (Overtravel)</div><table><tr><td>0</td><td>DB or coast to stop, same as PA001.0 (1~2)</td></tr><tr><td>1</td><td>Stop by torque set in PA406, then enter lock state</td></tr><tr><td>2</td><td>Stop by torque set in PA406, then coast to stop</td></tr><tr><td>3</td><td>Stop by torque set in PA406, after fully stopped, then enter DB state</td></tr><tr><td>4</td><td>Stop by torque set in PA406, decelerate at rate of PA522, then enter lock state</td></tr><tr><td>5</td><td>Stop by torque set in PA406, decelerate at rate of PA522, then coast to stop</td></tr><tr><td>6</td><td>Stop by torque set in PA406, decelerate at rate of PA522, then enter DB state</td></tr></table></div><div><div>AC/DC input power selection</div><table><tr><td>0</td><td>AC input: Single phase 220VAC among L1, L2, L3</td></tr><tr><td>1</td><td>AC input: Three phase 220VAC among L1, L2, L3</td></tr><tr><td>2</td><td>DC input: 310VDC between P+, (-)</td></tr></table></div><div><div>Enabling selection</div><table><tr><td>0</td><td>External enable from I/O or communication</td></tr><tr><td>1</td><td>Internal enable</td></tr></table></div></div> |                                             |      |        |           |   | 0 | DB (dynamic brake) to stop | 1 | DB (dynamic brake) to stop, then release DB | 2 | Coast to stop, DB not used | 3 | Decelerate at rate of PA522, & stay in DB state when speed is lower than PA523 | 4 | Decelerate at rate of PA522, & coast to stop when speed is lower than PA523 | 0 | DB or coast to stop, same as PA001.0 (1~2) | 1 | Stop by torque set in PA406, then enter lock state | 2 | Stop by torque set in PA406, then coast to stop | 3 | Stop by torque set in PA406, after fully stopped, then enter DB state | 4 | Stop by torque set in PA406, decelerate at rate of PA522, then enter lock state | 5 | Stop by torque set in PA406, decelerate at rate of PA522, then coast to stop | 6 | Stop by torque set in PA406, decelerate at rate of PA522, then enter DB state | 0 | AC input: Single phase 220VAC among L1, L2, L3 | 1 | AC input: Three phase 220VAC among L1, L2, L3 | 2 | DC input: 310VDC between P+, (-) | 0 | External enable from I/O or communication | 1 | Internal enable |
|       | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | DB (dynamic brake) to stop                  |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
|       | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | DB (dynamic brake) to stop, then release DB |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
|       | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Coast to stop, DB not used                  |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 3     | Decelerate at rate of PA522, & stay in DB state when speed is lower than PA523                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 4     | Decelerate at rate of PA522, & coast to stop when speed is lower than PA523                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 0     | DB or coast to stop, same as PA001.0 (1~2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 1     | Stop by torque set in PA406, then enter lock state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 2     | Stop by torque set in PA406, then coast to stop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 3     | Stop by torque set in PA406, after fully stopped, then enter DB state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 4     | Stop by torque set in PA406, decelerate at rate of PA522, then enter lock state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 5     | Stop by torque set in PA406, decelerate at rate of PA522, then coast to stop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 6     | Stop by torque set in PA406, decelerate at rate of PA522, then enter DB state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 0     | AC input: Single phase 220VAC among L1, L2, L3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 1     | AC input: Three phase 220VAC among L1, L2, L3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 2     | DC input: 310VDC between P+, (-)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 0     | External enable from I/O or communication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |
| 1     | Internal enable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |      |        |           |   |   |                            |   |                                             |   |                            |   |                                                                                |   |                                                                             |   |                                            |   |                                                    |   |                                                 |   |                                                                       |   |                                                                                 |   |                                                                              |   |                                                                               |   |                                                |   |                                               |   |                                  |   |                                           |   |                 |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Unit        | Defau  | Effective | R       |  |
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| PA002 | Basic function selection 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | d.0000~8112                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             | d.0000 | Restart   |         |  |
| PA002 | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div></div><div><div><div>Torque limit in position control &amp; speed control modes selection</div><div><div>0</div><div>Invalid</div></div><div><div>1</div><div>Use T-REF as external analog torque limit input</div></div><div><div>2</div><div>Use PCL, NCL as external analog torque limit input</div></div></div><div><div><div>Speed limit in torque control mode selection</div><div><div>0</div><div>Use PA407 as speed limit (internal speed limit)</div></div><div><div>1</div><div>Use V-REF &amp; PA301 setting as speed limit (external speed limit)</div></div></div><div><div><div>Use of absolute encoders</div><div><div>0</div><div>Use absolute encoders as incremental encoders</div></div><div><div>1</div><div>Use absolute encoders as absolute encoders</div></div></div><div><div><div>Encoder type selection</div><div><div>0</div><div>Absolute encoder (single-turn 17-bit, multi-turn 16-bit)</div></div><div><div>1</div><div>Single-turn absolute encoder (single-turn 17-bit, resolution 131072)</div></div><div><div>2</div><div>Line-saving encoder (5000ppr, resolution 20000ppr)</div></div><div><div>7</div><div>Resolver (4096ppr, resolution 16384)</div></div><div><div>8</div><div>20-bit encoder made by DORNA (Resolution 1048576)</div></div></div></div></div></div></div></div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |        |           |         |  |
|       | PA003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Basic function selection 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | b.0000~0111 |        | b.0011    | Restart |  |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div></div><div><div><div>Forward rotation prohibited (POT) (OT)</div><div><div>0</div><div>Valid</div></div><div><div>1</div><div>Invalid</div></div></div><div><div><div>Reverse rotation prohibited (NOT) (OT)</div><div><div>0</div><div>Valid</div></div><div><div>1</div><div>Invalid</div></div></div><div><div><div>OT alarm selection</div><div><div>0</div><div>No alarm at POT/NOT input</div></div><div><div>1</div><div>E.35 alarm at POT/NOT input</div></div></div><div><div><div>Z pulse signal negation</div><div><div>0</div><div>Not negated</div></div><div><div>1</div><div>Negated</div></div></div></div></div></div></div></div> |             |        |           |         |  |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Range       | Unit | Defau  | Effective | R |
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| PA004 | Basic function selection 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | b.0000~0011 |      | b.0001 | Restart   |   |
|       | <div><div>b. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Resolver resolution selection</div><div><div>0</div><div>12-bit, i.e.4096ppr</div></div><div><div>1</div><div>14-bit, i.e.16384ppr</div></div></div><div><div>Resolver anti-interference grade</div><div><div>0</div><div>Normal</div></div><div><div>1</div><div>Maximum effect</div></div></div><div><div>Reserved</div></div><div><div>Reserved</div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |      |        |           |   |
| PA005 | Basic function selection 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | d.0000~0044 |      | d.1022 | Immed     |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Speed instruction responsive grade</div><div><div>0~4</div><div>The higher this value, the less responsive to speed instructions</div></div></div><div><div>Speed feedback responsive grade</div><div><div>0~4</div><div>The higher this value, the less responsive to speed feedbacks</div></div></div><div><div>Reserved</div></div><div><div>E.29 alarm grade</div><div><div>0~5</div><div>The higher this value, the less sensitive to E.29. When the value is 5, E.29 is disabled.</div></div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |      |        |           |   |
| PA007 | Basic function selection 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | d.0000~1211 |      | b.0000 | Restart   |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Battery voltage alarm/warning selection</div><div><div>0</div><div>E.61 if battery voltage is less than 3.1V</div></div><div><div>1</div><div>A.97 if battery voltage is less than 3.1V</div></div></div><div><div>Multi-turn data overflow alarm (E.58)</div><div><div>0</div><div>Multi-turn data overflows will output E.58 (default).</div></div><div><div>1</div><div>Multi-turn data overflows will not output E.58.</div></div></div><div><div>Warning detection selection</div><div><div>0</div><div>Warning can be detected but will not affect motor running until alarm is detected.</div></div><div><div>1</div><div>Warning cannot be detected.</div></div><div><div>2</div><div>Detected warning will stop the motor at enabled state and output warning signal (Position control mode only)</div></div></div><div><div>Servo drive &amp; servo motor matching alarm selection (E.67)</div><div><div>0</div><div>Valid. If PA012 is incorrect, E.67 will output.</div></div><div><div>1</div><div>Invalid. If PA012 is incorrect, E.67 will not output.</div></div></div></div></div></div> |             |      |        |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Range       | Unit | Defau  | Effective | R |
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| PA008 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | b.0000~1111 |      | b.0000 | Restart   |   |
| PA009 | Basic function selection 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | b.0000~0011 |      | b.0000 | Restart   |   |
|       | <div><div>b.</div><div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><input type="checkbox"/></div><div><input type="checkbox"/></div><div><input type="checkbox"/></div><div><input type="checkbox"/></div></div></div><div><div><div>Regenerative circuit detection</div><div><div>0</div><div>Detect. E.17 will output if there are problems.</div></div><div><div>1</div><div>Not detect.</div></div></div></div><div><div><div>Regenerative resistor selection</div><div><div>0</div><div>Use internal resistor</div></div><div><div>1</div><div>Use external resistor. Make sure to set PA537, PA538 correctly.</div></div></div></div><div><div><div>IGBT temperature detection</div><div><div>0</div><div>Not detect.</div></div><div><div>1</div><div>Detect (only valid for 380V class models).</div></div></div></div><div><div><div>Motor temperature detection</div><div><div>0</div><div>Not detect.</div></div><div><div>1</div><div>Detect (only applicable to certain models).</div></div></div></div></div> |             |      |        |           |   |
| PA010 | Basic function selection 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | d.0000~9953 |      | d.0021 | Immed     |   |
|       | <div><div>d.</div><div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><input type="checkbox"/></div><div><input type="checkbox"/></div><div><input type="checkbox"/></div><div><input type="checkbox"/></div></div></div><div><div><div>Speed detection filter grade</div><div><div>0~3</div><div>The larger this value, the longer detection time. Sometimes this parameter can increase gain and reduce vibrations.</div></div></div></div><div><div><div>Analog instruction input delay</div><div><div>0~5</div><div>The larger this value, the more delay of analog instruction sampling, but the more accurate the measurement is.</div></div></div></div><div><div><div>Regenerative resistor load ratio selection</div><div><div>0~9</div><div>The larger this value, the longer overload time.</div></div></div></div><div><div><div>Motor overload grade</div><div><div>0~9</div><div>The larger this value, the longer overload time.</div></div></div></div></div>                                                  |             |      |        |           |   |
| PA011 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0~5         |      | 2      | Restart   |   |



| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Range       | Unit | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|--------|-----------|---|
| PA012 | <b>Motor model selection</b><br><b>Please refer to chapter 1.3 for correct matching parameter.</b> After modifying this parameter, AF05 must be executed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~135       |      | 12     | Restart   |   |
| PA013 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |      |        |           |   |
| PA014 | Status code display                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~50        |      | 50     | Restart   |   |
|       | Please refer to chapter 4.3 & 5.4 for details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |      |        |           |   |
| PA015 | RS485 communication address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1~31        |      | 1      | Immed     |   |
| PA016 | RS485 communication function selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | d.0000~1096 |      | d.0095 | Immed     |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>RS485 bit rate</div><div><div>0</div><div>2400bps</div></div><div><div>1</div><div>4800bps</div></div><div><div>2</div><div>9600bps</div></div><div><div>3</div><div>19200bps</div></div><div><div>4</div><div>38400bps</div></div><div><div>5</div><div>57600bps</div></div><div><div>6</div><div>115200bps</div></div></div></div><div><div><div>Communicational protocol</div><div><div>0</div><div>8, N, 1 (Modbus protocol, RTU mode)</div></div><div><div>1</div><div>8, N, 2 (Modbus protocol, RTU mode)</div></div><div><div>2</div><div>8, E, 1 (Modbus protocol, RTU mode)</div></div><div><div>3</div><div>8, O, 1 (Modbus protocol, RTU mode)</div></div><div><div>4</div><div>7, N, 2 (Modbus protocol, ASCII mode)</div></div><div><div>5</div><div>7, E, 1 (Modbus protocol, ASCII mode)</div></div><div><div>6</div><div>7, O, 1 (Modbus protocol, ASCII mode)</div></div><div><div>7</div><div>8, N, 2 (Modbus protocol, ASCII mode)</div></div><div><div>8</div><div>8, E, 1 (Modbus protocol, ASCII mode)</div></div><div><div>9</div><div>8, O, 1 (Modbus protocol, ASCII mode)</div></div></div></div><div><div>Reserved</div></div><div><div><div>Communicational data equivalent</div><div><div>0</div><div>Internal speed: 1rpm; internal torque: 1% rated torque.</div></div><div><div>1</div><div>Internal speed: 0.1rpm; internal torque: 0.1% rated torque.</div></div></div></div></div></div></div> |             |      |        |           |   |
| PA017 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1~127       |      | 1      |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Range                                     | Unit | Defau                                                             | Effective | R |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|------|-------------------------------------------------------------------|-----------|---|
| PA018 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | d.0000~0006                               |      | d.0003                                                            |           |   |
| PA019 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                           |      |                                                                   |           |   |
| PA020 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                           |      |                                                                   |           |   |
| PA021 | Analog output signal selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | d.0000~0015                               |      | d.0000                                                            | Immed     |   |
|       | <div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div></div><div><div><div>Analog output signal selection</div><div><div>0</div><div>Motor speed feedback</div></div><div><div>1</div><div>Motor torque feedback</div></div></div></div><div><div><div>Output voltage negation</div><div><div>0</div><div>Not negated</div></div><div><div>1</div><div>Negated</div></div></div></div><div><div><div>Reserved</div></div></div><div><div><div>Reserved</div></div></div></div> |                                           |      |                                                                   |           |   |
| PA022 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                           |      |                                                                   |           |   |
| PA023 | Analog voltage output gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~65535                                   |      | 0                                                                 | Immed     |   |
|       | The corresponding relations are as below:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |      |                                                                   |           |   |
|       | PA023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Analog output data: speed                 |      | When PA023≠0:                                                     |           |   |
|       | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500rpm = 1V, -1000rpm = -2V               |      | Output voltage = $\frac{\text{motor speed}}{\text{PA023}}$        |           |   |
|       | 500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 500rpm = 1V                               |      |                                                                   |           |   |
|       | 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1000rpm = 1V                              |      |                                                                   |           |   |
|       | 250                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 500rpm = 2V                               |      |                                                                   |           |   |
|       | PA023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Analog output data: torque                |      | When PA023≠0:                                                     |           |   |
|       | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100% torque = 3V, -100% torque = -3V      |      | Output voltage = $\frac{\text{torque} \times 1000}{\text{PA023}}$ |           |   |
|       | 333                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 100% torque = 3V, -100% torque = -3V      |      |                                                                   |           |   |
|       | 222                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 100% torque = 4.5V, -50%% torque = -2.25V |      |                                                                   |           |   |
| 666   | 100% torque = 1.5V, -200%% torque = -3V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                           |      |                                                                   |           |   |
| PA024 | Analog voltage output zero calibration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | -8000~8000                                | mV   | 0                                                                 | Immed     |   |
|       | PA024 is to calibrate zero voltage between voltage output & setting value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                           |      |                                                                   |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Range       | Unit   | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------|--------|-----------|---|
| PA025 | Basic function selection 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | d.0000~0012 |        | d.0000 | Immed     |   |
|       | <div><div>d.<div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div></div></div><div><div></div></div><div><div></div></div><div><div></div></div></div></div><div><div><div>Main circuit input power alarm selection</div><div><div>0</div><div>If there is no high voltage (220VAC or 380VAC) input, no alarm will output, S-RDY invalid.</div></div><div><div>1</div><div>If there is no high voltage input within 1 second after power on, an alarm will output.</div></div><div><div>2</div><div>If there is high voltage input after power on, but power is lost with 1 second during operation , an alarm will output.</div></div></div><div><div>Reserved</div></div><div><div>Reserved</div></div><div><div>Reserved</div></div></div></div> |             |        |        |           |   |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |        |        |           |   |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |        |        |           |   |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |        |        |           |   |
| PA100 | First position loop proportional gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1~1000      | 1/s    | 40     | Immed     |   |
|       | This parameter determines the responsiveness of position control systems. The higher this value, the shorter positioning time. But if this value is set too high, vibrations can be caused.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |        |        |           |   |
| PA101 | First speed loop proportional gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1~3000      | Hz     | 40     | Immed     |   |
|       | This parameter determines the responsiveness of speed control loops. If PA100 is increased, PA101 also has to be increased accordingly. But if this value is set too high, vibrations can be caused.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |        |        |           |   |
| PA102 | First speed loop integral time constant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1~2000      | 0.1 ms | 200    | Immed     |   |
|       | The lower this value, the stronger integral effects & counter-interference effects. But if this value is set too high, vibrations can be caused.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |        |        |           |   |
| PA103 | First speed detection filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0~1000      | 0.01ms | 10     | Immed     |   |
|       | This is the time constant of low pass filter. The higher this value, the higher time constant. This can reduce motor noise but will also reduce system responsiveness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |        |        |           |   |
| PA104 | First torque filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~1000      | 0.01ms | 30     | Immed     |   |
|       | This is to set the first grade hysteresis filter time constant of the torque instructions and can regulate vibrations caused by distorted resonance. The higher this value, the higher time constant. This can reduce motor noise but will also reduce system responsiveness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |        |        |           |   |
| PA105 | Second position loop proportional gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1~1000      | 1/s    | 40     | Immed     |   |
| PA106 | Second speed loop proportional gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1~3000      | Hz     | 80     | Immed     |   |
| PA107 | Second speed loop integral time constant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1~2000      | 0.1 ms | 10     | Immed     |   |
| PA108 | Second speed detection filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~1000      | 0.01ms | 5      | Immed     |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Range       | Unit   | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------|--------|-----------|---|
| PA109 | Second torque filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0~1000      | 0.01ms | 20     | Immed     |   |
| PA110 | Speed feedforward gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~100       | %      | 0      | Immed     |   |
|       | The combination of the value of speed control instruction processed from position control, and the value of speed control instruction processed from internal position control multiplying this parameter.                                                                                                                                                                                                                                                                                                                          |             |        |        |           |   |
| PA111 | Speed feedforward filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0~1000      | 0.1ms  | 0      | Immed     |   |
|       | This is to set the first grade hysteresis filter time constant of the speed feedforward.                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |        |        |           |   |
| PA114 | Friction compensation gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~1000      | 0.1%   | 0      | Immed     |   |
| PA115 | Friction compensation smoothness constant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~1000      | 0.1%   | 0      | Immed     |   |
| PA116 | Friction compensation threshold speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0~3000      | 0.1rpm | 100    | Immed     |   |
| PA118 | Load inertia ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~5000      | 1%     | 200    | Immed     |   |
|       | The ratio of load inertia to rotor inertia of the servo motor.<br><div>PA118 = (load inertia/rotor inertia) ×100%</div><br>This parameter is invalid at automatic gain tuning.                                                                                                                                                                                                                                                                                                                                                      |             |        |        |           |   |
| PA119 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0~32767     | 0.1ms  | 0      |           |   |
| PA120 | Gain switchover selection 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | d.0000~0034 |        | d.0000 | Immed     |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Mode switching condition selections</div><div><div>0</div><div>Use internal torque instructions PA121</div></div><div><div>1</div><div>Use speed instructions PA122</div></div><div><div>2</div><div>Use accelerations PA123</div></div><div><div>3</div><div>Use position deviations PA124</div></div><div><div>4</div><div>No mode switching.</div></div></div><div>Reserved</div><div>Reserved</div><div>Reserved</div></div></div></div> |             |        |        |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Range       | Unit    | Defau  | Effective | R |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|--------|-----------|---|
| PA121 | Mode switch (internal torque instructions)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~300       | 1%      | 200    | Immed     |   |
| PA122 | Mode switch (speed instructions)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~3000      | 1min-1  | 0      | Immed     |   |
| PA123 | Mode switch (accelerations)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0~65535     | 10rpm   | 0      | Immed     |   |
| PA124 | Mode switch (position deviations)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0~65535     | 1 pulse | 0      | Immed     |   |
| PA125 | Gain switchover selection 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | d.0000~0092 |         | d.0000 | Immed     |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>Gain switchover selections</div><div><div>0</div><div>No gain switchover</div></div><div><div>1</div><div>Manual gain switchover</div></div><div><div>2</div><div>Automatic gain switchover:<br/>When gain switch condition A is valid, switch from 1<sup>st</sup> gain to 2<sup>nd</sup> gain.<br/>When gain switch condition A is invalid, switch from 2<sup>nd</sup> gain to 1<sup>st</sup> gain</div></div></div></div><div><div><div>Gain switchover condition A</div><div><div>0</div><div>COIN is ON</div></div><div><div>1</div><div>COIN is OFF</div></div><div><div>2</div><div>NEAR is ON</div></div><div><div>3</div><div>NEAR is OFF</div></div><div><div>4</div><div>Position instruction filter output is 0 and instruction pulse input OFF</div></div><div><div>5</div><div>Position instruction pulse input ON</div></div><div><div>6</div><div>Torque instruction value is greater than PA126</div></div><div><div>7</div><div>Speed instruction value is greater than PA127</div></div><div><div>8</div><div>Speed instruction variation value is greater than PA128</div></div><div><div>9</div><div>Position deviation value is greater than PA129</div></div></div></div><div>Reserved</div><div>Reserved</div></div></div></div> |             |         |        |           |   |
| PA126 | Gain switchover grade (torque instruction)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~300       | 1%      | 200    | Immed     |   |
| PA127 | Gain switchover grade (speed instruction)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0~3000      | 1 min-1 | 100    | Immed     |   |
| PA128 | Gain switchover grade (speed instruction variation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0~65535     | 10rpm/s | 10000  | Immed     |   |
| PA129 | Gain switchover grade (position deviation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~65535     | 1pulse  | 100    | Immed     |   |

