HSD3 Series AC Servo Drive

User's Manual

HNC Electric Limited

Foreword

Thank you for your purchase and use of our HSD3-series servo drives, and in this operation manual, we will mainly introduce you the following contents:

- Description of the composition of servo drive
- Installation and inspection of servo drive
- All parameters of the servo drive
- Control function and adjustment method of servo drive
- Troubleshooting method
- Detection and maintenance

Please read this operation manual carefully and the safety precautions of the product at the same time before use. In addition, please put it in a safe place for easy access at any time. If you still have problems in using, please consult our customer service center for technical support.

Precautions for safety

- **Prevent to electric shock**

 **Danger**
. Before wiring or testing, please confirm that the power source is OFF. . Electrical engineering personnel are requested to do the wiring work. . Make sure to connect the ground terminal to the ground. . Please operate the switch by dry hands to prevent electric shock. . Please do not touch the terminal or open the cover, otherwise the electric shock may be caused when the power is on.

- **Fire prevention**

 **Notes**
. Please do not place the servo drive, servo motor and brake resistor on or near flammable substances. . Please do not make the servo drive exposed to the place where there exists moisture, corrosive gas or combustible gas substance, otherwise, it may cause fire. . In case of error signal in the use process of brake resistor, please cut off main power source. Or, the fault of brake resistor or similar failure may cause overheating brake resistor, resulting in fire disaster.

- **Wiring**

Notes
. Please confirm whether the voltage of the AC main circuit supply is consistent with the rated voltage of the driver. . Please do not directly connect AC power supply to the servo motor. . Confirm correct terminal polarity. . The driver must be connected with motor wire accordingly in strict accordance with the wiring diagram, and please note that do not make the motor rotate reversely via the way of exchanging U, V and W three-phase terminals.

- **Running and debugging**

Notes
. Please do not touch it, as the heat sink and brake resistance are in high temperature. . Do not change parameter settings too much, which may result in unstable in operation. . Do not touch the rotating part of the servo motor during it is in operation.

- **Others**

Notes
. Do not reinvent the servo drive by yourself.

Statement

—— Contents ——

Chapter I Outline

1.1 HSD3 Series servo drive basic function

Specifications						
HSD3 type		03A□□	06 A□□	10 A□□	16 A□□	25 A□□
Continuous output current （A）		3.0	6.0	10	16	25
Main circuit power supply		Three-phase AC200～230V（-15～+10%） 50/60Hz				
Control Power source		Single-phase AC200～230V（-15～+10%） 50/60Hz				
Control mode		Position control, JOG operation, speed contact, etc.				
Encoder feedback		Ordinary incremental encoder: 2500 lines incremental standard type, 2500 lines incremental saving line type.				
		Serial encoder：2^{17} bits incremental type encoder, $2^{17}/2^{16}$ bits absolute value encoder, 223/216 bits absolute value encoder.				
Conditions of usage	**Using ambient temperature/storage temperature.**	Using ambient temperature：0~+50℃，storage temperature：-20~+85℃.				
	Environmental humidity/storage humidity.	Less than 90%RH（No freezing or condensation）				
	Vibration/impact strength resistance	4.9m/s^2 / 19.6m/s^2				
Structure		Pedestal mounting type				
Performance	**Speed control range**	1:10000（The lower limit of the speed control range is in the stable running without crawling at the rated load）				
	Speed response	1KHz				
	Velocity volatility (load variation)	0～100% loading : less than ±0.01%（in rated speed）				
	Velocity volatility rate (voltage variation)	Rated voltage ±10%：0%（in rated speed）				
	Velocity volatility rate (voltage variation)	25±25℃：less than ±0.1%（in rated speed）				
Simulation speed Command Input	**Command voltage**	DC±10V				
	Input impedance	About 20KΩ				
	Circuit time parameter	47μs				
Simulation torque Command Input	**Command voltage**	DC±10V				
	Input impedance	About 20KΩ				
	Circuit time parameter	47μs				
Sequence control input Signal	**Number of points**	8 points				
	Function （distributable）	Servo ON (/ S - ON), P action (/P - CON), not forward the side drive (P - OT), not reverse side drive (N-OT), alarm reset (/ALM-RST), forward side torque limit (/P-CL), reverse side torque limit (/N-CL), zero position deviation (/CLR), internal set speed switch and so on The distribution of the above signals and the change of positive/negative logic				
Sequence control output Signal	**Number of points**	6 points				
	Function （distributable）	Servo alarm (ALM), position completion (/COIN), speed consistency inspection (/V-CMP), servo motor rotation detection (/TGON), servo readiness (/S-RDY), torque limit detection (/CLT), brake (/BK), encoder zero output (PGC). The distribution of the above signals and the change of positive/negative logic				
Encoder frequency division pulse output		A phase, B phase, C phase: linear drive output; frequency division pulse number: it can be set arbitrarily				
RS-485 Newsletter	**Communication protocol**	MODBUS				
	1:N communication	The maximum can be N = 127 stops				
	Axis address setting	Via parameter setting				
CAN communication	**Communication protocol**	CANOpen（DS301 + DS402 profile）				
	1:N communication	The maximum can be N = 127 stops				
	Axis address setting	Via parameter setting				
Display function		CHARGE indicator light, 7 segment digital tube 5 bits				
Regenerative treatment		Built-in regenerative resistors or external regenerative resistors (selected parts)				
Over travel (OT) prevention function		Dynamic brake (DB) stopping, decelerate stopping, or free running stop when it is at P-OT, N-OT input action				
Protection function		Over current, overvoltage, under voltage, overload, over speed, regeneration fault, encoder feedback error, etc.				
Monitoring function		RPM current position, instruction pulse accumulation, position deviation, motor current, running state, input and output signal, etc.				
Secondary functional		Gain adjustment, alarm record, JOG operation, origin search, movement of inertia test, etc.				
Intelligent function		Built-in gain automatic tuning function				
Applicable load inertia		Less than 5 times of the inertia motor				
Position control	**Feed forward compensation**	0 to 100% (setting unit 1%)				
	Type of input pulse	Symbol + pulse sequence, CW+CCW pulse sequence, 90° phase difference two phase pulse (A phase +B phase)				
	Input pulse form	Support linear drive and collector open circuit				
	The maximum input pulse frequency	Linear drive Symbol + pulse sequence, CW+CCW pulse sequence: 500K pps 90° phase difference two phase pulse (A phase +B phase): 500K pps Collector open circuit Symbol + pulse sequence, CW+CCW pulse sequence: 200K pps 90° phase difference two phase pulse (A phase +B phase): 200K pps				

1.2 HSD3 Series servo drive type explanation

HSD3-B S — 10 A 00

HSD3-B Series Servo drive	Axis Number	Continuous Output Current	Supply Voltage	Interface

Sign	Spec.
S	Single Axis
W	Two Axis

Sign	Spec.
03	3.0A
06	6.0A
10	10A
16	16A
25	25A

Sign	Spec.
A	Three-Phase 220VAC
D	Three-Phase 380VAC

Sign	Spec.
00	Pulse/Analog
01	CANopen BUS

1.3 HSD3 Series servo drive type explanation

HSD3-E S — 10 A 00

HSD3-E Series Servo Drive	Axis Number	Continuous Output Current	Supply Voltage	Interface

Sign	Spec.
S	Single Axis
W	Two Axis

Sign	Spec.
03	3.0A
06	6.0A
10	10A
16	16A
25	25A

Sign	Spec.
A	Three-Phase 220VAC
D	Three-Phase 380VAC

Sign	Spec.
00	Pulse/Analog
01	CANopen BUS
02	Tool Turrent
10	MECHATROLINK-II
20	MECHATROLINK-III
30	EtherCAT BUS

Chapter II The installation and size

2.1 servo drive

HSD3 Series servo drive is a pedestal mount type. Improper installation may cause failure as well, so, please install it properly according to the following notes.

2.1.1 The storage conditions

It shall be kept at the temperature of [-20 ~ +85] ℃ when drive is not used.

2.1.2 Installation site

- ■ Temperature：0～55℃；
- ■ The environment humidity: less than 90% RH (non condensation);
- ■ The elevation shall be less than 1000m；
- ■ The limit of vibration 4.9m/s^2;
- ■ The limit of impact 19.6m/s^2;
- ■ Other precautions for installation:

• Installation in control cabinet

It needs to make overall consideration for the size of control cabinet, placement mode of servo drive and cooling mode, so as to guarantee that the servo drive is in 55℃ environment temperature below, and the specific operational details can be as shown in the description of the 1.2.2 related sections;

• Installation near heat source

It needs to control the radiation of heat source and the temperature rise caused by convection current, so as to guarantee that the servo drive is in 55 ℃ environment temperature below;

• It shall be installed near the vibration source

It needs to install vibration isolation device to avoid influencing the servo drive by the vibration transmission;

• It is installed in the corrosive gas

The necessary measures shall be taken to prevent exposure to corrosive gas. Maybe, corrosive gas will not immediately influence the servo drive, but obviously, it will cause the fault of electron component and related contractor parts;

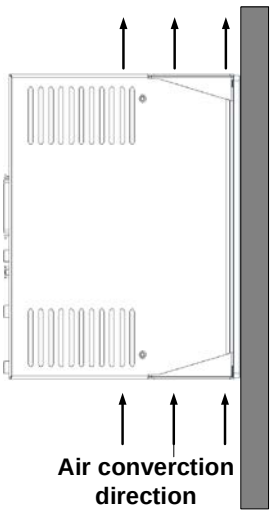
• Other situation

Do not put the driver in high temperature, high humidity, dewdrop, oil splashing, dust, and scrap iron or radiating places;

Note: when turn off the power and store the servo drive, please place the driver in the following environment:
-20～85 ℃, lower than 90% RH (free from moisture condensation)

2.1.3 Direction of travel

As shown in the figure below, it should be mounted vertical to the installation surface, and two mounting holes are used to firmly fix the servo drive on the installation base surface.

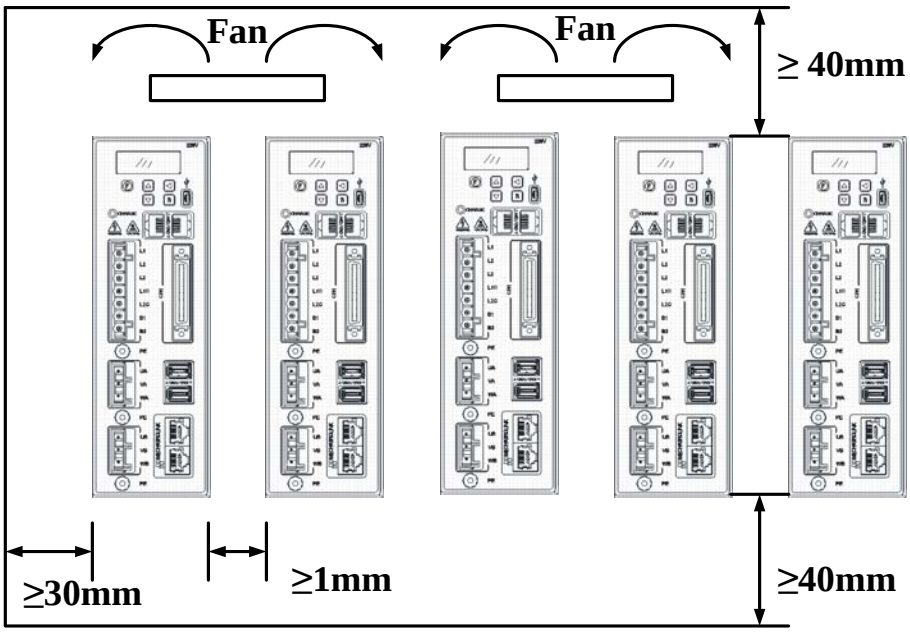


Installation Panel

If necessary, a fan is provided for the forced cooling of servo drive.

2.1.4 Installation of multiple drives

If multiple servo drives need to be installed in the control cabinet side by side, please be sure to carry out installation • heat dissipation according to the figure below.



■ Installation direction of the servo drive

Be sure to make the right side (wiring side) of servo drive facing to operators and make it vertical to the installation base surface.

■ Cooling

Enough space should be reserved around the servo drive to guarantee the cooling effect via fan or natural convection.

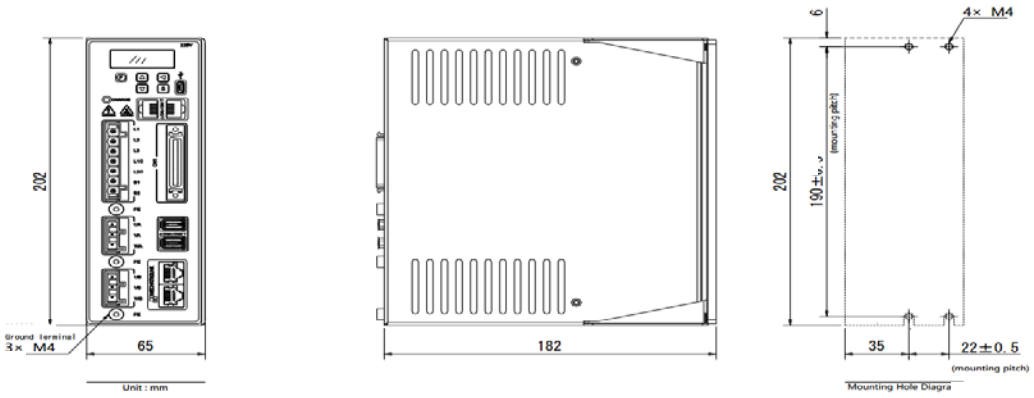
■ Installation side by side

As shown in the figure above, more than 10mm space should be reserved at both sides in horizontal direction, more than 50mm space should be reserved at top and bottom parts in vertical direction. Be sure to keep the temperature in the control cabinet even to avoid partial excess temperature of the servo drive, and if necessary, upper part of the servo drive is mounted with the fan for forced cooling convection.

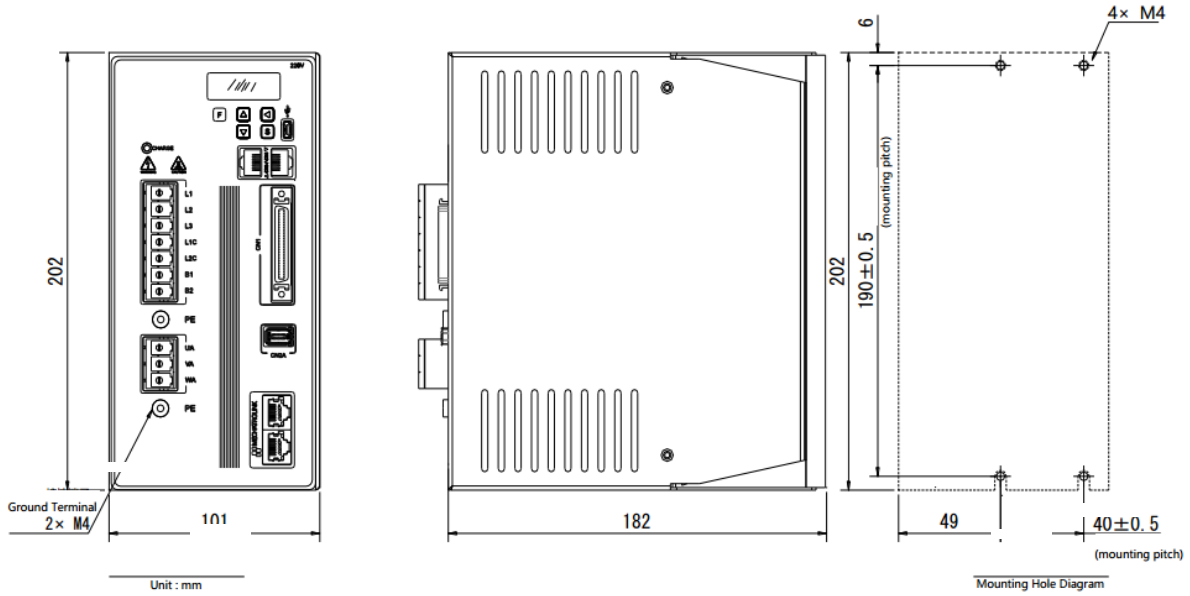
■ The normal working conditions of servo drive

1. Temperature：0~55 ℃
2. Humidity：Less than 90%RH，non condensation
3. Vibration：less than 4.9m/s^2
4. In order to guarantee long-term and stable use, it is recommended to use products at 45 ℃ environment ter

2.1.5 Exterior Dimensions



HSD3D□-03/06/10 Exterior Dimensions



HSD3D□-16/25 Exterior Dimensions

2.2 Servo motors

The servo motor can be mounted both in horizontal and vertical directions. And if there is existing error of mechanical coordination during operation, it seriously influences the service life of the servo motor and causes unexpected accident.
Please install it correctly in accordance with the following notes.

Precautions before installation
Motor shaft end is painted with antirust agent, and before motor installation, please wipe up the antirust agent with a piece of soft cloth dipped in diluents. Please do not make the diluents touching other parts of the servo motor when you wipe antirust agent.

2.2.1 Storage temperature

It shall be kept in the environment of temperature at [-20 ~ +60] ℃ when the servo motor is not used.

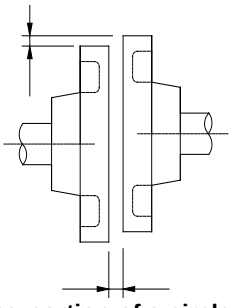
2.2.2 Directionality

The servo motor shall be installed indoor and meet the following environmental conditions.

- Non corrosive or flammable, explosive gas
- Well ventilated, less dust with dry environment
- The ambient temperature is in the range of 0 ~ 40 ℃
- The relative humidity is within the range of 26% to 80%RH, and non-condensation
- Easy to maintain and clean

2.2.3 Install the concentricity

Try to use elastic coupling for mechanical connection, and furthermore, keep the axis of servo motor in parallel to the axis of mechanical load. During installation, be sure to make the servo motor conforming to the requirements of concentricity tolerance in the figure below.



Measurement is conducted at the quartering portion of a circle, the difference between the maximum and minimum is less than 0.03mm. (Rotation with the coupler)

- **If concentricity tolerance is too high, it causes mechanical vibration, resulting in the bearing damage of servo motor.**
- **During coupler installation, axial knock is prohibited, or, it is very easy to damage the coder of servo motor.**

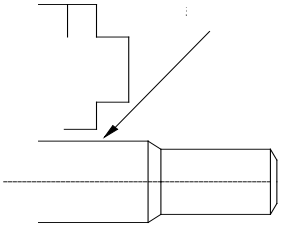
2.2.4 Installation direction

Servo motor can be installed in horizontal, vertical or any other direction.

2.2.5 Prevention measures for water and oil drop

The special treatment shall be taken to meet the protective requirements whether the product is used in water drop, oil drop or dew formation area. However, it is necessary to meet the protection requirements of the axis penetrating part when the motor is leaving the factory, and the motor model with oil seal shall be specified.

The shaft connection portion refers to the gap between the motor end extension and end face flange.



2.2.6 Cable tension degree

During cable connection, bending radius should be not too small, and excessive tension should be also avoided to the cable.

Especially for the core wire of signal line, the wire diameter is very thin; usually 0.2 or 0.3mm and excessive tension should be also avoided for wiring.

Chapter III Distribution line

3.1 Main circuit wiring

In this part, we will mainly describe the wiring examples of main circuit, functions of the main circuit terminal, ON sequence of power supply, etc.

Causion
• Please do not make the power line and signal line passing through a same pipe, nor bind them together. The power line and signal line shall be apart over 30cm when wiring. Or, may cause misoperation. • For the feedback line of signal line and coder (PG), please use stranded wire and multi-core stranded shielded wire. Regarding the length of wiring, the longest instruction input line is 3m, and the longest PG feedback line is 20m. • There may be high voltage in the servo drive even if the power is off. Do not contact the power supply terminal in 5 minutes. Please confirm that the inspection work is done after CHARGE indicator light turns off. • Do not ON/OFF power supply frequently. When it needs to carry out continuous power ON/OFF operation repeatedly, please control it below once within 1min. Because the power section of servo unit carries capacitance, there is relatively high charging current (charging time is 0.2s) when turn ON the power. Therefore, if power ON/OFF operation is conducted frequently, it causes the performance reduction of the main circuit components in the servo unit.

3.1.1 The name and function of the main circuit terminal

Terminal symbol	Title	Function
L1，L2，L3	Main circuit power supply input terminal	Three phases 200 ~ 230VAC +10% - 15% (50/60Hz)
L1C，L2C	Control circuit power supply input terminal	Single phase 200～230VAC +10% - 15% (50/60Hz)
B1，B2	Discharge resistance connection terminal	The resistance is connected to B1 and B2 when the external discharge resistance is used.
UA, VA, WA	A axis motor connecting terminal.	Connect to A axis servo motor.
UB，VB，WB	B axis motor connecting terminal.	Connect to b axis servo motor.
PE	Earth terminal	It is connected with power ground terminal and motor ground terminal for earthing treatment.

3.1.2 Wiring method of the power connector (spring-type) of main circuit

Causion
• When wiring is implemented to the power connector of main circuit, please obey the following notes. • During wiring period, please dismantle the power connector from the main body of servo unit. • Only 1 sheet of wire is inserted into the plug of the power connector. • When you plug in the wire, please avoid the short circuit between the core wire and adjacent wire.

The connector with dismountable power terminal of main circuit and control power terminal is used to the HSD3D□-03/06/10 driver. Please wire the power connector according to the following steps.

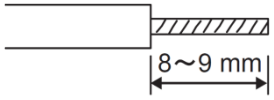
(1) Wire size

The wire size as shown below can be used. The wire can be used after strip the cover of the wire.

- When it is single line……0.5 ～ 1.6 mm
- When the wire is twisted……AWG28 ～ AWG12

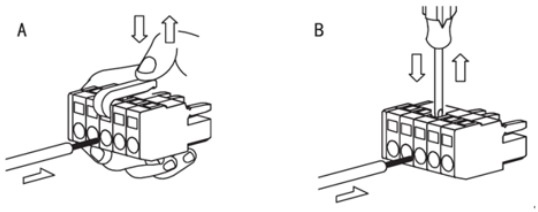
(2) Connection method

1. Strip the cover of the wire.



2. The wire inserting portion of the power connector is opened via a tool. The opening methods include the 2 methods shown in the Figure A and B
   - Under the condition of figure A, hang on the pull rod of the servo unit for opening.
   - In the case of Figure B, via normal screwdriver (the width of the blade 3.0 to 3.5mm) or the 54932-0000 produced by Japanese MOLEX
     Or the equivalent product can press the screwdriver into insert penning.

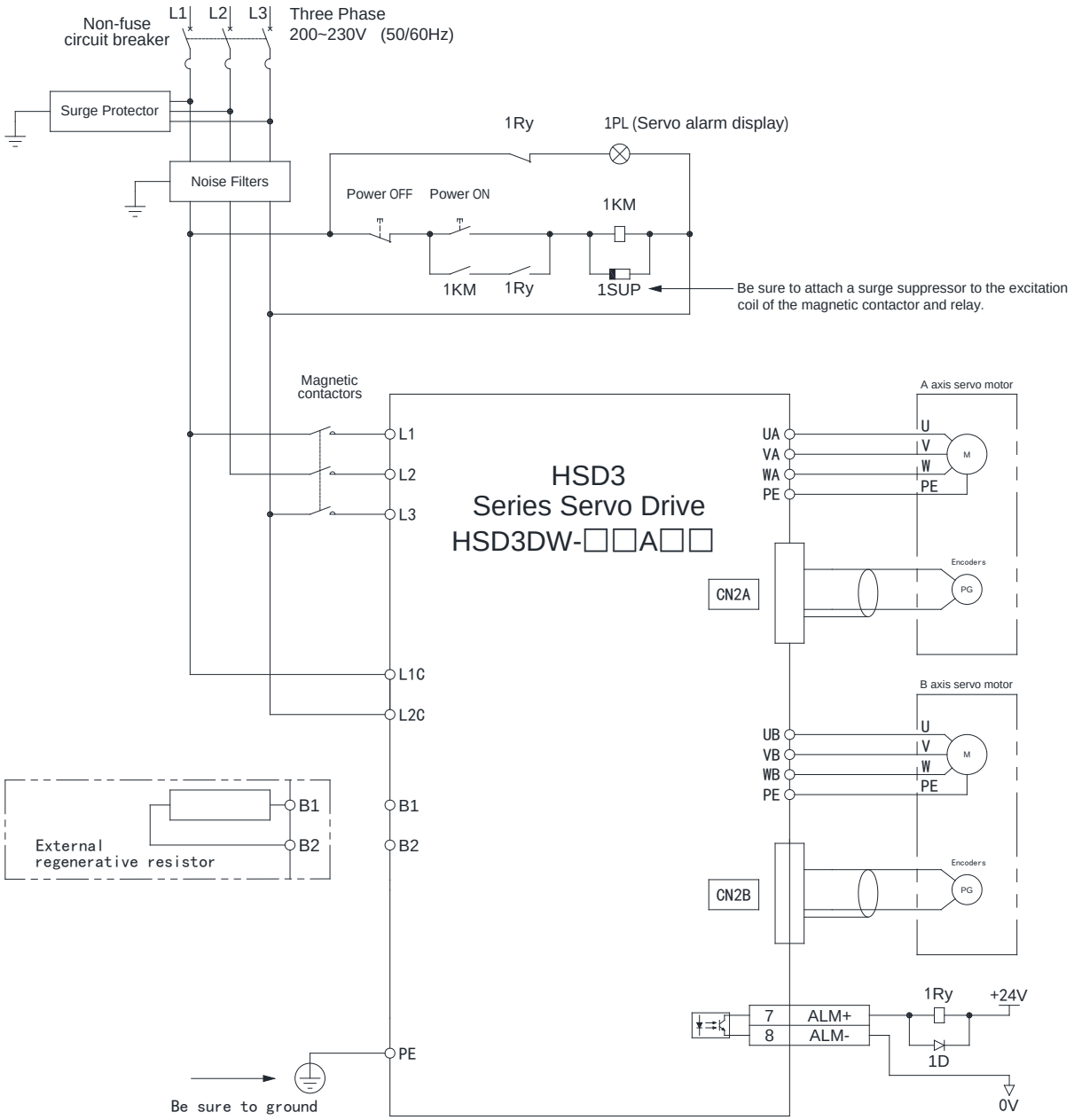
   You may operate and choose any of the methods in the Figure A, B



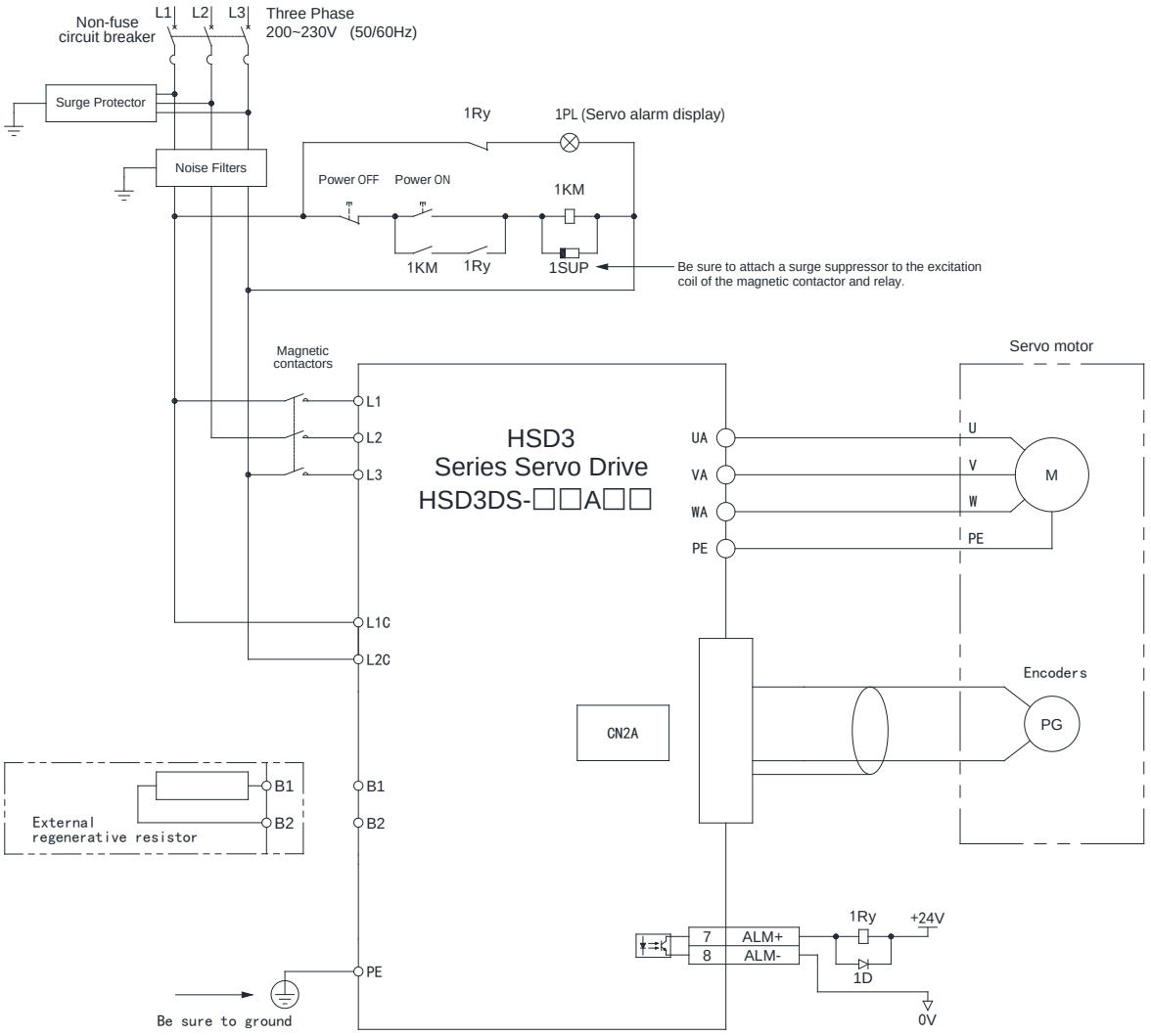
3. Insert the core line part of the wire into the opening. After inserted, loosen the pull rod or normal screwdriver.

3.1.3 Typical main circuit wiring example

■ Three-phases 220V (Biaxial drive HSD3DW-□□A□□)



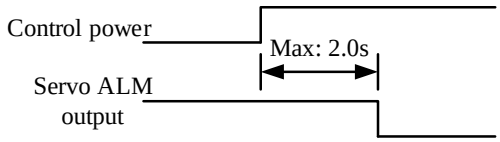
■ Three phases 220V (single axis drive HSD3DS-□□A□□)



■ The design of power supply ON sequence -

Please consider the following points in the power ON sequence design.

1. Please design the power ON sequence below: after output the signal of "servo alarm", be sure to make power supply being in OFF status. (Please refer to the above circuit diagram.)
2. Please press the power button for more than 2 seconds. After turn ON the control power of servo unit, output the signal of "servo alarm" for about 2s to the maximum (1Ry: OFF). This is the necessary step for the initial setting of the servo drive.



3. The power source specification of the use parts should be consistent with the input power.

3.2 Encoder signal wiring

The cable jumper of the coder and servo drive as well as its wiring pin model varies from the servo motor.

The signal name of the coder interface (CN2A/CN2B) on 2500-wire servo drive side:

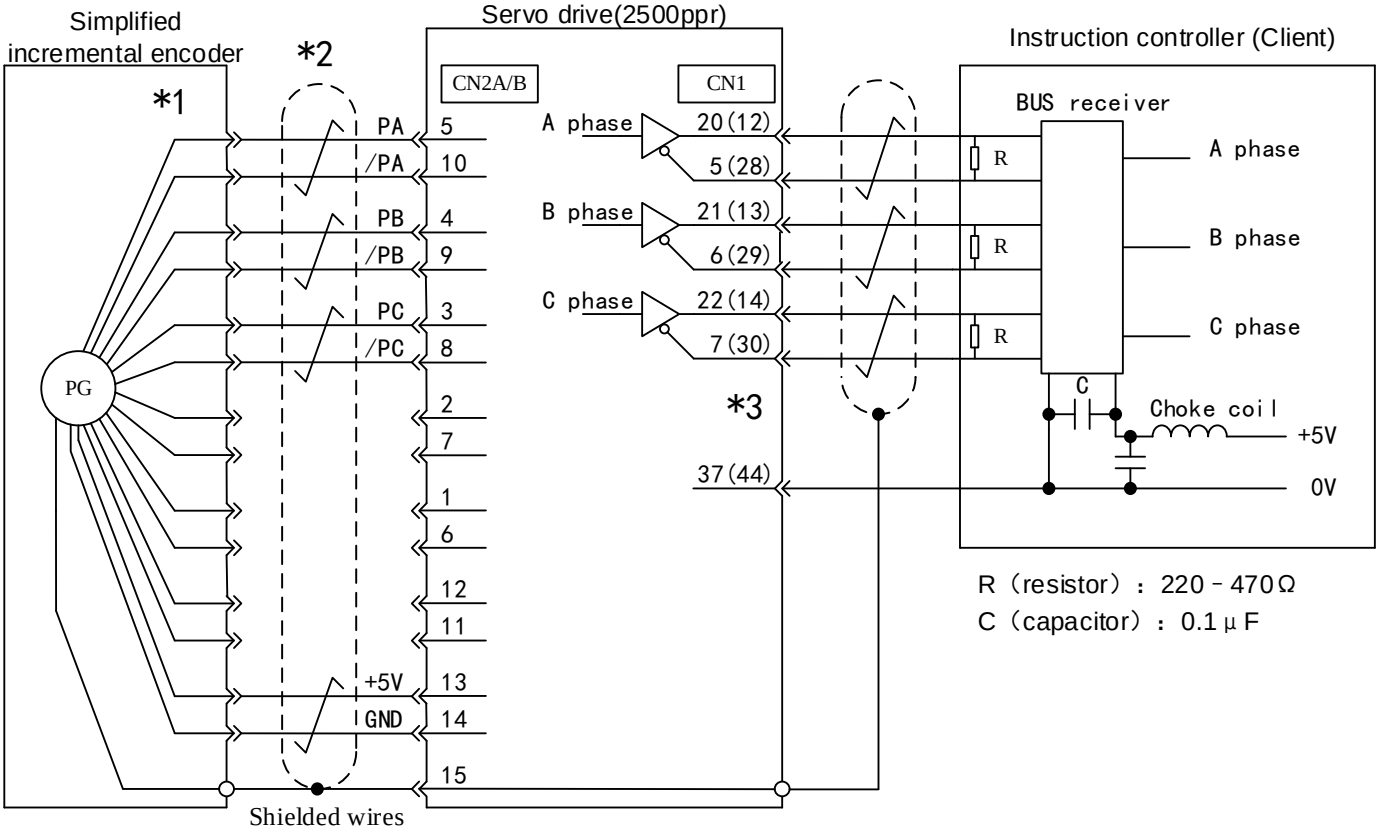
Terminal number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal name	V+	U+	C+	B+	A+	V-	U-	C-	B-	A-	W-	W+	5V	GND	FG

23 bits servo drive side encoder interface (CN2A/CN2B) signal name

Terminal number	1	2	3	4	5	6
Signal name	5V	GND	E+	E-	SD+	SD-

3.2.1 Connection with the encoder interface (CN2A /CN2B) and output signal processing from CN1

(1) 2500 incremental saving line encoder

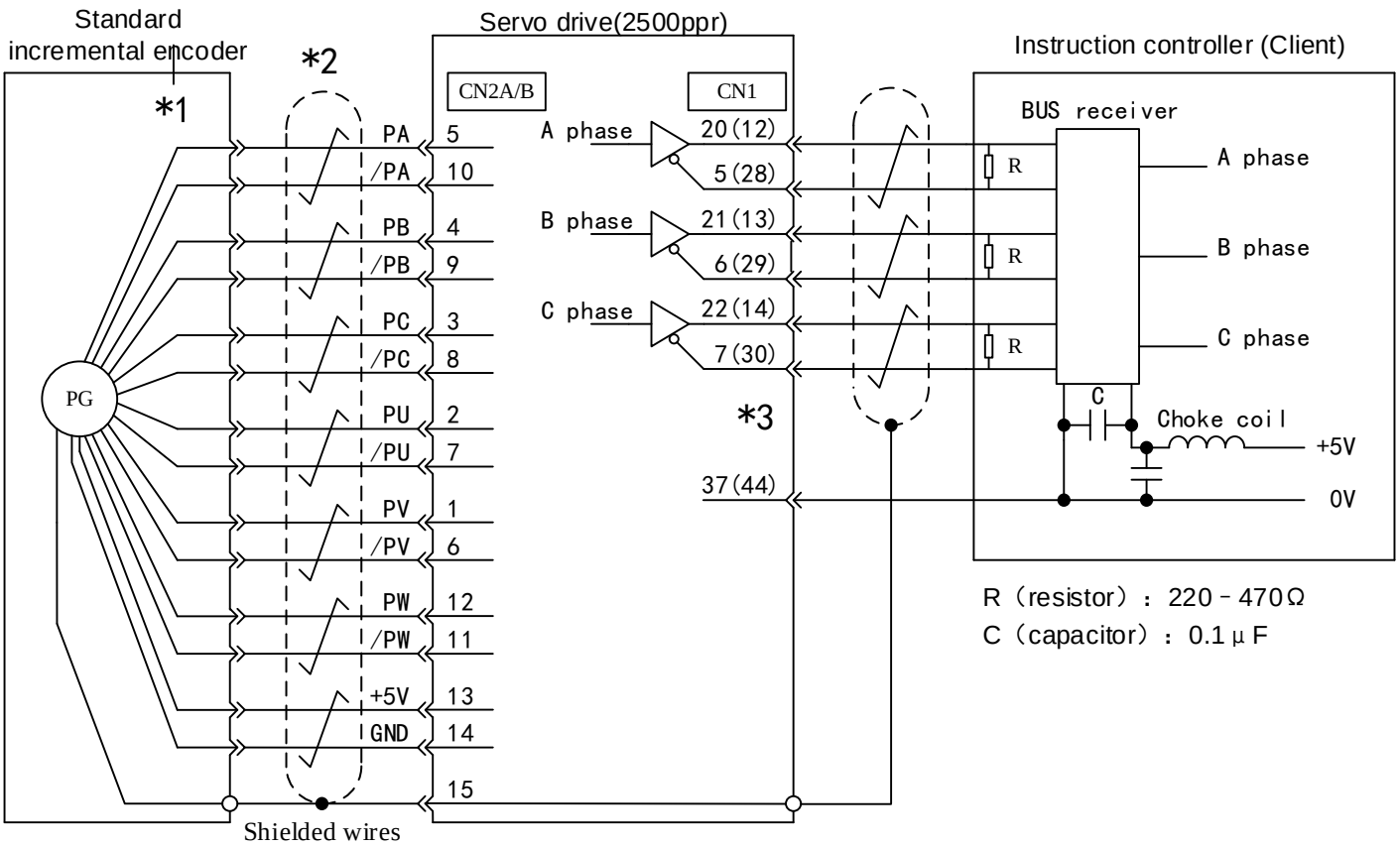


*1:The connector wiring is different from different servo motor used.

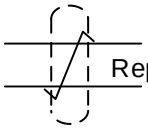
*2: Represents the multi - stranded shield Wire.

*3:The connector wiring is different from different servo drive used.
Inside () is the pin number of the axis b.

(2) 2500 incremental standard encoder

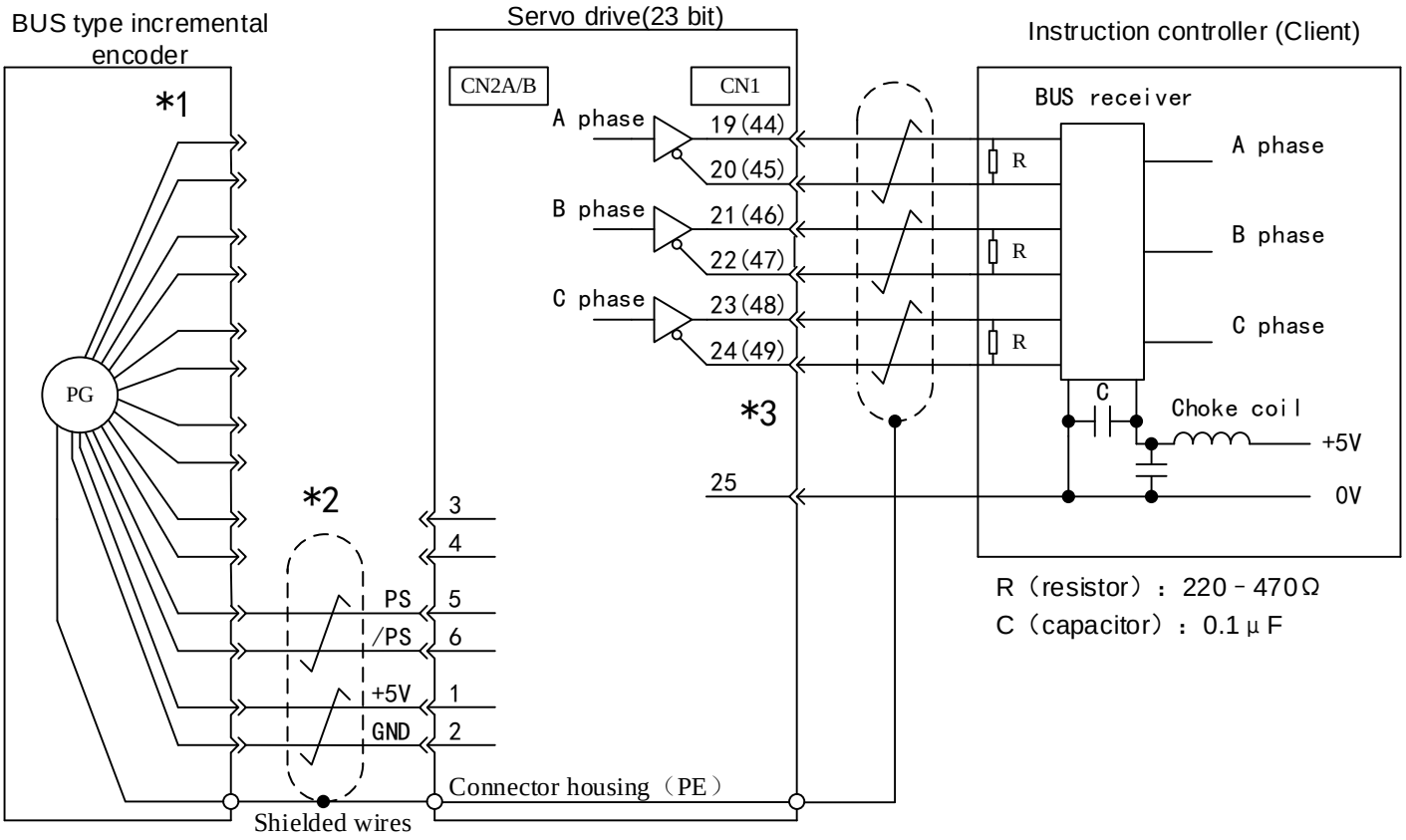


*1:The connector wiring is different from different servo motor used.

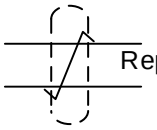
*2:  Represents the multi - stranded shield Wire.

*3:The connector wiring is different from different servo drive used.
Inside () is the pin number of the axis b.

(3) Bus incremental encoder

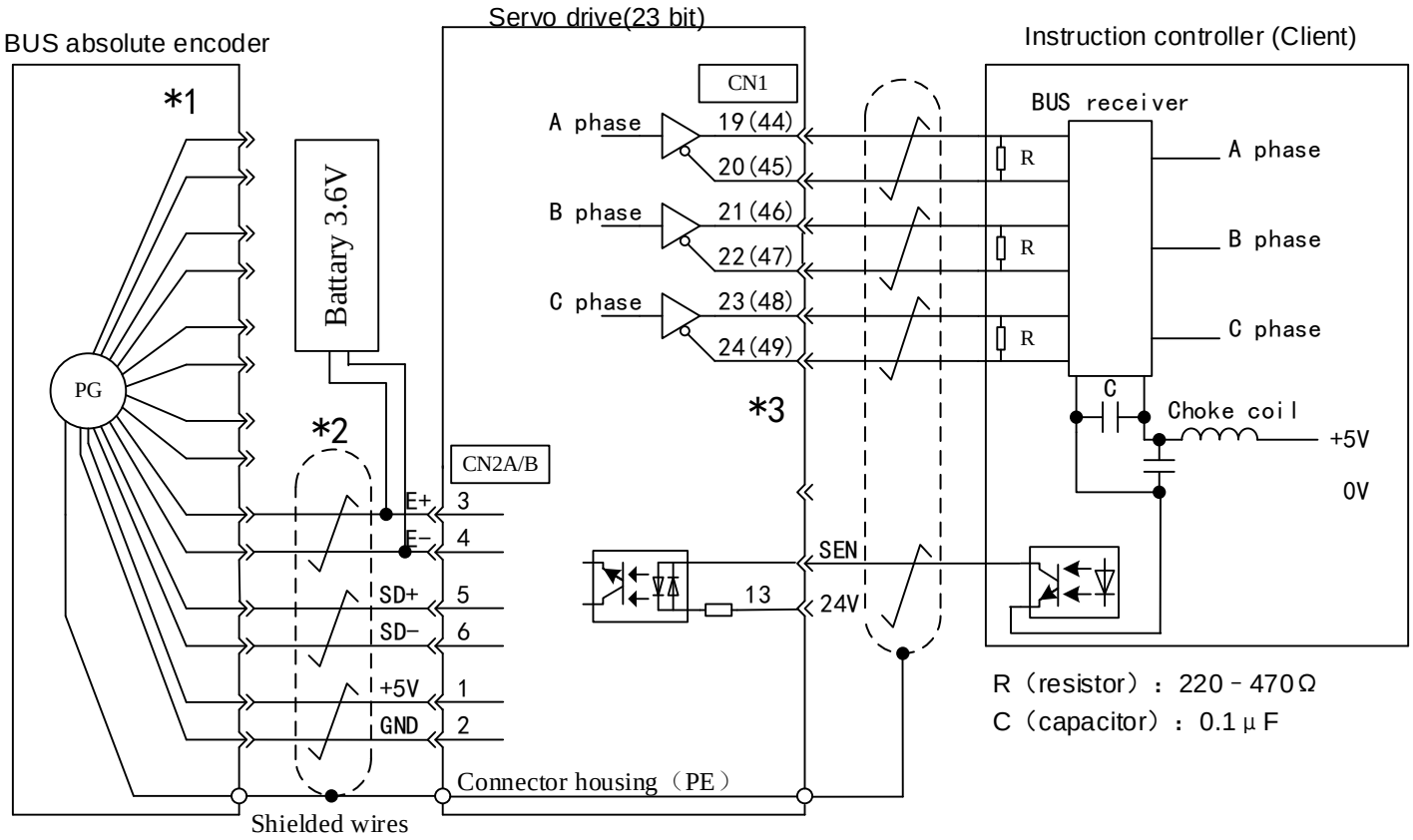


*1:The connector wiring is different from different servo motor used.

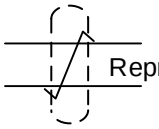
*2:  Represents the multi - stranded shield Wire.

*3:The connector wiring is different from different servo drive used.
Inside () is the pin number of the axis b.

(4) Bus absolute value encoder



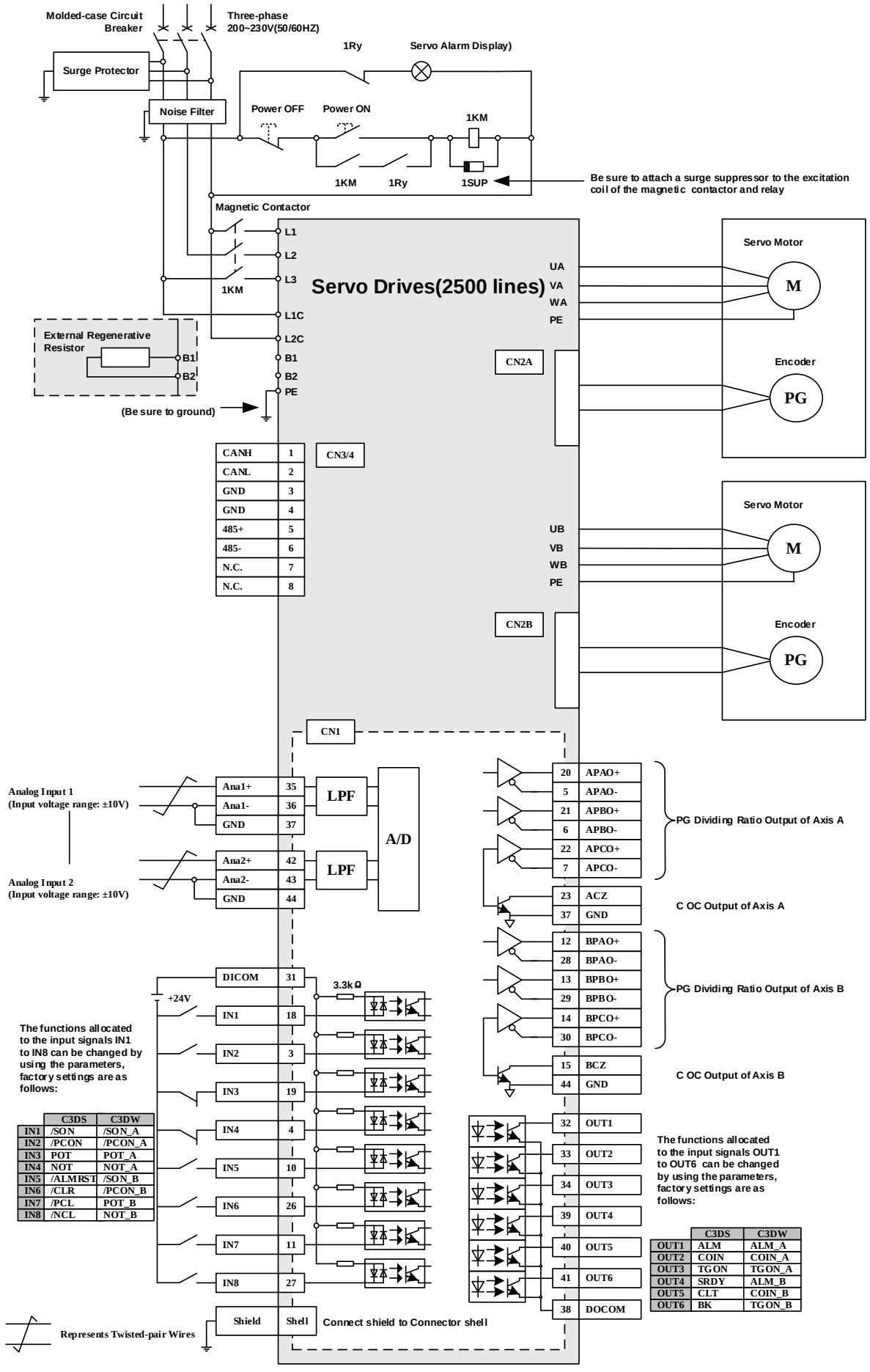
*1:The connector wiring is different from different servo motor used.

*2:  Represents the multi - stranded shield Wire.

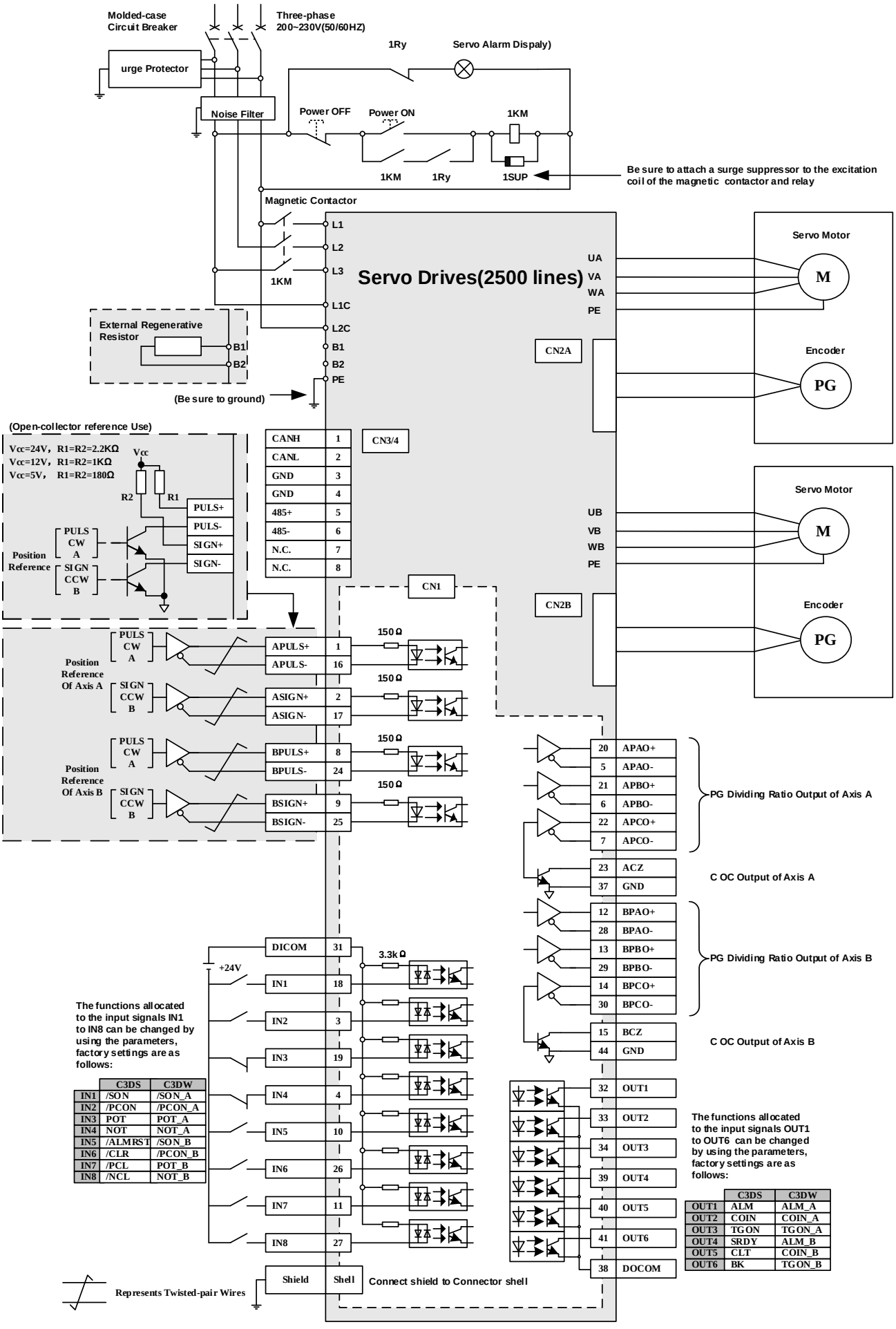
*3:The connector wiring is different from different servo drive used.
Inside () is the pin number of the axis b.

