EPS–B1 series

User manual

Dorna Technology Co., Ltd

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DORNA Technology Co., Ltd
Address : No 99, Zhuangchi Middle Rd, Ganyao Industrial Park ,
Jiashan Zhejiang, China
Tel: +86-0573-89100588
Fax: +86-0573-89100599
E-mail: oversea@cn-dorna.com
Web site: www.cn-dorna.com

Safety Notice

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

Dangers
■ **Input power** Input power of this driver is AC220V. ■ **When it is installed to a machine and begins running, the motor shall be placed under the state for emergency stop at any moment.** Otherwise, there may be personnel injuries and mechanical failure. ■ **When the power is on, the housing of power supply's terminal block must be fixed.** Otherwise, there may be electric shocks. ■ **After the power is turned off or after the voltage withstand test, when the indication light of charge (CHARGE) is on, do not touch the power supply terminal.** Otherwise, there may be electric shocks caused by residual voltage. ■ **Please conduct trial run according to the procedures and instructions in the product user manual.** When the servo motor is installed to the machine, operation mistakes may not only cause mechanical failures, but also cause personal injuries. ■ **Do not make any changes to this product. No persons except the designated ones can set, dismantle or repair this product.** Otherwise, there may be personnel injuries, mechanical failure or fire. ■ **Please set a stop device on the machine side to ensure the safety.** The holding brake of the servo motor equipped with a brake is not a stop device used to ensure safety. Otherwise, there may be injuries. ■ **Please ensure to connect the earth terminal of servo driver with the earth electrode (the earth resistance of servo driver for power input is below 100Ω).** Otherwise, there may be electric shocks or fire.

Notice to Storage and Handling
■ **The product shall not be stored and set in the environment like the following.** Otherwise, there may be fire, electric shocks or machinery breakdown. ➢ The place with direct sun light ➢ The place where the use environment temperature exceeds the temperature conditions for storage and setting ➢ The place where the relative humidity exceeds the humidity conditions for storage and setting ➢ The place with corrosive gases and flammable gases ➢ The place with too much dust, dirt, and too many saline matters and metal powders ➢ The place prone to water, oil and chemicals ➢ The place whether vibration or shocks may affect the principal part ■ **Please do not handle the product by grasping the cable, motor shaft or detector.** Otherwise, there may be personnel injuries or machine breakdown.

Notice to Installation
■ **Please do not block the air inlet and outlet, and do not make other matters enter the product.** Otherwise, the inner components may be aged and cause failure or fire. ■ **Please follow the order of installation.** Otherwise, there may be failure. ■ **During installation, please ensure there is specified space between the servo driver and internal surface of control cabinet and other machineries.** Otherwise, there may be fire or machine breakdown. ■ **Please do not impose too big impacts on the machine.** Otherwise, there may be machine breakdown.

Notice to Wiring
■ **Please connect wires correctly and reliably.** Otherwise, there may be out-of-control of motor, personnel injuries or machine fault. ■ **Please do not connect commercial power supply to the connecting terminals U, V and W of the servo motor of servo driver.** Otherwise, there may be personnel injuries or fire. ■ **Please connect the power terminal with the motor connecting terminal firmly.** Otherwise, there may be a fire. ■ **Please do not house the major loop cable, input-output signal cable/encoder cable with the same bushing, or tie them together. During wiring, the major loop cable shall be over 30cm from the input-output signal cable.** ■ **Cables for input-output signal and encoder shall be twin strands or multiple-core twinning bulk shielding strands.** ■ **Wiring length of input-output signal cable: the maximum length is 3 m; encoder cable: the maximum length is 30 m. Even when the power is turned off, there may still be residual high voltage inside the servo driver, so when the charge indication light (CHARGE) is on, do not touch the power terminal.** Please connect and check wires after confirming the charge indication light (CHARGE) is off. ■ **Please set safety devices such as circuit-breaker in case of short-circuit of external wiring.** Otherwise, there may be a fire. ■ **When used in the following places, please take appropriate measures for shielding.** ➢ When there may be interference of static electricity ➢ The place with strong electric field or high intensity field ➢ The place where there may be radioactive rays Otherwise, there may be machinery breakdown. ■ **When connecting to batteries, pay attention to the polarity.** Otherwise, it may lead to the damage and explosion of batteries, servo driver and servo motor.

Operation Notice
■ **In order to prevent accidents, please conduct trial run to the detached servo motor (when the machine is not connected with the transmission shaft of servo motor).** Connect it to the machine when there are no problems in the trial run. Otherwise, there may be injuries. ■ **When it is connected to the right machine and runs, please set the parameters appropriate to this machine in advance.** When the machine is started without parameter setting, the machine may be out of control or have failure. ■ **Please do not turn on/off the power supply frequently.** Because the power section of servo driver has a capacitor, when the power is on, heavy charging current may flow through it. Therefore, if the power is frequently turned on/off, performance of the major loop components inside the servo driver may decline. ■ **During JOG operation (AF 02) and manual load inertia detection (AF 15), please note that the emergency stop will become ineffective when there is over travel on the positive rotation side and over travel on the reverse rotation side.** Otherwise, there may be machinery breakdown. ■ **When the servo motor is used on the vertical axis, please set a safety device, in case workpiece drops when there is alarming and over travel. Besides, please set the machine to stop through zero-position fixation when there is over travel.** Otherwise, the workpiece may drop when there is over travel. ■ **Extreme parameter adjustment •setting alteration may cause the action of the servo system to be instable, so such operations are absolutely forbidden.** Otherwise, there may be personnel injuries and machinery breakdown. ■ **When there are alarms, please reset the alarm after find out the reasons and ensure operation safety, and then start operation again.** Otherwise, there may be machinery breakdown, fire or personnel injuries. ■ **Please do not use the brake of the servo motor which has a holding brake for braking.** Otherwise, there may be machine fault. ■ **The servo motor and servo driver shall be used in combination as specified.** Otherwise, there may be fire or machine breakdown.

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

Other Notices
■ In order to give detailed explanations, housing or safety protection devices are not included in some figures in this manual. During operation, please make sure to fix the housing or safety protection devices to the appropriate position and then start the machine according to the instructions of the user manual. ■ Illustrations in this manual are representative graphic symbols, which may be different from the products that you receive.

Other Notices
■ During the commissioning and use of driver, please set the relevant safety protection device. Our company will not bear any liability for the special losses, indirect losses and other relevant losses caused by our products. ■ Information in this manual is general descriptions or characteristic introduction which may not always be the case in practical use, or may not be completely applicable when the products are further improved.

Table of content

1.1 Product inspection

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

Confirmation item	Reference
Whether the product received is the right one you intend to buy?	Check the product model on the motor and driver nameplate respectively. Please refer to the note to model in the following sections.
Whether the motor shaft runs smoothly?	Rotate the rotor shaft of the motor. If it can rotate smoothly, it means the rotor shaft is normal. Note that the motor with electro-magnetic brake can not be rotated with hands!
Check whether there is superficial damage?	Check visually whether there are any superficial damages.
Whether there are loosened screws?	Check whether the mounting screws of servo driver are loosened with a screw driver.

In the event of any of the above said circumstances, please contact the agent or manufacturer to get appropriate solutions.

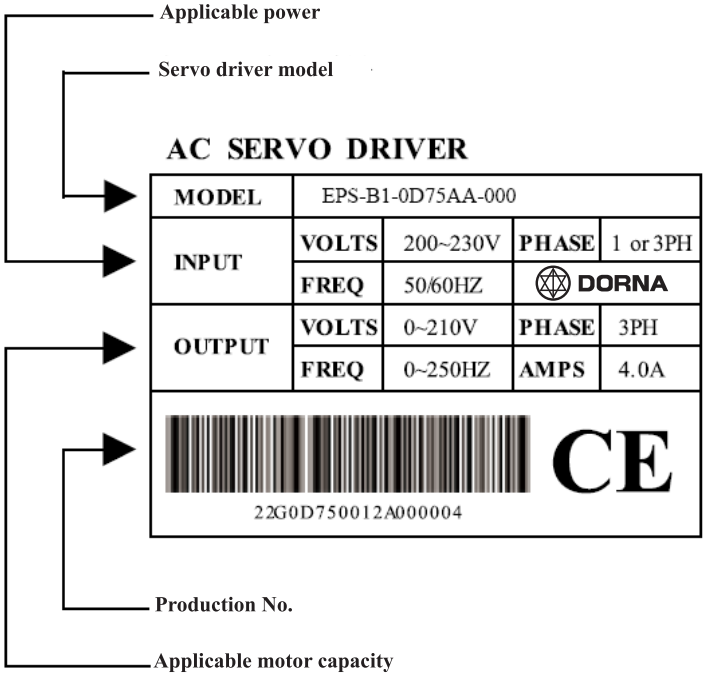
A complete set of servo components shall include the following.

No.	Reference
1	Servo driver and its auxiliary servo motor
2	Motor power line: Plug (standard configuration) at the power end of driver motor or a UVW motor power line (optional)
3	Motor encoder line: Plug at the encoder end of driver or plug at the encoder end of motor (standard configuration) or a encoder signal line (optional)
4	RJ45 joint for CN1, RS485 and CANopen communication (optional)
5	50-PIN joint for CN2 (3M simulation product) (optional)
6	20-PIN joint for CN3 (3M simulation product) (optional)
7	Driver power input plug: 5PIN quick connection terminal (L1. L2. L3. L1C. L2C)
8	External braking resistor and DC reactor plug: 5PIN quick connection terminal (P. D. C. － 1. － 2)
9	Two metal spiders
10	One installation manual

1.2 Product model

1.2.1 Description of nameplate

■ Description of the nameplate of EPS-B1 servo driver



1.2.2 Model description

■ Description of the model of EPS-B1 servo driver

EPS – B1 – 0D75 A A – □□□□

[1] [2] [3] [4] [5]

[1] Servo driver series	
Mark	Specification
B1	B1 series
[4] Hardware edition	
Mark	Specification
A	

[2] Driver power	
Mark	Specification
0D40	400W
0D75	750W
0001	1.0KW
01D5	1.5KW

[3] Rated input voltage	
Mark	Specification
A	220V
[5] Plant code	
Mark	Specification

■ Description of servo motor model

130 DN MA 1– 0D75 D K A M– □□□

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

[1] Pedestal No.	
Mark	Specification
60	60 Flange
80	80 Flange
130	130 Flange

[2] Product name	
Mark	Specification
DN	

[3] Voltage class	
Mark	Specification
MA	Medium/small inertia 220V
HA	High inertia 220V
MB	Medium/small inertia 380V
HB	High inertia 380V

[4] Design series	
Mark	Specification
1	

[5] Rated power	
Mark	Specification
0D40	400W
0D75	750 W
0001	1.0KW
01D2	1.2KW
01D5	1.5KW

[6] Rated speed	
Mark	Specification
A	1000rpm
B	1500rpm
C	2000rpm
D	3000rpm
E	2500rpm

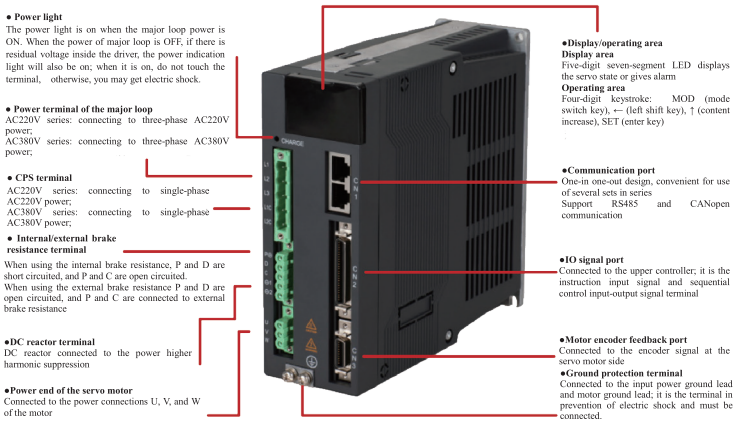
[7]Encoder type	
Mark	Specification
K	Line-saving, capacity-increasing 5000ppr
I	17-bit serial (increment type)
J	17-bit serial (absolute value type)

[8] Brake selection	
Mark	Specification
A	Without brake
B	With brake

[10] Plant code	
Mark	Specification

[9] Shaft end specification	
Mark	Specification
K	Have key groove; have no oil seal
Y	Have no key groove; have oil seal
M	Have key groove; have oil seal
N	Have no key groove; have no oil seal

1.3 Name of each part of the servo driver



1.4 Maintenance and inspection

Please give constant maintenance and inspection to the driver and motor, so as to use it safely and easily.

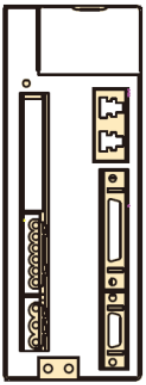
Daily inspection and periodic inspection shall meet the following requirements.

Type	Inspection period	Inspection items
Daily inspection	Daily	• Confirm the service temperature, humidity, and whether there is dirt and other matters. • Whether there is abnormal vibration and sound • Whether the input supply voltage is normal • Whether there is abnormal smell • Whether there are fiber stubs stuck to the ventilation opening • Whether the front end of driver and the connector are clean • Whether there the connection with control device and equipment motor is loose and whether the core feet deviates • Whether there are foreign matters in the load part
Periodic inspection	1 year	• Whether the fastening parts are loose • Whether it is superheated • Whether the terminal is damaged or loose

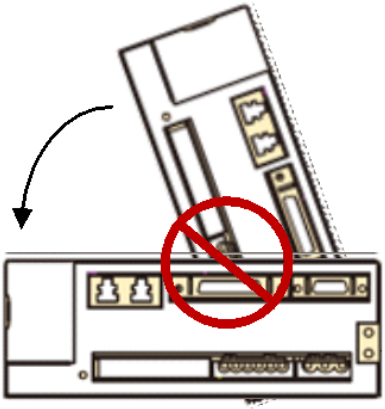
Chapter II Installation

2.1 Installation direction and space

The installation direction must be appropriate; otherwise, it may become the cause of troubles. In order to ensure the fine cooling cycle effects, when the AC servo driver is installed, it must keep adequate distance from the articles and boards (walls) in its four directions and near it; otherwise, it may become the cause of troubles. The air inlet and outlet shall not be blocked or placed inversely when the AC servo driver is installed; otherwise, it may cause fault.

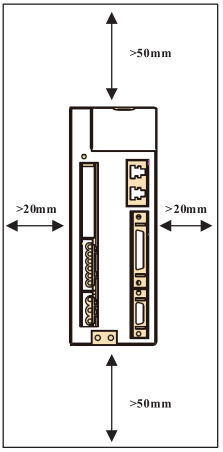


Correct



Wrong

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



2.2 Recommended specification of circuit-breaker and fuse

■ 220V type

Driver housing	Circuit-breaker	Fuse (Class T)
Type A housing	10A	20A
Type B housing	20A	40A
Type C housing	30A	80A
Type D housing	40A	120A

Note:
1. It is strongly recommended: the fuse and circuit-breaker acceptable to UL/CSA be used.
2. When a ELB is added to the driver for leakage protection, in order to prevent the false operation of ELB, the one whose sensitivity current is over 200mA and action time is over 0.1 s shall be used.

2.3 Countermeasures for noise disturbance and higher harmonic

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

Mount a noise filter on the input side of the main circuit cable of driver.

◆ Connection of AC/DC reactor for suppression of higher harmonic

◆ Please set the command input equipment and noise filter near the servo driver as much as possible.

◆ During wiring, the main circuit cable (cable for motor main circuit) shall be over 30cm from the input-output signal cable.

Do not house them in the same bushing or tie them together.

◆ Do not use the same power supply with the welding machine and spark machine. Even when different power supplies are used, when there is a RF generator nearby, a noise filter shall be connected to the input side of the main circuit cable.

◆ Ensure the earthing is appropriate.

2.3.1 Installation of noise filter

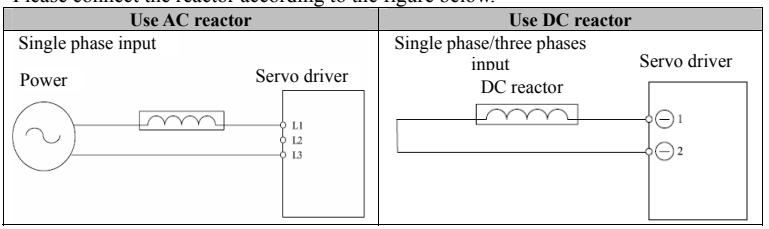
In order to ensure the EMI filter can fully suppress the interference to servo driver to the greatest extent, the servo driver shall be capable of being installed and wired according to the service manual, and attention shall also be given to the following:

Item No.	Description
1	The servo driver and noise filter shall be mounted on the same metal plane.
2	The wiring shall be shortened as much as possible.
3	The metal plane shall be well grounded.
4	The metal enclosure or earthing part of servo driver and noise filter shall be reliably fixed to the metal plane, and the contact area between them shall be enlarged as much as possible.
5	The motor power line shall be the cable with shielding copper screen (the one with double shielding layer is preferred).
6	The shielding copper screen on both ends of the motor wiring shall be grounded with the shortest distance and maximum contact area.

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

When measures are required to eliminate higher harmonic, an AC/DC reactor for suppression of higher harmonic can be connected to the servo driver.

Please connect the reactor according to the figure below.



2.4 Selection of regeneration resistance

When the pull-out torque of motor is opposite to the rotation speed, it means energy is sent from the load end to the driver. The energy enriches the capacitance of DC Bus and makes its magnitude of voltage rise. When it rises to a certain level, the recharged energy can only be consumed by the regeneration resistance. The driver contains a regeneration resistance inside, and users can also connect a regeneration resistance externally.

The table below shows the specification of regeneration resistance contained in EPS-B1 220V series.

Driver housing	Specification of internal regeneration resistance		Minimum allowable resistance value (Ohm)
	Resistance value (Ohm)	Capacity (Watt)	
Type A housing	-	-	30
Type B housing	30	60	20
Type C housing	20	100	10
Type D housing	10	150	10

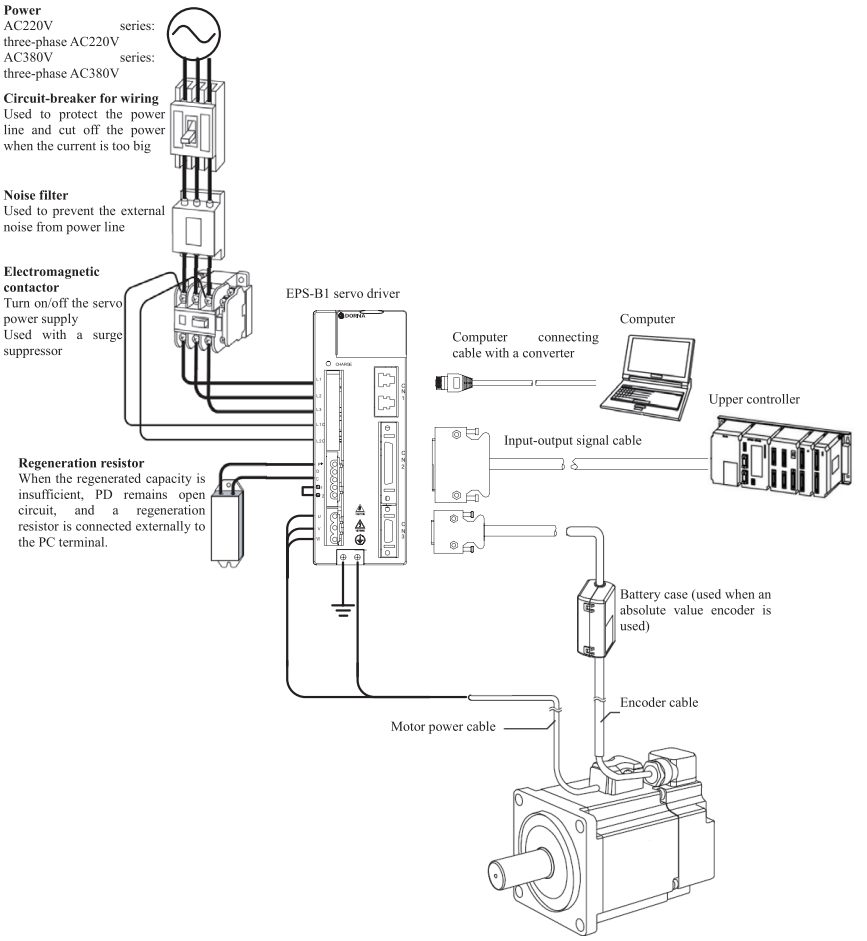
When the regenerated capacity exceeds the disposable capacity of the internal regeneration resistance, a regeneration resistor shall be connected externally. When using regeneration resistance, attention shall be paid to the following.

Item No.	Contents
1	Use external regeneration resistance alternatively.
2	Please set the resistance value and capacity of regenerated capacity correctly; otherwise, such function will be affected.
3	When users intend to connect external regeneration resistance, its resistance value shall not be smaller than the minimum allowable resistance value; If users intend to increase the power of regeneration resistor through parallel connection, please confirm whether the resistance value satisfies the limiting conditions.
4	In natural environment, when the disposable regenerated capacity (mean value) of regeneration resistor is used within the limit of nominal capacity, the temperature of resistor will rise to be above 120℃ (under continual regeneration). In order to ensure its safety, it is suggested the regeneration resistor with a thermo-switch be used.
5	When external regeneration resistance is used, the resistance shall be connected to P, C end, and P, D end shall be open. External regeneration resistance shall use the resistance value suggested in the table above.

Chapter III Wiring

3.1 System structure and wiring

3.1.1 Servo system structure



3.1.2 Connector and terminal of driver

Terminal mark	Name	Description
L1, L2, L3	Major loop power input terminal	Connect with three-phase alternating-current supply. (please choose the proper voltage specification according to the product model)
L1C, L2C	Control loop power input terminal	Connect with single-phase alternating-current supply. (please choose the proper voltage specification according to the product model)
P, D, C	External regeneration resistor connecting terminal	When a built-in regeneration resistor is used, please make P and D short circuit. When the built-in regeneration resistor is out of capacity, make P and D open circuit (remove the shorting stub), and connect the regeneration resistor between P and C. Users can choose to buy the external regeneration resistor.
⊖1, ⊖2	DC for suppression of higher harmonic Reactor connecting terminal	Usually, ⊖1 and ⊖2 are short circuited. When the higher harmonic of power supply needs to be suppressed, a DC reactor can be connected between ⊖1 and ⊖2.
U, V, W	Servo motor connecting terminal	Connected with the servo motor
⏚	Earth terminal	It is connected with power earth terminal and motor earth terminal for grounding.
CN1	Communication port connector	RJ45 joint, connecting RS-485 or CANopen
CN2	I/O connector	Connected with upper controller
CN3	Encoder connector	Connected with the motor encoder

3.1.3 Wiring of main circuit

1) Dimension of major loop wire of servo driver

External terminal name	Terminal mark	Line diameter mm2(AWG)				
		EPS-B1-				
		0D20A	0D40A	0D75A	0001A	01D5A
Main circuit power line	L1, L2, L3	1.25(AWG-16)		2.0(AWG-14)		
Control power line	L1C, L2C	1.25(AWG-16)				
Motor power line	U, V, W	1.25(AWG-16)		2.0(AWG-14)		
External regeneration resistance wire	P, D, C	1.25(AWG-16)				
Earth wire	⏚	Above 2.0(AWG-14)				

2) Example of typical main circuit wiring

Note to main circuit wiring

During the sequential control design of power on, the following aspects shall be considered.

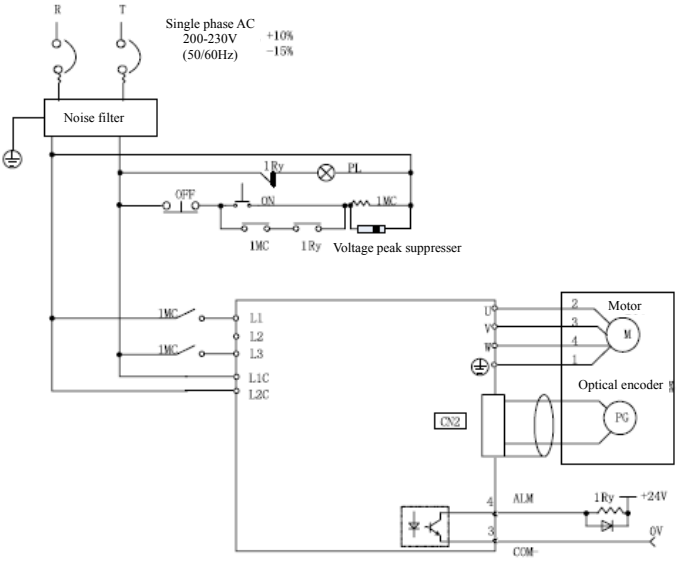
Please make the following design for power on sequential control: After the signal of "servo alarm" is given out, power supply of the main circuit shall be in OFF state.

When power on the control supply and main circuit supply, the two shall be powered on at the same time, or the main circuit supply shall be powered on after the control

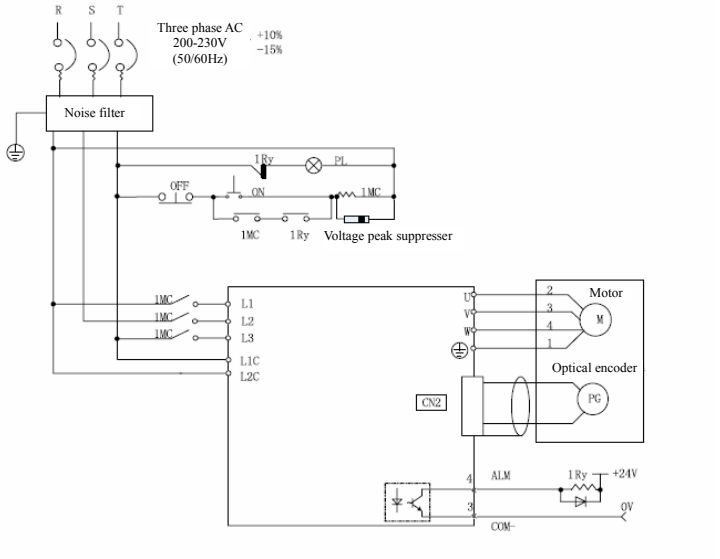
supply is on.

When powering off, the main circuit supply shall be powered off first, followed by the control supply.

- Single-phase AC220V power input

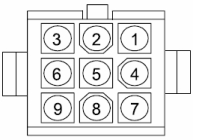
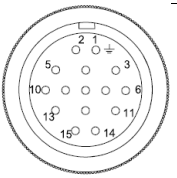


■ Three-phases AC220V power input

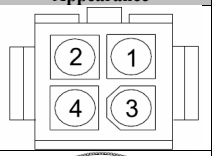
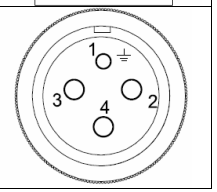


3.2 Wiring at motor side

3.2.1 Appearance and signal definition of connecting terminal of motor encoder

Matching encoder type	Terminal mark	Name	Function	Appearance
Line-saving encoder	1	5V	PG power supply +5V	
	2	0V	PG power supply +0V	
	3	PA	PG input A+ phase	
	4	/PA	PG input A- phase	
	5	PB	PG input B+ phase	
	6	/PB	PG input B- phase	
	7	PZ	PG input Z+ phase	
	8	/PZ	PG input Z- phase	
	9	FG	Shielding	
17-bit serial encoder (capacity-increasing type)	1	5V	PG power supply +5V	
	2	0V	PG power supply 0V	
	3	PD+	PG serial signal input	
	4	PD-	PG serial signal input	
	9	FG	Shielding	
17-bit serial encoder (absolute value type)	1	5V	PG power supply +5V	
	2	0V	PG power supply 0V	
	3	PD+	PG serial signal input	
	4	PD-	PG serial signal input	
	5	BAT+	Battery anode	
	6	BAT-	Battery cathode	
	9	FG	Shielding	
Line-saving encoder	1	FG	Shielding	
	2	5V	PG power supply +5V	
	3	0V	PG power supply 0V	
	4	PA	PG input A+ phase	
	5	PB	PG input B+ phase	
	6	PZ	PG input Z+ phase	
	7	/PA	PG input A- phase	
	8	/PB	PG input B- phase	
	9	/PZ	PG input Z- phase	
17-bit serial encoder (capacity-increasing type)	1	FG	Shielding	
	2	5V	PG power supply +5V	
	3	0V	PG power supply 0V	
	4	PD+	PG serial signal input	
	7	PD-	PG serial signal input	
17-bit serial encoder (absolute value type)	1	FG	Shielding	
	2	5V	PG power supply +5V	
	3	0V	PG power supply 0V	
	4	PD+	PG serial signal input	
	7	PD-	PG serial signal input	
	5	BAT+	Battery anode	
	8	BAT-	Battery cathode	

3.2.2 Appearance and signal definition of motor power connecting terminal

Terminal mark	Name	Function	Appearance
1	U	Motor U phase power	
2	V	Motor V phase power	
3	W	Motor W phase power	
4	PE	Casing	
3	U	Motor U phase power	
2	V	Motor V phase power	
4	W	Motor W phase power	
1	PE	Casing	

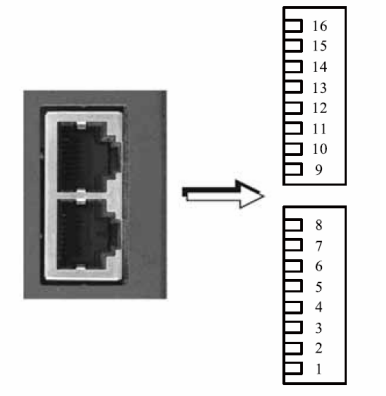
Note:
The above table is based on the terminal at motor side, so please pay attention to it when connecting wire.

3.3 Wiring of connector CN1

Connector CN1 is a communication plug. Servo driver provides RS485 and CANopen communications.