| P     | Descriptions                   | Range       | Unit  | Defau  | Effective | R |
|-------|--------------------------------|-------------|-------|--------|-----------|---|
| PA130 | Gain switchover time 1         | 0~10000     | 0.1ms | 10     | Immed     |   |
| PA131 | Gain switchover time 2         | 0~10000     | 0.1ms | 10     | Immed     |   |
| PA132 | Gain switchover waiting time 1 | 0~10000     | 0.1ms | 10     | Immed     |   |
| PA133 | Gain switchover waiting time 2 | 0~10000     | 0.1ms | 10     | Immed     |   |
| PA134 | Reserved                       | 0~10000     |       | 0      |           |   |
| PA137 | Reserved                       | 0~500       |       | 50     |           |   |
| PA138 | Reserved                       | 0~5000      |       | 0      |           |   |
| PA139 | Reserved                       | 0~10        |       | 0      |           |   |
| PA140 | Reserved                       | 0~5000      |       | 0      |           |   |
| PA141 | Reserved                       | 0~100       |       | 0      |           |   |
| PA200 | Position control switch 1      | d.0000~1232 |       | d.0000 | Restart   |   |

d.

3

2

1

0

Input pulse form

|   |                                         |
|---|-----------------------------------------|
| 0 | PULS + SIGN                             |
| 1 | CW + CCW                                |
| 2 | A phase + B phase (quadruple frequency) |

Pulse (PULS+SIGN) negations

|   |                                |
|---|--------------------------------|
| 0 | Neither negates                |
| 1 | PULS not negates, SIGN negates |
| 2 | PULS negates, SIGN not negates |
| 3 | Both negate                    |

Position deviation clearance

|   |                                                                           |
|---|---------------------------------------------------------------------------|
| 0 | Clear position deviation when S-ON is off, power is off or by CLR signal. |
| 1 | Clear position deviation only by CLR. CLR also clears OT lock.            |
| 2 | Clear position deviation only when servo has alarm or by CLR signal.      |

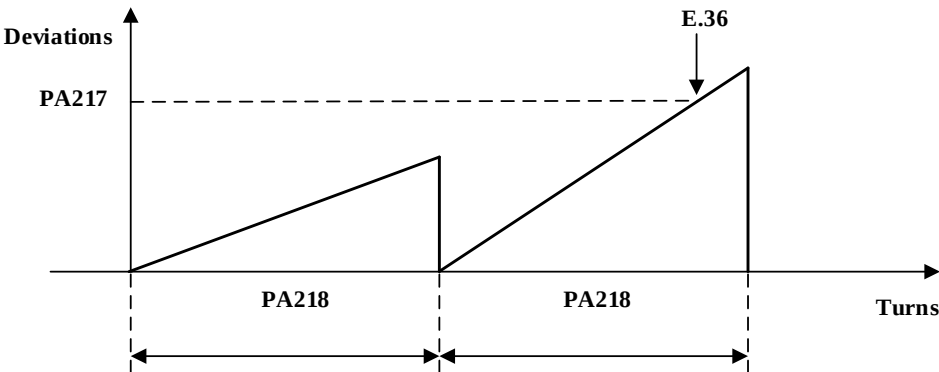
Input pulse channel

|   |                                      |
|---|--------------------------------------|
| 0 | High speed channel (Pin 7/8, 11/12)  |
| 1 | Low speed channel (Pin 16/17, 23/24) |