3.3 Input and output signal wiring

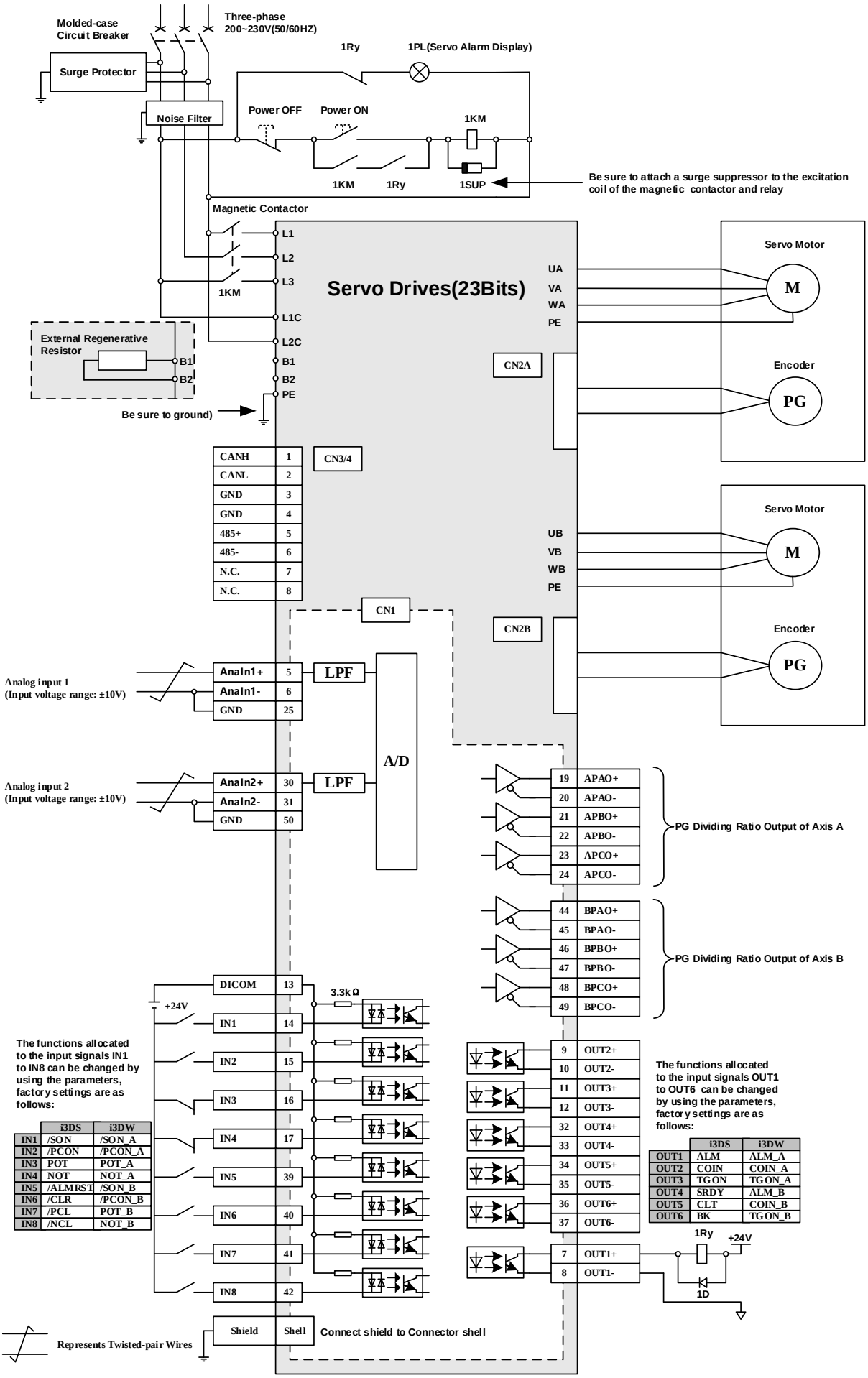
3.3.1 Speed / torque control mode (2500 line)



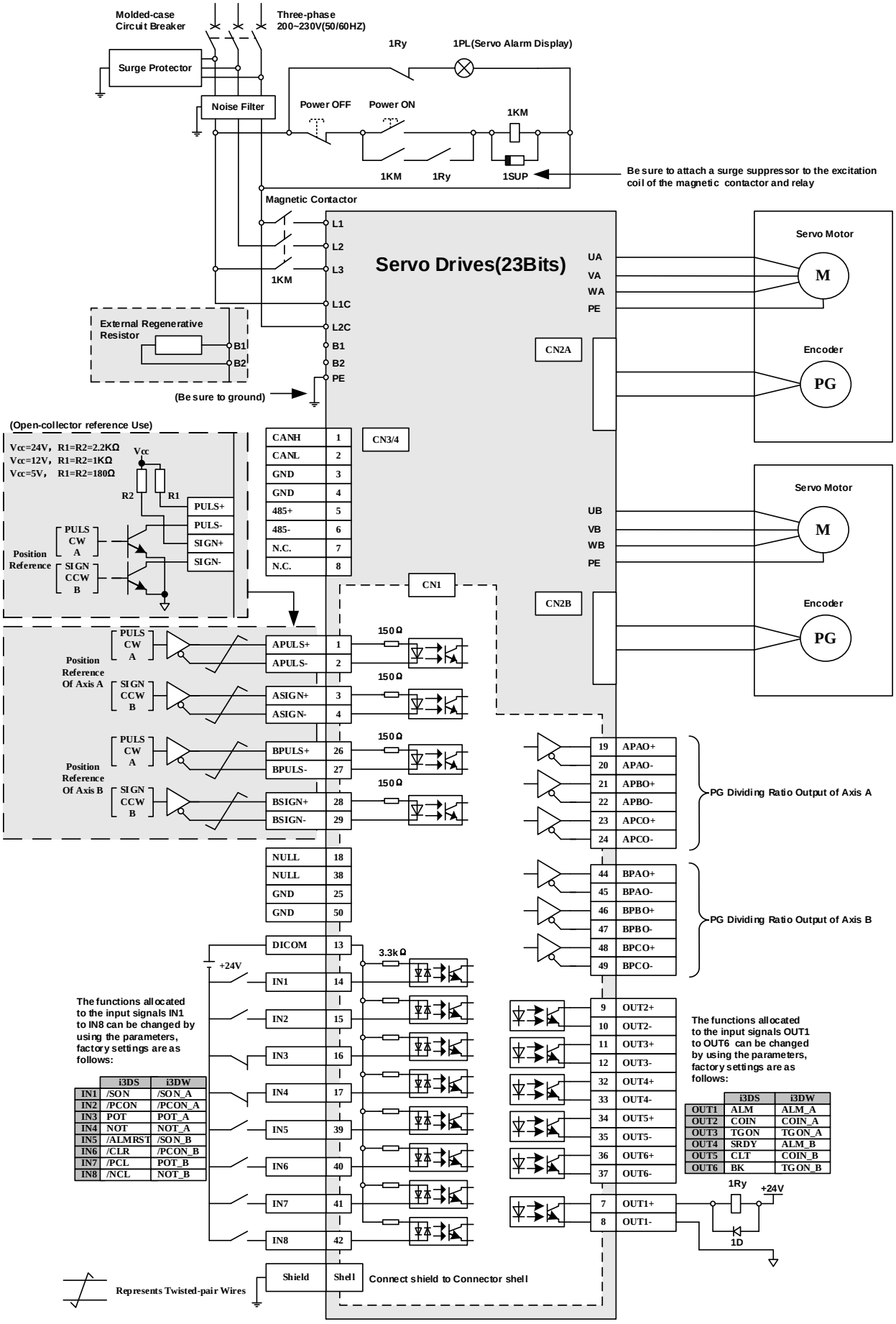
3.3.2 Position control mode (2500 line)



3.3.3 Speed / torque control mode (23 bits)



3.3.4 Position control mode (23 bits)



3.3.5 Input and output connector CN1 signal name and its function (2500 line)

Terminal number	Name	Function		Terminal number	Name	Function	
		Uniaxial drive	Biaxial drive			Uniaxial drive	Biaxial drive
1	APULS+	Command pulse input	A axis command pulse input	8	BPULS+	Reserve	B axis command pulse input
16	APULS-			24	BPULS-		
2	ASIGN+	Command symbol input	A axis command symbol input	9	BSIGN+	Reserve	B axis command symbol input
17	ASIGN-			25	BSIGN-		
18	IN1	The output port 1, which can be redistributed (leave the factory as: /S-ON)	The output port 1, which can be redistributed (leave the factory as: A axis /S-ON)	10	IN5	The output port 5, which can be redistributed (leave the factory as: /ALM-RST)	The output port 5, which can be redistributed (leave the factory as: b axis /S-ON)
3	IN2	The output port 2, which can be redistributed (leave the factory as: /P-CON)	The output port 2, which can be redistributed (leave the factory as: A axis /P-CON)	26	IN6	The output port 6, which can be redistributed (leave the factory as: /CLR)	The output port 6, which can be redistributed (leave the factory as: b axis /P-CON)
19	IN3	The output port 3, which can be redistributed (leave the factory as: POT)	The output port 3,which can be redistributed (leave the factory as: A axis POT)	11	IN7	The output port 7, which can be redistributed (leave the factory as: /PCL)	The output port 7, which can be redistributed (leave the factory as: b axis POT)
4	IN4	The output port 4, which can be redistributed (leave the factory as: NOT)	The output port 4, which can be redistributed (leave the factory as: A axis NOT)	27	IN8	The output port 8, which can be redistributed (leave the factory as: /NCL)	The output port 8, which can be redistributed (leave the factory as: b axis NOT)
32	OUT1	The output port 1, which can be redistributed (leave the factory as: ALM)	The output port 1, which can be redistributed (leave the factory as: A axis ALM)	39	OUT4	The output port 4, which can be redistributed (leave the factory as: /S-RDY)	The output port 4, which can be redistributed (leave the factory as: b axis ALM)
33	OUT2	The output port 2, which can be redistributed (leave the factory as: /COIN)	The output port 2, which can be redistributed (leave the factory as: A axis /COIN)	40	OUT5	The output port 5, which can be redistributed (leave the factory as: /CLT)	The output port 5, which can be redistributed (leave the factory as: b axis /COIN)
34	OUT3	The output port 3, which can be redistributed (leave the factory as: /TGON)	The output port 3, which can be redistributed (leave the factory as: A axis /TGON)	41	OUT6	The output port 6, which can be redistributed (leave the factory as: /BK)	The output port 6, which can be redistributed (leave the factory as: b axis /TGON)
31	DICOM	Input signal public end	Input signal public end	38	DOCOM	Output signal public terminal	Output signal public terminal
21	APAO+	PG frequency division output A phase	A axis PG frequency division output A phase	12	BPAO+	Reserve	B axis PG frequency division output A phase
5	APAO-			28	BPAO-		
22	APBO+	PG frequency division output B phase	A axis PG frequency division output B phase	13	BPBO+	Reserve	B axis PG frequency division output B phase
6	APBO-			29	BPBO-		
23	APCO+	PG frequency division output C phase	A axis PG frequency division output C phase	14	BPCO+	Reserve	B axis PG frequency division output C phase
7	APCO-			30	BPCO-		
23	ACZ	C phase collector open circuit output	A axis C collector open circuit output	15	BCZ	Reserve	B axis C collector open circuit output
35	AnIN1+	Speed command input	A axis command Input	42	AnIN2+	Torque command Input	B axis speed command Input
36	AnIN1-			43	AnIN2-		
37	GND	Signal ground	Signal ground	44	GND	Signal ground	Signal ground

(Note) 1. Empty terminal, do not use it.

2. Please connect the shielded wire for input/output signal cable to the connector shell.

3. The function distribution change of the following input/output signal can be achieved via the setting of user preferences.

Output: OUT1, OUT2, OUT3, OUT4, OUT5, OUT6

The above output opening can be changed to ALM, /COIN, /TGON, /S-RDY, /CLT, /BK of the A axis or B axis via the parameters.

Input: IN1, IN2, IN3, IN4, IN5, IN6, IN7, IN8

The above input opening can be changed to /S-ON, /P-CON, POT, NOT, /ALM-RST, /CLR, /PCL, /NCL, /GSEL, signals of the A axis or B axis via the parameters.

3.3.6 Input and output connector CN1 signal name and its function (23 bits)

Terminal number	Name	Function		Terminal number	Name	Function	
		Uniaxial drive	Biaxial drive			Uniaxial drive	Biaxial drive
1	APULS+	Command pulse input	A axis command pulse input	26	BPULS+	Reserve	b axis command pulse input
2	APULS-			27	BPULS-		
3	ASIGN+	Command symbol input	A axis command symbol input	28	BSIGN+	Reserve	b axis command symbol input
4	ASIGN-			29	BSIGN-		
5	AnIN1+	Speed command input	A axis command Input	30	AnIN2+	Torque command Input	b axis speed command Input
6	AnIN1-			31	AnIN2-		
7	OUT1+	The output port 1, which can be redistributed (leave the factory as: ALM)	The output port 1, which can be redistributed (leave the factory as: A axis ALM)	32	OUT4+	The output port 4, which can be redistributed (leave the factory as : /S-RDY)	The output port 4, which can be redistributed (leave the factory as: b axis ALM)
8	OUT1-			33	OUT4-		
9	OUT2+	The output port 2, which can be redistributed (leave the factory as: /COIN)	The output port 2, which can be redistributed (leave the factory as: A axis /COIN)	34	OUT5+	The output port 5, which can be redistributed (leave the factory as: /CLT)	The output port 5, which can be redistributed (leave the factory as: b axis /COIN)
10	OUT2-			35	OUT5-		
11	OUT3+	The output port 3, which can be redistributed (leave the factory as: /TGON)	The output port 3, which can be redistributed (leave the factory as: A axis /TGON)	36	OUT6+	The output port 6, which can be redistributed (leave the factory as: /BK)	The output port 6, which can be redistributed (leave the factory as: b axis /TGON)
12	OUT3-			37	OUT6-		
13	DICOM	Input signal public end	Input signal public end	38	NULL	Reserve	Reserve
14	IN1	The output port 1, which can be redistributed (leave the factory as: /S-ON)	The output port 1, which can be redistributed (leave the factory as: A axis /S-ON)	39	IN5	The output port 5, which can be redistributed (leave the factory as : /ALM-RST)	The output port 5, which can be redistributed (leave the factory as: b axis /S-ON)
15	IN2	The output port 2, which can be redistributed (leave the factory as: /P-CON)	The output port 2, which can be redistributed (leave the factory as: A axis /P-CON)	40	IN6	The output port 6, which can be redistributed (leave the factory as: /CLR)	The output port 6, which can be redistributed (leave the factory as: b axis /P-CON)
16	IN3	The output port 3, which can be redistributed (leave the factory as: POT)	The output port 3, which can be redistributed (leave the factory as: A axis POT)	41	IN7	The output port 7, which can be redistributed (leave the factory as: /PCL)	The output port 7, which can be redistributed (leave the factory as: b axis POT)
17	IN4	The output port 4, which can be redistributed (leave the factory as: NOT)	The output port 4, which can be redistributed (leave the factory as: A axis NOT)	42	IN8	The output port 8, which can be redistributed (leave the factory as: /NCL)	The output port 8, which can be redistributed (leave the factory as: b axis NOT)
18	NULL	Reserve	Reserve	43	NULL	Reserve	Reserve
19	APAO+	PG frequency division output A phase	A axis PG frequency division output A phase	44	BPAO+	Reserve	b axis PG frequency division output A phase
20	APAO-			45	BPAO-		
21	APBO+	PG frequency division output B phase	A axis PG frequency division output B phase	46	BPBO+	Reserve	b axis PG frequency division output B phase
22	APBO-			47	BPBO-		
23	APCO+	PG frequency division output C phase	A axis PG frequency division output C phase	48	BPCO+	Reserve	b axis PG frequency division output C phase
24	APCO-			49	BPCO-		
25	GND	Signal ground	Signal ground	50	GND	Signal ground	Signal ground

3.3.7 Interface circuit

The input/output signal of servo unit and its example of connection with instruction control unit are as follows.

(1) The interface with the instruction input circuit

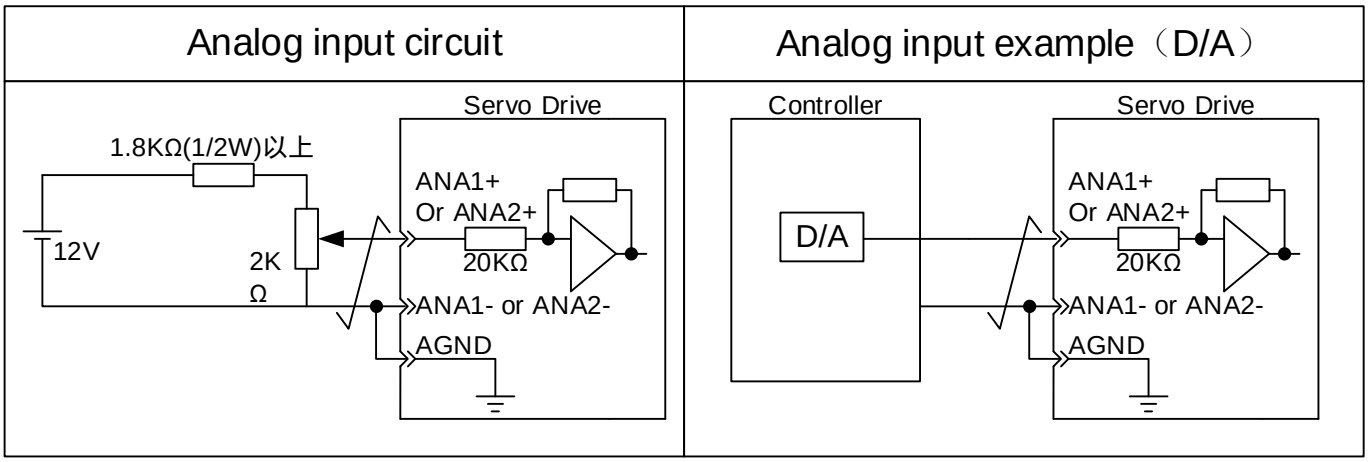
(a) Analog input circuit

Below is the ANA1 (speed instruction input) and ANA2 (torque instruction input) terminal of CN1 connector description.

The analog signal is a speed command or a torque command signal. Input impedance as shown below.

- Speed instruction input: About 20kΩ
- Torque instruction input: About 20kΩ

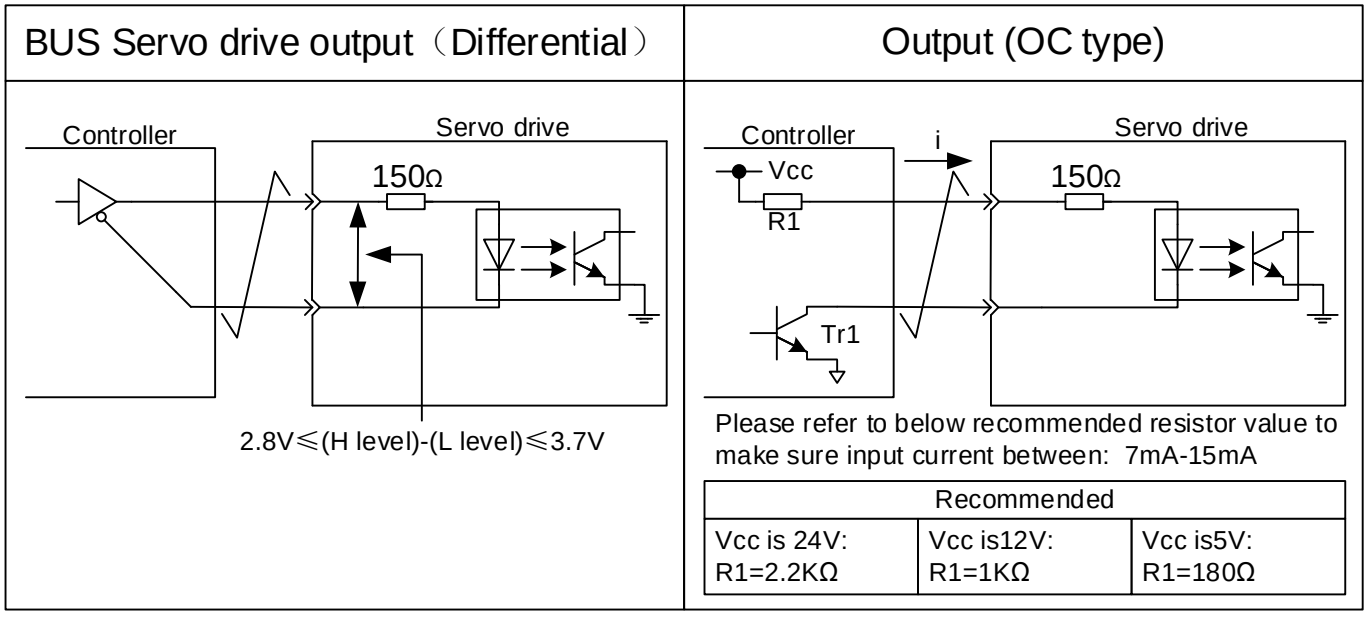
The maximum acceptable voltage of the input signal is±12V.



(b) Position instruction input circuit

And then, specify the 1-2(instruction pulse input) and 3-4 (instruction character input) of the CN1 connector.

The instruction pulse input circuit of the instruction control unit side can be selected from any one of the bus driver output and collector open circuit output, and its classification is as follows.



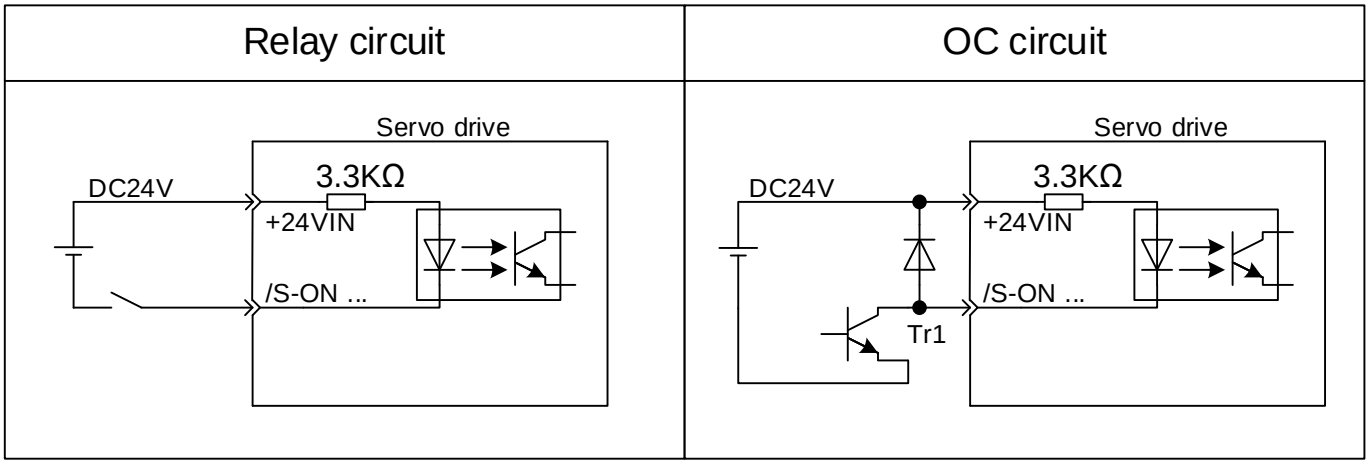
Please refer to below recommended resistor value to make sure input current between: 7mA-15mA

Recommended		
Vcc is 24V: R1=2.2KΩ	Vcc is12V: R1=1KΩ	Vcc is5V: R1=180Ω

(2) Interface with the direct control input circuit.

Below is IN1 ~ IN8 terminals of CN1 connector description.

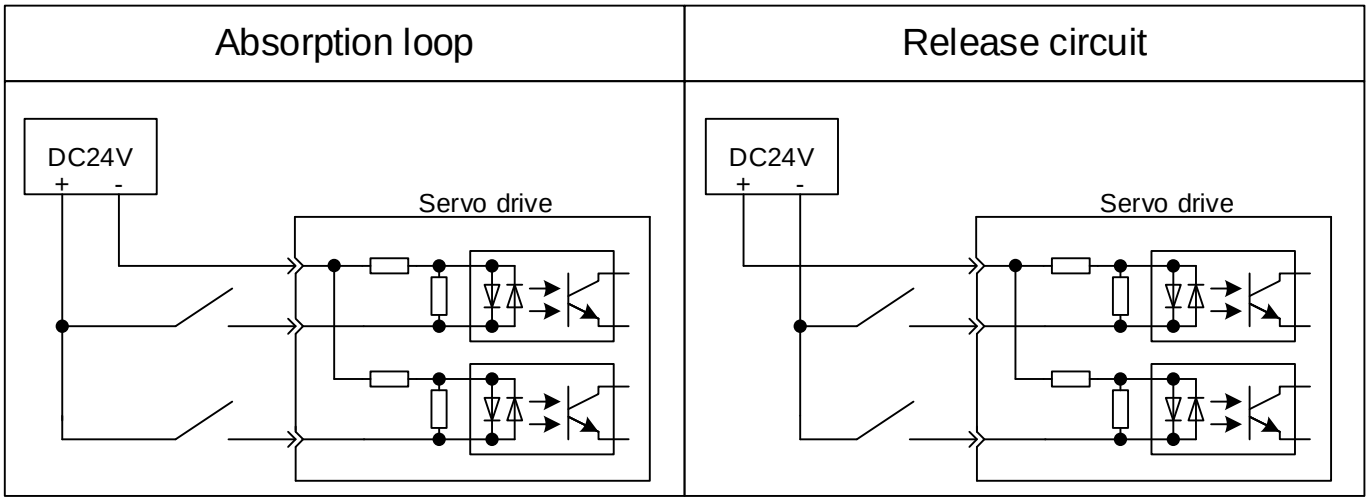
It is connected via the transistor circuit of relay or collector open circuit. When relay is used continuously, please choose the micro-current relay. If micro-current relay is not used, it causes poor contact.



Please refer to the section "the method of use of the absolute value encoder" for the interface of the SEN signal input circuit.

(3) Absorption loop and release circuit

The input circuit of the servo drive adopts bi-directional opto coupler. Please choose the connection of absorption circuit connection and the release circuit in accordance with the specifications of the machine.



(4) Interface with the output circuit

(a) Bus driver (differential) output circuit

Below is the description of the A phase signal, B phase signal and C phase signal terminal of CN1 connector.

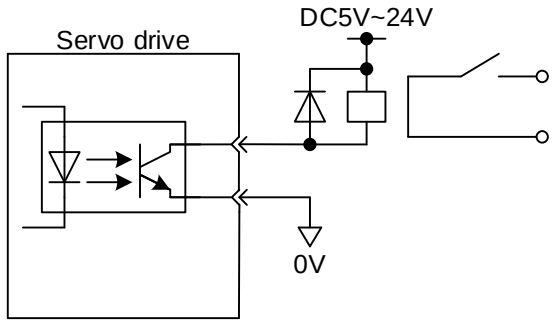
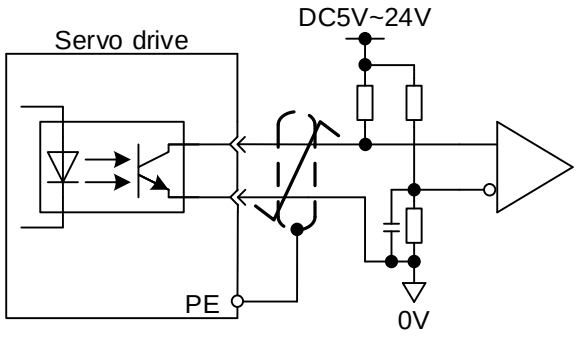
The serial data of the encoder is converted by two phases (A phase, B phase) and the output signal (PAO, /PAO, PBO, /PBO) and the origin pulse signal

(PCO, /PCO) is output by the output circuit of the bus driver. Usually, when the servo

unit the position control system is formed on the side of the command controller, the element is used by the speed control. On the instruction controller side, please use the bus receiver circuit for receiving.

(b) Output circuit of optical point coupler

The servo alarm (ALM), servo readiness (/S-RDY) and the other sequential output signals are made up of the output circuit of the opto-coupler. And through the relay circuit or the bus receiver circuit for connection.

Relay output	BUS receiving circuit
	

(Notes) The maximum allowable voltage and current capacity of the photoelectric coupler output circuit are shown below.

- Maximum voltage: DC30V
- Maximum current: DC50mA

3.4 Other wiring

3.4.1 Matters need attention for wiring

1. Use the specified cable for instruction input and wiring to encoder.
   Please select the cable with the shortest distance.
2. Use thick wires as much as possible for earth wiring (above 2.0mm^2).
   - Recommended grounding D or more (the value of grounding resistance is 100 Ω or less).
   - It must be grounded.
   - Please connect the servo motor directly to the ground when the servo motor and the machine are insulated from each other.
3. Do not bend the wire or bear the tension.
   The core line of the cable for signal is only 0.2mm or 0.3mm, very thin, please careful when using.
4. Please use the noise filter to deal with radio frequency interference.
   - When product is used near resident houses or when you worry about the influence of radio-frequency interference, please insert noise filter in the plug of power line.
   - As servo unit is a kind of commercial plant, the radio-frequency interference countermeasure is not taken.
5. In order to prevent the false operation caused by noise, the following handling method is effective.
   - Please try to configure the input instruction device and noise filter near the servo unit.
   - Please be sure to install surge suppressor on the coils of the relay, solenoid and electromagnetic contractor.
   - Please separate the power line (strong current circuit of power line, servo motor wiring, etc.) from the signal line during wiring, and keep a 30cm interval above. Do not put them in a same pipe or bind them together.
   - Do not use a same power supply with electric welding machine, electric discharge machine, etc. Although it is not the same power supply, and there exists high frequency generator nearby, please insert the noise filter on the input side of the power line.
6. Wiring breaker (QF) or fuse is used for protecting the power line.
   - The servo drive is directly connected on the industrial power line. That is to say, transformer is not used for insulation, in order to prevent the servo system from producing cross-electric shock accident, please be sure to use the wiring breaker (QF) or fuse.
7. Servo drive is not internally installed with ground protection circuit. In order to constitute a safer system, please configure the residual-current circuit breaker with dual purpose of overload/short-circuit protection or the special ground-electrode residual-current circuit breaker matched with wiring breaker.

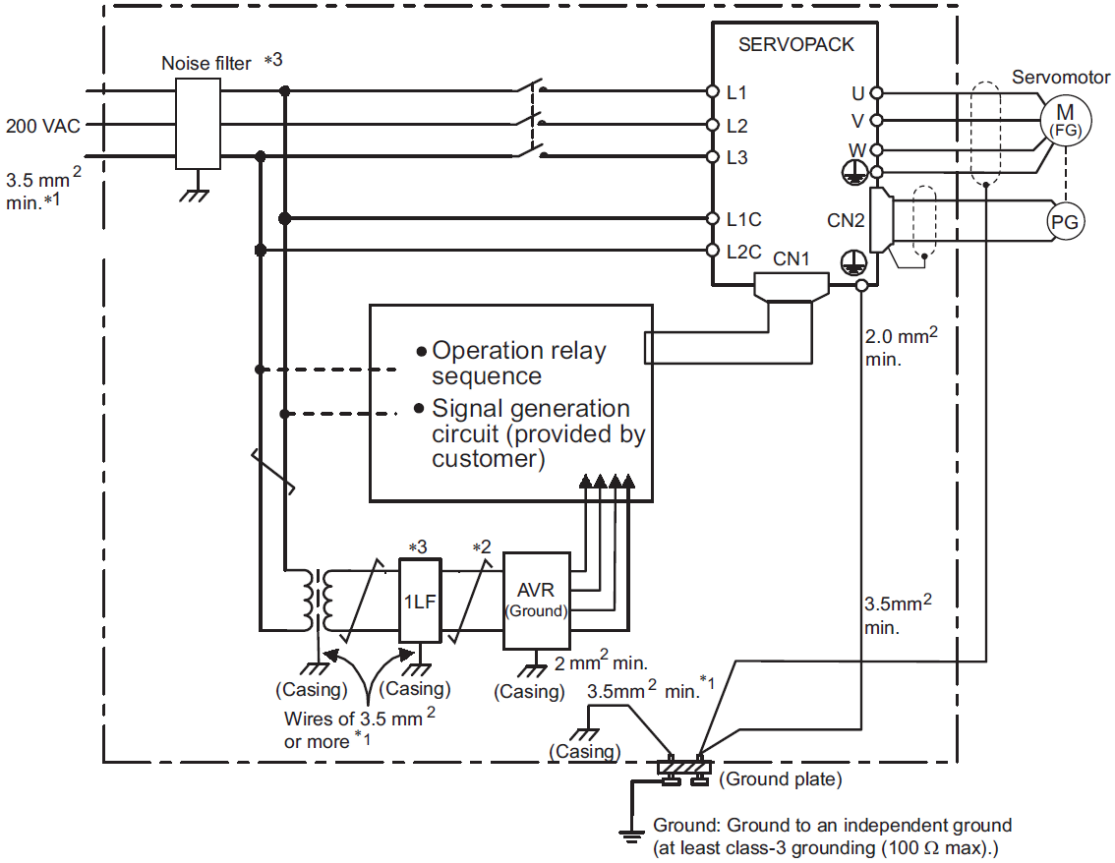
3.4.2 Anti-interference wiring

(1) An example of anti-interference distribution

"High-speed switch element" is used for the main circuit of the servo drive. According to the peripheral wiring and grounding treatment of servo drive, it may be influenced by the switch and noise due to switch element. Therefore, correct grounding method and wiring treatment are essential.

The servo drive is built in with a microprocessor (CPU). As a result, the "noise filter" needs to be configured in place to prevent external interference as much as possible.

The following figure is shown as an example of the wiring of the anti-interference measures.



∗1 For ground wires connected to the casing, use a thick wire with a thickness of at least 3.5mm^{2,} (preferably, plain stitch copper wire)

∗2 ⫽ : Represents twisted-pair wires

∗3 when using a noise filter, please follow the “(3) The method of using noise filter

(2) Correct grounding treatment

(a) Grounding of the motor frame

Please be sure to connect the motor frame terminal "FG" of the servo motor with the earthing terminal "PE" of the servo unit. In addition, the ground terminal "PE" shall be grounded.

When the servo motor is grounded via mechanical way and the switch interference current will flow from the power portion of the servo unit via the stray capacitance of servo motor.

The above content is the measure to prevent this effect.

(b) When the instruction input line is disturbed

Please connect the 0V line (GND) of the input line to the ground when the instruction input line is disturbed. Please connect the catheter and its junction box to the ground when the main electric circuit of the motor is passed through the metal pipe.

Please connect the above earth grounding to the ground.

(3) The method of using noise filter

In order to prevent interference from the power line, the blocking filter noise shall be used.

In addition, the power cord of the peripherals shall also be inserted into the noise filter as needed.

■ The power supply of brake uses the noise filter

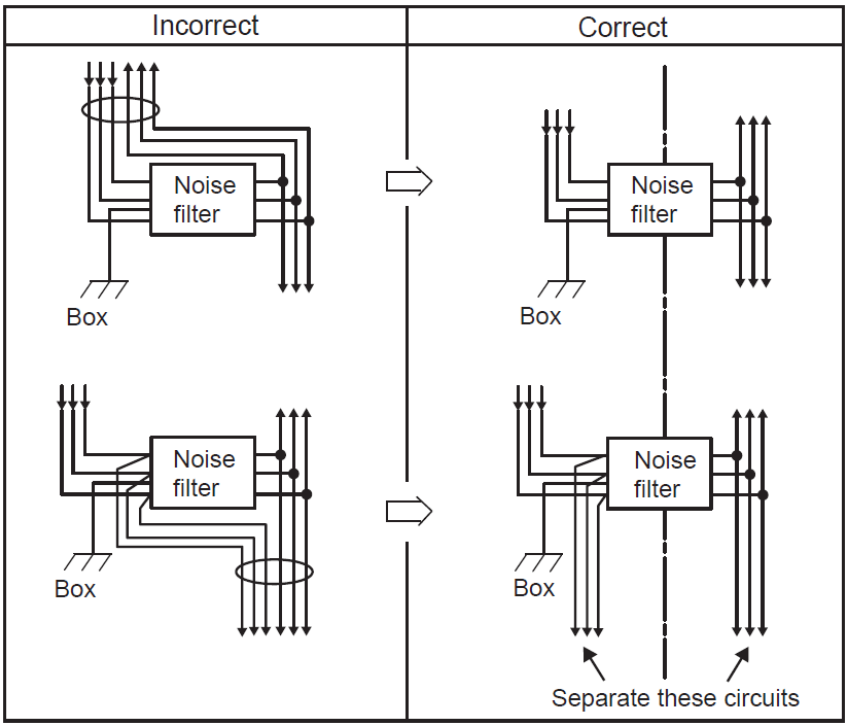
Use the following noise filter at the power input of the brake when using a servo motor with a brake under 400W.

Model: FN2070-6/07 (from SCHAFFNER)

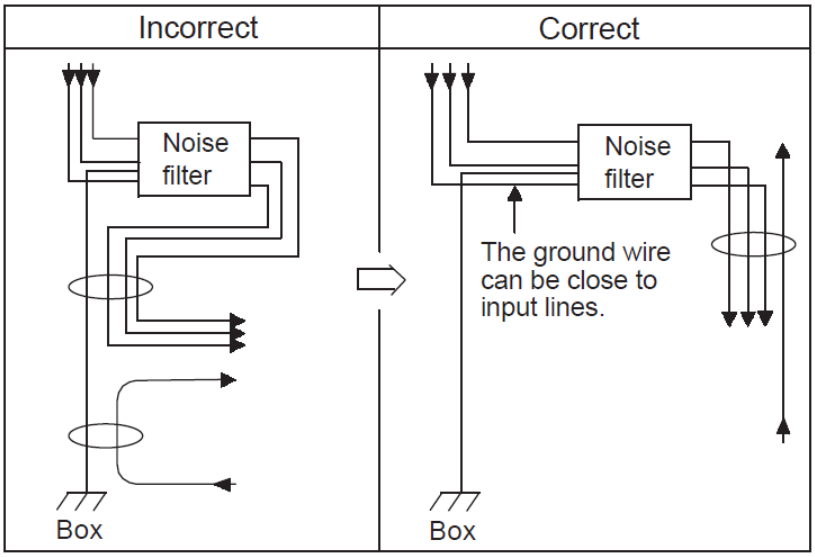
■ Note for the use of noise filter

Please follow the following precautions when the noise filter is installed and wired. If the error occurred in the using method, the effect of the noise filter will be greatly reduced.

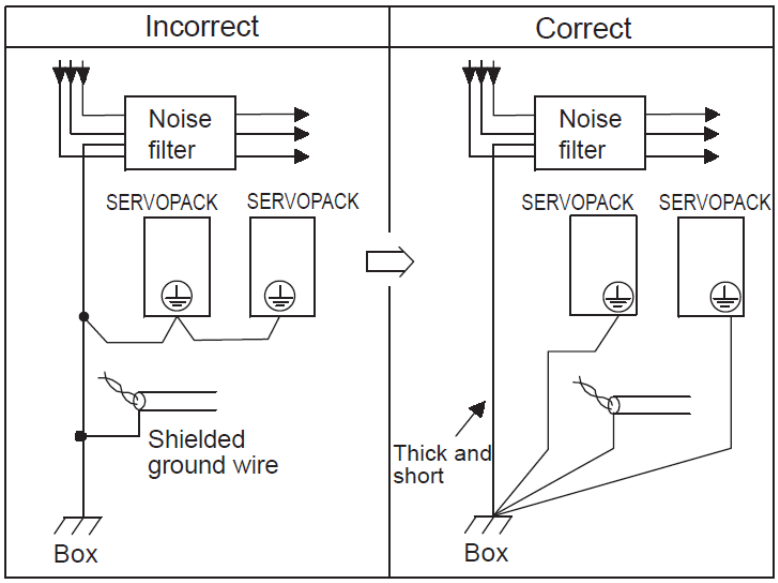
1. Please separate the input wiring from the output line. Do not put them into the same pipe or bundle together.



2. Separate the ground wire of the noise filter from the output wiring.
Please do not put the noise filter output wiring and other signal lines into the same pipe as the ground wire and do not bind them together.

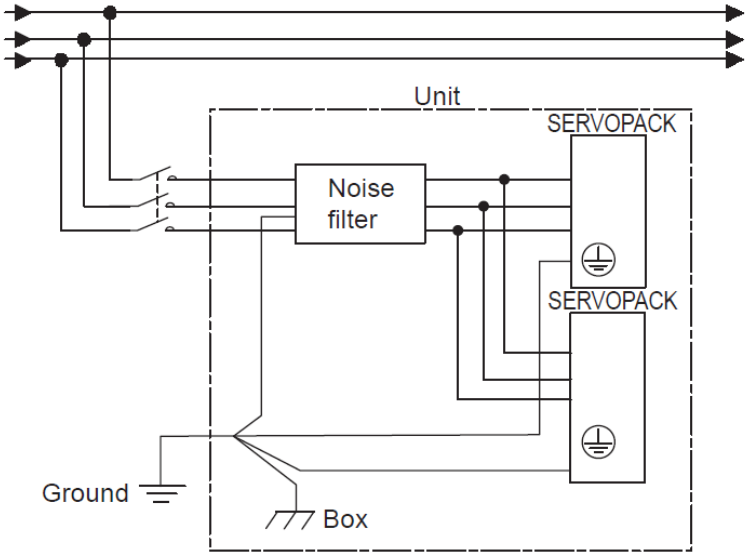


3. The ground wire of the filter line is connected to the floor separately. Do not connect to other ground lines.



4. The ground wire of the noise filter in the device.

Please connect the ground wire of the filter to the other mechanical grounding lines on the binding grounding plate, and then ground it when there is a noise filter in a certain device.



3.5 Electric motor wiring

3.5.1 Motor encoder with connector terminal wiring.

Bus type 23 bits encoder socket (7 cores):

Terminal number	1	2	3	4	5	6	7
Signal	FG	E-	E+	SD-	GND	SD+	5V

Note: SD+ and SD- are data output signals; E+ and E- are battery leads.

Bus type 23 bits encoder socket (17 cores):

Terminal number	J	S	t	L	G	K	H
Signal	FG	E-	E+	SD-	GND	SD+	5V

Note: SD+ and SD- are data output signals; E+ and E- are battery leads.

Servo motor 2500 wire incremental encoder socket (9 cores):

Terminal number	2	3	4	7	5	8	6	9	1
Signal	5V	GND	A+	A-	B+	B-	C+	C-	FG

Servo motor 2500 wire incremental encoder socket (17 cores):

Terminal number	H	G	A	B	C	D	E	F	J
Signal	5V	GND	A+	A-	B+	B-	C+	C-	FG

3.5.2 Motor power supply connector terminal wiring

Power socket 1 (4 cores):

Terminal number	1	2	3	4
Title	FG	U	V	W

Power socket 2 (4 cores):

Terminal number	D	A	B	C
Title	FG	U	V	W

Power socket 3 (6 cores):

Terminal number	1	2	3	4	5	6
Title	FG	U	V	W	BK+	BK-

Power socket 4 (9 cores):

Terminal number	E	F	I	B	G	H
Title	FG	U	V	W	BK+	BK-

3.5.3 Motor brake adopts the terminal wiring of the connector

Terminal number	1	2	3
Title	DC power supply (non polar access requirements)		——

110 Parameters of loss of electric brake in the seat configuration:

Working voltage: 24VDC (-15% ~ +10%), working current: ≤0.6A, the brake torque：≥8Nm

130 Parameters of loss of electric brake in the seat configuration:

Working voltage: 24VDC (-15% ~ +10%), working current: ≤0.6A, the brake torque：≥12Nm

180 Parameters of loss of electric brake in the seat configuration:

Working voltage: 24VDC (-15% ~ +10%), working current: ≤0.8A, the brake torque：≥30Nm

Chapter IV The using method of the panel operator

4.1 Basic operation

Panel operator can be used for the display and operation switch between A axis and b axis, setting of various parameters, execution of JOG running code, status display, etc. The names and functions of each key are summarized below.

4.1.1 The name and function of the key

Function key figure	Title	Function
F	Function Keys	Switching basic mode: state display, auxiliary function, parameter setting, monitoring Long press for switching A axis and B axis display and operation
▲	UP key	Press the UP key to increase the set value In auxiliary function mode JOG operation, it is used as positive start.
▼	DOWN key	Press the DOWN key to reduce the set value In auxiliary function mode JOG operation, it is used as reverse start
◀	Shift key	Press the key to move the selected bit (The decimal point is flashing) to the left.
S	Setting key	Press this button to display the setting and setting value of each parameter, and enter parameter setting state and the alarm can be cleared.

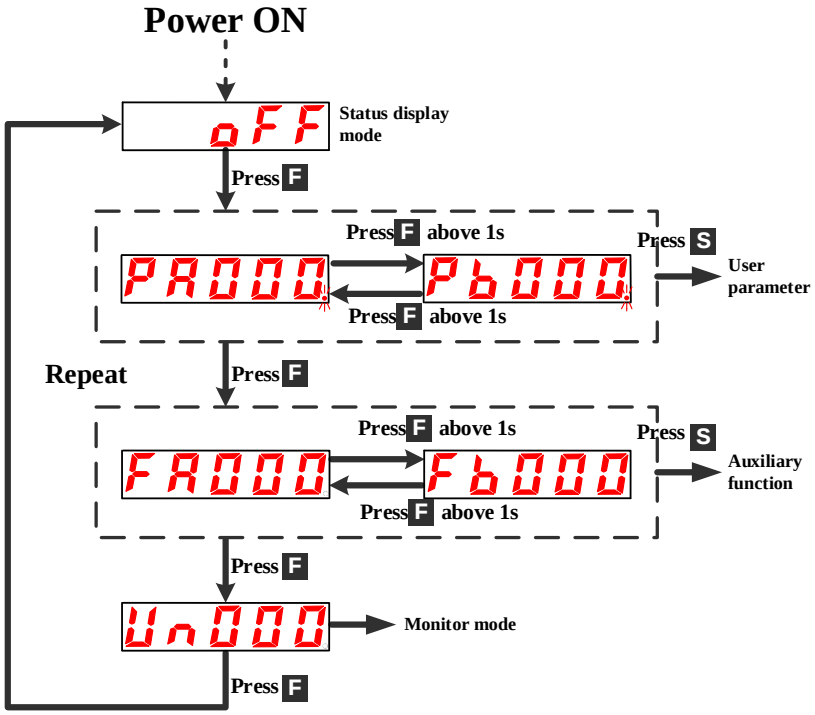
In the state display mode, the alarm can be cleared by press the SET key, and the alarm can also be cleared by alarm input signal /ALMRST.

Note: please find out the cause of the alarm first and then clear the alarm when the alarm occurs.

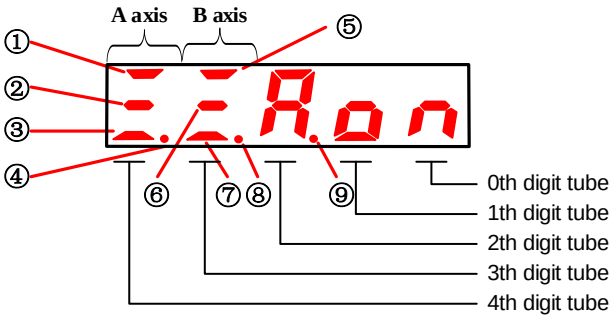
4.1.2 The selection and operation of basic mode

The display of running status, parameter setting, running code and other operation can be achieved via switching the basic mode of the panel operator.

The basic mode includes status display mode, parameter setting mode, monitoring mode and auxiliary function mode. After pressing the F key, the modes shall be switched in the order shown in the following figure.



4.1.3 Status display mode



■ Display content of the bit data

Item	Speed , torque control mode		Position control mode	
	Bit data	Display content	Bit data	Display content
①	A axis is running	Lit when the servo is in ON state. (electric motor is in the state of power On position)	A axis is running	Lit when the servo is in ON state (electric motor is in the state of powe On position)
②	A axis speed synchronous （/V-CMP）	The difference between the motor speed and the instruction speed is lower than the specified value Specified value: PA503 (The factory value is set as 10rpm)	A axis Positioning completed （/COIN）	Light it when the actual displacement of the position and motor position instruction is less than the specified value Specified value: PA500 (The factory value is set as 10 pulse)
③	A axis Torque output	Light it when the actual torque of the motor is 10% beyond the rated value	A axis Torque output	Light it when the actual torque of the motor is 10% beyond the rated value
④	A axis forward/reversal prohibition	The servo is in the limit: Lighting indicates that it is in the forward prohibition state Extinguishing indicates that it is in a reversal prohibition state Flicker indicates that it is in a forward/reversal prohibition state	A axis forward/reversal prohibition	The servo is in the limit: Lighting indicates that it is in the forward prohibition state Extinguishing indicates that it is in a reversal prohibition state Flicker indicates that it is in a forward/reversal prohibition state
⑤	B-axis is running	Lit when the servo is in ON state (electric motor is in the state of On position)	B-axis is running	Lit when the servo is in ON state (electric motor is in the state of On position)
⑥	B-axis Torque output	Light it when the actual torque of the motor is 10% beyond the rated value	B-axis Torque output	Light it when the actual torque of the motor is 10% beyond the rated value
⑦	B-axis Rotation detection （/TGON）	The difference between the motor speed and the instruction speed is lower than the specified value. Specified value: PA502 (The factory value is set as 20rpm)	B-axis Rotation detection （/TGON）	The difference between the motor speed and the instruction speed is lower than the specified value. Specified value: PA502 (The factory value is set as 20rpm)
⑧	B-axis forward/reversal prohibition	The servo is in the limit: Lighting indicates that it is in the forward prohibition state Extinguishing indicates that it is in a reversal prohibition state Flicker indicates that it is in a forward/reversal prohibition state	B-axis forward/reversal prohibition	The servo is in the limit: Lighting indicates that it is in the forward prohibition state Extinguishing indicates that it is in a reversal prohibition state Flicker indicates that it is in a forward/reversal prohibition state
⑨	Mains power supply is Ready	Light when the main circuit power supply is in operation Extinguishing when the main circuit power supply is off	Mains power supply is Ready	Light it when the main circuit power supply is in operation Extinguishing when the main circuit power supply is off

■ Display content of ellipsis

Ellipsis	Display content
	Both A axis and the b axis servo are in the OFF state (A axis and b axis electric motor is in the state of Off position)
	A axis servo is in the ON state (A axis electric motor is in the state of On position)
	b axis servo is in the ON state (b axis electric motor is in the state of On position)
	A axis is in a forward or reversal prohibition state (It is necessary to judge it according to the positive and reversal prohibition in the A axis display)
	b axis is in a forward or reversal prohibition state (It is necessary to judge it according to the positive and reversal prohibition in the b axis display)
	A axis alarm state Alarm number is displayed
	b axis alarm state Alarm number is displayed

4.2 The auxiliary function mode（F□□□□）

4.2.1 Summary of auxiliary function execution pattern

The operation of the digital operator used for motor operation and adjustment will be described in the section.

The following shows the overview of user parameter and functions of the auxiliary function execution mode.

Auxiliary function number	Function
F□000	Software of the servo
F□001	Position instruction (it is only valid in position mode)
F□002	Jogging (JOG) mode operation
F□003	Identify the percentage of load inertia (relative motor ontology of inertia)
F□004	Verification of the User's password
F□005	Confirmation of generator model
F□006	Manual adjustment of speed instruction offset
F□007	Manual adjustment of torque instruction offset
F□008	Automatic adjustment of analog quantity (speed, torque) instruction offset
F□009	Clear the multi loop information data of the bus encoder
F□010	Clear the internal error of the bus encoder
F□011	Initialize the user parameter setting value
F□012	Display the historical alarm data

Note: if it displays "A" in the above table "□" represents that it is in the current A axis auxiliary function mode, and if it displays "B" represents the current mode for the auxiliary function of B axis.

4.2.2 Servo Software version of displaying

The following is shown the operation steps of the software version of the b axis.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press F function key to choose the auxiliary function mode, and the present situation is A-axis auxiliary function mode.	F	
2	Please press F function key (last more than 1 second), switch to b axis auxiliary function mode to display the Fb000.	F	
3	Please press UP or DOWN key to select the auxiliary function Fb000 that you would like to operate.	▲ ▼	
4	Please press the settings key, if it display A-1.00, it indicate the processor version is V1.00..	S	
5	Please press down the shift key, if it display P-1.00, it indicate the FPGA program version is V1.00.	◀	
6	press down the settings key to Return to the Fb000 display.	S	

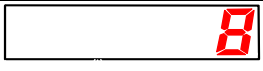
4.2.3 Position teaching operation

The following is shown the operation steps of the position teaching of A axis.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press F function key (last more than 1 second), switch to A axis auxiliary function mode to display the FA000.	F	
2	Please press UP or DOWN key to select the auxiliary function FA0001 that you would like to operate.	▲ ▼	
3	Please press down the setting button to display "2PCLr" and enter the position teaching operation.	S	
4	Please press down the setting key (last more than 1 second) until the flicker shows "donE", which indicates the position teaching operation has been completed successfully.	S	
5	Return to the FA001 display by press down the settings key.	S	

4.2.4 Recognition of the inertia percentage

The following are steps shown the procedure of the percentage of the inertia of A axis by showing the normal mode (clockwise 3 turns, then 3 turns counterclockwise).

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis parameter setting mode. Press UP key or DOWN key to set the PA127 whether PA127 is not displayed.	F	
2	Please press the setting button to show "H1341.", and the No. 0 of decimal point in the current display is flashing.	S	
3	Please press down 3 times shift key, select the third bit of current display, display "H1.341", and the third decimal point in the current display flashes.	◀	
4	Please press down UP key, change the data, and show "H2.341".	▲	
5	Return to the upper menu by press down the settings key.	S	
6	Please press F function key to select the auxiliary function FA003 that you would like to operate.	F	
7	Please press down the setting key to display the inertia recognition percentage operation interface "-JIn-".	S	
8	Please press F function key, start the inertia recognition operation, and the motor clockwise turn 3 circles first, and then counter clockwise 3 circles, blinking display "donE".	F	
9	The percentage of the current detected inertia is displayed after the test is completed.	——	
10	Return to the Fb000 display by press down the settings key.	S	

4.2.5 Confirmation of motor model

It is used for confirming the servo motor type, capacity and encoder model of the servo drive.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA005 if FA005 is not displayed.	F	
2	“A.0004” is displayed by press down the settings key.	S	
3	Please press down 1 time shift key and display "b.0220".	◀	
4	Please press down 1 time shift key and display "C.0010".	◀	
5	Please press down 1 time shift key and display "d.0020".	◀	
6	“A.0004” is displayed by press down the settings key.	◀	
7	Return to the Fb000 display by press down the settings key.	S	

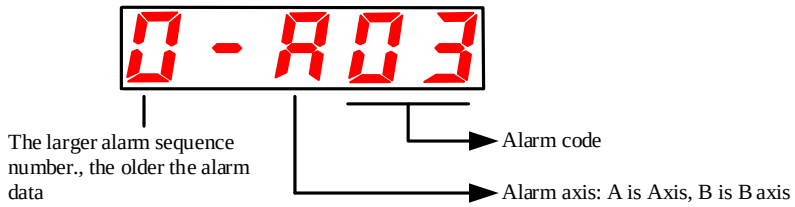
4.2.6 Initialize the user parameter setting value

The following operation steps show the initialization of the user parameters of A axis.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA011 if FA011 is not displayed.	▲ ▼	FA011
2	Entering the parameter initialization operation by press down the setting key.	S	P.InIt
3	Please press down the setting key (last more than 1 second) till the flicker shows "donE", which indicates the initialization of the user parameters of A axis has been completed successfully.	S	donE
4	Return to the FA011 display by press down the settings key.	S	FA011

4.2.7 Display the historical alarm data

The maximum 10 past alarms can be identified. The history alarm record will be deleted by the long press setting key. The historical alarm data cannot be deleted even if the alarm was reset or the servo powered off. In addition, the operation shall not be impacted the alarm history data itself.



For the alarm content, please refer to the "exception diagnosis and treatment measures".

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1. The alarm history data will not be updated if the same alarm occurs continuously.
2. Alarm history data of "A--" or "b--" indicates that no alarm has been reported.

Please follow the following steps to confirm the historical alarm.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA012 if FA012 is not displayed.	▲ ▼	FA012
2	Press down setting key, if it shows “0-A03”, it is the current alarm.	S	0-A03
3	Please press down UP key to show the previous 1 historical alarm (press down to show the next new 1 alarm).	◀	1-A01
4	If the UP key is pressed down, the alarms shall be displayed by order. * "A--" or = "b--" indicates that "no alarm".	▲	2-A--
5	Return to the Fb012 display by press down the settings key.	S	FA012

4.3 Operation under the user parameters mode（P□□□□）

Function may be selected or adjusted via setting parameters. There are "parameter setting" and "function selection", two types of user parameters.

Parameter setting is the function to change the parameter data to be adjusted within a certain range, and function selection is to choose the functions which have been distributed to the each bit of the panel operator.

4.3.1 User parameters setting

(1) Parameter setting

(a) Type of "parameter setting"

Please refer to the "user parameter list".

(b) Example of changing step of "parameter setting"

The data will be specified directly with numerical values for the parameter setting type user parameters.

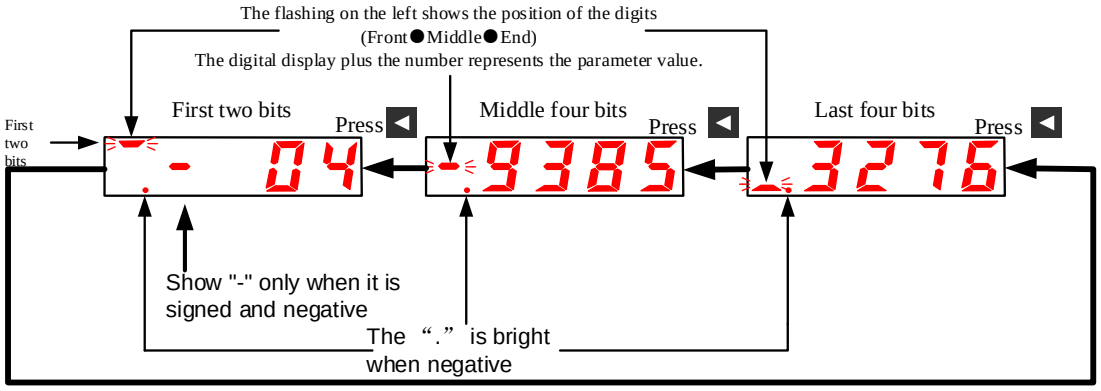
The scope of changing can be confirmed by user's parameter list.

Practical example: below is the operation step of changing the b - axis user parameter Pb100 (speed loop gain) from "40" to "100".

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select parameter setting mode.	F	PA000
2	Please press down F function key (last more than 1 second) and show Pb000. and the No. 0 of decimal point in the current display are flashing.	F	Pb000
3	Please press down 2 times shift key, to select the second bit of current display, display Pb0.00, and the third decimal point in the current display flashes.	◀	Pb0.00
4	Please press down UP key, change the data, and show Pb1.00.	▲	Pb 1.00
5	Pb100 current data is displayed by press down the settings key.	S	00040
6	Please press down 2 times shift key, select the second bit of current display, shows 000.40 and the second decimal point in the current display flashes.	◀	000.40
7	Please press down UP key, change the data, and show 001.40.	▲	00 1.40
8	Please press down 4 times shift key, select the first bit of current display, shows "0014.0", and the second decimal point in the current display flashes.	◀	00 14.0
9	Please press down key, change the data, and show 001.00.	▼	00 10.0
10	Please press down the setting key and return to Pb1.00 so that the content of the b axis speed loop gain Pb100 is changed from "40" into "100".	S	Pb 1.00

◆ The setting range is above 6 bits

Since the panel operator can only display 5 digits, the setting value beyond 6 bits shall be displayed as follows.



(2) Functional selection

(a) Category of "functional selection"

Please refer to the "User parameters list".

(b) Example of changing step of "functional selection"

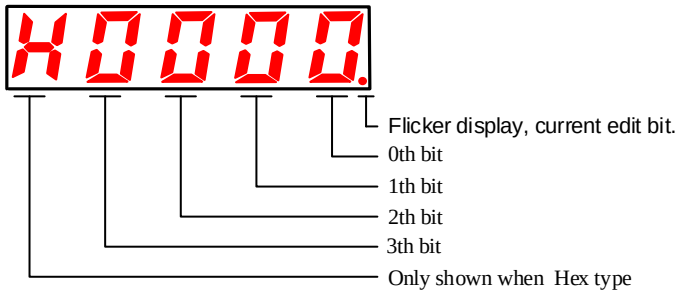
Example: the following is the operating step of choosing the control mode (PA000.1) of the basic switch PA000 for A-axis function, namely, changing from speed control to position control.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press F function key (last more than 1 second), and display PA0.00	F	
2	Press the setting key to show the current data of PA000, and the No. 0 of decimal point in the current display is flashing.	S	
3	Please press down 1 time shift key, select the first bit of current display, shows H000.0，and the first decimal point in the current display flashes.	◀	
4	Please press down UP key, change the data, and shows H001.0.	▲	
5	Return to the PA0.00 display by press down the settings key, so that the A axis control mode is changed to position control	S	

(c) User parameters in this manual

The user parameters of the function selection are expressed in hexadecimal number, and the each number of setting values has its own meaning.

The manual adopts the following representation for the user parameters of the function selection.



PA000.0 or A.Hxxx□ 。。。。。。	It indicates that the value represented by the setting value "0 digit" of the A axis of user parameter "PA000".
PA000.1 or A.Hxx□x 。。。。。。	It indicates that the value represented by the setting value "1 digit" of the A axis of user parameter "PA000".
PA000.2 or A.Hx□xx 。。。。。。	It indicates that the value represented by the setting value "2 digit" of the A axis of user parameter "PA000".
PA000.3 or A.H□xxx 。。。。。。	It indicates that the value represented by the setting value "3 digit" of the A axis of user parameter "PA000".
Pb000.0 or b.Hxxx□ 。。。。。。	It indicates that the value represented by the setting value "0 digit" of the A axis of user parameter "Pb000".
Pb000.1 or b.Hxx□x 。。。。。。	It indicates that the value represented by the setting value "1 digit" of the A axis of user parameter "Pb000".
Pb000.2 or b.Hx□xx 。。。。。。	It indicates that the value represented by the setting value "2 digit" of the A axis of user parameter "Pb000".
Pb000.3 or b.H□xxx 。。。。。。	It indicates that the value represented by the setting value "3 digit" of the A axis of user parameter "Pb000".

4.3.2 Input circuit signal distribution

Each input signal is the pin assigned to the input connector (CN1) according to the user parameter setting. (The distribution table is shown below.)

(1) Setting at the time leaving factory

The distribution of leaving the factory is the setting of thick wireframe in the following table.

(a) Leaving factory value of uniaxial drive

PA509 = H.4321 PA510 = H.8765 PA511 = H.0000 PA512 = H.0000

(b) Leaving factory value of biaxial drive

PA509 = H.4321 PA510 = H.0000 PA511 = H.0000 PA512 = H.0000

Pb509 = H.8765 Pb510 = H.0000 Pb511 = H.0000 Pb512 = H.0000

(2) Change distribution

Please set up user parameters according to the relationship between the using signal and the input connector pin. However, "power off"→ “power restarting" must be performed to the servo unit when the user parameters are changed.