3.3.1 Terminal arrangement

(I) Terminal appearance

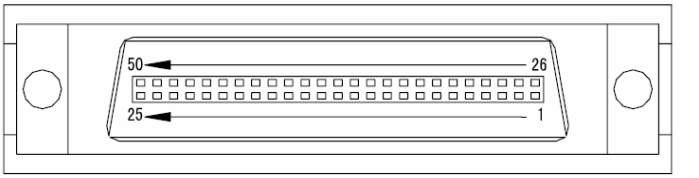


(II) Terminal signal definition

Terminal mark	Name	Function
1,9	RS485+	RS485+ Signal line
2,10	RS485-	RS485- Signal line
3,11	GND	Reference ground
4,12	NC	Unused
5,13	NC	Unused
6,14	GND	Reference ground
7,15	CANH	CANH Signal line
8,16	CANL	CANL Signal line
Casing	FG	Shield wire

3.4 Wiring of connector CN2

3.4.1 Arrangement of connector CN2



2			1	SG	GND	27	DO 3+	Digital output 3(+)	26	DO4 −	Digital output 4(-)
4			3	PL	Power input for open collector instruction	29	DO 2+	Digital output 2(+)	28	DO3 −	Digital output 3(-)
6	AGND	Speed instruction input (−)	5	V-REF	Speed instruction input (+)	31	DO 1+	ALM(+)	30	DO2 −	Digital output 2(-)
8	/PULS	Instruction pulse input (−)	7	PULS	Instruction pulse input (+)	33	PAO	Encoder divided pulse output A Phase (+)	32	DO1 −	ALM(-)
10	AGND	Torque instruction input (−)	9	T-REF	Torque instruction input (+)	35	PBO	Encoder divided pulse output B Phase (+)	34	/PAO	Encoder divided pulse output A Phase (-)
12	/SIGN	Instruction sign input (−)	11	SIGN	Instruction sign input (+)	37			36	/PBO	Encoder divided pulse output B Phase (-)
14			13			39			38		
16	HPULS	High-speed instruction pulse input (+)	15			41	DI2	Digital input 2	40	DI1	Digital input 1
18			17	/HPULS	High-speed instruction pulse input (-)	43	DI4	Digital input 4	42	DI3	Digital input 3
20	/PZO	Encoder divided pulse output Z phase (−)	19	PZO	Encoder divided pulse output Z phase (−)	45	DI6	Digital input 6	44	DI5	Digital input 5
2			21			4	CO	External 24V	4	DI7	Digital input

2						7	M+	power input	6		7
24	/HSIGN	High-speed instruction sign input (－)	23	HSIGN	High-speed instruction sign input (＋)	49			48	DI8	Digital input 8
			25	DO4+	Digital output 4(＋)				50	DI8	Digital input 8

(note)
1) Please do not use unoccupied terminal.
2) Please connect the shielding layer of input-output signal cable to the enclosure of connector. Conduct frame grounding (FG) through the connector at servo driver side.
3) Except alarm signal (ALM), all input-output signals can alter distribution through parameter setting

3.4.2 Signal description of connector CN2

■ Name and function of input signal (with default pin assignment)

Control mode	Signal name	Pin No.	Function	
Universal	S-ON	40	Servo ON: The motor is powered on.	
	C-MOD	41	Control mode switch: Switch of two control modes.	
	POT	42	Forward rotation driving prohibited	Overtravel prohibited: Stop operation of servo motor when it is on.
	NOT	43	Reverse rotation driving prohibited	
	CLR	44	Position deviation pulse clearance: Clear position deviation pulse during position control.	
	A-RST	45	Alarm reset: release servo alarm	
	INHIBIT	46	Pulse inhibition input	
	ZEROSPD	48	Zero-speed signal input	
	COM+	47	I/O signal electric power supply; need user to provide 24VDC power supply.	
Position control	HPULS+	16	High-speed channel pulse input * Sign＋pulse train * CCW+CW Pulse train * A ＋ B Pulse train	
	HPULS-	17		
	HSIGN+	23		
	HSIGN-	24		
	PULS+	7	Low-speed channel pulse input form: * Sign＋pulse train * CCW+CW Pulse train * A ＋ B Pulse train	
	PULS-	8		
	SIGN+	11		
	SIGN-	12		
	PL	3	Collector pulse signal terminal	
Speed control	V-REF	5	Speed instruction voltage input	
	AGND	6		
Torque control	T-REF	9	Torque instruction voltage input	
	AGND	10		

■ Name and function of output signal

Control mode	Signal name	Pin No.	Function	
Universal	PAO+	33	A phase signal	Two-phase pulse (A phase and B phase) encoder frequency dividing output signal
	PAO-	34		
	PBO+	35	B phase signal	
	PBO-	36		
	PZO+	19	Z phase signal	Origin pulse (Z phase) signal
	PZO-	20		
	ALM+	31	Servo alarm: OFF when abnormal state is detected.	
	ALM-	32		
	COIN+	29	Positioning completed: Under position control mode, when	

Control mode	Signal name	Pin No.	Function
	COIN-	30	deviation pulse is smaller than PA525(positioning completion width), the signal is under active state.
	CZ+	27	Opticalcoupler output Z phase pulse
	CZ-	28	
	BK+	25	External brake signal output
	BK -	26	

3.4.3 I/O signal distribution

(I) Distribution of input signal

Usually, input signal can be used according to the default set, or be distributed as required.

(1) When used according to the default set

■ The default input signal distribution state can be confirmed through PA500 ~ PA507.

Parameter No.	Name	Setting range	Unit	Factory setting	Effective time
PA500	**Port DI1 input signal selection** [0] Servo-on (S-ON) [1] Control mode switch (C-MODE) [2] Forward driving prohibited (POT) [3] Reverse driving prohibited (NOT) [4] Deviation counter clearance (CLR) [5] Alarm reset (A-RST) [6] Pulse input inhibition (INHIBIT) [7] Zero-speed restoration (ZEROSPD) [8] Forward torque limitation (PCL) [9] Reverse torque limitation (NCL) [10] Gain switch (GAIN) [11] Zero signal (ZPS) [12] Retention [13] Instruction frequency division/ multiplication switch 0(DIV0) [14] Instruction frequency division/ multiplication switch 1(DIV1) [15] Internal instruction speed selection 0(INSPD0) [16] Internal instruction speed selection 1(INSPD1) [17] Internal instruction speed selection 2(INSPD2)	0 ~ 17		0	Immediately
PA501	Port DI2 input signal selection			1	Immediately
PA502	Port DI3 input signal selection			2	Immediately
PA503	Port DI4 input signal selection			3	Immediately
PA504	Port DI5 input signal selection			4	Immediately
PA505	Port DI6 input signal selection			5	Immediately
PA506	Port DI7 input signal selection			6	Immediately
PA507	Port DI8 input signal selection			7	Immediately

■ Pins to input ports DI1 ~ DI8 and default signal name are as follows:

Parameter No.	Port name	CN2 port pin	Default signal
PA500	DI1	40	S-ON
PA501	DI2	41	C-MOD
PA502	DI3	42	POT
PA503	DI4	43	NOT
PA504	DI5	44	CLR
PA505	DI6	45	A-RST
PA506	DI7	46	INHIBIT
PA507	DI8	48	ZEROSPD

■ Note to selection of input signal

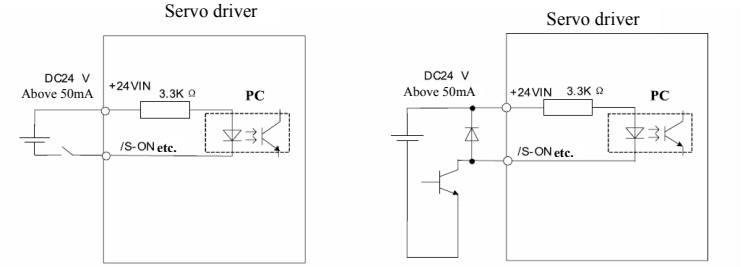
Parameter No.	Name	Setting range	Unit	Factory default	Effective time
PA508	**Selection of input signal 0** **b.0001: DI1 input signal selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive) **b.0010: DI2 input signal aspect selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive) **b.0100: DI3 input signal selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive) **b. 1000: DI4 input signal selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive)	n.0000~1111		n.0000	Immediately
PA509	**Selection of input signal 1** **b.0001: DI5 input signal selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive) **b.0010: DI6 input signal selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive) **b.0100: DI7 input signal selection;** [0] Signal L level active (opticalcoupler conductive)	n.0000~1111		n.0000	Immediately

Parameter No.	Name	Setting range	Unit	Factory default	Effective time
	[1] Signal H level active (opticalcoupler not conductive) **b. 1000: DI8 input signal selection;** [0] Signal L level active (opticalcoupler conductive) [1] Signal H level active (opticalcoupler not conductive)				

(2) Used after changing the distribution of input signal

When signals like servo ON, forward driving prohibited, and reverse driving prohibited are used through "polarity inversion", if there are abnormal states like breakage of signal line, it will cause movement deviating from the safety direction. If such setting has to be adopted, please confirm the action and ensure there are no safety problems.

The typical circuit of input signal is as follows:



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

CN2 pin	Name	Signal selection parameter	Signal name	Invert signal parameter	Signal state
40	DI1	PA500=0	Servo-on (S-ON)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=1	Control mode switch (C-MODE)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=2	Positive driving prohibited (POT)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=3	Negative driving prohibited (NOT)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=4	Deviation counter clearance (CLR)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=5	Alarm reset (A-RST)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=6	Pulse input inhibition (INHIBIT)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=7	Zero-speed restoration (ZEROSPD)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active

CN2 pin	Name	Signal selection parameter	Signal name	Invert signal parameter	Signal state
		PA500=8	Positive torque limitation (PCL)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=9	Negative torque limitation (NCL)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=10	Gain switch (GAIN)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=11	Zero signal (ZPS)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=12	Retention	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=13	Instruction frequency division/ multiplication switch 0(DIV0)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=14	Instruction frequency division/ multiplication switch 1(DIV1)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=15	Internal instruction speed selection 0(INSPD0)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=16	Internal instruction speed selection 1(INSPD1)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
		PA500=17	Internal instruction speed selection 2(INSPD2)	PA508.0=0	Signal L active
				PA508.0=1	Signal H active
41	DI2	PA501=n	Corresponding n # signal	PA508.1=0	Signal L active
				PA508.1=1	Signal H active
42	DI3	PA502=n	Corresponding n # signal	PA508.2=0	Signal L active
				PA508.2=1	Signal H active
43	DI4	PA503=n	Corresponding n # signal	PA508.3=0	Signal L active
				PA508.3=1	Signal H active
44	DI5	PA504=n	Corresponding n # signal	PA508.4=0	Signal L active
				PA508.4=1	Signal H active
45	DI6	PA505=n	Corresponding n # signal	PA508.5=0	Signal L active
				PA508.5=1	Signal H active
46	DI7	PA506=n	Corresponding n # signal	PA508.6=0	Signal L active
				PA508.6=1	Signal H active
48	DI8	PA507=n	Corresponding n # signal	PA508.7=0	Signal L active
				PA508.7=1	Signal H active

(3) Confirmation of input signal

Input signal state can be confirmed through input signal monitoring (dP012). Please refer to 8.4 Input signal monitoring for details of input signal monitoring (dP012).

(4) Relevant matters needing attention

■ If two IO pins are distributed to the same signal, the significant condition of the signal shall be subject to the ID signal with higher grade. If both DI0 and DI1 are set to be 0 (S-ON signal), the S-ON signal state of driver will be decided by DI1 (CN2-41 pin);

(II) Distribution of output signal

The output signal is distributed to input-output signal connector (CN2) according to PA510 and PA511 setting.

(1) Confirm the factory setting distribution state

The factory setting output signal distribution state can be confirmed through the following parameters.

Parameter No.	Name	Setting range	Unit	Factory setting	Effective time
PA510	**Output signal selection** **d.0001: DO1 Output signal selection** [0] Alarm signal output (ALM) **d.0010: DO2 Output signal selection** [0] Alarm signal output (ALM) [1] Positioning completed (COIN) [2] Z pulse collector signal (CZ) [3] External brake null signal (BK) [4] Servo ready output (S-RDY) [5] Speed compatibility output (VCMP) [6] Motor rotation detection (TGON) [7] Torque limited signal (TLC) [8] Zero-speed detection signal (ZSP) [9] Warning output (WARN) **d.0100: DO3 Output signal selection** The same as DO2 **d.1000: DO4 Output signal selection** The same as DO2	n.0000~9990		n.3210	Immediately
PA511	**Output signal negative** **b.0001: DO1(alarm signal ALM) output signal aspect selection;** [0] Signal H level active (opticalcoupler not conductive) [1] Signal L level active (opticalcoupler not conductive) **b.0010: DO2(alarm signal ALM) output signal aspect selection;** [0] Signal H level active (opticalcoupler not conductive) [1] Signal L level active (opticalcoupler not conductive) **b.0100: DO3(alarm signal ALM) output signal aspect selection;** [0] Signal H level active (opticalcoupler not conductive) [1] Signal L level active (opticalcoupler not conductive) **b.1000: DO4(alarm signal ALM) output signal aspect selection;** [0] Signal H level active (opticalcoupler not conductive) [1] Signal L level active (opticalcoupler not conductive)	n.0000~0011		n.0000	Immediately

Pins to input ports DO1 ~ DO4 are as follows:

Parameter No.	Name	CN2 port pin	Default signal
	DO1	31,32	ALM
PA510.1	DO2	29,30	COIN

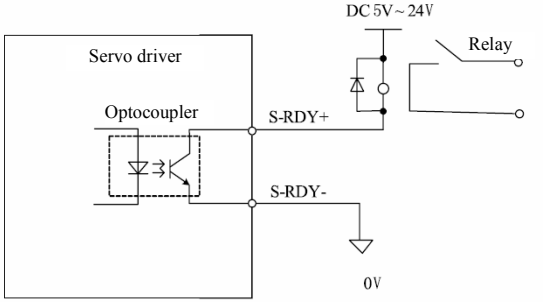
Parameter No.	Name	CN2 port pin	Default signal
PA510.2	DO3	27,28	CZ
PA510.3	DO4	25,26	BK

(2) Used after changing the distribution of output signal

• The signal which is not detected out is under "inactive" state. For example, during speed control, positioning completed (COIN) signal is "inactive".

Distribution of output signal is shown in the table below.

The typical circuit of output signal is as follows:



(note) The maximal allowable voltage and current capacity of the output circuit of opticalcoupler is as follows:

Voltage: DC30V (maximum)

Current: DC50mA (maximum)

Take the table above as an example. Parameter PA510 decides the level of COIN; When COIN signal is active, PA510 = 0, and opticalcoupler PC is conductive, L level is the active level of COIN signal; When PA510 = 1, and opticalcoupler PC is not conductive, H level is the active level of COIN signal.

CN2 pin	Name	Signal selection parameter	Signal name	Invert signal parameter	Signal state
31, 32	DO1		Servo alarm (ALM)	PA511.0=0	Signal active at H level
				PA511.0=1	Signal active at L level
29,30	DO2	PA510=0	Alarm signal output (ALM)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=1	Positioning completed (COIN)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=2	Z pulse collector signal (CZ)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=3	External brake null signal (BK)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=4	Servo ready output (S-RDY)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=5	Speed compatibility output (VCMP)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=6	Motor rotation detection (TGON)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level

CN2 pin	Name	Signal selection parameter	Signal name	Invert signal parameter	Signal state
		PA510=7	Torque limited signal (TLC)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=8	Zero-speed detection signal (ZSP)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
		PA510=9	Warning output (WARN)	PA511.1=0	Signal active at L level
				PA511.1=1	Signal active at H level
27,28	DO3	As above	Collector Z pulse (CZ)	PA511.2=0	Signal active at L level
				PA511.2=1	Signal active at H level
25,26	DO4	As above	External brake null signal (BK)	PA511.3=0	Signal active at L level
				PA511.3=1	Signal active at H level

(3) Relevant matters needing attention

- Pins for alarm signal cannot be distributed freely; only 31st (ALM+) and 32nd (ALM-) pins can be used;
- When Z pulse collector output signal is used, its output level state can not be changed (corresponding PA [511] position is inactive);
- If two IO pins are distributed to Z pulse collector output signal, the significant condition of the signal shall be subject to the DO signal with higher grade. If DO2 and DO3 are set to be 2 (Z pulse collector signal), DO3 (CN2-27 and 28 pins) outputs Z pulse signal;
- Note that when the alarm signal (ALM) is active, it means it gives an alarm; when it is inactive, it means it gives no alarm.

3.4.4 Example of the connection with upper device

Servo driver's input-output signal and its connection with the upper device are shown as follows.

(I) Instruction input circuit

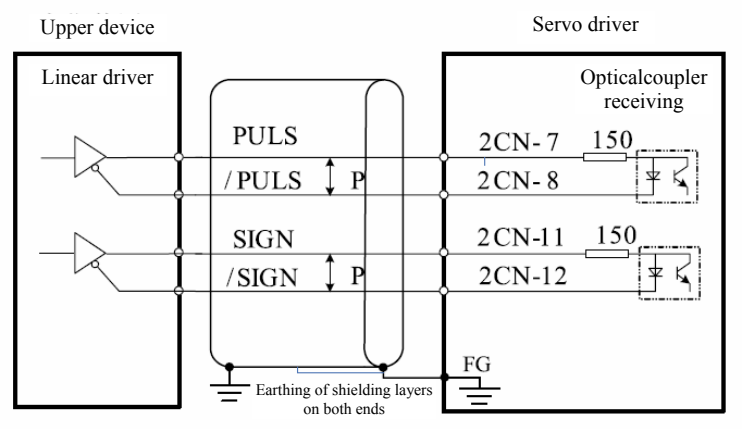
1) Instruction input circuit at low-speed position

The following is about the 7-8 (instruction pulse input) and 11-12 (instruction sign input) terminals of connector CN2.

Output circuit of instruction pulse on the upper device side can choose any one from the linear driver output and open collector output (2 kinds). The following part will enumerate them respectively.

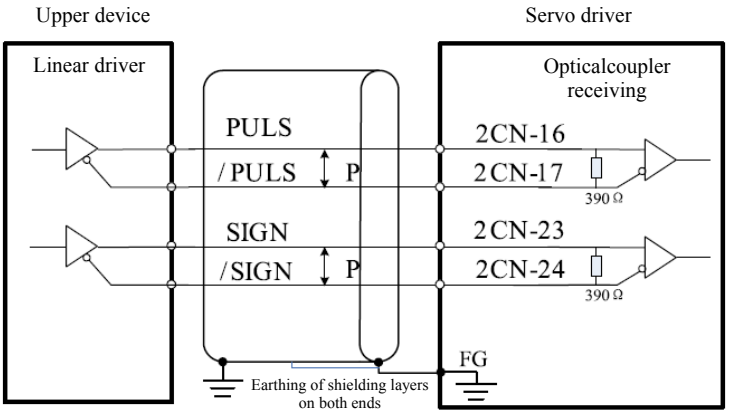
- Linear driver output

a) Driver receives through low speed pulse channel



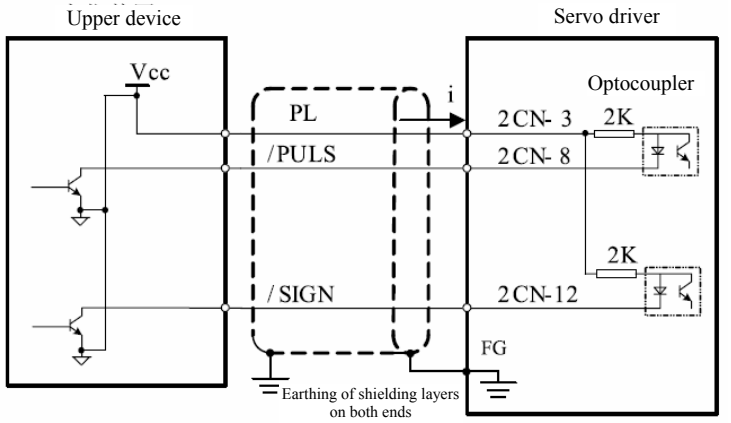
b) Driver receives through high speed pulse channel

■ Open collector output

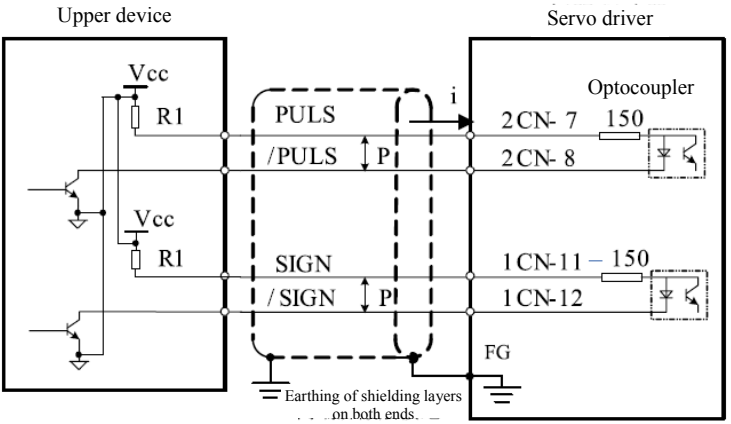


Applicable linear drivers include similar products of AM26LS31 of T1 Company.

a) When the upper device adopts open collector output and provides 24VDC signal power supply, the connecting type is 1.



b) When the upper device adopts open collector output and provides 5VDC, 12VDC and 24VDC signal power supply, the connecting type is 2.



Please define resistance R1 according to the following input current value scope.

Input current i ＝ 10～15mA:

When Vcc is 24V , R1=2KΩ

When Vcc is 12V , R1=510Ω

When Vcc is 5V , R1=180Ω

2) Instruction input circuit at high-speed position

The following is about the 16-17 (instruction pulse input) and 23-24 (instruction sign

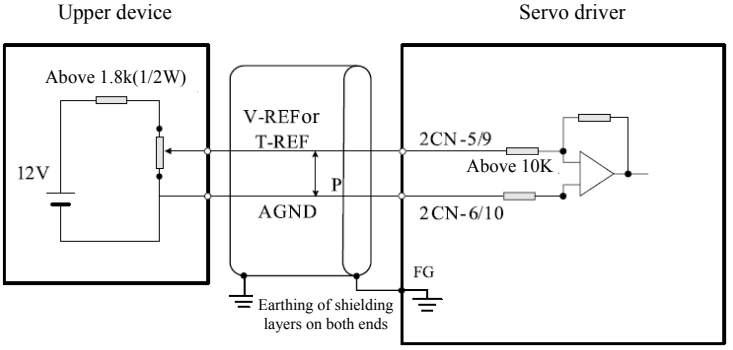
input) terminals of connector CN2.

The output circuit of instruction pulse on the upper device side can only be output from the linear driver. The following part will enumerate them respectively.

3) Read analog input loop

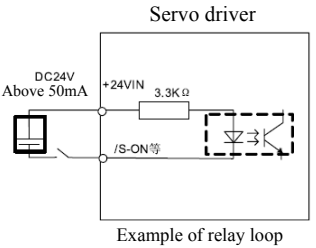
The following part is about 5-6 (speed instruction input) and 9-10 (torque instruction input) terminals of connector CN2.

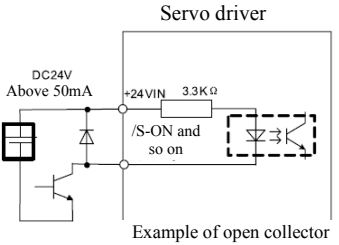
Analog quantity signal means the speed instruction or torque instruction signal. The input impedance is shown as follows.



4) Sequential control input loop

It is connected through the transistor loop of relay or open collector. If a relay is used for connection, the relay for minor current shall be used. If not, poor contact will be caused.

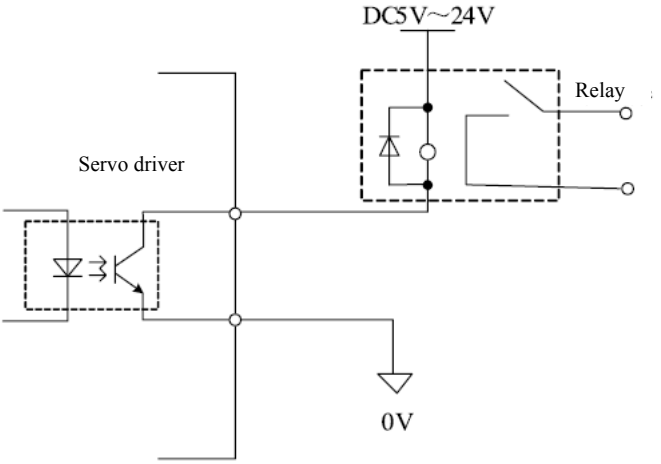




(II) Output circuit

1) Sequential control output loop

Servo alarm, servo ready and other sequential control output signals are composed of opticalcoupler output circuit and shall be connected through a relay.



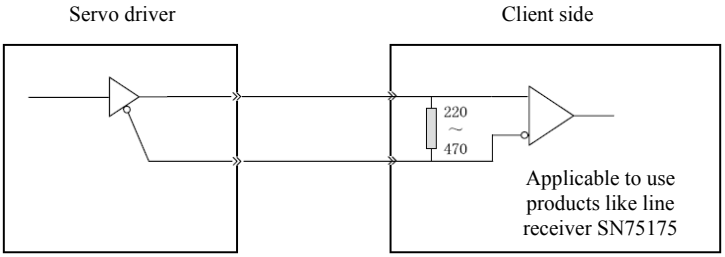
(Note) The maximum allowable voltage and maximum current of the output circuit of opticalcoupler are as follows:

- Voltage: DC30V (maximum)
- Current: DC50mA (maximum)

2) Linear driver output loop

The following part will describe 33-34 (A phase signal), 35-36 (B phase signal), and 19-20 (Z phase signal) terminals of CN2 port.

Change the serial data of encoder into the 2-phase (A phase and B phase) pulse output signals (PAO, / PAO, PBO, / PBO) and origin pulse signals (PZO, / PZO) and output through the linear driver output loop. Usually, during the speed control of servo driver, it can be used when a position control system is set on the upper device side. On the upper device side, please receive through the line receiver loop.

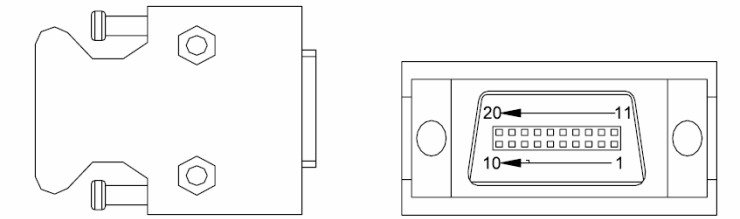


3.5 Wiring of connector CN3

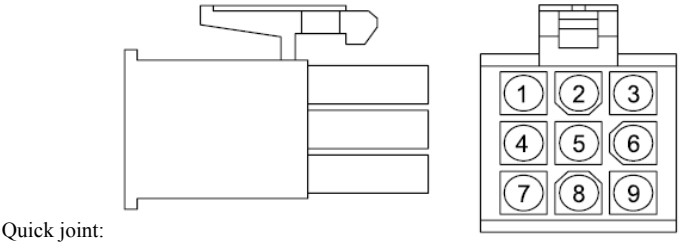
The following part will illustrate the encoder, servo driver and connection for output signal from the servo driver to the upper device, as well as the terminal arrangement of the port (CN3) for encoder connection.

3.5.1 Terminal arrangement of connector CN3

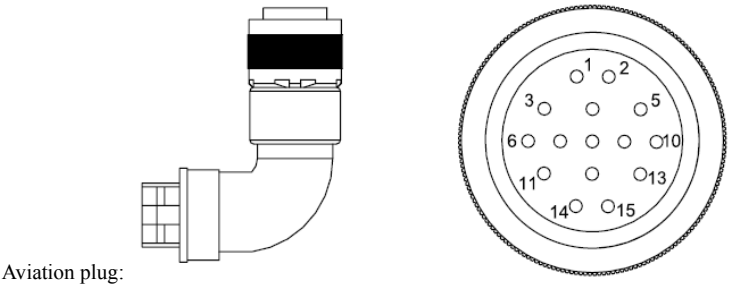
(I) Appearance of encoder connector CN3



(II) Connector CN3 to motor side



Quick joint:



Aviation plug:

Note:

The above figure is based on the terminal on the wire side, so please pay attention to it when connecting wire.

(III) Signal definition description

Signal definition of connector CN3

Terminal mark	Name	Function	Terminal mark	Name	Function
1	/PA	PG input/A phase	11		

Terminal mark	Name	Function	Terminal mark	Name	Function
2	PA	PG input A phase	12		
3	/PB	PG input/B phase	13		
4	PB	PG input B phase	14		
5	/PZ	PG input/Z phase	15		
6	PZ	PG input Z phase	16		
7	PG5V	PG supply +5V	17	PD-	PG serial signal input
8	PG5V	PG supply +5V	18	PD+	PG serial signal input
9	GND	PG supply 0V	19		
10	GND	PG supply 0V	20		

(IV) Encoder cable signal connection

Capacity-increasing encoder signal connection

Connector CN3 side			Motor side		
Terminal mark	Name	Function	Quick joint	Military joint	Color
2	PA	PG inputA phase	3	4	Green
1	/PA	PG input /A phase	4	7	Green black
4	PB	PG inputB phase	5	5	Purple
3	/PB	PG input /B phase	6	8	Purple black
6	PZ	PG input Z phase	7	6	Yellow
5	/PZ	PG input /Z phase	8	9	Yellow black
7/8	PG5V	PG supply +5V	1	2	Red
9/10	GND	PG supply 0V	2	3	Black
Casing	PE	Shielding	9	1	

17-bit serial encoder signal connection

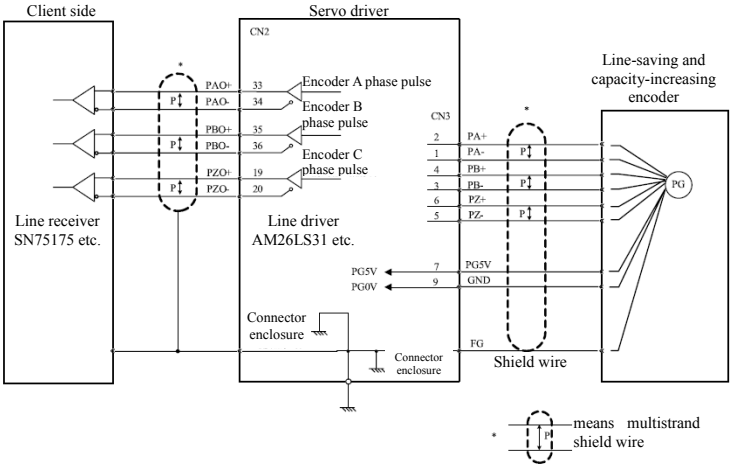
Connector CN3 side			Motor side		
Terminal mark	Name	Function	Quick joint	Military joint	Color
18	PD+	PG serial signal input	3	4	Blue
17	PD-	PG serial signal input	4	7	Blue black
		BAT+	5	5	Brown
		BAT-	6	8	Brown black
7/8	PG5V	PG supply +5V	1	2	Red
9/10	GND	PG supply 0V	2	3	Black
Casing	PE	Shielding	9	1	

Note:

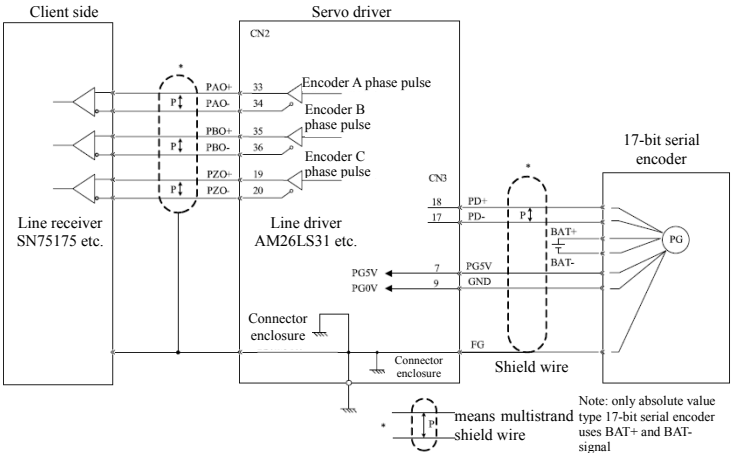
1. If the 17-bit serial encoder is absolute value type, it shall use BAT+ and BAT- to connect the external battery. If the 17-bit serial encoder is capacity-increasing type, it shall not use BAT+ and BAT- signal.
2. The above signal colors are only for your reference.