| P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Descriptions              | Range                                                                                                                                              | Unit | Defau  | Effective | R |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|-----------|---|-----------|----------------------|---------|---|-----|----------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|---|-----|---|----|---|----|---|----|---|----|---|---|
| PA201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Position control switch 2 | d.0000~3177                                                                                                                                        |      | d.0000 | Restart   |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| <div><div><div>d.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>Low speed (pulse input) channel filter grade</div><div>0~7</div><div>The higher this value, the longer filter time, the lower chop frequency. 0 means no filter.</div></div><div><div><div>High speed (pulse input) channel filter grade</div><div>0~7</div><div>The higher this value, the longer filter time, the lower chop frequency. 0 means no filter.</div></div><div><div><div>AB pulse output negation</div><div>0</div><div>Not negate.</div><div>1</div><div>Negate.</div></div><div><div><div>Z pulse output expansion</div><div>0</div><div>No expansion. (Communicational type) encoder Z pulse width is defined by one A pulse width, i.e. the smaller the value of PA210, the wider Z pulse width.</div><div>1</div><div>Expand. (Non-communicational type) encoder Z pulse is A pulse width.</div></div></div></div></div></div><div>Relations between value of PA210.0 &amp; I/O chop frequency</div><table><tr><th>【PA201.0】</th><th>Chop frequency (KHz)</th><th>Remarks</th></tr><tr><td>0</td><td>500</td><td rowspan="8"><ul style="list-style-type: none"><li>Check instruction pulse frequency by dP 14;</li><li>Set value PA201.0 (not too) higher than dP 14.</li></ul></td></tr><tr><td>1</td><td>340</td></tr><tr><td>2</td><td>170</td></tr><tr><td>3</td><td>80</td></tr><tr><td>4</td><td>40</td></tr><tr><td>5</td><td>20</td></tr><tr><td>6</td><td>10</td></tr><tr><td>7</td><td>5</td></tr></table></div></div></div> |                           |                                                                                                                                                    |      |        |           |   | 【PA201.0】 | Chop frequency (KHz) | Remarks | 0 | 500 | <ul style="list-style-type: none"><li>Check instruction pulse frequency by dP 14;</li><li>Set value PA201.0 (not too) higher than dP 14.</li></ul> | 1 | 340 | 2 | 170 | 3 | 80 | 4 | 40 | 5 | 20 | 6 | 10 | 7 | 5 |
| 【PA201.0】                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Chop frequency (KHz)      | Remarks                                                                                                                                            |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 500                       | <ul style="list-style-type: none"><li>Check instruction pulse frequency by dP 14;</li><li>Set value PA201.0 (not too) higher than dP 14.</li></ul> |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 340                       |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 170                       |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 80                        |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 40                        |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 20                        |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10                        |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5                         |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| PA202                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Position control switch 3 | d.0000~9112                                                                                                                                        |      | d.0000 | Immed     |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |
| <div><div><div>d.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>Positioning completion (COIN) signal output condition</div><div>0</div><div>When position deviation is less than PA525.</div><div>1</div><div>When position deviation is less than PA525 AND position instruction is 0 after filtering.</div><div>2</div><div>When position deviation is less than PA525 and position instruction is 0.</div></div><div><div><div>External linear encoder signal negation in fully closed loop mode</div><div>0</div><div>Not negate.</div><div>1</div><div>Negate.</div></div><div><div><div>Switchover between internal &amp; external loops in fully closed loop mode</div><div>0</div><div>C-MOD (0: external; 1: internal)</div><div>1</div><div>When electronic gear switch.(1:external; others:internal)</div></div><div><div><div>Pulse residual in fully closed loop mode</div><div>0~9</div><div>When pulse residual is less than this value, fully closed loop control is finished.</div></div></div></div></div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                           |                                                                                                                                                    |      |        |           |   |           |                      |         |   |     |                                                                                                                                                    |   |     |   |     |   |    |   |    |   |    |   |    |   |   |

| P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Descriptions                                     | Range                  | Unit                                               | Defau                  | Effective | R |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------|----------------------------------------------------|------------------------|-----------|---|-------|-------|------------------------|--|--|--|--|----|----|---------------|----------------------------------------------------|------------------------|--|--|----|----|---------------|------------------------------|------------------------|--|--|----|----|----|----|
| PA203                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Position control switch 4: Reserved              | d.0000~0022            |                                                    | d.0000                 | Restart   |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA204                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Reserved                                         |                        |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA205                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | First electronic gear ratio low place numerator  | 0~65535                |                                                    | 1                      | Immed     |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA206                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Electronic gear ratio low place denominator      | 0~65535                |                                                    | 1                      | Immed     |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| See table below:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                  |                        |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| <table border="1"> <thead> <tr> <th>PA206</th><th>PA226</th><th colspan="5">Instruction processing</th></tr> </thead> <tbody> <tr> <td>=0</td><td>=0</td><td>Pulse input →</td><td>Encoder resolution<br/><math>PA225 \times 10000 + PA205</math></td><td>Position instruction →</td><td></td><td></td></tr> <tr> <td>≠0</td><td>=0</td><td rowspan="3">Pulse input →</td><td rowspan="3"><math>PA225 \times 10000 + PA205</math></td><td rowspan="3">Position instruction →</td><td rowspan="3"></td><td rowspan="3"></td></tr> <tr> <td>=0</td><td>≠0</td></tr> <tr> <td>≠0</td><td>≠0</td></tr> </tbody> </table>                                                                                                                                                   |                                                  |                        |                                                    |                        |           |   | PA206 | PA226 | Instruction processing |  |  |  |  | =0 | =0 | Pulse input → | Encoder resolution<br>$PA225 \times 10000 + PA205$ | Position instruction → |  |  | ≠0 | =0 | Pulse input → | $PA225 \times 10000 + PA205$ | Position instruction → |  |  | =0 | ≠0 | ≠0 | ≠0 |
| PA206                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PA226                                            | Instruction processing |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| =0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | =0                                               | Pulse input →          | Encoder resolution<br>$PA225 \times 10000 + PA205$ | Position instruction → |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| ≠0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | =0                                               | Pulse input →          | $PA225 \times 10000 + PA205$                       | Position instruction → |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| =0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ≠0                                               |                        |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| ≠0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ≠0                                               |                        |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA207                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Second electronic gear ratio low place numerator | 0~65535                |                                                    | 1                      | Immed     |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA208                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Third electronic gear ratio low place numerator  | 0~65535                |                                                    | 1                      | Immed     |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA209                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Fourth electronic gear ratio low place numerator | 0~65535                |                                                    | 1                      | Immed     |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA210                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Encoder resolution (frequency-division) setting  | 16~16384               | 1 Pulse /Rev                                       | 16384                  | Restart   |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| <ul style="list-style-type: none"> <li>Encoder resolution is determined by number of OA or OB pulse output per revolution (multiplied by four) . For example, if PA210=1000, when motor rotates 1 revolution, number of OA pulse output is 1000 and number of OB pulse output is also 1000.</li> <li>When value of PA210 exceeds number of encoder structural lines, this value becomes invalid and the actual number of encoder structure lines will be used. For example, if a 5000-line incremental encoder is used, and PA210 is set to 6000, the valid value is still 5000.</li> <li>For communicational encoders, Z pulse width is set to be the width of one A pulse. Thus the smaller PA210 value, the wider Z pulse given the same speed settings.</li> </ul> |                                                  |                        |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| PA211                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | External (linear) encoder numerator              | 0~65535                | --                                                 | 0                      | Immed     |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |
| When PA211=0, the servo motor encoder resolution will become this numerator and user only need to set PA212 to the feedback pulse count from external encoder in one revolution.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                  |                        |                                                    |                        |           |   |       |       |                        |  |  |  |  |    |    |               |                                                    |                        |  |  |    |    |               |                              |                        |  |  |    |    |    |    |



| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Range   | Unit   | Defau | Effective | R |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|-------|-----------|---|
| PA212 | External (linear) encoder denominator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1~65535 | --     | 10000 | Immed     |   |
|       | Motor encoder resolutions: <ul style="list-style-type: none"><li>5000-line incremental: 20,000ppr;</li><li>17-bit encoder: 131, 072ppr;</li><li>20-bit encoder: 1,048,576ppr.</li></ul> External encoder gear ratio=PA211/PA212=Motor encoder resolution/External encoder resolution.<br>Notes:<br>If this gear ratio is wrong, the calculated position based on motor encoder feedback pulses will be different from the calculated position based on external encoder feedback pulses. This deviation will accumulate and will result in E.36 if the deviation exceeds PA217. |         |        |       |           |   |
| PA214 | Position instruction acceleration/deceleration time constant 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~1000  | 0.1 ms | 0     | Immed     |   |
| PA215 | Position instruction acceleration/deceleration time constant 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~1000  | 0.1 ms | 0     | Immed     |   |
| PA216 | Position instruction average-moving filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~500   | 0.1 ms | 0     | Immed     |   |
| PA217 | Fully closed loop position deviation threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0~65535 | pulse  | 2000  | Immed     |   |
|       | This is to set the hybrid deviations between motor encoder feedback & external linear encoder.<br>If PA217=0, the servo drive will not judge deviations.                                                                                                                                                                                                                                                                                                                                                                                                                        |         |        |       |           |   |
| PA218 | Fully closed loop hybrid deviation clearance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~65535 | turn   | 100   | Immed     |   |
|       | After the incremental moving distance is over PA218, the servo drive will clear the accumulated hybrid deviations. If PA218=0, this clearance function is disabled.<br><div></div>                                                                                                                                                                                                                                                                                                          |         |        |       |           |   |
|       | Please set PA218 properly based on mechanical structure and position limit sensors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |        |       |           |   |
| PA219 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |        |       |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Range       | Unit                   | Defau   | Effective | R |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------|---------|-----------|---|
| PA220 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                        |         |           |   |
| PA221 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                        |         |           |   |
| PA225 | First electronic gear ratio high place numerator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~32767     | ×10000                 | 0       | Immed     |   |
| PA226 | Electronic gear ratio high place denominator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~32767     | ×10000                 | 0       | Immed     |   |
| PA227 | Second electronic gear ratio high place numerator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~32767     | ×10000                 | 0       | Immed     |   |
| PA228 | Third electronic gear ratio high place numerator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0~32767     | ×10000                 | 0       | Immed     |   |
| PA229 | Fourth electronic gear ratio high place numerator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0~32767     | ×10000                 | 0       | Immed     |   |
| PA300 | Speed control switch 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | d.0000~1333 |                        | d.0200  | Restart   |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Speed instruction filter selection</div><div><div>0</div><div>Linear filter</div></div><div><div>1</div><div>S-curve</div></div><div><div>2</div><div>First grade filter</div></div></div><div>Reserved</div><div><div>Manual load inertia detection operating distance</div><div><div>0</div><div>1 turn</div></div><div><div>1</div><div>2 turns</div></div><div><div>2</div><div>4 turns</div></div><div><div>3</div><div>8 turns</div></div></div><div><div>Speed dead zone control</div><div><div>0</div><div>Use input signal: ZEROSPD</div></div><div><div>1</div><div>Automatic: use PA316 setting</div></div></div></div></div></div> |             |                        |         |           |   |
| PA301 | Speed instruction gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 150~30000   | 0.01 V<br>/Rated speed | 60<br>0 | Immed     |   |
| PA302 | Speed instruction filter time constant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0~1000      | 0.1 ms                 | 0       | Immed     |   |
| PA303 | Soft start acceleration time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0~5000      | 1ms                    | 0       | Immed     |   |