(a) Signal distribution table for the input circuit of uniaxial drive:

Signal name	Input signals	CN1 pin number								Don't connect it	
User parameters distribution		(IN1)	(IN2)	(IN3)	(IN4)	(IN5)	(IN6)	(IN7)	(IN8)	Regular time invalid	Regular time valid
Servo ON PA509.0 = H.xxx□	/S-ON	1	2	3	4	5	6	7	8	0	9
Proportional action instruction PA509.1 = H.xx□x	/P-CON	1	2	3	4	5	6	7	8	0	9
prohibited to have positive drive PA509.2 = H.x□xx	POT	1	2	3	4	5	6	7	8	0	9
prohibited to have reversal drive PA509.3 = H.x□xxx	NOT	1	2	3	4	5	6	7	8	0	9
Alarm reset PA510.0 = H.xxx□	/ALM-RST	1	2	3	4	5	6	7	8	0	9
Deviation counter reset PA510.1 = H.xx□x	/CLR	1	2	3	4	5	6	7	8	0	9
Positive rotation side external restrictions PA510.2 = H.x□xx	/PCL	1	2	3	4	5	6	7	8	0	9
Reversal rotation side external restrictions PA510.3 = H.x□xxx	/NCL	1	2	3	4	5	6	7	8	0	9
Gain switching PA511.0 = H.xxx□	/G-SEL	1	2	3	4	5	6	7	8	0	9
Internal location setting selection PA511.1 = H.xx□x	/POS0	1	2	3	4	5	6	7	8	0	9
Internal location setting selection PA511.2 = H.xx□xx	/POS1	1	2	3	4	5	6	7	8	0	9
Internal location setting selection PA511.3 = H.□xxx	/POS2	1	2	3	4	5	6	7	8	0	9
Reference point switch PA512.0 = H.xxx□	/HOME-REF	1	2	3	4	5	6	7	8	0	9
Location starting enable PA512.1 = H.xx□x	/POS-START	1	2	3	4	5	6	7	8	0	9
Position change step PA512.2 = H.x□xx	/POS-STEP	1	2	3	4	5	6	7	8	0	9
Return to zero PA512.3 = H.□xxx	/START-HOME	1	2	3	4	5	6	7	8	0	9

When multiple signals are distributed to the same input circuit, the input signal level will work on the all allocated signals.

(b) Signal distribution table for the input circuit of dual axis driver:

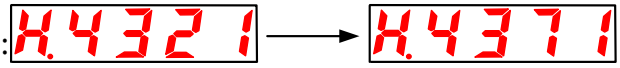
Signal name	Input signals	CN1 pin number								Don't connect it	
User parameters distribution		(IN1)	(IN2)	(IN3)	(IN4)	(IN5)	(IN6)	(IN7)	(IN8)	Regular time invalid	Regular time valid
Servo ON PA509.0 = H.xxx□	/S-ON	1	2	3	4	5	6	7	8	0	9
Proportional action instruction PA509.1 = H.xx□x	/P-CON	1	2	3	4	5	6	7	8	0	9
prohibited to have positive drive PA509.2 = H.x□xx	POT	1	2	3	4	5	6	7	8	0	9
prohibited to have reversal drive PA509.3 = H.x□xxx	NOT	1	2	3	4	5	6	7	8	0	9
Servo ON Pb509.0 = H.xxx□	/S-ON	1	2	3	4	5	6	7	8	0	9
Proportional action instruction Pb509.1 = H.xx□x	/P-CON	1	2	3	4	5	6	7	8	0	9
prohibited to have positive drive Pb509.2 = H.x□xx	POT	1	2	3	4	5	6	7	8	0	9
prohibited to have reversal drive Pb509.3 = H.x□xxx	NOT	1	2	3	4	5	6	7	8	0	9
Alarm reset P□510.0 = H.xxx□	/ALM-RST	1	2	3	4	5	6	7	8	0	9
Positive rotation side external restrictions P□510.2 = H.x□xx	/PCL	1	2	3	4	5	6	7	8	0	9
Reversal rotation side external restrictions P□510.3 = H.□xxx	/NCL	1	2	3	4	5	6	7	8	0	9
Gain switching P□511.0 = H.xxx□	/G-SEL	1	2	3	4	5	6	7	8	0	9
Internal location setting selection P□511.1 = H.xx□x	/POS0	1	2	3	4	5	6	7	8	0	9
Internal location setting selection P□511.2 = H.xx□xx	/POS1	1	2	3	4	5	6	7	8	0	9
Internal location setting selection P□511.3 = H.□xxx	/POS2	1	2	3	4	5	6	7	8	0	9
Reference point switch PA512.0 = H.xxx□P□512.0 = H.xxx□	/HOME-REF	1	2	3	4	5	6	7	8	0	9
Location starting enable P□512.1 = H.xx□x	/POS-START	1	2	3	4	5	6	7	8	0	9
Position change step P□512.2 = H.x□xx	/POS-STEP	1	2	3	4	5	6	7	8	0	9
Return to zero start P□512.3 = H.□xxx	/START-HOME	1	2	3	4	5	6	7	8	0	9

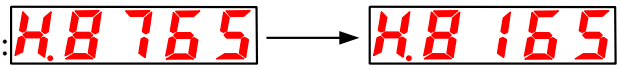
1. When multiple signals are distributed to the same input circuit, the input signal level will work on the all allocated signals.
2. Among P□510, P□511, P□512, "□" may be "A" or "b".

(3) Practical example of the distribution of the input signal

The following shows the change steps of allocating to CN1-IN2 servo ON (/PCON) and to the CN1-IN7 forward external torque limit (/PCL) by the single-axis driver.

Before change　　After change

PA509: 

PA510: 

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select parameter setting mode. When PA509 is not displayed, press UP key or DOWN key to set PA509.	F	
2	PA509 current data is displayed by press down the settings key. (/S-ON is assigned to CN1-14.)	S	
3	Please press shift key for once to choose the 1st bit of the present display and to display H.432.1, and the decimal point of the first presently-displayed bit flashes.	◀	
4	Please press down UP or DOWN key to set the current position to "7".	▲ ▼	
5	Return to the PA509 display by press down the settings key.	S	
6	Press down UP key or DOWN key to set the PA510.	▲ ▼	
7	PA510 current data is displayed by press down the settings key. (/PCL is assigned to CN1-41.)	S	
8	Please press down 2 times shift key, select the second bit of current display, shows H.87.54 and the second decimal point in the current display flashes.	◀	
9	Please press down UP or DOWN key to set the current position to "1".	▲ ▼	
10	Return to the PA510 display by press down the settings key. Thus, /S-ON is assigned to IN7 (CN1-41), and /PCL is assigned to IN1 (CN1-14).	S	

(4) Polarity reversal setting of the active level in input port

For the dual/single driver, polarity reversal of the IN1~IN7 active level can be achieved via setting the active level parameters (PA519, PA520) of the input port signal.

1. When the various signals, such as, servo ON, prohibition of forward drive and prohibition of reverse drive are used in the set condition of "polarity reversal", in case of occurring any abnormal circumstance caused by the disconnection of signal line, etc., it does not work towards the safety direction. If such kind of setting must be done as a last resort, please be sure to confirm the aspects of action and safety.
2. The effective level polarity reversal parameter of the biaxial drive input port, also PA519, PA520, Pb519 and Pb520 are invalid.

4.3.3 Output circuit signal distribution

(1) Setting at the time leaving factory)

(a) Leaving factory value of uniaxial drive：PA513 = H.0001　PA514 = H.0060

(b) Leaving factory value of biaxial drive：PA513 = H.0001　PA514 = H.0000　Pb513 = H.0654　Pb514 = H.0000

(2) Change distribution

The sequence signals shown below can be allocated by using the output circuit functionally. However, "power off"→ “power restarting" must be performed to the servo unit when the user parameters are changed. The distribution of leaving the factory is the setting of gray and low-cut frame in the following table.

(a) Signal distribution table for the output circuit of uniaxial drive:

CN1 pin number		OUT1		OUT2		OUT3		OUT4		OUT5		OUT6	
User parameters distribution		Signal output polarity setting											
		PA521=H.xxx□		PA521=H.xx□x		PA521=H.x□xx		PA521=H.□xxx		PA522=H.xxx□		PA522=H.xx□x	
		0	1	0	1	0	1	0	1	0	1	0	1
Servo alarm (ALM) PA513.0=H.xxx□	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Positioning completion / same speed detection (/COIN or /V-CMP) PA513.1=H.xx□x	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Motor rotation detection (/TGON) PA513.2=H.x□xx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Servo ready (/S-RDY) PA513.3=H.□xxx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Torque limitation detection (/CLT) PA514.0=H.xxx□	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Brake (/BK) PA514.1=H.xx□x	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Encoder origin pulse (/PGC) PA514.2=H.x□xx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H

1. When ALM signal is allocated to the same output circuit with other signals, only ALM signal is output by the output circuit.
2. The output circuit only outputs the PGC signal when the PGC signal is assigned to the same output circuit as other signals other than ALM.
3. The "or" (OR) circuit is used for output, when multiple signals (other than ALM, /PGC) are assigned to the same output circuit.

(b) Signal distribution table for the output circuit of dual axis driver:

CN1 pin number		7/(8)		9/(10)		11/(12)		32/(33)		34/(35)		36/(37)	
		OUT1		OUT2		OUT3		OUT4		OUT5		OUT6	
User parameters distribution		Signal output polarity setting											
		PA521=H.xxx□		PA521=H.xx□x		PA521=H.x□xx		PA521=H.□xxx		PA522=H.xxx□		PA522=H.xx□x	
		0	1	0	1	0	1	0	1	0	1	0	1
Servo alarm (ALM) PA513.0=H.xxx□	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Positioning completion / same speed detection (/COIN or /V-CMP) PA513.1=H.xx□x	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Motor rotation detection (/TGON) PA513.2=H.x□xx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Servo alarm (ALM) Pb513.0=H.xxx□	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Positioning completion / same speed detection (/COIN or /V-CMP) Pb513.1=H.xx□x	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Motor rotation detection (/TGON) Pb513.2=H.x□xx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Servo ready (/S-RDY) P□513.3=H.□xxx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Torque limitation detection (/CLT) P□514.0=H.xxx□	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Brake (/BK) P□514.1=H.xx□x	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H
Encoder origin pulse (/PGC) P□514.2=H.x□xx	0	Invalid											
	1	L	H										
	2			L	H								
	3					L	H						
	4							L	H				
	5									L	H		
	6											L	H

---

1. When ALM signal is allocated to the same output circuit with other signals, only ALM signal is output by the output circuit.
2. The output circuit only outputs the PGC signal when the PGC signal is assigned to the same output circuit as other signals other than ALM.
3. The "or" (OR) circuit is used for output, when multiple signals (other than ALM, /PGC) are assigned to the same output

circuit.

---

(3) Practical example of the distribution of the output signal

It is shown the step to set up uniaxial drive below when it is leaving the factory, and set it as a rotation detection (/TGON) allocated to CN1-OUT3, and replace it with the brake signal.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select parameter setting mode. Press UP key or DOWN key to set the PA513 whether PA513 is not displayed.	F	
2	PA513 current data is displayed by press down the settings key. (/TGON is assigned to CN1-11 (12).)	S	
3	Please press down 2 time shift key, select the second bit of current display, shows H.43.21 and the second decimal point in the current display flashes.	◀	
4	Please press down UP or DOWN key to set the current position to "0".	▲ ▼	
5	Return to the PA513 display by press down the settings key.	S	
6	Press down UP key or DOWN key to set the PA514.	▲ ▼	
7	PA514 current data is displayed by press down the settings key. (/BK is assigned to CN1-36 (37).)	S	
8	Please press down 1 time shift key, select the first bit of current display, shows H.006.5， and the first decimal point in the current display flashes.	◀	
9	Please press down UP or DOWN key to set the current position to "3". (/TGON is assigned to CN1-11 (12))	▲ ▼	
10	Return to the PA514 display by press down the settings key. Thus, /TGON is assigned to OUT3:CN1-OUT3.	S	

4.4 Operation under the monitoring mode（Un□□□）

Under monitoring mode, it is feasible to monitor the instruction value input into A-axis or b-axis servo drive, status of input/output signal and the internal servo status. Although servo motor is in running status, monitoring mode can be also changed.

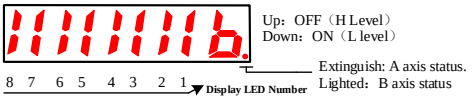
4.4.1 List of monitoring mode

(1) The displaying content under the monitoring mode

Surveillance number	Display content	Unit
Un000	motor speed	1r/min
Un001	Angle of rotation (electric angle)	1deg
Un002	Input instruction pulse speed (only effective in position control mode)	1KHz
Un003	Busbar voltage	1V
Un004	Analog input speed instruction value	1r/min
Un005	The instruction percentage of analog input torque (relative rated torque)	1%
Un006	Internal torque instruction (relative rated torque or motor current)	1% or 0.1A
Un007	Input port signal monitoring	—
Un008	Output port signal monitoring	—
Un009	Encoder signal monitoring (only effective on incremental encoder)	—
Un010	Input instruction pulse counter (32 bits and hex system display, only valid in position control mode)	1command pulse
Un011	Feedback pulse counter (encoder pulse 4 times frequency data, 32 bit hex system display)	1command pulse
Un012	Position offset counter(valid only in position control mode)	1command pulse
Un013	Cumulative load rate (set value of rated torque at 100%)	1%
Un014	Rotational inertia ratio (load rotational inertia relative moment of inertia of motor)	1%
Un015	Actual angle of the encoder(32 bits hexadecimal display)	1command pulse
Un016	Encoder circle number display (only valid at the absolute value encoder)	1 circle

(2) The monitoring display the input and output signals in sequence.

The monitoring display the input and output signals in sequence are shown as follows



(a) Monitoring display the state of the input signal

Display the input state of the signal assigned to the input terminal.

The upper side display segment (LED) is lit when the input is in OFF (open) state. The lower side display segment (LED) is lit when the input is in ON (short circuit) state.

Please refer to the "7.3.2 input circuit signal distribution" to confirm the relationship between the input terminal and the input signal.

Surveillance number	Display the LED number	Input terminal name	Set up at the time leaving factory	
			single-shaft	double-shaft
Un007	1	IN1（CN1-14）	/S-ON	A axis/S-ON
	2	IN2（CN1-15）	/P-CON	A axis/P-CON
	3	IN3（CN1-16）	POT	A axis POT
	4	IN4（CN1-17）	NOT	A axis NOT
	5	IN5（CN1-39）	/ALM-RST	B axis/S-ON
	6	IN6（CN1-40）	/CLR	B axis/P-CON
	7	IN7（CN1-41）	/PCL	B axis POT
	8	IN8（CN1-42）	/NCL	B axis NOT

(b) Monitoring display the state of the output signal

Display the state of the output signal assigned to the output terminal.

The upper side display segment (LED) is lit when the output is in OFF (open) state. The lower side display segment (LED) is lit when the output is in ON (short circuit) state.

Surveillance number	Display the LED number	Input terminal name	Set up at the time leaving factory	
			single-shaft	double-shaft
Un008	1	OUT1（CN1-7，-8）	ALM	A axis ALM
	2	OUT2（CN1-9，-10）	/COIN or /V-CMP	A axis /COIN or /V-CMP
	3	OUT3（CN1-11，-12）	/TGON	A axis /TGON
	4	OUT4（CN1-32，-33）	/S-RDY	B axis ALM
	5	OUT5（CN1-34，-35）	/CLT	B axis /COIN or /V-CMP
	6	OUT6（CN1-36，-37）	/BK	B axis /TGON
Un009 (only valid in the incremental encoder	1	PW（CN2□-12，-13）	□ Axis encoder W phase	
	2	PV（CN2□-10，-11）	□ Axis encoder V phase	
	3	PU（CN2□-8，-9）	□ Axis encoder U phase	
	4	UVW line break detection signal	□ Axis UVW line break detection	
	5	PC（CN2□-5，-6）	□ Axis encoder C phase	
	6	PB（CN2□-3，-4）	□ Axis encoder B phase	
	7	PA（CN2□-1，-2）	□ Axis encoder A phase	
	8	ABC line break detection signal	□ Axis UVW line break detection	

(3) The method of using under surveillance mode

The following is shown the operation steps of the Un000 data of b axis. (A axis and b axis servo motor rotate at the speed of 1000 and 1500r/min respectively)

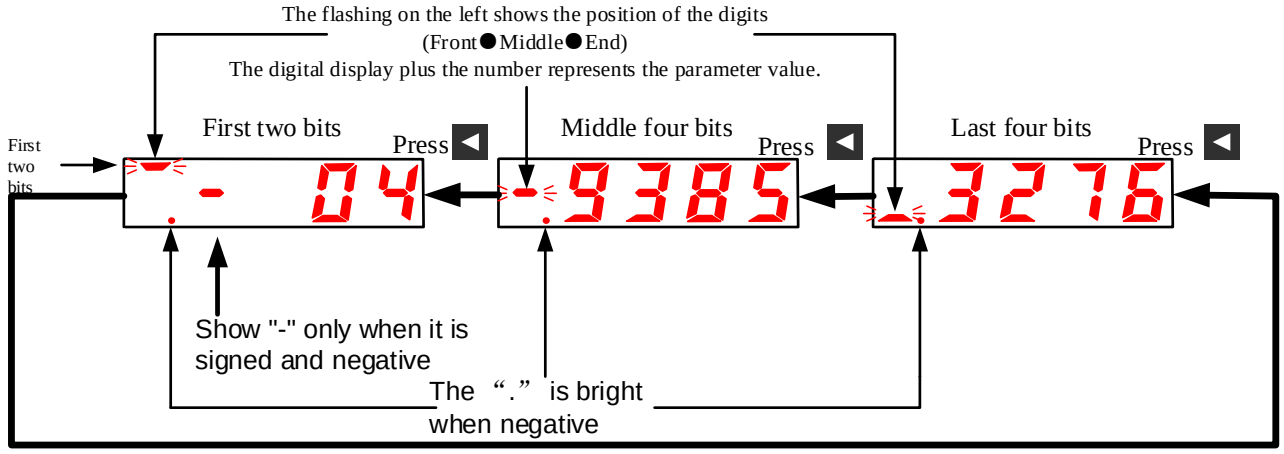
Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis surveillance mode. Press UP key or DOWN key to set the Un000 whether Un000 is not displayed.	F	Un000
2	Please press down the setting key to show Un000 data, display the zero decimal points is in put out state, therefore, it should be displayed as the Un000 of A axis.	S	1000
3	Please press down UP key or DOWN key, to display the zero decimal points is in put out state, therefore, it should be displayed as the Un000 of b axis.	▲ ▼	1500
4	Return to Monitor number display by press down the settings key.	S	Un000

(4) **Command pulse, feedback pulse counter and the actual angle of the encoder monitoring display**

The following is shown the operation steps of the Un010 data of A axis.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select surveillance mode.	F	Un000
2	Please press down UP or DOWN key to select the Monitor number Un010 that you would like to operate.	▲ ▼	Un010
3	Please press down the setting key and display the last 4 bits of the Un010 data	S	3276
4	Please press down the shift key and display the middle 4 bits of the Un010 data	◀	-9385
5	Please press down the shift key and display the front 2 bits of the Un010 data The back 4 bits of the display data are restored whether the shift key is pressed down again	◀	-04
6	Return to Monitor number display by press down the settings key.	S	Un010

The displayed reading methods are summarized as follows:



Chapter V Running

5.1 Trial running

Please take trial run after finish the wiring.

5.1.1 Trial running of servo motor unit

Notes

- Disconnect the connection part between the servo motor and machinery to make the unit of servo motor being in solid status only. In order to avoid the unexpected accident, the servo motor is placed in idling status (the status of servo motor unit whose coupling is separated from belt and the like) for test run in this specification.

In this item, confirm whether power supply is connected with the cable for motor main circuit and the encoder cable accurately. Most of the reasons why the servo motor fails to achieve smooth rotation under the condition of test run are the errors in such wiring. Therefore, please confirm it again.

After confirmed the correct wiring, please carry out the test run of servo motor unit according to the following sequence number.

- Jogging (JOG) mode operation (F□002)

The following is shown the operation steps of the JOG running of A axis.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press F function key (last more than 1 second), switch to A axis auxiliary function mode.	F	FA000
2	Please press F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA002 whether FA002 is not displayed.	▲ ▼	FA002
3	Entering the JOG operation by press down the S key.	S	A-.JoG
4	Please press F function key to enter the servo ON state (the motor is in power on state).	F	A-.JoG
5	Please press UP key (reverse clockwise rotation) or DOWN key (clockwise reversal), and the motor running.	▲ ▼	A-.JoG
6	Please press F function key to enter the servo Off state (the motor is in non power on state).	F	A-.JoG
7	Return to the FA002 display by press down the settings key.	S	FA002

P□304	JOG Speed	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 6000	1rpm	500	No need
Set the motor speed instruction value of the auxiliary function "JOG" mode operation (Fn002)				

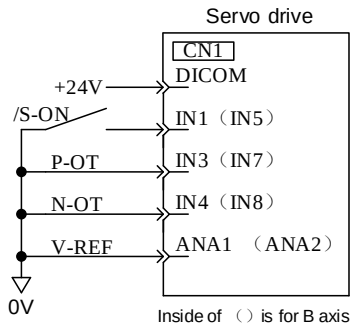
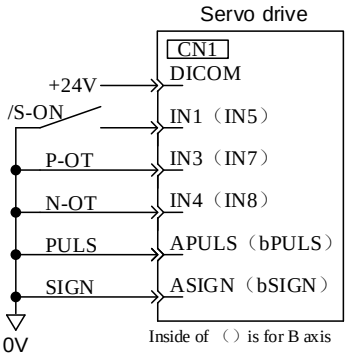
Please pay full attention to that in the JOGGING (JOG) operation mode, prohibited to forward drive (P-OT) and reversal drive (N-OT) signal are invalid.

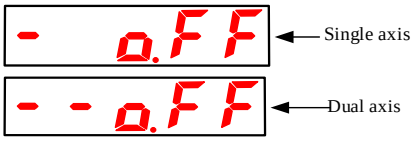
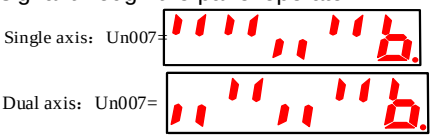
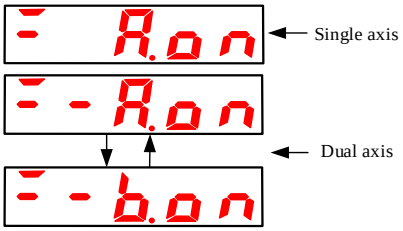
5.1.2 Test run of servo motor via up controller command

In this item, confirm whether the move instruction of inputting into the servo motor of servo unit from instruction control unit is correctly set with the input/output signal. Confirm whether the wiring and polarity between the instruction control unit and servo unit are correct, whether the action setting of servo unit is correct, etc. This is the final confirmation before connecting the servo motor to machinery.

(1) Servo ON instruction based on up controller command

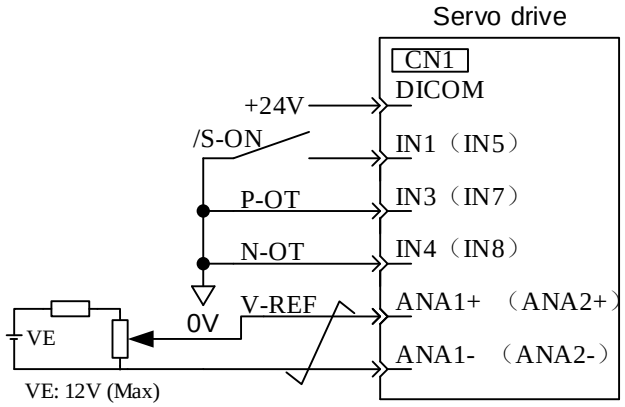
The following external input signal circuit and airdrop signal circuit must be configured.

Speed control（standard set） [P□000=H.□□0□]	Position control [P□000=H.□□1□]
	

Step	Content	Confirmation method and supplementary description
1	Form the input signal circuit required for servo ON. In order to achieve servo ON, it needs to input the signal required by the minimum limit, therefore, please carry out the input/output signal connector (CN1) wiring in the circuit equivalent to the circuit as shown in the preceding page. And then, cut off power and connect CN1 to the servo unit.	Please set it as follows. 1. Input the servo ON input signal (/S-ON) 2. Set (P-OT) and (N-OT) as ON (Low electrical level) (can be carried forward and reverse drive) 3. No (0V instruction or 0 pulse) instruction input But whether you to want to omit the external wiring, the input signal distribution function based on user parameters can be used to set the function of the input terminal as "Normal Open" and “Normal Closs" without input signal. Please refer to the "signal distribution of the input circuit". If the “absolute type encoder is used as incremental encoder (Pn001=H.□□□2)” in the trial operation for the time being, the wiring of SEN signal will be omitted when the absolute value encoder is used.
2	Please turn on the power to confirm whether the display on the panel operator is consistent with the following content. 	If it is not the display as shown in the left figure, the setting of input signal is incorrect. Please Input signal monitoring (Un007) is used for confirming the input signal through the panel operator.  Switch ON/OFF for each and every signal line that has been connected to confirm that the LED display of the digital operator is changed as shown in the below figure.
3	Please input the servo ON input signal (/S-ON). Please confirm that the panel operator is shown below. 	Please refer to the "Exceptional diagnosis and treatment measures” when the alarm is displayed, and exclude the alarm. If the instruction voltage contains interference element under speed control mode, the upper “-” display of the bit at the left end of the panel operator flashes now and then. During servo ON, the servo motor may rotate in a dead slow speed, under the circumstance, please reference "other wiring" and take corresponding measures.

(2) Operation steps of speed control mode （P□000=H.□□0□）

The following external input signal circuit and the equivalent signal circuit shall be configured.



Inside of （）is for B axis

Step	Content	Confirmation method and supplementary description
1	Please confirm the power and input signal circuit again and verify the speed instruction input (the voltage between V-REF and GND) is 0V.	Please refer to the input signal circuit shown in the above figure.
2	Please set the servo ON (/S-ON) input signal ON.	If the servo motor makes tiny rotation, please reference "adjustment of instruction offset" for the non-rotation setting of servo motor.
3	Please input the speed instruction (the voltage between V-REF and GND) slowly increase from 0V.	Default factory is 150(r/min)/V.
4	Please confirm that the speed instruction value (Un004[r/min]) input to the servo drive.	For the display method, please refer to “Basic mode of selection and operation”
5	Please confirm the servo motor speed (Un000[r/min]) value.	For the display method, please refer to “Basic mode of selection and operation”
6	Please confirm that value of step 4 is equal to the step 5 (Un004 and Un000).	For speed change instruction, input voltage to confirm whether Un004=Un000 is achieved under the mode of multiple speed instruction values.
7	Please confirm the input gain of speed instruction or the direction of motor rotation.	If input gain (P□300) is conducted to the speed change instruction, please reference the following formula. Un004 ＝ P□300[rpm/V]×(V-REF voltage)[V] If you want to change the direction of motor rotation under the condition of keeping the input voltage polarity of the speed instruction, please reference the "switching for the direction of motor rotation". Please start execution from step 2 after change. → check from step 2 again.
8	If it gets into servo OFF status when speeds input instruction is set as 0V, it shows the test run completion of the servo motor unit.	

■ Position control is configured on the instruction control unit

When servo is placed in speed control and position control is configured on the instruction control unit, please confirm the following items after the above "operating steps of speed control mode".

Step	Content	Confirmation method and supplementary description
9	Please confirm the power and input signal circuit again and verify the speed instruction input (the voltage between V-REF and GND) is 0V.	
10	Please set the servo ON (/S-ON) input signal ON.	If the servo motor makes tiny rotation, please reference "adjustment of instruction offset" for the non-rotation setting of servo motor.
11	Issue the instruction of the motor rotation amount (e.g., motor rotates 1 circle) easy to be confirmed in advance from the instruction control unit, and confirm the issued motor rotation amount and the rotated motor rotation amount via visual inspection and motor's real angle monitoring (Un015[pulse]).	Motor rotation angle 1 (Un015 [pulse]): number of pulses starting from the origin.
12	Whether the rotation value of step 11 is different, please set the PG frequency ratio (Pn201) of the output encoder pulse from the servo unit correctly.	Please refer to the "Encoder signal output” for the setting method. PG frequency ratio (Pn201[P/Rev]): the number of encoder pulses per rotation for 1 cycle.
13	Enter the servo into OFF state when the speed input instruction is set at 0V, and then it is indicated that the trial running of the command controller as position control has been completed.	

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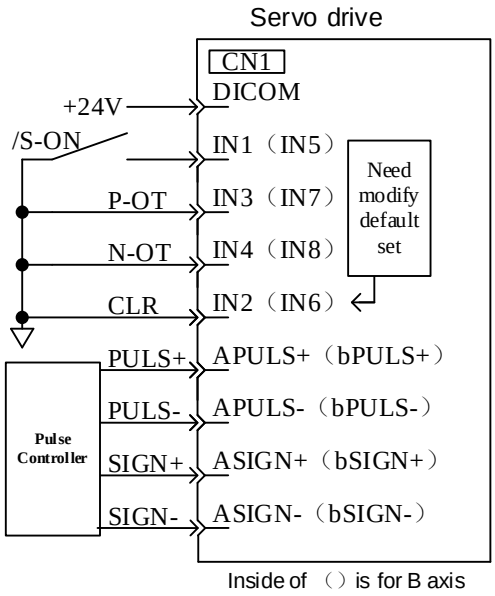
(3) Operation steps of position control mode （P□000=H.□□1□）

The following external input signal circuit and the equivalent signal circuit shall be configured.



Inside of （）is for B axis

Step	Content	Confirmation method and supplementary description
1	Please confirm whether the shape of the instruction pulse keeps consistent with the pulse output form of the up controller pulse.	The Command pulse form shall be set up by P□200=H.××□×. Please refer to "user parameters setting".
2	Set instruction unit and the number of electronic gear ratio according to the instruction controller.	The electronic gear ratio is set by (Pn202/Pn203). Please refer to "Setting of electronic gear".
3	Please switch on the power, set the servo ON (/S-ON) input signal ON.	
4	Make use of an easily predetermined motor rotation (such as 1 circle motor rotation) and output the slow instruction pulse from the command controller.	Please set the instruction pulse speed to the safety speed of the motor speed at around 100 r/min.
5	Please confirm the change volume in the input to the instruction pulse counter (Un010[pulse]) is input to the instruction pulse number in the servo unit.	For the display method, please refer to “Basic mode of selection and operation” Un010 (input pulse counter [pulse])
6	Please confirm the actual rotation of the motor rotation (Un011[pulse]) with the amount of change before and after the feedback pulse counter (Un011[pulse).	For the display method, please refer to “Basic mode of selection and operation” Feedback pulse counter(Un011[pulse])
7	Please confirm that the values of step 5 and 6 meet the following condition. Un011=Un010	
8	Please confirm whether it is consistent with the rotation direction of the servo motor issuing instructions.	Please confirm whether the polarity of the input pulse and the shape of the input instruction pulse. Please refer to the "selection of pulse command form".
9	Please confirm the direction of the motor rotation.	To change the direction of motor rotation without changing the input instruction pulse form, please refer to "switch in the direction of motor rotation". Please start execution from step 9 after change.
10	If it gets into servo OFF status when stop the pulse instruction input, the test run of the servo motor unit using higher position instruction has been completed under the mode of position control.	

5.1.3 Test operation of machine and servo motor

Danger

- Please follow the instructions as shown in this section.
  In case of occurring operation mistake under the mode of connection between servo motor and machinery, it not only causes mechanical damage, but also causes personal injury accident sometimes.

Operation is carried out according to the following steps:

Step	Content	Confirmation method and supplementary description
1	Please turn on the power to carry out the mechanical formation setting related to over travel, brake and other protection functions.	Please reference the "setting of general functions". When the brake-provided servo motor is used, please confirm the action of the brake under the condition of taking the corresponding measures to prevent the natural drop of machinery and the vibration caused by external force in advance. Please confirm whether the action of servo motor and brake is in normal condition. Please refer to “ Holding brake setting”
2	Please set the required user parameters according to the control mode used.	According to the using control mode, please refer to "Speed control (analog voltage instruction) operation" "Position control operation" "Torque control operation"
3	Please connect servo motor and the machine with the coupling, and in the state of power off.	Please refer to "Notes to the installation of servo motor".
4	Please connect the power of the machinery (instruction control unit) after confirming that servo controller changes into servo OFF (non-power up state of the servo motor). Please reconfirm whether the protection function works normally again in step1	Please reference the "setting of general functions". If the subsequent step suffers abnormal condition, execute the emergency stop capable of achieving safety stop.

Step	Content	Confirmation method and supplementary description
5	Test run is implemented under the condition of installing machinery and servo motor well based on the each item of "test run for the servo motor unit through up controller instruction".	Please reconfirm whether the result is same as the test run of the servo motor unit. In addition, please further confirm whether the instruction unit and the like accord with the machinery.
6	Please confirm that the user parameter setting is consistent with the control mode in step 2 again.	Please confirm that whether the servo motor operates according to the mechanical action specification.
7	Please adjust the servo gain to improve the responsiveness of servo motor as required.	It is possible to appear the "running-in" insufficiency with the machinery during test run, therefore, please carry out the test run fully.
8	Please record the user parameter set for maintenance in the "12.4 Memorandum of user parameter setting". And so far, the "supporting test run between machinery and servo motor" has been completed.	

5.1.4 The trial run of the servo motor with brake

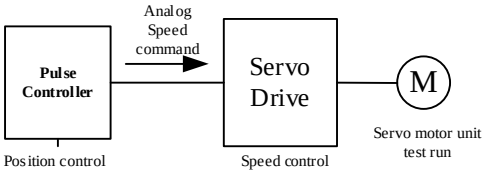
The holding brake action of the brake-provided servo motor is controlled via the brake interlocking output (/BK) signal.

Before confirming the brake action, please take the corresponding measures to prevent the natural drop of machinery and the vibration caused by external force in advance. Please confirm the action of the servo motor and holding brake action under the condition that servo motor is separated from the machinery. If the action of the both two is in normal condition, connect the servo motor and machinery for test run.

For the wiring and user parameter settings of the brake-provided servo motor, please reference the "setting of holding brake".

5.1.5 Conduct position control through instruction controller

As previously mentioned, please be sure to carry out the test run of servo motor unit after confirming that the servo motor is separated from the machinery. Please refer to the following table for confirmation of the motor action and specification beforehand.



Instruction of the instruction controller	The items to be confirmed	The methods to be confirmed	The places revised	Reference
JOG action (a certain speed instruction input by instruction controller)	Servo motor RPM	The method below is used to confirm the speed of the servo motor. • Monitor the motor speed with the panel operator(Un000) • Trial running the servo motor at low speed. For example, enter the speed instruction of the 60r/min and confirm that 1 cycle in 1 second.	Please confirm the setting value by user parameter, determine the speed command input gain P□300 and if it is correct.	
Simple positioning	Servo motor Rotation amount	Input is equivalent to the instruction of the 1 circle rotation of the servo motor, and the visual inspection confirms that the servo motor axis rotates 1 cycles.	Please confirm that the setting value via user parameter, determine the PG frequency dividing ratio P□201 and if it is correct.	
Over travel action (when using POT and NOT signals)	Enter POT, NOT signal, whether the servo motor stops.	Please confirm that the servo motor stops running after the POT and NOT signal is set to ON when the servo motor is rotated continuously.	Please correct the wiring of POT and NOT again If the servo motor does not stop running.	

5.2 Control mode selection

Below is the description of the control method (control mode) that can be carried out by the servo drive.

User parameters		Control method (Control mode)	Reference
P□000	H.□□0□	Speed control (analog voltage instruction) The revolving speed of the servo motor is controlled by the analog voltage speed instruction. Please use it on the following occasions. • When you want to control the revolving speed • Feedback the frequency output by using the encoder from the servo and configures the position ring and position control in the instruction controller.	
	H.□□1□	Position control (pulse train instruction) Position of the servo motor is controlled by the pulse train position command. Position is controlled by the number of input pulse and the speed is controlled by the frequency of the input pulse. Please use it when the position action is needed.	
	H.□□2□	Torque control (analog voltage instruction) The output torque of the servo motor is controlled by the analog voltage and torque instruction. Please use the torque when you want to output the compression-extrusion.	
	H.□□3□	Speed control (internal speed selection) Use /P-CON，/P-CL，/N-CL total 3 input signals and the speed control is achieved by setting the running speed in the servo in advance. The servo can set 3 operating speeds. (Analog voltage instruction is not required at this time.)	
	H.□□3□ . . . H.□□B□	It is a switch mode that matches with the 4 control methods mentioned above. Please select the switch mode that is suitable for customer using.	
	H.□□C□	Motion control mode	

5.3 Setting of general basic function

5.3.1 Servo ON setting

Set the servo ON signal (/S-ON) of servo motor at power on / the non-power state command.

(1) Servo ON signal (/S-ON)

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Input	/S-ON	CN1-IN1	CN1-IN5	ON =L electrical level	Servo motor power on state (servo ON state). It may be operated.
				OFF=H electrical level	The power off state of the servo motor (servo OFF state). It can't run.

■ Important

Please be sure to send the input instruction to start/stop the servo motor after sending the servo ON signal. Please do not send out the input instruction first, then use the /SON signal to start / stop the servo motor. If the AC power supply is repeated ON and OFF, the internal components will be aged and the accident will occur.

The input connector pin number can be assigned to other place via user parameters by /S-ON signal. Please refer to the "signal distribution of the input circuit".

(2) Choose to use / do not use servo ON signal

User parameters can be used to set the constant time servo ON. No need /S-ON wiring at this time, but as the servo drive changes into the action state at the same time as the power ON, therefore, please handle it carefully.

User parameters			Significance
P□509	A axis	H.□□1□	From the input terminal CN1-IN1 input /S-ON signal. (set up at the time leaving factory)
		H.□□9□	The /S-ON signal is fixed to constant time "valid"
	B-axis	H.□□5□	From the input terminal CN1-IN5 input /S-ON signal. (set up at the time leaving factory)
		H.□□9□	The /S-ON signal is fixed to constant time "valid"

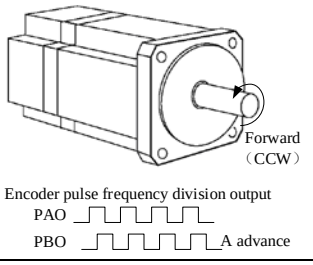
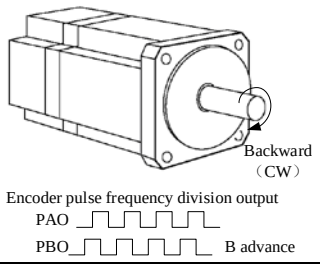
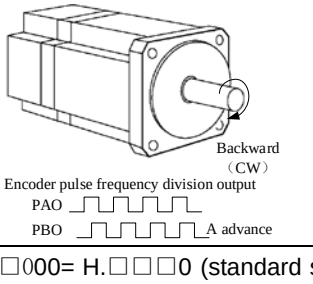
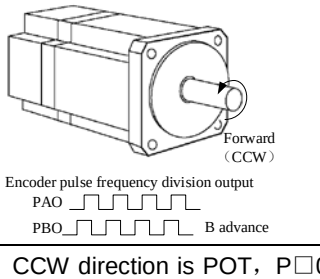
- It is necessary to restart the power to make the setting effective after change the user parameters.
- The alarm can be reset only by the restarting of the power supply when the signal is fixed to a constant time "valid" condition. (Alarm reset is not valid.)

5.3.2 Switch of rotation direction of motor

It only needs to reverse the rotation direction of the servo motor instead of changing the instruction pulse of the input servo drive and the polarity of instruction voltage.

And at this time, the axis (+,-) rotates reversely, while the coder pulse output, analog monitoring signal and other output signal from the servo keep same polarity.

The "forward direction" under the mode of standard setting is "counterclockwise rotation" viewed from the angle of "servo motor load".

User parameters		Name	Directives	
			Forward rotation instruction	Reversal instruction
P□000	H.□□□0	Standard settings (CCW is forward rotation) (Factory setting)		
	H.□□□1	Inversion mode (CW is positive rotation)		

Switch the direction of POT and NOT. When it is P□000= H.□□□0 (standard setting)，CCW direction is POT，P□000= H.□□□1 (inversion mode)，CW direction is POT.

5.3.3 Over travel setting

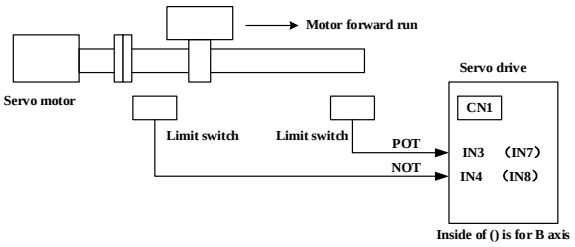
Over travel refers to the status of making the limit switch acting (ON) when the movable part of the machinery exceeds removable setting region, and the over travel function of the servo drive refers to the function of force stop under such situation.

(1) Connection of over travel signal

In order to use the over travel function, please correctly connect the input signal of the following over travel limit switch to the corresponding pin No. of the servo drive CN1 connector.

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Input	POT	CN1-IN3	CN1-IN7	ON =L electrical level	It can be forward run (normal running)
				OFF=H electrical level	It is prohibited forward (forward turn and over travel)
Input	NOT	CN1-IN4	CN1-IN8	ON =L electrical level	It can reversal run (normal running)
				OFF=H electrical level	It is prohibited reversal (reversal turn and over travel)

In order to prevent machinery damage under the condition of linear driving, etc., please be sure to connect the limit switch according to the figure below.
Although it is in over travel status, it still drives towards the opposite side.
For example, it drives towards the reversal side under the condition of forward over travel.



■ Important
If motor stops running via over travel under the mode of position control, there exists position offset pulse.
In order to eliminate the position offset pulse, be sure to input clear signal (CLR).

Notes

When servo motor is used in vertical axis, the work piece may drop under over travel status.
In order to prevent the work piece falling down during the process of over travel, please be sure to set P□000= H.1□□□ so that enter zero clamping state after stop. (please refer to "The selection of the motor stop method when using the over travel")

(2) Choose to use / do not use over travel signal

When the over travel signal is not used, it can be set as non-use by setting the internal user parameters of the servo drive. Then, the wiring of the input signal is not needed for the over travel.

User parameters			Significance
P□509	A axis	H.□3□□	The forward turn drive signal (POT) is prohibited from the CN1-IN3 input. Set up at the time leaving factory
		H.□9□□	The prohibition of the forward turn drive signal (POT) is invalid. (It can be forward turn and side drive usually)
	B-axis	H.□7□□	The forward turn drive signal (POT) is prohibited from the CN1-IN17 input. Set up at the time leaving factory
		H.□9□□	The prohibition of the forward turn drive signal (POT) is invalid. (It can be forward turn and side drive usually)
	A axis	H.4□□□	The reversal turn drive signal (NOT) is prohibited from the CN1-IN4 input. Set up at the time leaving factory
		H.9□□□	The prohibition of the reversal turn drive signal (NOT) is invalid. (It can be reversal turn and side drive usually)
	B-axis	H.9□□□	The reversal turn drive signal (NOT) is prohibited from the CN1-IN8 input. Set up at the time leaving factory
		H.9□□□	The prohibition of the reversal turn drive signal (NOT) is invalid. (It can be reversal turn and side drive usually)

- Effective control methods: speed control, position control, torque control
- It is necessary to restart the power to make the setting effective after change the user parameters.

* POT, NOT signal can freely assign the input number of the input connector via the user parameters. For detail, please refer to the "signal distribution of the input circuit".

(3) The selection of the motor stop method when using the over travel

The stop method of the input over travel (POT, NOT) signal during the rotation of the servo motor.

User parameters		Motor stop method	After motor stop	Significance
P□000	H.□0□□	Reverse braking stop	Inertial operating state	It stops and slow down by emergency stop torque (P□407) and the servo motor enters the inertial running (power off) state after the servo motor stopped.
	H.□1□□	Inertial operation stop		It stops based on the stop method (inertia running stop) same as the servo OFF, and the servo motor gets into the inertia running (non-power on) status after stop.
	H.0□□□	Reverse braking stop	Inertial operating state	It stops and slow down by emergency stop torque (P□407) and the servo motor enters the inertial running (power off) state after the servo motor stopped.
	H.1□□□	Reverse braking stop	Zero clamping state	It stops and slows down by emergency stop torque (P□407) and the servo motor enters the zero clamp position (power off) state after the servo motor stopped.
	H.2□□□	Inertial operation stop	Inertial operating state	It stops based on the stop method (inertia running stop) same as the servo OFF, and the servo motor gets into the inertia running (non-power on) status after stop.

- It is necessary to restart the power to make the setting effective after change the user parameters.
- Set H.□1□□ during the inertia in the process of operation, If the servo ON signal is received, the servo motor can be controlled.

■ Wording

- The friction resistance of the motor is stopped automatically through the friction resistance of the rotation of motor.
- Reverse braking stop: slow down (brake) torque (P□407) stop.
- Zero clamping position state: using position instruction zero configuration position ring state.

* For servo OFF and stop method when alarm occurs, please refer to "stop method selection when servo OFF".

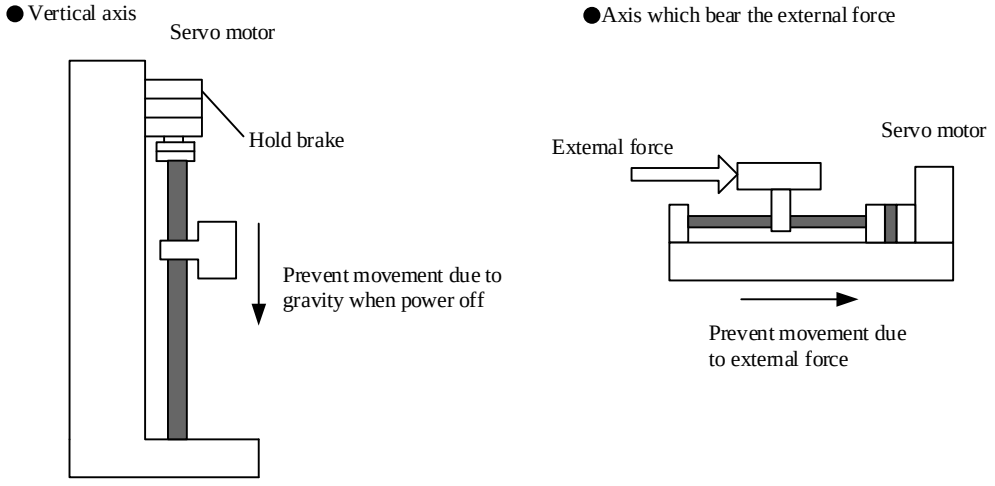
(4) Stop torque setting at the time of over travel

P□407	Reverse brake torque limitation	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	300	No need

· Set brake torque when over travel signal (POT,NOT) input
· The setting unit is % of the rated torque.(rated torque is 100%)
· The default E-stop torque must be set up to 300% maximum motor rated torque, but the actual output torque depends on the rating of the motor.

5.3.4 Holding brake setting

It is used for servo motor to drive the vertical shaft. When the power supply of the servo drive is OFF, the servo motor with brake is used to keep the movable part away from moving by gravity. (Please refer to the "trial run of the servo motor with brake".)



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1. The built in servo motor with brake is the special brake for non-excitation action type. It can't be used for braking it can only be used for keeping the servo motor in the stop state. The braking torque is above 120% of the rated torque of the servo motor.
2. When only use the speed ring to make the servo motor move, the servo is set to OFF and the input instruction is set to "0V".
3. When the servo motor is stopped, so do not make the mechanical brake action when the position ring is configured due to the servo motor is in a servo lock state.

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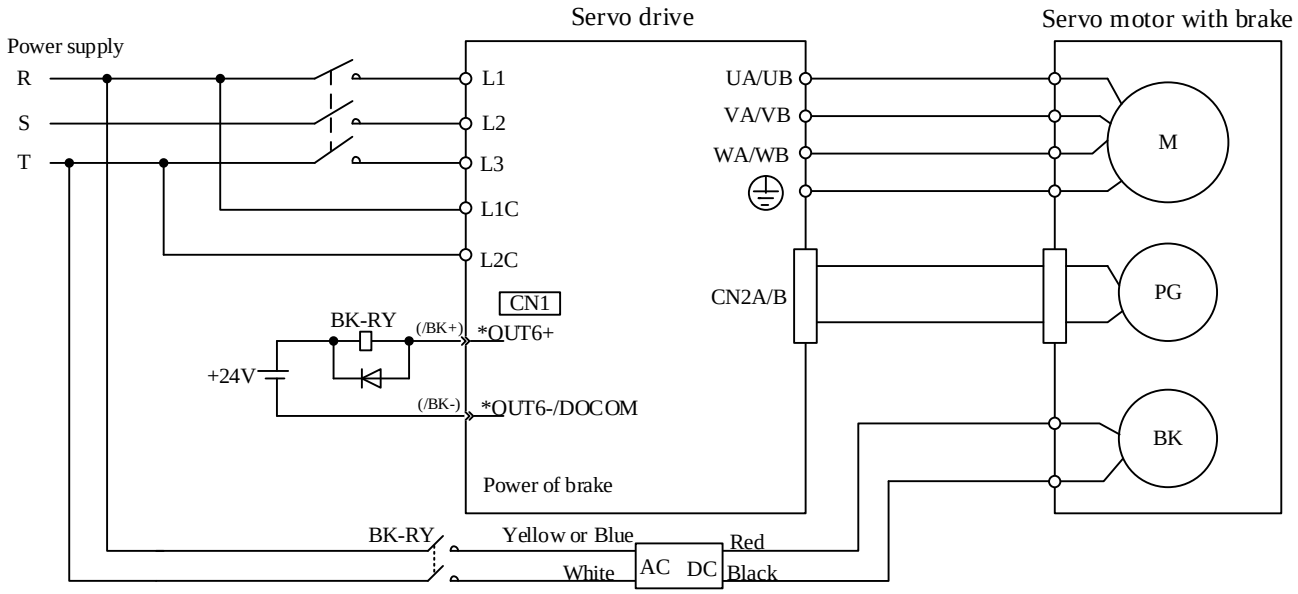
(1) Connection instance

The sequential output signal of the servo drive "/BK" and the brake power supply formed the ON/OFF circuit of the brake. The standard connection instances are shown as follows.



BK-RY：Brake relay

*： the output terminal number assigned by the user parameterP□514.1

(2) Brake interlocking output

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Output	/BK	Distributed through P□514		ON =L electrical level	Release the brake,
				OFF=H electrical level	Hold the brake.
The output signal of the brake is controlled when the servo motor with a brake is used. Moreover, the output signal is not used in the factory setting. Distribution of output signals is required (P□514 setting). Do not connect when using a motor without brake.					

(3) Distribution of the brake signal (/BK)

The brake signal (/BK) cannot be used in the factory setting state. Therefore, the distribution of the output signals is required.

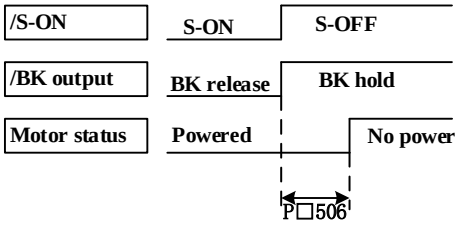
User parameters		Connector Pin number	Significance
P□514	H.□□0□	——	Not use /BK signal. (Default factory setting)
	H.□□1□	OUT1	Output /BK signal from the CN1-OUT1 output terminal.
	H.□□2□	OUT2	Output /BK signal from the CN1-OUT2 output terminal.
	H.□□3□	OUT3	Output /BK signal from the CN1-OUT3 output terminal.
	H.□□4□	OUT4	Output /BK signal from the CN1-OUT4 output terminal.
	H.□□5□	OUT5	Output /BK signal from the CN1-OUT5 output terminal.
	H.□□6□	OUT6	Output /BK signal from the CN1-OUT6 output terminal.
■ Important It is invalid for the brake signal (/BK) set at the factory setting. Output by OR logic, when multiple signals are assigned to the same output terminal. Only if the /BK signal output is valid, other signals assigned to the output terminal of the distribution /BK signal are assigned to other output terminals or to be invalid. For the distribution of other output signals of the servo unit, please refer to the "Signal distribution of the output circuit".			

(4) Setting of the timing of brake ON (after the servo motor stopped)

When conduct the factory setting, the /BK signal outputs at the same time that the /S-ON signal is set to OFF (servo OFF), but it can change the timing of the servo OFF through the user parameters.

P□506	Brake instruction-Servo OFF delay time	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 500	10ms	0	No need

• When used ON the vertical axis, due to the timing of the brake ON, the machine can move. Some of it can sometimes be caused by a small amount of movement due to gravity or external force. Through this user parameter delay servo OFF action can eliminate this small amount of movement.
• This user parameter can change the brake ON timing when the servo motor stops. Please refer to "Brake ON timing setting (servo motor rotation)" for brake movement in the rotation of servo motor.



■ important

When an alarm occurs, the servo motor enters the non-current state immediately and has no relation to the setting of the user parameters. Due to the influence of mechanical part self-weight or external force, the machine will sometimes move in the time before the brake action

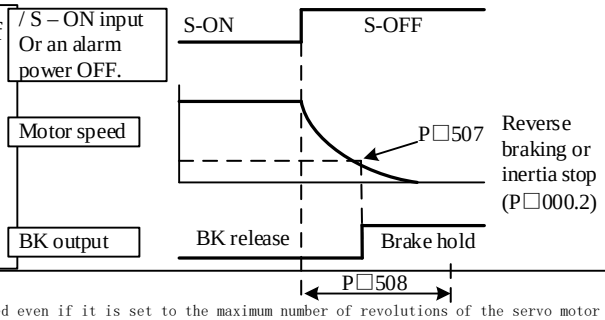
(5) Setting of the timing of brake ON (when the servo motor is rotating)

Send stop instruction to the rotating servo motor under the condition of servo OFF or alarm, the output condition of the /BK signal can be changed according to the following user parameters.

P□507	Brake instruction output speed level	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	100	No need

P□508	Servo OFF-Brake instruction waiting time	Speed	Position	Torque
	Range	Unit	Default	Restart
	10 ~ 100	10ms	50	No need

The output condition of /BK signal during rotation of servo motor.
When any of the following conditions is established, the /BK signal is set to H level.
(brake start).
· after servo OFF, the motor speed is below P□507.
· after the servo OFF, more than the setting time of P□507.



■Important

• the servo motor will also be limited by the motor's own maximum speed even if it is set to the maximum number of revolutions of the servo motor used for P□5077.
• please assign the motor rotation detection signal (/TGON) and brake signal (/BK) to other terminals.
• when the brake signal (/BK) is assigned to the same output terminal as the motor rotation detection signal (/TGON), due to the speed falling on the vertical axis,
/TGON signal becomes L level, even if the condition of this user parameter is established, /BK signal may not be changed to H level. Because you will lose more than one.
The output signal is assigned to the same output terminal with OR logic output. For distribution of output signals, please refer to "signal distribution of output circuit"。

5.3.5 Stop method selection while servo OFF

Select the stop method when the servo unit is in the servo OFF state.

User parameters		Motor stop method	After motor stop	Significance
P□000	H.□0□□	Reverse braking stop	Inertial operating state	It stops and slow down by emergency stop torque (P□407) and the servo motor enters the inertial running (power off) state after the servo motor stopped.
	H.□1□□	Inertial operation stop		It stops based on the stop method (inertia running stop) same as the servo OFF, and the servo motor gets into the inertia running (non-power on) status after stop.

The setting of the user parameters is valid in the following cases.

- When the /S-ON input signal OFF (servo OFF)
- When the main power supply (L1, L2, L3) OFF

■ Wording

- Reverse braking stop: slow down (brake) torque (P□407) stop.
- Inertial operation stop: Not braking, but stop automatically through the friction resistance of the rotation of motor.

■ Important

- The following servo drive will force the reverse brake stop regardless of the above user parameters setting, when the main circuit power (L1, L2, L3) OFF or control power (L1C, L2C) OFF.
- The servo drive will be inertia stopped when the servo drive alarm occurs.

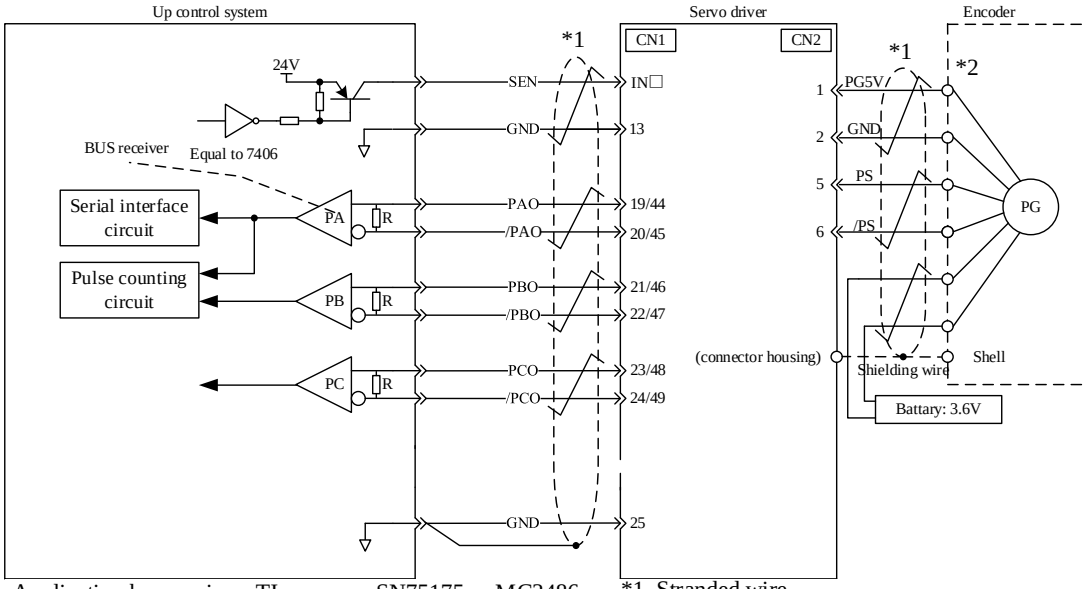
5.4 The using method of absolute value encoder

The absolute value detection system can be configured at the command controller (upper controller system) whether the servo motor with the absolute value encoder is used. It can run directly without reset the original point and the result is that it is running after the power supply ON.

Absolute value encoder resolving ability	Multi - rotation data output range	Action beyond the limit value
17 Bits (131072 pulse / ring)	-32768 ~ +32767	The upper limit value above the forward direction (+32767) , the multi rotation data will be changed into -32768 The upper limit value above the reversal direction (-32768) , the multi rotation data will be changed into +32767
23 Digit (8388608 pulse / ring)	-32768 ~ +32767	The upper limit value above the forward direction (+32767) , the multi rotation data will be changed into -32768 The upper limit value above the reversal direction (-32768) , the multi rotation data will be changed into +32767

5.4.1 Interface circuit

The standard connection of the absolute value encoder mounted on the servo motor is shown as follows.



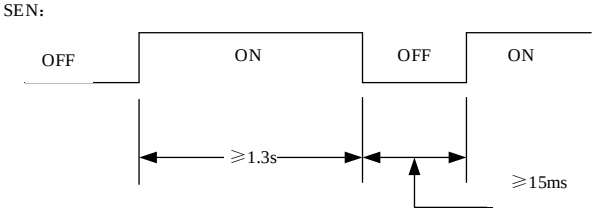
Application bus receiver: TI company SN75175 or MC3486.
Terminal resistor R：220~470Ω

*1. Stranded wire
*2. Refer to section 2.2 for the wiring description

- The connection of SEN signal

/SEN signal description

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Input	SEN	Not allocated		ON	The position data of the absolute value encoder is not requested. (It is the state when the power supply is connected)
				OFF	The position data of the absolute value encoder requests to the servo.
The input signal must be used to output the absolute value data from the servo unit. Please place SEN signal at the H electrical level after the power is connected for 3 seconds. If SEN signal is switched to L electrical level → H electrical level, then, output multiple turn data and the initial increment pulse. Even if the servo ON signal (/SON) is ON, the servo motor will not be powered on until the action is finished. The operation panel displays "oFF".					
■ Important Set the SEN signal at ON state to OFF and reset it to ON again, then, takes operation after the H electrical level over 1.3 seconds as shown in the right figure.					