3.5.2 Example of connector CN3 connection

■ Wiring of line-saving and capacity-increasing encoder

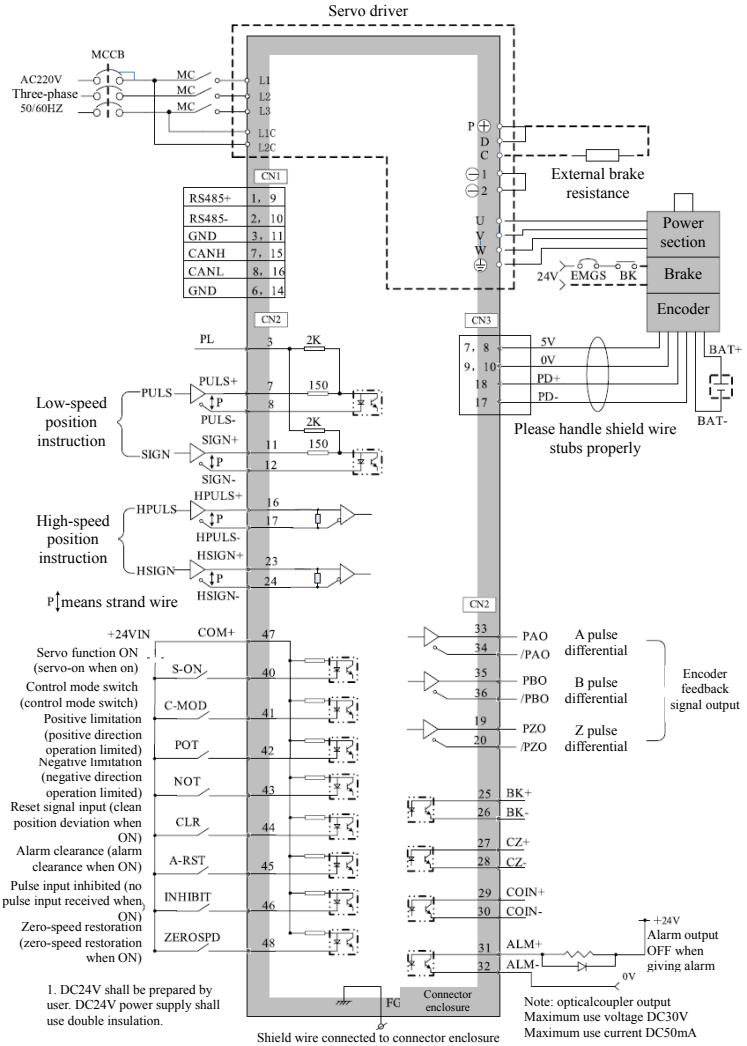


■ Wiring of 17-bit serial encoder

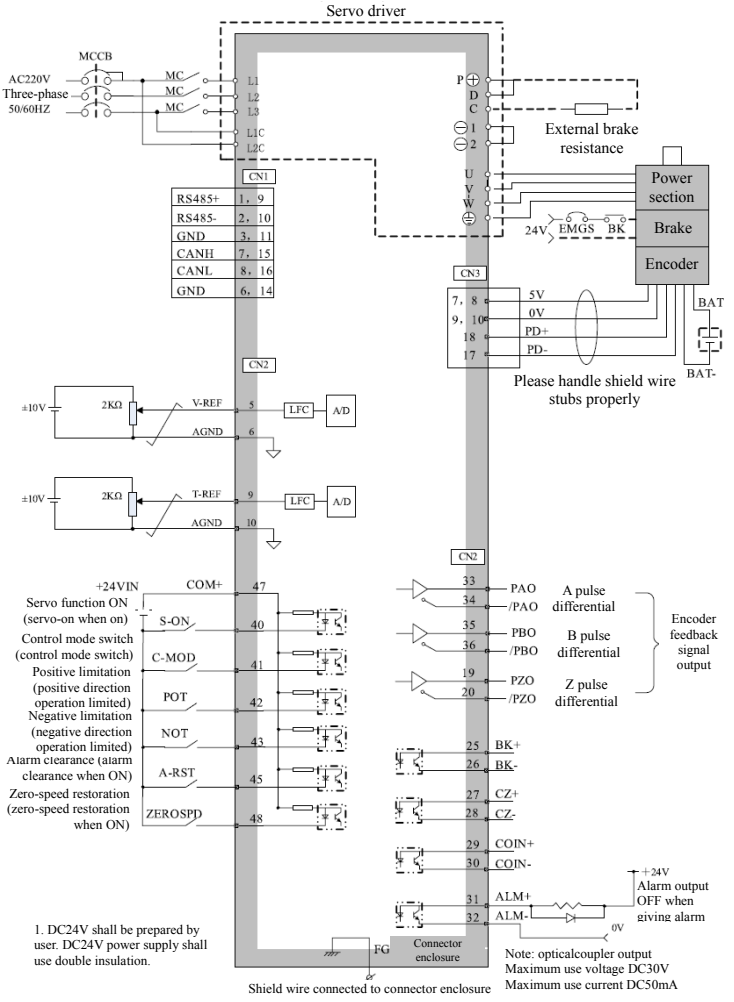


3.6 Standard wiring mode

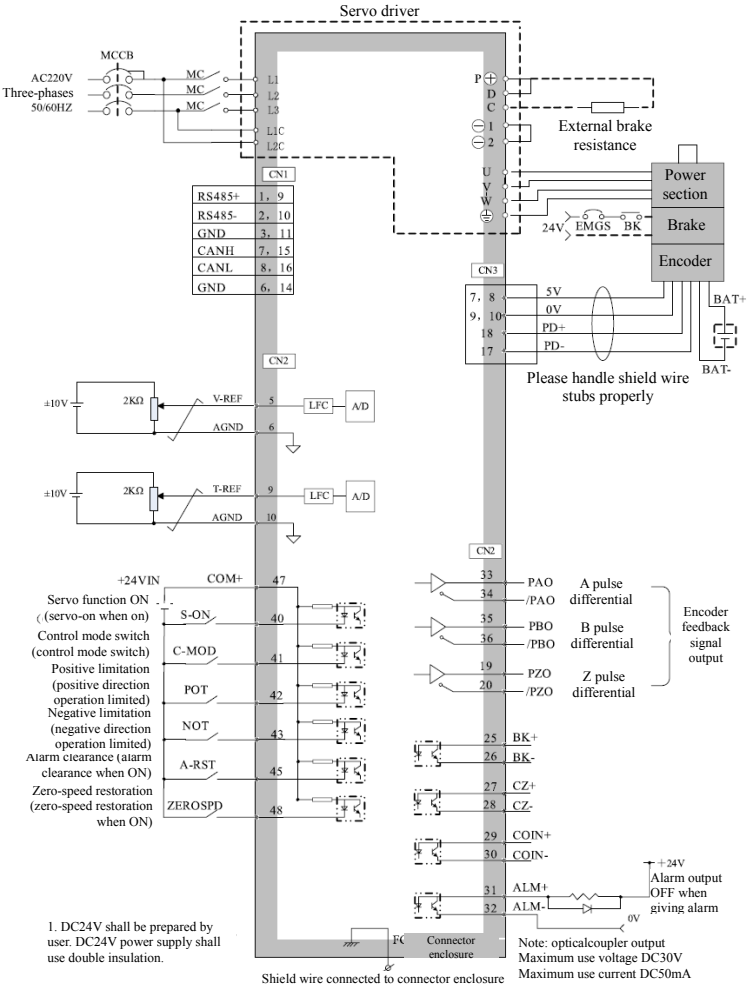
3.6.1 Example of position control connection



3.6.2 Example of speed control connection



3.6.3 Example of torque control connection



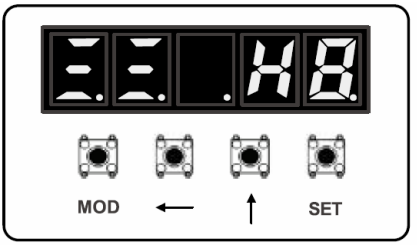
Chapter IV Panel Operation

4.1 Panel manipulator

The panel manipulator consists of its display part and keys.

The panel manipulator can display status, implement auxiliary functions, set up parameters, and monitor the action of servo driver.

Name and functions of keys of the panel manipulator are shown as follows.



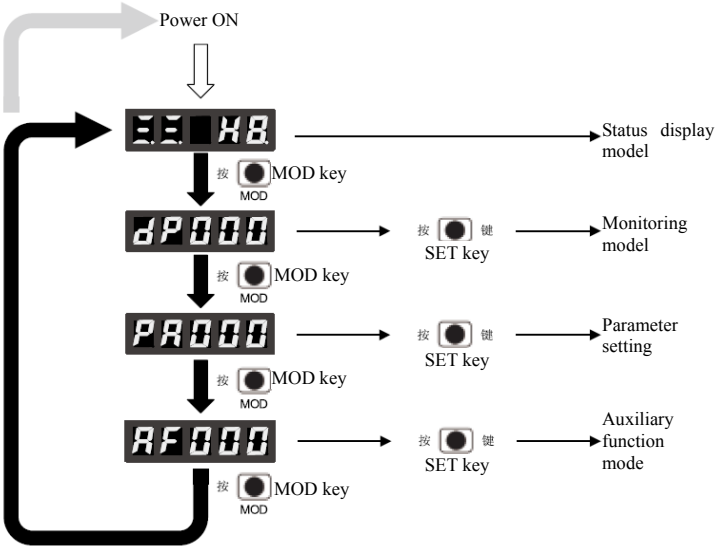
Key	Function description
MOD	Switch between different models or exit gradually as cancel button
←	Function digit rotate left
↑	Number of function digit increases constantly without generating carry bit. If the data are signed number, the function digit switches between + and–
SET	Enter the parameters and display menu; equivalent to ENTER

How to reset servo alarm?
Press UP key and DOWN key at the same time to reset servo alarm.
(Note) Before reset servo alarm, please find out the alarm causes.

4.2 Function switch

Press MODE/SET, the functions will be switched as follows.

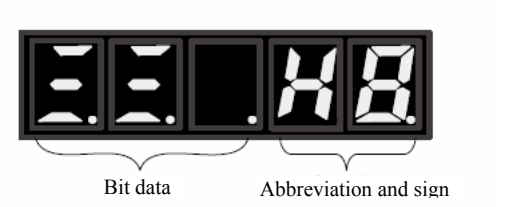
For the operating methods of each function, pelase read the relevant sections.



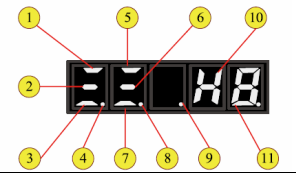
4.3 Status monitoring

In status display model, state of servo driver is represented by number of bit.

Status display can be judged in the methods below.



Display content



Bit Data			
Monitoring No.	Name	Description of position control model	Description of speed, torque control model
1	Display of power supply	Light on when the main circuit power is ON;	Light on when the main circuit power is ON;

	ready	Light off when the main circuit power is OFF.	Light off when the main circuit power is OFF.
②	Compatibility mark	Positioning completed (COIN)	Speed compatibility (VCMP) display
③	Erase input mark	Light on when there is reset signal (CLR) input Light off when there is no reset signal input	Light on when there is reset signal (CLR) input Light off when there is no reset signal input
④	Position control model mark	Light on	Light off
⑤	Rotation detection display	When speed is higher than the set speed, the light is on (TGON)	When speed is higher than the set speed, the light is on (TGON)
⑥	Instruction input mark	Display of instruction pulse input	During speed control: display of speed instruction inputting During torque control: display of torque instruction input
⑦	Torque detection display	The light is on when the torque instruction during input is greater than the set value (20% of nominal torque), and is off when it is smaller than the set value.	The light is on when the torque instruction during input is greater than the set value (20% of nominal torque), and is off when it is smaller than the set value.
⑧	Speed control model mark	Light off	The light is on when the present model is under speed control
⑨	Torque control model mark	Light off	The light is on when the present model is under speed control
Abbreviation and Sign			
⑩	Limit sign	 for left limit  for right limit Alternative display of  and  during simultaneous limit	 for left limit  for right limit Alternative display of  and  during simultaneous limit
⑪	Operation mark	When the motor is under excited state, it displays  of operation dynamically. When the motor is not under excited state, it stops rotation.	When the motor is under excited state, it displays  of operation dynamically. When the motor is not under excited state, it stops rotation.

4.4 Monitor display (dP □□)

Under monitoring model, it can monitor (display) the servo driver's instruction value, input-output signal state and internal state of servo driver. On the panel manipulator, it is displayed as the serial number beginning with DP.

4.4.1 Display content

Please refer to section 5.1 for the contents displayed under monitoring model.

4.4.2 Example of operation under monitoring model

The following part will take motor speed (dP 00) as an example to explain the operating methods of monitor display.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. is not DP00, press "↑" or "←" to show "DP100".
3			Press SET to enter the monitoring interface; it will show the left figure and display the motor speed as 1500rpm.
4			Press SET or MOD to return to the display in procedure 1.
5	End of operation		

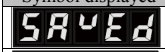
4.5 Parameter mode

4.5.1 Relevant instructions

Set parameters of the servo driver. On the panel manipulator, it is displayed as the serial number beginning with PA.

■ Storage setting state

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

Symbol displayed	Description
	Correct setting value, saved (Saved)
	Parameter active after restarted (Reset)
	Wrong setting value or input data out of range (Out of Range)
	Parameter protected by cryptograph, not available for modification (Can not operation)

■ Value type

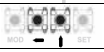
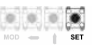
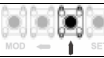
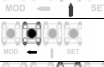
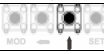
The most significant digit of the parameter shows the value type.

Symbol displayed	Description
	The most significant digit is not displayed, which means the parameter setting is on decimal base. When the data are unsigned number, the most significant digit is set to be 0 ~ 6, and other digits may be 0 ~ 9; When the data are signed number, the most significant digit is the sign digit.
	The most significant digit is shown as "b", meaning that the parameter setting is on a binary base. Scope for each digit is 0 ~ 1.
	The most significant digit is shown as "d", meaning that the parameter setting is on a decimal base. Scope for each digit is 0 ~ 9.
	The most significant digit is shown as "h", meaning that the parameter setting is on a hexadecimal base. Scope for each digit is 0 ~ F.

4.5.2 Example of parameter setting (PA□□□)

The following part will introduce the method for revising parameters taking the loop

gain (PA100) of the first position as am example. Revise the number of PA100 from 40 to 200.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” and it will show “PA100”.
3			Press SET to enter the parameter editing interface; it will show the left figure which means the current number is 40.
4			Press “←” to move the digit flickering and make the digit 4 flicker. (the number flickering is the modifiable number.)
5			Press“↑” for 6 times and the value showed becomes “00”.
6			Press “←” to move the digit flickering, as shown in the left figure.
7			Press“↑” for 2 times and the value showed becomes “200”.
8			Press SET to revise the value of PA100 to 200. If the set value is between the maximum and minimum values of the parameter and can become effective immediately, the panel is shown as in the left figure.
			If the set value is between the maximum and minimum values of the parameter and can become effective only after it's powered on again, the panel is shown as in the left figure.
			If the set value is not between the maximum and minimum values of the parameter, the panel is shown as in the left figure. The value set will be abandoned.
9			After about 1s, the display will return to the parameter editing interface, as shown in procedure 2.
10			Press MODE and the value of PA100 will not be revised; the display will exit from the parameter editing interface and return to procedure 2.
11	End of operation		

4.6 Example of auxiliary function (AF□□)

Auxiliary functions include the functions relating to the setting and adjustment of servo driver.

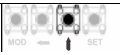
On the panel manipulator, it is displayed as the serial number beginning with AF.

4.6.1 Contents of auxiliary function

Please refer to section 6.1.

4.6.2 Example of auxiliary function (AF□□)

The following part will take resetting to factory default (AF005) as an example to explain the operating methods of auxiliary function.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press "↑" or "←" to show "AF005".
3			If the servo is under non operation state, press SET and the panel will display the left figure.
			If the servo is in operation state or the front panel lock (AF 03) is set, the panel will display the left figure, meaning operation of the auxiliary function is not available.
4			Press "↑" persistently to show the left figure.
5			Continue pressing it and the left figure means operation is completed.
6			Relieve the key and the panel displays the left figure.
7			Press MOD or SET to exit from the auxiliary function and return to the display in procedure 2.
8	End of operation		

4.7 Parameter writing method in this manual

The following part will introduce the methods to write the parameters in this manual.

4.7.1 Writing method of setting value parameter

Parameter number	Name	Setting range	Unit	Factory setting	Effective	Others
PA 100	Loop gain at the 1st position	1~100	1/S	40	Immediately	

Parameter label

Range of parameter available for setting

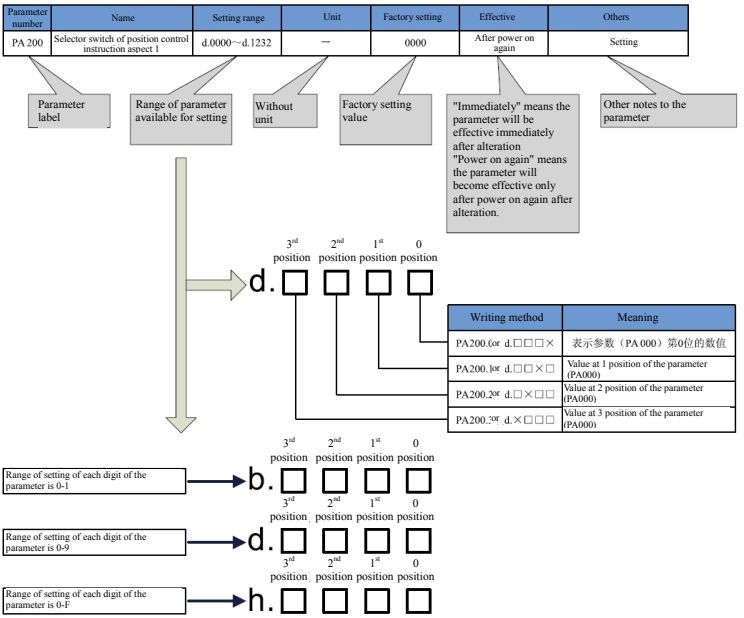
The "minimum" setting unit (scale of setting value) in the parameter

Factory setting

"Immediately" means the parameter will be effective immediately after alteration
"Power on again" means the parameter will become effective only after power on again after alteration.

Other notes to the parameter

4.7.2 Writing method of function selection parameter



Chapter V Monitor Display

5.1 Overview of monitor display

Monitor display refers to the display of instruction value set in the servo driver, state of input-output signal, and internal state of servo driver.

Monitor display is shown in the table below.

Monitoring No.	Display contents	Unit
dP 00	**Motor speed** Display the motor operating speed	[r/min]
dP 01	**Motor feedback pulse number (encoder unit, lower 4 digits)** Display the lower 4 digits of the sum of motor encoder feedback pulse.	[1 Encoder pulse]
dP 02	**Motor feedback pulse number (encoder unit, lower 5 digits)** Display the lower 5 digits of the sum of motor encoder feedback pulse.	[10000 Encoder pulse]
dP 03	**Motor instruction input pulse number (before electronic gear) (user unit, lower 4 digits)** Under position control, it shows the lower 4 digits of the sum of motor instruction input pulse number.	[1 Instruction pulse]
dP 04	**Motor instruction input pulse number (before electronic gear) (user unit, lower 5 digits)** Under position control, it shows the lower 5 digits of the sum of motor instruction input pulse number.	[10000 Encoder pulse]
dP 05	**Error pulse number (encoder unit, lower 4 digits)** Under position control, it shows the lower 4 digits of the sum of error pulse number.	[1 Encoder pulse]
dP 06	**Error pulse number (encoder unit, lower 5 digits)** Under position control, it shows the lower 5 digits of the sum of error pulse number.	[10000 Encoder pulse]
dP 07	**Speed instruction (analog voltage instruction)** Under speed control (analog quantity instruction), it displays the voltage value of analog input. The value displayed is the value after correction of null shift. When the voltage exceeds ±10V, it cannot be displayed correctly.	[0.1V]
dP 08	**Internal speed instruction** Display the internal speed instruction under speed control and position control.	[r/min]
dP 09	**Torque instruction (analog voltage instruction)** Under torque control (analog quantity instruction), it displays the voltage value of analog input. The value displayed is the value after correction of null shift. When the voltage exceeds±10V, it cannot be displayed correctly.	[0.1V]
dP 10	**Internal torque instruction (value in relation to the rated torque)** Display the internal torque instruction under torque control, speed control and position control.	[%]
dP 11	**Torque feedback (value in relation to the rated torque)** Display the torque feedback value under torque control,	[%]

Monitoring No.	Display contents	Unit
	speed control and position control.	
dP 12	**Input signal monitoring** Display the control input signal state connected to CN2 connector	--
dP 13	**Output signal monitoring** Display the driver output signal state connected to CN2 connector	--
dP 14	**Instruction pulse frequency** Display the frequency of instruction pulse of the upper device under position control.	[0.1Khz]
dP 15	**Major loop voltage** Display the DC voltage of input power after rectification	[V]
dP 16	**Total operation time** Display the total operation time of the driver. The time is a record of the time when the driver is powered on; if AF005 operation (reset to factory default) is implemented, the value will be reset.	[Hous]
dP 17	**Rotation angle** Display the electric rotation angle of the motor.	[deg]
dP 18	**Real position of encoder (single ring absolute value or multiple-ring absolute value encoder)** When absolute value encoder is used (single ring absolute value or multiple ring absolute value encoder), it displays the absolute position data of the encoder in one ring.	[2 Encoder pulse]
dP 19	**Display of number of encoder rings (only effective for absolute value encoder)** When absolute value encoder is used (multiple ring absolute value encoder), it displays the absolute position data of the encoder in one ring.	[1 ring]
dP 20	**Cumulative load factor (take the rated value of cumulative load as 100%)** Display the corresponding rate of alarm grade during motor overload protection	[%]
dP 21	**Regeneration load factor (take the rated value of regeneration load as 100%)** Display the corresponding rate of alarm grade during regeneration overload protection	[%]
dP 22	**DB load factor (take the rated value of DB load as 100%)** Display the corresponding rate of alarm grade during DB braking protection	[%]
dP 23	**Ratio of inertias of load** Display the ratio between load inertia and motor inertia.	[%]
dP 24	**Effective gain monitoring** Display the gain data used in position and speed control. 1: means the first group of gains 2: means the second group of gains	

5.2 Example of monitor display operation

Take dP 00 as an example. Operation of monitor display is illustrated as follows.

The following part is an example of display when the rotating speed of servo motor is 1600 rpm.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. is not DP00, press "↑" or "←" to show "DP00".
3			Press SET to enter the monitoring interface; it will show the left figure and display the motor speed as 1600rpm.
4			Press SET or MOD to return to the display in procedure 1.
5	End of operation		

5.3 Input signal monitoring

Input signal state can be confirmed through input signal monitoring (dP 12). The procedures, judgment method and example of display are shown as follows.

5.3.1 Display procedures

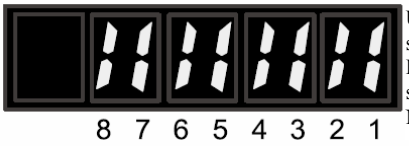
Display procedures of input signal are as follows.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. is not DP12, press "↑" or "←" to show "DP12".
3			Press SET to enter the monitoring interface; it will show the left figure
4			Press SET or MOD to return to the display in procedure 1.
5	End of operation		

5.3.2 Judgment method of display

The distributed input signal is displayed through the section's (LED) illumination state of panel manipulator.

Corresponding relation between the input pin and LED No. is shown in the table below.



Upper: corresponding to input signal active
Lower: corresponding to input signal level
No.

◆When the input signal is in active state, the upper section (LED) is illuminated.

◆When the input signal is L level (input opticalcoupler conductive), the lower section (LED) is illuminated.

Display LED No.	Input pin	Signal name (default set)
1	40	S-ON
2	41	C-MOD

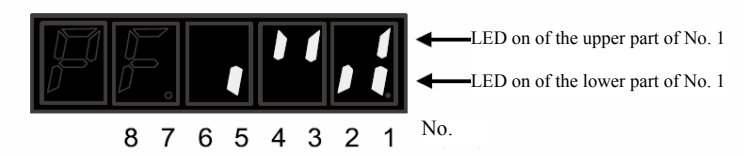
Display LED No.	Input pin	Signal name (default set)
3	42	POT
4	43	NOT
5	44	CLR
6	45	A-RST
7	46	INHIBIT
8	48	ZEROSPD

[Note]
1. When there is no external input, the corresponding IO signal can also be active by revising parameters PA [508] and PA [509] (selection of input signal aspect). dp 12 can not only display the state of external input IO signal level, but also display the active state of internal signal.
2. When the input signal is not negative, POT and NOT signals are inactive when the opticalcoupler is not conductive, meaning driving inhibited (overtravel).

5.3.3 Example of display

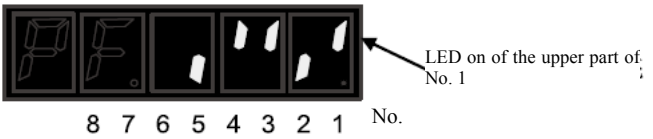
Display of input signal is illustrated as follows.

The input opticalcoupler is conductive, PA508.0 = 0, and S-ON signal is active (servo ON at L level).



The input opticalcoupler is conductive, PA508.0 = 1, and S-ON signal H is inactive (servo ON at H level).

The input opticalcoupler is not conductive, PA508.0 = 1, and S-ON signal is inactive (servo ON at H level).



5.4 Output signal monitoring

Output signal state can be confirmed through output signal monitoring (dP 13). The procedures, judgment method and example of display are shown as follows.

5.4.1 Display procedures

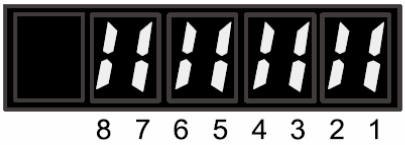
Display procedures of output signal are as follows.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. is not DP12, press "↑" or "←" to show "DP12".
3			Press SET to enter the monitoring interface; it will show the left figure
4			Press SET or MOD to return to the display in procedure 1.
5	End of operation		

5.4.2 Judgment method of display

The distributed output signal is displayed through the section's (LED) illumination state of panel manipulator.

Corresponding relation between the input pin and LED No. is shown in the table below.



Upper: corresponding to input signal active
Lower: corresponding to input signal level
No.

◆When the input signal is in active state, the upper section (LED) is illuminated.

◆When the input signal is L level (input opticalcoupler conductive), the lower section (LED) is illuminated.

Display LED No.	Input pin	Signal name (default set)
1	31,32	ALM
2	29,30	COIN
3	27,28	CZ
4	25,26	BK

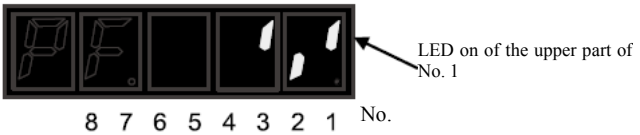
[Note]
1. Even when the output signal is in null state, the polarity of corresponding IO level can also be changed by revising parameter PA [511] (selection of output signal aspect). dp 13 can not only display the state of output signal level, but also display the active state of internal signal.
2. Output pin 2CN-31 and 2CN-32 can only be used as ALM signal and its output polarity can be revised through parameter PA [511] (selection of output signal aspect). When the output pin is Z pulse collector output (CZ), the corresponding digit of dp 13 is not illuminated. When more than 1 pin is selected for Z pulse output, only one Z signal (with priority of DO2> DO3> DO4) can be output.

5.4.3 Example of display

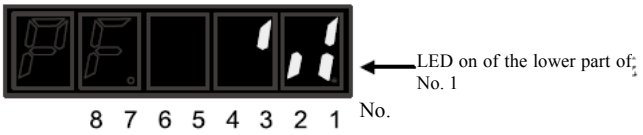
Display of input signal is illustrated as follows.

PA511.0=0, ALM signal is inactive, and the opticalcoupler is conductive (ALM signal is L level)

PA511.0=0, ALM signal H is active, and the opticalcoupler is not conductive (ALM signal is H level)



PA511.0=1, ALM signal L is active, and the opticalcoupler is conductive (ALM signal is L level)



5.5 Monitor display when power-on

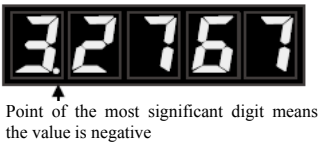
If dP No. is set through PA014, when the power is on, the panel manipulator will display the dP No. already set.

But if it has been set to be 50 (factory default), it will display the status when the power is on.

Parameter No.	Name	Setting range	Unit	Factory default	Effective time
PA014	Initial display status Please check the monitoring contents. When it is set to be 50, the panel will display the status code	0 ~ 50		50	Power-on again

5.6 Other notes

◆ The value display range of dP 01, dP 03 and dP 05 is [-32767, 32767]; when it is -32767, the panel display is as follows:



When the absolute value of motor feedback pulse number (dP 02×10000＋dP 01),

pulse instruction input pulse number (dP 04×10000＋dP 03) and deviation pulse number (dP 06×10000＋dP 05) is greater than 327679999, and display data will not be updated.

Chapter VI Auxiliary Functions

6.1 Overview of auxiliary function

Auxiliary functions are represented by the No. beginning with AF, and they mainly realize the functions relating to the operation and adjustment of servo motor.

The table blow is an overview of the auxiliary functions and lists some referential sections.

AF No	Functions	Referential sections
AF 00	Display of error logging	6.2
AF 01	Location assignment (only active under location model)	6.3
AF 02	Jog operation model	6.4
AF 03	Front panel lock operation	6.5
AF 04	Clearance of alarm logging	6.6
AF 05	Parameter initialization	6.7
AF 06	Self-regulation of analog quantity (speed and torque) instruction offset	6.8
AF 07	Manual regulation of speed instruction offset	6.9
AF 08	Manual regulation of torque instruction offset	6.10
AF 09	Check the relevant parameters of motor	6.11
AF 10	Display of software version of servo driver	6.12
AF 12	Set absolute value encoder	6.13
AF 15	Manual detection of load inertia	6.14

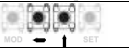
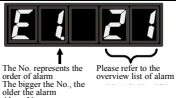
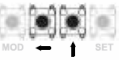
6.2 Display of alarm logging (AF 00)

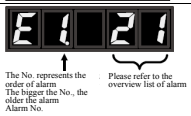
The servo diver can trace back to previous displays and can display at most 10 previous alarm loggings.

It can confirm the alarm No. and time stamp *.

* Time stamp means the function to measure the time of duration after the control power supply and major loop power are charged on with 1 Hour as the unit, and display the total operation time when the alarm is given out. If operated in 24 hours a day, 365 days a year, it can continuously measure for about 7.5 years.

Display procedures of alarm logging are as follows.

Proceed ures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. is not DP00, press "↑" or "←" to show "DP00".
3			Press SET and the left figure will be displayed, meaning the latest alarm code.
4			Press "←" once and it will display one previous alarm. Press "↑" once and it will display a new alarm. The bigger the number on the left side, the older the alarm displayed.

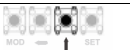
5			Press MOD, and it will display the hexadecimal time stamp.
6			Press MOD again, the interface will be switched back to the alarm No. displaying the time stamp. Press "↑" once and it will display a new alarm.
7			Press SET to exit from the auxiliary function and return to procedure 2.
8	End of operation		

＜Supplementary note＞

- When the same alarms are given continuously, if the interval between errors is less than 1 hour, they will not be saved; if the interval exceeds 1 hour, all of them will be saved.
- When there are no alarms, the alarm No. is 0.
- The alarm logging can be deleted through Deletion of Alarm Logging (AF 04). Even though there is alarm reset or the major loop power supply of servo driver is cut off, the alarm logging will not be deleted.

6.3 Location assignment (AF 01)

After the location assignment function of servo driver is implemented, the motor feedback location and set pulse position will be set to be PA741 and PA742, and the unit of PA741 is circle.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press "↑" or "←" to show "AF001".
3			Press SET and the left figure will be displayed
4			Press "↑" persistently to show the left figure.
5			Press it continually till the left figure is shown which means operation is completed.
6			Relieve the key and the panel displays the left figure.
7			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
8	End of operation		

6.4 JOG operation(AF 02)

JOG operation means the function to confirm the servo motor action through speed control without connecting to the upper device.

During JOG operation, the overtravel prevention function is inactive. The range of

operation of the machinery used shall also be considered during operation.

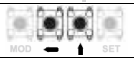
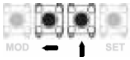
(1) Setting before operation

Before JOG operation, the following settings are necessary.

- When S-ON input signal is ON, please switch it to OFF.
- Please set the JOG speed after considering the range of operation of the machine. JOG operating speed can be set through PA306.
- Please take necessary safety measures and enable it to stop under any emergent occasions.
- In order to ensure safety, a stop device shall be set on the machine side.

(2) Operation steps

JOG operation steps are as follows. The following part will introduce the operation steps when the rotation direction of servo motor is set to be PA000.0=0 (rotating positively under instructions for positive rotation).