| P     | Descriptions                                                    | Range       | Unit                | Defau | Effective | R |
|-------|-----------------------------------------------------------------|-------------|---------------------|-------|-----------|---|
| PA304 | Soft start deceleration time                                    | 0~5000      | 1ms                 | 0     | Immed     |   |
| PA305 | Speed instruction S-curve linear acceleration/deceleration time | 0~5000      | 1ms                 | 0     | Immed     |   |
| PA306 | JOG speed                                                       | 0~5000      | 1 min <sup>-1</sup> | 500   | Immed     |   |
| PA307 | Internal speed 0                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 100   | Immed     |   |
| PA308 | Internal speed 1                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 200   | Immed     |   |
| PA309 | Internal speed 2                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 300   | Immed     |   |
| PA310 | Internal speed 3                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 400   | Immed     |   |
| PA311 | Internal speed 4                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 500   | Immed     |   |
| PA312 | Internal speed 5                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 600   | Immed     |   |
| PA313 | Internal speed 6                                                | -5000~ 5000 | 1 min <sup>-1</sup> | 700   | Immed     |   |
| PA314 | Internal speed 7                                                | -5000~ 5000 | 1 min-1             | 800   | Immed     |   |
| PA315 | Speed control switch 2                                          | 0000~0012   |                     | 0     | Immed     |   |

d. ☐ 3 ☐ 2 ☐ 1 ☐ 0

#### Zero-speed clamp selection

|   |                                                                                                                                                                                                                                                                                                                                                        |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0 | After the zero-speed clamp signal is active based on PA300.3, speed instruction is forced to be 0                                                                                                                                                                                                                                                      |
| 1 | After the zero-speed clamp signal is active based on PA300.3, speed instruction is forced to be 0 and when motor speed is below PA316, switch to position control mode and lock the servo in this position. When ZEROSPD signal is inactive or control mode is switched, exit this zero-speed clamp status.                                            |
| 2 | After the zero-speed clamp signal is active based on PA300.3, decelerate at rate of PA522 and when motor speed is below PA316, switch to position control mode and lock the servo in this position. When ZEROSPD signal is inactive or control mode is switched, exit this zero-speed clamp status. This stop pattern is only suitable when PA300.0=0. |

#### Instruction source selection when INSPD2=INSPD1=INSPD0=0 in internal speed control

|   |                       |
|---|-----------------------|
| 0 | PA307 setting         |
| 1 | External analog input |

Reserved

Reserved

| P     | Descriptions                            | Range   | Unit                  | Defau | Effective | R |
|-------|-----------------------------------------|---------|-----------------------|-------|-----------|---|
| PA316 | Zero-speed clamp grade                  | 1~2000  | rpm                   | 30    | Immed     |   |
| PA317 | Reserved                                |         |                       |       |           |   |
| PA318 | Reserved                                |         |                       |       |           |   |
| PA400 | Torque instruction gain                 | 10~1000 | 0.1V<br>/rated torque | 30    | Immed     |   |
| PA401 | Torque instruction filter time constant | 0~1000  | 0.1ms                 | 0     | Immed     |   |
| PA402 | Forward rotation torque limit           | 0~300   | 1%                    | 250   | Immed     |   |
| PA403 | Reverse rotation torque limit           | 0~300   | 1%                    | 250   | Immed     |   |
| PA404 | Forward rotation external torque limit  | 0~100   | 1%                    | 100   | Immed     |   |
| PA405 | Reverse rotation external torque limit  | 0~100   | 1%                    | 100   | Immed     |   |
| PA406 | Emergency stop torque                   | 0~300   | 1%                    | 250   | Immed     |   |
| PA407 | Speed limit in torque control mode      | 0~5000  | 1 min <sup>-1</sup>   | 1500  | Immed     |   |
| PA408 | Reserved                                |         |                       |       |           |   |
| PA409 | Torque instruction reached (VCMP)       | 0~100   | 1%                    | 2     | Immed     |   |
| PA410 | Grade 1 notch filter frequency          | 50~2000 | 1 Hz                  | 2000  | Immed     |   |
| PA411 | Grade 1 notch filter attenuation rate   | 0~32    | db                    | 0     | Immed     |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Range       | Unit                       | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------|--------|-----------|---|
| PA412 | Grade 2 notch filter frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 50~2000     | 1 Hz                       | 2000   | Immed     |   |
| PA413 | Grade 2 notch filter attenuation rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0~32        | db                         | 0      | Immed     |   |
| PA414 | Internal torque register 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -3000~3000  | 1%                         | 0      | Immed     |   |
|       | In torque control mode, when external I/O signals are INTor1 or INTor0, torque output will follow table below:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                            |        |           |   |
|       | INTor1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | INTor0      | Torque control instruction |        |           |   |
|       | Invalid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Invalid     | External analog input      |        |           |   |
|       | Invalid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Valid       | Internal torque register 0 |        |           |   |
|       | Valid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Invalid     | Internal torque register 1 |        |           |   |
|       | Valid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Valid       | Internal torque register 2 |        |           |   |
|       | If PA016.3=1, the unit of PA414 is 0.1%, i.e. when PA414=100, corresponding internal torque is 10% of rated torque.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                            |        |           |   |
| PA415 | Internal torque register 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -3000~3000  | 1%                         | 0      | Immed     |   |
| PA416 | Internal torque register 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -3000~3000  | 1%                         | 0      | Immed     |   |
| PA417 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                            |        |           |   |
| PA418 | Torque control switch 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | d.0000~0011 |                            | d.0000 | Immed     |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Deceleration control of speed limit in torque control mode</div><div><div>0</div><div>No deceleration control</div></div><div><div>1</div><div>Use PA522 setting</div></div></div><div><div>Torque compensation</div><div><div>0</div><div>No torque compensation</div></div><div><div>1</div><div>Torque compensation in position or speed control mode. Compensation value is in accordance with torque instruction. (Analog input or internal torque registers)</div></div></div><div>Reserved</div><div>Reserved</div></div></div></div> |             |                            |        |           |   |