/SEN signal distribution

User parameters			Significance
P□511	A axis	H.0□□□	Not distributed input pin (Set up at the time leaving factory)
		H.4□□□	Input the SEN signal from IN4(CN1-17)
	B-axis	H.0□□□	Not distributed input pin (Set up at the time leaving factory)
		H.8□□□	Input the SEN signal from IN8(CN1-42)

5.4.2 Absolute value encoder selection

The absolute value encoder may also be used as an incremental encoder.

User parameters		Significance
P□001	H.□□□0	The absolute value encoder is used as the absolute value encoder to enable the absolute value data serial output (PG fractional frequency PAO □)
	H.□□□1	The absolute value encoder may be used as an incremental encoder.
	H.□□□2	The absolute value encoder is used as the absolute value encoder to unable the absolute value data serial output (PG fractional frequency PAO □)

- As incremental encoder, SEN signals and batteries are not required.
- It is necessary to restart the power to make the setting effective after change the user parameters.

5.4.3 The method of using battery

The recommended lithium battery specifications:

ER36V

■ Battery replacement steps

1. Please replace the battery under the condition of maintaining the control power of the servo unit is ON.
2. After replacing battery, please clear away the absolute value encoder alarm via auxiliary function F□010, so as to relieve the battery alarm of absolute value encoder.
3. If there is no abnormal action after restarting the power of servo drive, it shows the end of battery replacement.

Important:

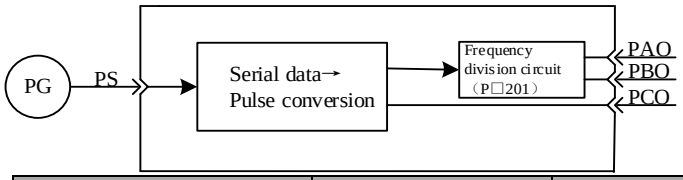
The data in the absolute encoder will be lost when the servo power of the servo drive is set to OFF and the battery line is removed. Then, it must set operation of the absolute value encoder. Please refer to “Absolute value encoder Settings（F□009）”

5.4.4 The receiving sequence of absolute value data

Servo drive receives the output from the absolute value encoder and sends the absolute value data to the sequence of the command controller as shown below.

(1) Outline of the absolute value signal

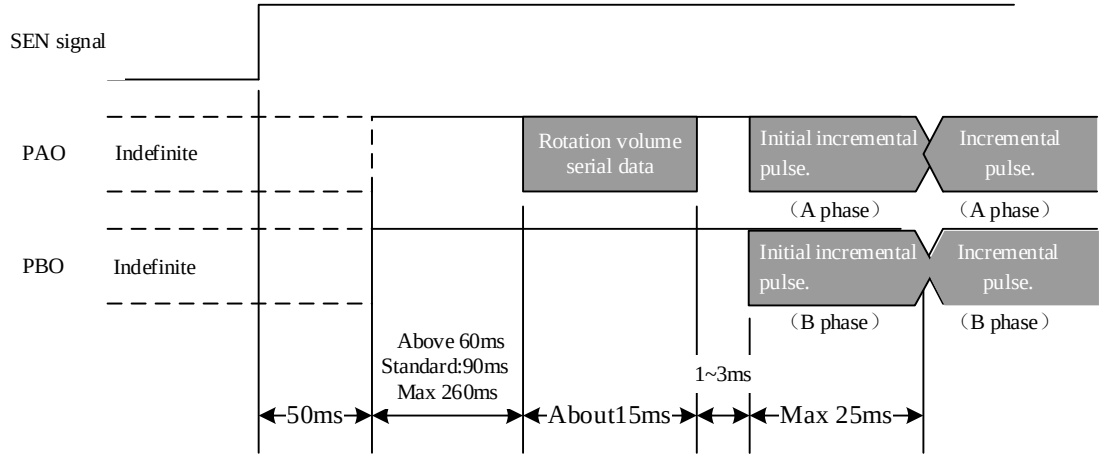
As shown below, the serial data and pulse of the absolute value encoder output by the servo drive are output through "PAO, PBO, PCO".



Signal name	State	Signal content
PAO	Initial time	Serial Data Initial incremental pulse
	Usual time	Incremental type pulse
PBO	Initial time	Initial incremental pulse
	Usual time	Incremental type pulse
PCO	Regularly	Origin point pulse

(2) The sending sequence and content of absolute value data

1. Set /SEN signal as H electrical level
2. After 100ms, it enters the serial data reception pending state. The reversible counter used for incremental pulse counts is cleared to zero.
3. Receive 8-byte serial data
4. After received the final serial data, it becomes the usual incremental action state after around 25ms.

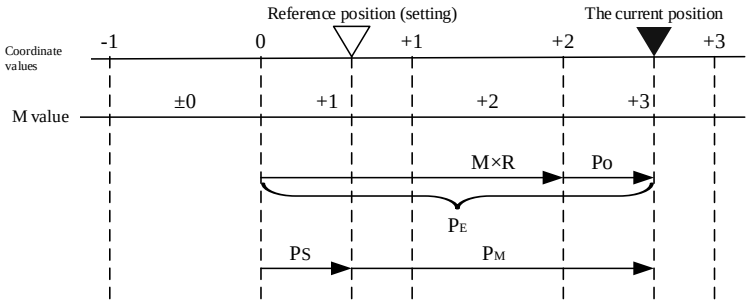


＊ Serial data

Represents the position of the motor shaft is located in the position from the base position (the value set at the setting).

＊ Initial incremental pulse

Pulse is input from the original location of the motor shaft to the current position of the motor shaft via the pulse speed same as the rotation, namely, about 1250rpm (under the condition that the frequency-dividing pulse at 17-bit is the factory setting).



The final absolute value data PM can be calculated as follows:

PE = M × R + P0

PM = PE － PS

Note: the reverse mode（P□000.0 = 1）will adopt the following formula,

PE = －M × R + P0

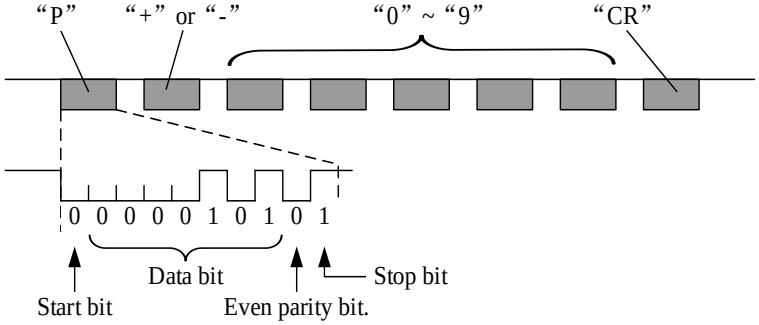
PM = PE － PS

PE	The current value read from the encoder
M	Multi rotation data (number of encoder rotations circle)
P0	Initial incremental pulse number
PS	The number of initial increment-type pulses read on the point of setting (the value is kept and managed by upper computer)
PM	The current value that must be in the customer system
R	The number of pulses (the value of Pn201) in 1 rotation circle of the encoder.

(3) Detailed specification of PAO serial data

The rotation quantity of the output 5 digits

Data transmission method	Start and stop synchronization (ASYNC)
Baud rate	9600 bps
Starting position	1 Digit
Park Position	1 Digit
Odd-even checking	Even checking
Character code	ASCII 7 bits
Data format	5 characters as shown in the figure below.



2，The range of rotation Value is between "+32767 ~ -32768".

If range is exceeded, the data is changed to "-32768" at "+32767";changed to "+32767" at “-32768”

5.4.5 Absolute value encoder setting

Then, it must set operation of the absolute value encoder.

- ＊ Initial start of the machine
- ＊ The "bus type encoder multi-loop information error (A25/b25)" occurs.
- ＊ The "bus type encoder multi-loop information overflow (A26/b26)" occurs.
- ＊ The "bus type encoder battery alarm 1 (A27 / b27)"
- ＊ Set the multi rotation data of the absolute value encoder as 0.

Set up with the panel operator.

Important:

1. The encoder setting operation can be performed only in the servo OFF state.
2. Please perform auxiliary functions F / 010 operations to remove the alarm when the absolute encoder is in the display alarm. The alarm cannot be dismissed when the alarm reset (/ALM-RST) by servo drive.
   - ＊ The "bus type encoder multi-loop information error (A25/b25)"
   - ＊ The "bus type encoder multi-loop information overflow (A26/b26)"
   - ＊ The "bus type encoder battery alarm 1 (A27 / b27)"
   - ＊ The "bus type encoder battery alarm 2 (A28 / b28)"
   - ＊ Over speed of bus encoder (A41 / b41)

5.4.6 Clear the absolute value encoder multi-loop data

When using the bus absolute encoder, the multi loop information can be cleared by the operation.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA009 whether FA009 is not displayed.	F	
2	“PoSCL” is displayed by press down the settings key.	S	
3	Please press down F function key and display "CLFIn" to complete the multi loop information and complete the removal of the encoder.	F	
4	Return to the FA009 display by press down the settings key.	S	

5.4.7 Clear the internal error of the bus encoder

When using the bus absolute encoder, the internal error of the encoder can be cleared by this operation.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA010 whether FA010 is not displayed.	F	
2	“ErrCL” is displayed by press down the settings key.	S	
3	Please press down F function key and display "CLFIn" to complete the multi loop information and complete the removal of the encoder.	F	
4	Return to the FA010 display by press down the settings key.	S	

5.5 Speed control (analog voltage instruction) operation

5.5.1 User parameters setting

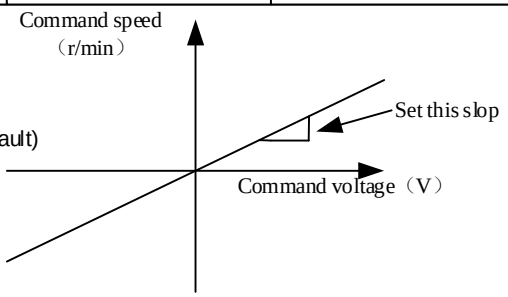
User parameters		Significance
P□000	H.□□0□	Control mode choice: speed control (analog voltage instruction)

P□300 Speed command input gain. Speed Position Torque

Range	Unit	Default	Restart
0 ~ 3000	（r/min）/V	150	No need

Set the analog command voltage - the command speed slope.

■Example
P□300=150：Represents the input 150r/min for every 1V voltage (Default)
P□300=300：Represents the input 300r/min for every 1V voltage
P□300=200：Represents the input 200r/min for every 1V voltage



5.5.2 Input signal setting

(1) Speed command Input

The speed control of the analog voltage instruction form is sent to the servo drive, and the servo motor is controlled at a rate proportional to the input voltage.

Category	Signal name	Connector pin number (leave factory)		Significance
		A axis	B-axis	
Input	V-REF	CN1-ANA1	CN1-ANA2	Speed command Input
	GND			Signal ground used for speed command input

It is used for speed control (analog voltage instruction). (P□000.1=0，4，7，9，A)
Use P□300 to set speed input gain. For detailed instructions on setting, please refer to "user parameters setting"
■ Input specification
• Input voltage range: DC ± 10V
• The Maximum allowable input voltage: DC ± 12V

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

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Input	/P-CON	CN1-IN2	CN1-IN6	ON =L electrical level	Run the servo drive in P control mode.
				OFF=H electrical level	Run the servo drive in PI control mode.

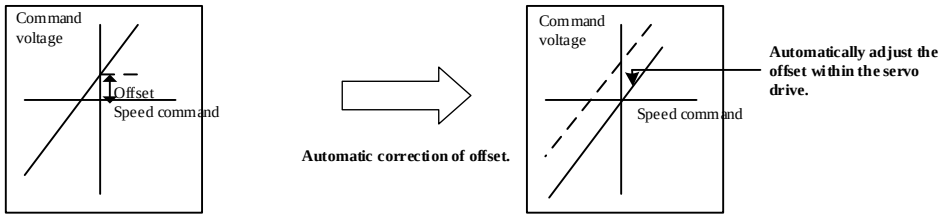
/P-CON signal is signal that selects the speed control mode from PI (proportional integral) or the P (proportional) control.
If P control is set, it can ease the motor rotation and minor vibration caused by the drift of the speed instruction input.
Input instruction: the rotation of the servo motor caused by the drift at 0V can be reduced, while the servo rigidity (braced force) during stop drops.
The input connector pin number may be assigned to another location via /P-CON signal by user parameters. Please refer to the "signal distribution of the input circuit".

5.5.3 Adjustment of instruction offset

When speed control mode is used, as the analog instruction voltage, it will also cause the minor rotation of the motor although issue the 0V instruction. Such situation will occur when the instruction voltage of the up controller or external circuit suffers tiny (unit: mV) offset (amount). Under such situation, automatic adjustment • manual adjustment is implemented to the instruction offset via the panel operator. Please reference the "4.2 Operation under the execution mode of auxiliary function".

The automatic adjustment of analog (speed • torque) instruction offset is the function to measure the offset and adjust voltage automatically.

When the voltage instruction of the up controller and external circuit suffers offset, the servo drive makes the following adjustment to the offset automatically.



The offset will be saved in the internal servo drive once the automatic adjustment of the instruction offset is conducted.

The offset can be confirmed via the manual adjustment (F□006) of speed instruction offset. Please reference the "5.5.3(2) Manual adjustment of speed instruction offset".

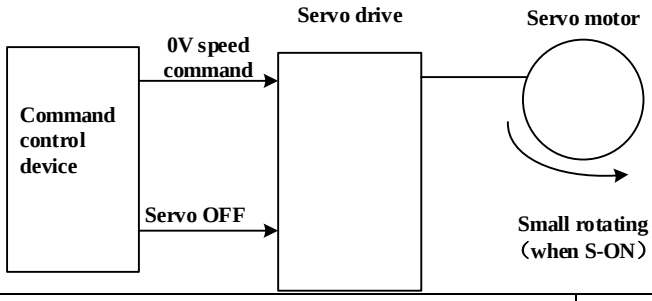
(1) The automatic adjustment of velocity instruction offset

When the shift pulse at servo locking stop is set as 0 under the condition of configuring position loop on the instruction control unit, it is not allowed to use the automatic adjustment of instruction offset (F□008). Under such situation, please use the manual adjustment (F□00A) of speed instruction offset.

Under the condition of zero speed instruction, it is further equipped with the zero clamping speed control function capable of achieving the forced execution of servo locking. Please reference the "5.5.5 Use of zero clamping function".

Please perform the automatic adjustment of the zero offset of the analog value when the servo is in OFF state.

Please adjust the A axis speed instruction offset automatically according to the following steps.

Work procedure	Work instruction	Action Keys	Post operation display
1			Please set the servo unit as servo OFF and input the 0V instruction voltage through the instruction controller or external circuit.
2	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA008 whether FA008 is not displayed.	F	FA008
3	“rEF_o” is displayed by press down the settings key.	S	rEF_o
4	Please press down F function key, start automatic zero setting, flashing display "donE".	F	donE
5	After complete the automatic zeroing, the flashing display "donE" is finished, and "rEF_o" is displayed.	——	rEF_o
6	Return to the FA008 display by press down the settings key.	S	FA008

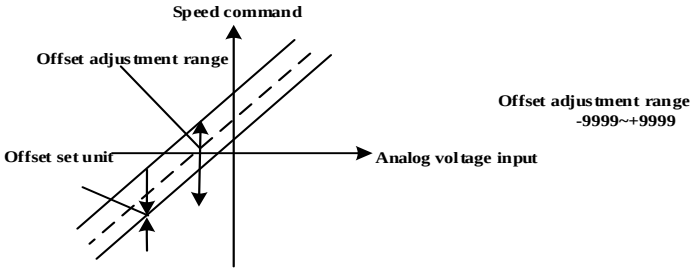
(2) Manual adjustment of speed instruction offset

Please use the manual adjustment (F□006) of the speed instruction offset in the following situations.

- The instruction controller configures the position ring to set the offset pulse of the servo lock at zero.
- Set the offset to a certain amount consciously
- Confirm the offset data group with automatic adjustment

The basic function and the analog (speed and torque) automatically adjust instruction offset (F / 008) are the same, but when it is in the manual adjustment (F - 006), it must be in direct input offset and adjustment.

The adjustment range of the offset and the setting unit are shown as follows.



Please adjust the A axis speed instruction offset manually according to the following steps.

Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA006 whether FA006 is not displayed.	F	FA006
2	“A.SPd” is displayed by press down the settings key.	S	A SPd
3	Please press the setting key 1s above and displays "0000".	◀	0000
4	Press down UP key or DOWN key to set offset quantity.	▲ ▼	0083
5	Please press the setting key 1s above and save the offset data.	◀	A SPd
6	Return to the FA006 display by press down the settings key.	S	FA006

5.5.4 Soft start

Soft start refers to the function of switching the step velocity instruction into the instruction of acceleration/deceleration certainly in the internal servo drive.

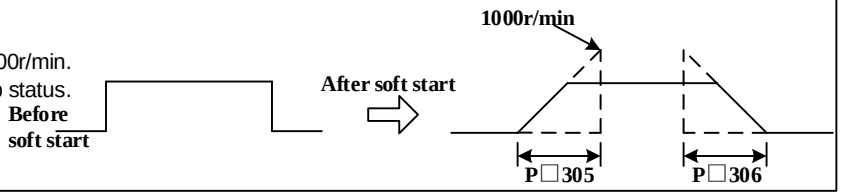
(1) Trapezoid starting

User parameters		Significance
P□309	H.□□□0	Trapezoid starting

P□305	Soft starter Acc time		Speed	
	Range	Unit	Default	Restart
	0 ~ 10000	1ms	0	No need

P□306	Soft starter Dec time		Speed	
	Range	Unit	Default	Restart
	0 ~ 10000	1ms	0	No need

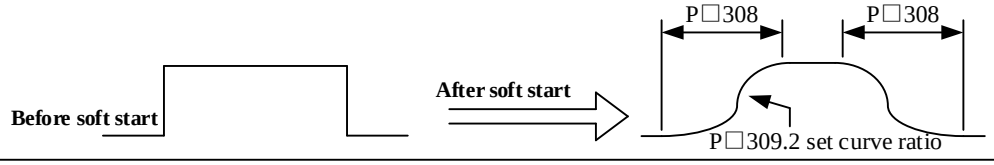
Smooth speed control can be achieved when the input step speed instruction or the internal setting speed is selected.(general speed control is set to "0".)
The set values are shown below.
· P□305：Time from stop status to 1000r/min.
· P□306：Time from 1000r/min to stop status.



(2) S curve way starting

User parameters		Significance	
P□309	H.□□□1	S curve way starting	
	H.□0□□	Close to the linear	Ratio selection of S curves
	H.□1□□	Low	
	H.□2□□	Medium	
	H.□3□□	High	

P□308	The S curve goes up time		Speed	
	Range	Unit	Default	Restart
	0 ~ 10000	1ms	0	No need

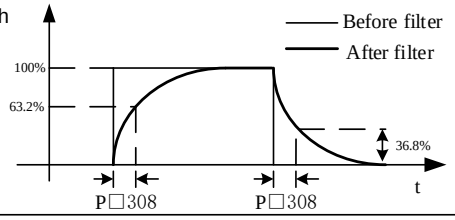


(3) Acceleration and deceleration filter mode starting

User parameters		Significance
P□309	H.□□□2	Acceleration and deceleration filter mode starting
	H.□□0□	The first times acceleration and deceleration filtering
	H.□□1□	The second times acceleration and deceleration filtering

P□307	Speed command filter time.		Speed	
	Range	Unit	Default	Restart
	0 ~ 10000	1ms	0	No need

The acceleration and deceleration filter is used to smooth the speed instruction.
If you set too large a value, the response will decrease.



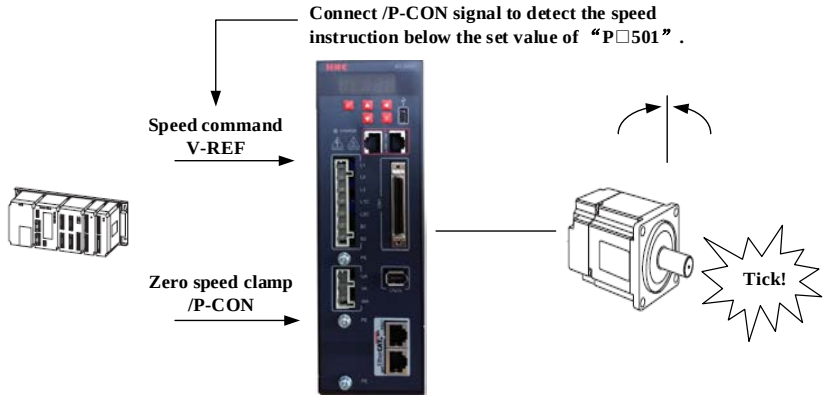
5.5.5 The use of zero clamping function

(1) The meaning of zero clamping

It refers to the function used in the condition that instruction control unit is not configured with position loop system under speed control mode.

If zero clamping (/P-CON) signal is set as ON, and when the input voltage of speed instruction (V-REF) is up to below the revolving speed of P□501(zero clamping level), position loop is configured in the servo motor, the speed instruction is ignored, and furthermore, make the servo motor stopping urgently to get into servo lockout state.

The servo motor is clamped into the ± 1 pulse in the valid position of zero clamping, although it is rotated via external force, it still can return to the zero clamping position.

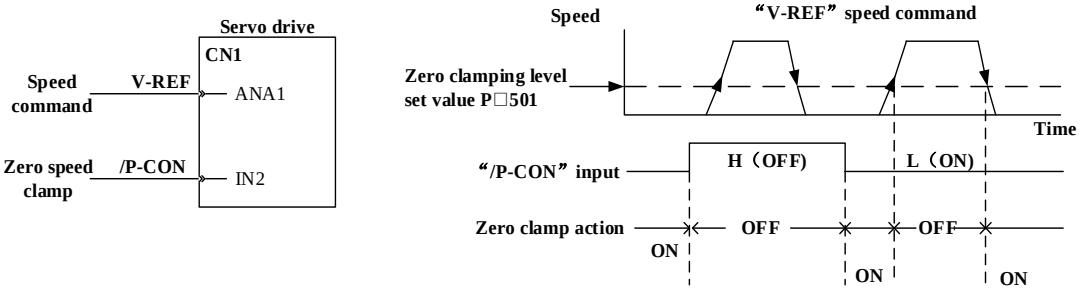


User parameters		Significance
P□000	H.□□A□	Control mode：←→ speed control (analog voltage instruction) zero clamping

Zero clamping action switching conditions

Set P□000= H.□□A□，and as long as one of the following two conditions is established, the zero clamping action will be entered.

- /P-CON is ON(L electrical level)
- The speed instruction (V-REF) is lower than the set value of P□501



P□501	Zero clamping electric level.		Speed	
	Range	Unit	Default	Restart
	0 ~ 10000	1r/min	10	No need

When select the speed control with zero clamping function (P□000=H.□□□A□).The maximum speed of the servo motor is still valid, even if set Value in P□501 exceed the maximum speed of the servo motor.

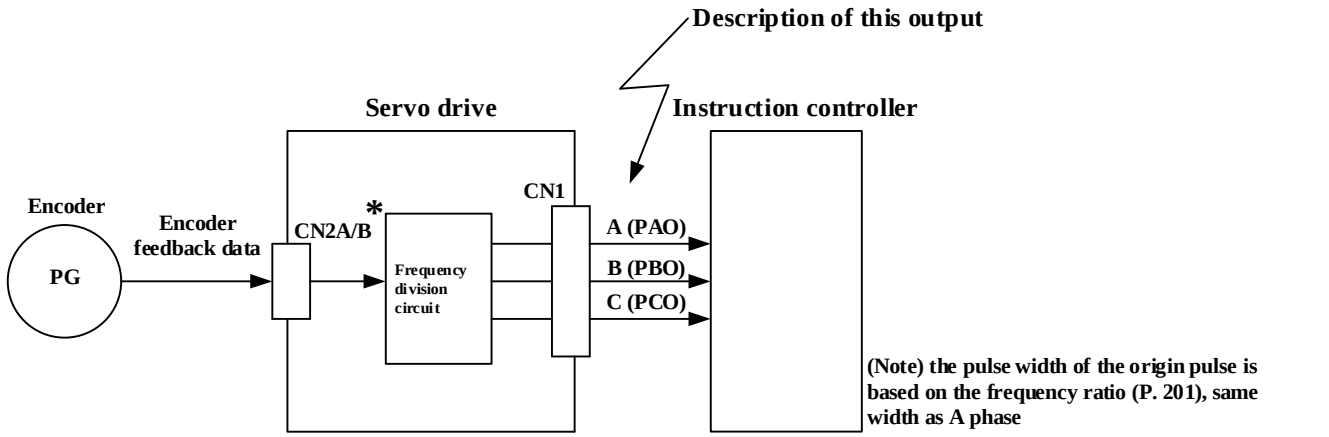
(3) Input signal setting

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Input	/P-C0N	CN1-IN2	CN1-IN6	ON =L electrical level	Zero clamping function ON (valid)
				OFF=H electrical level	Zero clamping function OFF (invalid)
It is input signal for switching to zero clamping action. Any one of the /P-CON signals can be switched to zero clamping. For distribution method, please refer to the "signal distribution of the input circuit".					

5.5.6 Encoder signal output

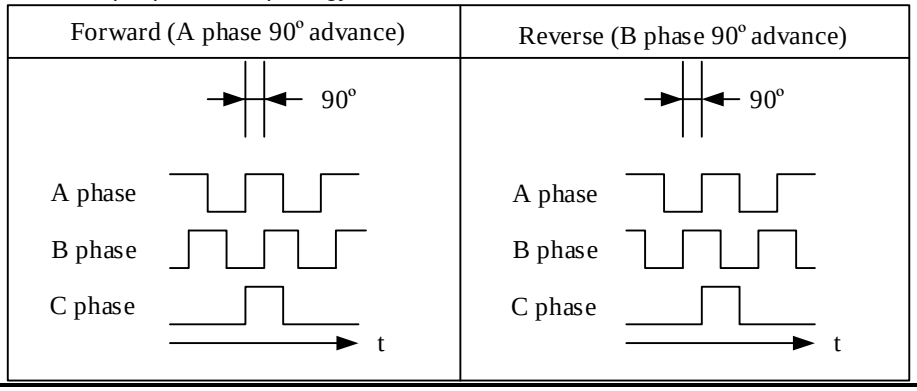
The feedback pulse of the encoder outputs to the outside after the servo unit is internal processed.

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Output	APAO+			Encoder output A+ phase
	APAO-			Encoder output A- phase
Output	APBO+			Encoder output B+ phase
	APBO-			Encoder output B- phase
Output	APCO+			Encoder output C+ phase
	APCO-			Encoder output C- phase
Input	SEN			SEN signal input (valid when using absolute encoder)
	GND			Signal ground



* Even it is in the reverse mode (P / 000.0=1), the frequency output phase morphology and standard setting (P / 000.0=0) are the same.

■ The output phase morphology



When it is in Bus type encoder status:

After two cycles of rotating the servo motor, uses C phase pulse output of servo drive and perform the mechanical origin reset action.

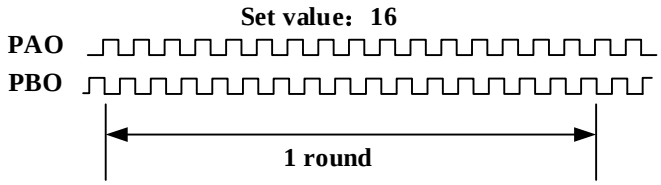
- The setting of the frequency ratio of the encoder pulse

P□201	PG Frequency division value	Speed	Position	Torque
	Range	Unit	Default	Restart
	16 ~ 32768	1P/rev	2500	Need

Set the output pulse number of a PG output signal (PAO,PBO) from the servo drive.
The feedback pulse from each round of the encoder is divided into a set value of P□201 in the servo drive and output.(please set according to the mechanical and instruction controller's system specifications.)

■Output instance

P□201=16(16 pulse output per round).



5.5.7 Same speed detection output

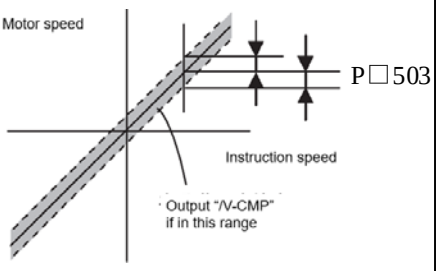
Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Output	/V-CMP	CN1-9 CN1-10	CN1-34 CN1-35	ON =L electrical level	Same speed state
				OFF=H electrical level	Different speed State
The output signal can be assigned to other output terminals via the user parameter P□513. For the distribution of output signals, please refer to the "Signal distribution of the output circuit".					

P□503	Same speed detection signal width.	Speed		
	Range	Unit	Default	Restart
	0 ~ 100	1r/min	10	No need

If the difference between the motor speed and the instruction speed is lower than the set value of P□503, Then output "/V-CMP" signal.

■Example:

P□503=100, the instruction speed is 2000r/min, if the motor turns.
The speed is between 1900 ~ 2100r/min and the "/V-CMP" is set as ON.



■Added

"/VCMP" signal is the output signal of speed control. If it is position control, the function automatically becomes "/COIN", and if it is torque control, it automatically becomes "OFF(H level)".

5.6 Position control operation

5.6.1 User parameters setting

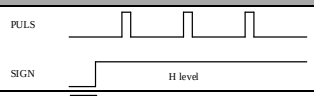
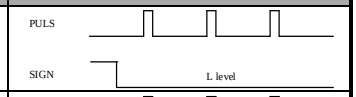
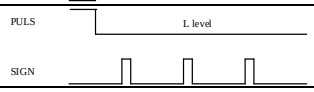
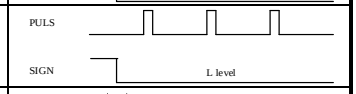
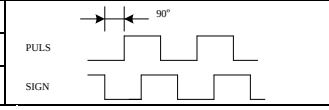
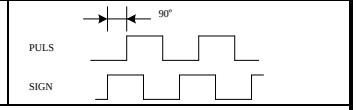
Please set the following user parameters while using the pulse train for position control.

(1) Control mode selection

User parameters		Significance
P□000	H.□□1□	Control mode selection: position control (pulse train instruction)

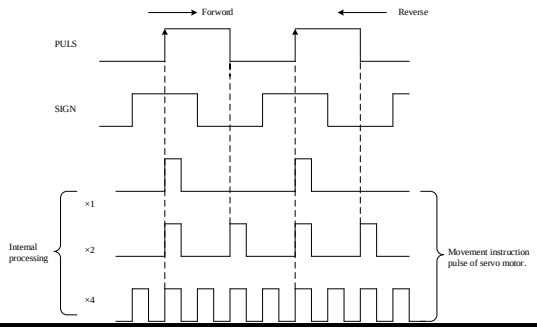
Category	Signal name	Connector Pin number		Name
		A axis	b-axis	
Input	PULS+			Command pulse input
	PULS-			Command pulse input
	SIGN+			Symbol input
	SIGN-			Symbol input

(2) Selection of pulse instruction form

User parameters		Instruction form	Input double value	Positive rotation instruction	Reversal instruction
P□200	H.□□0□	Symbol + pulse train	——		
	H.□□1□	CW+CCW	——		
	H.□□2□	90° phase position difference 2 phase pulse	×1		
	H.□□3□		×2		
	H.□□4□		×4		

■ Supplement

90°phase position difference 2 phase pulse instruction form may set the input multiplier.



(3) The pulse instruction input is reversed.

User parameters		Significance
P□200	H.□0□□	PULS input does not reversed, SIGN input does not reversed
	H.□1□□	PULS input does not reversed, SIGN input reversed
	H.□2□□	PULS input reversed, SIGN input does not reversed
	H.□3□□	PULS input reversed, SIGN input take reversed
The user can reverse the logic of the pulse instruction by setting the parameter.		

(4) Clear signal form selection

Category	Signal name	Connector pin number (leave factory)		Name
		A axis	B-axis	
Input	/CLR	Distributed through P□510		Clear input

The following action is performed if the clear action takes effect.

- The offset counter inside the servo drive is set as "0".
- Set the position ring action at the invalid state.

  → The servo clamping does not work when it is maintained in the clear state, and the servo motor can sometimes rotate at a small speed due to the drift of the speed ring.

(5) Choice of clear action

Under the conditions other than the clear signal CLR, the offset pulse can be cleared at which timing is selected according to the state of the servo drive. The shift pulse operation mode is cleared through the following user parameters of 3 types of P□200.0.

User parameters		Significance
P□200	H.□□□0	The offset pulse is cleared during the servo OFF, and the offset pulse is not cleared during the over travel
	H.□□□1	The offset pulse is not cleared when the servo OFF or the over travel.
	H.□□□2	The offset pulse is cleared when the servo OFF or the over travel.

5.6.2 Setting of electronic gear

(1) Encoder pulse number

Type of encoder	Encoder pulse number	
Ordinary incremental encoder	2500 P/R	
Bus type encoder	23 Digit	2097152P/R

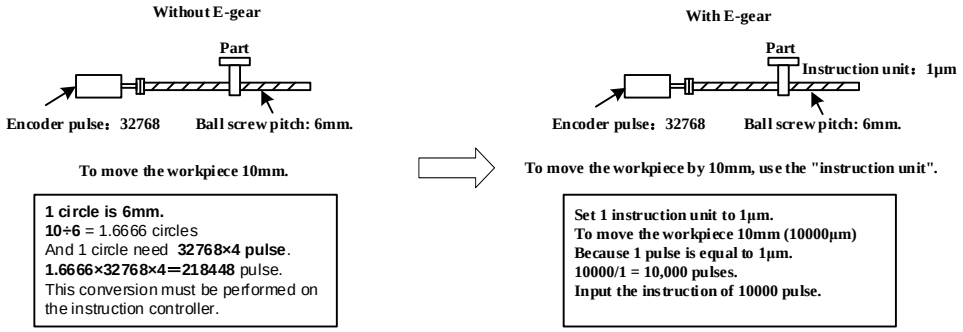
The number of digit of the encoder resolution is not the same as that of the encoder signal output (phase A, phase B). The encoder pulse number x 4(multiplication) is equal to the number of digits of the resolution.

---

(2) Electronic gear

Electronic gear function refers to the function of setting the motion distance of the work piece equivalent to the input instruction 1 pulse of the instruction control unit into any value.

The instruction 1 pulse from instruction control unit, namely, the minimum unit is called "1 instruction unit".



(3) The related user parameters

P□202	Electronic gear (numerator)		Position	
	Range	Unit	Default	Restart
	1 ~ 1073741823	—	1	Need

P□204	Electronic gear (denominator)		Position	
	Range	Unit	Default	Restart
	1 ~ 1073741823	—	1	Need

If the mechanical deceleration ratio of the motor shaft and the load side is set to n/m, the set value of the electronic tooth number ratio can be obtained by the following formula.

(when the servo motor turns m ring and the load axis is rotated n laps)

$$\text{E-gear ratio } \frac{B}{A} = \frac{P\square 202}{P\square 204} = \frac{\text{Encoder pulse} \times 4}{\text{ditance of the load axis by 1 circle}} \times \frac{m}{n}$$

When you exceed the set range, divide the numerator and the denominator into an integer within the set range. Please be careful not to change the number of electronic gear (B/A).

■Important

The setting range of electronic gear ratio: $0.01 \leq (B/A) \leq 100$.

When the above range is exceeded, the servo drive cannot function normally. Please change the mechanical composition or instruction unit.

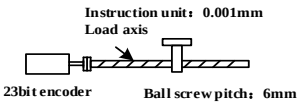
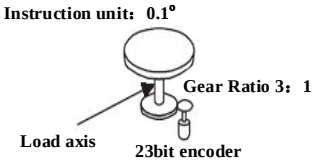
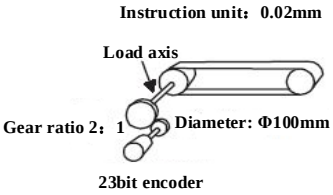
(4) Setting steps of the number ratio of electronic gear

Please set the number of electronic gear ratio according to the following steps.

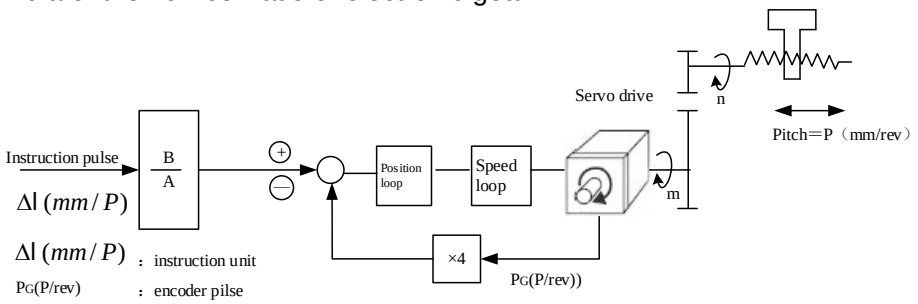
Step	Content	Description
1	Confirmation of mechanical specifications	The ratio of the deceleration, the pitch of the ball screw, the diameter of the pulley is confirmed.
2	Encoder pulse number is confirmed	Confirm the number of encoder pulses for the servomotor used.
3	Decision instruction unit	Determine 1 instruction unit from the command controller. Please determine the unit of instruction on the basis of factors such as mechanical specifications and positioning accuracy and so on.
4	Calculate the movement of 1 ring rotation of the load axis	Calculate the amount of instruction required for the 1 rotation of the load axis based on the determined instruction unit.
5	Calculate the number ratio of electronic gear	The number ratio of electronic gear (B/A) is calculated on the basis of the calculation formula of the number of electronic gear.
6	Set the user parameters	Set the calculated values as the number ratio of the electronic gear.

(5) Setting instance of the number ratio of electronic gear

In fact, the number of electronic gear is determined by several examples.

Step	Content	Machine composition					
		Ball screw		Round table		Belt and pulley	
							
1	Confirm the mechanical composition	• Ball screw pitch: 6mm • Speed reducing ratio：1/1		The rotation angle of 1 circle: 360° Speed reducing ratio：3/1		Diameter of pulley: 100 mm. (pulley perimeter: 314 mm) • Speed reducing ratio：2/1	
2	Encoder	23 bits: 8388608P/R		23 bits: 8388608P/R		23 bits: 8388608P/R	
3	Set the instruction unit	1 instruction unit：0.001mm(1μm)		1 instruction unit：0.1°		1 instruction unit：0.02mm	
4	1 cycle of rotation of the load axis Amount of movement	6mm/0.001mm=6000		360°/0.1°=3600		314mm/0.02mm=15700	
5	Calculate the number ratio of electronic gear	$\frac{B}{A}=\frac{8388608}{6000}\times\frac{1}{1}$		$\frac{B}{A}=\frac{8388608}{3600}\times\frac{3}{1}$		$\frac{B}{A}=\frac{8388608}{15700}\times\frac{2}{1}$	
6	Set the user parameters	P□202	8388608	P□202	8388608	P□202	8388608
		P□204	6000	P□204	1200	P□204	7850

(6) The calculation formula of the number ratio of electronic gear



$\Delta l\ (mm/P)$

$\Delta l\ (mm/P)$: instruction unit

P_G(P/rev) : encoder pilse

P (mm/rev) : ball screw pitch

$\frac{m}{n}$: gear ratio

$$\frac{n\times p}{\Delta l}\times(\frac{B}{A})=4\times P_G\times m$$

$$(\frac{B}{A})=\frac{4\times P_G\times m\times\Delta l}{n\times p}=\frac{4\times P_G}{\frac{P}{\Delta l}}\times\frac{m}{n}$$

A and B are set by user parameters:

A : P□204 B : P□202

5.6.3 Position instruction

The command of pulse train form is used to control the position of servo motor.
The pulse train output form of the instruction controller includes the following types.

- BUS driver output
- +24V open-collector output
- +12V open-collector output
- +5V open-collector output

■ Notes to the open-collector output
The noise tolerance of input signal will decrease when pulse input through the open collectoring.
Change it in the following user parameters when the noise is offset.

User parameters		Significance
P□200	H.1□□□	Instruction input filtering for open-collector(OC) signal

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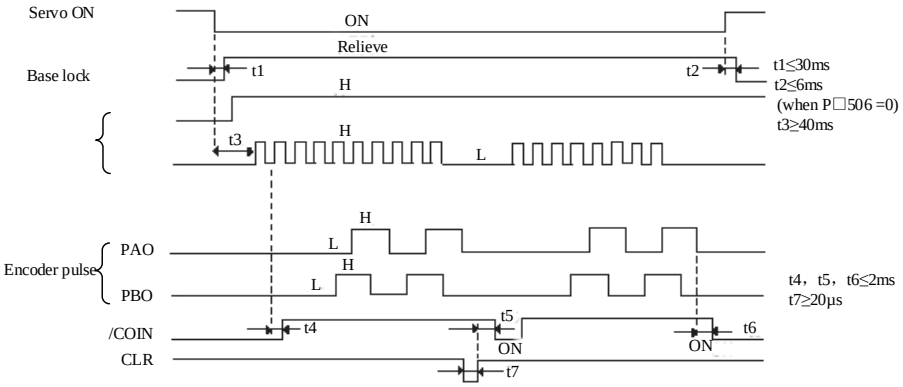
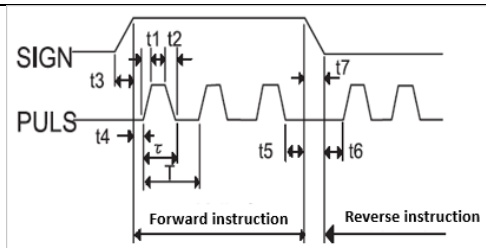
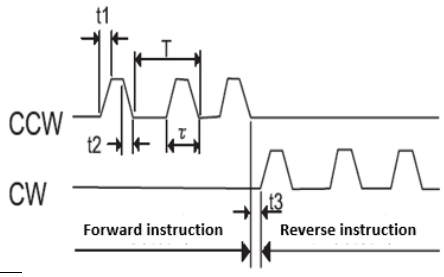
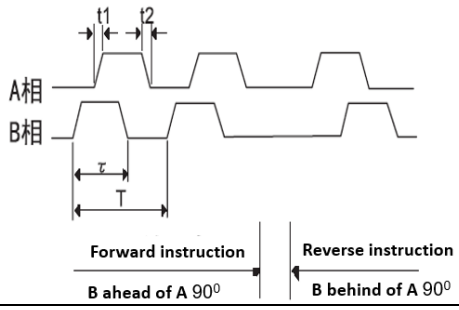
(1) Timing example of input/output signals



(Note) 1. The interval between the servo ON signal from ON to the input instruction pulse shall be controlled above 40ms. The servo drive sometimes does not accept the command pulse whether instruction pulse is input within 40ms of the servo ON signal.
2. Please set the ON of the clear signal as above 200μs.

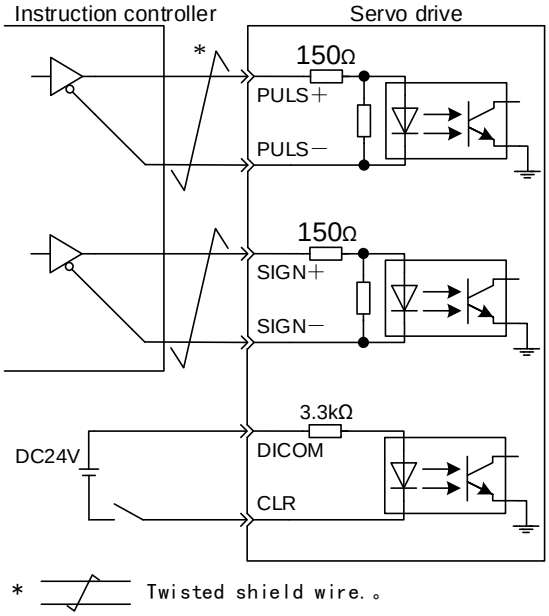
Table: Timing of the command pulse input signal

The command pulse signal form	Electrical specifications	Remarks
Symbol + pulse train input (SIGN + PULS signal) The maximum instruction frequency: 500kpps (when the open collector output: 200kpps)	 t1, t2 ≤ 0.1μs t3, t7 ≤ 0.1μs t4, t5, t6 > 3μs τ ≥ 1.0μs (τ /T)×100≤ 50%	Symbol (SIGN) H= forward instruction L= reversal instruction
CW pulse +CCW pulse The maximum instruction frequency: 500kpps (when the open collector output: 200 kpps)	 t1, t2 ≤ 0.1μs t3 > 3μs τ ≥ 1.0μs (τ /T)×100 ≤ 50%	
90° phase difference of 2 phase pulse (A phase+B phase) Maximum instruction frequency: .1 Multiplier：500kpps .2 Multiplier：400kpps .4 Multiplier：200kpps	 t1, t2 ≤ 0.1μs τ ≥ 1.0μs (τ /T)×100=50%	Multiplier mode can be set through the user parameter P□200.1 Switching

(2) Connection instance

(a) Bus driver output connection example

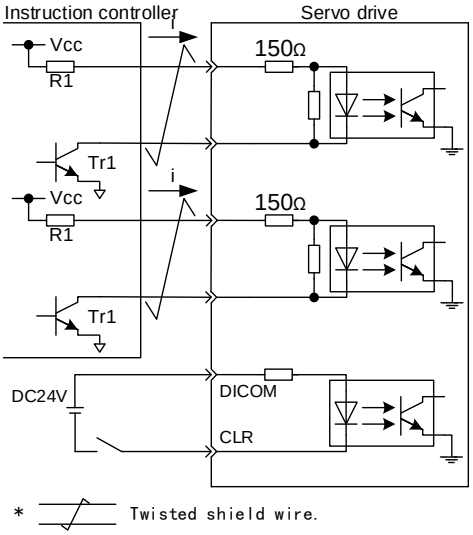
Applicable bus driver: TI system SN75174 or MC3487 equivalent product



(b) The practical example of open collector output

Please choose the limit resistance R1 to ensure that the input current I enter the following range.

The input current i ＝ 7 ～ 15mA



Please refer to the following applicable examples to set the value of the work resistance R1 so that the input current I is within the range of 7ma-15ma.7mA-15mA。

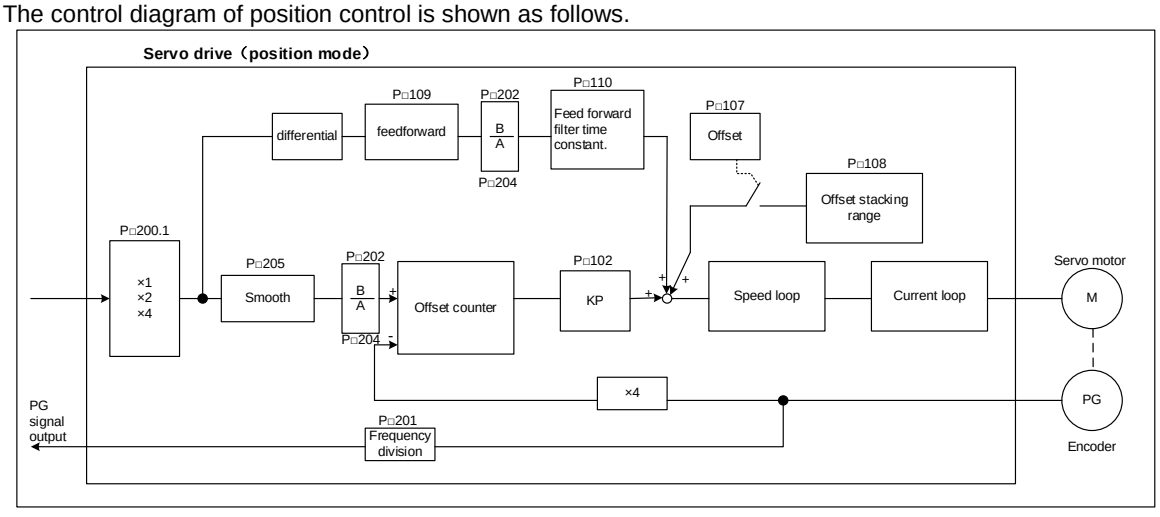
Recommend		
Vcc=24V; R1=2.2KΩ	Vcc=12V; R1=1KΩ	Vcc=5V; R1=180Ω

Note:

The noise tolerance of input signal is reduced when the instruction pulse is emitted through the collector opening. When deviation occurs due to interference, Please set P□200.3=1

(3) Control diagram

The control diagram of position control is shown as follows.



5.6.4 Smoothness

The input pulse of a certain frequency can be filtered for the internal servo unit.

(1) Selection of position instruction filter

User parameters		Significance
P□209	H.□□□0	The first times acceleration and deceleration filtering
	H.□□□1	The second times acceleration and deceleration filtering

(2) Filter related user parameters

P□208	Position command Acc/Dec filter time parameter.		Position	
	Range	Unit	Default	Restart
	0 ~ 6400	0.1ms	0	No need

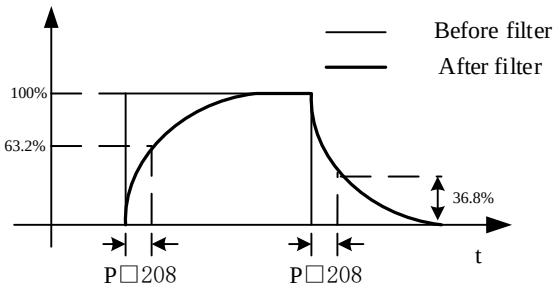
■Important

In the case of the change parameter (Pn204), the value of the change is valid only when no input pulse and the offset pulse is 0. For to effectively reflect the set value, enter the clear signal (CLR) to disable the command pulse of the instruction controller, or to remove the offset pulse as a servo.

The motor can be run smoothly even in the following situations. In addition, this setting has no effect on the amount of movement (instruction pulse number).

· the command controller issuing the instruction cannot be accelerated or decelerated.

· large number of electronic Gear ratio (10 times more).



5.6.5 Positioning completed signal

It is the signal of positioning of the servo motor in position control; please use it while the instruction controller is positioned to complete the confirmed interlock.

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Output	/COIN			ON =L electrical level	Positioning completed
				OFF=H electrical level	Positioning uncompleted
Complete positioning signal via the user parameter P□513 allocated to other output terminals. For the distribution of output signals, please refer to the "Signal distribution of the output circuit".					

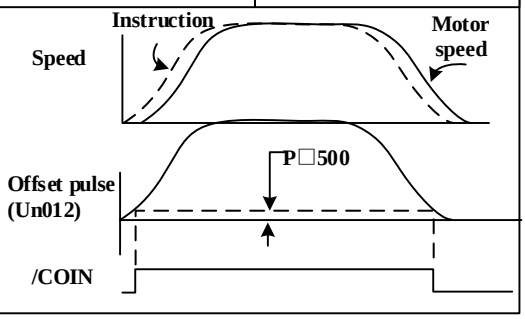
P□500	Positioning completion width		Position	
	Range	Unit	Default	Restart
	0 ~ 250	1 instruction unit	10	No need

If the instruction controller's pulse output is lower than that of the servo motor (the offset pulse) is lower than the set value of this user parameter, then output positioning completion signal (/COIN) The setting unit is the instruction unit. This depends on the unit of instruction set by the electronic gear.

If you set too large a value, you can reduce the offset at low speed, but it is possible to output "/COIN" at normal times.

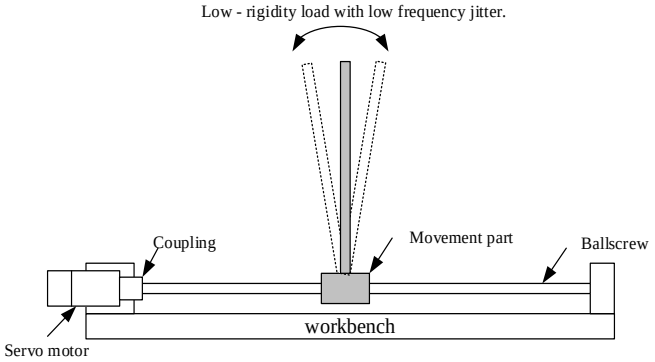
Please note.

The setting of this user parameter does not affect the final positioning accuracy.



5.6.6 Low frequency jitter suppression

For the low rigid load, it is easy to cause continuous low-frequency dithering in front end of load during quick startup/shutdown to extend positioning time, influencing production efficiency. Servo drive contains the dithering-elimination control function to achieve the effect of restraining low-frequency dithering via calculating load position and compensation.



(1) Scope of Application

For the low rigid load, it is easy to cause continuous low-frequency dithering in front end of load during quick startup/shutdown to extend positioning time, influencing production efficiency.

Servo drive contains the dithering-elimination control function to achieve the effect of restraining low-frequency dithering via calculating load position and compensation.

- Vibration is intensified as of the external force
- The jitter frequency is other than 5.0Hz to 50.0Hz
- There is mechanical clearance in the mechanical joint of vibration structural parts.
- When the turn time is less than one vibration period

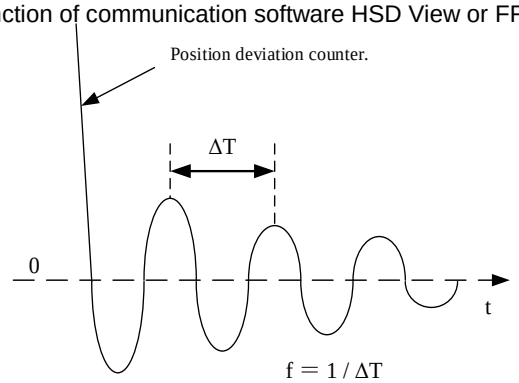
(2) User parameters setting

P□413	B type vibration (low frequency jitter) frequency.	Speed	Position
Range	Unit	Default	Restart
10 ~ 1000	0.1Hz	1000	No need

P□414	B type vibration (low frequency jitter) damping.	Speed	Position
Range	Unit	Default	Restart
0 ~ 200	—	25	No need

After the measured load jitter frequency is written to the parameter P□413 can be adjusted to obtain the best inhibition effect. If the motor continues to vibrate at the stop, it can be appropriately increased P□414, usually with the parameter P of P□414 without modification.

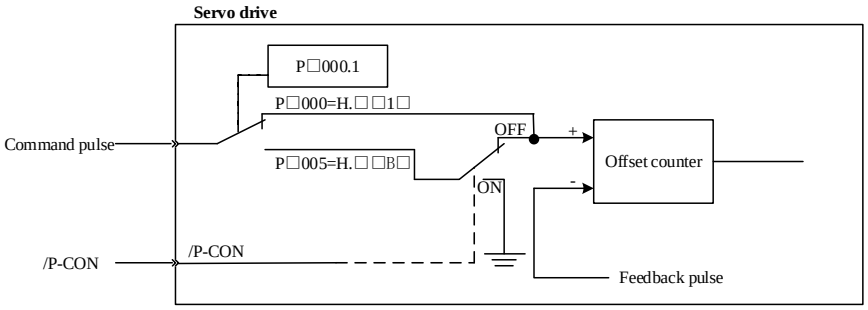
Whether the jitter frequency can be measured directly by an instrument (such as a laser interferometer), the measured frequency data (unit 0.1Hz) is written to the parameters directly P□413。 If there is no measuring apparatus, the dithering frequency of the load can be indirectly measured via the drawing function of communication software HSD View or FFT analysis function.



5.6.7 Prohibition function of instruction pulse (INHIBIT function)

(1) Prohibition function of instruction pulse (INHIBIT function)

Stop (prohibit) the function of the command pulse input count when it is in the position control.
Enter into the servo locking (clamping) state during the use of the function.

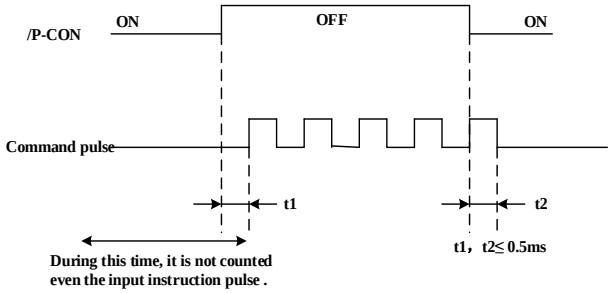


(2) User parameters setting

User parameters		Significance
P□000	H.□□B□	Control mode: position control (pulse train instruction) ←→ position prohibition

■ Prohibition (INHIBIT) switching condition

• /P-CON signal is ON(L electrical level)



(3) Input signal setting

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Input	/P-CON	IN2	IN6	ON =L electrical level	INHIBIT function ON (stop counting the instruction pulse)
				OFF=H electrical level	INHIBIT function OFF (counting the instruction pulse)

5.7 Torque control operation

5.7.1 User parameters setting

User parameters		Significance
P□000	H.□□2□	Control method: Torque control (analog voltage instruction)

P□400 Torque command input gain. Speed | Position | Torque

Range	Unit	Default	Restart
10 ~ 100	0.1V/rated torque	30 (3V/rated torque)	No need

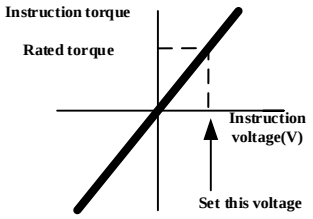
Set analog voltage level of torque commands (T-REF) required to run the servo motor at rated torque.

■Example:

P□400=30: the motor rated torque used when setting 3V input (Default)

P□400=30: the motor rated torque used when setting 10V input.

P□400=30: the motor rated torque used when setting 2V input.



5.7.2 Torque instruction input

The torque control of the analog voltage instruction form is sent to the servo drive, and the servo motor is controlled at a rate proportional to the input voltage.

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	T-REF	CN1-ANA2	Not allocated	Torque instruction input
	GND			Signal ground is adopted for torque instruction input

It is used for torque control (analog voltage instruction). (P□000.1=2，6，8，9)

Use P□400 to set torque command input gain. For detailed instructions on setting, please refer to "8.7.1 user parameters setting"

■ Input specification

- Input range: DC ± 1V ~ ± 10V/ rated torque
- The Maximum allowable input voltage：DC ± 12V
- Set up at the time leaving factory

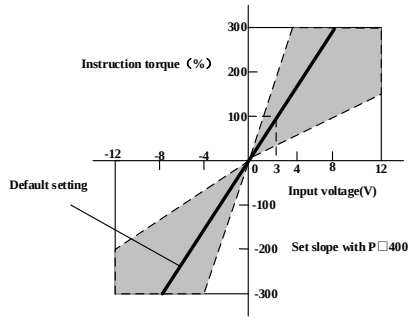
  Under P / 400 = 30:3V is rated torque

  +3V input: rated torque in the forward direction

  +9V input: The forward direction is 300% of the rated torque.

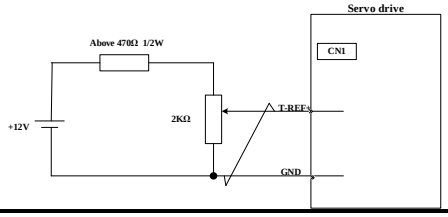
  -0.3V input: the reverse direction is 10% of the rated torque.

  Change voltage input range via user parameter P□400.



■ Practical example of input circuit

To take effective measures to prevent interference, please be sure to use a number of strands for the wiring.



■ Internal torque command confirmation.

The internal torque instruction can be confirmed under the monitoring mode (Un005). Please refer to “Operation under the monitoring mode”

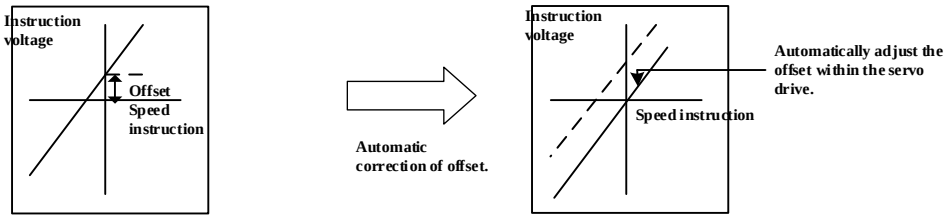
5.7.3 Offset adjustment

(1) Automatic adjustment of torque instruction offset

As the analog instruction voltage, even if the 0V instruction is issued, the motor will rotate at a slow speed when using the torque control mode. Such situation will occur when the instruction voltage of the higher control device or external circuit suffers tiny (unit: mV) offset (amount). Under such situation, automatic adjustment• manual adjustment is implemented to the instruction offset via the panel operator.