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. does not show AF 02, press "↑" or "←" to show "AF 02".
3			If the servo is not under operation state and has go ready, press SET to enter JOG operation interface and the panel will display the left figure.
4			If the servo is in operation state or the front panel lock (AF 03) is set, the panel will display the left figure, meaning operation of the auxiliary function is not available.
5			Press MODE to enter the state of servo ON (motor power on).
6			Press "←" (to rotate positively) or "↑" (to rotate negatively) While pressing the keys, the servo motor will rotate at the speed set by PA306.
7			Press MODE to enter the state of servo OFF (motor power off). ＜supplement＞ Users can also press SET to exit from JOG operation and the servo will also be OFF.
8			Press SET to exit from the auxiliary function and return to procedure 2.
9	End of operation		

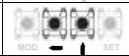
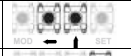
6.5 Front panel lock (AF 03)

Password setting

When it is set to be 58, it means no parameters and functions can be operated.

When it is set to be 315, it means all parameters and functions can be operated.

When it is set to be other value, it means only the parameters and functions in the operating manual can be operated.

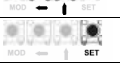
Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press "↑" or "←" to display "AF003".
3			Press SET and the left figure will be displayed
4			Press SET to enter the lock password setting.
5			Press "↑" or "←" to set the password.
6			Press SET to lock the password and return to procedure 2.
7	End of operation		

6.6 Deletion of alarm logging (AF 04)

Delete all the functions of alarm logging in servo driver logging.

Note) The alarm logging can be deleted through this function. Even though there is alarm reset or the major loop power supply of servo driver is cut off, the alarm logging will not be deleted.

The operation procedures are shown as follows.

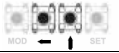
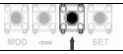
Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press "↑" or "←" to display "AF004".
3			Press SET and the left figure will be displayed
4			Press "↑" constantly to show the left figure.
5			Press it continually till the left figure is shown which means operation is completed.
6			Relieve the key and the panel displays the left figure.
7			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
8	End of operation		

6.7 Initialization of parameter setting value (AF 05)

It is the function which can reset the parameter to the factory defaults.

- Initialization of parameter setting value shall be conducted when the servo is OFF. It can not be conducted when the servo is ON.
- In order to make the setting active, the servo driver shall be powered on again after the setting.

The operation procedures are shown as follows.

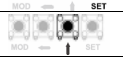
Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF005”.
3			If the servo is under non operation state, press SET and the panel will display the left figure.
4			If the servo is in operation state or the front panel lock (AF 03) is set, the panel will display the left figure, meaning operation of the auxiliary function is not available.
5			Press “↑” constantly to show the left figure.
6			Press it continually till the left figure is shown which means operation is completed.
7			Relieve the key and the panel displays the left figure.
8			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
9	Power-on again		
10	End of operation		

6.8 Automatic zero calibration of dummy instruction (AF 06)

Self-regulation of the instruction offset is a method for self-regulation of the instruction voltage (speed instruction and torque instruction) after measuring the offset.

The offset measured will be saved in the servo driver.

The procedures of using panel manipulator for the self-regulation of instruction offset are as follows.

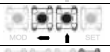
Proced ures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF006”.
3			Press SET and the panel will display the left figure.
4			Press “↑” constantly to show the left figure.
5			Press it continually till the left figure is shown which means operation is completed.

6			Relieve the key and the panel displays the left figure.
7			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
8	End of operation		

6.9 Manual regulation of speed instruction offset (AF 07)

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

The procedures of using panel manipulator for the manual regulation of instruction offset are as follows.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF007”.
3			Press SET and the panel will display the left figure.
4			If the motor is on, the left figure will be displayed.
5			Press SET again to display the present offset of the speed instruction.
6			Press “↑” or “←” for regulation
7			When pressing SET, "Save" will flicker, and then the panel display will switch to procedure 2.
8			If users do not wanna store data, just press MOD to exit and then the panel will display procedure 2.
9	End of operation		

6.10 Manual zero calibration of torque dummy instruction (AF 08)

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

The procedures of using panel manipulator for the manual regulation of instruction offset are as follows.

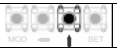
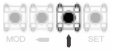
Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF008”.
3			Press SET and the panel will display the left figure.
4			If the motor is on, the left figure will be displayed.
5			Press SET again to display the present offset of the speed instruction.

Procedures	Panel display after operation	Keys used	Operation
6			Press “↑” or “←” for regulation
7			When pressing SET, "Save" will flicker, and then the panel display will switch to procedure 2.
8			If users do not wanna store data, just press MOD to exit and then the panel will display procedure 2.
9	End of operation		

6.11 Display of motor model (AF 09)

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

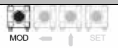
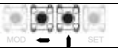
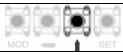
The operation procedures are shown as follows.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF009”.
3			Press SET to show the left figure. It means the driver model is 0, and the first letter is identified as "d".
4			Press “↑” to show the motor model, and the first letter is identified as “F”.
5			Press “↑” to show the model of encoder. 0 means it is an absolute value encoder; 1 means it is a single ring absolute value encoder; 2 means it is a line-saving and capacity-increasing encoder. The first letter is identified as "E".
6			Press SET to lock the password and return to procedure 2.
7	End of operation		

6.12 Display of software version of servo driver (AF 10)

Display of software version of servo driver and encoder.

The operation procedures are shown as follows.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF005”.
3			Press SET to show the left figure. "d 1.00" means the DSP software version is 1.00.
4			Press “↑” to show the left figure. “F 1.03”means FPGA software version is

Procedures	Panel display after operation	Keys used	Operation
			1.03.
5			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
6	End of operation		

6.13 Set absolute value encoder (AF 11)

This operation is only effective when the absolute value encoder is used; generally, it is used under the following conditions.

- Absolute value motor is used for the first time;
- There is relevant encoder alarm;
- When the value of multiple rings of an absolute value encoder will be set 0;

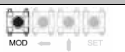
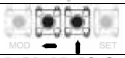
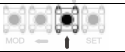
Note:

1. Encoder setting can only be operated when the servo is OFF;

2. When there are alarms relating to the absolute value encoder, the alarms can only be cancelled through this operation, and use of alarm reset signal (A-RST) can not cancel these alarms;

3. After this operation is ended, please power on again before correct operations to check whether there are alarms;

4. After the operation is ended, the multiple-ring value of the absolute value encoder is 0, and the relevant alarms relating to the absolute value encoder can be cleaned up.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press "↑" or "←" to display "AF0011".
3			Press SET to show the left figure.
4			Press "↑" continuously.
5			Press it continually till the left figure is shown which means operation is completed.
6			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
7	Power-on again		
8	End of operation		

6.14 Manual detection of load inertia (AF 15)

Manual detection of load inertia means the servo system finishes detecting the load inertia value through manual operation.

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

inertia. The range of operation of the machinery used shall also be considered during operation. The running distance during testing can be set through parameter PA300.2.

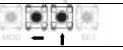
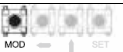
(1) Setting before operation

Before manual detection of load inertia, the following settings are a must.

- When S-ON input signal is ON, please switch it to OFF.
- Please set the running distance after considering the range of operation of the machine. The running distance can be set through PA300.2.
- Please take necessary safety measures and enable it to stop under any emergent occasions.
- In order to ensure safety, a stop device shall be set on the machine side.

(2) Operation procedures

Operation procedures of manual detection of load inertia are as follows.

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			Press “↑” or “←” to display “AF0015”.
3			If the servo is under non operation state and has been ready, press SET and the panel will display the left figure.
4			If the servo is in operation state or the front panel lock (AF 03) is set, the panel will display the left figure, meaning operation of the auxiliary function is not available.
5			Press MOD key for manual detection of load inertia.
6			During detection, if the detection needs to be stopped immediately, users can press SET to exit directly.
7			After the detection, the panel will display the load inertia value. Its unit is Kg.Cm2
8			Press MOD or SET to exit from the auxiliary function and return to procedure 2.
9	End of operation		

Chapter VII Test Run

7.1 Inspection and matters needing attention before the test run

In order to ensure safety and conduct test run correctly, please check and confirm the following items in advance.

Project	Content
Servo motor	Whether the motor has been released from load?
	Whether the wiring and connection are right?
	Whether the fastening parts are loose?
	If the servo motor has a holding brake, whether the brake has been released in advance? When the brake is released, certain voltage shall be imposed on the brake (generally DC24V)
Servo driver	Whether the wiring and connection are right?
	Whether the supply voltage to the servo driver is normal?

7.2 Conduct JOG operation through panel manipulator

The following part will introduce the procedures to use panel manipulator for JOG operation.

- JOG operation means the function to confirm the servo motor action through speed control without connecting to the upper device.
- During JOG operation, the overtravel prevention function is inactive. The range of operation of the machinery used shall also be considered during operation.

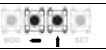
(1) Setting before operation

Before JOG operation, the following settings are a must.

- When S-ON input signal is ON, please switch it to OFF.
- Please set the JOG speed after considering the range of operation of the machine. JOG operating speed can be set through PA306.

(2) Operation procedures

JOG operation steps are as follows. The following part will introduce the operation steps when the rotation direction of servo motor is set to be PA000.0=0 (rotating positively under instructions for positive rotation).

Procedures	Panel display after operation	Keys used	Operation
1			Press MOD key to choose the auxiliary function.
2			If the parameter No. is not “AF 02”, press “↑” or “←” to show “AF 02”.
3			Press SET to enter the JOG operation interface, and the panel will show the left figure. (Note) When it is set to be "write inhibit", the panel will display "no_oP". Please switch to the writeable state through "AF03" before

Procedures	Panel display after operation	Keys used	Operation
			operation.
4			Press MODE to enter the state of servo ON (motor power on). The rightmost point of nixie tube is illuminated, which means the motor has been excited.
5			Press "↑" (to rotate positively) or "←" (to rotate negatively) While pressing the keys, the servo motor will rotate at the speed set by PA306.
6			Press MODE to enter the state of servo OFF (motor power off). ＜Supplement＞ Users can also press SET to exit from JOG operation and the servo will also be OFF.
7			Press SET to exit from the auxiliary function and return to procedure 2.
8	End of operation		

7.3 Test run of separate servo motor according to the upper device instructions

Before the test run of separate servo motor according to the upper device instructions, please confirm the following items:

Project	Content
1	Confirm whether the move instructions and input-output signal of servo motor input from the upper device to the servo driver are correctly set.
2	Confirm whether the connection between upper device and servo driver is correct and whether the polarity is set correctly.
3	Confirm whether the action of servo driver is correctly set.

7.3.1 Connection and status confirmation of input signal loop

Before the test run of speed control and position control according to the upper device instructions, the connection confirmation shown in the following procedure 1 shall be conducted.

Please confirm the connection and state of input signal according to the following procedures.

Procedure	Operation	Referential sections
1	Please connect the input signal loop required by the test run to the input-output signal connector (CN2). The following conditions shall be satisfied during connection. ·Servo ON input signal (S-ON) is in the state available for input. ·Inhibit positive rotation driving (POT), negative rotation driving (NOT) and input signal ON (L level) (available for positive rotation and inverse rotation driving)	
2	Connect the connector of upper device to the port (CN2) for input-output signal.	
3	Switch on the power of servo driver. Confirm the "Power ready" on the panel manipulator is illuminated. Confirm the state of input signal through input monitoring (dP012).	4.3

4	Input S-ON signal and keep the servo ON. Confirm the "operation sign" on the panel manipulator is correctly displayed.	4.3
5	Then preparations for the test run are completed. Please go on with the test run under the control modes.	

7.3.2 Test run under position control

The following part will introduce the methods for test run under position control. It will mainly introduce the procedures of test run after the connection of input signal for position control.

Procedure	Operation	Referential sections
1	Reconfirm the power supply and input signal loop and then switch on the control power supply of servo driver.	3.1
2	Use PA200.0 to set the instruction pulse aspect according to the pulse output aspect of upper device.	8.4.1
3	Set the instruction unit and use PA205 and PA206 to set the electric gear ratio and the number of frequency division PA210 according to the upper device.	8.4.2
4	Power on again. Bring the parameter alteration in procedure 3 into effectiveness. Switch on the major loop power supply of the servo driver.	8.5.7
5	Place servo ON (S-ON) input signal on ON.	
6	Output low speed pulse instruction from the upper device with easily confirmed motor rotation (such as: 1 ring).	
7	Monitor the variations of pulse before and after the instruction is given out according to the input instruction pulse counter (dP003 and dP004), based on this to confirm the number of instruction pulse inputted to the servo driver.	
8	Monitor the variations of pulse before and after the instruction is given out according to the feedback pulse counter (dP001 and dP002), based on this to confirm the actual rotation amount of motor.	5.1
9	Confirm whether the servo motor rotates in the direction given by the instruction.	5.1
10	If the driver has feedback pulse, check whether the number of feedback pulse corresponds with the expected number. Number of feedback pulse ＝(dP01*10000+dP02) *PA210*4/ Encoder resolution	
11	Stop the pulse instruction and make the servo OFF.	5.1

7.3.3 Test run under speed control

The following part will introduce the methods for test run under speed control. It will mainly introduce the procedures of test run after the connection of input signal for speed control (please refer to 4.3.1Connection and status confirmation of input signal loop).

Procedure	Operation	Referential sections
1	Reconfirm the power supply and input signal loop and then switch on the control power supply of servo driver.	3.1
2	Adjust the speed instruction input gain (PA301)	8.5
3	Switch on the major loop power supply of the servo driver.	
4	Confirm the speed instruction input (voltage between V- REF and AGND) is 0 V, and then switch on the servo ON (S-ON) input signal.	

Procedure	Operation	Referential sections
5	The speed instruction input voltage (voltage between V-REF and AGND) rises from 0V slowly.	
6	Confirm the speed instruction value (voltage) through the speed instruction monitoring (dP07).	5.1
7	Confirm the motor speed (rotating speed) through motor speed monitoring (dP00).	5.1
8	Confirm the values in procedures 6 and 7 (dP07 and dP00) are consistent according to the conversion relation.	5.1
9	Confirm whether the servo motor rotates in the direction given by the instruction.	
10	Return speed instruction input to 0V, and make the servo OFF. Then the speed test run is finished.	

7.4 Test run after the servo motor is connected with machine

After the servo motor has passed the test run separately, connect the servo motor with the machine and conduct the test run again.

Procedure	Project	Operation	Referential sections
1	Parameter setting 1	Switch on the control power supply and major loop power supply, and conduct the setting relating to the safety functions and overtravel and brake protection functions.	3.1 8.2
2	Parameter setting 2	Set the necessary parameters according to the control mode used.	
3	Installation	Put the power OFF and connect the servo motor with the machine using couplings.	
4	Check	Switch on the power of the upper device, and set the servo of servo driver OFF, and then confirm whether the protection functions set in procedure 1 function normally.	
5	Operation	Conduct test run according to "7.3 Test run of separate servo motor according to the upper device instructions". Confirm the test run result is the same with the test run result of the servo motor separately. And then confirm the setting of instruction unit sorts with the machine.	—
6	Adjustment	Adjust the servo gains as required and improve the response characteristic of servo motor. (Note) During the test run, the servo motor may not adapt to the machine well at the beginning. Please operate times after times to make them adapt to each other.	—
7	S-ON Signal input	Then, the test run is finished.	Upper instructions

7.5 Test run of the servo motor with a brake

Test run of the servo motor with a brake shall follow the following requirements.

Project	Content
1	When conducting test run of the servo motor with a brake, before confirming the action of brake, measures to prevent the natural fall or vibration due to external force

Project	Content
	of the machine shall be taken.
2	When conducting the test run of servo motor with a brake, please first of all confirm the action of servo motor and holding brake before connecting the servo motor with the machine. If there are no problems, conduct the test run again by connecting the servo motor with the machine.
3	Please control the action of the holding brake of the servo motor with a brake using the brake interlocking output signal (BK) of the servo driver.

Chapter VIII Operation

8.1 Selection of control mode

The following part will introduce the available control modes (control patterns) of EPS-B1 servo drivers.

User parameter		Control mode (control pattern)	Referential sections
PA000	h. ☐☐ 0 ☐ [Factory default]	**Position control (pulse train instruction)** The position of servo motor is controlled through the pulse train position instruction. The position is controlled through the pulse number inputted, and speed is controlled through the frequency of input pulse. It is used when the action needs to be positioned.	8.4
	h. ☐☐ 1 ☐	**Speed control (analog quantity voltage instruction)** Use the analog quantity voltage speed instruction to control the rotating speed of servo motor. Please use it under the following occasions. ◆ To control the rotating speed ◆ Use the encoder pulse output of servo driver and establish the position loop through the upper device for position control.	8.5
	h. ☐☐ 2 ☐	**Torque control (analog quantity voltage instruction)** Use the analog quantity voltage torque instruction to control the output torque of servo motor. Please use it when there is a need to output racking.	8.6
	h. ☐☐ 3 ☐	**Speed control (internal setting speed selection)** Use 3 input signals, INSPD0, INSPD1 and INSPD2, for speed control through the operating speed P8 preset in the servo driver. When such control mode is used, the analog quantity instruction is not needed.	8.7
	h. ☐☐ 4 ☐ ~ h. ☐☐ 9 ☐	The switch model used together with the above said 4 control modes; users can choose the switch model matching the control mode.	8.8
	h. ☐☐ A ☐	**Position contact control (internal position instruction)** System position control will be conducted without the upper device.	

8.2 Setting of general basic functions

8.2.1 Servo ON setting

Set the servo ON signal (S-ON) which gives instructions for servo motor on/off.

(1) Servo ON signal (S-ON)

Type	Signal	State	Input level	Remarks
Input	S-ON	ON	2CN-40: “L” level	The servo motor is on (servo ON) and can be operated.
		OFF	2CN-40: “H” level	The servo motor is off (servo OFF) and can not be operated.

(2) Selection of the input level of servo ON signal

The input level can be selected through the user parameter, that's to say, to set the

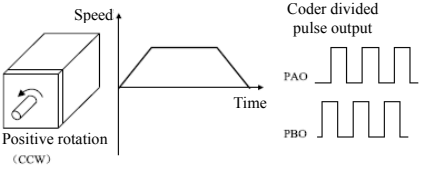
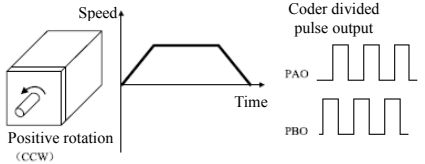
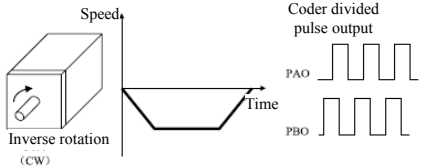
active level of servo ON signal (2CN40).

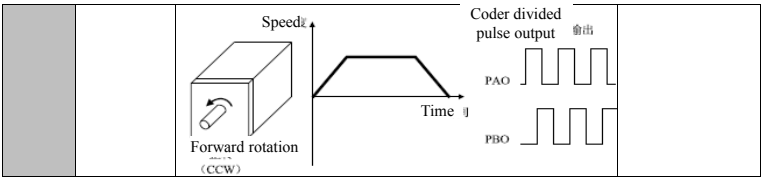
User parameter		Description
PA508	b. □□□ 0	The S-ON signal inputted from input terminal 2CN-40 is active low. (factory default)
	b. □□□ 1	The S-ON signal inputted from input terminal 2CN-10 is active high.

8.2.2 Switch of motor rotation direction

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

The "positive rotation direction" set normally is counter clockwise rotation (CCW) when judged from the load side of the servo motor. "Negative rotation mode" only changes the rotation direction of the motor; under such circumstances, the "positive rotation" becomes "clockwise rotation" when judged from the load side of the servo motor. Under such circumstances, the travel direction of axis (+,－) is inverse, but the polarity of encoder pulse output signal, analog quantity monitor signal and other output signals from the servo driver remains unchanged.

<table>
<tr><th colspan="2">User parameter</th><th>Instruction</th><th>Overtravel (OT)</th></tr>
<tr><td rowspan="4">PA000</td><td rowspan="2">h. □□□ 0
Standard setting (Positive rotation instruction for positive rotation, CCW direction) (factory default)</td><td>■Action when there is positive rotation instruction
 
</td><td>During positive rotation:
Stop through POT</td></tr>
<tr><td>■ Action when there is inverse rotation instruction
 
</td><td>During reverse rotation:
Stop through NOT</td></tr>
<tr><td rowspan="2">h. □□□ 1
Inverse rotation mode (Positive rotation instruction for inverse rotation, CW direction)</td><td>■ Action when there is inverse rotation instruction
 
</td><td>During reverse rotation:
Stop through NOT</td></tr>
<tr><td>■Action when there is positive rotation instruction</td><td>During reverse rotation:
Stop through NOT</td></tr>
</table>



8.2.3 Overtravel setting

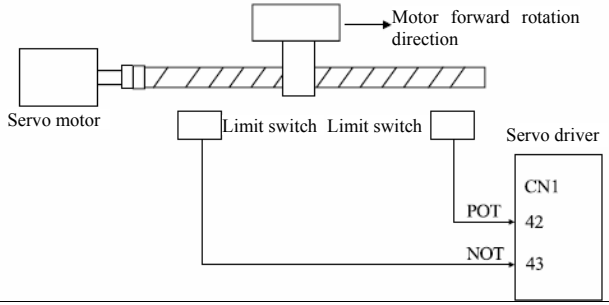
Overtravel refers to the safety function which can make the limit switch function (ON) and force the servo motor to stop when the moving parts of a machine go beyond the movable area.

Notice
Installation of limit switch During rectilinear motion, the limit switch shall be installed in case of machine failure. When the contact part of limit switch has poor contact or breakage, please use the "normally closed contact" to make the motor move along the safe direction. **When the servo motor is used with vertical axis** Under the overtravel state, the workpiece may drop; in order to prevent the workpiece from dropping, the servo motor shall be set to be under the zero-position fixation state during overtravel. Please refer to “” for the setting method.

(1) Overtravel signal connection

In order to activate the overtravel function, please connect the input signal of the following overtravel limit switches to the corresponding pins of the connector CN2 of servo driver correctly.

Type	Signal name	Connector pin	Setting	Meaning
Input	POT	CN2-42 (factory default)	ON=L level	Positive rotation driving allowed (normal operation)
			OFF=H level	Positive rotation driving prohibited (overtravel on positive rotation side)
Input	NOT	CN2-43 (factory default)	ON=L level	Inverse rotation driving allowed (normal operation)
			OFF=H level	Inverse rotation driving prohibited (overtravel on positive rotation side)
Under the state of linear driving, in order to prevent mechanical failure, please connect the limit switch according to the figure below. Even under the overtravel state, driving to opposite side is also allowed. For example, when there is overtravel on the positive rotation side, driving to the inverse rotation side is allowed.				



■ Important

* Under position control, when the motor is forced to stop by overtravel, there may be retention of position deviation pulse. In order to clear the position deviation pulse, it is a must to input the clear signal (CLR).
* POT and NOT signal can freely distribute the input connector pin through the user parameters. For details, please refer to 3.4.3 IO signal distribution.
* Before using POT and NOT signal, please set PA003.0 and PA003.1 to be 0 (make POT and NOT signal active).
* During deceleration

(2) Selection of the method for motor stop when overtravel function is used

Set the method for motor stop when the overtravel signals (POT NOT) are inputted during servo motor rotation.

User parameter		Motor stop method	After motor stop	Meaning
PA001	d. □□0□ d. □□□0	DB stop	Inertial running state	Stop fast through DB (dynamic brake); the servo motor will begin inertial (power off) running after it's stopped.
	d.□□0□ d.□□□1			Stop through inertial running (stop naturally); the servo motor will begin inertial (power off) running after it's stopped.
	d.□□0□ d.□□□2	Inertial running stop		Stop with the same method during servo OFF (inertial running stop); the servo motor will begin inertial (power off) running after it's stopped.
	d.□□1□	Deceleration stop	Zero speed state	Stop by deceleration through the emergency stop torque (PA406); the servo motor will enter the zero speed (servo locked) state after it's stopped.
	d.□□2□		Inertial running state	Stop by deceleration through the emergency stop torque (PA406); the servo motor will enter the zero speed (power off) state after it's stopped.

- After alter the user parameter, the setting will become effective only after the motor is power-on again.
- When setting the n.□□□2 inertial running, if there is servo ON signal received, the servo motor can only be controlled when the speed of motor becomes 0.

■ Vocabulary

- DB: Stop through the dynamic brake (short-circuit of the servo driver's interior circuit).
- Inertial running stop: Stop naturally through the frictional resistance generated during motor rotation, instead of using DB.

- Deceleration stop: Stop through the use of deceleration (brake) torque.
- Zero speed state: The position instruction is zero. Under the zero speed state, the position deviation will be automatically cleared.

* For the method for stop during servo OFF and alarm, please refer to "8.2.5 Selection of the method for stop during servo OFF".

(3) Enable overtravel signal

User parameter		Description
PA003	b.□□□0	Positive rotation side drive prohibited (POT) signal active
	b.□□□ 1	Positive rotation side drive prohibited (POT) signal inactive (factory default)
	b. □□0□	Negative rotation side drive prohibited (NOT) signal active
	b.□□1□	Negative rotation side drive prohibited (NOT) signal inactive (factory default)

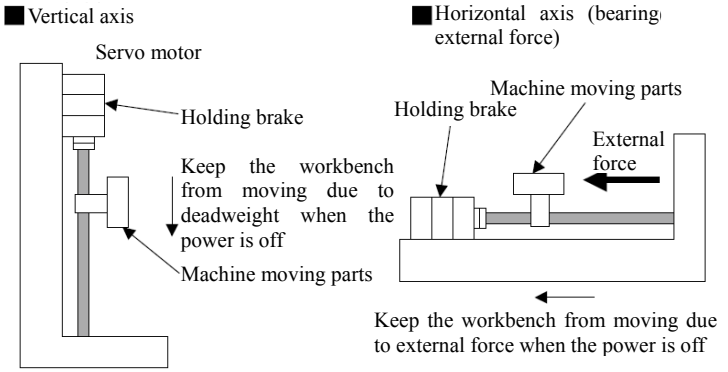
(4) Stop torque setting during overtravel

PA406	Emergency Stop Torque			
	Setting range	Setting unit	Factory setting	Effective time
	0 ~ 300	1%	300	Immediately

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

8.2.4 Setting of holding brake

The holding brake is used when the servo motor drives the vertical axis. When the power of servo driver is OFF, the servo motor with a brake can keep the moving parts from moving due to gravity. (please refer to "7.5 Test run of the servo motor with a brake)



1. The brake of the servo motor with a brake is special excitation-free action type holding brake; it can not be used for braking, and can only be used to maintain the halt state of the servo motor. The brake torque is about 80% of the rated torque of servo motor.

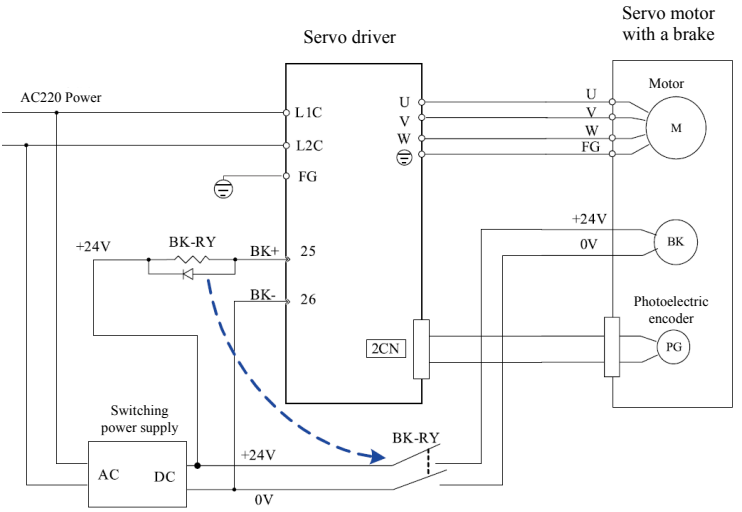
2. If only the speed loop is used to activate the servo motor, when the brake functions,

set the servo OFF and input instruction to be "0V".

3. When setting the position loop, because the servo motor is under servo locked state when it's stopped, the mechanical brake shall not function.

(1) Example of connection

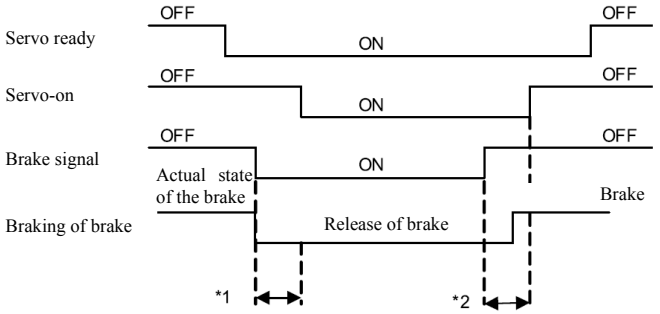
The sequential output signal of servo driver (BK) and brake power supply forms the ON/OFF of the brake. Standard connection of a circuit is illustrated as follows.



Note:

1. BK-RY: brake controls relay
2. The current provided by switching power supply shall be determined according to the brake; different brakes have different working currents. Normally, the DC24V of switching power supply shall be capable of providing the current >1A;
3. DC24V input of the brake is not restricted by direction

The brake has delay action time; please refer to the figure below for the order of ON and OFF of the action.



*1. The time from brake signal active to brake release is different for different types of brake.
*2 is PA518 number

(2) Brake interlocking output

Type	Signal name	Connector pin	Setting	Meaning
Output	BK	Needing distribution	ON=L level	Release brake
			ON=H level	Use brake

Use of the servo motor with a brake needs to control the output signal of brake. In addition, the output signal is not available in factory default setting. Therefore, it is necessary to distribute the output signal (setting of PA510). Do not connect with it when the motor without a brake is used.
■ Important
Under the overtravel state, even the servo motor is powered off, no BK signal is outputted.

(3) Distribution of brake signal (BK)

Brake signal (BK) is distributed to DO4 (CN2-25, CN2-26) signal by default.

User parameter		Connector pin		Meaning
		+ Terminal	- Terminal	
PA510	n.□□3□	CN2-29	CN2-30	Output terminals CN2-29 and CN2-30 output the BK signal.
	n. □□3□	CN2-27	CN2-28	Output terminals CN2-27 and CN2-28 output the BK signal.
	n.3□□□	CN2-25	CN2-26	Output terminals CN2-25 and CN2-26 output the BK signal.

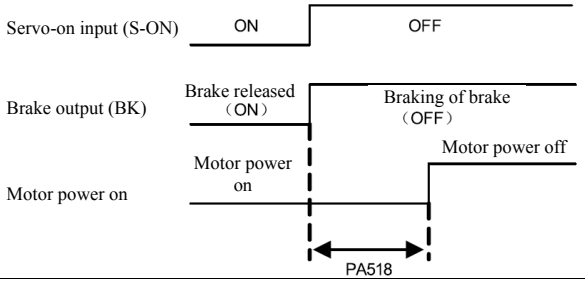
■ Important
For other output signal distribution methods of the servo driver, please refer to "3.4.3 IO signal distribution".

(4) Setting of brake ON timing (after servo motor stop)

Normally, BK signal is outputted when S-ON signal is OFF (servo OFF), but users can change the timing of servo OFF through user parameters.

PA518	Brake instruction- Servo OFF delay time			
	Setting range	Setting unit	Factory default	Effective time
	0 ~ 500	ms	100	

• When used on a vertical axis, owing to the timing of brake ON, moving parts of the machine sometimes may move slightly due to deadweight or external force. The slight movement may be eliminated by using the user parameter to delay the servo OFF.
• The user parameter can change the timing of brake ON when the servo motor stops.
For the brake action during the rotation of servo motor, please refer to "8.2.4(5) Setting of brake ON timing (during the rotation of servo motor)".



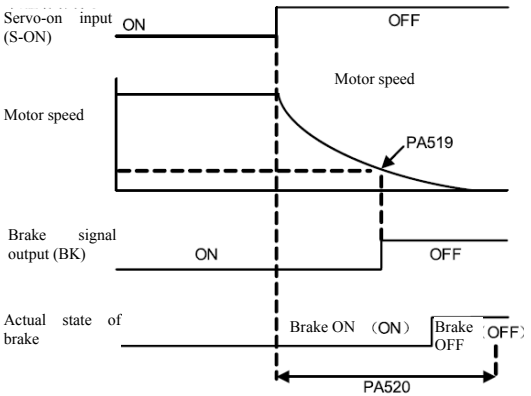
■ Important
When an alarm is given out, the servo motor will be immediately powered off, and this is not determined by the setting of the user parameter.
Owing to the deadweight of machine moving parts or the external force, the machine sometimes may move before the brake functions.