| P     | Descriptions                                                                         | Range | Unit | Defau | Effective | R |
|-------|--------------------------------------------------------------------------------------|-------|------|-------|-----------|---|
| PA500 | <b>DI 1 input signal selection</b>                                                   | 0~50  |      | 0     | Immed     |   |
|       | [0] Servo-on (S-ON)                                                                  |       |      |       |           |   |
|       | [1] Control mode switch (C-MODE)                                                     |       |      |       |           |   |
|       | [2] Forward rotation prohibited (POT)                                                |       |      |       |           |   |
|       | [3] Reverse rotation prohibited (NOT)                                                |       |      |       |           |   |
|       | [4] Deviation counter clearance (CLR)                                                |       |      |       |           |   |
|       | [5] Alarm reset (A-RESTART)                                                          |       |      |       |           |   |
|       | [6] Pulse input inhibited (INHIBIT)                                                  |       |      |       |           |   |
|       | [7] Zero-speed clamp (ZEROSPD)                                                       |       |      |       |           |   |
|       | [8] Forward torque limitation (PCL)                                                  |       |      |       |           |   |
|       | [9] Reverse torque limitation (NCL)                                                  |       |      |       |           |   |
|       | [10] Gain switch (GAIN)                                                              |       |      |       |           |   |
|       | [11] Zero switch signal (ZPS)                                                        |       |      |       |           |   |
|       | [12] Negation signal for internal position control & internal speed control (CMDINV) |       |      |       |           |   |
|       | [13] Instruction frequency division/ multiplication switch 0 (DIV0)                  |       |      |       |           |   |
|       | [14] Instruction frequency division/ multiplication switch 1 (DIV1)                  |       |      |       |           |   |
|       | [15] Internal speed register 0 (INSPD0)                                              |       |      |       |           |   |
|       | [16] Internal speed register 1 (INSPD1)                                              |       |      |       |           |   |
|       | [17] Internal speed register 2 (INSPD2)                                              |       |      |       |           |   |
|       | [18] Internal position register 0 (INPOS0)                                           |       |      |       |           |   |
|       | [19] Internal position register 1 (INPOS1)                                           |       |      |       |           |   |
|       | [20] Internal position register 2 (INPOS2)                                           |       |      |       |           |   |
|       | [21] Internal position register 3 (INPOS3)                                           |       |      |       |           |   |
|       | [22] Internal position control trigger (PTRG)                                        |       |      |       |           |   |
|       | [23] Internal position control Forward JOG (P-POS)                                   |       |      |       |           |   |
|       | [24] Internal position control Reverse JOG (N-POS)                                   |       |      |       |           |   |
|       | [25] Internal position control homing start (SHOME)                                  |       |      |       |           |   |
|       | [26] Internal position control stops (PZERO)                                         |       |      |       |           |   |
|       | [28] Internal torque register 0 (INTor0)                                             |       |      |       |           |   |
|       | [29] Internal torque register 1 (INTor1)                                             |       |      |       |           |   |
|       | [30] Incremental/Absolute mode selection in internal position control mode (PAbs)    |       |      |       |           |   |
|       | [OTHER] invalid                                                                      |       |      |       |           |   |
| PA501 | <b>DI 2 input signal selection (same as PA500)</b>                                   | 0~50  |      | 1     | Immed     |   |
| PA502 | <b>DI 3 input signal selection (same as PA500)</b>                                   | 0~50  |      | 2     | Immed     |   |
| PA503 | <b>DI 4 input signal selection (same as PA500)</b>                                   | 0~50  |      | 3     | Immed     |   |
| PA504 | <b>DI 5 input signal selection (same as PA500)</b>                                   | 0~50  |      | 4     | Immed     |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Range       | Unit | Defau  | Effective | R |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|--------|-----------|---|
| PA505 | DI 6 input signal selection (same as PA500)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~50        |      | 5      | Immed     |   |
| PA506 | DI 7 input signal selection (same as PA500)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~50        |      | 6      | Immed     |   |
| PA507 | DI 8 input signal selection (same as PA500)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~50        |      | 7      | Immed     |   |
| PA508 | Input signal level selection 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | b.0000~1111 |      | b.0000 | Immed     |   |
|       | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>DI 1 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div><div><div>DI 2 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div><div><div>DI 3 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div><div><div>DI 4 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div></div></div></div></div> |             |      |        |           |   |
| PA509 | Input signal level selection 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | b.0000~1111 |      | b.0000 | Immed     |   |
|       | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div>DI 5 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div><div><div>DI 6 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div><div><div>DI 7 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div><div><div>DI 8 input signal level selection</div><div>0L level active (optocoupler conductive)</div><div>1H level active (optocoupler not conductive)</div></div></div></div></div></div> |             |      |        |           |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Range           | Unit | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|--------|-----------|---|
| PA510 | Output signal selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | h.0000~DDD<br>D |      | h.3210 | Immed     |   |
|       | <div><div><div>h.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div></div><div><div><div>DO 1 output signal selection</div><div><div>0</div><div>Alarm signal output (ALM)</div></div><div><div>1</div><div>Positioning completed (COIN): position deviation is less than PA525.</div></div><div><div>2</div><div>Z pulse open-collector signal (CZ)</div></div><div><div>3</div><div>Brake release signal (BK): can be adjusted by PA518.</div></div><div><div>4</div><div>Servo ready signal (S-RDY): active when servo is in proper status.</div></div><div><div>5</div><div>Speed instruction reached (VCMP): speed deviation is less than PA517.</div></div><div><div>6</div><div>Motor rotation detection (TGON): active when rotational speed exceeds PA516.</div></div><div><div>7</div><div>Torque limited signal (TLC): active when load torque reaches PA402/PA403.</div></div><div><div>8</div><div>Zero-speed detection signal (ZSP): active when rotational speed is less than PA515.</div></div><div><div>9</div><div>Warning output (WARN)</div></div><div><div>A</div><div>Internal position control homing completion signal (HOME)</div></div><div><div>B</div><div>Internal position control position instruction completion signal (CMD-OK)</div></div><div><div>C</div><div>Internal position control positioning &amp; command completion signal (MC-OK)</div></div><div><div>D</div><div>Torque reached (TREACH): load torque exceeds PA404 or PA405.</div></div></div><div><div>DO 2 output signal selection</div><div><div>0~D</div><div>same allocation method as DO 1</div></div></div><div><div>DO 3 output signal selection</div><div><div>0~D</div><div>same allocation method as DO 1</div></div></div><div><div>DO 4 output signal selection</div><div><div>0~D</div><div>same allocation method as DO 1</div></div></div></div></div></div></div> |                 |      |        |           |   |
| PA511 | Output signal level selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | b.0000~1111     |      | b.0000 | Immed     |   |
|       | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div></div><div><div><div>DO 1 output signal level selection</div><div><div>0</div><div>H level active (optocoupler not conductive)</div></div><div><div>1</div><div>L level active (optocoupler conductive)</div></div></div><div><div>DO 2 output signal level selection</div><div><div>0</div><div>L level active (optocoupler conductive)</div></div><div><div>1</div><div>H level active (optocoupler not conductive)</div></div></div><div><div>DO 3 output signal level selection</div><div><div>0</div><div>L level active (optocoupler conductive)</div></div><div><div>1</div><div>H level active (optocoupler not conductive)</div></div></div><div><div>DO 4 output signal level selection</div><div><div>0</div><div>L level active (optocoupler conductive)</div></div><div><div>1</div><div>H level active (optocoupler not conductive)</div></div></div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |      |        |           |   |
| PA512 | Input signal filter time<br>(DC bus voltage compensation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1~1000          | 1ms  | 10     | Immed     |   |



| P     | Descriptions                                                                                                                                                                                                                                     | Range    | Unit                | Defau | Effective | R |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------|-------|-----------|---|
| PA513 | Serial encoder communicational alarm time                                                                                                                                                                                                        | 1~100    | 0.1ms               | 5     | Immed     |   |
| PA514 | Reserved                                                                                                                                                                                                                                         |          |                     |       |           |   |
| PA515 | Zero position fixed value                                                                                                                                                                                                                        | 0~3000   | 1 min <sup>-1</sup> | 10    | Immed     |   |
| PA516 | Rotation detection value                                                                                                                                                                                                                         | 1~3000   | 1 min <sup>-1</sup> | 20    | Immed     |   |
| PA517 | VCMP signal detection width                                                                                                                                                                                                                      | 1~100    | 1 min <sup>-1</sup> | 10    | Immed     |   |
| PA518 | BK signal hysteresis time after Servo-OFF                                                                                                                                                                                                        | 0~500    | 1 ms                | 100   | Immed     |   |
| PA519 | BK signal speed limit                                                                                                                                                                                                                            | 0~1000   | 1 min <sup>-1</sup> | 100   | Immed     |   |
| PA520 | BK signal waiting time at Servo-OFF                                                                                                                                                                                                              | 100~1000 | 1 ms                | 500   | Immed     |   |
| PA521 | Instantaneous power off holding time                                                                                                                                                                                                             | 40~800   | 1ms                 | 60    | Immed     |   |
| PA522 | <b>Deceleration at Servo OFF</b> <ul style="list-style-type: none"> <li>PA522=1000: deceleration time for motor from 1000rpm to 0rpm is 1000ms</li> <li>PA522=200: deceleration time for motor from 200rpm to 0rpm is 400ms (200ms*2)</li> </ul> | 0~5000   | 1ms                 | 100   | Immed     |   |
| PA523 | Servo OFF stop threshold                                                                                                                                                                                                                         | 20~2000  | rpm                 | 50    | Immed     |   |
| PA525 | COIN signal width                                                                                                                                                                                                                                | 0~65535  | pulse               | 10    | Immed     |   |
| PA526 | NEAR signal width                                                                                                                                                                                                                                | 0~65535  | 4 pulses            | 100   | Immed     |   |
| PA527 | Position over-deviation WARN threshold at S-ON                                                                                                                                                                                                   | 1~65535  | 0.01r               | 200   | Immed     |   |
|       | Encoder resolution shall be taken into calculations.<br>For example, if the encoder resolution is 20,000ppr, the unit of this value is 200 pulses (20000*0.01)<br>and by default, the WARN value is 200*200=40000 pulses.                        |          |                     |       |           |   |
| PA528 | Position over-deviation ERR threshold at S-ON                                                                                                                                                                                                    | 1~65535  | 0.01r               | 500   | Immed     |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Range       | Unit | Defau  | Effective | R |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|--------|-----------|---|
| PA529 | Speed deviation ERR detection time                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 20~2000     | 1ms  | 300    | Immed     |   |
| PA530 | Speed deviation ERR threshold grade                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0~10        |      | 5      | Immed     |   |
|       | If speed deviation exceeds this threshold, E.28 will output.<br>If PA530=10, speed deviation ERR is disabled.                                                                                                                                                                                                                                                                                                                                                                                               |             |      |        |           |   |
| PA531 | Overload WARN threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5~100       | %    | 50     | Immed     |   |
| PA532 | Speed increment threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0~1000      | rpm  | 0      | Immed     |   |
| PA533 | ALM clearance input setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0~3         |      | 0      | Immed     |   |
| PA534 | Main power off detection time                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100~2000    | 1ms  | 100    | Immed     |   |
|       | This is the detection time when main power off status continues.<br>If PA534=2000, main power off detection is disabled.                                                                                                                                                                                                                                                                                                                                                                                    |             |      |        |           |   |
| PA535 | Special switch 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | b.0000~1111 |      | b.0000 | Immed     |   |
|       | <div><div>b.</div><div><div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>ADC detection at power on</div><div><div>0</div><div>Detect.</div></div><div><div>1</div><div>Not detect.</div></div></div><div><div><div>Torque limit at stop</div><div><div>0</div><div>Invalid.</div></div><div><div>1</div><div>Torque limit at stop is PA404 &amp; PA405.</div></div></div><div><div><div>Reserved</div></div></div><div><div><div>Reserved</div></div></div></div></div></div></div> |             |      |        |           |   |
| PA536 | High voltage compensation of pumping process                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -20~20      | V    | -5     | Immed     |   |
| PA537 | Resistance of external regenerative resistor                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5~200       | Ohm  | 30     | Restart   |   |
| PA538 | Capacity of external regenerative resistor                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 20~3000     | Watt | 60     | Restart   |   |
| PA542 | Low voltage compensation of pumping process                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -20~20      | V    | 5      | Immed     |   |

| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Range       | Unit  | Defau  | Effective | R |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|--------|-----------|---|
| PA543 | IGBT temperature adjustment amplitude                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -20~20      | ℃     | 0      | Immed     |   |
| PA544 | Dynamic brake (DB) start time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0~1000      | 0.1ms | 500    | Immed     |   |
| PA545 | S-RDY time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0~1000      | 1ms   | 10     | Immed     |   |
| PA600 | Adjustment switch 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | h.0000~03F6 |       | h.0220 | Restart   |   |
|       | <div><div>d. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>Auto-tuning selection</div><div><div>0</div><div>Invalid</div></div><div><div>1</div><div>Valid</div></div></div><div><div><div>Load inertia estimation pace at auto-tuning</div><div><div>0~F</div><div>The larger this value, the faster auto-tuning pace but the less accurate.</div></div></div><div><div><div>Load inertia estimation pattern selection</div><div><div>0</div><div>Invalid.</div></div><div><div>1</div><div>Minor change. When load inertia changes, respond with minute instructions.</div></div><div><div>2</div><div>Small change. When load inertia changes, respond with second instructions.</div></div><div><div>3</div><div>Drastic change. When load inertia changes, respond with the fastest instructions.</div></div></div><div><div>Reserved</div></div></div></div></div></div></div> |             |       |        |           |   |
| PA601 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0000~0512   |       | 0000   |           |   |
| PA602 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0000~1111   |       | 0000   |           |   |
| PA603 | Adjustment switch 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | b.0000~1111 |       | b.0010 | Immed     |   |
|       | <div><div>b. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div><div>PA118 (load inertia ratio) adjustment after load inertia detection</div><div><div>0</div><div>Automatic adjustment</div></div><div><div>1</div><div>Manual adjustment</div></div></div><div><div><div>Load inertia value at auto-tuning</div><div><div>0</div><div>Use estimated value</div></div><div><div>1</div><div>Use PA118 value</div></div></div><div><div>Reserved</div></div><div><div>Reserved</div></div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                             |             |       |        |           |   |

| P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Descriptions                                                                                                                                         | Range       | Unit   | Defau  | Effective | R |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------|--------|-----------|---|---|--------------------------------------------------------|---|--------------------------------------------------|---|------------------------------------------------------|---|----------------------|---|-------------------|---|------------------------------------------------|-----|---------------------------------|-----|-------------------------------|
| PA604                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reserved                                                                                                                                             | 0000~1111   |        | 0000   |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA605                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reserved                                                                                                                                             | 0000~0003   |        | 0000   |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA606                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Inertia stabilization criteria                                                                                                                       | 0~100       |        | 2      | Immed     |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | When estimated inertia is less than [PA606*motor inertia] and this lasts for a certain period of time, user can determine end of inertia estimation. |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA608                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reserved                                                                                                                                             | 0~100       | 1%     | 0      |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA609                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reserved                                                                                                                                             | 0~1000      | 0.01ms | 100    |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA610                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Bandwidth setting at auto-tuning                                                                                                                     | 1~1000      | Hz     | 40     | Immed     |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The larger this value, the faster the response and the greater the rigidity, but the higher possibility of vibration.                                |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA612                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reserved                                                                                                                                             | 0~9         |        | 0      |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA613                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Reserved                                                                                                                                             | 0~1000      | 0.1ms  | 10     |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| PA700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Internal position control switch 1                                                                                                                   | h.0000~FF02 |        | h.1002 | Immed     |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| <div><div>h. <div><div>3</div><div>2</div><div>1</div><div>0</div></div><div><div>Internal position running pattern</div><table><tr><td>0</td><td>INPOS selects internal position section; PTRG trigger.</td></tr><tr><td>1</td><td>PTRG triggers; internal position runs in cycles.</td></tr><tr><td>2</td><td>Internal position runs in cycles at internal timing.</td></tr></table><div>Incremental or absolute position selection</div><table><tr><td>0</td><td>Incremental position</td></tr><tr><td>1</td><td>Absolute position</td></tr><tr><td>2</td><td>PAbs selects incremental or absolute position.</td></tr></table><div>Cycle run starting position</div><table><tr><td>0~F</td><td>To select the starting position</td></tr></table><div>Cycle run ending position</div><table><tr><td>0~F</td><td>To select the ending position</td></tr></table></div></div></div> |                                                                                                                                                      |             |        |        |           |   | 0 | INPOS selects internal position section; PTRG trigger. | 1 | PTRG triggers; internal position runs in cycles. | 2 | Internal position runs in cycles at internal timing. | 0 | Incremental position | 1 | Absolute position | 2 | PAbs selects incremental or absolute position. | 0~F | To select the starting position | 0~F | To select the ending position |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | INPOS selects internal position section; PTRG trigger.                                                                                               |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PTRG triggers; internal position runs in cycles.                                                                                                     |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Internal position runs in cycles at internal timing.                                                                                                 |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Incremental position                                                                                                                                 |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Absolute position                                                                                                                                    |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PAbs selects incremental or absolute position.                                                                                                       |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 0~F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To select the starting position                                                                                                                      |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |
| 0~F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To select the ending position                                                                                                                        |             |        |        |           |   |   |                                                        |   |                                                  |   |                                                      |   |                      |   |                   |   |                                                |     |                                 |     |                               |

| P     | Descriptions                            | Range       | Unit  | Defau  | Effective | R |
|-------|-----------------------------------------|-------------|-------|--------|-----------|---|
| PA701 | Internal position 0 distance low place  | h.0000~FFFF | pulse | h.4E20 | Immed     |   |
| PA702 | Internal position 0 distance high place | h.0000~FFFF |       | h.0000 | Immed     |   |
| PA703 | Internal position 1 distance low place  | h.0000~FFFF | pulse | h.9C40 | Immed     |   |
| PA704 | Internal position 1 distance high place | h.0000~FFFF |       | h.0000 | Immed     |   |
| PA705 | Internal position 2 distance low place  | h.0000~FFFF | pulse | h.EA60 | Immed     |   |
| PA706 | Internal position 2 distance high place | h.0000~FFFF |       | h.0000 | Immed     |   |
| PA707 | Internal position 3 distance low place  | h.0000~FFFF | pulse | h.3880 | Immed     |   |
| PA708 | Internal position 3 distance high place | h.0000~FFFF |       | h.0001 | Immed     |   |
| PA709 | Internal position 4 distance low place  | h.0000~FFFF | pulse | h.86A0 | Immed     |   |
| PA710 | Internal position 4 distance high place | h.0000~FFFF |       | h.0001 | Immed     |   |
| PA711 | Internal position 5 distance low place  | h.0000~FFFF | pulse | h.D4C0 | Immed     |   |
| PA712 | Internal position 5 distance high place | h.0000~FFFF |       | h.0001 | Immed     |   |
| PA713 | Internal position 6 distance low place  | h.0000~FFFF | pulse | h.22E0 | Immed     |   |
| PA714 | Internal position 6 distance high place | h.0000~FFFF |       | h.0002 | Immed     |   |
| PA715 | Internal position 7 distance low place  | h.0000~FFFF | pulse | h.7100 | Immed     |   |
| PA716 | Internal position 7 distance high place | h.0000~FFFF |       | h.0002 | Immed     |   |
| PA717 | Internal position 8 distance low place  | h.0000~FFFF | pulse | h.BF20 | Immed     |   |