The automatic adjustment of analog (speed • torque) instruction offset is the function to measure the offset and adjust voltage automatically.

When the voltage instruction of the up controller and external circuit suffers offset, the servo drive makes the following adjustment to the offset automatically.



The offset will be saved in the internal servo drive once the automatic adjustment of the instruction offset is conducted.

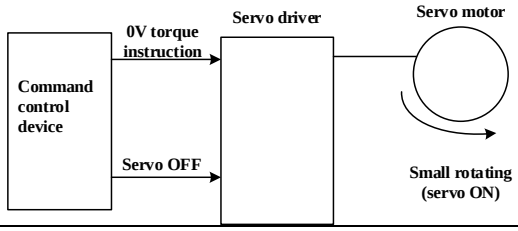
The offset can be confirmed via the manual adjustment (F□006) of speed instruction offset.

When the shift pulse at servo locking stop is set as 0 under the condition of configuring position loop on the instruction control unit, it is not allowed to use the automatic adjustment of instruction offset (F□008). Under such situation, please use the manual adjustment (F□00A) of speed instruction offset.

Under the condition of zero speed instruction, it is further equipped with the zero clamping speed control function capable of achieving the forced execution of servo locking. Please refer to the "Using of zero clamping function"

Please perform the automatic adjustment of the zero offset of the analog value when the servo is in OFF state.

Please adjust the A axis torque instruction offset automatically according to the following steps.

Work procedure	Work instruction	Action Keys	Post operation display
1			Please set the servo unit as servo OFF and input the 0V instruction voltage through the instruction controller or external circuit.
2	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA008 whether FA008 is not displayed.	F	FA008
3	“rEF_o” is displayed by press down the “S” key.	S	rEF_o
4	Please press down F function key, start automatic zero setting, flashing display "donE".	F	donE
5	After complete the automatic zeroing, the flashing display "donE" is finished, and "rEF_o" is displayed.	——	rEF_o
6	Return to the FA008 display by press down the settings key.	S	FA008

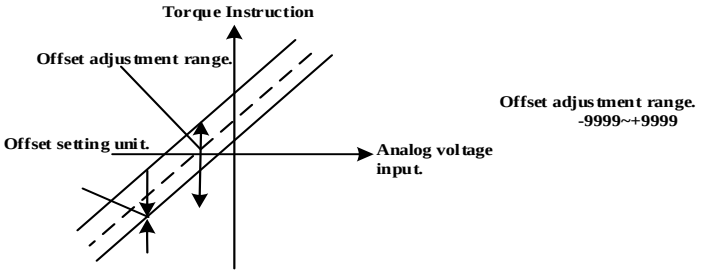
(2) Manual adjustment of torque instruction offset

Please use the manual adjustment (F□007) of the torque instruction offset in the following situations.

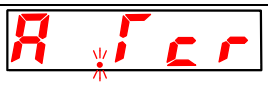
- The instruction controller configures the position ring to set the offset pulse of the servo lock at zero.
- Set the offset to a certain amount consciously
- Confirm the offset data group with automatic adjustment

The basic function and the analog (speed and torque) automatically adjust instruction offset (F□008) are the same, but when it is in the manual adjustment (F□007), it must be in direct input offset and adjustment.

The following figure shows the offset adjustment range and the setting unit.



Please adjust the A axis torque instruction offset automatically according to the following steps.

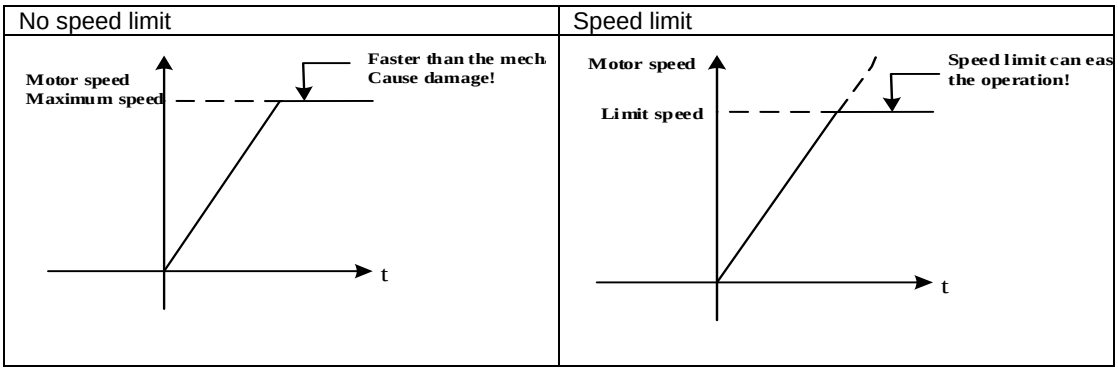
Work procedure	Work instruction	Action Keys	Post operation display
1	Please press down F function key and select A axis auxiliary function mode. Press UP key or DOWN key to set the FA007 whether FA007 is not displayed.	F	
2	“A.Tcr” is displayed by press down the settings key.	S	
3	Please press the setting key 1s above and displays "0000".	◀	
4	Press down UP key or DOWN key to set offset quantity.	▲ ▼	
5	Please press the setting key 1s above and save the offset quantity.	◀	
6	Return to the FA007 display by press down the settings key.	S	

5.7.4 Speed limit for torque control

As servo motor should be controlled in torque control to output the torque issuing instructions, motor speed management is not implemented.

If too high instruction torque is set relatively to the load torque of the machinery side, it exceeds machinery torque, resulting in remarkable increase of motor speed.

As the protective measure of the machinery side, it is equipped with the function to limit the speed of servo motor during torque control.



(1) Choice of speed control mode (torque limit option)

User parameters		Significance
P□001	H.□0□□	Take the P□408 set value as the speed limit. (Internal speed limit function)
	H.□1□□	V-REF is used as external speed limit input.

(2) Internal speed limit function

P□408	Speed limit for torque control.		Torque
Range	Unit	Default	Restart
0 ~ 6000	1r/min	1500	No need

Set motor speed limit in torque control mode
The user's parameters are set to take effect when P□001=H.□0□□.
Even if The speed set in P□408 exceed the maximum speed of the servo motor, the actual value is still limited to the maximum speed of the servo motor.

(3) External speed limit function

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	V-REF	CN1-5	CN1-30	External speed limit input
	GND	CN1-6	CN1-31	Signal ground

The motor revolving speed limit when using input torque limit with analog voltage instruction.
When P□001=H.□1□□， the smaller value is the valid value between the speed limit input of V-REF and the speed limit of P□408 “Torque control speed limit”
The set value of P□300 determines the voltage electrical level of limit input. It has nothing to do with polarity.

P□300	Speed command input gain.	Speed	Position	Torque
Range	Unit	Default	Restart	
0 ~ 3000	（r/min）/V	150	No need	

In torque control mode, set the voltage level of the external speed limit.
P□300=150 (default), the actual speed limit will be limited to 900r/min if V-REF input voltage is 6V.

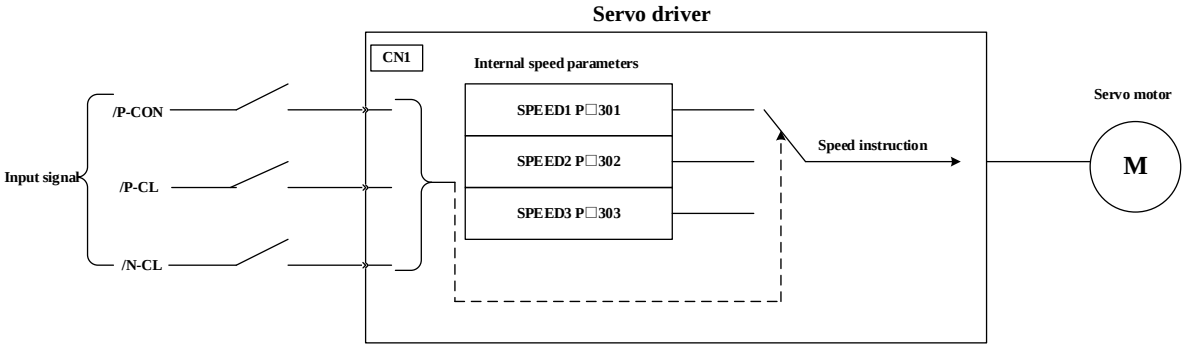
■ The principle of speed limit
Negative feedback is conducted to the torque in proportion to the speed difference of speed limit beyond the scope of speed limit, so as to return to the speed limit scope. Therefore, the limit value of the actual motor speed will vary from the load condition.

5.8 Speed control (internal speed selection) operation

- The definition of internal setting speed selection

  The selection of internal setting speed is achieved via setting 3 kinds of motor speed through the internal user parameters of the servo drive, and furthermore, the speed is selected via external input signal to achieve the function of speed control. If running speed is within 3 kinds of motor speed, speed control is valid.

  It is unnecessary to configure speed generator or pulse generator externally.



5.8.1 User parameters setting

User parameters		Significance
P□000	H.□□3□	Control method choice: internal set speed control (contact instruction)

P□301	Internal speed 1		Speed	
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	100	No need
P□302	Internal speed 2		Speed	
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	200	No need
P□303	Internal speed 3		Speed	
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	300	No need

(Note)
The actual value is still limited to the maximum speed of the servo motor, even if speed set in P□301～P□303 exceed the maximum speed of the servo motor.

5.8.2 Input signal setting

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	/P-CON	CN1-15	CN1-40	Servo motor rotation direction switching
	/PCL	It is need to be allocated		Selection of internal setting speed
	/NCL	It is need to be allocated		Selection of internal setting speed

■ On input signal selection

Uniaxial drive: /PCL, /NCL are allocated to CN1-41 and CN1-42 respectively when they are leaving the factory.

Biaxial drive: /PCL, /NCL shall be allocated via the parameters of P□510.

- The operation mode of three input signals of /P-CON, /P-CL, /N-CL (It is set as the pin that has been allocated when it left the factory.)

5.8.3 Internal set speed operation

It can be run through internal setting by using the ON/OFF combination of the following input signals.

Input signals			Direction of motor rotation	
/P-CON	/PCL	/NCL		
OFF(H)	OFF(H)	OFF(H)	Forward	Stop the internal speed by instruction 0
	OFF(H)	ON(L)		P□301：internal set speed 1(SPEED1)
	ON(L)	ON(L)		P□302：internal set speed 2(SPEED2)
	ON(L)	OFF(H)		P□303：internal set speed 3(SPEED3)
ON(L)	OFF(H)	OFF(H)	Reversal	Stop the internal speed by instruction 0
	OFF(H)	ON(L)		P□301：internal set speed 1(SPEED1)
	ON(L)	ON(L)		P□302：internal set speed 2(SPEED2)
	ON(L)	OFF(H)		P□303：internal set speed 3(SPEED3)

(Note) signal OFF(H electrical level)，signal ON(L electrical level)

■ When control method is switching mode

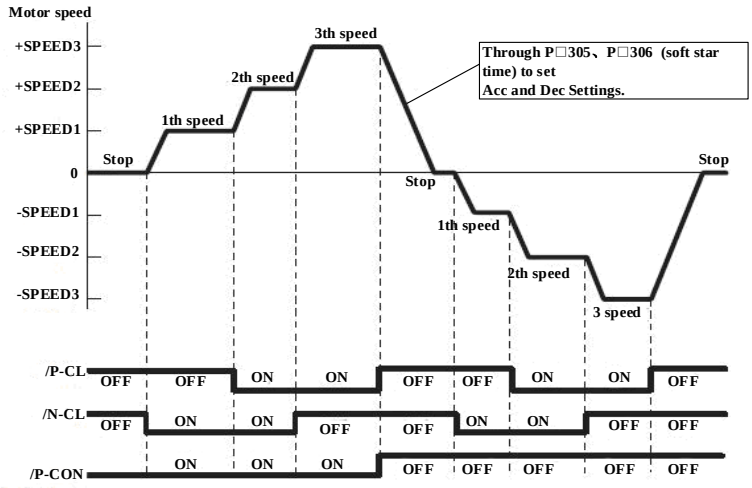
When P□000.1 = 4，5，6 ，If anyone signal of /PCL，/NCL is set as OFF(H electrical level)，then switch the control mode in between.

For example)P□000.1=5：Set the internal setting speed; choose setting speed <—> position control (pulse train)

Input signals		Operating speed
/PCL	/NCL	
OFF(H)	OFF(H)	Stop the internal speed by instruction 0
OFF(H)	ON(L)	P□301：internal set speed 1(SPEED1)
ON(L)	ON(L)	P□302：internal set speed 2(SPEED2)
ON(L)	OFF(H)	P□303：internal set speed 3(SPEED3)

- Practical example based on the selection of internal speed setting

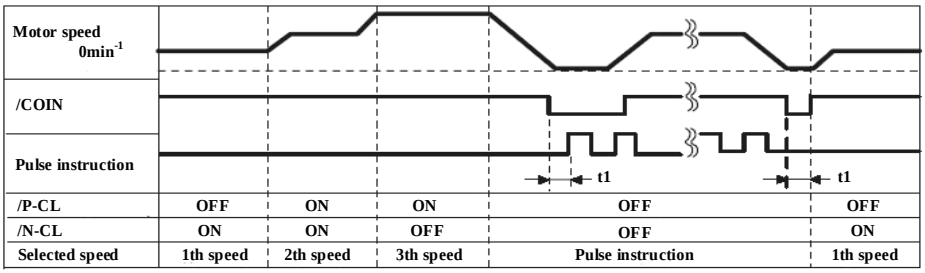
If the soft start function is used, the impact of the speed switching will be smaller.
For soft starting, please refer to "soft start".
Example) Based on internal setting speed + soft start running practical example



Setting of "(P□000.1 = 5 internal set speed control<—> position control)", soft start function is only working when choose the internal setting speed". The soft start function cannot be used when the pulse instruction is inputting. It will switch to the input of pulse command whether it is running at any one of first ~ third speed. Then the servo drive accepts the pulse command after the position of the output signal (/COIN) output. Please make sure to start output the user instruction controller's pulse instruction after the position of the servo drive completes the signal output.

Based on the (internal setting speed + soft starting) <—> position control (pulse train instruction operation practical example)

Signal timing of position control



t1>2ms

(Note) 1. As shown in the above figure, the conditions of using the soft start function.
2. The t1 value will not be affected by the using of the soft start.
Reading of /PCL and /NCL may have maximum 2ms delay.

5.9 Torque limit

For the purpose of protecting the machinery and other purposes, the output torque shall be limited. There are 4 kinds of torque limit methods for the servo drive.

Method	Restriction mode	Reference
1	Internal torque limit	
2	External torque limit	
3	Torque limit based on analog voltage instruction	
4	Based on external torque limit + Torque limit based on analog voltage instruction	

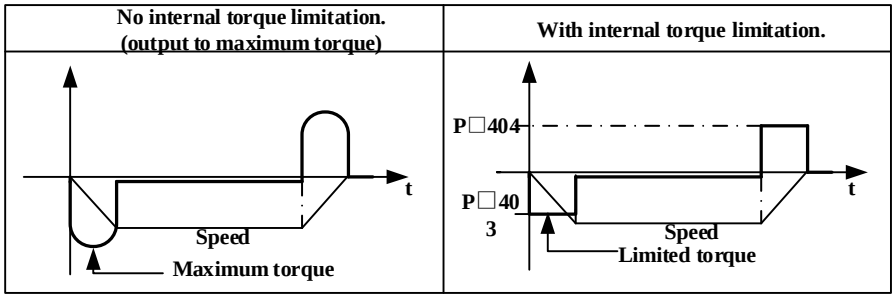
5.9.1 Internal torque limit (maximum output torque limit)

Internal torque limit is the function of limiting the maximum output torque via user's parameters.

P□403	Positive torque limitation.	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	300	No need

P□404	Negative torque limitation	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	300	No need

The set value of is valid normally. The setting unit is % of the motor rated torque
Even if the maximum torque value of the servo motor is exceeded, it will be limited to the actual maximum torque of the servo motor. Default value is 300%。



■Important
If P□403、P□404 are set as too small, the torque will be insufficient when the servo motor is Acc/Dec.

5.9.2 External torque limit (external torque limit via input signal)

External torque limit is used while the machine is running or when certain torque is required. For example, it is used for pressing stop action or to maintain the robot's work piece.

The torque limit set in the user parameters in advance is changed to be valid by the input signal.

(1) The related user parameters

P□405	Forward side external torque limitation.	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	100	No need
P□406	Reverse side external torque limitation.	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	100	No need

(Note) the setting unit is % of the rated torque relative to the servo motor used. (The limit of the rated torque is 100 %.)

(2) Input signals

Category	Signal name	Connector Pin number A axis	Connector Pin number B-axis	Setting	Significance	Limit value
Input	/PCL	Single/biaxial drive are different		ON =L electrical level	Forward external torque limit ON	One of the smaller values in Pn403 and Pn405
				OFF=H electrical level	Forward external torque limit OFF	Pn403
Input	/NCL	Single/biaxial drive are different		ON =L electrical level	Reversal external torque limit ON	One of the smaller values in Pn404 and Pn406
				OFF=H electrical level	Reversal external torque limit OFF	Pn404

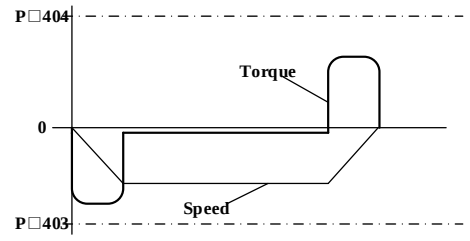
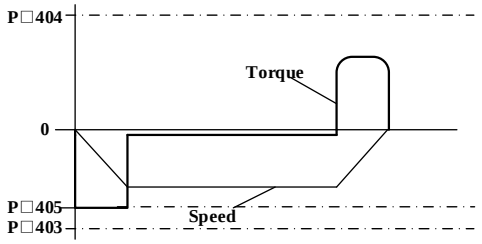
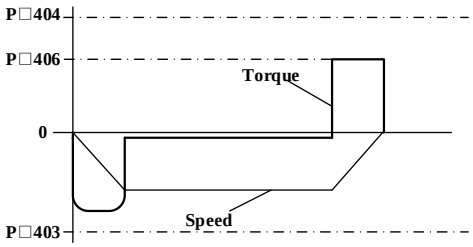
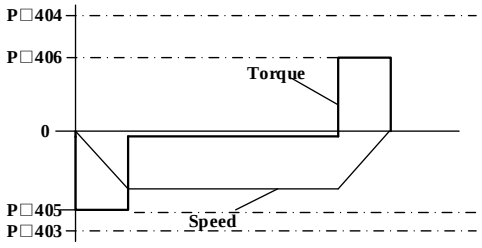
Uniaxial drive: /PCL, /NCL are allocated to IN7 and IN8 respectively when they are leaving the factory.

Biaxial drive: /PCL, /NCL shall be allocated via the parameters of P□510.

Please make sure that other signals are assigned to the same terminals as /P-CL and /N-CL when using external torque limit. It becomes OR logic as the multiple signals are allocated to one terminal, therefore, it will be affected by other signals ON/OFF assigned to the same terminal. For the distribution of input signals, please refer to the "Signal distribution of the input circuit".

(3) Change of output torque of external torque is limited

The internal torque limit (P□403，P□404)=300%

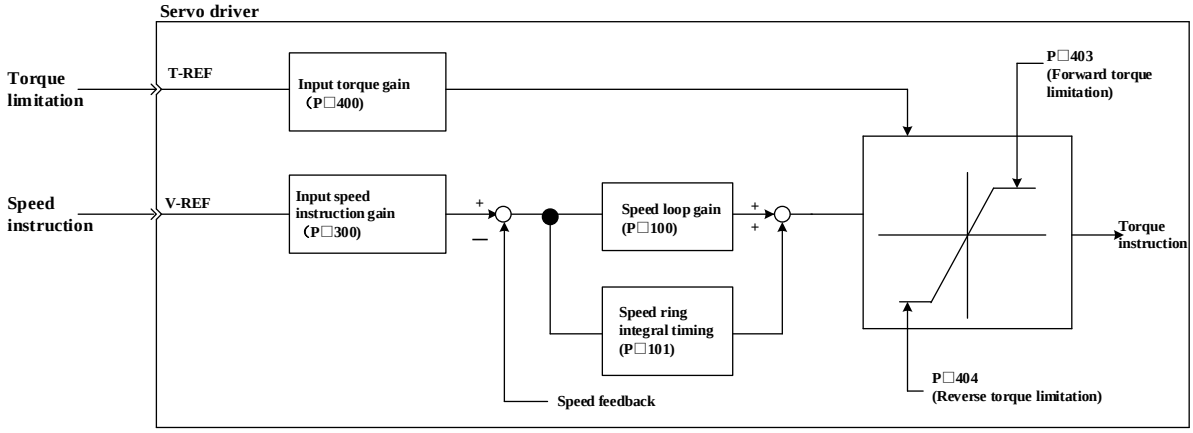
		/PCL(Forward external torque limit) H electrical level	/PCL(Forward external torque limit) L electrical level
/NCL (Reversal external torque limit)	H electrical level		
	L electrical level		

(Note) in the setting of P□000=H. □□□ 0 (standard setting [set CCW as forward direction] selects the motor rotation direction.

5.9.3 Torque limit based on analog voltage instruction

Function of arbitrary torque limit by analog voltage instruction. T-REF is used as analog voltage instruction input terminal. Hence, the function cannot be used for torque control. It can only be used in speed control or position control.

Using block diagram of "torque limit by analog voltage instruction" in the case of speed control is shown in the figure below.



The input voltage of the analog voltage instruction for the torque limit is non polar.

The absolute values are taken in both + and - voltage, and the torque limit based on the absolute value is applied to both forward and reverse rotation directions.

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(1) The related user parameters

User parameters		Significance
P□001	H.□□1□	Speed control option: use T-REF terminal as an external torque limit input.
If set to H.□□2□，then T-REF terminal can be used for torque feed forward input and please be noted that you cannot use them simultaneously.		

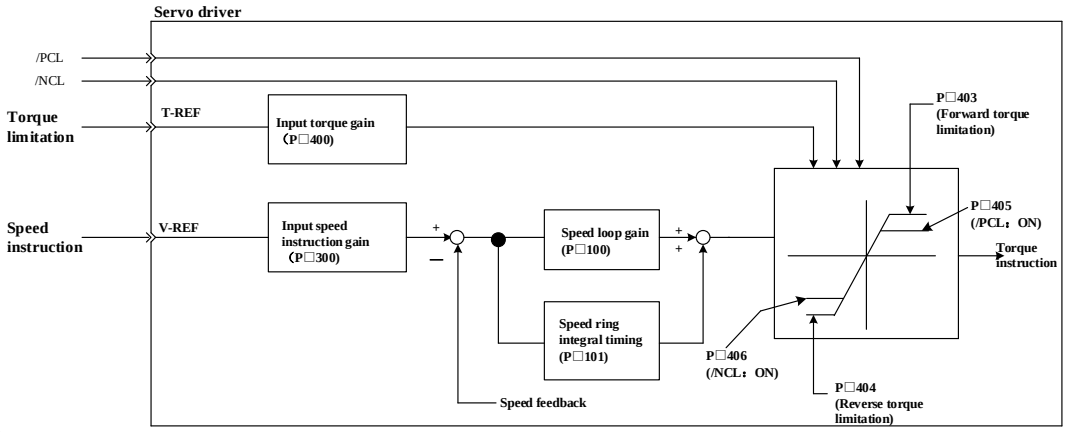
(2) Input signals

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	T-REF	ANA2+	Not allocated	Torque instruction input
	GND	ANA2-		Signal ground
Use P□400 to set torque command input gain. Please refer to "user parameters setting".				

5.9.4 Torque limit by external torque limit + analog voltage instruction.

The torque limit via the external input signal and the torque limit through the analog voltage instruction can be used simultaneously. The analog voltage instruction is used for torque limit from T-REF input. Therefore, it cannot be used when the torque is limited. When external input signal for torque limit, use /P-CL and /N-CL.

If /P-CL (or /N-CL) signal is set at ON, then use the analog voltage command torque limit and the set value of P□405 (or P□406) the smaller value shall be limit in torque.



(1) The related user parameters

User parameters		Significance
P□001	H.□□3□	Speed control options: /P-CL, /N-CL take effect, uses the T-REF terminal as an external torque limit input.
If set to H.□□2□，then T-REF terminal can be used for torque feed forward input and please be noted that you cannot use them simultaneously		

P□405	Forward side external torque limitation	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	100	No need
P□406	Reverse side external torque limitation	Speed	Position	Torque
	Range	Unit	Default	Restart
	0 ~ 300	1%	100	No need

(2) Input signals

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	T-REF	ANA2+	Not allocated	Torque instruction input
	GND	ANA2-		Signal ground
Use P□400 to set torque command input gain. Please refer to "user parameters setting".				

Category	Signal name	Connector Pin number		Setting	Significance	Limit value
		A axis	b-axis			
Input	/PCL	Single biaxial drive are different		ON =L electrical level	Forward external torque limit ON	One of the smaller values in Pn403 and Pn405
				OFF=H electrical level	Forward external torque limit OFF	Pn403
Input	/NCL	Single biaxial drive are different		ON =L electrical level	Reversal external torque limit ON	One of the smaller values in Pn404 and Pn406
				OFF=H electrical level	Reversal external torque limit OFF	Pn404
Uniaxial drive: /PCL, /NCL are allocated to IN7 and IN8 respectively when they are leaving the factory. Biaxial drive: /PCL, /NCL shall be allocated via the parameters of P□510. Please make sure that other signals are assigned to the same terminals as /P-CL and /N-CL when using external torque limit + analog voltage instruction torque limit. It becomes OR logic as the multiple signals are allocated to one terminal, therefore, it will be affected by other signals ON/OFF assigned to the same terminal. For the distribution of input signals, please refer to the "Signal distribution of the input circuit".						

5.9.5 Confirmation of output torque limit

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Output	/CLT	It is need to be allocated		ON =L electrical level	Motor output torque is limited
				OFF=H electrical level	It is not in the torque limit state
In order to use the motor output torque limit signal, the output terminal must be distributed through the user parameter of P□514. Please refer to the "signal distribution of the output circuit".					

5.10 Control mode switching

The servo drive can be used in various control modes.

The switch method and conditions are described below.

5.10.1 User parameters setting

The following combination of control method can be chosen. Please use it according to the customer's use.

User parameters		Significance
P□000	H.□□4□	The internal setting speed control (DI instruction)←→ speed control (analog instruction)
	H.□□5□	The internal setting speed control (DI instruction)←→ speed control (pulse train instruction)
	H.□□6□	The internal setting speed control (DI instruction)←→ torque control (analog instruction)
	H.□□7□	Position control (pulse train instruction)←→ speed control (analog instruction)
	H.□□8□	Position control (pulse train instruction)←→ torque control (analog instruction)
	H.□□9□	Position control (analog instruction)←→ speed control (analog instruction)
	H.□□A□	Speed control (analog instruction)←→ Zero clamping position
	H.□□B□	Position control (pulse train instruction) ←→ position control (pulse prohibition)

5.10.2 Control mode switching

(1) Switching between internal speed control (P□00.1=4，5，6)

Category	Signal name	Connector Pin number		Setting	Significance
		A axis	B-axis		
Input	/PCL	Single biaxial drive different		OFF=H electrical level	Control mode switching
Input	/NCL	Single biaxial drive different		OFF=H electrical level	
Uniaxial drive: /PCL, /NCL are allocated to IN7 and IN8 respectively when they are leaving the factory. Biaxial drive: /PCL, /NCL shall be allocated via the parameters of P□510.					

(2) Switching other than internal speed control (P□000.1=7，8，9，A，B)

Please switch the control mode with the following signal. The control mode is switched as follows according to the signal state.

Category	Signal name	Connector Pin number		Setting	P□000 setting				
		A axis	B-axis		H.□□7□	H.□□8□	H.□□9□	H.□□A□	H.□□B□
Input	/PCON	CN1-IN2	CN1-IN6	ON =L electrical level	Speed	Torque	Speed	Zero clamping position	Prohibited
				OFF=H electrical level	Position	Position	Torque	Speed	Position

5.11 Other output signals

Although there is no direct relation with each control way, it is available to specify it in terms of the other output signals. Please use it according to the customer's machinery protection and other purpose.

5.11.1 Servo alarm output (ALM)

(1) Servo alarm output (ALM)

When the servo drive detects the exception it is the signal of the output.

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	b-axis		
Output	ALM	CN1-OUT1	CN1-OUT4	ON =L electrical level	Servo drives normal state.
				OFF=H electrical level	Servo drive alarm state
■ Important It is necessary to ensure that the main circuit power supply of the servo drive is set OFF in the case of alarm output, when the external circuit is formed.					

(2) Alarm reset

Category	Signal name	Connector pin number (leave factory)		Name
		A axis	b-axis	
Input	/ALM-RST	Single biaxial drive are different		
Uniaxial drive: /PCL, /NCL are allocated to IN7 and IN8 respectively when they are leaving the factory. Biaxial drive: /PCL, /NCL shall be allocated via the parameters of P□510. The signal can be assigned to other pin number via the user parameter P□510. For detail, please refer to the "signal distribution of the input circuit". /ALM-RST signal is set by the allocation of the external input signal; therefore, it cannot be set as "constant time effective". Please make use of an action from the H electrical level to the L electrical level to reset the alarm. When "servo alarm (ALM)" occurs, eliminate the cause and the alarm state can be reset by placing the signal (/ALM-RST) from OFF (H electrical level) to ON (L electrical level). Moreover, the alarm reset can also be operated by the panel operator or the digital operator. Please refer to the "Name and function of the key".				

---

1. The encoder alarm sometimes input /ARM-RST signal still cannot be reset. In this case, please reset it by power off the control power.
2. When the alarm occurs, please make sure to reset the alarm after the alarm is excluded.
   The "Alarm display and processing measures" has been described in the troubleshooting method of the alarm.

5.11.2 Rotation detection output (/TGON)

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Output	/TGON	Need P□513 allocation		ON =L electrical level	The servo motor is rotating (motor revolving speed is greater than the set value of P□502)
				OFF=H electrical level	Servo motor stop rotating (motor speed is higher than the set value of P□502)
■Important The brake signal (/BK) and rotation detection signal (/TGON) are allocated to the same output terminal, due to falling on the vertical axis speed, the /TGON signal becomes L electrical level, but the /BK signal may not change to H electrical level. (As the output signals are assigned to the same output terminal to output the OR logic), please allocate (/TGON) signals and (/BK) signals to other terminals.					

5.11.3 Servo ready output (/S-RDY)

Category	Signal name	Connector pin number (leave factory)		Setting	Significance
		A axis	B-axis		
Output	/S-RDY	Need P□513 allocation		ON =L electrical level	Servo ready status
				OFF=H electrical level	Servo not ready status
It indicates that the servo unit has been in the servo ON signal ready state for receiving. The main circuit output is in the state of ON without servo alarm.					

5.12 Mode motion sequence mode

15 sets of data groups are supported by the product, which can set parameters in the parameter mode. In the communication mode, 32 sets of data can be used to set parameters. These data groups may start individually or in sequence.

It contains setting for data group types and the setting of related target values and subsequent data groups in the data group of set parameters

The following types of movement are available:

- Invalid movement (empty data)
- Absolute movement
- Relative movement

The data group may start in 2 different ways.

- Start single data group

  Only the selected data group starts when a single data group is starting. No other data groups will start after the successful execution of the data group. Time coordination between multiple data groups is accomplished through the main control system (such as PLC).

- Start the sequence of data groups (multiple data groups are arranged in turn)

  It starts from the selected data group when the sequence starts. The subsequent data group will start when a data group is successfully executed and the transition condition is satisfied. The time coordination between each data group is completed through the product.

5.12.1 Single data group mode

The single data group mode adopts with 15 sets of built-in motion tasks. The incremental or absolute type may be chosen for the form of motion.

(1) User parameters setting

User parameters		Significance
P□000	H.□□C□	Choice of control mode: mode motion sequence mode
P□764	H.□□□0	Startup data group mode selection: single data group mode

P□700	Group 0 data group type			Position
	Range	Unit	Default	Restart
	0 ~ 2	——	0	Need

0: Invalid data group.
1. The data group is absolute motion mode.
2. The data group is relative motion mode

P□701	Low bit of Group 0 data group position.			Position
	Range	Unit	Default	Restart
	−9999 ~+9999	1 pulse instruction	0	Need
P□702	High bit of Group 0 data group position.			Position
	Range	Unit	Default	Restart
	−9999 ~+9999	10000 pulse instruction	0	Need
P□703	Group 0 data group speed.			Position
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	0	Need

The parameters of the data group 1 are P□708 ~ P□711; The parameters of the data group 2 are P□716 ~ P□719;
The parameters of the data group 3 are P□724 ~ P□727; The parameters of the data group 4 are P□732 ~ P□735;
The parameters of the data group 5 are P□740 ~ P□743; The parameters of the data group 6 are P□748 ~ P□751;
The parameters of the data group 7 are P□756 ~ P□759.

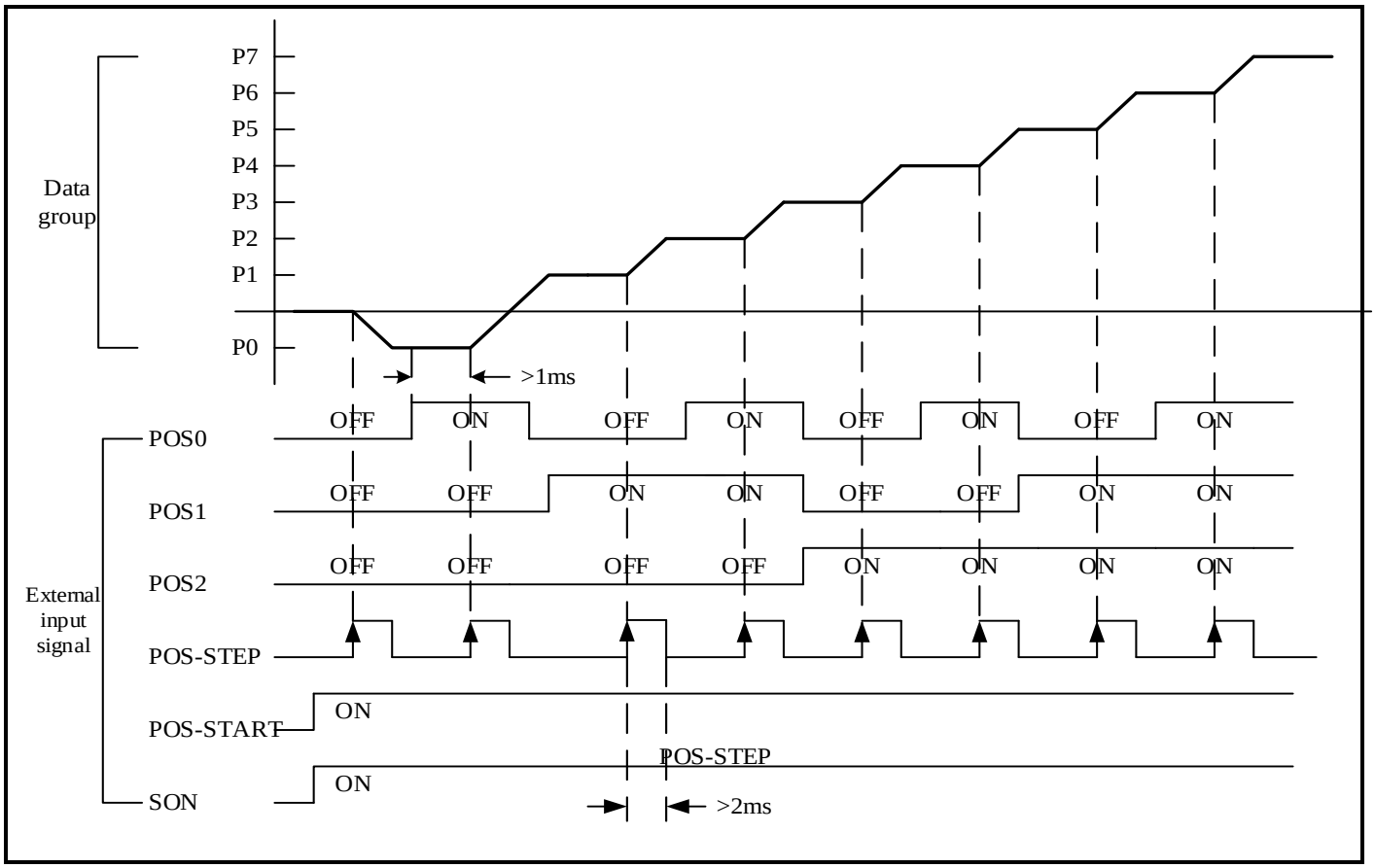
P□765	Data group acceleration			Position
	Range	Unit	Default	Restart
	1 ~ 60000	10r/min/s	10000	Need
P□766	Data group deceleration			Position
	Range	Unit	Default	Restart
	1 ~ 60000	10r/min/s	10000	Need
P□767	Data group emergency deceleration			Position
	Range	Unit	Default	Restart
	1 ~ 60000	10r/min/s	60000	Need
P□768	Data group electronic gear (numerator)			Position
	Range	Unit	Default	Restart
	1 ~ 65535	——	2	Need
P□769	Data group electronic gear (denominator)			Position
	Range	Unit	Default	Restart
	1 ~ 65535	——	1	Need

(2) Input signal setting

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	/POS-START	Need P□512 allocation		Mode motion sequence starting signal
Input	/POS-STEP	Need P□512 allocation		Mode of motion sequence change step signal
Input	/POS0	Need P□511 allocation		Mode motion sequence data group select switch 0 signal
Input	/POS1	Need P□511 allocation		Mode motion sequence data group select switch 1 signal
Input	/POS2	Need P□511 allocation		Mode motion sequence data group select switch 2 signal
Input	/PCON	Need P□509 allocation		Mode motion sequence data group select switch 3 signal
When it is single data group mode and the /POS-START signal is ON, the motor operation is allowed; when it is OFF, the motor operation is suspended.				

Input signals (/POS-START, /POS-STEP, /POS0, /POS1, /POS2, /PCON) can choose 15 sets of data group s as the data group to be executed at the moment, as shown in the following table.

Data group	/POS2	/POS1	/POS0	/POS-START	/POS-STEP	Corresponding parameters
P0	OFF	OFF	OFF	ON	↑	P□700 ~ P□703
P1	OFF	OFF	ON	ON	↑	P□708 ~ P□711
P2	OFF	ON	OFF	ON	↑	P□716 ~ P□719
P3	OFF	ON	ON	ON	↑	P□724 ~ P□727
P4,	ON	OFF	OFF	ON	↑	P□732 ~ P□735
P5	ON	OFF	ON	ON	↑	P□740 ~ P□743
P6	ON	ON	OFF	ON	↑	P□748 ~ P□751
P7	ON	ON	ON	ON	↑	P□756 ~ P□759
The sequence diagram between the input signal and the data group is as follows:						


Data group
P7
P6
P5
P4
P3
P2
P1
P0
>1ms
External input signal
POS0
POS1
POS2
POS-STEP
POS-START
SON
OFF
ON
POS-STEP
>2ms

5.12.2 Data group sequence mode

The data group sequence supports 8 groups of data groups in the parameter mode, and supports up to 32 groups of data groups in the communication mode. The incremental or absolute type may be chosen for the form of motion.

(1) User parameters setting

User parameters		Significance
P□000	H.□□C□	Choice of control mode: mode motion sequence mode
P□764	H.□□□1	Starting data group mode selection: task mode (data group sequence)

P□700 Group 0 data group type — Position

Range	Unit	Default	Restart
0 ~ 2	——	0	Need

0: Invalid data group.
1. The data group is absolute motion mode.
2. The data group is relative motion mode

User parameters		Significance
P□704	H.□□□0	No step change, directly start the subsequent data group; the second step changing condition is invalid.
	H.□□□1	Delay step change, delay time of the data group "1 value step change conditions"
	H.□□□2	For the change step of pulse edge, the "change step condition 1 value" in the data group determines the rising edge or falling edge, which is valid.
	H.□□□3	The "change step condition 1" in the data group determines whether the high level or low level is effective.

User parameters		Significance
P□704	H.□□0□	No step change, directly start the subsequent data group;
	H.□□1□	No step change, directly start the subsequent data group;
	H.□□2□	For the change step of pulse edge, the "change step condition 2 value" in the data group determines whether the rising edge or falling edge is effective.
	H.□□3□	The "change step condition 2" in the data group determines whether the high level or low level is effective.

P□705 Change step condition 1 for group 0. — Position

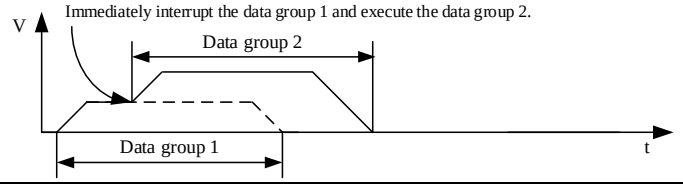
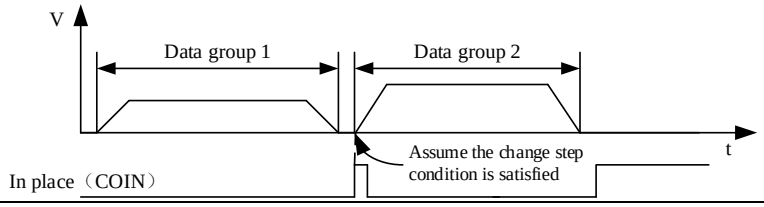
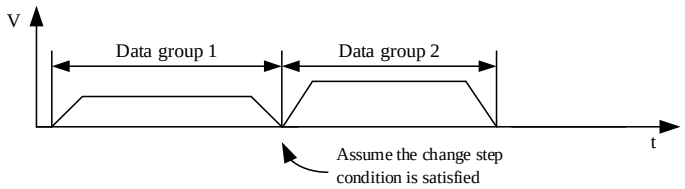
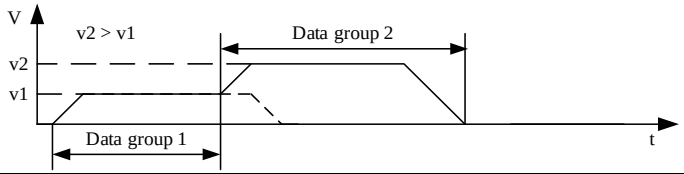
Range	Unit	Default	Restart
0 ~ 65535	——	0	Need

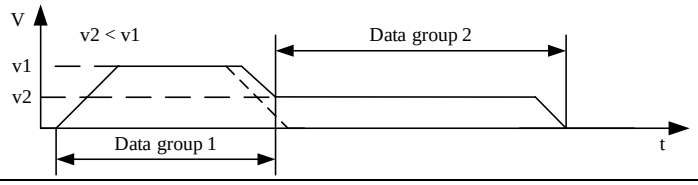
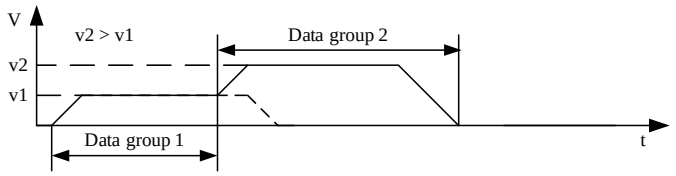
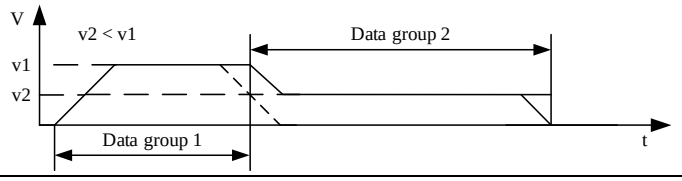
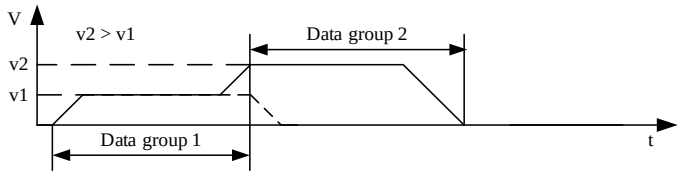
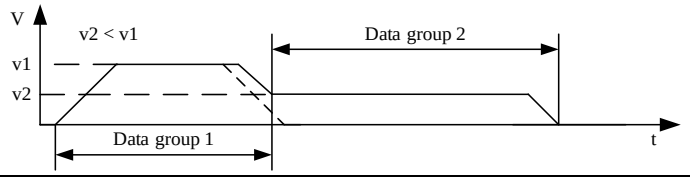
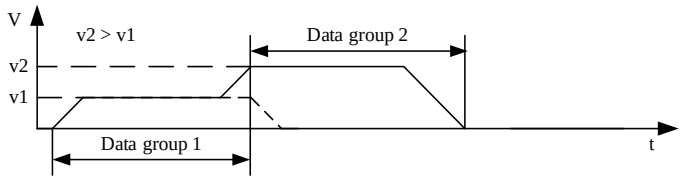
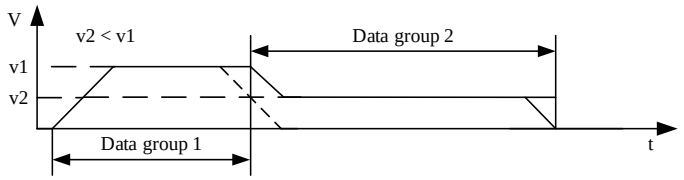
The meaning of this parameter depends on the data group change step condition 1 type, when the data group change step condition 1 type is.
• no changing conditions.
- nonsense
• delay change
- delay time 0 ~ 65535, unit: ms.
• pulse edge:.
Value 0: rise edge to change step.
Value 1: down edge to change step.
Value 2:rise edge or down edge to change step.
- other values: invalid.
• pulse edge:.
Value 3: high electric level To change step.
Value 4: low electric level To change step..
- other values: invalid

P□706	Change step condition 2 for group 0.		Position	
	Range	Unit	Default	Restart
	0 ~ 65535	——	0	Need

The meaning of this parameter depends on the data group change step condition 1 type, when the data group change step condition 1 type is.
• no changing conditions.
- nonsense
• delay change
- delay time 0 ~ 65535, unit: ms.
• pulse edge:.
Value 0: rise edge to change step.
Value 1: down edge to change step.
Value 2:rise edge or down edge to change step.
- other values: invalid.
• pulse edge:.
Value 3: high electric level To change step.
Value 4: low electric level To change step..
- other values: invalid

User parameters		Significance
P□704	H.□0□□	No connection, step change 2 conditions is invalid.
	H.□1□□	"And" connection between Condition 1 and condition 2.
	H.□2□□	"Or" connection between Condition 1 and condition 2.

User parameters		Significance
P□704	H.0□□□	Aborting: ignore the step change condition, immediately stop motion, and start the subsequent data group.
		
	H.1□□□	Standard: the current motion is in place and the step change condition is satisfied, and then, start the subsequent data group.
		 V Data group 1 Data group 2 t Assume the change step condition is satisfied In place（COIN）
	H.2□□□	Buffered: reaches the target position and step change condition is satisfied and start the subsequent data group.
		 V Data group 1 Data group 2 t Assume the change step condition is satisfied
	H.3□□□	Blending Low: ignore the step change conditions. Speed is adjusted at the speed of the subsequent data group when the target is reached.
		 V v2 > v1 Data group 2 v2 v1 Data group 1 t

		
	H.4□□□	Blending Previous: Ignore the step change conditions. Speed is adjusted at the speed of the subsequent data group when the target is reached.
		 
	H.5□□□	Blending Next: ignore the step change conditions. Speed is adjusted at the speed of the subsequent data group when the target is reached.
		 
	H.6□□□	Blending High: ignore the step change conditions. Speed is adjusted at the speed of the subsequent data group when the target is reached.
		 

P□707	The next data group number behind the group 0.		Position
Range	Unit	Default	Restart
0 ~ 7	1r/min	0	Need

The parameters of the data group 1 are P□708 ~ P□715; The parameters of the data group 2 are P□716 ~ P□723;
The parameters of the data group 3 are P□724 ~ P□731; The parameters of the data group 4 are P□732 ~ P□739;
The parameters of the data group 5 are P□740 ~ P□747; The parameters of the data group 6 are P□748 ~ P□755;
The parameters of the data group 7 are P□756 ~ P□763.

P□765	Data group acceleration			Position
	Range	Unit	Default	Restart
	1 ~ 60000	10r/min/s	10000	Need
P□766	Data group deceleration			Position
	Range	Unit	Default	Restart
	1 ~ 60000	10r/min/s	10000	Need
P□767	Step change filter time			Position
	Range	Unit	Default	Restart
	0 ~ 1000	0.1ms	1	Need
P□768	Data group electronic gear (Numerator)			Position
	Range	Unit	Default	Restart
	1 ~ 1073741823	——	1	Need
P□770	Data group electronic gear (Denominator)			Position
	Range	Unit	Default	Restart
	1 ~ 1073741823	——	1	Need

(2) Input signal setting

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	/POS-START	Need P□512 allocation		Mode motion sequence starting signal
Input	/POS-STEP	Need P□512 allocation		Mode of motion sequence change step signal

/POS-START signal from OFF →ON，；When it is ON， motor operation is allowed； When it is OFF， motor running will pause.

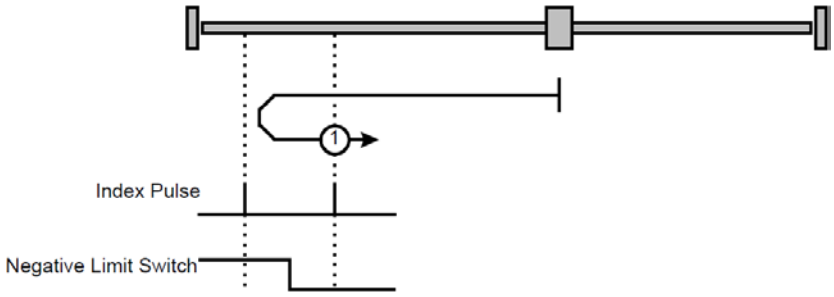
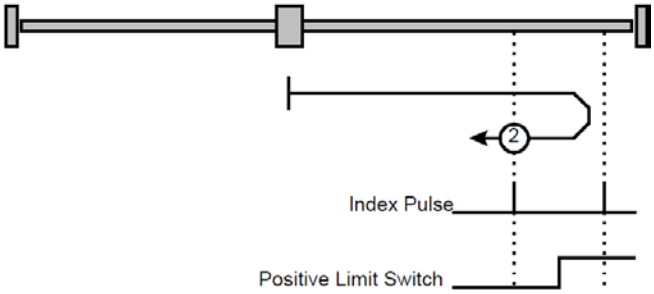
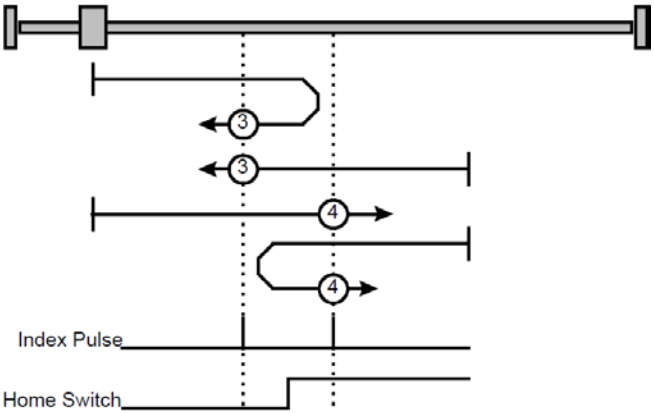
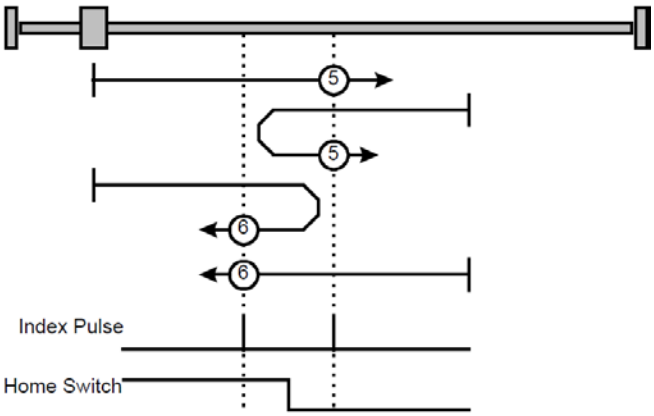
■Important

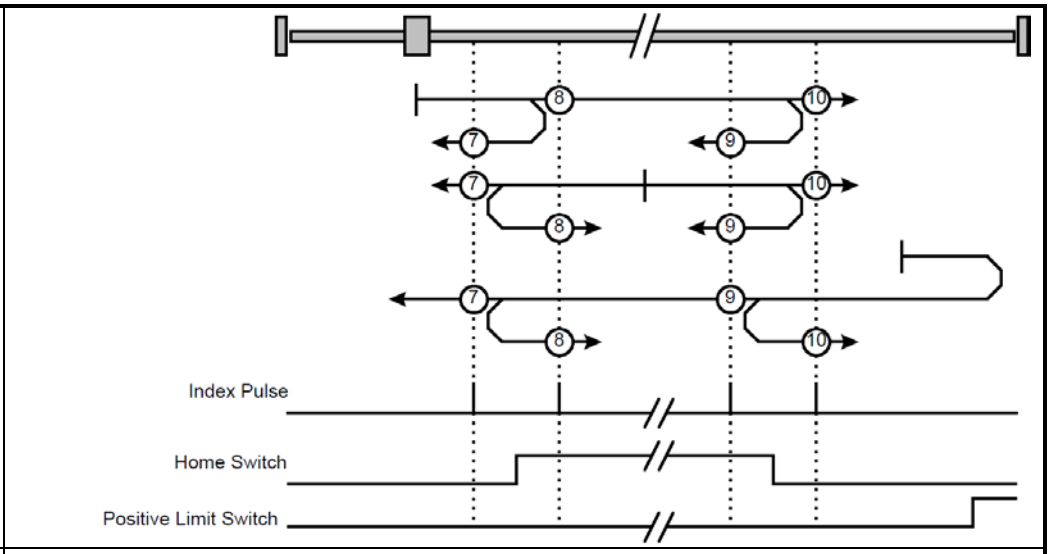
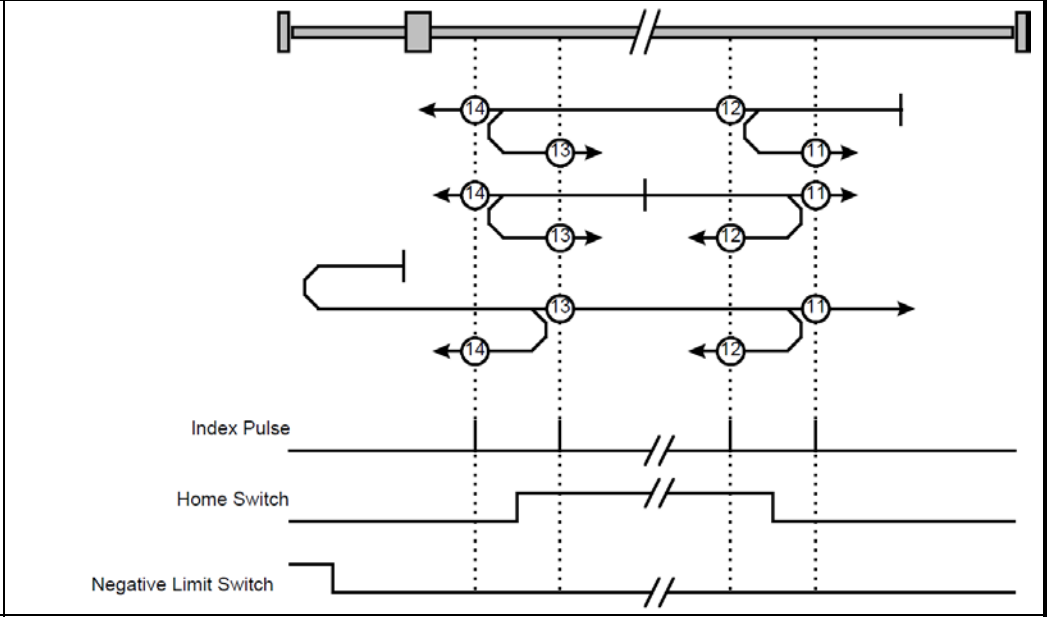
After each servo OFF (or alarm solution), the /POS-START signal is first set from ON to OFF before it is restarted, and then set to ON to start loading data group.

5.12.3 Locate the reference point (return to zero) operation

The zero point can also be determined by the datum point. The zero point is the reference point of the absolute motion in the mode of motion sequence.

(1) User parameters setting

User parameters		Significance
P□772	H.□□□0	Current position is zero point
	H.□□□1	
	H.□□□2	
	H.□□□3 H.□□□4	
	H.□□□5 H.□□□6	

	H.□□□7 H.□□□8 H.□□□9 H.□□□A	
	H.□□□B H.□□□C H.□□□D H.□□□E	
P□772	H.0□□□	After power on, it does not return to zero automatically.
	H.1□□□	After power on, servo enable automatic return to zero in the 1st time, and the mode of return to zero shall be determined by P□770.0.

P□773	Impact reference point switch speed.			Position
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	100	Need
P□774	Leave the reference point switch speed.			Position
	Range	Unit	Default	Restart
	0 ~ 6000	1r/min	30	Need

(2) Input signal setting

Category	Signal name	Connector Pin number		Name
		A axis	B-axis	
Input	/POS-START	Need P□512 allocation		Mode motion sequence starting signal
Input	/HOME-REF	Need P□512 allocation		Zero point reference switch
Input	/POS-START-HOME	Need P□512 allocation		Start return to zero, and locates the zero point according to P□770.0.
When the /POS-START signal is ON, the motor operation is allowed (allowed return to zero); when it is OFF, the motor is suspended (pause return to zero).				

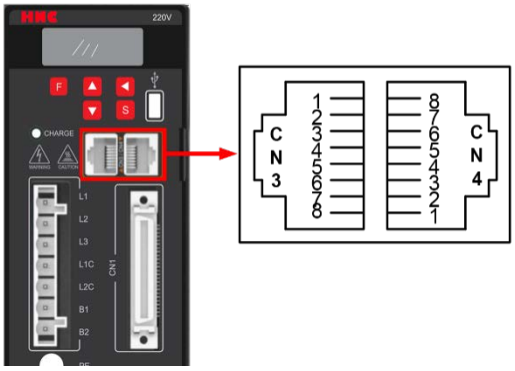
Chapter VI Communication

HSD3 standard servo drive is equipped with MODBUS communication with RS485 interface, and optional CANopen with CAN interface (conforming to DS301 and DS402 standard protocol). The chapter mainly describes the MODBUS communication, and for CANopen communication, please refers to the "HSD3 servo drive CANopen communication manual".