(5) Setting of brake ON timing (during the rotation of servo motor)

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

PA519	Limitation of Brake Instruction Action Speed			
	Setting range	Setting unit	Factory default	Effective time
	0 ~ 1000	rpm	100	Immediately
PA520	Servo OFF - Waiting Time of Brake Instruction			
	Setting range	Setting unit	Factory default	Effective time
	100 ~ 1000	1ms	500	Immediately

When one of the following BK signal output conditions is effective during the rotation of servo motor, BK signal will be set to H level (brake start).
• The motor speed is below PA519 when servo OFF
• The setting time of PA520 is exceeded when servo OFF



■ Important
• Even PA519 is set to be above the maximum number of revolutions of the servo motor used, the servo motor will be restricted by its own maximum speed.

8.2.5 Selection of the method for stop during servo OFF

Choose the method to stop the servo driver during servo OFF.

User parameter		Servo motor stop method	After servo motor stops	Meaning
PA001	d. □□□ 0	DB stop	DB holding	Stop through the dynamic brake (DB); the servo motor keeps in DB state after it stops. (factory default)
	d. □□□ 1	Inertial running stop	Inertial running state	Stop through DB (dynamic brake); the servo motor will begin inertial (power off) running after it's stopped.
	d. □□□ 2		Inertial running state	Stop through inertial running; the servo motor will begin inertial (power off) running after it's stopped.

Under the following occasions, setting of the user parameters is effective.
• S-ON input signal OFF (servo OFF)
• An alarm gives out
• Major power supply off (L1, L2 and L3)
In the above setting "DB state maintenance after DB stops" of "d.□□□0", if the servo motor stops or rotates at a very low speed, no brake force will be generated like in the initial running state.
■ Vocabulary
• DB stop: Brake and stop through the dynamic brake (short-circuit of the servo motor's interior circuit)
• Inertial running stop: Stop naturally through the frictional resistance generated during motor rotation, instead of applying brake.

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

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

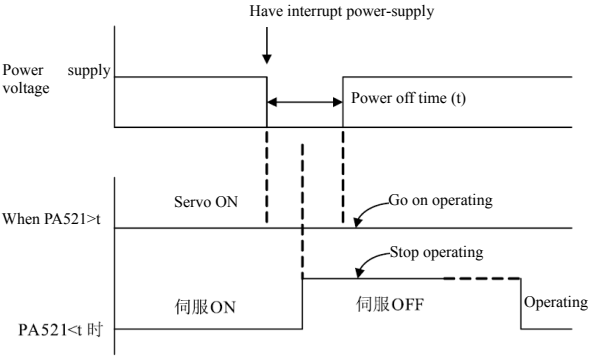
8.2.6 Setting of interrupt power-supply treatment

When the voltage to the major power supply of the servo driver is OFF instantly, whether the motor shall go on operating or set to be servo OFF

PA521	Holding time of interrupt power-supply			
	Setting range	Setting unit	Factory setting	Effective time
	40 ~ 800	1ms	60	

Detection of interrupt power-supply is to check the major power supply ON/OFF.
If the OFF→ON resetting time is below the setting value of user parameter, keep operating.

But under the following circumstances, the setting value of user parameter will not become effective.
• The load of servo motor is too big, which causes " under tension warning (A.96)" during interrupt power-supply
• When the control power supply is out of control (the same to the usual power OFF operation) during the period of interrupt power-supply



■ Important

The maximum holding time setting value is 800ms during interrupt power-supply, but the holding time of control power supply of the servo motor is about 200ms. The holding time of major power supply varies along with the output of servo driver.

Please use a UPS in order to go on controlling the servo driver under the interrupt power-supply state beyond the holding time.

8.3 Use method of absolute value encoder

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

Type of absolute value encoder	Resolution	Output range of multiple rotation data	Action going beyond the limitation
Multiple-ring absolute value encoder	17 bit	-32768 ~ +32767	• When going beyond the upper value (+32767) of positive rotation direction, the multiple rotation data become -32768. • When going beyond the lower range value (-32768) of reverse rotation direction, the multiple rotation data become +32767.

8.3.1 Selection of absolute value encoder

User parameter		Meaning
PA002	d. ☐ 0 ☐☐	Use the absolute value encoder as the capacity-increasing encoder. (factory default)
	d. ☐ 1 ☐☐	Use the absolute value encoder as the absolute value encoder.
• When it is used as a capacity-increasing encoder, it needs no emergency battery. • After alter the user parameter, the setting will become effective only after the motor is power-on again.		

8.3.2 Battery use method

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

(1) Battery selection

Please make preparations according to the specification of instruction control unit; the

battery shall be the product equivalent to ER3V (3.6V, 1000mA TOSHIBA battery).

(2) Battery installation

The battery shall be mounted inside the battery case of the encoder cable; pay attention not to make the polarity reversed.

8.3.3 Battery replacement

When the battery voltage drops to be below 3.1V, the servo driver will give out "17-bit serial encoder battery warning (A.97)". But this warning only gives out when the servo driver is power on. Therefore, if the battery voltage is too low when the servo driver is power on, the servo driver will give no warning. It can be set to battery voltage low warning by setting user parameters.

- Procedures to replace the battery

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

When the control power supply of servo driver is OFF and the battery connection has been moved (so has the encoder cable), data inside the absolute value encoder will be lost. Therefore, setting of absolute value encoder is very necessary. Please refer to “8.4.5 Setting of absolute value encoder (AF011)”.

8.3.4 Setting of absolute value encoder (AF011)

Under such circumstances, setting of absolute value encoder is very necessary.

- When the machine is started
- When there is "17-bit serial encoder battery warning (A.97)"
- When there is E55 ~ E62 alarm
- When the multiple rotation data of the absolute value encoder will be set 0

Please set through the driver panel manipulator (please refer to 7.13).

8.4 Position control operation

8.4.1 User parameter setting

When pulse train is used for position control, please set the following use parameters.

(1) Control mode selection

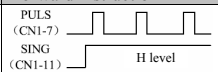
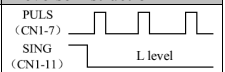
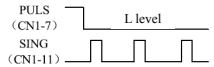
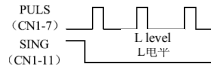
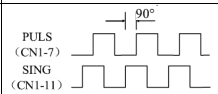
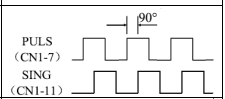
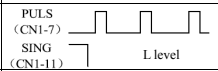
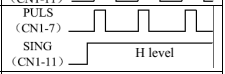
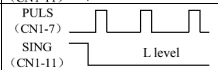
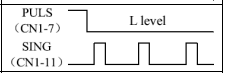
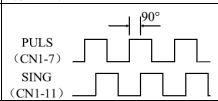
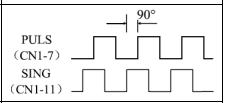
	User parameter	Meaning
PA000	h. ☐ ☐ 0 ☐	Control mode selection: Position control (pulse train instruction)

(2) Pulse instruction form selection

Type	Signal name	Connector pin number	

Type		Signal name	Connector pin number	
Input	Low speed pulse input channel	PULS+	CN2 – 7	Instruction pulse input
		PULS+	CN2 – 8	Instruction pulse input
		SIGN+	CN2 – 11	Sign input
		SIGN-	CN2 – 12	Sign input
	High speed pulse input channel	HPULS+	CN2 – 16	Instruction pulse input
		HPULS-	CN2 – 17	Instruction pulse input
		HSGN+	CN2 – 23	Sign input
		HSING-	CN2 – 24	Sign input

For the input form at the servo driver side, please set the user parameters PA200.0 and PA200.1 according to the specification of the instruction controller.

User parameter		Instruction type	Forward instruction	Reverse instruction
PA200	d. □□□ 0	Symbol + Pulse train (Positive logic) (Factory default)		
	d. □□□ 1	CW + CCW (Positive logic)		
	d. □□□ 2	90º phase difference (Positive logic)		
	d. □□ 0 □	Symbol + Pulse train (Negative logic)		
	d. □□ 1 □	CW+CCW (Negative logic)		
	d. □□ 2 □	90º phase difference (2 phase pulse) (Negative logic)		

(3) Clear action selection

In cases other than clear signal (CLR), a timed clear deviation pulse can be selected for clear purpose according to the state of servo driver. The action mode of deviation pulse may be the one of the following three types selected through use parameter PA200.2.

User parameter		Contents
PA200	d. □ 0 □□	Deviation pulse is cleared in case of basic module and CLR signal input (factory default). Basic module means that S-ON signal is set to OFF, main power set to OFF, and alarm is given.
	d. □ 1 □□	Deviation pulse is not cleared. Only CLR signal is used for clear.
	d. □ 2 □□	Deviation pulse is cleared only alarm is given or clear signal (CLR) is input.

(4) Selection of instruction pulse input channel

Pulse input channel is selected by setting parameter PA200.3.

User parameter		Contents
PA200	d. 0 □□□	**PULS and SIGN input (low speed pulse channel)**

		Pulse input in this channel is received by opto-coupler. It is suitable for upper computer of collector output and long-line transmitter output, frequency ≤ 500K.
	d. 1□□□	**PULSE and SIGNH input (high speed pulse channel)** Pulse input in this channel is received by long-line receiver. It is suitable for upper computer of long-line transmitter output, frequency ≤ 4000K.

8.4.2 Electronic gear setting

(1) Coder pulse count

User parameter		Encoder specification	Encoder pulse count (P/R)	Resolution ratio
PA002	d. 0 □□□	Absolute value coder	32768	131072 (17bit)
	d. 1 □□□	Gain coder	32768	131072 (17bit)
	d. 2 □□□	Gain coder	5000	20000

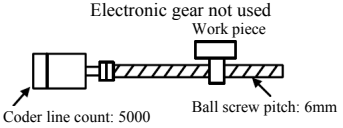
Supplement: Digit count representing coder's resolution ratio is not same as pulse count of coder signal output (phase A or phase B). Coder's pulse count is multiplied by 4 (times) to get the digit counts of resolution ratio.

(2) Electronic gear

The function of electronic gear means the function that the work piece movement amount equivalent to instruction controller input instruction 1 pulse can be set to any value.

Such instruction 1 pulse from instruction controller, i.e. minimum unit, is called “1 instruction unit".

Electronic gear not used

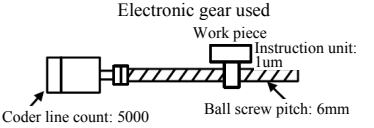


Move the work piece by 10mm

As one turn is 6mm, to move 10mm, you need to rotate by 10÷6 = 1.66667 turns;
As rotating by 1 turn needs to use 5000*4 pulses, so the instruction needs to input 5000 x 4 x10÷6 =33333 pulses.
This computation must be conducted on instruction controller.

Electronic gear is 1:1

Electronic gear used



Move the work piece by 10mm by using the "instruction unit"

As 1 instruction unit is set to 1um,
To move a work piece by 10mm (10000um),
As 1 pulse is equivalent to 1um,
The instruction inputs 10000/1=10000 pulses to move the work piece by 10mm.

Electronic gear is 20:6

(3) Relevant user parameters

PA205	First electronic gear (numerator)			
	Setting range	Setting unit	Factory default	Effective time
	1 ~ 65535	—	1	Immediately
PA206	First electronic gear (denominator)			
	Setting range	Setting unit	Factory default	Effective time
	1 ~ 65535	—	1	Immediately
If mechanical reduction ratio of motor shaft and load side is set to n/m, the set value of electronic gear ratio can be got by using the following formula. (Load shaft rotates by n turn when servo motor rotates by m turn);				

$$\text{Electronic gear} = \frac{B}{A} = \frac{PA205}{PA206} = \frac{\text{Coder pulse count} \times 4}{\text{Movement amount when load shaft rotates by 1 turn}} \times \frac{m}{n}$$

* When the set range is surpassed, please reduce the numerator and denominator to an integer within a setting range.
Please note: Don't change the electronic gear ratio.

■ Important
Recommended setting range of electronic gear count ratio: 0.01 ≤ Electronic gear ratio (B/A) ≤ 100

(4) Setting steps of electronic gear ratio

Please set electronic gear ratio according to the following steps:

Procedure	contents	Remarks
1	Confirm machinery specification	Confirm reduction ratio, ball screw pitch, pulley diameter, etc.
2	Confirm coder pulse count	Confirm coder pulse count of the servo motor used
3	Determine instruction unit	Determine 1 instruction unit from instruction controller Please determine instruction unit based on machinery specification and positioning precision.
4	Calculate movement amount after load shaft rotates by 1 turn	Calculate the instruction unit amount after the load shaft rotates by 1 turn based on the determined instruction unit
5	Calculate electronic gear ratio	Calculate electronic gear ratio (B/A) according to the electronic gear ratio calculation formula
6	Set user parameters	Set the calculated value as the electronic gear ratio.

(5) Electronic gear ratio calculation method

Under position control mode, actual speed of load is:

Instruction pulse speed x (B/A) x Machinery reduction ratio

In case of driving by belt pulley, the calculation method for electronic gear ratio (B/A) is as follows:

$$\frac{B}{A} = \frac{P_{pulse} \times M \times i}{L}$$

P pulse: Motor coder's resolution ratio. It means the pulse count fed back by motor feedback element after motor rotates by 1 turn. For example, as regards 5000-line gain coder, the pulse count fed back to driver is 5000×4 = 20000;

M: Pulse calculation equivalent (mm). It means upper controller's resolution ratio;

L: Lead screw pitch (mm);

i: Mechanical gear ratio

$$i = \frac{\text{Gear count of belt pulley at driven side (machine tool side)}}{\text{Gera count of belt pulley at driving side (motor side)}}$$

For example: Upper controller's pulse equivalent is 0.001mm (1um); mechanical reduction ratio is I = driven wheel / driving wheel = 36 / 24; Lead screw pitch is 6mm; motor coder is 5000P/r, and coder's feedback pulse count per turn is 5000×4＝20000.

Then by calculating with the formula as above, you get:

$$\frac{B}{A} = \frac{20000 \times 0.001 \times \frac{36}{24}}{6} = \frac{10}{2} = 5$$

8.4.3 Position instruction

It's the instruction about the form of pulse train sent and it controls the position of servo motor.

Instruction controller's pulse train output forms include the following:

• Bus driver output

• +24V open-collector output

• +12V open-collector output

• +5V open-collector output

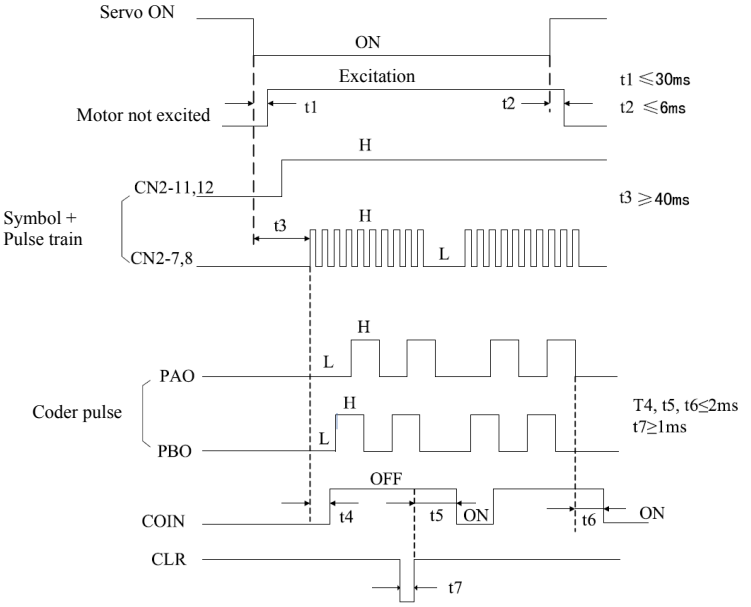
■ Matters needing attention in case of open-collector output

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

User parameter		Meaning
PA200	d.0 □□□	Low speed pulse input channel selection
	d.1 □□□	High speed pulse input channel selection

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

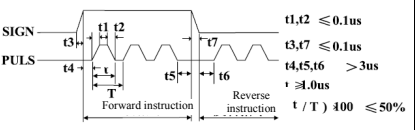
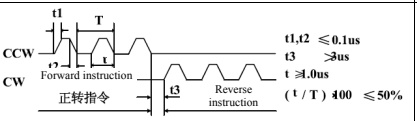
(1) Examples for input and output signal timing

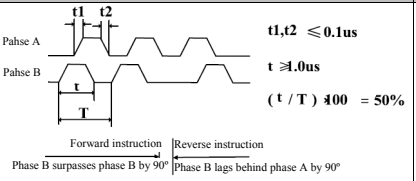


(Note) 1. The duration from servo ON signal is set to ON to instruction pulse is input should be controlled to above 40ms. If instruction pulse is input within 40ms since servo ON signal is set to ON, servo driver sometimes can't receive the instruction pulse.

2. Please set clear signal ON to above 20 μ s.

Table 8.1 Instruction pulse input signal timing

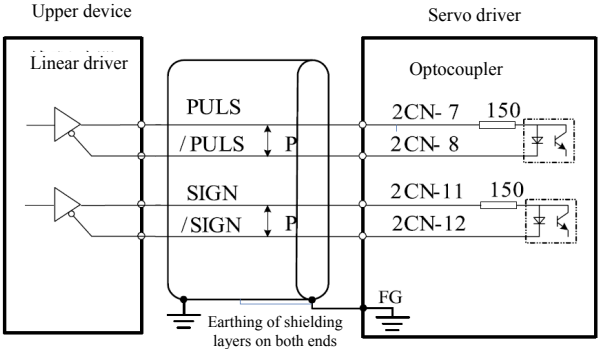
Instruction pulse signal form	Electrical specification	Remarks
Symbol + Pulse train input (SIGN + PULS signal) Max. Instruction frequency: 500kpps (in case of open-collector input: 200kpps)		Symbol (SIGN) H = Forward instruction L = Reverse instruction
CW pulse + CCW pulse Max. instruction frequency: 500kpps (In case of open-collector output: 200kpps)		

Instruction pulse signal form	Electrical specification	Remarks
Phase difference 2 pulse (Phase A + Phase B) Max. instruction frequency: x 4 times multiplication: 200kpps (In case of open-collector output: ps)		

(2) Connection examples

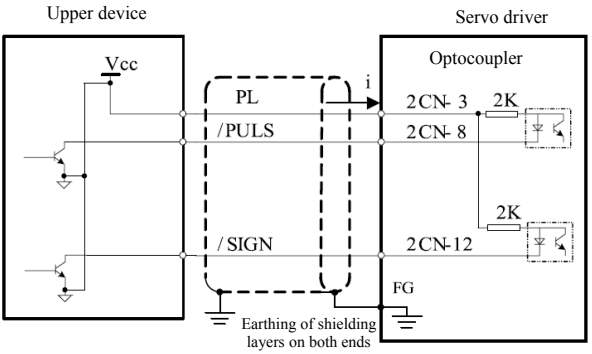
(a) Connection examples for bus driver output

Applicable linear driver, e.g. similar AM26LS31 products of T1 Company

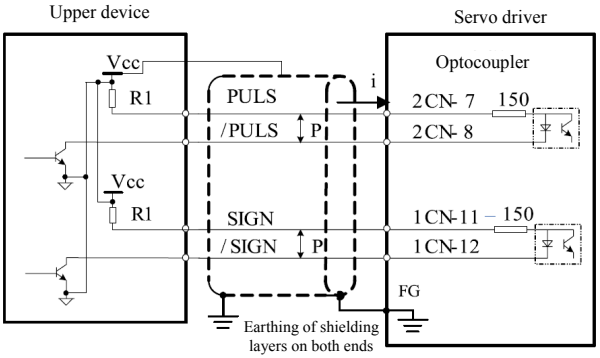


(b) Connection examples for open-collector output

When collector power is 24V, connection may be done according to the following chart:



When collector power is 12V or 5V, connection can be done according to the following chart:



Please select the value that limits resistor R1 to ensure that input current i is within the following scope:

Input current i = 7 ~ 15mA.

■ Important

In case of open-collector output instruction pulse, the interference tolerance for output signal is lower, so please increase the user parameter PA201.0/PA201.1 set value in case of deviation due to interference.

PA214	Position instruction acceleration/deceleration time parameter 1			
	Setting range	Setting unit	Factory default	Effective time
	0 ～ 1000	0.1ms	0	Immediately
PA215	Position instruction acceleration/deceleration time parameter 2			
	Setting range	Setting unit	Factory default	Effective time

	0 ～ 1000	rpm	0	Immediately
PA216	Position instruction movement mean time			
	Setting range	Setting unit	Factory default	Effective time
	0 ~ 500	rpm	0	Immediately

■ Important

If position instruction acceleration/deceleration time parameter (PA214, PA215) is changed, the changed value takes effect only if there's no instruction input. In order to truly reflect the set value, please input clear signal (CLR) to prohibit instruction controller's instruction pulse or clear deviation pulse as servo ON.

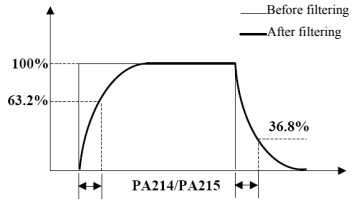
Even in the following cases, motor can operate smoothly, and this setting has no effect on movement amount (instruction pulse count).

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

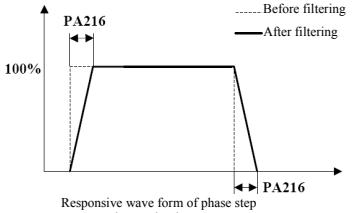
■ Supplement

The difference between position instruction acceleration/deceleration time constant (PA214, PA215) and position instruction mean movement time (PA216) is as follows

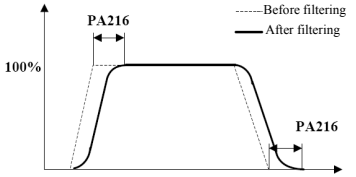
Acceleration/deceleration time parameter		Mean movement filter
PA214	PA215	PA216



Responsive wave form of phase step instruction input



Responsive wave form of phase step instruction input



Responsive wave form of trapezoidal instruction input

8.4.4 Positioning completion signal (COIN)

This signal means that servo motor monitoring is completed in case of position control. Please use it when the instruction controller's positioning is completed and confirmed for interlocking.

Type	Signal name	Connector pin number	Level	Name
Output	COIN	CN2-29, 30 (factory default)	ON=L level	Positioning completed
			OFF=H level	Positioning not completed
The positioning completion signal can be assigned to the output terminal through the user parameter PA510. Please refer to "3.4.3 input/output signal distribution". The factory setting is assigned to CN2-29 and 30.				

PA525	Positioning completion width			
	Setting range	Setting unit	Factory default	Effective time
	0 ~ 65535	1pulse	10	Immediately
If the difference between the instruction controller's instruction pulse input count and the servo motor's movement amount (deviation pulse) is lower than the set value of this use parameter, then the set unit for positioning completion signal (COIN) output is instruction unit, which depends on the instruction unit of electronic gear setting. If the set value is too high, deviation may be reduced in low speed operation, but it's possible that COIN model is output at normal times, so attention should be paid to this. Setting of this user parameter does not affect the final positioning precision.				
■ Supplement COIN signal is the signal in case of position control.				

8.4.5 Positioning near signal (NEAR)

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

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

Type	Signal name	Connector pin number	Level	Name
Otput	NEAR	Need to be assigned	ON=L level	Already arrived at near positioning completion
			OFF=H level	Not arrived at near positioning completion
The positioning near signal can be assigned to the output terminal through the user parameter PA510. Please refer to "3.4.3 input/output signal distribution".				

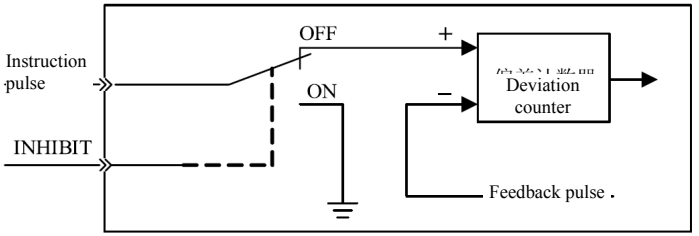
PA526	NEAR signal width			
	Setting range	Setting unit	Factory default	Effective time
	0 ~ 65535	4pulse	100	Immediately
If the difference between the instruction controller's instruction pulse input count and the servo motor's movement amount (deviation) is lower than the set value of this use parameter PA526, then the positioning near signal (NEAR) is output。 The set unit is instruction unit, which depends on the instruction unit of electronic gear setting. Generally, you should set a value that is greater than the positioning completion width (PA525). Distribution of input signal is needed. Please refer to "3.4.3 input/output signal distribution".				

8.4.6 Instruction pulse inhibition function (INHIBIT function)

(1) Instruction pulse inhibition function (INHIBIT function)

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

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



(2) Input signal setting

Type	Signal name	Connector pin number	Level	Name
Input	INHIBIT	CN2-46 (factory default)	ON=L level	INHIBIT function is ON (stops (inhibits) instruction pulse counting)
			OFF=H level	INHIBIT function is OFF (Instruction pulse counting goes on)
INHIBIT signal function is effective only in case of position control.				

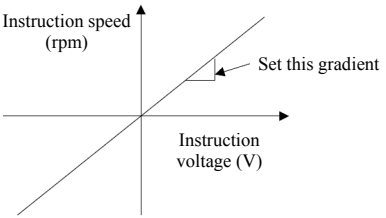
8.5 Speed control (analog voltage instruction) operation

8.5.1 User parameter setting

User parameter		Meaning
PA000	h. □□ 1 □	Control mode selection: Speed control (analog voltage instruction)

	Speed instruction input gain			
	Setting unit	Factory setting	Effective time	Setting unit
PA301	150 ~ 3000 (1.5 ~ 30.0V/ rated speed)	0.1V/ rated speed	600	Not required

Set the analog voltage level of speed instruction (V-REF) needed for operating servo motor at rated rotating speed.



■ Examples

PA301=600 means that when 6V input is set, the motor is operating at the rated speed (factory default)

PA301=1000 means that when 10V input is set, the motor is operating at the rated speed

PA301=200 means that when 2V input is set, the motor is operating at the rated speed.

8.5.2 Input signal setting

(1) Speed instruction input

If speed instruction in form of analog voltage instruction is sent to the servo driver, speed control is implemented over the servo motor at a speed proportional to input voltage.

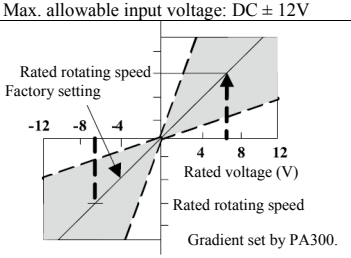
Type	Signal name	Connector pin number	Name
Input	V-REF	CN2-5	Speed instruction input
	AGND	CN2-6	New ground wire for speed instruction input

It is used in case of speed control (analog voltage instruction). (PA000.1 = 1, 5, 7, 9)
PA301 is used to set speed instruction input gain. As regards detailed description of setting, please refer to "8.5.1 User Parameter Setting".

■ Input specification

• Input scope: DC±2V ～ ±10V / rated speed

• Max. allowable input voltage: DC ± 12V



• Examples of setting

PA301 = Rated rotating speed under 600: ± 6V

Specific examples are as follows

Speed instruction input	Rotating direction	Rotating speed	Rated rotating speed = 3000rpm type motor
+6V	Forward	Rated rotating speed	3000rpm
+1V	Forward	1/6 rated rotating speed	500rpm
-3V	Reverse	1/2 rated rotating speed	-1500rpm

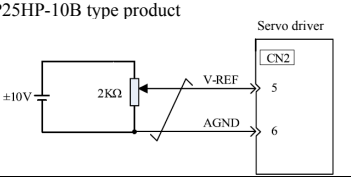
Voltage input scope can be changed by user parameter PA301.

■ Examples of input circuits

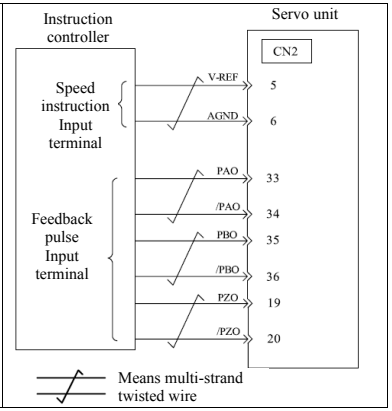
• In order to adopt measures that can effectively prevent interference, be sure to use multi-strand twisted wire for wiring purpose.

• Examples of variable resistor

P25HP-10B type product



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



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

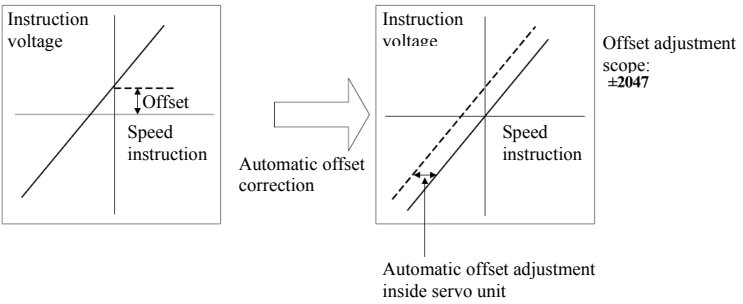
Type	Signal name	Connector pin number	Setting	Meaning
Input	P-CON	Terminal distribution is required	ON=L level	Servo driver is operating in the mode of P control.
			OFF=H level	Servo driver is operating in the mode of PI control.

P-CON signal is a signal in respect of which speed control mode is selected from PI (proportion ´ integral) or P (proportion) control.
If it's set to P, then control can relieve motor rotation and slight vibration caused by speed instruction input drifting.
Input instruction: It can progressively reduce servo motor rotation caused by drifting at 0V, but servo rigidity (support strength) decreases at stop.
P-CON signal can assign the input connector pin number to other places through user parameter. Please refer to "3.4.3 input/output signal distribution".

8.5.3 Instruction offset adjustment

When speed system mode is used, even analog instruction voltage sends 0V instruction, the case that motor rotates at a slight speed still occurs. This happens when instruction voltage of upper controller or external circuit has slight (mV unit) deviation (offset). In this case, instruction offset can be adjusted automatically or manually by using the panel operator. Please refer to "7.2 Operation under Auxiliary Function Execution Mode (AF □□□)".

Automatic adjustment of analog (speed· torque) instruction offset is the function of offset measuring and automatic voltage adjustment. When the voltage instruction of upper control device and external circuit is deviated, the servo driver will adjust the offset automatically as follows:



Once instruction offset is automatically adjusted, the offset will be stored inside servo driver. The offset can be confirmed through manual adjustment (AF007) of speed instruction offset. Please refer to “8.5.3(2) Manual adjustment of speed instruction offset".

(1) Automatic adjustment of speed instruction offset

The deviation pulse when servo is locked and stopped is set to zero time under the condition of configuration position ring of instruction controller, but don’t use automatic adjustment (AF006) of instruction deviation. In this case, please use manual adjustment of speed instruction deviation (AF007).

In case of zero speed instruction, there is the zero-clamping speed control function for forcibly executing servo locking. Please refer to “8.5.6 Use of Zero Clamping Function”.

Important: Please execute automatic adjustment of analog zero offset when servo is OFF.

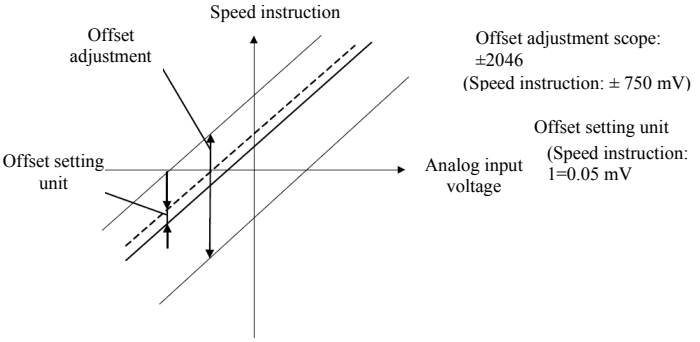
(2) Manual adjustment of speed instruction offset

Please use manual adjustment of speed instruction offset (AF007) under the following circumstances.