| P     | Descriptions                             | Range       | Unit    | Defau  | Effective | R |
|-------|------------------------------------------|-------------|---------|--------|-----------|---|
| PA718 | Internal position 8 distance high place  | h.0000~FFFF |         | h.0002 | Immed     |   |
| PA719 | Internal position 9 distance low place   | h.0000~FFFF | pulse   | h.0D40 | Immed     |   |
| PA720 | Internal position 9 distance high place  | h.0000~FFFF |         | h.0003 | Immed     |   |
| PA721 | Internal position 10 distance low place  | h.0000~FFFF | pulse   | h.5B60 | Immed     |   |
| PA722 | Internal position 10 distance high place | h.0000~FFFF |         | h.0003 | Immed     |   |
| PA723 | Internal position 11 distance low place  | h.0000~FFFF | pulse   | h.A980 | Immed     |   |
| PA724 | Internal position 11 distance high place | h.0000~FFFF |         | h.0003 | Immed     |   |
| PA725 | Internal position 12 distance low place  | h.0000~FFFF | pulse   | h.F7A0 | Immed     |   |
| PA726 | Internal position 12 distance high place | h.0000~FFFF |         | h.0003 | Immed     |   |
| PA727 | Internal position 13 distance low place  | h.0000~FFFF | pulse   | h.45C0 | Immed     |   |
| PA728 | Internal position 13 distance high place | h.0000~FFFF |         | h.0004 | Immed     |   |
| PA729 | Internal position 14 distance low place  | h.0000~FFFF | pulse   | h.93E0 | Immed     |   |
| PA730 | Internal position 14 distance high place | h.0000~FFFF |         | h.0004 | Immed     |   |
| PA731 | Internal position 15 distance low place  | h.0000~FFFF | pulse   | h.E200 | Immed     |   |
| PA732 | Internal position 15 distance high place | h.0000~FFFF |         | h.0004 | Immed     |   |
| PA733 | Internal position 0 speed                | 0~5000      | 1 min-1 | 100    | Immed     |   |
| PA734 | Internal position 1 speed                | 0~5000      | 1 min-1 | 100    | Immed     |   |

| P     | Descriptions                                       | Range  | Unit    | Defau | Effective | R |
|-------|----------------------------------------------------|--------|---------|-------|-----------|---|
| PA735 | Internal position 2 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA736 | Internal position 3 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA737 | Internal position 4 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA738 | Internal position 5 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA739 | Internal position 6 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA740 | Internal position 7 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA741 | Internal position 8 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA742 | Internal position 9 speed                          | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA743 | Internal position 10 speed                         | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA744 | Internal position 11 speed                         | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA745 | Internal position 12 speed                         | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA746 | Internal position 13 speed                         | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA747 | Internal position 14 speed                         | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA748 | Internal position 15 speed                         | 0~5000 | 1 min-1 | 100   | Immed     |   |
| PA749 | Internal position 0 acceleration/deceleration time | 0~500  | ms      | 0     | Immed     |   |
| PA750 | Internal position 1 acceleration/deceleration time | 0~500  | ms      | 0     | Immed     |   |
| PA751 | Internal position 2 acceleration/deceleration time | 0~500  | ms      | 0     | Immed     |   |

| P     | Descriptions                                        | Range       | Unit  | Defau | Effective | R |
|-------|-----------------------------------------------------|-------------|-------|-------|-----------|---|
| PA752 | Internal position 3 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA753 | Internal position 4 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA754 | Internal position 5 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA755 | Internal position 6 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA756 | Internal position 7 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA757 | Internal position 8 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA758 | Internal position 9 acceleration/deceleration time  | 0~500       | ms    | 0     | Immed     |   |
| PA759 | Internal position 10 acceleration/deceleration time | 0~500       | ms    | 0     | Immed     |   |
| PA760 | Internal position 11 acceleration/deceleration time | 0~500       | ms    | 0     | Immed     |   |
| PA761 | Internal position 12 acceleration/deceleration time | 0~500       | ms    | 0     | Immed     |   |
| PA762 | Internal position 13 acceleration/deceleration time | 0~500       | ms    | 0     | Immed     |   |
| PA763 | Internal position 14 acceleration/deceleration time | 0~500       | ms    | 0     | Immed     |   |
| PA764 | Internal position 15 acceleration/deceleration time | 0~500       | ms    | 0     | Immed     |   |
| PA765 | Internal position dead zone time                    | 0~65535     | ms    | 100   | Immed     |   |
| PA766 | Position demonstration low place                    | h.0000~FFFF | pulse | 0     | Immed     |   |
| PA767 | Position demonstration high place                   | h.0000~FFFF |       | 0     | Immed     |   |
| PA768 | JOG speed in internal position control mode         | 0~5000      | rpm   | 100   | Immed     |   |



| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Range   | Unit | Defau | Effective | R |       |       |     |      |      |      |
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| PA769 | Switch of incremental/absolute position in internal position control mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0~65535 | --   | 0     | Immed     |   |       |       |     |      |      |      |
|       | Incremental/absolute positions are determined by corresponding binary data: <div><div><div>Position 15</div><div>Position 14</div><div>Position 2</div><div>Position 1</div><div>Position 0</div></div><table><tr><td>BIT15</td><td>BIT14</td><td>...</td><td>BIT2</td><td>BIT1</td><td>BIT0</td></tr></table></div> <div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div></div> <div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div><div></div><div></div></div><div><div></div><div></div></div></div> <div><div><div></div><div></div></div><div><div></div><div></div></div></div> 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| BIT15 | BIT14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| P     | Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Range       | Unit  | Defau  | Effective | R |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|--------|-----------|---|
| PA772 | Internal position control switch 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | b.0000~1111 |       | b.0000 | Immed     |   |
|       | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div></div><div><div><div>Calculating absolute positions</div><div><div>0</div><div>Use feedback position</div></div><div><div>1</div><div>Use reference position</div></div></div><div><div>Reserved</div></div><div><div><div>Use of electronic gear for communication position feedback</div><div><div>0</div><div>Feedback data 0x0783, 0x0784 as data after electronic gear.</div></div><div><div>1</div><div>Feedback data 0x0783, 0x0784 as motor feedback data to be used with dP 00 and dP 01.</div></div></div><div><div><div>High/low switchover</div><div><div>0</div><div>Same as user manual, 32-bit data not negate</div></div><div><div>1</div><div>Contrary to user manual, 32-bit data negate</div></div></div></div></div></div></div> |             |       |        |           |   |
| PA773 | Internal position control switch 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | b.0000~1111 |       | b.0000 | Immed     |   |
|       | <div><div><div>b.</div><div><div>3</div><div>2</div><div>1</div><div>0</div></div></div><div><div><div>CLR signal function</div><div><div>0</div><div>Only clear position deviation.</div></div><div><div>1</div><div>Clear all position data</div></div></div><div><div><div>Homing position limit</div><div><div>0</div><div>Valid</div></div><div><div>1</div><div>Invalid. Only valid when homing completed after run backwards and find zero point.</div></div></div><div><div>Reserved</div></div><div><div>Reserved</div></div></div></div></div>                                                                                                                                                                                                                                                                               |             |       |        |           |   |
| PA774 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |       |        |           |   |
| PA775 | Homing speed before contacting zero signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0~3000      | rpm   | 500    | Immed     |   |
| PA776 | Homing speed after contacting zero signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0~500       | rpm   | 30     | Immed     |   |
| PA777 | Zero switch offset low place                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | h.0000~FFFF | Pulse | 0      | Immed     |   |
| PA778 | Zero switch offset high place                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | h.0000~1FFF |       | 0      | Immed     |   |

| P     | Descriptions                              | Range       | Unit  | Defau  | Effective | R |
|-------|-------------------------------------------|-------------|-------|--------|-----------|---|
| PA779 | Positive software limit switch low place  | h.0000~FFFF | Pulse | h.0000 | Immed     |   |
| PA780 | Positive software limit switch high place | h.0000~FFFF |       | h.1000 | Immed     |   |
| PA781 | Negative software limit switch low place  | h.0000~FFFF | Pulse | h.0000 | Immed     |   |
| PA782 | Negative software limit switch high place | h.0000~FFFF |       | h.E000 | Immed     |   |