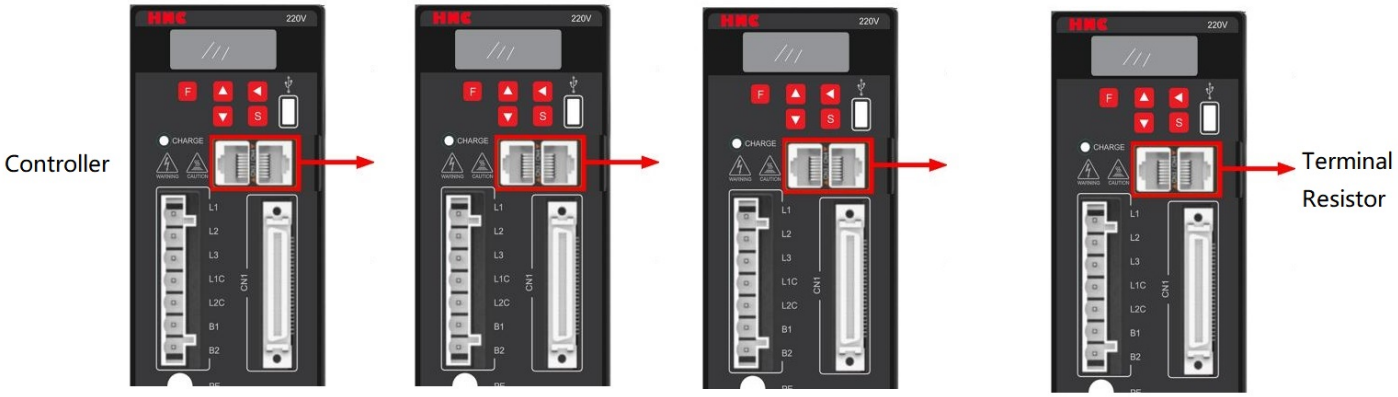
6.1 Communication connection

Signal name and function of communication connector are as follows:

Terminal number		1	2	3	4	5	6	7	8
Name	CN3	CANH-	CANL	GND	GND	RS485+	RS485-	Reserve	Reserve
	CN4	CANH-	CANL	GND	GND	RS485+	RS485-	Built in 120 ohms resistance	



The servo drive CN3 is always adopted as the input terminal for the communication cable, and the CN4 is always adopted as the output terminal of the communication cable. Multiple servo drive connection diagrams are as follows:



6.2 User parameters

P□600	RS-485 Axis address		Speed	Position	Torque
	Range	Unit	Default	Restart	
	1 ~ 127	——	1（A axis） 2（b axis）	No need	
P□602	RS-485 communication timeout		Speed	Position	Torque
	Range	Unit	Default	Restart	
	0 ~ 1000	100ms	0	No need	

· P□602 set to zero, close the communication timeout detection.;
· P□602 is set to be greater than zero, it means that it must communicate within the set time, otherwise there will be a communication error. For example, P□602 is set to 50. In time, it must communicate with the servo driver once every 5 seconds.
· This feature is only available for software version v2.10 or above.

User parameters		Significance
P□601	H.□□□0	RS485 communication baud rate：4800 bps
	H.□□□1	RS485 communication baud rate：9600 bps
	H.□□□2	RS485 communication baud rate：19200 bps
	H.□□□3	RS485 communication baud rate：384600 bps
	H.□□0□	ASCII method，7 bits data bit，no verifying，2 bits stopping bit
	H.□□1□	ASCII method，7 bits data bit，even verifying，2 bits stopping bit
	H.□□2□	ASCII method，7 bits data bit，odd verifying，2 bits stopping bit
	H.□□3□	ASCII method，8 bits data bit，no verifying，1 bits stopping bit
	H.□□4□	ASCII method，8 bits data bit，even verifying，1 bit stopping bit
	H.□□5□	ASCII method，8 bits data bit，odd verifying，1 bit stopping bit
	H.□□6□	ASCII method，8 bits data bit，no verifying，1 bit stopping bit
	H.□□7□	ASCII method，8 bits data bit，even verifying，1 bit stopping bit
	H.□□8□	ASCII method，8 bits data bit，odd verifying，1 bit stopping bit

6.3 MODBUS communication protocol

Using RS-485 communication, each servo drive must preset parameters P□600 ~ P□601. Communication mode adopts the MODBUS protocol, which can be used in the following two modes:

ASCII mode

RTU mode.

The following is the description of MODBUS communication.

■ Encoding meaning

ASCII mode:

Each 8-bit data is composed of two ASCII characters. For example, a 1-byte data 64H (HEX). ASCII code “64” expression，contains ‘6’ ASCII code（36 H）and ‘4’ ASCII code（34 H）。

The number 0 to 9, the letter A to F ASCII code, as following table:

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

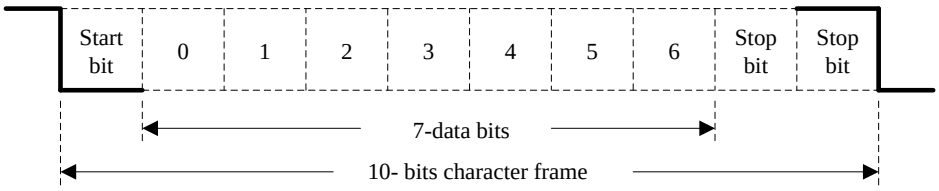
RTU mode:

Each 8-bit data is composed of two 4-bit's HEX data. For example, the decimal 100 is represented as 64 H with 1-byte RTU data.

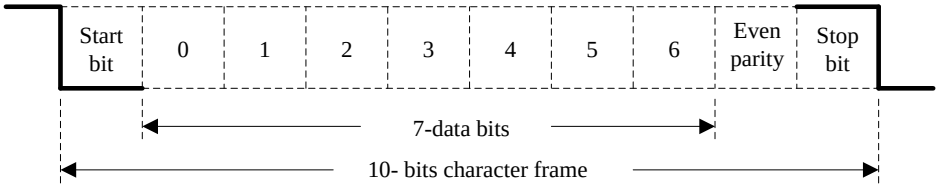
■ Character structure

10bit character format (for 7-bit data)

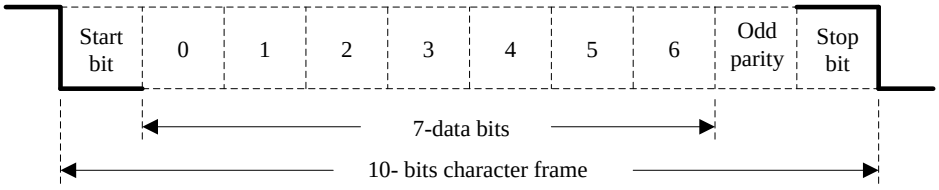
7，N，2（Modbus，ASCII）



7，E，1（Modbus，ASCII）

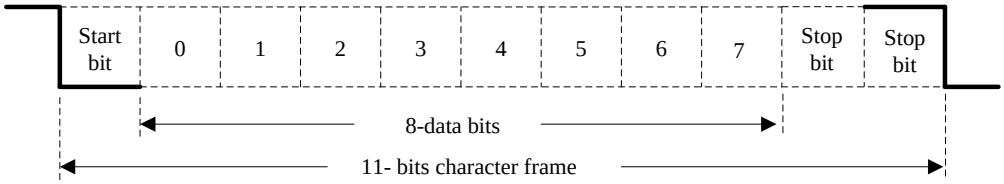


7，O，1（Modbus，ASCII）

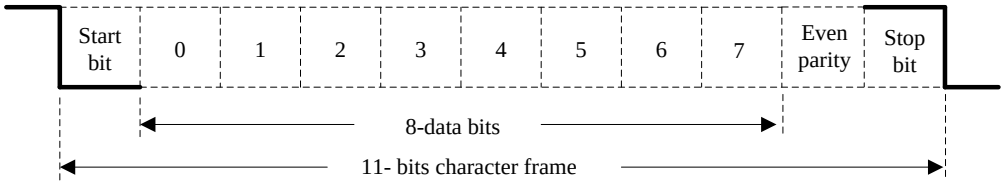


11bit character format (for 8-bit data)

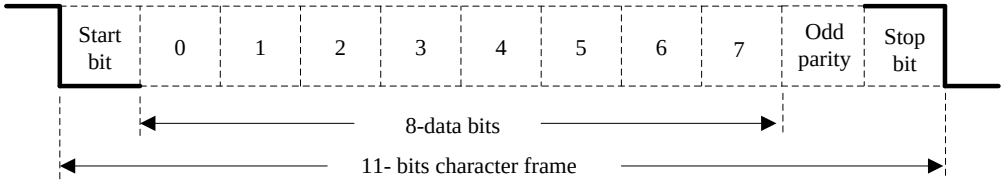
8，N，2（Modbus，ASCII / RTU）



8，E，1（Modbus，ASCII / RTU）



8，O，1（Modbus，ASCII / RTU）



■ Communication data structure

Communication data structure:

ASCII mode:

STX	The starting character ':' = > ($3A_H$)
ADR	Communication address＝＞1-byte including 2 ASCII codes
CMD	Command code＝＞1-byte contains 2 ASCII codes
DATA(n-1) …… DATA(0)	Data content ＝ ＞ n-word=2n-byte contains 4n ASCII codes，n is less than 12
LRC	Check code＝＞1-byte contains 2 ASCII codes
End 1	End code 1 = > ($0D_H$) (CR)
End 0	End code 0 = > ($0A_H$) (LF)

RTU mode:

STX	At least 4 bytes transfer time at rest period.
ADR	Communication address = > 1-byte
CMD	Instruction code = > 1-byte
DATA(n-1) …… DATA(0)	Data content＝＞n-word=2n-byte，n not greater than 12
CRC	CRC check code＝＞1-byte
End 1	At least 4 bytes transfer time at rest period.

The communication protocol data format is described as follows:
STX **(communication start)**
ASCII mode：‘：’character.
RTU mode: more than 4 bytes communication time (automatically changed according to the speed of communication).

ADR **(communication address)**
The legitimate address range is between 1 and 254.
For example, communicate with 32 servo address (Hex is 20):
ASCII mode：ADR=‘2’，‘0’=＞‘2’=32 $_H$，‘0’=30 $_H$
RTU mode: ADR=20 $_H$

CMD (command instruction) and DATA (data)
The format of the data is based on the command code. Commonly used command codes are as follows:
Command code: 03 $_H$, read N words (word), and the maximum N is 20.
For example, From the servo address as 01 $_H$ reads two words from the starting address 0200 $_H$.

ASCII mode:

Instruction information:

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘0’
	‘3’
Start data bit	‘0’
	‘2’
	‘0’
	‘0’
Data Number	‘0’
	‘0’
	‘0’
	‘2’
LRC Check	‘F’
	‘8’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response information:

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘0’
	‘3’
Data bit （cal by byte）	‘0’
	‘4’
Start data add 0200H Content	‘0’
	‘0’
	‘B’
	‘1’
2nd data add 0201H Content	‘1’
	‘F’
	‘4’
	‘0’
LRC Check	‘E’
	‘8’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU mode:

Instruction information:

ADR	01H
CMD	03H
Start data add	02H （high byte）
	00H （Low byte）
Data byte （Cal by word）	00H
	02H
CRC Check Low	C5H （Low byte）
CRC Check High	B3H （high byte）

Response information:

ADR	01H
CMD	03H
Data （cal by byte）	04H
start data add 0200H content	00H （high byte）
	B1H （Low byte）
2nd data add 0201H content	1FH （high byte）
	40H （Low byte）
CRC Check Low	A3H （Low byte）
CRC Check High	D4H （high byte）

Instruction code: 06 $_H$, write 1 word (word)
For example, 100 (0064 $_H$) is written to the servo address 0200 $_H$ of the address number 01 $_H$.

ASCII mode:

Instruction information:

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'6'
Start Data Add	'0'
	'2'
	'0'
	'0'
Data Content	'0'
	'0'
	'6'
	'4'
LRC Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response information:

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'6'
Start Data Add	'0'
	'2'
	'0'
	'0'
Data Content	'0'
	'0'
	'6'
	'4'
LRC Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU mode:

Instruction information:

ADR	01H
CMD	06H
Start data add	02H (high byte)
	00H (Low byte)
Data content	00H (high byte)
	64H (Low byte)
CRC Check Low	89H (Low byte)
CRC Check High	99H (High byte)

Response information:

ADR	01H
CMD	06H
Start data add	02H (high byte)
	00H (Low byte)
Data content	00H (high byte)
	64H (Low byte)
CRC Check Low	89H (Low byte)
CRC Check High	99H (High byte)

The calculation of detection error value for LRC（ASCII mode）and CRC（RTU mode）：

The LRC calculation of the ASCII mode:

ASCII mode adopts the LRC (Longitudinal Redundancy Check) detection error value. LRC error detection value is the result obtained by that the sum of the content from ADR to the final data, with 256 as unit, remove the exceeding part (e.g., the total result is hexadecimal 128 $_{H,}$ only take 28 $_{H}$) from the obtained result, and then, calculate its complement.

For example: read 1 word from the 0201 address of the office number 01 $_{H}$ servo drive.

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Start Data Add	'0'
	'2'
	'0'
	'1'
Data Number	'0'
	'0'
	'0'
	'1'
LRC Check	'F'
	'8'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Add the data from ADR to the last data:

01 $_{H}$ +03 $_{H}$ +02 $_{H}$ +01 $_{H}$ +00 $_{H}$ +01 $_{H}$ =08 $_{H}$

Complement of 2 for 08 $_{H}$ is F8 $_{H}$, so LRC is' F ',' 8 '.

CRC calculation of the RTU mode

RTU mode adopts CRC (Cyclical Redundancy Check) detection error value.

Steps for calculating the CRC error value are as follows:

Step 1: load a 16-bit register with a content of FFFF H, which is called the "CRC" register.

Step two: XOR operation is conducted to the first bit (bit0) of instruction message and 16-bit CRC register of the least significant digit (LSB), and furthermore, the result is saved to the CRC register;

Step three: check the lowest order (LSB) of the CRC register, if the bit is 0, the value of the CRC register makes 1 right shift, and if the bit is 1, the CRC register makes 1 right shift and carries out XOR operation with A001 $_{H}$;

Step four: get back to step three till the step three has been executed for 8 times, and then, carry out step five;

Step five: for the next bit of the instruction message, repeat steps two to four till all bits have been processed like this, and at this time, the content of CRC register is the CRC error detection value.

Specifications: after calculating the CRC error detection value, it needs to fill in the CRC low order in advance, and then, fill in the CRC high order, please reference the following examples.

For example, 2 words (word) are read from the servo 0101 $_H$ address of the office number of 01 $_H$. The final content of the CRC register calculated from ADR to the number of data is 3794 $_H$, and the instruction message is shown below. Please be noted that 94 H is transmitted before 37h.

ADR	01 $_H$
CMD	03 $_H$
Start data address	01_H (address high)
	01_H (address low)
Data number (calculated by word)	00 $_H$ (high)
	02_H (low)
CRC check low	94_H (check low)
CRC check high	37_H (check high)

End1, End0 (communication detection completed)

ASCII mode:

（0D $_H$）character'\r'『carriage return』and（0A $_H$）the character is '\n'『new line』，representing the end of the communication.

RTU mode:

The rest period of the 4 byte of communication time over the current communication rate indicates the end of the communication.

EXAMPLE:

The CRC value is generated from the C language below. The function requires two parameters:
Unsigned char * data;
Unsigned char length;
This function will pass back the CRC value of the unsigned integer type.

```
unsigned int crc_chk(unsigned char * data, unsigned char length){
  int i,j;
  unsigned int crc_reg = 0xFFFF;
  while(length- -){
        crc_ reg ^=*data++;
        for(j=0;j<8;j++){
              if(crc_reg & 0x01){
                   crc_reg=( crc_reg >>1)^0xA001;
               }
               Else
               {
                     crc_reg＝crc_reg >>1;
               }
          }
      }
      return crc_reg;
}
```

■ Communication error

During communication process, it is possible to go wrong, and the common error source is as follows:

- ■ Data address is wrong while reading and writing parameter;
- ■ The data exceeds the maximum value or is less than the minimum value of the parameter while writing parameter;
- ■ Communication is disturbed to cause data transmission error or check code error.

In case of occur the above two communication errors, the servo drive keeps normal operation and the servo drive makes a feedback of error frame at the same time. In case of occurring the third kind of error, data transmission is regarded as invalidity discard and is not back to the frame.

The wrong frame format is as follows:

Start	From the station address	Command	Data address, data, etc	Check
		Command		

Servo drive feedback error frame:

Start	From the station address	Responses codes	Error code	Check
		Command + 80 $_H$		

Where

Error frame response code＝command＋80 $_H$;

Error code = 00 $_H$: normal communication;

= 01 $_H$: the servo drive cannot identify the requested function;

= 02 $_H$: the data address in the request does not exist in the servo drive;

= 03 $_H$: the data in the request is not allowed in the servo drive (exceeding the maximum or minimum of parameters);

= 04 $_H$: the servo drive has begun to implement the request, but cannot complete the request;

For example: servo drive axis No. 03_H, the parameters of Pn100 write data 06_H, because the parameter range of Pn100 is 0~6, so write data will not be allowed, servo drive will return an error frame, error code 03H (greater than the parameters of the maximum or minimum value), structure as follows:

Data frame of upper computer:

Start	From the station address	Command	Data address, data, etc	Check
	03_H	06_H	0002_H 0006_H	

Servo drive feedback error frame:

Start	From the station address	Responses codes	Error code	Check
	03_H	86_H	03_H	

In addition, if the passive station in the data frame transmitted by the upper computer is 00H, it shows that the data frame is broadcast data and the servo drive does not return the frame.

6.4 MODBUS communication address

Communication data address	Meaning	Description	Operation properties	
Hexadecimal			Read and write	Length (bit)
0000$_h$ ~ 03FF$_h$	Parameter area	Parameters in the corresponding parameter table	Readable and writable	16
0400$_h$ ~0409$_h$	Alarm information in the storage area	10 historical alerts	Read-only	16
0420$_h$	Motor speed	Unit: 1r/min	Read only	32
0422$_h$	Angle of rotation (electric angle)	Unit: 1deg	Read-only	32
0424$_h$	Input instruction pulse speed	Unit: 1kHz	Read-only	32
0426$_h$	Busbar voltage	Unit: 1V	Read-only	32
0428$_h$	Analog input speed instruction value	Unit: 1 r/min	Read only	32
042A$_h$	The instruction percentage of analog input torque	Unit: 1%	Read-only	32
042C$_h$	Percentage of internal torque instruction	Unit: 1% or 0.1A	Read only	32
042E$_h$	Input signals monitoring	——	Read only	32
0430$_h$	Output signals monitoring	——	Read only	32
0432$_h$	Encoder signal monitoring	——	Read only	32
0434$_h$	Input instruction pulse counter	Unit: 1 instruction pulse	Read-only	32
0436$_h$	Feedback pulse counter	Unit: 1 instruction pulse	Read-only	32
0438$_h$	Position offset counter	Unit: 1 instruction pulse	Read-only	32
043A$_h$	Cumulative load	Unit: 1%	Read-only	32
043C$_h$	Rotation inertia percentage	Unit: 1%	Read-only	32
043E$_h$	Actual angle of the encoder	Unit: 1 instruction pulse	Read-only	32
0440$_h$	Encoder multi loop position	Unit: 1 loop	Read-only	32
044A$_h$	Current alarm		Read-only	16
0451$_h$	Communication IO signal *1	It is not saved as power off	Readable and writable	16
0452$_h$	Communication output negation	It is not saved as power off	Readable and writable	16
0457$_h$	Servo operation state *2		Read only	16
045E$_h$	Software version number		Read only	16
045F$_h$	FPGA version number		Read only	16
0460$_h$	Electronic gear molecule	It is not saved as power off	Readable and writable	32
0462$_h$	Electronic gear denominator	It is not saved as power off	Readable and writable	32
0520$_h$	Clear the history alarm	1. Clear the history alarm	Readable and writable	16
0521$_h$	Clear the current alarm	1. Clear the current alarm	Readable and writable	16
0522$_h$	Clear bus encoder alarm	1. Clear bus encoder alarm	Readable and writable	16
0523$_h$	Clear the multi loop data of the bus encoder	1:Clear the multi loop data of the bus encoder	Readable and writable	16
0528$_h$	JOG speed (speed of P□304 setting)	BIT15:1 JOG servo enabling BIT01:1 JOG+（JOG forward） BIT00:1 JOG+（JOG reversal）	Readable and writable	16
0529$_h$	Position of JOG (speed of P□304 setting)	BIT15:1 Enter into the position point action mode. BIT01:1 JOG- BIT00:1 JOG+	Readable and writable	16
0540$_h$	Reset to Factory Defaults	1: Reset to Factory Defaults	Writable	16
0541$_h$	Reset	1：Reset	Writable	16
05F0$_h$	Currently running data numbers		Read-only	16
05F1$_h$	The running data group number		Read-only	16
05F2$_h$	16 bit low than practical position	Position contact electronic gear rear position	Read-only	16
05F3$_h$	The actual position is 16 bits high		Read-only	16
05F4$_h$	Position node mode	0: Task 1: external	Read-only	16
05F5$_h$	Acceleration	10rpm/s/s	Readable and writable	16
05F6$_h$	Deceleration	10rpm/s/s	Readable and writable	16
05F7$_h$	Emergency reduction	10rpm/s/s	Readable and writable	16
05F8$_h$	Position contact electron gear molecule		Readable and writable	16
05F9$_h$	Position contact electron gear denominator		Readable and writable	16
05FA$_h$	Locate the reference points		Readable and writable	16
05FB$_h$	Switch speed for reference point	0~6000 rpm	Readable and writable	16
05FC$_h$	Switch speed for leaving reference point	0~6000 rpm	Readable and writable	16
05FD$_h$	Low position of teaching position		Readable and writable	16
05FE$_h$	High position of teaching position		Readable and writable	16
Parameters of data group 0 :				
0600$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0601$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0602$_h$	Target speed	rpm	Readable and writable	16
0603$_h$	Step change attributes *3		Readable and writable	16
0604$_h$	Value of the change step condition 1		Readable and writable	16
0605$_h$	2 numerical conditions of changing step		Readable and writable	16
0606$_h$	The following data group number		Readable and writable	16
0607$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 1 :				

Communication data address	Meaning	Description	Operation properties	
Hexadecimal			Read and write	Length (bit)
0608$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0609$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
060A$_h$	Target speed	rpm	Readable and writable	16
060B$_h$	Condition attributes of changing step		Readable and writable	16
060C$_h$	Value of the change step condition 1		Readable and writable	16
060D$_h$	2 numerical conditions of changing step		Readable and writable	16
060E$_h$	The following data group number		Readable and writable	16
060F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 2 :				
0610$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0611$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0612$_h$	Target speed	rpm	Readable and writable	16
0613$_h$	Condition attributes of changing step		Readable and writable	16
0614$_h$	Value of the change step condition 1		Readable and writable	16
0615$_h$	2 numerical conditions of changing step		Readable and writable	16
0616$_h$	The following data group number		Readable and writable	16
0617$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 3 :				
0618$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0619$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
061A$_h$	Target speed	rpm	Readable and writable	16
061B$_h$	Condition attributes of changing step		Readable and writable	16
061C$_h$	Value of the change step condition 1		Readable and writable	16
061D$_h$	2 numerical conditions of changing step		Readable and writable	16
061E$_h$	The following data group number		Readable and writable	16
061F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 4 :				
0620$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0621$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0622$_h$	Target speed	rpm	Readable and writable	16
0623$_h$	Condition attributes of changing step		Readable and writable	16
0624$_h$	Value of the change step condition 1		Readable and writable	16
0625$_h$	2 numerical conditions of changing step		Readable and writable	16
0626$_h$	The following data group number		Readable and writable	16
0627$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 5 :				
0628$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0629$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
062A$_h$	Target speed	rpm	Readable and writable	16
062B$_h$	Condition attributes of changing step		Readable and writable	16
062C$_h$	Value of the change step condition 1		Readable and writable	16
062D$_h$	2 numerical conditions of changing step		Readable and writable	16
062E$_h$	The following data group number		Readable and writable	16
062F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 6 :				
0630$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0631$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0632$_h$	Target speed	rpm	Readable and writable	16
0633$_h$	Condition attributes of changing step		Readable and writable	16
0634$_h$	Value of the change step condition 1		Readable and writable	16
0635$_h$	Value of the change step condition 2		Readable and writable	16
0636$_h$	The following data group number		Readable and writable	16
0637$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 7 :				
0638$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0639$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
063A$_h$	Target speed	rpm	Readable and writable	16
063B$_h$	Condition attributes of changing step		Readable and writable	16
063C$_h$	Value of the change step condition 1		Readable and writable	16
063D$_h$	Value of the change step condition 2		Readable and writable	16
063E$_h$	Follow array number		Readable and writable	16
063F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 8 :				
0640$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0641$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0642$_h$	Target speed	rpm	Readable and writable	16
0643$_h$	Condition attributes of changing step		Readable and writable	16
0644$_h$	Value of the change step condition 1		Readable and writable	16
0645$_h$	Value of the change step condition 2		Readable and writable	16
0646$_h$	The subsequent data group number		Readable and writable	16
0647$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16

Communication data address	Meaning	Description	Operation properties	
Hexadecimal			Read and write	Length (bit)
Parameters of data group 9 :				
0648$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0649$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
064A$_h$	Target speed	rpm	Readable and writable	16
064B$_h$	Condition attributes of changing step		Readable and writable	16
064C$_h$	Value of the change step condition 1		Readable and writable	16
064D$_h$	2 numerical conditions of changing step		Readable and writable	16
064E$_h$	The following data group number		Readable and writable	16
064F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 10 :				
0650$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0651$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0652$_h$	Target speed	rpm	Readable and writable	16
0653$_h$	Condition attributes of changing step		Readable and writable	16
0654$_h$	Value of the change step condition 1		Readable and writable	16
0655$_h$	2 numerical conditions of changing step		Readable and writable	16
0656$_h$	The following data group number		Readable and writable	16
0657$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 11 :				
0658$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0659$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
065A$_h$	Target speed	rpm	Readable and writable	16
065B$_h$	Condition attributes of changing step		Readable and writable	16
065C$_h$	Value of the change step condition 1		Readable and writable	16
065D$_h$	2 numerical conditions of changing step		Readable and writable	16
065E$_h$	The following data group number		Readable and writable	16
065F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 12 :				
0660$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0661$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0662$_h$	Target speed	rpm	Readable and writable	16
0663$_h$	Condition attributes of changing step		Readable and writable	16
0664$_h$	Value of the change step condition 1		Readable and writable	16
0665$_h$	2 numerical conditions of changing step		Readable and writable	16
0666$_h$	The following data group number		Readable and writable	16
0667$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 13 :				
0668$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0669$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
066A$_h$	Target speed	rpm	Readable and writable	16
066B$_h$	Condition attributes of changing step		Readable and writable	16
066C$_h$	Value of the change step condition 1		Readable and writable	16
066D$_h$	2 numerical conditions of changing step		Readable and writable	16
066E$_h$	The following data group number		Readable and writable	16
066F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 14 :				
0670$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0671$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0672$_h$	Target speed	rpm	Readable and writable	16
0673$_h$	Condition attributes of changing step		Readable and writable	16
0674$_h$	Value of the change step condition 1		Readable and writable	16
0675$_h$	2 numerical conditions of changing step		Readable and writable	16
0676$_h$	The following data group number		Readable and writable	16
0677$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 15 :				
0678$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0679$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
067A$_h$	Target speed	rpm	Readable and writable	16
067B$_h$	Condition attributes of changing step		Readable and writable	16
067C$_h$	Value of the change step condition 1		Readable and writable	16
067D$_h$	2 numerical conditions of changing step		Readable and writable	16
067E$_h$	The following data group number		Readable and writable	16
067F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 16 :				
0680$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0681$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0682$_h$	Target speed	rpm	Readable and writable	16
0683$_h$	Condition attributes of changing step		Readable and writable	16
0684$_h$	Value of the change step condition 1		Readable and writable	16
0685$_h$	2 numerical conditions of changing step		Readable and writable	16
0686$_h$	The following data group number		Readable and writable	16

Communication data address	Meaning	Description	Operation properties	
Hexadecimal			Read and write	Length (bit)
0687$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 17 :				
0688$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0689$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
068A$_h$	Target speed	rpm	Readable and writable	16
068B$_h$	Condition attributes of changing step		Readable and writable	16
068C$_h$	Value of the change step condition 1		Readable and writable	16
068D$_h$	Value of the change step condition 2		Readable and writable	16
068E$_h$	The following data group number		Readable and writable	16
068F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 18 :				
0690$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0691$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
0692$_h$	Target speed	rpm	Readable and writable	16
0693$_h$	Condition attributes of changing step		Readable and writable	16
0694$_h$	Value of the change step condition 1		Readable and writable	16
0695$_h$	2 numerical conditions of changing step		Readable and writable	16
0696$_h$	The following data group number		Readable and writable	16
0697$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 19 :				
0698$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
0699h	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
069A$_h$	Target speed	rpm	Readable and writable	16
069B$_h$	Condition attributes of changing step		Readable and writable	16
069C$_h$	Value of the change step condition 1		Readable and writable	16
069D$_h$	2 numerical conditions of changing step		Readable and writable	16
069E$_h$	The following data group number		Readable and writable	16
069F$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 20 :				
06A0$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06A1$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06A2$_h$	Target speed	rpm	Readable and writable	16
06A3$_h$	Condition attributes of changing step		Readable and writable	16
06A4$_h$	Value of the change step condition 1		Readable and writable	16
06A5$_h$	2 numerical conditions of changing step		Readable and writable	16
06A6$_h$	The following data group number		Readable and writable	16
06A7$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Data group 21 parameters:				
06A8$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06A9$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06AA$_h$	Target speed	rpm	Readable and writable	16
06AB$_h$	Condition attributes of changing step		Readable and writable	16
06AC$_h$	Value of the change step condition 1		Readable and writable	16
06AD$_h$	2 numerical conditions of changing step		Readable and writable	16
06AE$_h$	The following data group number		Readable and writable	16
06AF$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 22 :				
06B0$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06B1$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06B2$_h$	Target speed	rpm	Readable and writable	16
06B3$_h$	Condition attributes of changing step		Readable and writable	16
06B4$_h$	Value of the change step condition 1		Readable and writable	16
06B5$_h$	2 numerical conditions of changing step		Readable and writable	16
06B6$_h$	The following data group number		Readable and writable	16
06B7$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 23 :				
06B8$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06B9$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06BA$_h$	Target speed	rpm	Readable and writable	16
06BB$_h$	Condition attributes of changing step		Readable and writable	16
06BC$_h$	Value of the change step condition 1		Readable and writable	16
06BD$_h$	2 numerical conditions of changing step		Readable and writable	16
06BE$_h$	The following data group number		Readable and writable	16
06BF$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 24 :				
06C0$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06C1$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06C2$_h$	Target speed	rpm	Readable and writable	16
06C3$_h$	Condition attributes of changing step		Readable and writable	16
06C4$_h$	Value of the change step condition 1		Readable and writable	16
06C5$_h$	2 numerical conditions of changing step		Readable and writable	16

Communication data address	Meaning	Description	Operation properties	
Hexadecimal			Read and write	Length (bit)
06C6$_h$	The following data group number		Readable and writable	16
06C7$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 25 :				
06C8$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06C9$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06CA$_h$	Target speed	rpm	Readable and writable	16
06CB$_h$	Condition attributes of changing step		Readable and writable	16
06CC$_h$	Value of the change step condition 1		Readable and writable	16
06CD$_h$	2 numerical conditions of changing step		Readable and writable	16
06CE$_h$	The following data group number		Readable and writable	16
06CF$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 26 :				
06D0$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06D1$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06D2$_h$	Target speed	rpm	Readable and writable	16
06D3$_h$	Condition attributes of changing step		Readable and writable	16
06D4$_h$	Value of the change step condition 1		Readable and writable	16
06D5$_h$	2 numerical conditions of changing step		Readable and writable	16
06D6$_h$	The following data group number		Readable and writable	16
06D7$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 27 :				
06D8$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06D9$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06DA$_h$	Target speed	rpm	Readable and writable	16
06DB$_h$	Condition attributes of changing step		Readable and writable	16
06DC$_h$	Value of the change step condition 1		Readable and writable	16
06DD$_h$	Value of the change step condition 2		Readable and writable	16
06DE$_h$	The following data group number		Readable and writable	16
06DF$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 28 :				
06E0$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06E1$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06E2$_h$	Target speed	rpm	Readable and writable	16
06E3$_h$	Condition attributes of changing step		Readable and writable	16
06E4$_h$	Value of the change step condition 1		Readable and writable	16
06E5$_h$	2 numerical conditions of changing step		Readable and writable	16
06E6$_h$	The following data group number		Readable and writable	16
06E7$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 29 :				
06E8$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06E9$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06EA$_h$	Target speed	rpm	Readable and writable	16
06EB$_h$	Condition attributes of changing step		Readable and writable	16
06EC$_h$	Value of the change step condition 1		Readable and writable	16
06ED$_h$	2 numerical conditions of changing step		Readable and writable	16
06EE$_h$	The following data group number		Readable and writable	16
06EF$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 30 :				
06F0$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06F1$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06F2$_h$	Target speed	rpm	Readable and writable	16
06F3$_h$	Condition attributes of changing step		Readable and writable	16
06F4$_h$	Value of the change step condition 1		Readable and writable	16
06F5$_h$	2 numerical conditions of changing step		Readable and writable	16
06F6$_h$	The following data group number		Readable and writable	16
06F7$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16
Parameters of data group 31 :				
06F8$_h$	Low position of target position	Unit: 1 instruction pulse	Readable and writable	16
06F9$_h$	High position of target position	Unit: 10000 instruction pulse	Readable and writable	16
06FA$_h$	Target speed	rpm	Readable and writable	16
06FB$_h$	Condition attributes of changing step		Readable and writable	16
06FC$_h$	Value of the change step condition 1		Readable and writable	16
06FD$_h$	2 numerical conditions of changing step		Readable and writable	16
06FE$_h$	The following data group number		Readable and writable	16
06FF$_h$	Data group type	0:NULL; 1: absolute; 2: relative	Readable and writable	16

Address description:

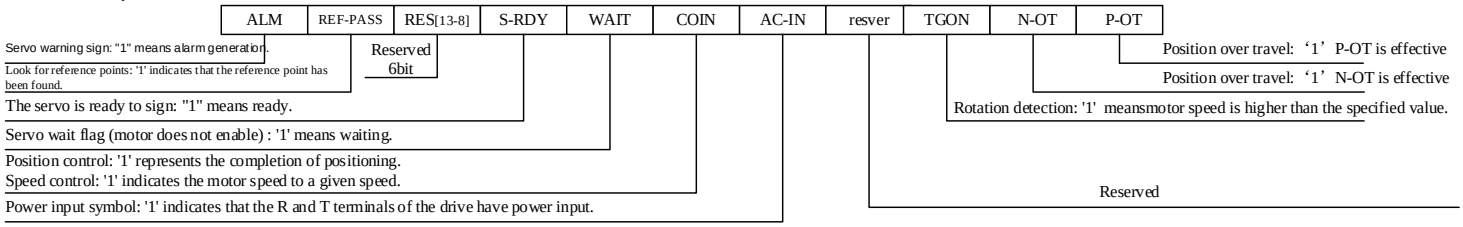
*1. Communication IO input (0451_h)

Input signal can input through the communication IO input (0451h) register the MODBUS communication, which is defined as follows:

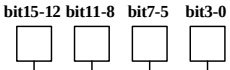
bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
/START-HOME	/POS-STEP	/POS-START	/POS-REF	/POS2	/POS1	/POS0	/G-SEL
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
/N-CL	/P-CL	/CLR	/ALM-RST	N-OT	P-OT	/P-CON	/SON

The signal input in the register is valid only if the signal is not input from CN1 (the signal allocation parameter is set as "invalid").
Example: communication through the IO input /POS-START input register should set up P□512.1=0 modify input of IO (**0451_h**) communication register and the bit13 bits will be valid.

*2. Servo operation state （**0457_h**）



*3. Condition attributes of changing step



Data group change step condition 1 type.	
0	Unconditional
1	Delay
2	Signal input (/POS-STEP) pulse edge.
3	Signal input (/POS-STEP) level.

Data group change step condition 2 type.	
0	Unconditional
1	Delay
2	Signal input (/POS-STEP) pulse edge.
3	Signal input (/POS-STEP) level.

Logic between change step 1 and change step 2	
0	No connection
1	AND
2	OR

Change step mode.	
0	Aborting
1	Standard
2	Buffered
3	BlendingLow
4	BlendingPrevious
5	BlendingNext
6	BlendingHigh

Chapter VII Maintenance and inspection

7.1 Exception diagnosis and treatment measures

7.1.1 Alarm display summary

The following table is shown the relationship between the alarm display and the alarm encoding output ON/OFF.
Motor stop method when alarm occurs: free running stop: the natural stopping method of friction resistance through the rotation of the motor without braking.

Alarm number		Alarm name	Can it be cleared
Main alarm number	Auxiliary alarm number		
01	0	Encoder PA, PB, PC disconnection	Ok
02	0	Encoder PU, PV, PW disconnection	Ok
03	0	Overload	Ok
04	0	A/D transformation channel anomaly	Ok
10	0	Over current	Ok
11	0	Over voltage	No
12	0	Under voltage	No
13	0	Parameter failure	Ok
14	0	Instruction over speed	Ok
	1	motor real speed is over than instruction	Ok
15	0	Deviation counter spillover	Ok
16	0	Position offset over than limit	Ok
17	0	Electronic gear error	Ok
18	0	The 1st channel exception of current detection	Ok
19	0	The 2nd channel exception of current detection	Ok
22	0	Motor model error	Ok
23	0	The mismatch between the servo drive and the motor	Ok
25	0	Bus type encoder multi-loop information error	Ok
26	0	Bus type encoder multi-loop information overflow	Ok
27	0	Bus type encoder battery alarm 1	Ok
28	0	Bus type encoder battery alarm 2	Ok
30	0	Discharge resistance wire break alarm	Ok
31	0	Regenerative overload	No
34	0	Abnormity of rotating transformer	Ok
40	0	Bus type encoder communication exception	Ok
41	0	Bus type encoder over speed	Ok
42	0	Absolute state error of bus type encoder	Ok
43	0	Bus type encoder counting error	Ok
44	0	control domain verifying of bus type encoder error	Ok
45	0	Bus type encoder communication data verifying error	Ok
46	0	Bus type encoder state domain error	Ok
47	0	Bus type encoder SFOME error	Ok
48	0	Bus type encoder EEROM uninitialized	Ok
49	0	Bus type encoder EEROM data check error	Ok
60	0	MODBUS communication timeout	Ok
61	0	CANopen main station heartbeat timeout	Ok
63	0	M-II communication fault	Ok
64	0	M-II synchronization exception	Ok
65	0	CANopen synchronization timeout	Ok
70	0	Driver overheating alarm	Ok

Alarm number		Alarm name	Can it be cleared
Main alarm number	Auxiliary alarm number		
71	0	M-III communication ASIC fault 1	No
	1	M-III communication ASIC failure 2	No
73	0	M-III communication cycle setting error	Ok
	1	M-III communication data size setting incorrect	Ok
	2	M-III communication station address setting error	No
74	0	M-III communication synchronization exception	Ok
	1	M-III communication synchronization failure	Ok
75	0	M-III communication failure (reception error)	Ok
	1	M-III transmission cycle exception (synchronous interval exception)	Ok
	3	M-III communication synchronization frame undeceived	Ok
76	0	Data setting alarm 1 (parameter number)	Ok
	1	Data setting alarm 2 (beyond the range of parameters)	Ok
	3	Data set alarm 4 (data length)	Ok
77	0	M-III instruction alarm 1 (other than the instruction condition)	Ok
	1	M-III instruction alarm 2 (unsupported instruction)	Ok
	3	M-III instruction alarm 4 (instruction interference)	Ok
	4	M-III instruction alarm 5 (non - available sub instruction)	Ok
	6	M-III instruction alarm 7 (layer exception)	Ok
80	0	Incorrect ESM requirements for exception protection	Ok
	1	Undefined ESM requires exception protection	Ok
	2	Boot status requirement exception protection	Ok
	3	PLL not complete exception protection	Ok
	4	PDO watchdog exception protection	Ok
	6	PLL exception protection	Ok
	7	Synchronization signal exception protection	Ok
81	0	Synchronization period setting exception protection	Ok
	1	Mailbox setting exception protection	Ok
	4	PDO watchdog setting exception protection	Ok
	5	DC setting exception protection	Ok
	6	SM event mode setting exception protection	Ok
	7	SM2/3 setting exception protection	Ok
85	0	TxPDO distribution exception protection	Ok
	1	RxPDO distribution exception protection	Ok
	2	Lost link exception protection	Ok
	3	SII EEPROM exception protection	Ok
88	1	Control mode setting exception protection	Ok
00	0	Error free display	--

(Note):

1. “□” shown in alarm display may be "A" or "B", alarm of A or b axis alarm respectively.
2. □25, □26, □27, and □41 it is necessary to clear the internal alarm through the auxiliary function mode, so that the alarm can be reset.

7.1.2 The causes of alarm display and of alarm display

Whether servo drive adverse situation, the panel operator may appear with alarm display A□□ or b□□ the alarm displaying and its handling measures are shown below.

Whether the adverse condition cannot be solved after the treatment, please contact the service department of our company.

（1）Alarm display list

Call the police	Alarm content	Alarm situation	Reason	Treatment measures
□01	Incremental encoder ABC disconnection	Occur during the power supply is connected or during operation	Encoder line welding error	Modify encoder wiring
			The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable is damaged.	Modify encoder cable casting
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
□03	Overload	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		Occurs when servo is ON	Motor wiring exception (adverse wiring and adverse connection)	Correct motor wiring
			Encoder wiring exception (adverse wiring and adverse connection)	Modify encoder wiring
			Servo drives circuit board failure.	Change the servo drive
		The servo motor is not rotated when the instruction is input	Motor wiring exception (adverse wiring and adverse connection)	Correct motor wiring
			Encoder wiring exception (adverse wiring and adverse connection)	Modify encoder wiring
			Starting torque exceeds the maximum torque	Reconsider the load conditions, operating conditions, or reconsider the capacity of the motor
		It occurs under normal operation	The effective torque exceeds the rated torque or starting torque to a large extent over the rated torque	Reconsider the load conditions, operating conditions, or reconsider the capacity of the motor
□10	Over current	Occurs when the control power supply is connected	Overloading alarm reset several times for power disconnection	Reset method for changing alarms
			Servo drives circuit board failure.	Change the servo drive
		It occurs over the main circuit power or produce over current during the operation of the motor	U, V, W and ground wire connection error	Check the wiring and connect it correctly
			The short circuit between the U, V, W of the motor main electric circuit and the ground wire	Amend or replace motor main circuit cable
			The short circuit between the U, V, W of the motor main electric circuit	
			Overloading alarm reset several times for power disconnection	Reset method for changing alarms
			Sharp change in position speed instruction	Reassessment of instruction values
			If the load is too large, and whether it is beyond the capacity of regenerative processing.	Review the load conditions and operating conditions
			Encoder is slippery	Change of the servo motors
			Servo unit fan stops rotating.	Change the servo drive
			Servo drives circuit board failure.	
□11	Overpressure ＊Check it when the main circuit power supply is connected	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		When the main circuit power supply is connected It happens	AC power supply voltage is too high	Adjust the AC power supply voltage to the normal range
			Servo drives circuit board failure.	Change the servo drive
		It occurs under normal operation	Check the AC power supply voltage (Whether there is too much voltage change)	Adjust the AC power supply voltage to the normal range
			With high RPM, inertia of load too high(insufficient regeneration capacity)	Review the load conditions and operating conditions
			Servo drives circuit board failure.	Change the servo drive
		When the servo motor decelerates	With high RPM, inertia of load too high	Review the load conditions and operating conditions
□12	Under voltage ＊Check it when the main circuit power supply is connected	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		When the main circuit power supply is connected It happens	AC power supply voltage is too low	Adjust the AC power supply voltage to the normal range
			The fuse of the servo unit is blowed.	Change the servo drive
			Impact current limit resistance disconnection (whether the power supply voltage is exception, and whether impact current limit resistance is overloaded)	Replace the servo unit (confirm the power supply voltage, reduce the frequency of the main circuit ON/OFF)
			Servo drives circuit board failure.	Change the servo drive
		It occurs under normal operation	AC power supply voltage is low (whether there is too large pressure drop)	Adjust the AC power supply voltage to the normal range
			Instantaneous power failure	Restart operation by alarm reset
			The short circuit of the motor main electric circuit	Amend or replace motor main circuit cable
□13	Parameter failure	Occurs when the control power supply is connected	Power off when the parameters is being setting	Perform parameter initialization processing (F□011)
			Servo drives circuit board failure.	Change the servo drive
□14	Over speed	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		Occurs when servo is ON	Motor wiring U, V, W phase sequence error	Correct motor wiring
			Encoder wiring error	Modify encoder wiring
			Error action of encoder wiring due to interference	To implement the anti-interference countermeasures of encoder
			Servo drives circuit board failure.	Change the servo drive
		It occurs when the servo motor starts running or rotating in a high speed.	Motor wiring U, V, W phase sequence error	Correct motor wiring
			Encoder wiring error	Modify encoder wiring
			Error action of encoder wiring due to interference	To implement the anti-interference countermeasures of encoder
			The input of position / speed instruction is too large	Down command value
			Instruction input gain setting error	Correct command input gain
			Servo drives circuit board failure.	Change the servo drive
□15	Position counter overflows	It occurs when the servo motor starts running or rotating in a high speed.	Motor locked-rotor	Check the load
			Input instruction frequency exception	The upper computer reduces the frequency
			Wiring error	Correct wiring
□16	Position offset too large (The servo is in the ON state Lower position offset over User parameters overflow	Occurs when the control power supply is connected	The position offset large alarm electrical level (P□523) is not correct.	Set the user parameter P□523 value other than 0 value
			Servo drives circuit board failure.	Change the servo drive
		It takes place at high speed	The wiring of the U, V, W of the servo motor is exception (incomplete connection)	Correct motor wiring
				Modify encoder wiring

Call the police	Alarm content	Alarm situation	Reason	Treatment measures
	Electrical level P□523 setting)		Servo drives circuit board failure.	Change the servo drive
		It occurs when the servo motor is not rotated and the position instruction is input	Adverse wiring of the U, V, W of the servo motor	Correct motor wiring
			Servo drives circuit board failure.	Change the servo drive
		The action is normal, but it occurs for the long instruction.	The adverse gain adjustment of the servo drive	Increase the speed loop gain (P□100), and the position loop gain (P□102)
			The frequency of the position instruction pulse is too high	Slow down position instruction frequency
				Add the smoothing function
				Reevaluate the electronic gear ratio
			The position offset large alarm electrical level (P□523) is not correct.	Set the parameters of P□523 as the correct value
			Load conditions (torque, moment of inertia) are not consistent with the motor specifications	Discuss reassessment of load or motor capacity
□17	Electronic gear error	Occurs when the control power supply is connected	Electronic gear is not set correctly.	Reset P□202, P□204
		It occurs when the servo motor starts to run		
□18	The 1st channel exception of current detection	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		It occurs when the servo motor starts to run		
□19	The 1st channel exception of current detection	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		It occurs when the servo motor starts to run		
□22	Motor model error	Occurs when the control power supply is connected	Drive motor parameters setting is exception	Change the servo drive
			The parameter written to the encoder is exception	Change the servo motors(encoder)
			Servo drives circuit board failure.	Change the servo drive
□23	The mismatch between the servo drive and the motor	Occurs when the control power supply is connected	The setting of drive motor model code is not set or set wrong	Set the correct motor model code parameters
□25	Multi loop data of bus encoder error	Occurs when the control power supply is connected	Absolute encoder multi loop data exception	The bus encoder is performed with multiple loop positions (F□009) and clear the bus encoder alarm registers (F□010)
		It occurs when the servo motor is running		
□26	The multi loop data of the bus encoder overflow	Occurs when the control power supply is connected	Absolute encoder multi loop data exception	The bus encoder is performed with multiple loop positions (F□009) and clear the bus encoder alarm registers (F□010)
		It occurs when the servo motor is running		
□27	Bus encoder battery alarm 1	Occurs when the control power supply is connected	Battery is not correctly connected or not connected	Connect the battery correctly
			Battery Voltage is low than the specific value (2.5V)	Replace the battery and restart the PG power supply
□28	Bus encoder battery alarm 2	Occurs when the control power supply is connected	Battery Voltage is low than the specific value (3.1V)	Replace the battery and restart the PG power supply
□30	Exception again	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		It occurs when the main circuit power is connected	Not external connect the regenerated resistance	Connect the regenerated resistance
			Check whether the regenerated resistance is defective, broken or disconnected.	Correct the wiring of the external regenerative resistance
		It occurs under normal operation	Check whether the regenerative resistance is adverse connected or whether it is fall off	Correct the wiring of the external regenerative resistance
			Regenerative resistance disconnected (whether the regenerative energy is too large)	Replace the regenerative resistance or replace the servo drive (reconsider the load and operating conditions)
			Fault of servo drive (regenerative transistor, voltage detection part fault)	Change the servo drive
□31	Regenerative overload	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
		It occurs when the main circuit power is connected	Power supply voltage is over 270V	Correcting voltage
		It occurs under normal operation (the regenerated resistance temperature increases greatly)	Regenerative energy is too large	Choose the capacity of the regenerative resistance again or reconsider the load conditions and operating conditions
			Under continuous regeneration state	
		When the servo motor decelerates	Regenerative energy is too large	Choose the capacity of the regenerative resistance again or reconsider the load conditions and operating conditions
□40	Bus encoder counting disconnection	Occurs when the control power supply is connected	Encoder wiring error	Modify encoder wiring
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
		Occurs during the operation	Encoder wiring error	Modify encoder wiring
			The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable is damaged and the signal line is disturbed	Modify encoder cable casting
□41	Bus encoder over speed	Occurs when the control power supply is connected	Servo motor rotates at the speed over 100r/min when the PG power is connected	Set PG power supply ON when the RPM of servo motor is less than 100 r/min
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
		Occurs during the operation	Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
□42	Bus encoder FS state error	It occurs under normal operation	Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive

Call the police	Alarm content	Alarm situation	Reason	Treatment measures
□43	Bus encoder counting error	It occurs under normal operation	Servo drives circuit board failure.	Change the servo drive
□44	Check the control domain of bus encoder error	Occur during the power supply is connected or during operation	The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
			The encoder cable is tied up with large current line or too long distance.	Lay the encoder cable in position where the surge voltage is not applied.
			The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	Connect the equipment ground wire to avoid FG shunting to the PG side
			The signal line of the encoder is disturbed	To implement the anti-interference countermeasures of encoder
□45	Check the control domain of bus encoder error	Occur during the power supply is connected or during operation	Encoder wrong wiring and poor contact	Modify encoder wiring
			The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
			The encoder cable is tied up with large current line or too long distance.	Lay the encoder cable in position where the surge voltage is not applied.
			The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	Connect the equipment ground wire to avoid FG shunting to the PG side
			The signal line of the encoder is disturbed	To implement the anti-interference countermeasures of encoder
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
□46	Bus encoder state domain cutoff position error	Occur during the power supply is connected or during operation	Encoder wrong wiring and poor contact	Modify encoder wiring
			The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
			The encoder cable is tied up with large current line or too long distance.	Lay the encoder cable in position where the surge voltage is not applied.
			The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	Connect the equipment ground wire to avoid FG shunting to the PG side
			The signal line of the encoder is disturbed	To implement the anti-interference countermeasures of encoder
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
□47	Bus encoder SFOME cutoff position error	Occur during the power supply is connected or during operation	Encoder wrong wiring and poor contact	Modify encoder wiring
			The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
			The encoder cable is tied up with large current line or too long distance.	Lay the encoder cable in position where the surge voltage is not applied.
			The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	Connect the equipment ground wire to avoid FG shunting to the PG side
			The signal line of the encoder is disturbed	To implement the anti-interference countermeasures of encoder
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
□48	The bus encoder data is not initialized	Occurs when the control power supply is connected	Encoder EEROM uninitialized	Change of the servo motors
□49	Bus encoder data and counting check error	Occur during the power supply is connected or during operation	Encoder wrong wiring and poor contact	Modify encoder wiring
			The encoder cable has different specifications and disturbed	Change cable specification to multi - stranded wire shield.
			It is disturbed as the encoder cable is too long	The longest line distance of the wiring is 20m
			The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
			The encoder cable is tied up with large current line or too long distance.	Lay the encoder cable in position where the surge voltage is not applied.
			The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	Connect the equipment ground wire to avoid FG shunting to the PG side
			The signal line of the encoder is disturbed	To implement the anti-interference countermeasures of encoder
			Encoder failure	Change of the servo motors
			Servo drives circuit board failure.	Change the servo drive
□60	MODBUS communication timeout	Occur during the power supply is connected or during operation	MODBUS main station communication timeout	Check the MODBUS main station
□61	CANopen main station heartbeat timeout	Occur during the power supply is connected or during operation	Heartbeat of the main station timeout	Inspect CANopen main station
□70	Overheating	Occurs when the control power supply is connected	Servo drives circuit board failure.	Change the servo drive
			Overloading alarm reset several times for power disconnection	Reset method for changing alarms
		The heat sink overheating occurs while the main power supply is ON or the motor runs	The load exceeds the rated load	Reconsider the load conditions, operating conditions, or reconsider the capacity of the motor
			The ambient temperature of servo drive is over 55 ℃	Lower the ambient temperature of the servo drive to 55℃ and below
			Servo drives circuit board failure.	Change the servo drive

7.1.3 The causes and treatment measures of other reverse conditions

In the absence of alarm state, the reasons for the reverse situation and the appropriate measures to deal with it are as the following table.

Whether the adverse condition cannot be solved after the treatment, please contact the company's agent or technical service personnel.

Reverse condition	Reason	Inspection method	Treatment measures
		: Please check and process the power of the servo system after put it at OFF.	
Servo motor does not start	Control power supply is not connected	Check the voltage between the control power terminals.	Correct the control power supply ON circuit
	Main circuit power supply is not connected	Check the voltage between the main circuit power supply terminals.	Correct the main circuit power supply ON circuit
	Input and output (CN1 connector) wiring error and fall off	Check the installation and wiring of CN1 connector	Wiring the CN1 connector correctly
	Wiring of servo motor ad encoder comes off	Check the wiring	Connect the wiring
	Form overload	Implement unloaded test operation	Reduce load, or replace the servo motor with large capacity.
	Not input the speed/position instruction	Check input pin	Correct input speed/position instruction
	Set the input signal selection P□509 ～P□512 error	Check the setting of input signal P□509 ～P□512	Select the setting of input signal of P□509 ～P□512 correctly
	Servo ON (/S-ON) input keeps in the OFF state	Confirm the setting value of user parameter P□50A.0	Set the user setting correctly and set the ON server (/S-ON) input at ON
	SEN input keeps in the OFF state	Check SEN signal input (valid when using absolute encoder)	Set the SEN signal input at ON
	Mode selection of instruction pulse error	Check user parameters setting and instruction pulse form	Set the user parameter setting of P□200.1 correctly
	Speed control: speed instruction input is not appropriate	Confirm whether the control mode is consistent with the input or check whether V-REF is consistent with GND	Control parameter setting or input correctly
	Torque control: torque instruction input is not appropriate	Confirm whether the control mode is consistent with the input or check whether T-REF is consistent with GND	Control parameter setting or input correctly
	Position control: position instruction is not appropriate	Check P□200.1 command pulse form or symbol + pulse signal	Control parameter setting or input correctly
	Offset pulse clearance input (CLR) and keep it at the ON state	Check /CLR input	Set /CLR input signal as OFF
	Prohibit the forward drive (P-OT), and the reverse drive (N-OT) input signal and keep it at the OFF state	Check POT or NOT input signal	Set POT or NOT input signal to ON
	Servo drive failure	Servo drives circuit board failure.	Change the servo drive
The servo motor will stop after an instant operation.	Motor wiring error	Check the motor wiring	Electrical wiring correctly
	Encoder wiring error	Check encoder wiring	Encoder wiring correctly
It stops all of sudden during operation and then motionless.	Alarm reset (ALM-RST) signal and keep it at the ON state and active the alarm	Check alarm reset signal	The alarm reset signal is changed from ON to OFF after the alarm is excluded
Motor rotation instability	Poor connection of the servo motor	Power line (U, V, W phase) and encoder connectors are unstable.	Tighten the fastening part of the terminal and connector.
The motor rotates without instruction	Speed control: speed instruction input is not appropriate	Confirm whether the control mode is consistent with the input or check whether V-REF is consistent with GND	Control parameter setting or input correctly
	Torque control: torque instruction input is not appropriate	Confirm whether the control mode is consistent with the input or check whether T-REF is consistent with GND	Control parameter setting or input correctly
	Speed instructions is offset	The offset adjustment of the servo driver is poor	The offset adjustment of the servo driver
	Position control: position instruction is not appropriate	Check P□200.1 command pulse form or symbol + pulse signal	Control parameter setting or input correctly
	Servo drive failure	Servo drives circuit board failure.	Change the servo drive
An abnormal sound made from the motor	·Machine is not mounted properly	Is the servo motor mounting screw loose?	Tighten the mounting screws again
		Is the core of the coupling aligned?	Aligning the axis core of the coupling.
		Does the coupling lose balance?	Keep balance of the coupling
	Exception in bearing	Check the sound and vibration conditions near the bearing	If there are any exceptions, please contact our technical service staff
	The supporting machine has the vibration source	Is there any foreign matter entering or breaking or deforming into the movable part of the mechanical side?	Please consult the machine manufacturer
	The input signal line specifications are different and are disturbed	Multi - stranded wire or multi - stranded shielded wire core 0.12mm2 above, multi - ply tinned copper stranded wire?	The input signal line shall be conforming to the specification
	The length of the input signal line is disturbed due to beyond the range of use	It is confirmed that the maximum line length is 3M, and the impedance is less than 100 Omega.	Length of signal input line is conforms to the specification
	The encoder cable has different specifications and disturbed	Multi - stranded wire or multi - stranded shielded wire core 0.12mm2 above, multi - ply tinned copper stranded wire?	Make the encoder cable conform to the specification
	The length of the encoder cable is disturbed due to it beyond the range of use	The longest line distance of the wiring is 20m	Make the length of encoder cable conform to the specification
	It is disturbed as the encoder cable is too long	The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
	Encoder cable excessive interference	Whether the encoder cable too closes?	Lay the encoder cable in position where the surge voltage is not applied.
	The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	What is the grounding state of the servo motor side; the welding machine and so on (forget ground, not fully grounded)?	Connect the equipment ground wire to avoid FG shunting to the PG side
	The pulse count of the servo drive caused by the interference error	Whether the signal line of the encoder is disturbed?	To implement the anti-interference countermeasures of encoder
	The encoder is affected by excessive vibration impact)	Mechanical vibration or the motor is not installed properly (Precision, fixing, partial core of installation surface	Decrease mechanical vibration or install servo motor correctly
	Encoder failure	Encoder failure	Change of the servo motors
The frequency is about 200 ~ 400Hz motor vibration	The setting of speed gain of P□100 is too high	The factory setting：Kv=40.0Hz	Correctly set the speed loop gain P□100
	The setting of position loop gain Pn102 is too high	The factory setting ： Kp=40.0/s	Correctly set the position loop gain P□102
	The setting of speed loop integral time parameter P□101 is not appropriate	The factory setting : Ti=20.00ms	Set speed loop integral time parameter P□101 correctly
	Automatic tuning: mechanical rigidity setting is not properly	Re-evaluate the selection of mechanical rigidity setting.	Select mechanical rigidity correctly
	When the automatic tuning is not used: the moment of inertia is not appropriate to the data	Check the inertia ratio data of P□103	Correct the inertia ratio data of P□103
The speed of starting and stopping is too high.	The setting of speed gain of P□100 is too high	The factory setting：Kv=40.0Hz	Correctly set the speed loop gain P□100
	The setting of position loop gain Pn102 is too high	The factory setting ： Kp=40.0/s	Correctly set the position loop gain P□102

Reverse condition	Reason	Inspection method	Treatment measures
		: Please check and process the power of the servo system after put it at OFF.	
	The setting of speed loop integral time parameter P□101 is not appropriate	The factory setting : Ti=20.00ms	Set speed loop integral time parameter P□101 correctly
	Automatic tuning: mechanical rigidity setting is not properly	Re-evaluate the selection of mechanical rigidity setting.	Select mechanical rigidity correctly
	When the automatic tuning is not used: the moment of inertia is not appropriate to the data	Check the inertia ratio data of P□103	Correct the inertia ratio data of P□103
			Check the mode switch function
Absolute encoder position offset error (The position of the power disconnected from the instruction controller is different from the position of the next power ON).	The encoder cable has different specifications and disturbed	Multi - stranded wire or multi - stranded shielded wire core 0.12mm2 above, multi - ply tinned copper stranded wire?	Make the encoder cable conform to the specification
	The length of the encoder cable is disturbed due to it beyond the range of use	The longest line distance of the wiring is 20m	Make the length of encoder cable conform to the specification
	It is disturbed as the encoder cable is too long	The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
	Encoder cable excessive interference	Whether the encoder cable is tied up with large current line or too close?	Lay the encoder cable in position where the surge voltage is not applied.
	The potential of FG is changed due to the influence of the motor side equipment	What is the grounding state of the servo motor side; the welding machine and so on (forget ground, not fully grounded)?	Connect the equipment ground wire to avoid FG shunting to the PG side
	The pulse count of the servo drive caused by the interference error	Whether the signal line of the encoder is disturbed?	To implement the anti-interference countermeasures of encoder
	The encoder is affected by excessive vibration impact	Mechanical vibration or the motor is not installed properly (Precision, fixing, partial core of installation surface)	Decrease mechanical vibration or install motor correctly
	Encoder failure	Encoder failure (impulse does not change)	Change of the servo motors
	Servo drive failure	The servo driver does not send multiple rotation data	Change the servo drive
	The multi rotation data of instruction controller read error	Check the error detection of the check instruction controller	Make the error detection part of the instruction controller back to normal
		Whether data is implemented in an instruction controller (odd-even check) Inspecting?	Odd-even check for multi rotation data
		The signal line between the servo drive and the command controller is disturbed	There will be interference (above) when there is no checking.
Over travel (OT) (It beyond the area specified by the command controller)	Prohibit forward / reverse drive input signal reaches (POT or NOT H electrical level)	Is the voltage of the input signal using external power (+24V) correct?	Correct external +24V power supply
		Is the action state of the over travel limit SW correct?	Correct the state of the over travel SW
		Is the wiring of the over travel limit SW correct?	Amend the wiring of the modified over travel SW
	Prohibit forward / reverse drive input signal generates misoperation (POT or NOT signals are often changes)	The input signal with the external power supply (+24V) and voltage will be changed?	Clear away the change of external +24V power supply
		Whether the action state of the over travel limit SW stable?	Make the action of the over travel limit SW stable
		Is the wiring of the over travel limit SW correct? (Cable damage, screw fastening)	Amend the wiring of the modified over travel SW
	It is prohibited to have forward rotation/ reverse drive input signal (P-OT/N-OT) signal selection error	Check the POT signal selection P□510.2	Revise the POT signal selection P□510.2
		Check the POT signal selection P□510.3	Revise the POT signal selection P□510.3
	Motor stop method selection error	How to choose the inert operation stop at servo in OFF state?	Check P□000.2, P□000.3
		How about the inert operation setting for torque control?	Check P□000.2, P□000.3
	Over travel position inappropriately	The position of OT is shorter than the inert operation	Place the OT position in an appropriate state
	The encoder cable has different specifications and disturbed	Multi - stranded wire or multi - stranded shielded wire core 0.12mm2 above, multi - ply tinned copper stranded wire?	Make the encoder cable conform to the specification
	The length of the encoder cable is disturbed due to it beyond the range of use	The longest line distance of the wiring is 20m	Make the length of encoder cable conform to the specification
	It is disturbed as the encoder cable is too long	The encoder cable the damaged by engaging-in and foreskin, and the signal line is disturbed.	Modify encoder cable casting
	Encoder cable excessive interference	Whether the encoder cable is tied up with large current line or too close?	Lay the encoder cable in position where the surge voltage is not applied.
	The potential of FG is changed due to the influence of the motor side equipment (welding machine, etc.).	What is the grounding state of the servo motor side; the welding machine and so on (forget ground, not fully grounded)?	Connect the equipment ground wire to avoid FG shunting to the PG side
	Error of servo unit pulse counting caused by interference	Whether the signal line of the encoder is disturbed?	To implement the anti-interference countermeasures of encoder
	The encoder is affected by excessive vibration impact	Mechanical vibration or the servo motor is not installed properly (mounting surface precision, fixed and partial core)	Decrease mechanical vibration or install servo motor correctly
	Encoder failure	Encoder failure (impulse does not change)	Change of the servo motors
	Servo drive failure	The servo driver does not send multiple rotation data	Change the servo drive
Position offset (not outputting alarm, causing position offset)	The coupling of mechanical and servo motor is exception.	Whether the coupling part of the mechanical and servo motor offset?	Connect the coupling between the machine and the servo motor correctly
	The input signal line specifications are different and are disturbed	Multi - stranded wire or multi - stranded shielded wire core 0.12mm2 above, multi - ply tinned copper stranded wire?	The input signal line shall be conforming to the specification
	The length of the input signal line is disturbed due to beyond the range of use	It is confirmed that the maximum line length is 3M, and the impedance is less than 100 Ω mega.	Length of signal input line is conforms to the specification
	Encoder failure (impulse does not change)	Encoder failure (impulse does not change)	Change of the servo motors

7.2 Maintenance and inspection of servo driver

7.21 Servo motor inspection

It is only necessary to perform daily simple inspection since AC servo motor does not have electrical brush. It is the general standard in the table during inspection period. Please determine the most appropriate period of inspection according to the service condition and operating environment.