- When instruction controller is configured with position ring to set deviation pulse to zero when servo is locked and stopped.
- When offset is intentionally set to a certain value.
- In case of confirmation of offset data set by automatic adjustment.

The basic function is the same as automatic adjustment (AF006) of analog (speed·torque) instruction offset, but in case of manual adjustment (AF007), adjustment must be done when offset is input directly.

The adjustment scope and set unit of offset are as follows.



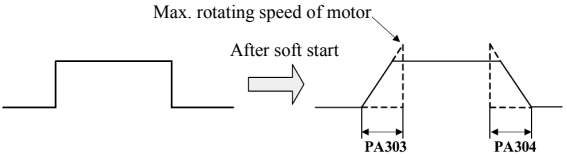
Please implement automatic adjustment of speed instruction offset according to the following steps.

8.5.4 Soft start

Soft start means the function that phase step speed instruction input is transformed to instruction with certain acceleration and deceleration inside servo driver.

PA303	Soft start acceleration time			
	Setting range	Setting unit	Factory setting	Effective time
	0~5000	1ms	0	Immediately
PA304	Soft start deceleration time			
	Setting range	Setting unit	Factory setting	Effective time
	0~5000	1ms	0	Immediately

Smooth speed control can be done when phase step speed instruction is input or internal set speed is selected. (Please set general speed control to "0").
The set values are as follows
• PA303: Time from stop state to 1000rpm, i.e. acceleration time of interval 1000rpm
• PA304: Time from stop state to 1000rpm, i.e. deceleration time of interval 1000rpm



8.5.5 Speed instruction filter

PA302	Speed instruction filter time parameter			
	Setting unit	Factory setting	Effective time	Setting unit
	0~1000	0.01ms	40	Immediately

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

8.5.6 Use of zero clamping function

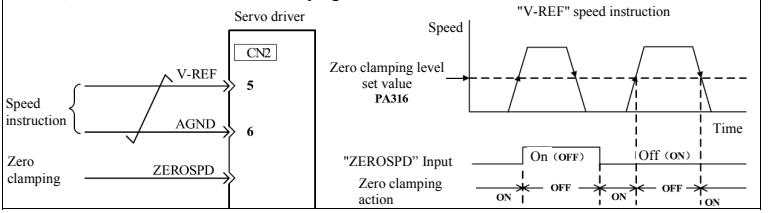
(1) Meaning of zero clamping function

It is a function used when instruction controller is not configured with position ring in case of speed control.

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

(2) User parameter setting

User parameter	Meaning
PA300	Speed control function switch 0
	PA300.3 = 0, Control is achieved by external IO (ZEROSPD signal)
	PA300.3 = 1, Automatic (Acting as speed dead zone based on the scope of PA316)
Zero clamping action switch-over conditions Set PA000 = h. ☐☐ 1 ☐, PA300.3 = 0, ZEROSPD is ON (L level), and it will enter into zero clamping action. Set PA000 = h. ☐☐ 1 ☐, PA300.3 = 1, speed instruction (V-REF) is lower than the set value of PA316, then it will enter into zero clamping action.	



PA316	Zero clamping level			
	Setting range	Setting unit	Factory setting	Effective time
	1~2000	1rpm	30	Immediately
In case of speed control, effective selection of ZERPSPD can make motor into zero clamping state. Even a value that is over the maximum rotating speed of servo motor is set in PA316, the maximum rotating speed of servo motor still adopt the maximum rotating speed value.				

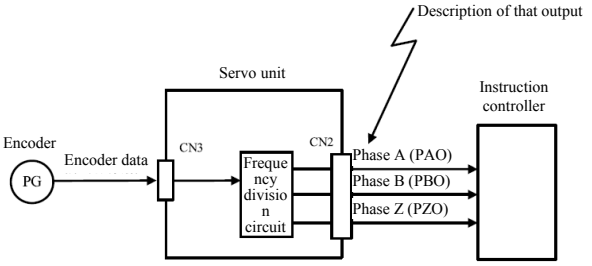
(3) Input signal setting

Type	Signal name	Connector pin number	Setting	Meaning
Input	ZERPSPD	Need to be assigned	ON=L level	Zero clamping function ON (effective)
			OFF=H level	Zero clamping function OFF (not effective)
It is the input signal for switching over to zero clamping action. When the ZERPSPD signal is used, input signal needs to be assigned. As regards the way of distribution, please refer to "3.4.3 Input/output signal distribution".				
■ Important When ZEROSPD signal has been assigned, zero clamping action is effective even if PA000=h. ☐☐ 1 ☐ (speed control).				

8.5.7 Coder signal output

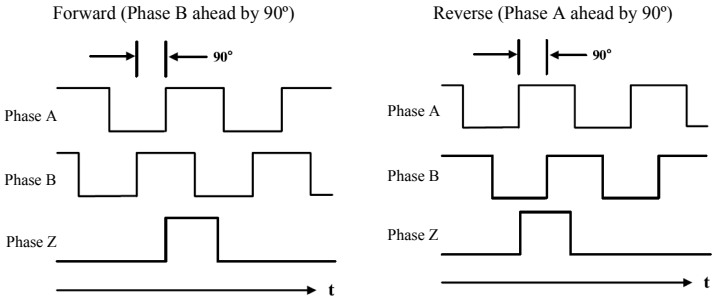
Feedback pulse of coder is output to outside after being processed inside servo driver.

Type	Signal name	Connector pin number	Name
Output	PAO	CN2-33	Coder output phase A
	/PAO	CN2-34	Coder output/phase A
Output	PAO	CN2-35	Coder output/phase B
	/PAO	CN2-36	Coder output/phase B
Output	PZO	CN2-19	Coder output phase Z (original point pulse)
		CN2-20	Coder output/phase Z (original point pulse)



Note: The width of original point pulse is fixed and irrelevant to frequency division ratio.

■ Output phase form



Please make servo driver rotate by two turns before using servo driver's phase Z pulse output for mechanical original point reset action.

According to the structure of the mechanical system, if the above-mentioned action can't be done, please implement original point reset action at speed below 600rpm (calculated according to servo motor's rotating speed). If rotating speed above 600rpm is adopted, phase Z pulse can't be output correctly.

Frequency division

It means that the value is transformed to the pulse density set by user parameter (PA210) and output based on pulse data of the coder installed on the servo motor. The unit is "pulse count/1 turn".

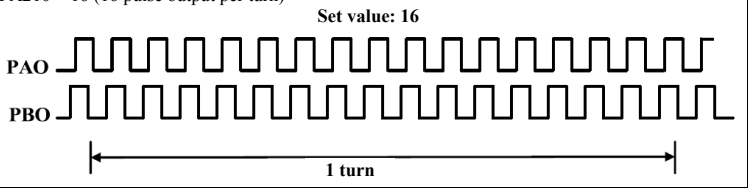
• Coder pulse frequency dividing ratio setting

PA210	PG frequency dividing ratio			
	Setting range	Setting unit	Factory setting	Effective time
	16~16384	1P/rew	16384	Immediately

Set the output pulse count of PG output signal (PAO, /PAO, PBO, /PBO) sent outside from servo driver.
Every 1 turn feedback pulse from coder is frequency division inside servo driver into PA210 set values which are output. (Please make settings according to system specification of machinery and instruction controller).
In addition, the setting scope varies with coder pulse count of servo motor.

encoder specification	encoder pulse count (P/R)	Resolution ratio	Setting range
Line-saving gain coder	20000 pulses / turn	5000P/R	16 ~ 5000
Absolute value coder	17 digits, 131072 pulses / turn	32768P/R	16 ~ 16384

■ Important
When PA210 value is set to be a value over coder line count, its frequency division value is the coder line count. For example, if 5000ppr gain coder is used, PA210 setting is 16384, its frequency division pulse count is the coder line count 5000.
■ Examples of output
PA210 = 16 (16 pulse output per turn)



8.5.8 Same-speed test and output

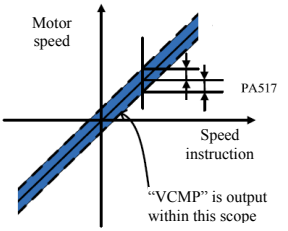
When the rotating speed of servo motor is same that that of instruction, same-speed test and output (VCMP) signal is output, please use it when it is interlocked with instruction controller.

Type	Signal name	Connector pin number	Setting	Meaning
Output	VCMP	Need to be assigned	ON=L level	Same-speed state
			OFF=H level	Different-speed state

This output signal needs to be assigned through parameter PA510.
As regards distribution of output signal, please refer to “3.4.3 Input/output signal distribution”.

PA517	Same-speed test width			
	Setting range	Setting unit	Factory setting	Effective time
	0 ~ 100	rpm	10	Immediately

If the difference between motor’s rotating speed and instruction speed is lower than the set value of PA517, the “VCMP" signal is output.



■ Example

When PA517 = 100 and instruction speed is 2000rpm, if rotating speed of motor is 1900 ~ 2100rpm, "VCMP" is set to ON.
■ Supplement "VCMP" is output signal in case of speed control.

8.6 Torque control operation

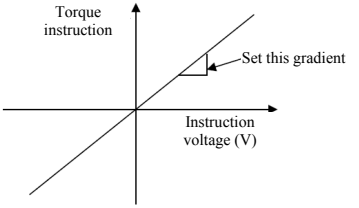
8.6.1 User parameter setting

When torque control operation is implemented by using analog voltage instruction, the following user parameter needs to be set:

User parameter		Meaning
PA000	h. ☐ ☐ 2 ☐	Control mode selection: Torque control (analog instruction)

PA400	Torque instruction input gain			
	Setting range	Setting unit	Factory setting	Effective time
	10 ~ 100	0.1V/ rated torque	30	Immediately

Set torque instruction needed for operating servo motor at rated torque
Analog voltage level of (T-REF)



■ Example
PA400=30 means motor's rated torque (factory default) is used when 3V input is set
PA400=1000 means motor's rated torque is used when 10V input is set
PA400=200 means motor's rated torque is used when 2V input is set

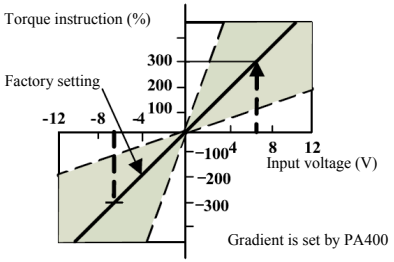
8.6.2 Torque instruction input

If torque instruction is sent to servo driver in form of analog voltage instruction, torque control is implemented over servo motor at a torque proportional to voltage.

Type	Signal name	Connector pin number	Name
Input	T-REF	CN2-9	Torque instruction input
	AGND	CN2-10	

It is used when torque control (analog voltage instruction) is used (PA000.1 = 2, 6, 8, 9).
PA400 is used to set torque instruction input gain.
■ Input specification
Input scope DC 1V ~ 10V / rated torque
Max. allowable input voltage DC12V

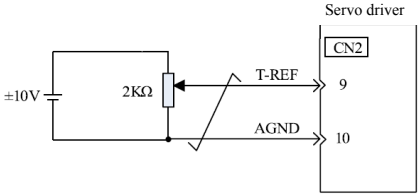
In case of factory default, PA400 = 30, rated torque is under 3V
It is rated torque when +3V input is forward
It is 300% rated torque when +9V input is forward
It is 10% rated torque when -0.3V input is reverse
Voltage input scope can be changed through user parameter PA400



■ Example of input circuit

In order to take effective anti-interference measures, please be sure that multi-strand twisited wire is used in wiring.

Example of variable resistor: P25HP-10B type product



Torque of internal torque instruction

1. Confirming internal torque instruction through panel operator

Internal torque instruction can be confirmed in the monitoring mode (dP010). Please refer to 4.4.2 Operation in monitoring mode

8.6.3 Offset adjustment

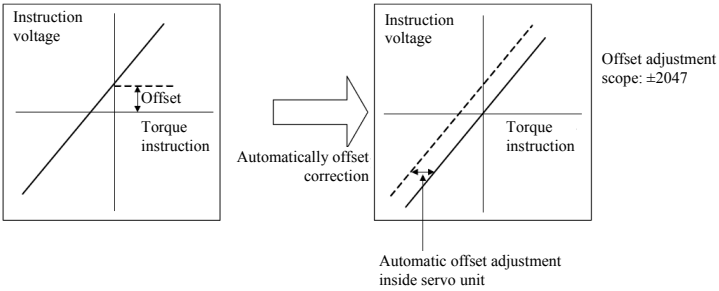
(1) Automatic adjustment of torque instruction offset

When the torque control mode is used, as regards the analog instruction voltage, even if it sends 0V instruction, the motor will still rotate at a slight speed. This situation happens when the instruction voltage of upper control device or external circuit has slight (mV unit) deviation (offset).

In this case, the instruction offset may be adjusted automatically or manually by using the panel operator.

Automatic adjustment (AF006) of analog (speed torque) instruction offset is a function that measures offset and automatically adjusts voltage.

When voltage instruction of upper control device and external circuit has any deviation, the servo driver will adjust the offset automatically as follows:



Once automatic adjustment of instruction offset is implemented, that offset will be stored inside servo driver.

Offset can be confirmed through manual adjustment (AF008) of torque instruction offset.

If the deviation pulse is set to zero when servo is locked and stopped in the state where instruction controller is configured with position ring, automatic adjustment (AF006) of instruction offset cannot be used, in which case, please use manual adjustment (AF008) of torque instruction offset.

Please implement automatic adjustment of torque instruction offset according to the following steps.

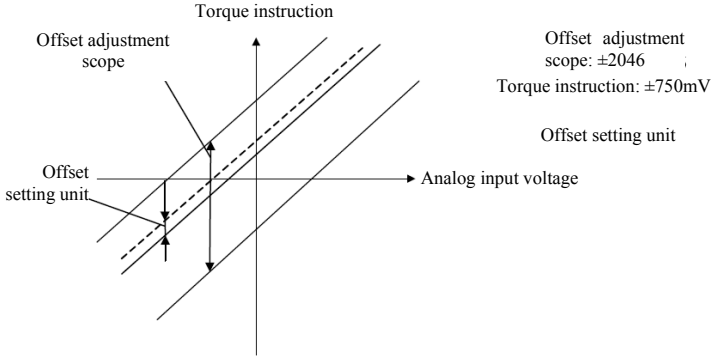
(2) Manual adjustment of torque instruction offset

Please use manual adjustment (AF008) of torque instruction offset under the following circumstances.

- When instruction controller is configured with position ring to set deviation pulse to zero when servo is locked and stopped.
- When offset is intentionally set to a certain value.
- When offset data set through automatic adjustment are confirmed.

The basic function is same as automatic adjustment (AF006) of analog (speed, torque) instruction offset, but in case of manual adjustment (AF008), adjustment must be done when offset is directly input.

The following chart indicates the offset adjustment scope and setting unit.



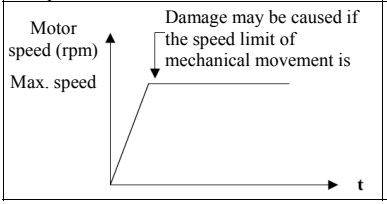
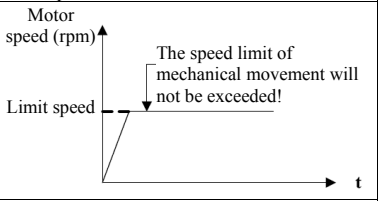
Please adjust the torque instruction offset manually according to the following steps.

8.6.4 Speed limit in case of torque control

As servo motor needs to be controlled in case of torque control to output the torque that sends the instruction, so motor's rotating speed is not managed.

If instruction torque is set to be to too large as relative to the load torque at mechanical side, mechanical torque may be surpassed, resulting in great increase of motor's rotating speed.

As regards the protection measure at mechanical side, it has the function of limiting servo motor's rotating speed in case of torque control.

No speed limit	With speed limit
	

(1) Speed limit mode selection (torque limit option)

User parameter		Meaning
PA002	d. □□ 0 □	Use the set value of PA407 serves as the speed limit (internal speed limit function)
	d. □□ 1 □	Use V-REF (CN2-5, 6) as external speed limit input to provide speed limit with V-REF input voltage and set value of PA301 (external speed limit function)

(2) Internal speed limit function

PA407	Speed limit in case of torque control			
	Setting range	Setting unit	Factory setting	Effective time
	0 ~ 5000	rpm	1500	Immediately
Motor's rotating speed limit when torque limit is set When PA002.1 = 0, this user parameter setting takes effect. Even a value that exceeds the maximum rotating speed of the servo motor is set in PA407, the				

actual value is still limited to the maximum rotating speed of the servo motor.

(3) External speed limit function

Type	Signal name	Connector pin number	Name
Input	V-REF	CN2-5	External speed limit input
	AGND	CN2-6	External speed limit input
Motor's rotating speed limit when torque limit is input by using analog voltage instruction When PA002.1 = 1, the speed limit input of V-REF or the speed limit in case of PA407 torque control, whichever the smaller, is the effective value. Determination of set value of PA301 for voltage level of limit input is irrelevant to polarity.			

PA301	Speed limit in case of torque control			
	Setting range	Setting unit	Factory setting	Effective time
	150 ~ 3000	0.01 V/ Rated speed	600	Immediately
It is used to set the voltage level of rotating speed in respect of which external speed is limited in case of torque control. When PA301 = 600 (factory default), if input V – REF (CN2-5, 6) is 6V voltage, the actual rotating speed is limited to the rated rotating speed of the servo motor used.				

(4) Output signal when motor's rotating speed is limited

Type	Signal name	Connector pin number	Name	
Input	VLT +	CN2 - ☐ ☐ (Needs to be assigned)	ON=L level	Motor's rotating speed is being limited
	VLT -	CN2 - ☐ ☐ (Needs to be assigned)	OFF=H level	Not in the state of limitation of motor's rotating speed
In case of torque limit, if motor's rotating speed reaches the set value of PA407 or the speed limit based on the analog voltage instruction, the /VLT signal is output. In order to use /VLT signal, output terminal distribution must be done through user parameter PA510. Please refer to "3.4.3 Input/output signal distribution".				

8.7 Speed control (internal set speed selection) operation

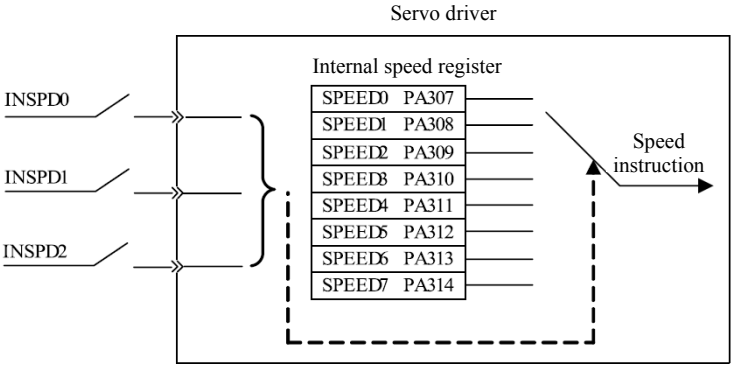
Meaning of internal set speed selection

Internal set speed selection means to set 8 rotating speeds of motor beforehand through user parameter inside servo driver and to select among them by using external input signal.

The speeds are for the function of operation control by speed and are effective for the speed control with up to 8 rotating speeds of motor.

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

Internal speed is selected in combination for INSPD2, INSPD1 and INSPD0. INSPD2 is high position and INSPD0 is low position. If INSPD2 is effective, while INSPD1 and INSPD0 are not effective, the internal speed SPEED4 is selected.



8.7.1 User parameter setting

User parameter		Meaning
PA000	h. ☐ ☐ 3 ☐	Control mode selection: Internal set speed control (junction instruction)

PA307	Internal set speed (SPEED0)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	100	Immediately
PA308	Internal set speed (SPEED1)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	200	Immediately
PA309	Internal set speed (SPEED2)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	300	Immediately
PA310	Internal set speed (SPEED3)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	400	Immediately
PA311	Internal set speed (SPEED4)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	500	Immediately
PA312	Internal set speed (SPEED5)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	600	Immediately
PA313	Internal set speed (SPEED6)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	700	Immediately
PA314	Internal set speed (SPEED7)			
	Setting range	Setting unit	Factory setting	Effective time
	- 5000 ~ 5000	rpm	800	Immediately

■ Important
Even a value exceeding the maximum rotating speed of servo motor is set in PA307 ~ PA314, the actual value is still limited to the maximum rotating speed of servo motor.

8.7.2 Input signal setting

Operating speed is switched over by using the following input signals.

Type	Signal name	Connector pin number	Name
Input	INSPD0	CN2 - ☐ ☐ (Distribution is needed	Internal speed selection signal 0
	INSPD1	CN2 - ☐ ☐ (Distribution is needed	Internal speed selection signal 1
	INSPD2	CN2 - ☐ ☐ (Distribution is needed	Internal speed selection signal 2
As regards input signal selection The combination of the three signals INSPD0, INSPD1 and INSPD2 correspond to 8 speeds. When operation is achieved by using INSPD0, INSPD1 and INSPD2, input signal must be distributed through user parameter PA500 ~ PA507. Please refer to "3.4.3 Input/output signal distribution".			

8.8 Control mode combination selection

Servo units may select two of various control modes. These two control modes can be combined with each other and switched over from each other. The control mode is selected through Pn000.1. The following is a description of switchover method and condition.

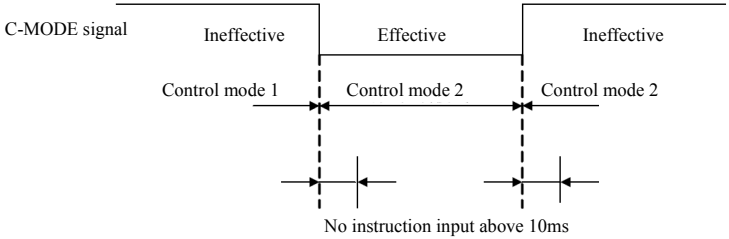
8.8.1. User parameter setting

User parameter		Control mode combination
PA000	h. ☐☐ 4 ☐	Internal speed control (junction instruction) ←→ Position control (signal instruction)
	h. ☐☐ 5 ☐	Internal speed control (junction instruction) ←→ Speed control (analog instruction)
	h. ☐☐ 6 ☐	Internal speed control (junction instruction) ←→ Torque control (analog instruction)
	h. ☐☐ 7 ☐	Position control (pulse instruction) ←→ Speed control (analog instruction)
	h. ☐☐ 8 ☐	Position control (pulse instruction) ←→ Torque control (analog instruction)
	h. ☐☐ 9 ☐	Torque control (analog instruction) ←→ Speed control (analog instruction)
	■ Important Switchover of control modes must be done by using external input signal. Input signal distribution must be done through user parameter PA500 ~ 507.	

8.8.2 Instruction on control mode switchover

When PA000.1 is set to combined control by 4~9, either 1 or 2 may be selected when selecting the input signal through control mode (C-MODE).

When C-MODE signal is not effective, control mode 1 is selected; when C-MODE signal is effective, control mode 2 is selected. Don't input instruction 10ms before and after selection. The process of control mode switchover by C-MODE signal is shown as the following chart.


C-MODE signal
Ineffective
Effective
Ineffective
Control mode 1
Control mode 2
Control mode 2
No instruction input above 10ms

Chapter X Fault Diagnosis

10.1 List of alarms

Alarm No.	Alarm name	Alarm content	Clearable or not
E.03	Parameter error	Abnormal parameter and verification	No
E.04	Parameter format abnormal	Abnormal data format of internal parameter of servo driver	No
E.05	Current test channel 1 abnormal	Abnormal internal circuit	No
E.06	Current test channel 2 abnormal	Abnormal internal circuit	No
E.08	Internal communication error	Wrong internal communication of servo driver	No
E.10	Coder line disconnection	Gain coder's signal line is disconnected	No
E.11	Coder AB pulse loss	AB pulse count of gain coder is abnormal	No
E.12	Coder Z pulse loss	Coder Z pulse loss	No
E.13	Coder UVW error	Coder UVW error	No
E.14	Coder state error	Wrong initial state of line-saving style	No
E.15	Main circuit power wiring error	One phase of main circuit power is not connected	No
E.16	Regeneration error	Abnormal regenerative processing loop	No
E.17	Regenerative resistor error	Regenerative resistor fault	No
E.18	Under-voltage	DC voltage of main loop is insufficient	No
E.19	Overvoltage	DC voltage of main loop is abnormally high	No
E.20	Power module alarm	Power module abnormality caused by too high current	No
E.21	Overload	Continuous operation is done at a torque over rated value	Yes
E.22	Regeneration overload	Overload protection of regenerative resistor	Yes
E.23	DB overload	Rotational energy exceeds DB resistor's capacity due to action of DB (dynamic brake)	Yes
E.25	Deviation counter overflow	Internal position deviation counter overflows and position deviation exceeds 256×65536	Yes
E.26	Position out of tolerance	Position deviation pulse exceeds the set value of user parameter PA528	Yes
E.27	Over-speed	Motor's speed exceeds 1.2 times of its maximum rotating speed	Yes
E.28	Motor stalling	Motor's speed does not match given speed for long time	Yes
E.29	Motor out of control	Motor operates abnormally, possibly due to motor's power line malfunction, or coder line malfunction, or mismatch between	Yes

Alarm No.	Alarm name	Alarm content	Clearable or not
		motor and driver	
E.30	Electronic gear protection	Electronic gear ratio set too large	Yes
E.31	Internal data calculation protection	Internal value is large, calculation is over 32 bits	Yes
E.35	Driver inhibits input protection	Signal input with limited bits	Yes
E.44	Driver reset error	Driver reset is caused by too fast power feed or abnormal driver	Yes
E.45	Internal error 1	Internal fault of driver 1	Yes
E.46	Internal error 2	Internal fault of driver 2	Yes
E.47	Internal error 3	Internal fault of driver 3	Yes
E.50	Abnormal communication of 17bit serial coder	Servo driver can't communicate with coder	Yes
E.51	Verification error in 17bit serial coder control field	Wrong odd-even position or cutoff position; coder signal is interfered or coder's decoding circuit is damaged	Yes
E.52	Verification error in 17bit serial coder communication data	Coder's signal is interfered or coder's decoding circuit is damaged	Yes
E.53	Cut-off position error in 17bit serial coder state field	Coder's signal is interfered or coder's decoding circuit is damaged	Yes
E.54	SFOME cut-off position error in 17bit serial coder	Coder's signal is interfered or coder's decoding circuit is damaged	Yes
E.55	Over-speed of 17bit serial coder	Coder rotates at high speed when power is ON. Or absolute coder is not connected to battery.	Yes
E.56	Wrong absolute state of 17bit serial coder	Coder's signal is interfered or coder's decoding circuit is damaged	Yes
E.57	Wrong count of 17bit serial coder	Coder's signal is interfered or coder's decoding circuit is damaged	Yes
E.58	Multi-turn information overflow of 17bit serial coder	Multi-turn information overflow	Yes
E.59	Overheat of 17bit serial coder	Absolute coder overheat	Yes
E.60	Multi-turn information error in 17bit serial coder	Multi-turn information error	Yes
E.61	Battery alarm in 17bit serial coder	Battery voltage below 3.1v, too low battery voltage	Yes
E.62	Battery alarm in 17bit serial coder	Battery voltage below 2.5v, multi-turn position information already lost	Yes
E.63	17bit serial coder data not initialized	Data error in storage area of 17bit serial coder	Yes
E.64	17bit serial coder data and digit verification	Abnormal data and digit verification in storage area of 17bit serial coder	Yes
E.67	Mismatch between driver and motor	Driver does not match motor's model (PA012)	Yes
E.68	Motor model error	Driver should not be equipped with this type of motor	Yes
E.69	Servo driver model error	Motor does not match this servo	Yes

Alarm No.	Alarm name	Alarm content	Clearable or not
		driver	
E.70	Electronic gear error in CAN communication	Too high electronic gear ratio in CAN communication	Yes
E.71	CAN connection failure	CAN communication line disconnection or CAN communication client side failure	Yes

10.2 Cause for alarm and treatment measures

Alarm No.	Alarm name	Cause for failure	Treatment measures
E.03	Parameter error	Abnormal parameter and verification	1. Execute reset to factory default (AF005)
E.04	Parameter format abnormal	Abnormal data format of internal parameter of servo driver	1. Execute reset to factory default (AF005)
E.05	Current test channel 1 abnormal	Abnormal internal circuit	1. Power off, and power on again 1 minute later
E.06	Current test channel 2 abnormal	Abnormal internal circuit	1. Power off, and power on again 1 minute later
E.08	Internal communication error	Wrong internal communication of servo driver	1. Power off, and power on again 1 minute later
E.10	Coder line disconnection	Line-saving coder's signal line is disconnected	1. Check coder's cables and wires; 2. Check whether PA002.3 matches motor's coder
E.11	Coder AB pulse loss	Gain coder's AB pulse is lost	1. Check coder's cables and wires; 2. Check earth wire connection of driver and motor and check whether shielded wire is correctly connected 3. Check whether coder wiring is separated from strong current wiring;
E.12	Coder Z pulse loss	Coder Z pulse loss	1. Check coder's wiring
E.13	Coder UVW error	Coder UVW error	1.Check whether the coder installed on the motor is line-saving coder; 2. Check coder's wiring
E.14	Coder state error	Wrong initial state of line-saving style	1. Check whether the coder installed on the motor is line-saving coder; 2. Check coder's wiring
E.15	Main circuit power wiring error	One of three phase inputs of main circuit power is not connected	1. Check whether any phase is lost in input power; 2. Check whether input power voltage meets the requirements;
E.16	Regeneration error	Abnormal regenerative processing loop	1. Regenerative processing loop is abnormal; 2. Too low voltage of L1, L2 and L3 input power;
E.17	Regenerative resistor error	Regenerative resistor fault	1. Check whether driver's terminal "P, D, C" are reliably connected; 2. Check whether regenerative resistor is damaged; 3. Check whether voltage of L1, L2 and L3 input power is too low;

Alarm No.	Alarm name	Cause for failure	Treatment measures
			4. If brake resistor is not used, you can set PA009.0 = 1;
E.18	Under-voltage	DC voltage of main loop is insufficient	Check input power voltage;
E.19	Overvoltage	DC voltage of main loop is abnormally high	1. Check whether input power voltage is correct; 2. Check whether regenerative resistor is damaged;
E.20	Power module alarm	Power module alarm	1. Check whether driver matches motor (PA012) correctly; 2. Reduce driver's overload multiples (PA402, PA403); 3. Increase torque filtering time (PA104);
E.21	Overload	Motor operates continuously at a torque exceeding the rated value	1. Increase overload curve (PA010.3), provided motor temperature rise meets the requirements; 2. Increase servo system's acceleration/deceleration time (in case of position control: reduce PA100 and increase PA214 and PA215 and so on); 3. Reduce servo overload multiples (PA402, PA403); 4. Replace the servo system with one having greater power;
E.22	Regeneration overload	Overload protection of regenerative resistor	1. Increase servo system's acceleration/deceleration time (in case of position control: reduce PA100 and increase PA214 and PA215, etc.); 2. Increase parameter PA010.2, provided that the regenerative resistor can bear it;
E.23	DB overload	Rotational energy exceeds DB resistor's capacity due to action of DB (dynamic brake)	
E.25	Deviation counter overflow	Internal position deviation counter overflows and position deviation exceeds 256×65536	1. Check whether motor operates correctly under JOG 2. Check whether electronic gear setting is correct; 3. Check whether servo's torque setting is correct; 4. Check whether there is any limit;
E.26	Position out of tolerance	Position deviation pulse exceeds the set value of user parameter PA528	1. Check whether motor operates correctly under JOG 2. Check whether electronic gear setting is correct; 3. Check whether there is any limit; 4. Increase PA528 value;
E.27	Over-speed	Motor's speed exceeds 1.2 times of its maximum rotating speed	1. Check whether motor's U, V and W wiring is correct; 2. Check whether servo parameter

Alarm No.	Alarm name	Cause for failure	Treatment measures
			is correct. If load inertia is high and system gain parameter is low, much overshooting will occur, which may cause an alarm.
E.28	Motor stalling	Motor's speed does not match given speed for long time	1. Check whether motor's U, V and W wiring is correct; 2. Check whether servo parameter is much changed; 3. Increase PA530 set value;
E.29	Motor out of control	Motor operates abnormally, possibly due to motor's power line malfunction, or coder line malfunction, or mismatch between motor and driver	1. Check whether motor's U, V and W wiring is correct; 2. Check whether coder type is correct (PA002.3); 3. Check whether driver matches motor correctly; 4. Reduce driver's relevant gains (e.g. PA100, PA101, increase PA102, etc.); 5. Increase parameter PA005.3, provided that operation safety can be ensured;
E.35	Driver inhibits input protection	Signal input with limited bits	1. Check limit signal
E.44	Driver reset error	Driver reset is caused by too fast power feed or abnormal driver	1. Driver's power-on time interval is greater than 5 seconds; 2. Check whether there is serious interference source outside;
E.45	Internal error 1	Internal fault of driver 1	
E.46	Internal error 2	Internal fault of driver 2	
E.47	Internal error 3	Internal fault of driver 3	
E.50	Abnormal communication of 17bit serial coder	Servo driver can't communicate with coder	1. Check whether coder wiring is correct; 2. Replace motor;
E.51	Verification error in 17bit serial coder control field	Wrong odd-even position or cutoff position; coder signal is interfered or coder's decoding circuit is damaged	1. Check whether coder wiring is correct; 2. Check whether coder's shield wire is correctly connected to servo side; 3. Replace motor;
E.52	Verification error in 17bit serial coder communication data	Coder's signal is interfered or coder's decoding circuit is damaged	Same as above
E.53	Cut-off position error in 17bit serial coder state field	Coder's signal is interfered or coder's decoding circuit is damaged	Same as above
E.54	SFOME cut-off position error in 17bit serial coder	Coder's signal is interfered or coder's decoding circuit is damaged	Same as above
E.55	Over-speed of 17bit serial coder	Coder rotates at high speed when power is OFF. Or absolute coder is not connected to battery.	1. Check whether motor shaft moves at high speed when servo is power off; 2. Execute absolute coder alarm

Alarm No.	Alarm name	Cause for failure	Treatment measures
			clear operation (AF.12); 3. Check whether absolute coder is connected to battery;
E.56	Wrong absolute state of 17bit serial coder	1. Coder is damaged or coder's decoding circuit is damaged; 2. Serial communication is interfered;	Execute absolute coder alarm clear and multi-turn information clear operation (AF.11)
E.57	Wrong count of 17bit serial coder	1. Coder is damaged or coder's decoding circuit is damaged; 2. Serial communication is interfered;	Execute absolute coder alarm clear and multi-turn information clear operation (AF.11)
E.58	Multi-turn information overflow of 17bit serial coder	Motor operates toward one direction by over 65535 turns, multi-turn information overflow	Execute absolute coder alarm clear and multi-turn information clear operation (AF.11)
E.59	Overheat of 17bit serial coder	Absolute coder overheat	1. Check motor temperature; 2. Execute absolute coder alarm clear (AF.12)
E.60	Multi-turn information error in 17bit serial coder	Multi-turn information error	1. Check absolute coder's battery voltage; 2. Execute absolute coder alarm clear and multi-turn information clear operation (AF.11)
E.61	Battery alarm in 17bit serial coder	Battery voltage below 3.1v, too low battery voltage	1. Replace absolute coder's power battery; 2. Execute absolute coder alarm clear (AF.12)
E.62	Battery alarm in 17bit serial coder	Battery voltage below 2.5v, multi-turn position information already lost	Same as above
E.63	17bit serial coder data not initialized	Data error in storage area of 17bit serial coder	1. Please be sure that PA002.3 correctly matches motor coder model; 2. Please be sure that 17bit serial coder has executed initialization;
E.64	17bit serial coder data and digit verification	Abnormal data and digit verification in storage area of 17bit serial coder	1. Please be sure that PA002.3 correctly matches motor coder model; 2. Please be sure that 17bit serial coder has executed initialization;
E.67	Mismatch between driver and motor	Driver does not match motor's model (PA012)	Although this alarm can be cleared and also be shielded with PA007.3, inappropriate match may cause poor operating performance of motor or occurrence of E.29 alarm in operation. 1. Check whether motor model set for PA012 is correct; 2. Use a driver that matches this motor to replace the old one; 3. Reset PA012 value after replacing the motor or driver.
E.68	Motor model error	Driver should not be	Although this alarm can be cleared

Alarm No.	Alarm name	Cause for failure	Treatment measures
		equipped with this type of motor	and also be shielded with PA007.3, inappropriate match may cause poor operating performance of motor or occurrence of E.29 alarm in operation. 1. Modify the current motor model (PA012) to the motor model in use; 2. Use the driver that matches this motor to replace the old one;
E.69	Servo driver model error	Motor does not match this servo driver	Although this alarm can be cleared and also be shielded with PA007.3, inappropriate match may cause poor operating performance of motor or occurrence of E.29 alarm in operation. 1. Modify the current motor model (PA012) to the motor model in use; 2. Use the driver that matches this motor to replace the old one;
E.70	Absolute coder count error detected	Absolute coder count error detected	It is effective only when coder test mode is effective, PA949.3 = 1
E.71	CAN connection failure	CAN communication line disconnection or CAN communication client side failure	Check communication cable; Check whether upper machine is operating normally.

10.3 List of warnings

The list of warnings is shown as follows.

Alarm No.	Alarm name	Warning content
A.90	Too much position deviation	Accumulated position deviation pulses exceed the set proportion.
A.91	Overload	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.
A.92	Regeneration overload	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.
A.93	DB overload	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.
A.94	Vibration	Abnormal vibration in rotating speed of motor is detected.
A.95	Overvoltage warning	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.
A.96	Under-voltage warning	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.
A.97	17bit serial coder battery warning	Battery voltage is below 3.1v, too low battery voltage

10.4 Cause for warning and treatment measures

Alarm No.	Alarm name	Cause for failure	Treatment measures
A.90	Too much position deviation	Accumulated position deviation pulses exceed the set proportion.	1. Check whether electronic gear setting is correct; 2. Check whether there is any limit; 3. Increase PA527 value

Alarm No.	Alarm name	Cause for failure	Treatment measures
A.91	Overload	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.	1. Increase acceleration/ deceleration time or start /stop times; 2. Increase PA010.3 value; 3. Reduce load; 4. Use a servo system with greater power to replace the old one;
A.92	Regeneration overload	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.	1. Increase acceleration/ deceleration time or start /stop times; 2. Increase PA010.2 value; 3. Use external discharge resistor (greater power and less resistance);
A.95	Overvoltage warning	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.	1. Increase acceleration/ deceleration time or start /stop times;
A.96	Under-voltage warning	This is the warning indication about to reach overload warning. If it continues to run, warning may be given.	1. Check whether input voltage meets the requirements
A.97	17bit serial coder battery warning	Battery voltage is below 3.1v, too low battery voltage	1. Check battery voltage; 2. Replace battery.

Chapter XI Specifications

11.1 Specification of servo driver

11.1.1 Basic specifications

Basic specifications of servo driver are as follows.

Basic specifications			
Input power	220V system		Three phase AC220V +10 ~ -15%, 50/60Hz
	380V system		Three phase AC380V +15 ~ -15%, 50/60Hz
Control mode			Single phase or three phase full wave rectification IGBT PWM control, sine-wave current drive
Feedback			Line-saving gain coder: 5000ppr (1/20000 resolution ratio, gain); 17bit serial coder: 17bit (gain/absolute);
Operating conditions	Operating environment temperature / storage temperature		Operating environment humidity : 0 ~ 55° C storage temperature: - 20 ~ 85° C
	Operating environment humidity / storage humidity		Below 90% RH (no freezing and dewing)
	Vibration / impact strength		4.9 m/s2 ~ 19.6 m/s2
	Protection class / cleanness		Protection class: IP10; Cleanness: 2 But should be: • No corrosive or flammable gas • No water, oil or chemical splashing • With little dust, ash, salt or metallic powder
	Elevation		Below 1000m
Applicable standard			CE
Structure			Pedestal installation type
Performance	Speed control range		1: 5000
	Speed fluctuation ratio	Load fluctuation	0 ~ 100% load: Below ± 0.01% (at rated rotating speed)
		Voltage fluctuation	Rated voltage ± 10%: 0.001% (at rated rotating speed)
		Temperature fluctuation	25 ± 25° C: Below 0.1% (at rated rotating speed)
	Torque control accuracy (reproducibility)		± 3%
	Soft start time setting		0 ~ 10S (acceleration and deceleration settable respectively)
Input/output signal	Encoder frequency division pulse output		Phase A, phase B, phase Z: linear drive output Frequency division pulse count: Line-saving gain coder is 16 ~ coder line count; 17bit serial coder is 16 ~ 16384;
	Sequence	Distributable	Point 8 points

	control input signal	input signal	count	
			Function	Servo switch-on input (S-ON), control mode switch-over input (control mode switch-over input), forward drive inhibition input (POT), reverse drive inhibition input (NOT), deviation counter clear input (CLR), alarm clear (A-RST), gain switch-over input (GAIN), instruction pulse inhibition input (INHIBIT), etc. Distribution of the signals mentioned above and change of positive/negative logic can be achieved.
	Sequence control output signal	Non-distributable input signal	Point count	1 point. Alarm signal;
		Distributable input signal	Point count	3 points
			Function	Alarm signal (ALM), positioning completion signal (COIN), Z pulse collector signal (CZ), external brake lifting signal (BK), servo ready (S-RDY), etc. Distribution of signals mentioned above and change of positive /negative logic can be achieved.
Communication function	RS485 communication	1: N communication	Up to N = 31, in case of relay use	
		Shaft address setting	Settable through parameter	
		Connecting equipment	Computer and upper machine	
	CANopen communication	1: N communication	Up to N = 127, in case of relay use	
		Shaft address setting	Settable through parameter	
		Connecting equipment	Upper machine	
Display key function			7-segment RED x 5 digits, 4 keys	
Dynamic brake (DB)			Action in case of main loop power OFF, servo alarm, servo OFF, and over-travel (OT)	
Regeneration processing			Built-in regenerative resistor or external regenerative resistor	
Over-travel (OT) prevention function			Dynamic brake (DB) stops, deceleration stops, or free operation stops in case of POT or NOT input action	
Protection function			Over-current, over-voltage, under-voltage, overload, regeneration failure, etc.	

11.1.2 Speed, position and torque control specification

Speed, position and torque control specification of servo driver are as follows.

Overview and specification			
Control mode			
Position control	Feed forward compensation		0 ~100% (setting unit: 1%)
	Positioning completion width setting		0 ~ 65535 coder units
	Input signal	Input pulse type	Select any of the following: Symbol + Pulse train, CW + CCW pulse train, 90º phase difference two-phase pulse (Phase A + Phase B)
		Input pulse form	Support linear drive and open collector
		Max. input pulse frequency	**Long-line receiver drive:** Symbol + Pulse train, CW pulse + CCW pulse train; 4Mpps 90º phase difference two-phase pulse: 1Mpps **Linear drive:** Symbol + Pulse train, CW pulse + CCW pulse train: 500pps 90º phase difference two-phase pulse: 125Kpps **Open collector:** Symbol + Pulse train, CW pulse + CCW pulse train: 200kpps 90º phase difference two-phase pulse: 200kpps
		Clear signal	Clear deviation pulse Support long-line receiver drive, linear drive, and open collector
	Internal set position control	Position selection	Use external IO signal input selection
Speed control	Soft start time setting		0 ~ 5S (acceleration and deceleration settable respectively)
	Input signal	Instruction voltage	Max. input voltage: ± 10V (motor rotates forwardly in case of positive voltage instruction)
		Input impedance	About 9kΩ
	Internal set speed control	Speed selection	Use external IO signal input selection
Torque control	Input signal	Instruction voltage	Max. input voltage: ± 10V (torque output at forward rotating side in case of positive voltage instruction)
		Input impedance	About 9kΩ

11.2 Servo motor specification

Working system: S1 continuous	Heat resistance class: B
Vibration: 5G	Insulation withstand voltage: AC1500V, 1 minute
Insulation resistance: DC500V, above 10MΩ	Installation mode: Flange
Operating temperature: 0~40℃ (no freezing)	Operating humidity: 20%~80% (no dewing)
Altitude: Below 1000m altitude	Protection mode: Full-enclosed and self-cooled IP65 (except the shaft-through part)

11.2.1 Parameter list of 60/80 series servo motor

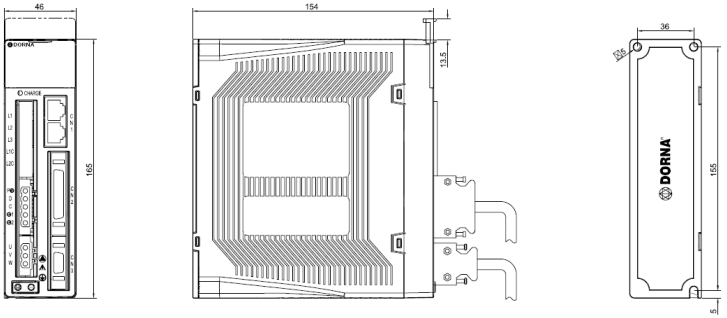
Motor model		60DNMA1-0D 20D	60DNMA1-0D 40D	80DNMA1-0D 75D
Pedestal No.		☐ 60	☐ 60	☐ 80
Rated output	W	200	400	750
Rated torque	N・m	0.64	1.28	2.39
Instantaneous max. torque	N・m	1.91	3.81	7.16
Rated current	Arms	1.7	2.9	4.2
Instantaneous max. current	Arms	5	8.7	12.6
Rated rotating speed	Min^{-1}	3000	3000	3000
Max. rotating speed	Min^{-1}	5000	5000	4500
Torque constant	N·m/Arms	0.38	0.44	0.57
Rotation inertia	$Kg·m^2x10^{-4}$	0.094	0.24	0.94

11.2.2 Parameter list of 130 series servo motor

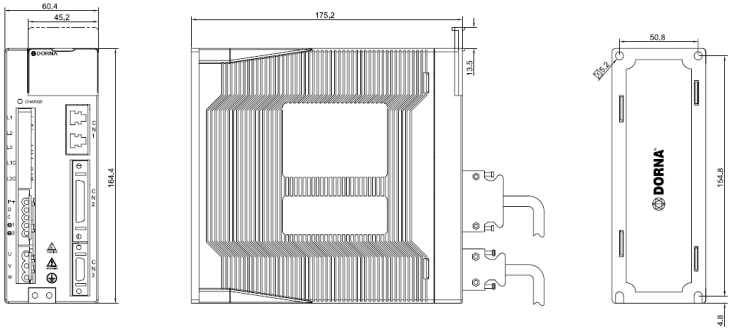
Voltage class		220V			
Motor model		130DNMA 1 -0D85C	130DNMA 1 -0001C	130DNMA 1 -01D2C	130DNMA 1 -01D5C
Pedestal No.		☐ 130	☐ 130	☐ 130	☐ 130
Rated output	W	850	1000	1200	1500
Rated torque	N・m	4.0	5.0	6.0	7.2
Instantaneous max. torque	N・m	12.0	15.0	18.0	21.6
Rated current	Arms	4.1	5.1	6.3	7.5
Instantaneous max. current	Arms	12.7	15.8	19.5	22.8
Rated rotating speed	Min^{-1}	2000	2000	2000	2000
Max. rotating speed	Min^{-1}	3000	3000	3000	3000
Torque constant	N·m/Arms	0.98	0.98	0.95	0.96
Rotation inertia	$Kg·m^2x10^{-4}$	7.7	9.5	11.4	14.3

11.3 Dimensions of servo driver

11.3.1 EPS-0D20A, EPS-0D40A (Type A case)



11.3.2 EPS-0D75A, EPS-0001A, EPS-01D5A (Type B case)



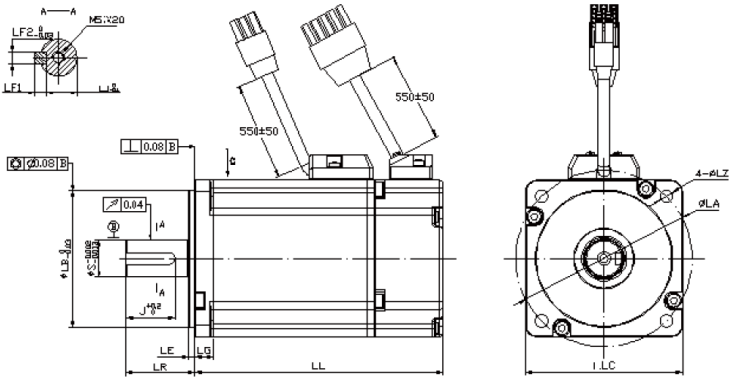
Note:

1) Size unit is mm, and weight unit is Kg.

2) Size and weight data are subject to change without notification due to product change.

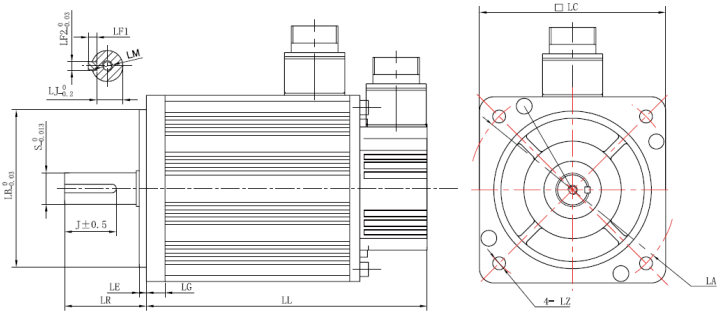
11.4 Dimensions of servo motor

11.4.1 Installation dimensions of 60/80 series motor: Unit (mm)



Model	Flange face size				Shaft end size					LL	LR	LE	LG
	LC	LA	LB	LZ	S	LJ	J	LF1	LLF2				
60DNMA1-0D20D	60	70	50	5.5	14	11	20	5	5	103	30	3	8
60DNMA1-0D40D	60	70	50	5.5	14	11	20	5	5	123	30	3	8
80DNMA1-0D75D	80	90	70	5.5	15.5	15.5	25	5	6	129.7	30	3	9.8

11.4.2 Installation dimensions of 130 series motor: Unit (mm)



Model	Flange face size				Shaft end size					LL	LR	LE	LG
	LC	LA	LB	LZ	S	LJ	J	LF1	LLF2				
130DMNA1-0D85C	130	145	110	9	22	18.5	36	6	6	163	57	5	13
130DMNA1-0001C	130	145	110	9	22	18.5	36	6	6	172	57	5	13
130DMNA1-01D2C	130	145	110	9	22	18.5	36	6	6	181	57	5	13
130DMNA1-01D5C	130	145	110	9	22	18.5	36	6	6	197	57	5	13

Chapter XII Appendix

12.1 List of motoring modes

Monitoring No.	Display contents	Unit
dP 00	Motor speed	[r/min]
dP 01	Motor feedback pulse number (encoder unit, lower 4 digits)	[1 Encoder pulse]
dP 02	Motor feedback pulse number (encoder unit, higher 5 digits)	[10000 Encoder pulse]
dP 03	Motor instruction input pulse number (before electronic gear) (user unit, lower 4 digits)	[1 Instruction pulse]
dP 04	Motor instruction input pulse number (before electronic gear) (user unit, lower 5 digits)	[10000 Encoder pulse]
dP 05	Error pulse number (encoder unit, lower 4 digits)	[1 Encoder pulse]
dP 06	Error pulse number (encoder unit, lower 5 digits) Under position control, it shows the lower 5 digits	[10000 Encoder pulse]
dP 07	Speed instruction (analog voltage instruction)	[V]
dP 08	Internal speed instruction	[r/min]
dP 09	Torque instruction (analog voltage instruction)	[V]
dP 10	Internal torque instruction (value in relation to the rated torque)	[%]
dP 11	Torque feedback (value in relation to the rated torque)	[%]
dP 12	Input signal monitoring	--
dP 13	Output signal monitoring	--
dP 14	Instruction pulse frequency	[0.1Khz]
dP 15	Major loop voltage	[V]
dP 16	Total operation time	[Hous]
dP 17	Rotation angle	[deg]
dP 18	Real position of encoder (single ring absolute value or multiple-ring absolute value encoder)	[2 Encoder pulse]
dP 19	Display of number of encoder rings (only effective for absolute value encoder)	[1 ring]
dP 20	Cumulative load factor (take the rated value of cumulative load as 100%)	[%]
dP 21	Regeneration load factor (take the rated value of regeneration load as 100%)	[%]
dP 22	DB load factor (take the rated value of DB load as 100%)	[%]
dP 23	Ratio of inertias of load	[%]
dP 24	Effective gain monitoring	1: Means first group gain
dP 25	Reserved	
dP 26	Reserved	
dP 27	Reserved	
dP 28	Load inertia value (automatic)	0.1Kgcm^2
dP 29	Reserved	

12.2 List of auxiliary functions

AF No	Functions	Referential sections
AF 00	Display of error logging	6.2
AF 01	Location assignment (only active under location model)	6.3
AF 02	Jog operation model	6.4
AF 03	Front panel lock operation	6.5

AF No	Functions	Referential sections
AF 04	Clearance of alarm logging	6.6
AF 05	Parameter initialization	6.7
AF 06	Self-regulation of analog quantity (speed and torque) instruction offset	6.8
AF 07	Manual regulation of speed instruction offset	6.9
AF 08	Manual regulation of torque instruction offset	6.10
AF 09	Check the relevant parameters of motor	6.11
AF 10	Display of software version of servo driver	6.12
AF 11	Set absolute value encoder	6.13
AF 15	Manual detection of load inertia	6.14

12.3 List of user parameters

12.3.1 Display modes of user parameters

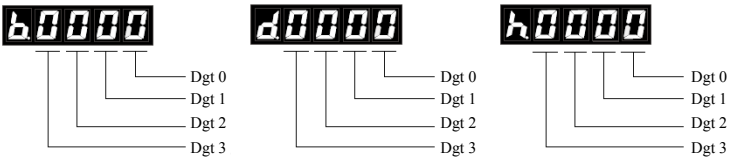
User parameters are displayed in the following ways:

12.3.2 Display modes of function selection parameters

Every bit of function selection parameter has its own meaning.

This manual adopts the following method of representation for function selection parameters.

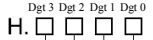
Parameter	Meaning
PA000.0 or n. x x x ☐	Means the value expressed by the "0-digit number" of the set value of user parameter "PA000".
PA000.1 or n. x x ☐ x	Means the value expressed by the "1-digit number" of the set value of user parameter "PA000".
PA000.2 or n. x ☐ x x	Means the value expressed by the "2-digit number" of the set value of user parameter "PA000".
PA000.3 or n. ☐ x x x	Means the value expressed by the "3-digit number" of the set value of user parameter "PA000".
n. x x x x	Means b. x x x x, d. x x x x or h. x x x x

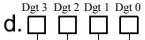


b: means binary system display setting, digit value setting range: 0 ~ 1;

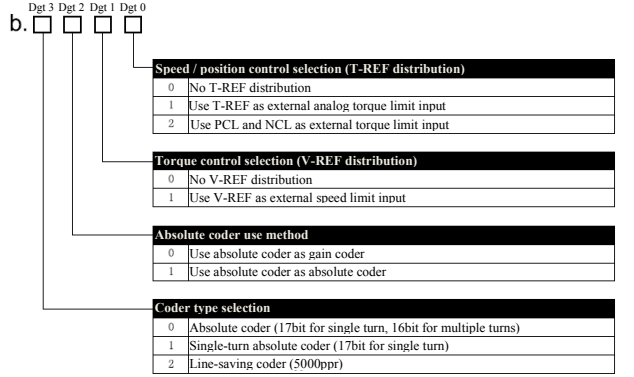
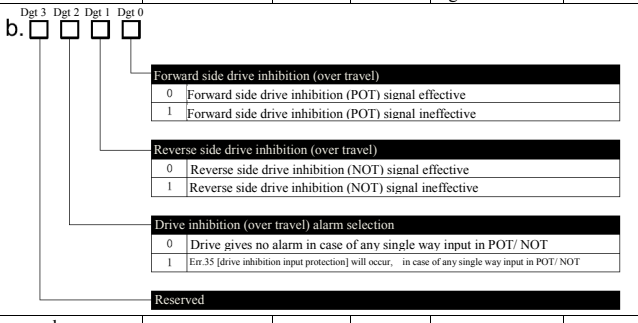
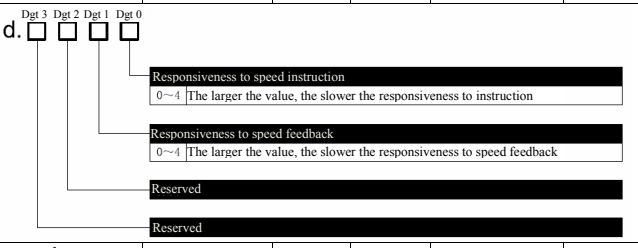
d: means decimal system display setting, digit value setting range: 0 ~ 9;

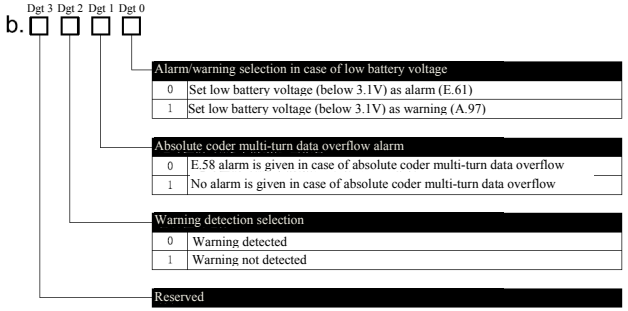
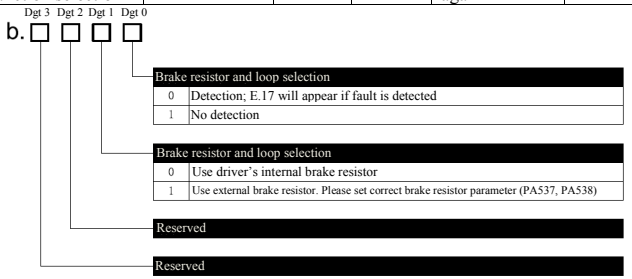
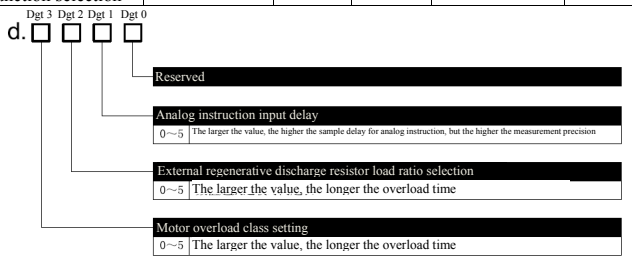
h: means hexadecimal system display setting, digit value setting range: 0 ~ F;

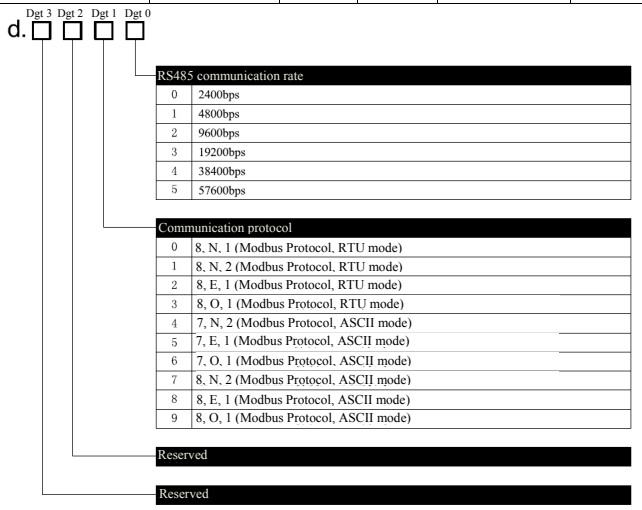
<table>
<tr><th>Parameter No.</th><th>Name</th><th>Setting scope</th><th>Unit</th><th>Factory setting</th><th>Effective time</th><th>Reference</th></tr>
<tr><td>PA000</td><td>Basic switch 1 for function selection</td><td>h.000~01A1</td><td></td><td>h.000</td><td>Power-on again</td><td></td></tr>
<tr><td colspan="7">


<table>
<tr><th colspan="2">Rotating direction selection</th></tr>
<tr><td>0</td><td>Normal mode</td></tr>
<tr><td>1</td><td>Reverse mode</td></tr>
</table>
<table>
<tr><th colspan="2">Control mode selection</th></tr>
<tr><td>0</td><td>Position control (pulse instruction)</td></tr>
<tr><td>1</td><td>Speed control (analog instruction)</td></tr>
<tr><td>2</td><td>Torque control (analog instruction)</td></tr>
<tr><td>3</td><td>Internal speed control (junction instruction</td></tr>
<tr><td>4</td><td>←→Position control (analog instruction)</td></tr>
<tr><td>5</td><td>←→Speed control (analog instruction)</td></tr>
<tr><td>6</td><td>←→Torque control (analog instruction)</td></tr>
<tr><td>7</td><td>Position control (pulse instruction) ←→Speed control (analog instruction)</td></tr>
<tr><td>8</td><td>←→Torque control (analog instruction)</td></tr>
<tr><td>9</td><td>Torque control (analog instruction) ←→Speed control (analog instruction)</td></tr>
<tr><td>A</td><td>Internal position control (junction instruction)</td></tr>
</table>
<table>
<tr><th>Reserved</th></tr>
</table>
<table>
<tr><th>Reserved</th></tr>
</table>
</td></tr>
<tr><td>PA001</td><td>Basic switch 2 for function selection</td><td>d.0000~0264</td><td></td><td>d.0000</td><td>Power-on again</td><td></td></tr>
<tr><td colspan="7">