Inspect items	Checking period	Essential for checking and maintenance	Remarks
Confirmation of vibration and sound	Every day	Judging it by feeling and hearing.	No increase compared it to usual.
Visual inspection.	As per the condition of fouling	Clean it with cloth or air gun	—
Insulation resistance measurement	At least once a year	Switch off the connection with the servo unit and measure the insulation resistance by 500V tram egger. It is normal for the resistance value exceeds 10M EU.	Please contact the Vendor when it is below 10M Europe.
Fluid seal replacement.	At least 1 times every 5000 hours	Please contact the Vendor.	Servo motors only has fluid seal.
Comprehensive inspection	At least once in 20000 hours or every 5 years	Please contact the Vendor.	—

7.2.2 Inspection of servo drive

No need for daily inspection, but should check it more than once a year.

Inspect items	Checking period	Essential for checking and maintenance	Remarks
Cleaning of the main body and the circuit board	At least once a year	Please contact the Vendor.	
Screw loosening		The wiring board, the connector installation screw shall not be loosened.	Please tighten it further.

7.2.3 General standards for replacement of internal components of servo drive

Mechanical wear and aging will occur in electrical and electronic parts. To ensure safety, please check regularly.
Please contact the Vendor for replacement of parts.
For the servo drive under overhaul of the company's, its user parameters have been adjusted back to the factory setting. Please be sure to reset the user parameters for using before running.

Part name	Standard replacing years	Conditions of usage
Coolant fan	4 – 5 years	• Ambient temperature annual average 30℃ • Load ratio: less than 80% • Operation rate: less than 20 hours / day
Smooth capacitor	7 – 8 years	
Relay type	—	
Fuse	10 years	
Aluminum electrolytic capacitor on printed circuit board	5 years	

Appendix A User parameters list

Parameter number	Name	Range	Unit	Factory value	Effective	Remarks
Pn000	Basic switch of function selection 0	---	--	0010	Restart	

H [The 3rd bit] [The 2nd bit] [The 1st bit] [The 0 bit]

Direction of rotation selection

0	CCW (counter clockwise) for forward rotation direction
1	CW (clockwise) for forward rotation direction (reverse mode)

Control mode selection

0	Speed control (analog command)
1	Position control (pulse train command)
2	Torque control (analog command)
3	Internal set speed control (node instruction)
4	The internal setting speed control (node instruction)←→ speed control (analog command)
5	The internal setting speed control (node instruction)←→ speed control (pulse train command)
6	The internal setting speed control (node instruction)←→ torque control (analog command)
7	Position control (pulse train command)←→ speed control (analog command)
8	Position control (pulse train command)←→ torque control (analog command)
9	Torque Position control (analog command)←→ speed control (analog command)
A	Speed control (analog command)←→ Zero clamping position
B	Position control (pulse train command) ←→ position control (pulse prohibition)
C	Internal position control
D	Speed control (analog command: PCL control forward, NCL control reversal)
E	spindle Orientation control
F	Spindle speed / position (Cs) control

Servo OFF stopping

0	Reverse braking slows down and stops the motor and put it in free sliding state.
1	Put the motor in the state of inertia operating

The stopping mode of over travel （OT）

0	Reverse braking stops the motor deceleration and put it in free sliding state.
1	Reverse braking slows down and stops the motor and then put it in servo locking state
2	Put the motor in the state of inertia operating

Pn001	Basic switch 1of function selection	----	--	0001	Restart	

H [The 3rd bit] [The 2nd bit] [The 1st bit] [The 0 bit]

The using method of encoder

0	Use as the absolute value encoder to enable the absolute data serial output (PG fractional frequency PA0 port)
1	Use as an incremental encoder.
2	The absolute encoder is used as the absolute encoder to disable the absolute data serial output

Speed control option (T-REF allocation)

0	None
1	Use T-REF as an external torque limit input.
2	Use T-REF as a torque feed forward input
3	Use T-REF as an external torque limit input when P-CL & N-CL are “valid”

Torque control option (V-REF allocation)

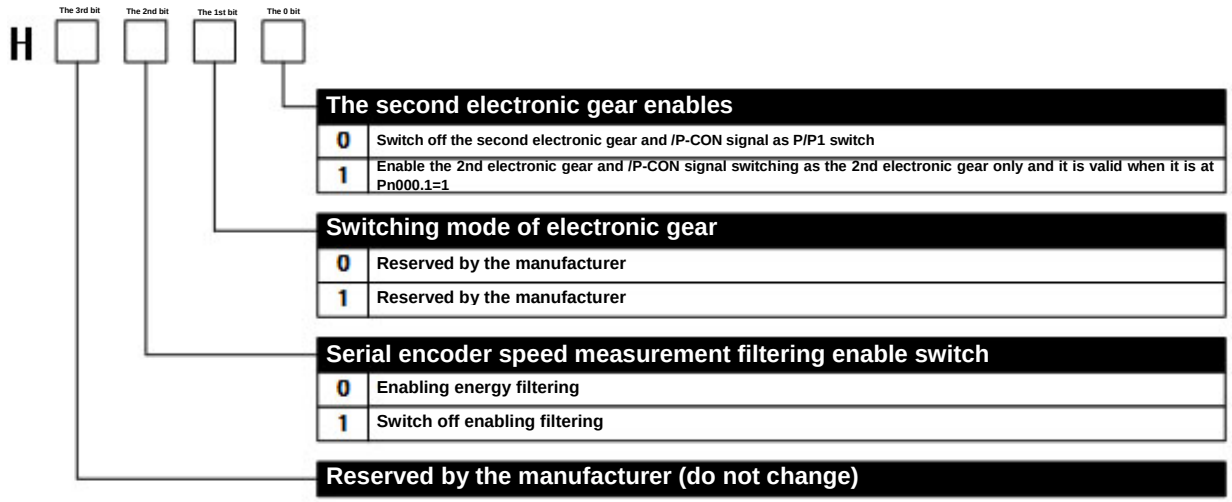
0	None
1	Use V-REF as an external torque limit input.

Feed forward selection under acceleration

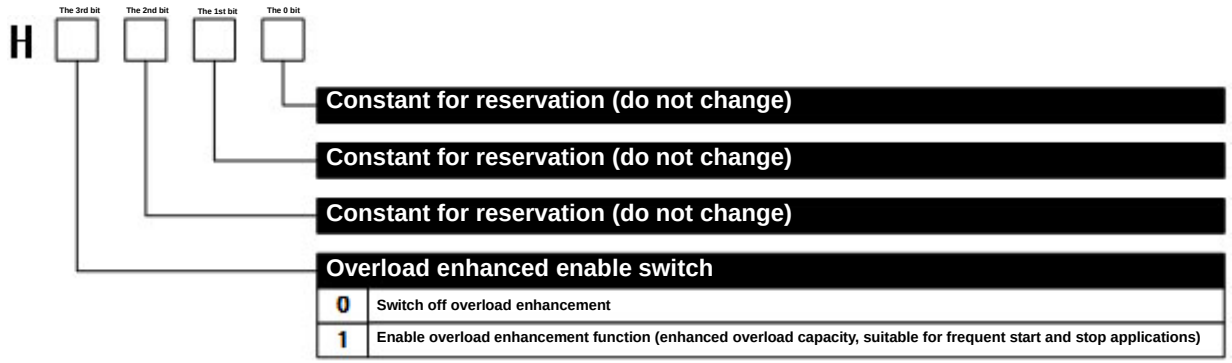
0	Acceleration feed forward type 1 (filtering computational method)
1	Acceleration feed forward type 2 (fast computational method)

Parameter number	Name	Range	Unit	Factory value	Effective	Remarks

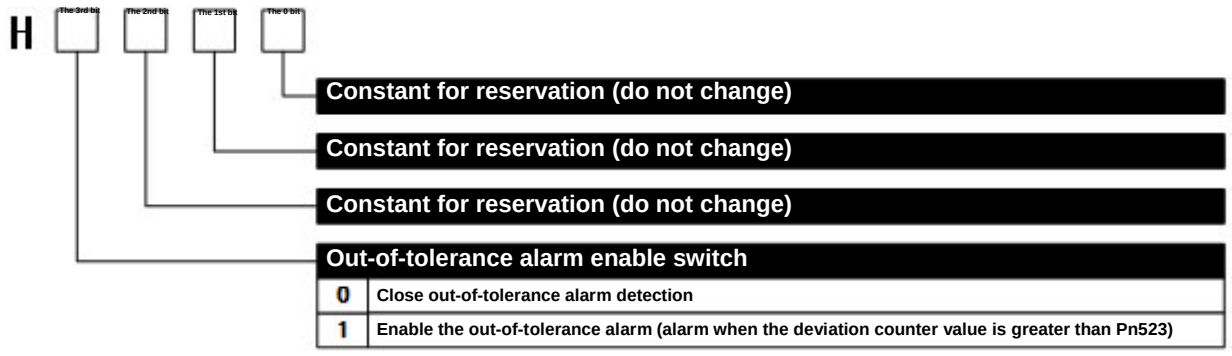
Parameter number	Name	Range	Unit	Factory value	Effective	Remarks
Pn002	Basic switch 2 of function selection	----	--	0000	Restart	



Pn003	Basic switch 3 of function selection	----	--	0000	Restart	



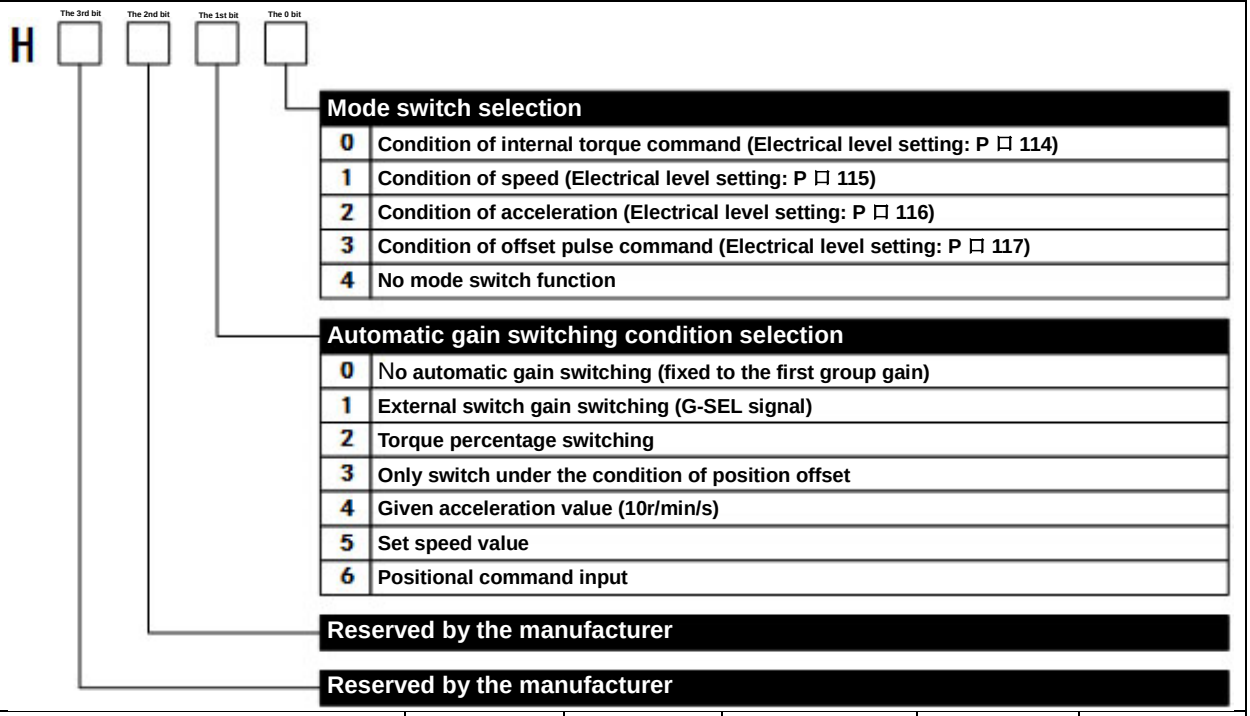
Pn004	Basic switch 4 of function selection	----	--	1100	Restart	



Pn100	Speed loop gain	1 - 20 000	0.1Hz	400	Immediately	
Pn101	Speed loop integral time	1 - 40 000	0.01ms	2000	Immediately	
Pn102	Position loop gain	1 - 20 000	0.1/s	400	Immediately	
Pn103	Rotation inertia ratio	0 - 20 000	1%	0	Immediately	
Pn104	2nd speed loop gain	1 - 20 000	0.1Hz	400	Immediately	
Pn105	2nd speed loop integral time	1 - 40 000	0.01ms	2000	Immediately	
Pn106	2nd position loop gain	1 - 20 000	0.1/s	400	Immediately	
Pn107	Offset (speed offset)	1 - 2000	1rpm	0	Immediately	

Parameter number	Name	Range	Unit	Factory value	Effective	Remarks
Pn108	Offset superposition range	----	Command pulse	0000	Immediately	

Parameter number	Name	Range	Unit	Factory value	Effective	Remarks
Pn109	Feed forward	0 - 100	1%	0	Immediately	
Pn110	Feed forward filtering time	0 - 640	0.1ms	0	Immediately	
Pn111	Acceleration feed forward percentage	0 - 100	1%	0	Immediately	
Pn112	Acceleration feed forward filtering time	0 - 640	0.1ms	0	Immediately	
Pn113	Gain type application switch	0000 - 0064	--	0004	Restart	



Pn114	Mode switch (torque command)	0 - 300	1%	0	Immediately	
Pn115	Mode switch (speed command)	0 – 100 00	1rpm	0	Immediately	
Pn116	Mode switch (acceleration command)	0 - 300	10rpm/s	0	Immediately	
Pn117	Mode switch (offset pulse)	0 – 100 00	Command pulse	0	Immediately	
Pn118	Gain switching delay time	0 – 200 00	0.1ms	0	Immediately	
Pn119	Gain switching amplitude	0 – 200 00	--	0	Immediately	
	Pn113.1=2, Unit: 1% Pn113.1=3, Unit: 1 command pulse	Pn113.1=4, Unit: 10rpm/s Pn113.1=5, Unit: 1rpm		Pn113.1=6, Unit: 1 command pulse		
Pn120	Position gain switching time	0 – 200 00	0.1ms	0	Immediately	
Pn121	Position gain switching hysteresis loop	0 – 200 00	0.1ms	0	Immediately	
Pn122	Friction load	1 - 3000	1 ‰	0	Immediately	
Pn123	Friction compensation velocity hysteresis loop	0 - 100	1rpm	0	Restart	
Pn124	Viscous friction load	0 – 200 00	0.1Hz	0	Immediately	
Pn125	Friction gain	0 – 200 00	1 ‰ /k rpm	0	Immediately	
Pn126	Velocity observer period	0 – 300 00	0.1Hz	0	Immediately	

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn127	On-line automatic tuning type switch	-----	--	1340	Restart	

H The 3rd bit The 2nd bit The 1st bit The 0 bit

Real time automatic gain setting — Power reset: Y

0	None real time automatic gain setting
1	Conventional mode (suitable for applications where load inertia remains unchanged in operating)
2	Conventional mode (suitable for applications where load inertia changes very little in operating)
3	Conventional mode (suitable for applications where load inertia changes very significantly in operating)
4	Vertical load (suitable for applications where load inertia remains unchanged in operating)
5	Vertical load (suitable for applications where load inertia changes very little in operating)
6	Vertical load (suitable for applications where load inertia changes very significantly in operating)

Real time automatic gain mechanical rigidity setting — Power reset: N

0	Mechanical rigidity of real-time automatic gain adjustment may be chosen. The greater value set of the parameter. Faster response. If the parameter is set up too big suddenly, the gain of the system will be changed significantly, which result in great impact on the machine. And it is suggested that a smaller value shall be set first, and increase the rigidity by monitoring the machine working status.
--	
F	

Reserved by the manufacturer

Conventional automatic adjustment mode setting — Power reset: N

0	Rotation circle number: 1 circle, rotation direction: CCW → CW
1	Rotation circle number: 2 circle, rotation direction: CCW → CW
2	Rotation circle number: 3 circle, rotation direction: CCW → CW
3	Rotation circle number: 4 circle, rotation direction: CCW → CW
4	Rotation circle number: 1 circle, rotation direction: CW → CCW
5	Rotation circle number: 2 circle, rotation direction: CW → CCW
6	Rotation circle number: 3 circle, rotation direction: CW → CCW
7	Rotation circle number: 4 circle, rotation direction: CW → CCW

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn200	Selection switch of position control command form	----	--	0000	Restart	

H The 3rd bit The 2nd bit The 1st bit The 0 bit

Offset pulse clearing mode

0	The offset pulse cleared under servo OFF condition, and the offset pulse is not cleared under the over travel status
1	The offset pulse is not cleared when the servo OFF or the over travel.
2	The offset pulse is cleared when the servo OFF or the over travel(except for zero clamp).

Command pulse form

0	Symbol + pulse
1	CW+CCW
2	PhaseA+PhaseB (1 time frequency)
3	PhaseA+PhaseB (double frequency)
4	PhaseA+PhaseB (quadrupling frequency)

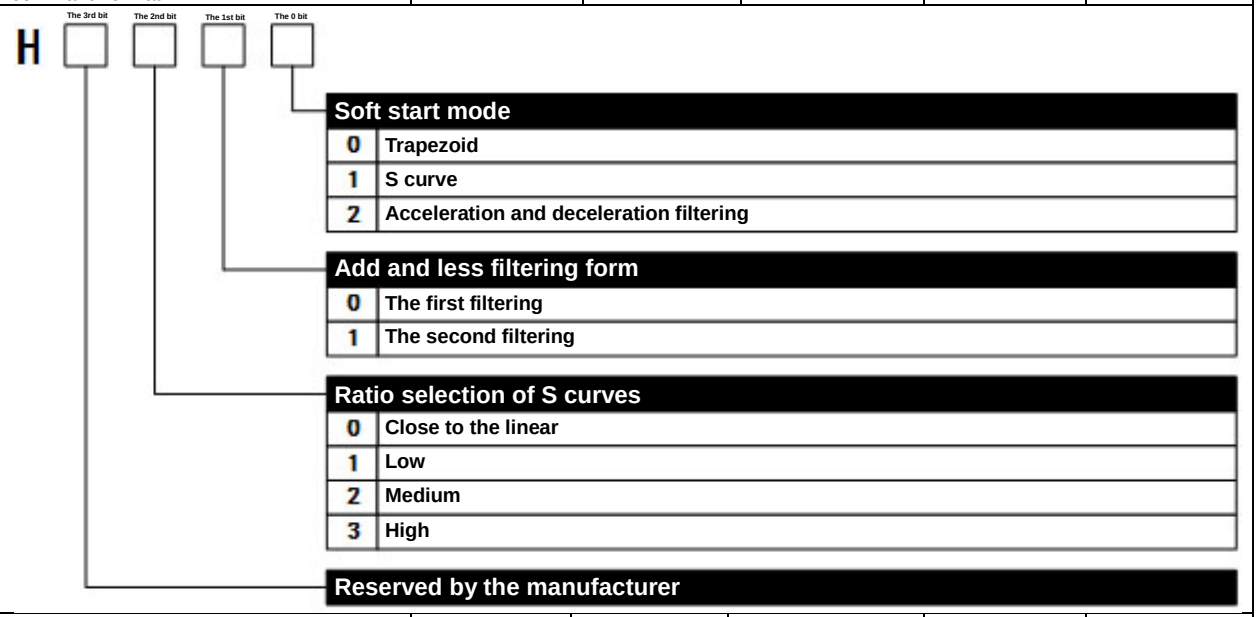
The command pulse signal form negation

0	PULS command does not take the negation, and the SIGN command does not take negation
1	PULS command does not take the negation, and the SIGN command take negation
2	PULS command takes the negation, and the SIGN command does not take negation
3	PULS command takes the negation, and the SIGN command takes negation

Filter selection

0	Bus driver signal command input filter
1	Command input filter for collector open signal

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn201	PG frequency number	16 – 32768	1P/rev	2500	Restart	
Pn202	The 1st Electronic gear numerator	1 - 1073741823	--	1	Restart	
Pn204	The 1st Electronic gear denominator	1 - 1073741823	--	1	Restart	
Pn206	No. 2 Electronic gear numerator	1 - 1073741823	--	1	Restart	
Pn208	Position command deceleration time	0 – 6400	0.1ms	0	Immediately	
Pn209	Position command filtering form selection	0 – 1	--	0	Restart	
Pn300	Speed command Input gain	0 - 3000	rpm/v	150	Immediately	
Pn301	Internal speed 1	0 - 6000	rpm	100	Immediately	
Pn302	Internal speed 2	0 - 6000	rpm	200	Immediately	
Pn303	Internal speed 3	0 - 6000	rpm	300	Restart	
Pn304	Jogging (JOG) speed	0 - 6000	rpm	500	Immediately	
Pn305	Soft start acceleration time	0 - 10000	1ms	0	Immediately	
Pn306	Soft start deceleration time	0 - 10000	1ms	0	Immediately	
Pn307	Velocity command filtering constant	0 - 10000	1ms	0	Immediately	
Pn308	S curve rising time	0 - 10000	1ms	0	Immediately	
Pn309	Selection switch of position control command format	----	--	0000	Restart	
Pn400	Torque command input gain	10 - 100	0.1v/Nm	30	Immediately	
Pn401	Torque command filtering time	0 - 250	0.1ms	4	Immediately	
Pn402	2Nd torque command filtering time	0 - 250	0.1ms	4	Immediately	
Pn403	Forward torque limit	0 - 300	1%	300	Immediately	
Pn404	Reverse torque limit	0 - 300	1%	300	Immediately	
Pn405	External limit of forward torque	0 - 300	1%	100	Immediately	
Pn406	External limit of reverse torque	0 - 300	1%	100	Immediately	
Pn407	External limit of inversed reverse braking torque	0 - 300	1%	300	Immediately	
Pn408	Speed limit under torque control	0 - 6000	1rpm	1500	Immediately	



Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn409	1 segment frequency of notching filter	50 - 5000	1Hz	5000	Immediately	
Pn410	1 segment depth of notching filter	0 - 100	--	10	Immediately	
Pn411	2 segment frequency of notching filter	50 - 5000	1Hz	5000	Immediately	
Pn412	2 segment depth of notching filter	0 - 100	--	10	Immediately	
Pn413	B type vibration frequency	10 - 1000	0.1Hz	1000	Immediately	
Pn414	B type vibration damping	0 - 200	--	25	Immediately	
Pn500	Positioning completed width	0 - 1073741823	The instruction unit	10	Immediately	
Pn502	Rotating detectable value	0 - 3000	1rpm	20	Immediately	
Pn503	Output range of speed uniform signal	0 - 100	1rpm	10	Immediately	
Pn504	Zero clamping velocity value	0 - 3000	1rpm	10	Immediately	
Pn505	Servo ON waiting time	0 - 2000	1ms	0	Immediately	
Pn506	Brake command - servo OFF delay time	0 - 500	1ms	0	Immediately	
Pn507	Brake command output speed value	0 - 6000	1rpm	100	Immediately	
Pn508	Servo OFF- brake command waiting time	10 - 100	10ms	50	Immediately	
Pn509	Input signal selection 0	----	--	4321	Restart	B axis: 8765

H □ □ □ □

The 3rd bit | The 2nd bit | The 1st bit | The 0 bit

/S-ON signal allocation

0	Keep the signal as "invalid"
1	It is valid when CN1-IN1 input signal is ON
2	It is valid when CN1-IN2 input signal is ON
3	It is valid when CN1-IN3 input signal is ON
4	It is valid when CN1-IN4 input signal is ON
5	It is valid when CN1-IN5 input signal is ON
6	It is valid when CN1-IN6 input signal is ON
7	It is valid when CN1-IN7 input signal is ON
8	It is valid when CN1-IN8 input signal is ON
9	Keep the signal as "valid"

/P-CON signal allocation (P control when it is ON)

0-9	Same as /S-ON signal allocation

P-OT signal allocation (it is prohibited to have forward rotation side drive when it is OFF)

0	Keep the signal as "Prohibited to have forward rotation side drive"
1	It is valid when CN1-IN1 input signal is ON
2	It is valid when CN1-IN2 input signal is ON
3	It is valid when CN1-IN3 input signal is ON
4	It is valid when CN1-IN4 input signal is ON
5	It is valid when CN1-IN5 input signal is ON
6	It is valid when CN1-IN6 input signal is ON
7	It is valid when CN1-IN7 input signal is ON
8	It is valid when CN1-IN8 input signal is ON
9	Fix the signal as "Allowed to have forward rotation side drive"

N-OT signal allocation (it is prohibited to have reversal rotation side drive when it is OFF)

0-9	Same as P-OT signal allocation

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn510	Input signal selection 1	----	--	8765	Restart	B axis: 0000

H The 3rd bit The 2nd bit The 1st bit The 0 bit

/ALIM-RST signal allocation (clear alarms when it is from OFF to ON)

0	Keep the signal at "OFF"
1	It is valid when CN1-IN1 input signal is ON
2	It is valid when CN1-IN2 input signal is ON
3	It is valid when CN1-IN3 input signal is ON
4	It is valid when CN1-IN4 input signal is ON
5	It is valid when CN1-IN5 input signal is ON
6	It is valid when CN1-IN6 input signal is ON
7	It is valid when CN1-IN7 input signal is ON
8	It is valid when CN1-IN8 input signal is ON
9	Keep the signal at "ON"

/CLR signal allocation

0-9	Same as /S-ON signal settings

/P-CL signal allocation

0-9	Same as /S-ON signal settings

/N-CL signal allocation

0-9	Same as /S-ON signal settings

Pn511	Input signal selection 2	----	--	0000	Restart	

H The 3rd bit The 2nd bit The 1st bit The 0 bit

/G-SEL signal allocation

0-9	Same as /S-ON signal settings

/POSO signal allocation [M2/M3: external interlock /EXT1 signal allocation] [ECAT: external/EXT1 signal allocation]

0-9	Same as /S-ON signal settings

/POS1 signal allocation [M2/M3: external interlock /EXT1 signal allocation] [ECAT: external/EXT2 signal allocation]

0-9	Same as /S-ON signal settings

/POS2 signal allocation [M2/M3: external interlock /EXT3 signal allocation]

0-9	Same as /S-ON signal settings

Pn512	Input signal selection 3	----	--	0000	Restart	

H The 3rd bit The 2nd bit The 1st bit The 0 bit

/HOME-REF [M2/M3 bus: allocation of /DEC) signal of the original point reset reduction and deceleration switch

0-9	Same as /S-ON signal settings

/POS-START

0-9	Same as /S-ON signal settings

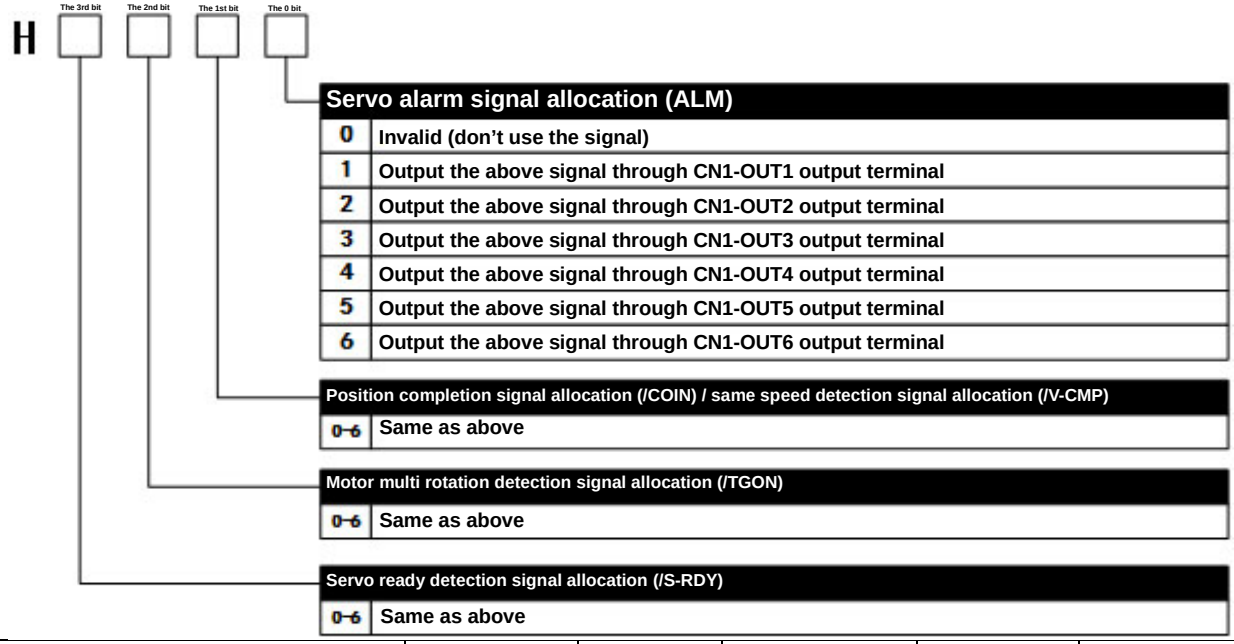
/POS-STEP

0-9	Same as /S-ON signal settings

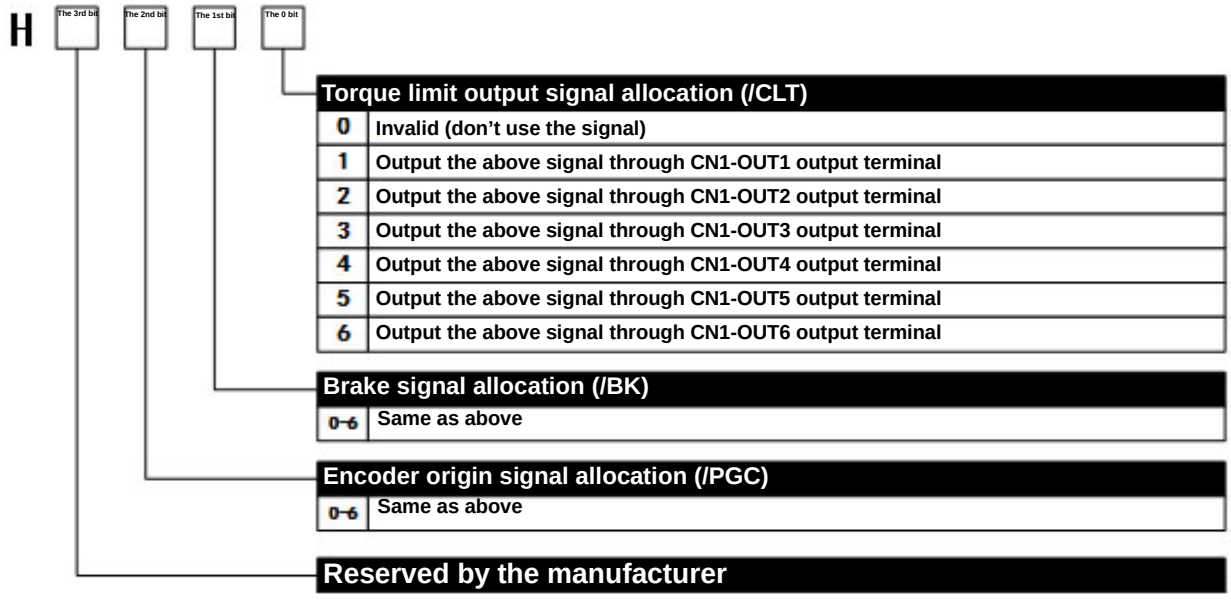
/POS-START-HOME

0-9	Same as /S-ON signal settings

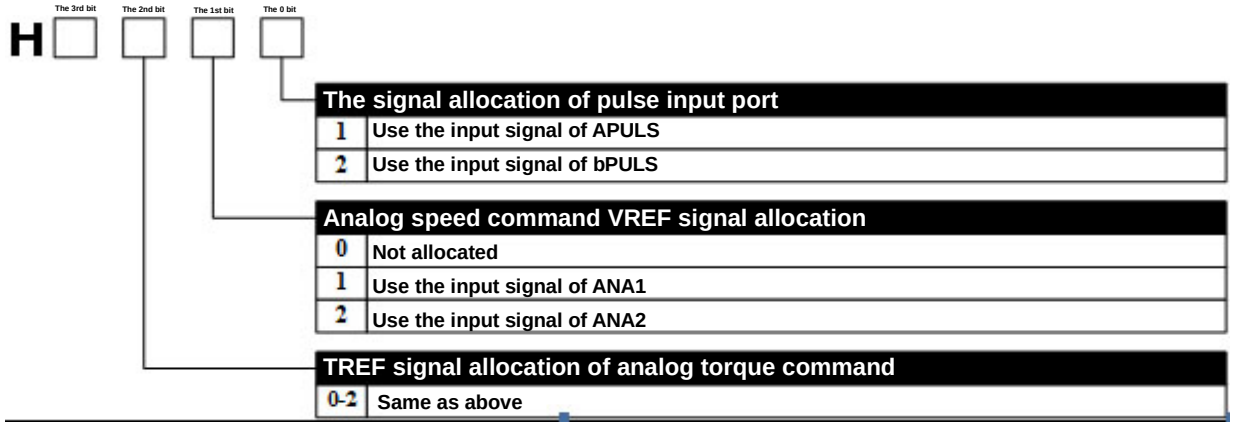
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn513	Output signal selection 0	----	--	0001	Restart	A axis: 0001 b axis: 0004



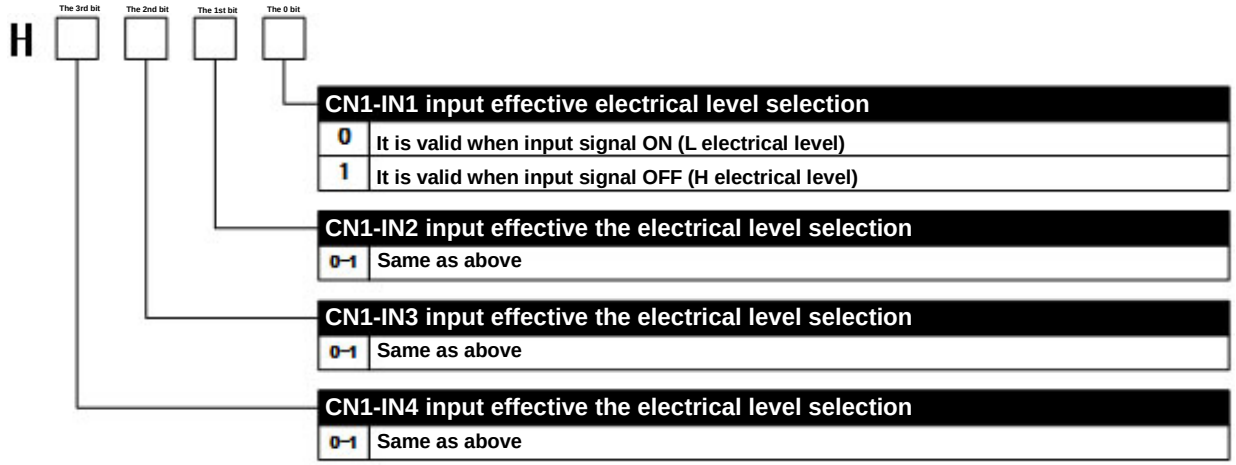
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn514	Input signal selection 1	---	--	0060	Restart	A axis: 0000 b axis: 0000



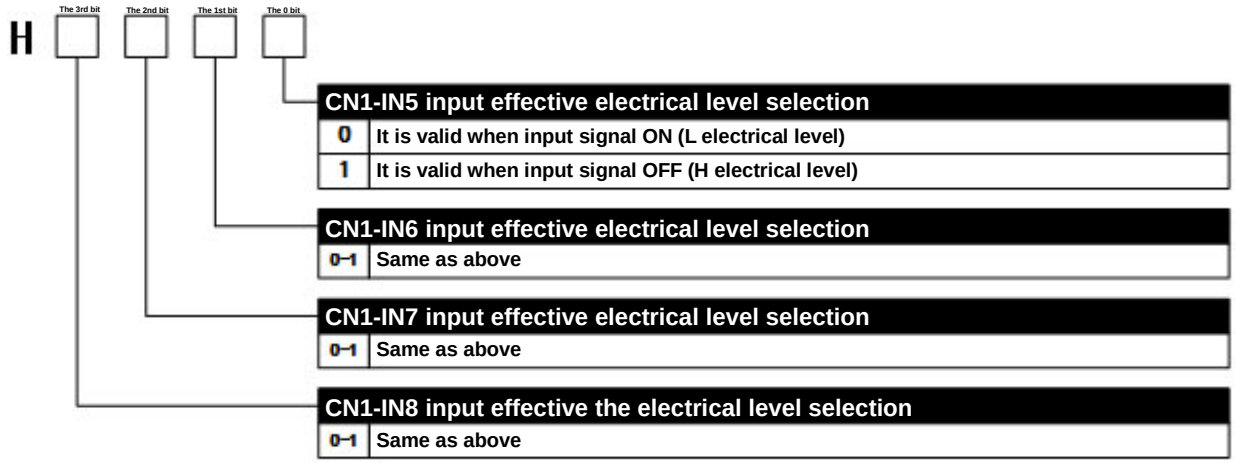
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn516	Input signal selection 2	---	--	0211	Restart	A axis: 0011 b axis: 0022



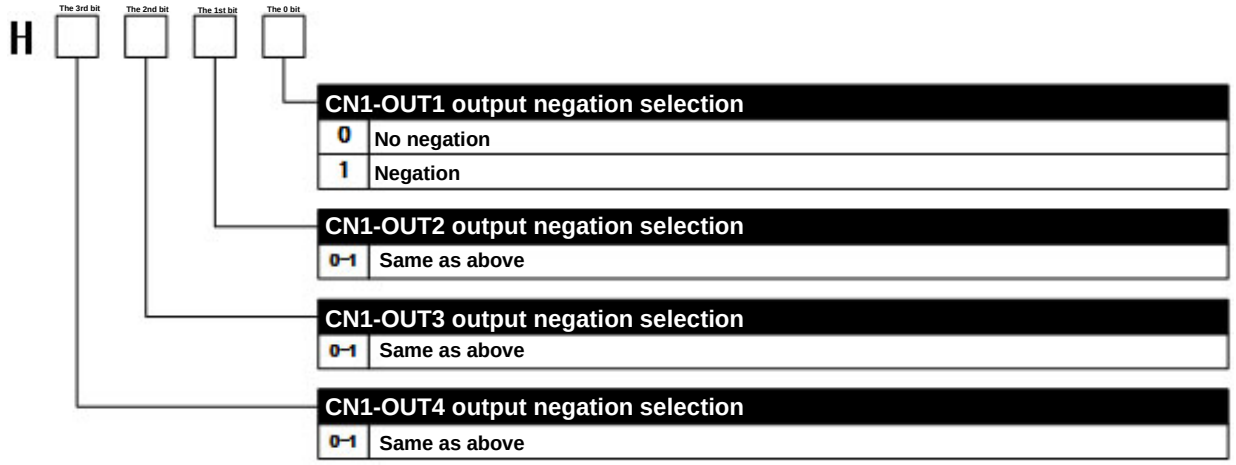
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn517	Input port filtering time	0 – 100	0.1ms	1	Immediately	
Pn518	Alarm input port filtering time	0 - 3	0.1ms	1	Immediately	
Pn519	Input port signal effective electrical level selection 0	----	--	0000	Immediately	



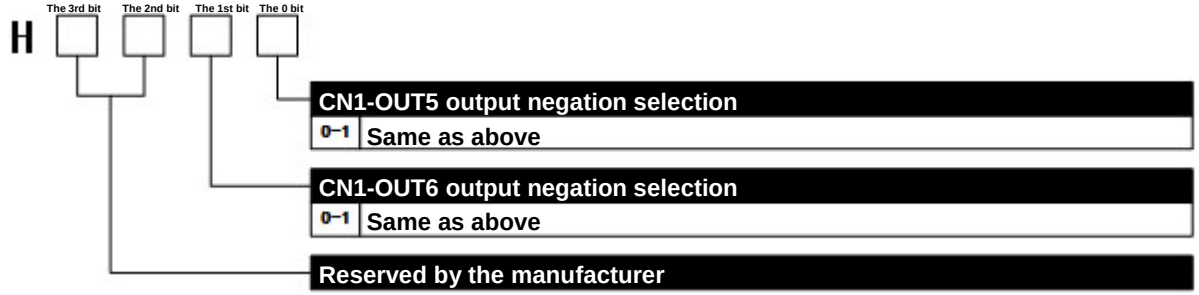
Pn520	Input port signal effective electrical level selection 1	----	--	0000	Immediately	



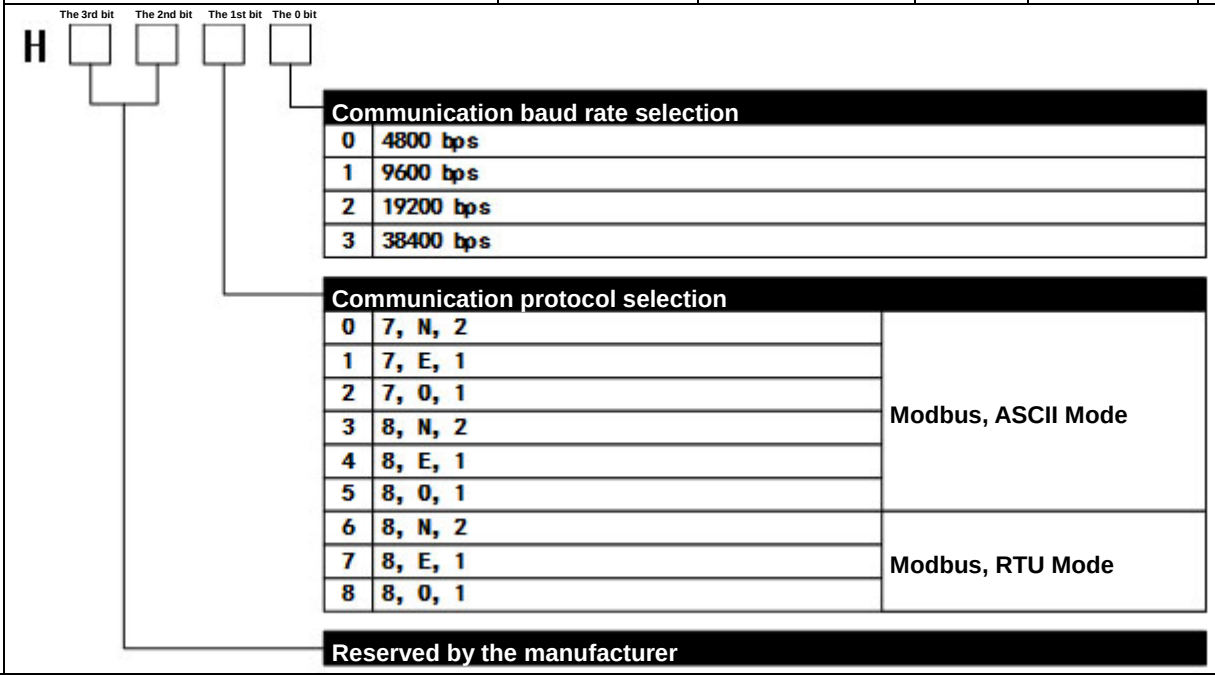
Pn521	Output port signal negation selection 0	---	--	0000	Immediately	



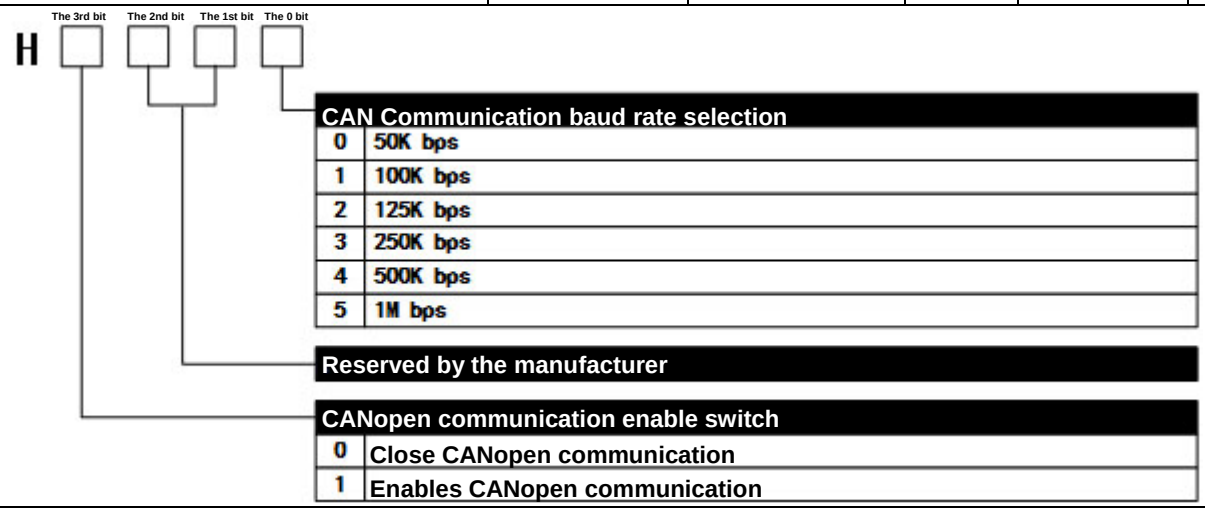
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn522	Output port signal negation selection 1	----	--	0000	Immediately	

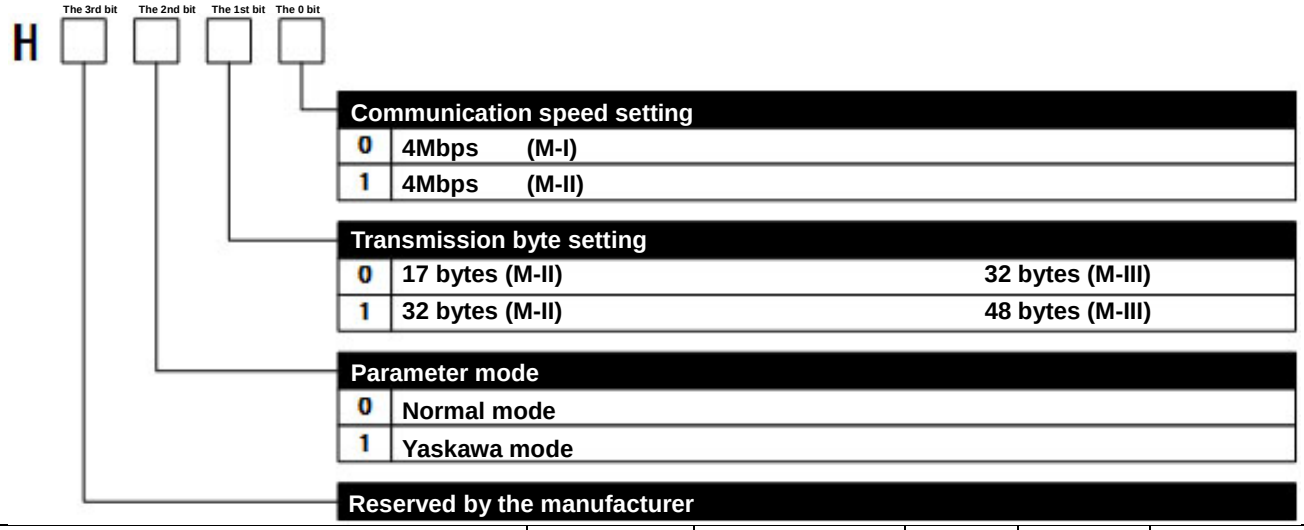


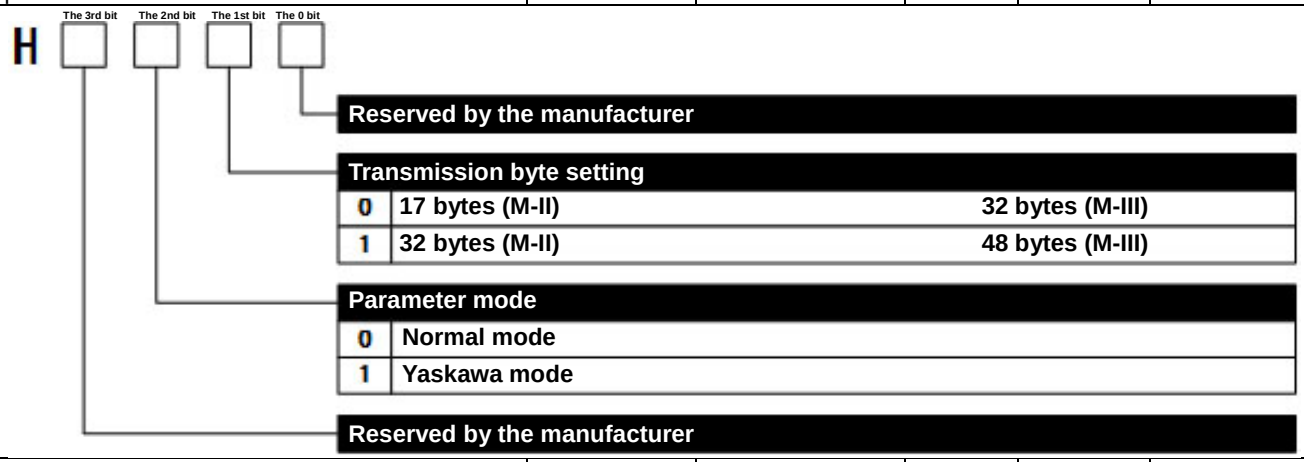
Pn523	Offset pulse overflow electrical level	1 - 1073741823	Command pulse	524288	Immediately	
Pn526	Positioning completed time	0 - 60000	0.1ms	500	Immediately	
Pn527	Analog input speed command filtering time	0 - 32768	0.1ms	0	Immediately	
Pn528	Analog input torque command filtering time	0 - 32768	0.1ms	0	Immediately	
Pn600	Axis address(Modbus/CANopen/USB)	1 - 127	--	1	Restart	B axis: 2
Pn601	Modbus communication parameter selection switch	----	--	0051	Restart	



Pn603	CANopen communication parameter selection switch	----	--	0004	Restart	

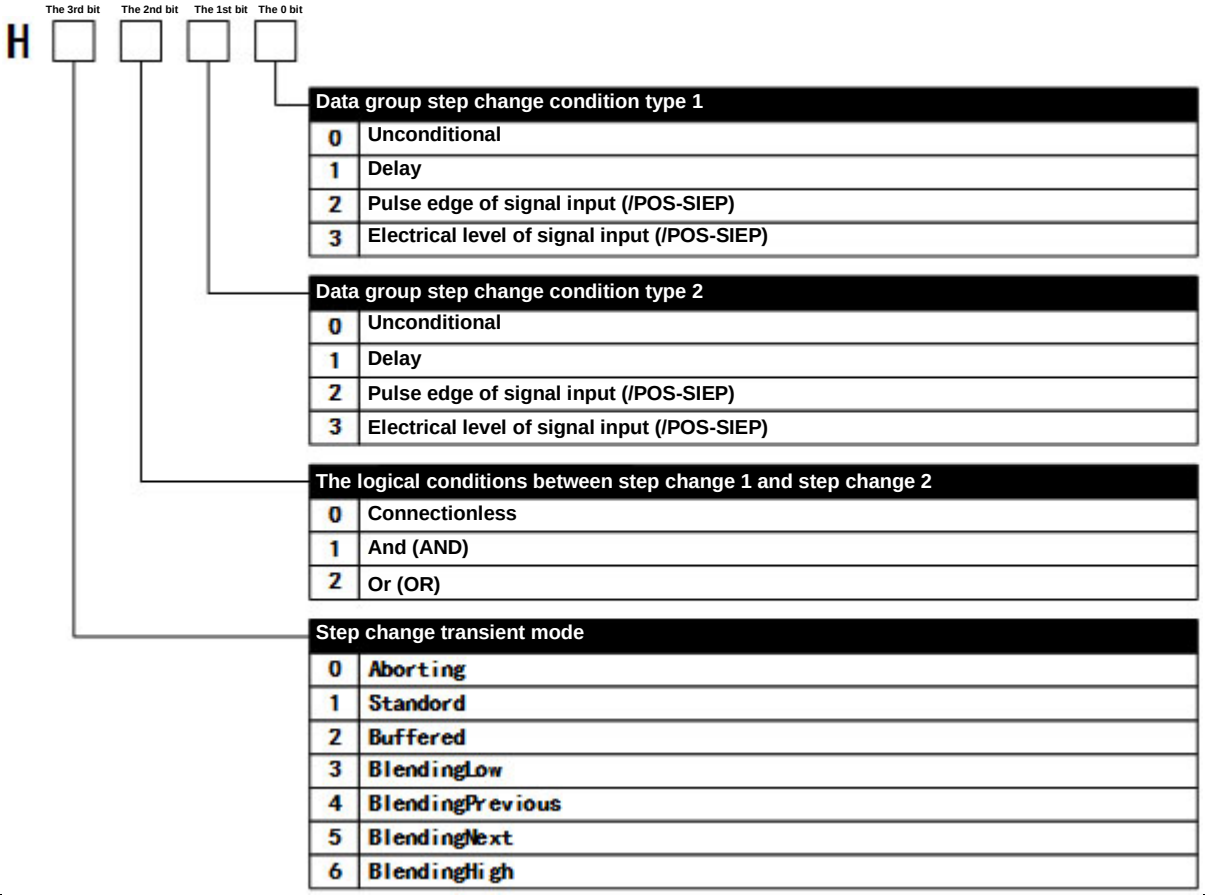


Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn605	M2 communication parameter selection switch	----	--	0111	Restart	
						
Pn606	M2 axis address	0000 - 00FE	--	0001	Restart	B axis: 0002

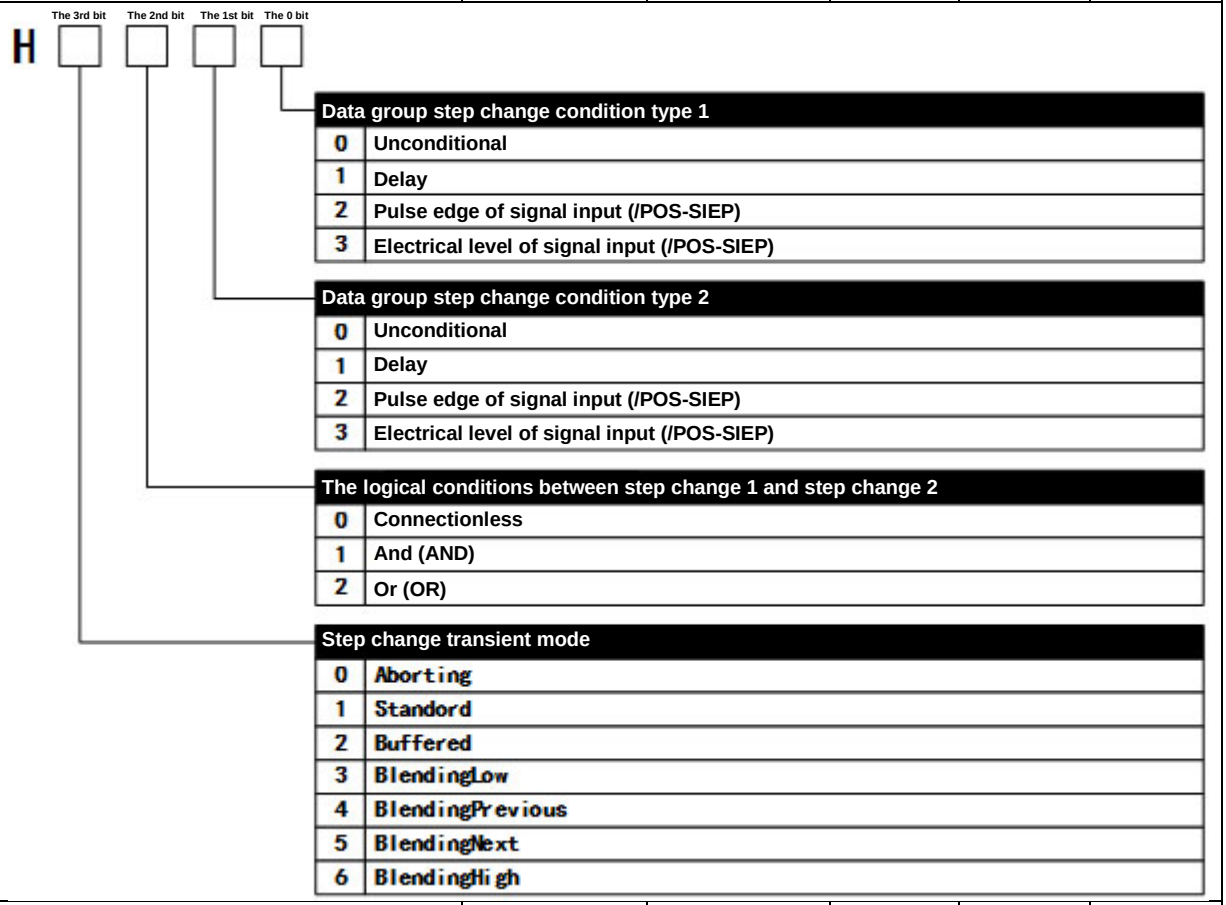
Pn605	Selection switch of M3 communication parameter	---	--	0111	Restart	
						
Pn606	M3 axis address	0000 - 00FE	—	0021	Restart	B axis: 0022

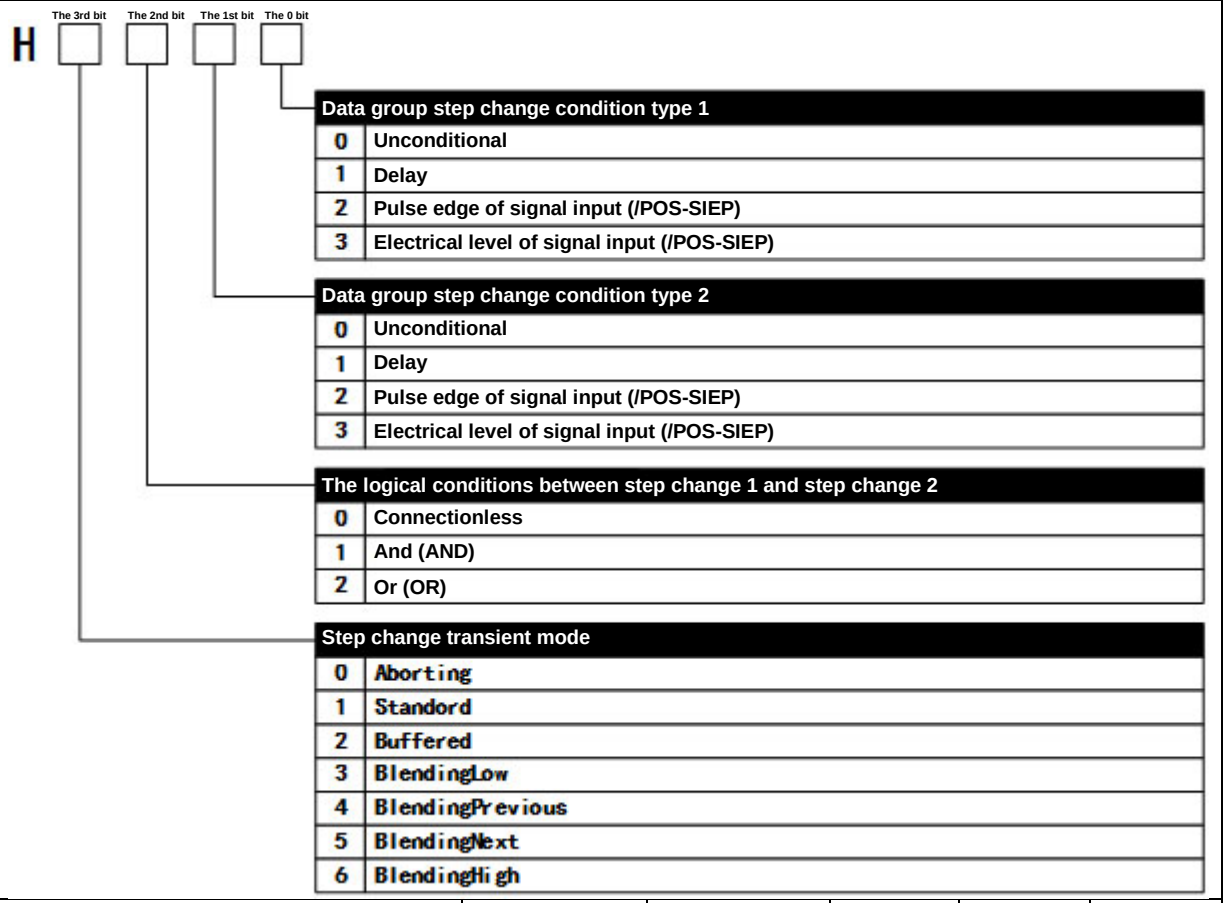
Pn605	EtherCAT Station address selection	0 - 1	—	0	Restart	B axis invalid
	0：The setting value of PA60 parameter is the EtherCAT station address (Station alias) 1：The value (0004h) of SII area Ether CAT is the station address (Station alias)					
Pn606	EtherCAT the station address	0000 ~ FFFF	—	0000	Restart	B axis invalid

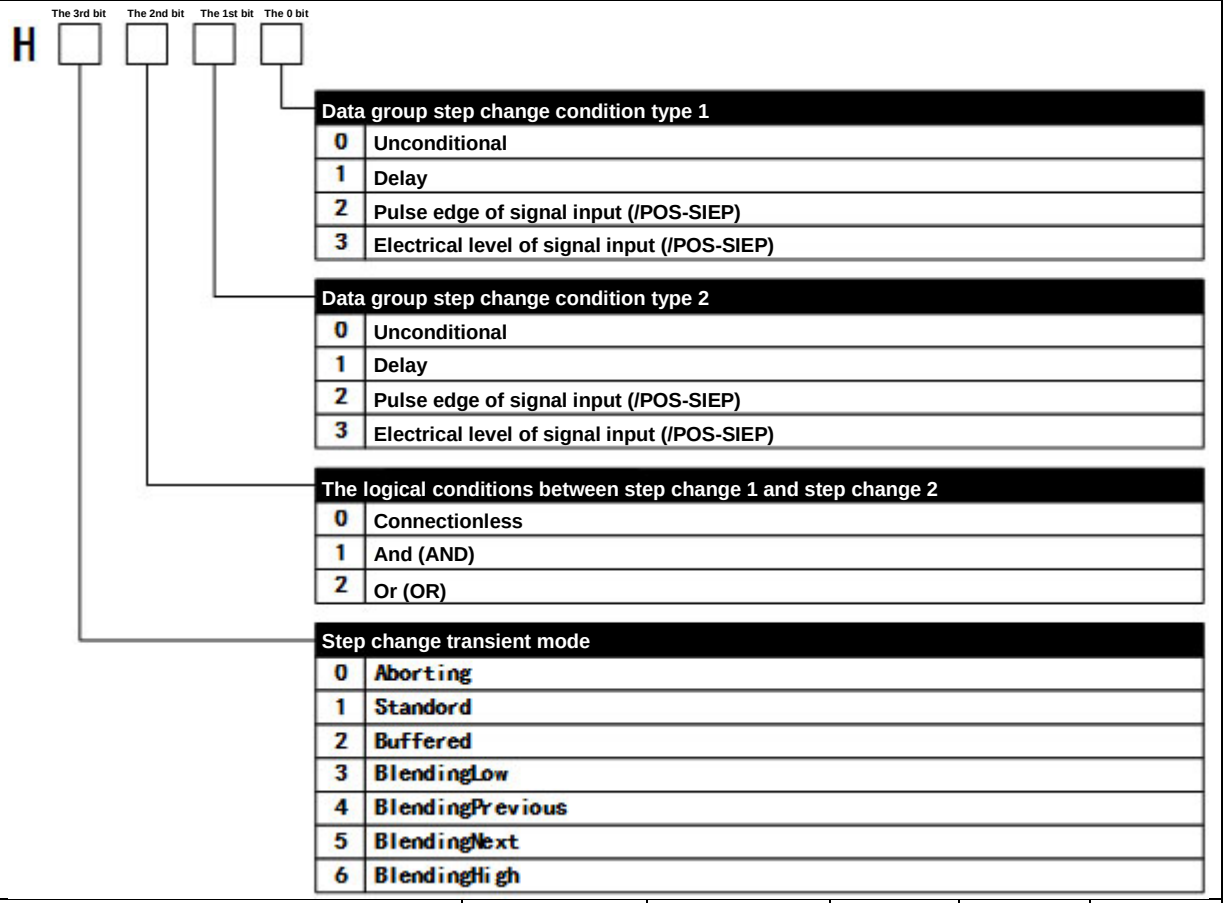
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn610	No. 8 data group type	----	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn611	No. 8 group data group low position	-9999 - +9 999	The command unit	0	Restart	
Pn612	No. 8 group data group high position	-9999 - +9 999	10000 the command unit	0	Restart	
Pn613	No. 8 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn614	No. 8 data group step changing property	----	--	0000	Restart	
Pn615	No. 8 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn616	No. 8 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn617	No. 8 data group subsequent data group	0 - 14	--	9	Restart	

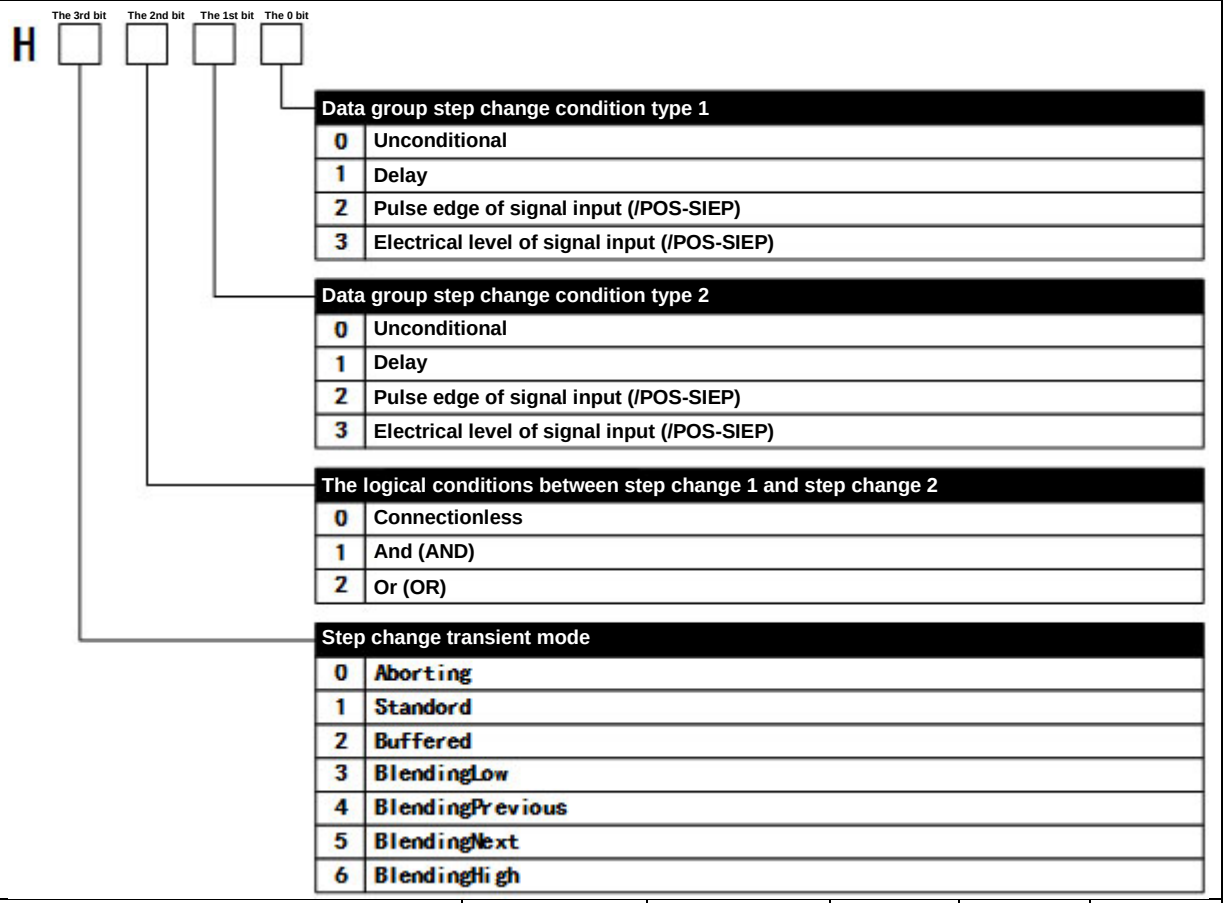


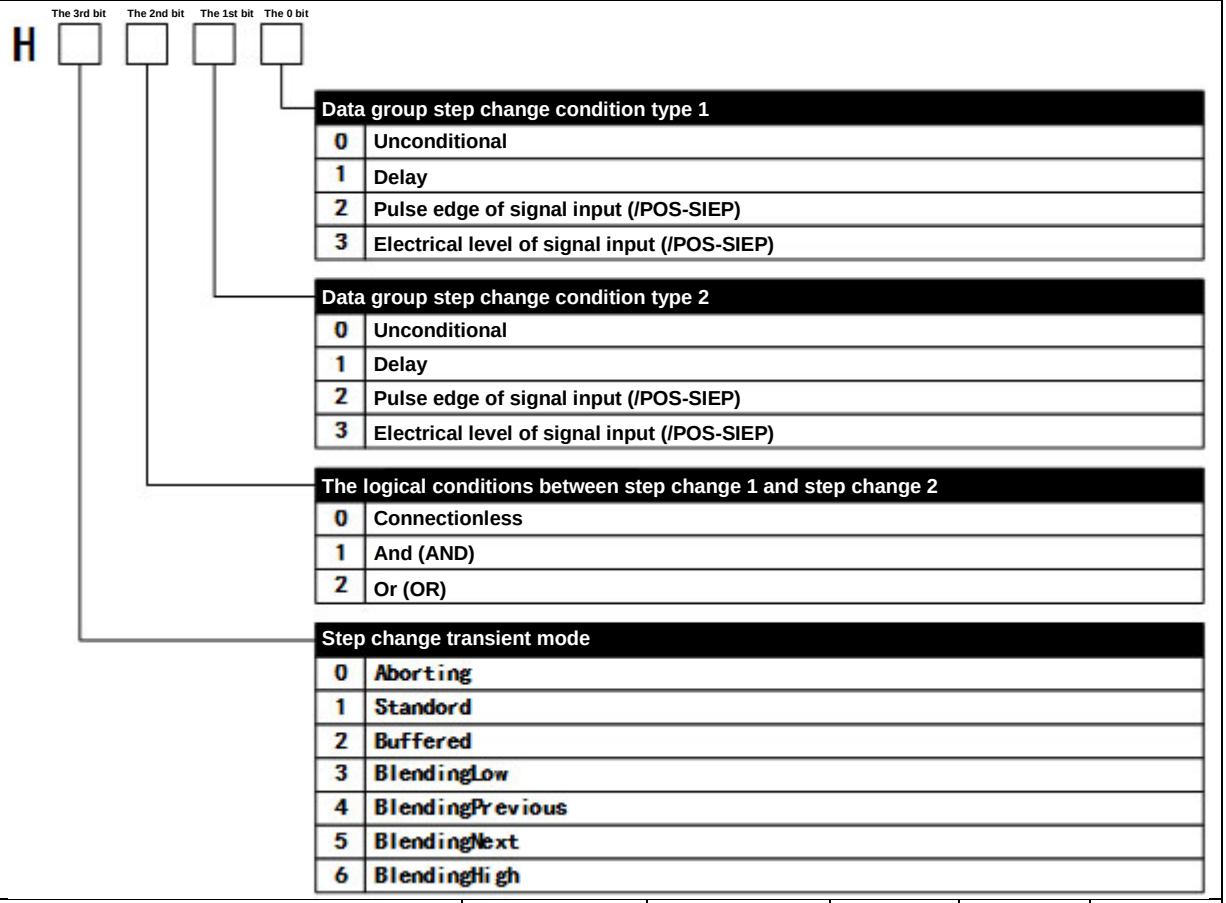
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn618	No. 9 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn619	No. 9 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn620	No. 9 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn621	No. 9 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn622	No. 9 data group step changing property	---	--	0000	Restart	
Pn623	No. 9 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn624	No. 9 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn625	No. 9 data group subsequent data group	0 - 14	--	9	Restart	



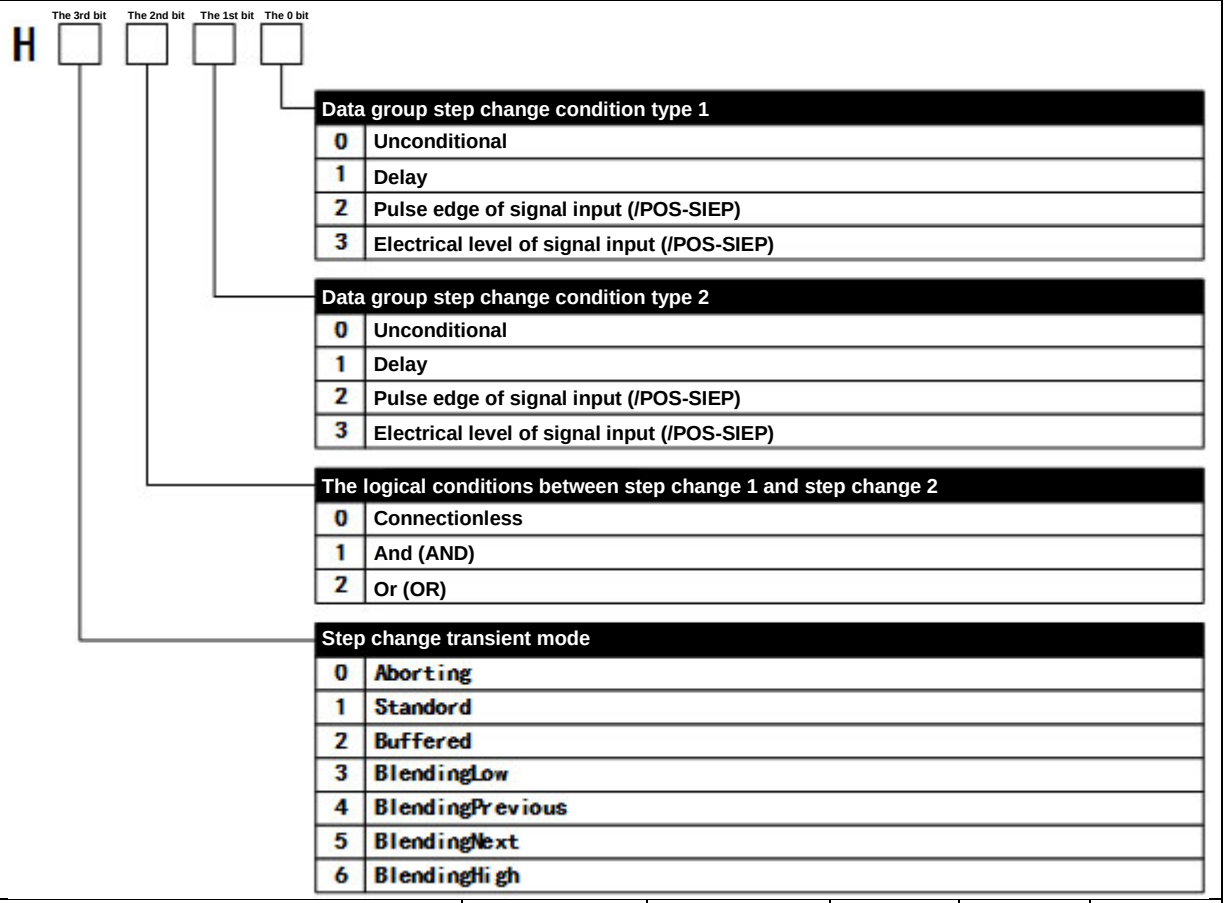
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn634	No. 11 data group type	----	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn635	No. 11 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn636	No. 11 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn637	No. 11 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn638	No. 11 data group step changing property	---	--	0000	Restart	
						
Pn639	No. 11 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn640	No. 11 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn641	No. 11 data group subsequent data group	0 - 14	--	9	Restart	

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn642	No. 12 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn643	No. 12 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn644	No. 12 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn645	No. 12 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn646	No. 12 data group step changing property	---	--	0000	Restart	
						
Pn647	No. 12 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn648	No. 12 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0---65535, the waiting time is 0 - 65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn649	No. 12 data group subsequent data group	0 - 14	--	9	Restart	

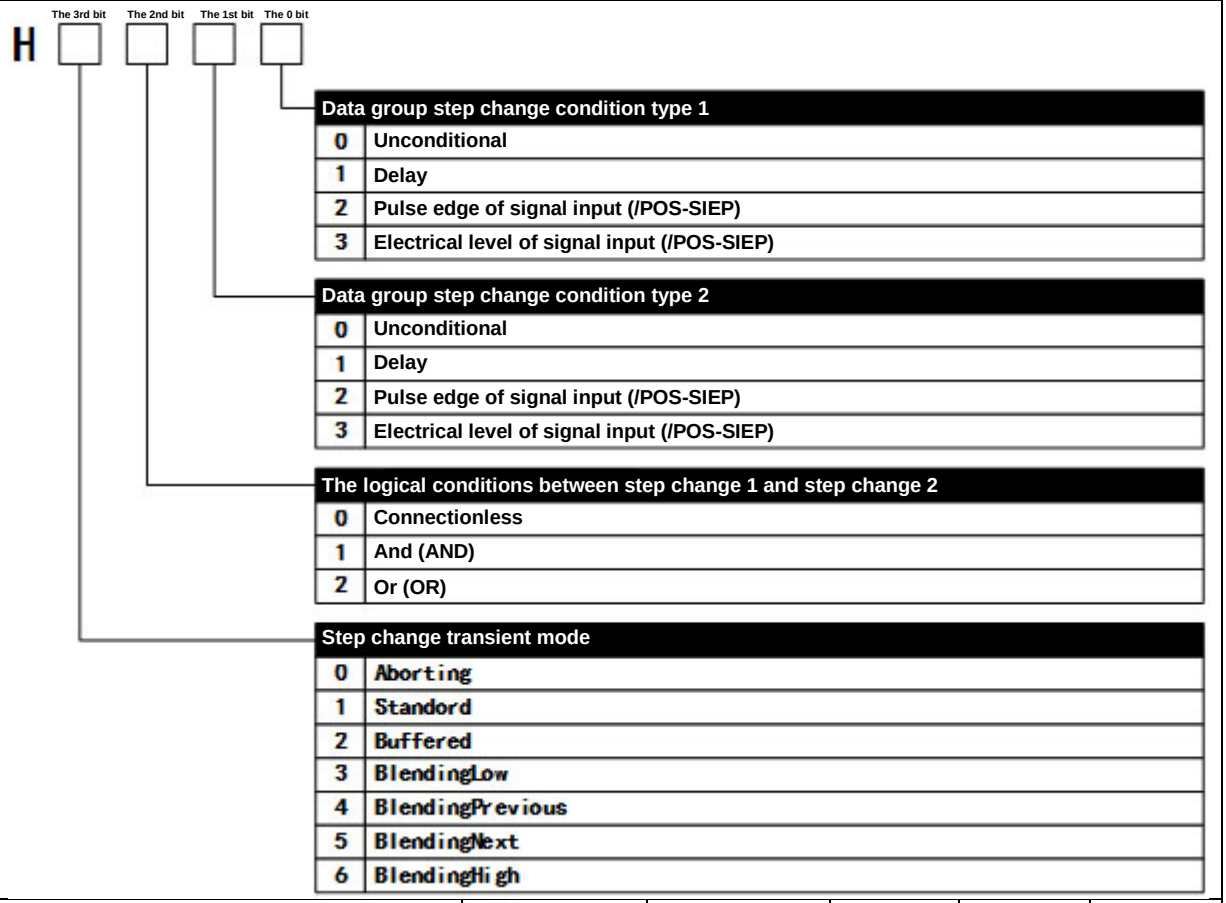
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn650	No. 13 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn651	No. 13 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn652	No. 13 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn653	No. 13 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn654	No. 13 data group step changing property	---	--	0000	Restart	
						
Pn655	No. 13 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn656	No. 13 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn657	No. 13 data group subsequent data group	0 - 14	--	9	Restart	

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn658	No. 14 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn659	No. 14 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn660	No. 14 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn661	No. 14 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn662	No. 14 data group step changing property	---	--	0000	Restart	
						
Pn663	No. 14 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn664	No. 14 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn665	No. 14 data group subsequent data group	0 - 14	--	9	Restart	

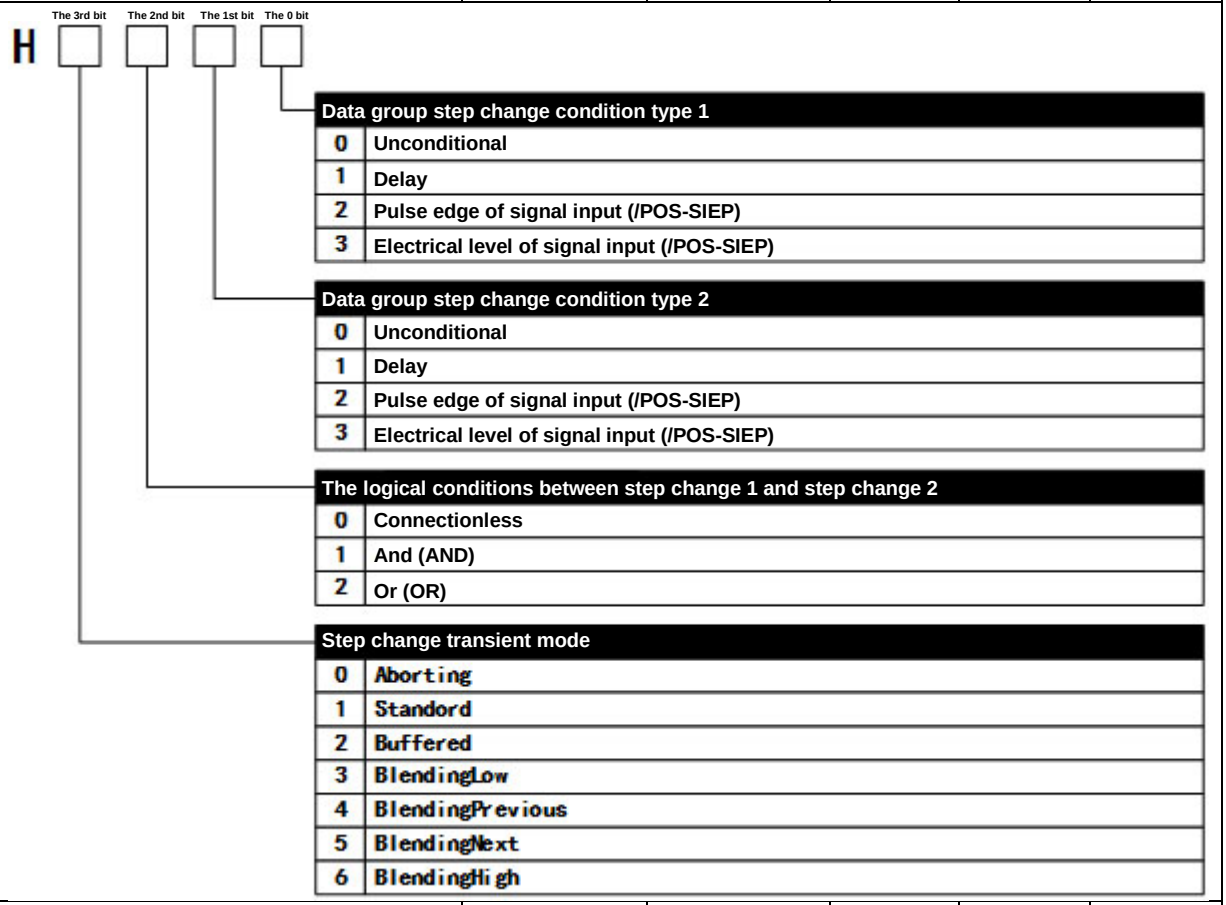
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn700	No. 0 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn701	No. 0 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn702	No. 0 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn703	No. 0 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn704	No. 0 data group step changing property	----	--	0000	Restart	



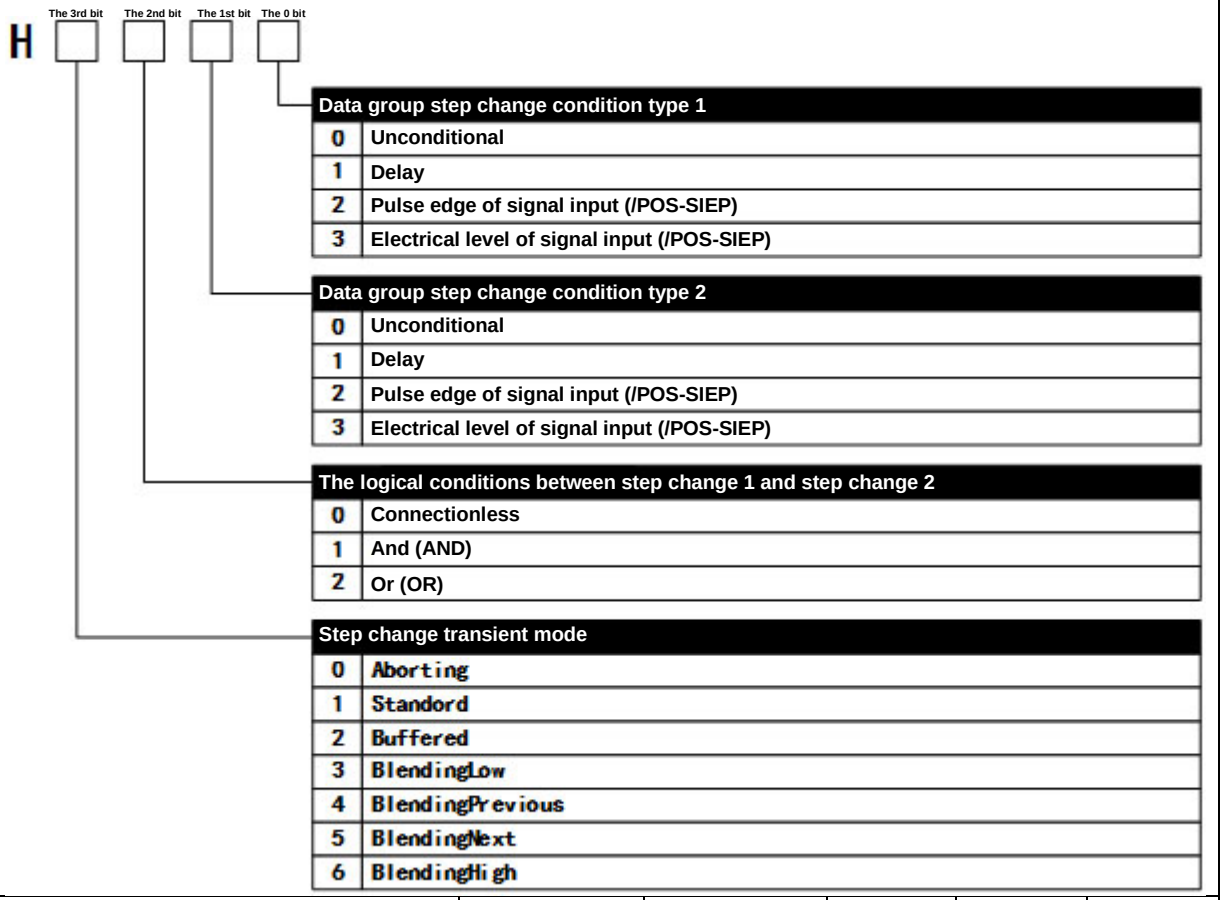
Pn705	No. 0 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn706	No. 0 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn707	No. 0 data group subsequent data group	0 - 14	--	9	Restart	

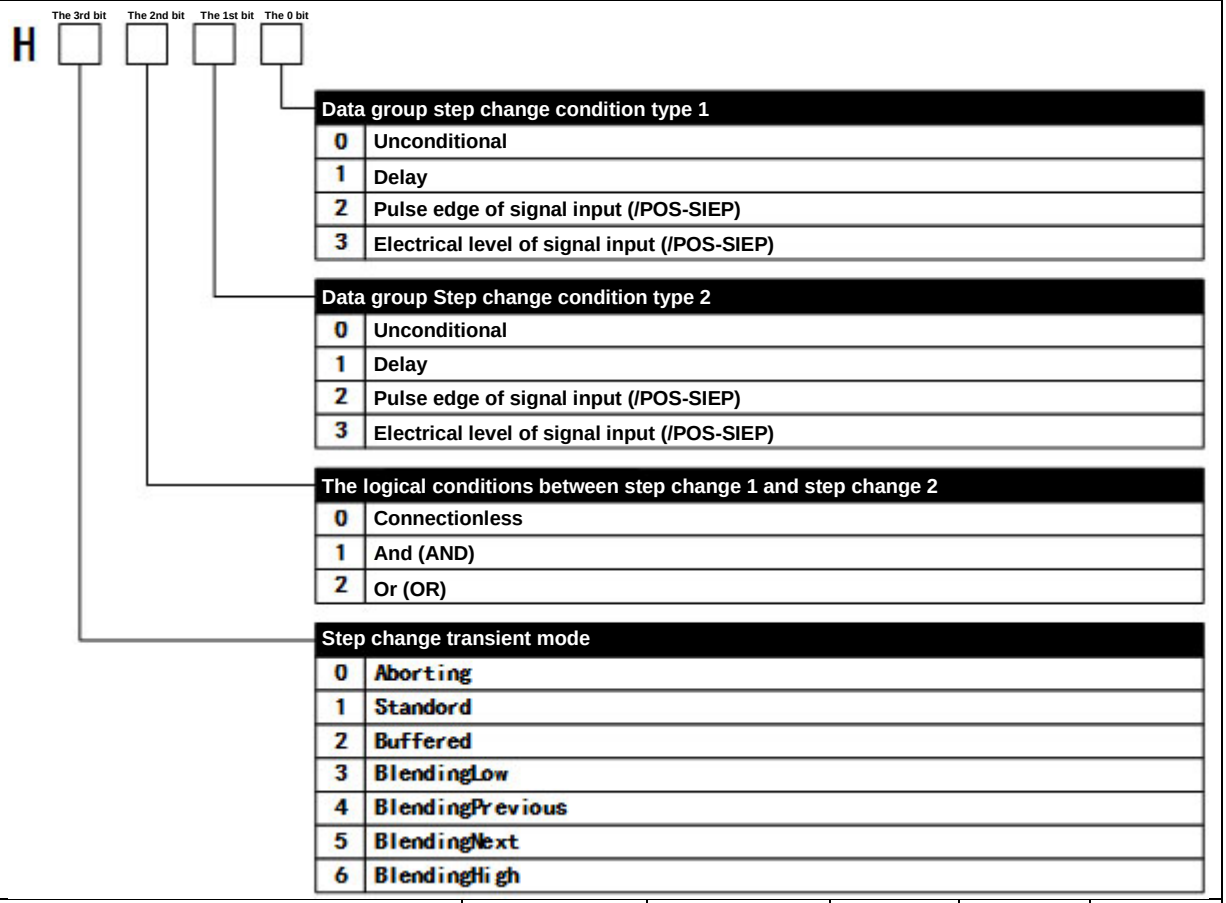
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn708	No. 1 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn709	No. 1 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn710	No. 1 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn711	No. 1 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn712	No. 1 data group step changing property	----	--	0000	Restart	
						
Pn713	No. 1 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn714	No. 1 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn715	No. 1 data group subsequent data group	0 - 14	--	9	Restart	

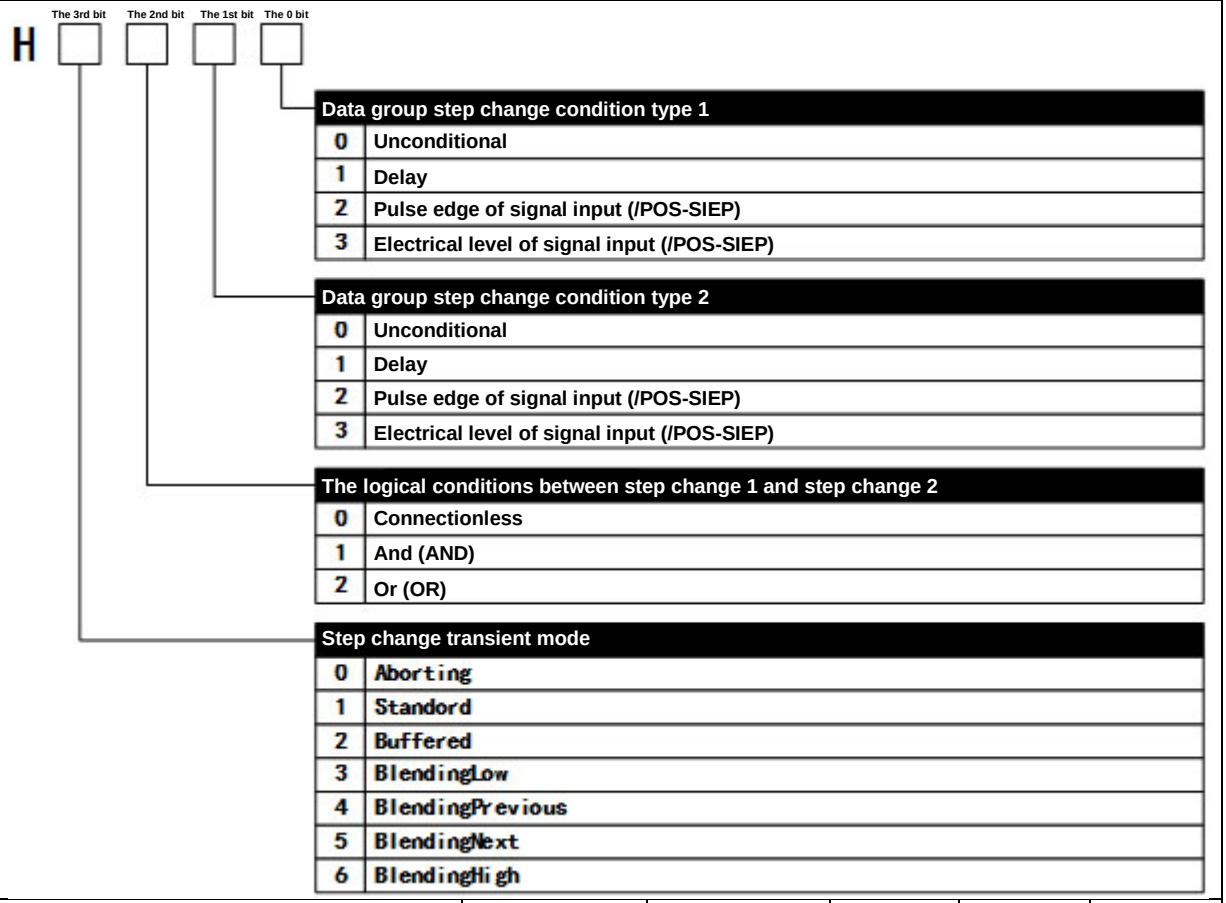
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn716	No. 2 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn717	No. 2 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn718	No. 2 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn719	No. 2 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn720	No. 2 data group step changing property	----	--	0000	Restart	
Pn721	No. 2 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn722	No. 2 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn723	No. 2 data group subsequent data group	0 - 14	--	9	Restart	

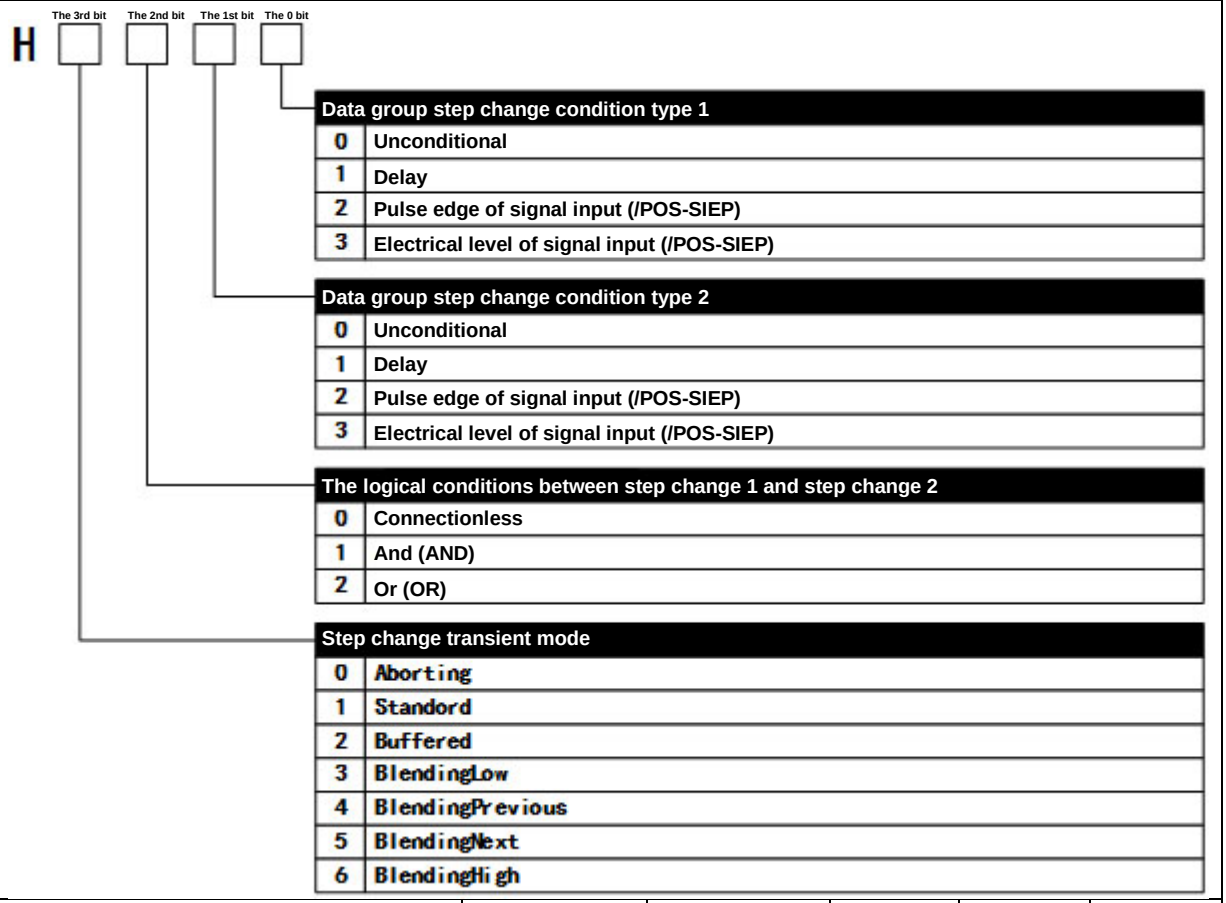


Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn724	No. 3 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn725	No. 3 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn726	No. 3 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn727	No. 3 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn728	No. 3 data group step changing property	---	--	0000	Restart	
Pn729	No. 3 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn730	No. 3 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn731	No. 3 data group subsequent data group	0 - 14	--	9	Restart	

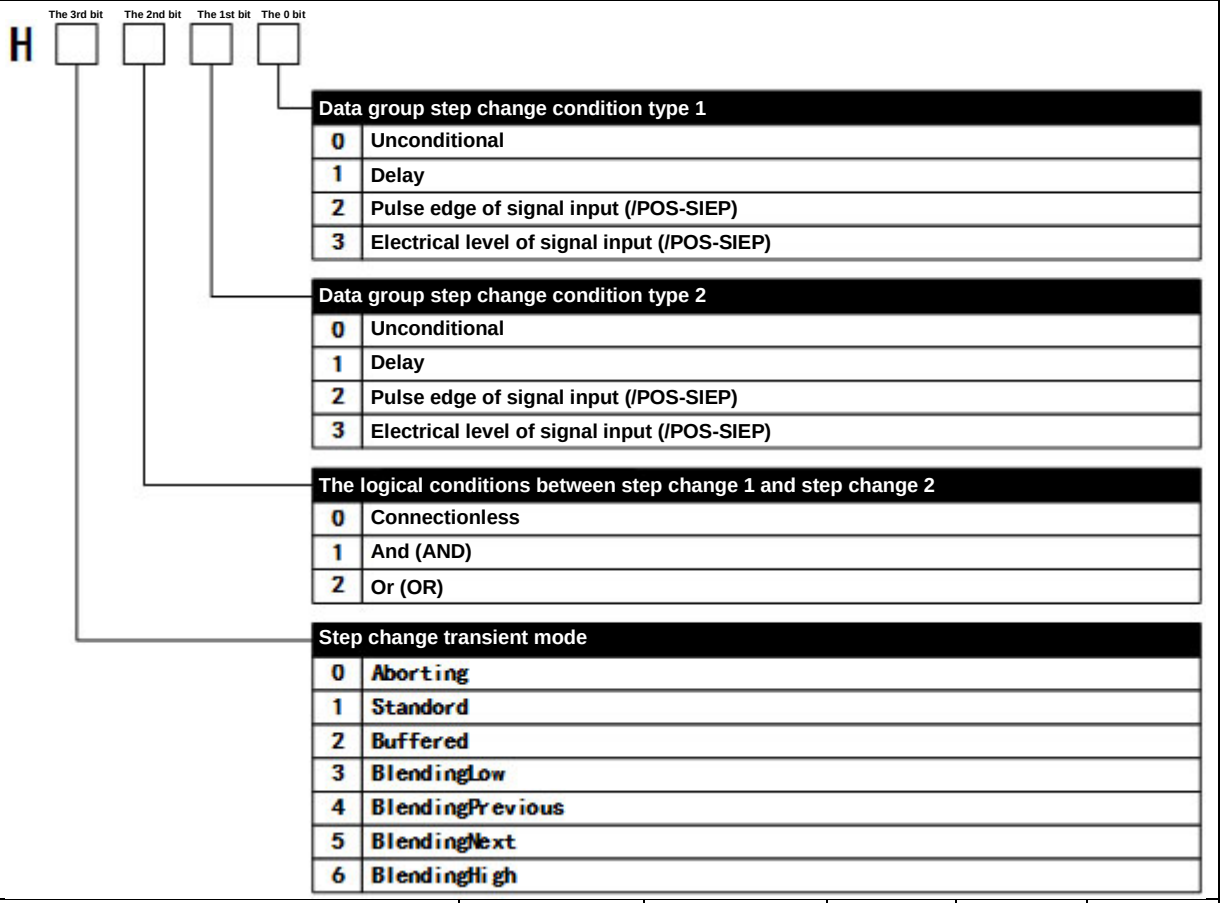


Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn732	No. 4 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn733	No. 4 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn734	No. 4 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn735	No. 4 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn736	No. 4 data group step changing property	---	--	0000	Restart	
						
Pn737	No. 4 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn738	No. 4 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn739	No. 4 data group subsequent data group	0 - 14	--	9	Restart	

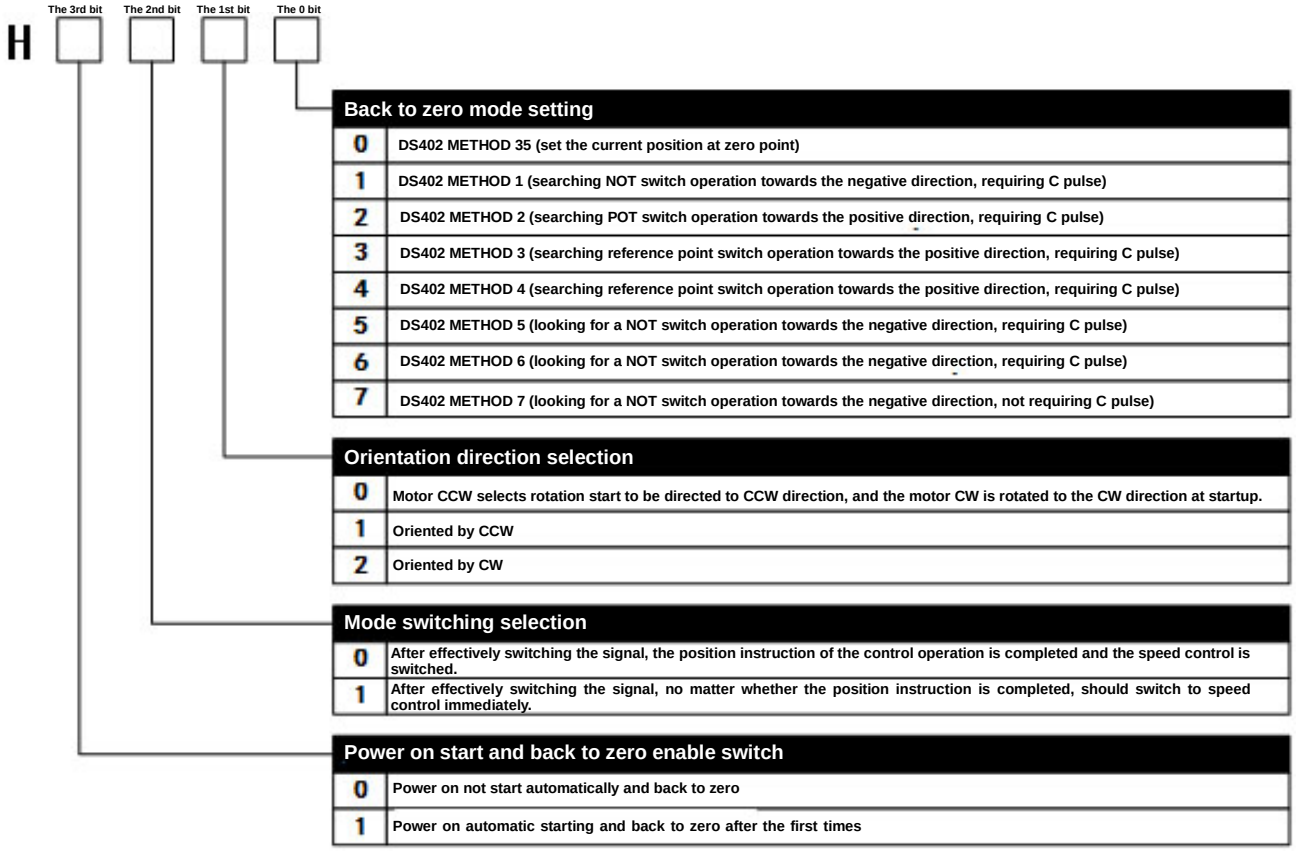
Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn740	No. 5 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn741	No. 5 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn742	No. 5 data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn743	No. 5 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn744	No. 5 data group step changing property	----	--	0000	Restart	
						
Pn745	No. 5 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn746	No. 5 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn747	No. 5 data group subsequent data group	0 - 14	--	9	Restart	

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn748	No. 6 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn749	No. 6 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn750	No. 6 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn751	No. 6 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn752	No. 6 data group step changing property	---	--	0000	Restart	
						
Pn753	No. 6 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn754	No. 6 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn755	No. 6 data group subsequent data group	0 - 14	--	9	Restart	

Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn756	No. 7 data group type	---	--	0	Restart	
	0: the data group is invalid 1: the absolute motion mode 2: the relative motion mode					
Pn757	No. 7 group data group low position	-9999 - +9 999	The instruction unit	0	Restart	
Pn758	No. 7 group data group high position	-9999 - +9 999	10000 the instruction unit	0	Restart	
Pn759	No. 7 data group operating speed	0 - 6000	1rpm	100	Restart	
Pn760	No. 7 data group step changing property	---	--	0000	Restart	
Pn761	No. 7 data group step change 1 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn762	No. 7 data group step change 2 value	0 - 65535	--	0	Restart	
	-Unconditional: no transition condition value - Delay: value 0...65535, the waiting time is 0...65535, and the unit time is ms - Pulse edge: the value 0 identifies the rising edge value 1 indicates the descent edge value 2 indicates the rising edge or the descending edge Electrical level: value 3 indicates 1 electrical level value 4 indicates 0 electrical level					
Pn763	No. 7 data group subsequent data group	0 - 14	--	9	Restart	



Reference number	Name	Range	Unit	Factory value	Effective	Remarks
Pn764	Data group mode	0 - 1	--	0	Restart	
	0: internal mode (Single data group mode)		1: task mode (data group sequence)			
Pn765	Data group acceleration	1-60000	10rpm/s	10000	Restart	
Pn766	Data group speed deceleration	1-60000	10rpm/s	10000	Restart	
Pn767	Step signal filtering time	0-1000	0.1ms	1	Restart	
Pn768	Data group position electronic gear (numerator)	1-1073741823	--	1	Restart	
Pn770	Data group position electronic gear (denominator)	1-1073741823	--	1	Restart	
Pn772	Back to zero mode selection switch	----	--	0000	Restart	
Pn773	Switch speed for reference point	0 - 6000	1rpm	100	Restart	
Pn774	Switch speed for leaving reference point	0 - 6000	1rpm	30	Restart	
Pn775	Speed / position switch reference point position low point	0 - 9999	The instruction unit	0	Immediately	
Pn776	Speed / position switch reference point position high point	0 - 9999	10000 the instruction unit	0	Immediately	



Appendix B Alarm Display list

Alarm number		Alarm name	Can it be cleared
Main alarm number	Auxiliary alarm number		
01	0	Encoder PA, PB, PC disconnection	Ok
02	0	Encoder PU, PV, PW disconnection	Ok
03	0	Overload	Ok
04	0	A/D transformation channel abnormal	Ok
10	0	Over current	Ok
11	0	Over voltage	No
12	0	Under voltage	No
13	0	Parameter failure	Ok
14	0	command over speed	Ok
	1	Exceeding the speed limit of ,motor speed	Ok
15	0	Deviation counter overflow	Ok
16	0	Position offset too large	Ok
17	0	Electronic gear error	Ok
18	0	Error of the 1st channel current detection	Ok
19	0	Error of the 2nd channel current detection	Ok
22	0	Motor model error	Ok
23	0	The mismatch between the servo drive and the motor	Ok
25	0	Bus type encoder multi-loop information error	Ok
26	0	"bus type encoder multi-loop information overflow	Ok
27	0	"bus type encoder battery alarm 1”	Ok
28	0	"bus type encoder battery alarm 2”	Ok
30	0	Discharge resistance wire break alarm	Ok
31	0	Regenerative overload	No
33	0	Instantaneous power failure alarm	Ok
34	0	Abnormity of rotating transformer	Ok
40	0	Bus type encoder communication error	Ok
41	0	Bus type encoder over speed	Ok
42	0	Absolute state error of bus type encoder	Ok
43	0	Bus type encoder counting error	Ok
44	0	Control domain of bus type encoder error	Ok
45	0	Bus type encoder communication data error	Ok
46	0	Bus type encoder state domain error	Ok
47	0	Bus type encoder SFOME error	Ok
48	0	Bus type encoder EEROM uninitialized	Ok
49	0	Bus type encoder EEROM data check error	Ok
60	0	MODBUS communication timeout	Ok
61	0	CANopen main station heartbeat timeout	Ok
63	0	Metrolink-II communication fault	Ok
64	0	Metrolink-II synchronization error	Ok
65	0	CANopen synchronization timeout	Ok
70	0	Driver overheating alarm	Ok

Alarm number		Alarm name	Can it be cleared
Main alarm number	Auxiliary alarm number		
71	0	Metrolink-III communication ASIC fault 1	No
	1	Metrolink-III communication ASIC failure 2	No
73	0	Metrolink-III communication cycle setting error	Ok
	1	Metrolink-III communication data size setting incorrect	Ok
	2	Metrolink-III communication station address setting error	No
74	0	Metrolink-III communication synchronization error	Ok
	1	Metrolink-III communication synchronization failure	Ok
75	0	Metrolink-III communication failure (reception error)	Ok
	1	Metrolink-III transmission cycle error (synchronous interval error)	Ok
	3	Metrolink-III communication synchronization frame not received	Ok
76	0	Data setting alarm 1 (parameter number)	Ok
	1	Data setting alarm 2 (beyond the range of parameters)	Ok
	3	Data set alarm 4 (data length)	Ok
77	0	Metrolink-III command alarm 1 (beyond the command condition)	Ok
	1	Metrolink-III command alarm 2 (unsupported command)	Ok
	3	Metrolink-III command alarm 4 (command interference)	Ok
	4	Metrolink-III command alarm 5 (non - available sub command)	Ok
	6	Metrolink-III command alarm 7 (layer error)	Ok
80	0	Incorrect ESM requirements for fault protection	Ok
	1	Undefined ESM requires fault protection	Ok
	2	Boot status requirement fault protection	Ok
	3	PLL not complete fault protection	Ok
	4	PDO watchdog fault protection	Ok
	6	PLL fault protection	Ok
	7	Synchronization signal fault protection	Ok
81	0	Synchronization period setting fault protection	Ok
	1	Mailbox setting fault protection	Ok
	4	PDO watchdog setting fault protection	Ok
	5	DC setting fault protection	Ok
	6	SM event mode setting fault protection	Ok
	7	SM2/3 setting fault protection	Ok
85	0	TxPDO distribution fault protection	Ok
	1	RxPDO distribution fault protection	Ok
	2	Lost link fault protection	Ok
	3	SII EEPROM fault protection	Ok
88	1	Control mode setting fault protection	Ok
00	0	Error free display	--

(Note) 1. Alarm displays in “□”may be "A" or "B"; A or b axis alarm respectively.
2. -□25, □26, □27, □41 are required by the auxiliary function model and FA010/Fb010 The internal alarm clearance of encoder can be used to reset the alarm.

Version: 3.1.14
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