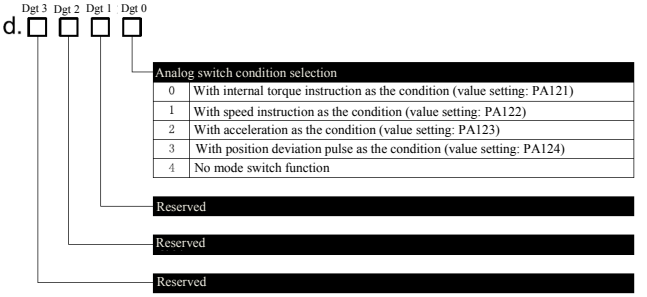
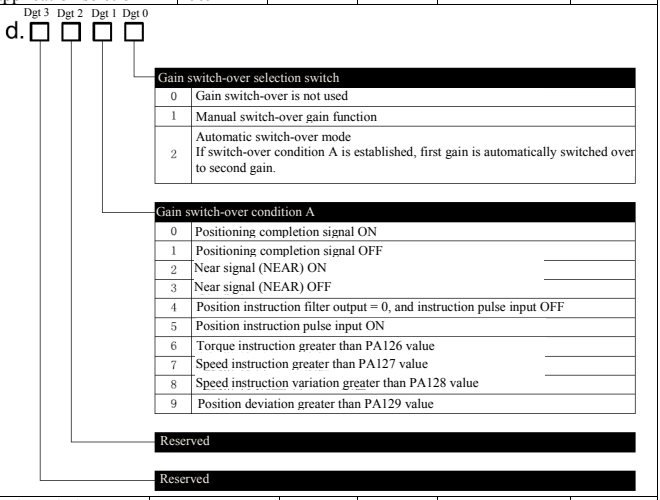
<table>
<tr><th colspan="2">Stoppage when servo is OFF and in case of warning</th></tr>
<tr><td>0</td><td>Motor is stopped by DB (dynamic brake)</td></tr>
<tr><td>1</td><td>Motor is stopped by DB and then DB is let go</td></tr>
<tr><td>2</td><td>No DB is used but motor is set to free state</td></tr>
<tr><td>3</td><td>Motor is stopped at PA522 deceleration when servo is OFF; motor is in DB state when speed is reduced to PA523</td></tr>
<tr><td>4</td><td>Motor is stopped at PA522 deceleration when servo is OFF; motor is in free state when speed is reduced to PA523</td></tr>
</table>
<table>
<tr><th colspan="2">Stoppage in case of over-travel (OT)</th></tr>
<tr><td>0</td><td>DB stop or free operation stop (stop method same as 0-2 setting of PA001.0)</td></tr>
<tr><td>1</td><td>Motor is stopped by set torque of PA406, and then it enters into servo locking state</td></tr>
<tr><td>2</td><td>Motor is stopped by set torque of PA406, and then it enters into free operation state</td></tr>
<tr><td>3</td><td>Motor is stopped by set torque of PA406, and then it enters into DB state</td></tr>
<tr><td>4</td><td>Motor is stopped by set torque of PA406 and PA522 deceleration, and then it enters into servo locking state</td></tr>
<tr><td>5</td><td>Motor is stopped by set torque of PA406 and PA522 deceleration, and then it enters into free operation state</td></tr>
<tr><td>6</td><td>Motor is stopped by set torque of PA406 and PA522 deceleration, and then it enters into DB state</td></tr>
</table>
<table>
<tr><th colspan="2">AC/DC power input selection</th></tr>
<tr><td>0</td><td>AC power input: Single phase AC220V power is input from L1, L2 and L3 terminals</td></tr>
<tr><td>1</td><td>AC power input: Three phase AC220V power is input from L1, L2 and L3 terminals</td></tr>
<tr><td>2</td><td>DC power input: DC310V power is input between P+, ⊖</td></tr>
</table>
<table>
<tr><th>Reserved</th></tr>
</table>
</td></tr>
<tr><td>PA002</td><td>Basic switch 3 for function selection</td><td>d.0000~2112</td><td></td><td>d.0000</td><td>Power-on again</td><td></td></tr>
</table>

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
						
PA003	Basic switch 4 for function selection	b.0000~0111		d.0011	Power-on again	
						
PA004	Reserved					
PA005	Basic switch 6 for function selection	d.0000~0044		d.0022	Immediately	
						
PA006	Reserved					
	Basic switch 8 for function selection	b.0000~1111		b.0000	Power-on again	

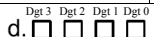
Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
PA007						
PA008	Reserved	b.0000~1111		b.0000	Power-on again	
PA009	Switch 10 for function selection	b.0000~0011		b.0000	Power-on again	
						
PA010	Switch 11 for function selection	d.0000~5553		d.0021	Immediately	
						
PA011	Reserved	0 ~ 5		2	Power-on again	
PA012	Motor model selection	0 ~ 59		12	Power-on again	
PA013	Reserved					
PA014	Initially displayed number	0~50		50	Power-on again	
	Please look up the content of monitoring. When 50 is set, state code is displayed; when a number other than 50 is set, the initially displayed content is what corresponds to the					

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	monitor number.					
PA015	RS485 communication address	1~31		1	Immediately	
PA016	RS485 communication function selection switch	d.0000 ~ 0095		d.0095	Immediately	
						
PA017	Reserved	1 ~ 127		1		
PA018	Reserved	d.0000 ~ 0006		d.0003		
PA019	Reserved					
PA020	Reserved					
PA021	Reserved					
PA022	Reserved					
PA023	Reserved					
PA024	Reserved					
PA100	First position ring gain	1 ~ 1000	1/s	40	Immediately	
	It decides the responsiveness characteristics of position control system. Positioning time can be shorted, if larger position ring gain value is set. However, vibration may be caused, if the set value is too large, so please pay attention to this problem in modification.					
PA101	First speed ring gain	1 ~ 3000	Hz	40	Immediately	
	It decides the responsiveness characteristics of speed ring. In order to increase position ring gain and improve servo system's total responsiveness, the speed ring gain setting should be increased. However, vibration may be caused, if the set value is too large, so please pay attention to this problem in modification.					
PA102	First speed ring integral time	1 ~ 2000	0.1 ms	200	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	constant					
	Time constant is used to set speed ring integral time constant. The smaller the set value, the greater the integral's function, and the stronger the anti-disturbance capability, but too large setting may cause vibration.					
PA103	First speed detection filter	0 ~ 1000	0.01 ms	10	Immediately	
	After speed detection, time constant of low-pass filter can be set. The greater the set value, the larger the time constant, but the responsiveness will decrease, despite the reduced motor noise.					
PA104	First torque filter	0 ~ 1000	0.01 ms	30	Immediately	
	Set the first-order lag filter time constant that is inserted into torque instruction part. It can control vibration caused by distortion resonance. The greater the set value, the larger the time constant, but the responsiveness will decrease, despite the reduced motor noise.					
PA105	Second position ring gain	1 ~ 1000	1/s	40	Immediately	
PA106	Second speed ring gain	1 ~ 3000	1 Hz	80	Immediately	
PA107	Second speed ring integral time constant	1 ~ 2000	0.1 ms	10	Immediately	
PA108	Second speed detection filter	1 ~ 1000	0.01ms	5	Immediately	
PA109	Second torque filter	0 ~ 1000	0.01ms	20	Immediately	
PA110	Speed feed-forward	0 ~ 100	%	0	Immediately	
	In the speed control instruction calculated based on internal position instruction, add the value got by multiplying this parameter ratio into the speed instruction from position control processing.					
PA111	Speed feed-forward filter	0 ~ 1000	0.01ms	0	Immediately	
	Set the time constant of first-order lag filter required for speed feed-forward input.					
PA114	Friction compensation gain	1 ~ 1000	0.1%	0	Immediately	
PA115	Friction compensation smoothing constant	0 ~ 1000	0.1%	0	Immediately	
PA116	Friction compensation threshold speed	0 ~ 3000	0.1rpm	100	Immediately	
PA117	Reserved					
PA118	Inertia ratio	0 ~ 5000	1%	200	Immediately	
	Set the relevant motor rotor inertia and load inertia ratio. PA118 = (Load inertia / rotor inertia) x 100 [%]. This parameter is ineffective in case of real time automatic gain adjustment.					
PA119	Reserved	0 ~ 32767	0.1ms	0		
PA120	Gain application selection switch 1	d.0000 ~ 0034		d.0000	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
						
PA121	Mode switch (torque instruction)	0 ~ 300	1%	200	Immediately	
PA122	Mode switch (speed instruction)	0 ~ 3000	1min-1	0	Immediately	
PA123	Mode switch (acceleration)	0 ~ 65535	10rpm	0	Immediately	
PA124	Mode switch (position deviation)	0 ~ 65535		0	Immediately	
PA125	Switch 2 for gain application selction	d.0000~ 0092		d.0000	Immediately	
						
PA126	Gain switch-over class (torque instruction)	0 ~ 300	1%	200	Immediately	
PA127	Gain switch-over class (speed instruction)	0 ~ 3000	1min-1	100	Immediately	
PA128	Gain switch-over class (speed	0 ~ 65535	10rpm/s	10000	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	instruction variation)					
PA129	Gain switch-over class (position deviation)	0 ~ 65535	1 pulse	100	Immediately	
PA130	Gain switch-over time 1	0 ~ 10000	0.1 ms	10	Immediately	
PA131	Gain switch-over time 2	0 ~ 10000	0.1 ms	10	Immediately	
PA132	Gain switch-over waiting time 1	0 ~ 10000	0.1 ms	10	Immediately	
PA133	Gain switch-over waiting time 2	0 ~ 10000	0.1 ms	10	Immediately	
PA134	Reserved	0 ~ 10000		0		
PA136	Reserved					
PA137	Reserved	0 ~ 500		50		
PA138	Reserved	0 ~ 5000		0		
PA139	Reserved	0 ~ 10		0		
PA140	Reserved	0 ~ 5000		0		
PA141	Reserved	0 ~ 100		0		
PA142	Reserved					
PA200	Position control function switch 1	d.0000~ 1232		d.0000	Power-on again	



Instruction pulse form

0	Symbol + Pulse
1	CW + CCW
2	Phase A + Phase B (4 times frequency)

Pulse signal negation operation

0	Neither PULS nor SIGN is negated
1	PULS is not negated, but SIGN is negate
2	PULS is negated, but SIGN is not
3	Both PULS and SIGN are negated

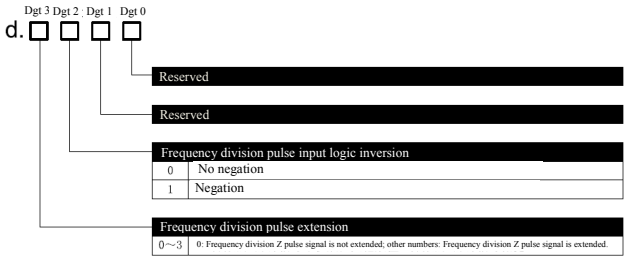
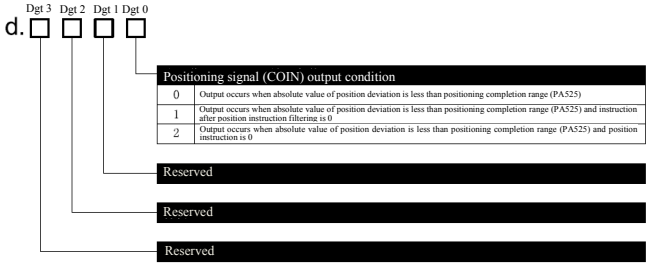
Pulse clear action

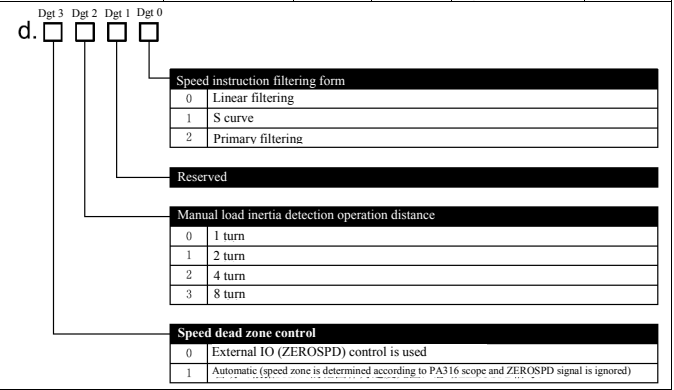
0	Clear position deviation pulse when servo is OFF and alarm
1	"Do not clear position deviation pulse (clearance can only be achieved through CLR signal, and lock state" under OT status will also be cleared).
2	BClear position deviation pulse only when alarm occurs

Pulse input channel selection

0	PULS and SIGN input (low speed pulse channel)
1	PULSH and SIGNH input (high speed pulse channel)

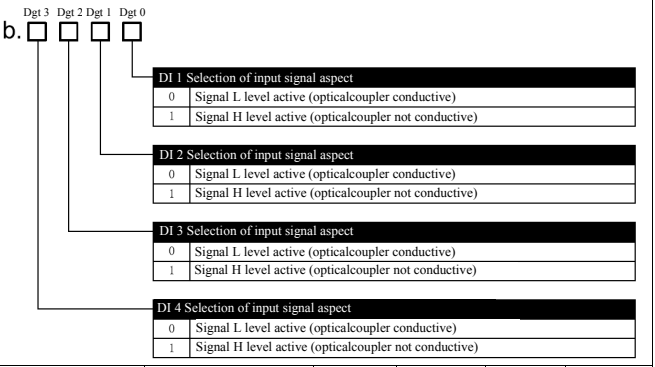
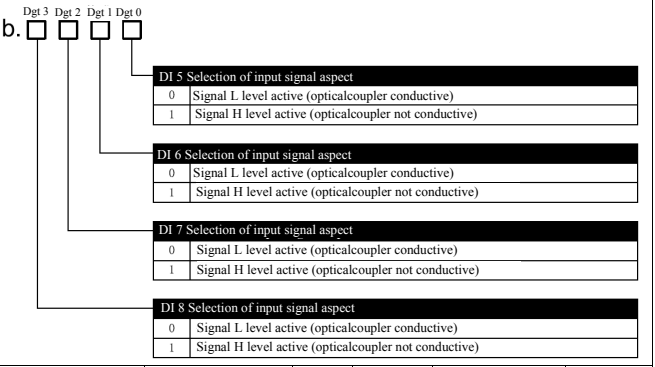
PA201	Position control function switch 2	d.0000~3177		d.0000	Power-on again	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
						
PA202	Position control function switch 3	d.0000~0012		d.0000	Immediately	
						
PA203	Reserved					
PA204	Reserved					
PA205	First electronic gear ratio (numerator)	1 ~ 65535		1	Immediately	
PA206	Electronic gear ratio (denominator)	1 ~ 65535		1	Immediately	
PA207	Second electronic gear ratio (numerator)	1 ~ 65535		1	Immediately	
PA208	Third electronic gear ratio (numerator)	1 ~ 65535		1	Immediately	
PA209	Fourth electronic gear ratio (numerator)	1 ~ 65535		1	Immediately	
PA210	Coder frequency -divided pulse count	16 ~ 16384	1P/Rev	16384	Power-on again	
	The resolution ratio of pulse output is set by using output pulse value where OA and OB rotate by 1 turn respectively. When PA201 value is set to exceed the coder line count, its fractional frequency value is the coder line count. When 5000ppr gain coder is used, PA210 is set to be greater than 5000, and its frequency division pulse count is coder line count 5000.					
PA211	Reserved					
PA212	Reserved					
PA213	Reserved					
PA214	Position instruction acceleration /deceleration time	0 ~ 1000	0.1 ms	0	Immediately	

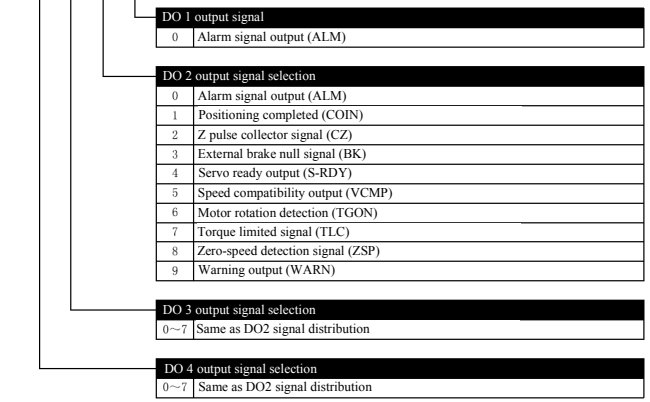
Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	parameter 1					
PA215	Position instruction acceleration /deceleration time parameter 2	0 ~ 1000	0.1 ms	0	Immediately	
PA216	Position instruction mean filter	0 ~ 500	0.1 ms	0	Immediately	
PA217	Reserved					
PA218	Reserved					
PA219	Reserved					
PA300	Speed control function switch	d.0000 ~ 1333		d.0200	Power-on again	
						
PA301	Speed instruction input gain	150 ~ 3000	0.01V / rated speed	600	Immediately	
PA302	Speed instruction filtering time constant	0 ~ 1000	0.1 ms	0	Immediately	
PA303	Instruction linear acceleration time	0 ~ 5000	1 ms	0	Immediately	
PA304	Instruction linear deceleration time	0 ~ 5000	1 ms	0	Immediately	
PA305	Instruction S style acceleration / deceleration time	0 ~ 5000	1 ms	0	Immediately	
PA306	JOG speed	0 ~ 5000	1 min-1	500	Immediately	
PA307	Internal 0th speed	- 5000 ~ 5000	1 min-1	100	Immediately	
PA308	Internal st speed	- 5000 ~ 5000	1 min-1	200	Immediately	
PA309	Interna 2nd speed	- 5000 ~ 5000	1 min-1	300	Immediately	
PA310	Internal 3rd speed	- 5000 ~ 5000	1 min-1	400	Immediately	
PA311	Internal 4th speed	- 5000 ~ 5000	1 min-1	500	Immediately	
PA312	Internal 5th speed	- 5000 ~ 5000	1 min-1	600	Immediately	
PA313	Internal 6th speed	- 5000 ~ 5000	1 min-1	700	Immediately	
PA314	Internal 7th speed	- 5000 ~ 5000	1 min-1	800	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
PA315	Zero-speed clamping function selection	0 ~ 2		0	Immediately	
	[0] After the setting of zero-speed clamping signal based on PA300.3 takes effect, the speed instruction is forcibly put to 0; [1] After the setting of zero-speed clamping signal based on PA300.3 takes effect, the speed instruction is forcibly put to 0; and when motor's actual speed is changed to below PA316 (zero speed clamping class), it is switched over to position control, and servo is locked at that position. When zero speed clamping signal is ineffective or control mode is switched over, it exits from this zero speed clamping state. [2] After the setting of zero-speed clamping signal based on PA300.3 takes effect, stop is achieved by PA522 deceleration; and when motor's actual speed is changed to below PA316 (zero speed clamping class), it's switched over to position control, and servo is locked at this position. When zero speed clamping signal is ineffective or control mode is switched over, it exits from this zero speed clamping state. This stop mode is only applicable to PA300.0 = 0.					
PA316	Zero-speed clamping class	1 ~ 2000	rpm	30	Immediately	
PA317	Reserved					
PA318	Reserved					
PA400	Speed instruction input gain	10 ~ 100	0.1V / Rated torque	30	Immediately	
PA401	Torque input filtering time constant	0 ~ 1000	0.1 ms	0	Immediately	
PA402	Forward side torque limit	0 ~ 300	1%	300	Immediately	
PA403	Reverse side torque limit	0 ~ 300	1%	300	Immediately	
PA404	Forward side external torque limit	0 ~ 100	1%	100	Immediately	
PA405	Reverse side external torque limit	0 ~ 100	1%	100	Immediately	
PA406	Emergency stop torque limit	0 ~ 300	1%	300	Immediately	
PA407	Speed limit at torque control	0 ~ 5000	1 min-1	1500	Immediately	
PA408	Reserved					
PA409	Reserved				Immediately	
PA410	Segment 1 notch filter frequency	50 ~ 2000	1 Hz	2000	Immediately	
PA411	Segment 1 notch filter frequency attenuation rate	0 ~ 32	db	0	Immediately	
PA412	Segment 2 notch filter frequency	50 ~ 2000	1 Hz	2000	Immediately	
PA413	Segment 2 notch filter frequency	0 ~ 32	db	0	Immediately	
PA414	Reserved					
PA415	Reserved					
PA416	Reserved					

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
PA417	Reserved					
PA418	Reserved					
PA419	Reserved					
PA500	Port DI1 input signal selection	0 ~ 25		0	Immediately	
	[0] Servo-on (S-ON) [1] Control mode switch (C-MODE) [2] Positive driving prohibited (POT) [3] Negative driving prohibited (NOT) [4] Deviation counter clearance (CLR) [5] Alarm reset (A-RST) [6] Pulse input inhibition (INHIBIT) [7] Zero-speed restoration (ZEROSPD) [8] Positive torque limitation (PCL) [9] Negative torque limitation (NCL) [10] Gain switch (GAIN) [11] Zero signal (ZPS) [12] Retention [13] Instruction frequency division/ multiplication switch 0(DIV0) [14] Instruction frequency division/ multiplication switch 1(DIV1) [15] Internal instruction speed selection 0(INSPD0) [16] Internal instruction speed selection 1(INSPD1) [17] Internal instruction speed selection 2(INSPD2) [Other] Special function and usage					
PA501	Port DI2 input signal selection	0 ~ 25		1	Immediately	
PA502	Port DI3 input signal selection	0 ~ 25		2	Immediately	
PA503	Port DI4 input signal selection	0 ~ 25		3	Immediately	
PA504	Port DI5 input signal selection	0 ~ 25		4	Immediately	
PA505	Port DI6 input signal selection	0 ~ 25		5	Immediately	
PA506	Port DI7 input signal selection	0 ~ 25		6	Immediately	
PA507	Port DI8 input signal selection	0 ~ 25		7	Immediately	
PA508	Input signal form selection 1	b.0000 ~ 1111		b.0000	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
						
PA509	Input signal form selection 2	b.0000~1111		b.0000	Immediately	
						
PA510	Input signal form selection	d.0000~9990		d.3210	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	d. Dgt 3 Dgt 2 Dgt 1 Dgt 0					



DO 1 output signal

0	Alarm signal output (ALM)

DO 2 output signal selection

0	Alarm signal output (ALM)
1	Positioning completed (COIN)
2	Z pulse collector signal (CZ)
3	External brake null signal (BK)
4	Servo ready output (S-RDY)
5	Speed compatibility output (VCMP)
6	Motor rotation detection (TGON)
7	Torque limited signal (TLC)
8	Zero-speed detection signal (ZSP)
9	Warning output (WARN)

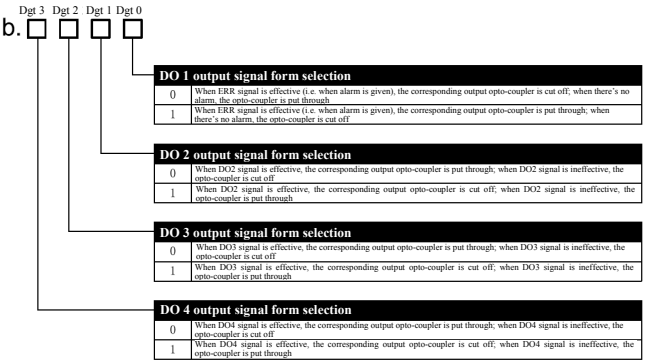
DO 3 output signal selection

0～7	Same as DO2 signal distribution

DO 4 output signal selection

0～7	Same as DO2 signal distribution

PA511	Output signal negation	b.0000 ~ 1111		b.0000	Immediately	
	b. Dgt 3 Dgt 2 Dgt 1 Dgt 0					



DO 1 output signal form selection

0	When ERR signal is effective (i.e. when alarm is given), the corresponding output opto-coupler is cut off; when there's no alarm, the opto-coupler is put through
1	When ERR signal is effective (i.e. when alarm is given), the corresponding output opto-coupler is put through; when there's no alarm, the opto-coupler is cut off

DO 2 output signal form selection

0	When DO2 signal is effective, the corresponding output opto-coupler is put through; when DO2 signal is ineffective, the opto-coupler is cut off
1	When DO2 signal is effective, the corresponding output opto-coupler is cut off; when DO2 signal is ineffective, the opto-coupler is put through

DO 3 output signal form selection

0	When DO3 signal is effective, the corresponding output opto-coupler is put through; when DO3 signal is ineffective, the opto-coupler is cut off
1	When DO3 signal is effective, the corresponding output opto-coupler is cut off; when DO3 signal is ineffective, the opto-coupler is put through

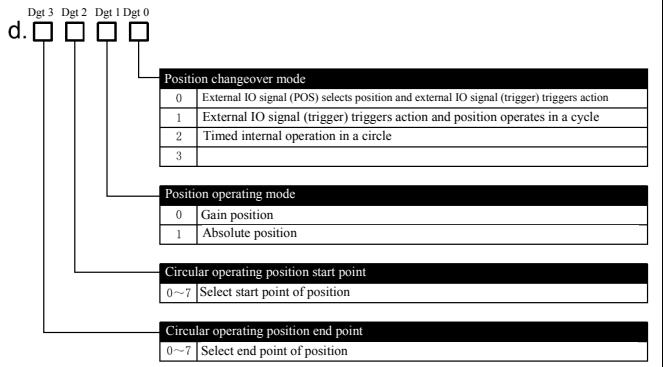
DO 4 output signal form selection

0	When DO4 signal is effective, the corresponding output opto-coupler is put through; when DO4 signal is ineffective, the opto-coupler is cut off
1	When DO4 signal is effective, the corresponding output opto-coupler is cut off; when DO4 signal is ineffective, the opto-coupler is put through

PA512	Input signal filtering time	1 ~ 1000	1 ms	10	Immediately	
PA513	Serial coder communication alarm time	1 ~ 100	0.1 ms	5	Immediately	
PA514	Reserved					
PA515	Zero fixed value	0 ~ 3000	1 min-1	10	Immediately	
PA516	Rotation detected value	1 ~ 3000	1 min-1	20	Immediately	
PA517	Same-sped signal detected width	1 ~ 100	1 min-1	10	Immediately	
PA518	Brake instruction – Servo OFF delay	0 ~ 500	1 ms	100	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	time					
PA519	Brake instruction action speed limit	0 ~ 1000	1 min-1	100	Immediately	
PA520	Servo OFF – Brake instruction waiting time	100 ~ 1000	1 ms	500	Immediately	
PA521	Instantaneous power failure keeping time	40 ~ 800	1 ms	60	Immediately	
PA522	Servo OFF stop acceleration	0 ~ 1000	1 ms	100	Immediately	
PA523	Servo OFF stop threshold	20 ~ 2000	rpm	50	Immediately	
PA524	Reserved					
PA525	Positioning completion width	0 ~ 65535	Pulse	10	Immediately	
PA526	NEAR signal width	0 ~ 65535	4pulse	100	Immediately	
PA527	Position when Servo is ON	1 ~ 65535	0.01r	200	Immediately	
	Over-deviation warning value (WARN) Unit is 0.01r. It varies with different resolution ratios of coder. For example, if coder‘s resolution ratio is 5000ppr , the unit is 5000*4*0.01=200pulse; when warning value is set to 200, the over-deviation warning value is 200*200=40000 pulses					
PA528	Too much position deviation alarm value (ERR) when servo is ON Same as above	1 ~ 65535	0.01r	500	Immediately	
PA529	Speed deviation alarm detection time	20 ~ 2000	1 ms	300	Immediately	
PA530	Speed deviation alarm threshold class	0 ~ 10		5	Immediately	
	If speed deviation exceeds this threshold, E.28 (speed over-deviation protection) will appear. When set value is 10, speed over-deviation protection is not detected.					
PA531	Overload warning value	5 ~ 100	%	50	Immediately	
PA532	Reserved					
PA533	Alarm clear input setting	0 ~ 3		0	Immediately	
PA534	Main power off detection time	100 ~ 2000	1 ms	100	Immediately	
	When main power's disconnection state continues, the time for disconnection detection is set. When it is 2000, the main power turns off detection as ineffective.					
PA535	Reserved					
PA536	Reserved					
PA537	External regenerative resistor's value of resistance	5 ~ 200	Ohm	30	Power-on again	
PA538	External regenerative	20 ~ 3000	Watt	60	Power-on again	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
	resistor's capacity					
PA539	Reserved					
PA540	Reserved					
PA541	Reserved					
PA542	Reserved					
PA543	Reserved					
PA544	Reserved					
PA600	Adjustment type switch 1	h.0000 ~ 03F6	h.0220		Power-on again	
	d. Dgt 3 Dgt 2 Dgt 1 Dgt 0 Real time automatic adjustment mode 0 Real time automatic adjustment function is ineffective. 1 Real time automatic adjustment function is effective. Inertia presumed speed in case of real time automatic adjustment 0~F The larger the value, the faster the presumed speed, but presumption accuracy will decrease Presumed speed in case of real time automatic adjustment 0 No change. Load characteristic presumption is stopped. 1 Little change. As regards load characteristic change, minute instruction is used for response. 2 Slow change. As regards load characteristic change, second instruction is used for response. 3 Dramatic change. As regards load characteristic change, fastest presumption is implemented. Reserved					
PA601	Reserved	0000 ~ 0512	0000			
PA602	Reserved	0000 ~ 1111	0000			
PA603	Adjustment type switch 4	b.0000 ~ 1111	b.0010		Immediately	
	b. Dgt 3 Dgt 2 Dgt 1 Dgt 0 Offline inertia detection update 0 Inertia ratio PA118 is updated automatically after completion of offline inertia detection 1 Inertia ratio is not updated and it's necessary to set PA118 by hand Inertia selection in case of automatic adjustment 0 Presumed inertia value is used under automatic adjustment mode 1 Manually set inertia value PA118 is used under automatic adjustment mode Reserved Reserved					
PA604	Reserved	0000 ~ 1111	0000			
PA605	Reserved	0000 ~ 0003	0000			
PA606	Inertia stability criteria	0~100		2	Immediately	
	When the presumed inertia value is less than rated inertia of PA606* motor and it lasts within a certain period of time, it is deemed as end of inertia presumption.					
PA608	Reserved	0 ~ 100	1%	0		
PA609	Reserved	0 ~ 1000	0.01ms	100		
PA610	Bandwidth setting	1 ~ 1000	Hz	40	Immediately	
	Under the automatic mode, the greater the value, the faster the response, and the greater the rigidity, but the higher possibility of vibration.					

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
PA611	Reserved					
PA612	Reserved	0 ~ 9		0		
PA613	Reserved	0 ~ 1000	0.1 ms	10		
PA614	Reserved					
PA615	Reserved					
PA700	Internal position mode switch 1	d.0000 ~ 7702		d.1002	Immediately	
						
PA701	Internal position 0 high-order	- 9999 ~ 9999	turn	1	Immediately	
PA702	Internal position 0 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA703	Internal position 1 high-order	- 9999 ~ 9999	turn	2	Immediately	
PA704	Internal position 1 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA705	Internal position 2 high-order	- 9999 ~ 9999	turn	1	Immediately	
PA706	Internal position 2 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA707	Internal position 3 high-order	- 9999 ~ 9999	turn	2	Immediately	
PA708	Internal position 3 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA709	Internal position 4 high-order	- 9999 ~ 9999	turn	1	Immediately	
PA710	Internal position4 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA711	Internal position 5 high-order	- 9999 ~ 9999	turn	2	Immediately	
PA712	Internal position 5 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA713	Internal position 6 high-order	- 9999 ~ 9999	turn	1	Immediately	
PA714	Internal position 6 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA715	Internal position 7 high-order	- 9999 ~ 9999	turn	2	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
PA716	Internal position 7 low-order	- 9999 ~ 9999	pulse	0	Immediately	
PA717	Internal position speed 0	0 ~ 5000	1 min-1	100	Immediately	
PA718	Internal position speed 1	0 ~ 5000	1 min-1	100	Immediately	
PA719	Internal position speed 2	0 ~ 5000	1 min-1	100	Immediately	
PA720	Internal position speed 3	0 ~ 5000	1 min-1	100	Immediately	
PA721	Internal position speed 4	0 ~ 5000	1 min-1	100	Immediately	
PA722	Internal position speed 5	0 ~ 5000	1 min-1	100	Immediately	
PA723	Internal position speed 6	0 ~ 5000	1 min-1	100	Immediately	
PA724	Internal position speed 7	0 ~ 5000	1 min-1	100	Immediately	
PA725	Internal position 0 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA726	Internal position 1 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA727	Internal position 2 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA728	Internal position 3 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA729	Internal position 4 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA730	Internal position 5 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA731	Internal position 6 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA732	Internal position 7 acceleration / deceleration time	0 ~ 500	ms	0	Immediately	
PA733	Internal position 0 stop time	0 ~ 65535	ms	100	Immediately	
PA734	Internal position 1 stop time	0 ~ 65535	ms	100	Immediately	
PA735	Internal position 2 stop time	0 ~ 65535	ms	100	Immediately	
PA736	Internal position 3 stop time	0 ~ 65535	ms	100	Immediately	
PA737	Internal position 4 stop time	0 ~ 65535	ms	100	Immediately	
PA738	Internal position 5 stop time	0 ~ 65535	ms	100	Immediately	

Parameter No.	Name	Setting scope	Unit	Factory setting	Effective time	Reference
PA739	Internal position 6 stop time	0 ~ 65535	ms	100	Immediately	
PA740	Internal position 7 stop time	0 ~ 65535	ms	100	Immediately	
PA741	Position demonstration high-level	-9999 ~ 9999	turn	0	Immediately	
PA742	Position demonstration low-level	-9999 ~ 9999	pulse	0	Immediately	
PA743	Reserved					
PA744	Reserved					
PA745	Reserved					