

## SERVO MOTOR

### SV-X3 SERIES INSTRUCTION MANUAL

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Thank you for purchasing the HCFA products.

This Instruction Manual provides instructions for advanced use of the SV-X3 series servo motors.

- Before use, read this manual and manuals of relevant products fully to acquire proficiency in handling and operating the product.
- Please read the safety precautions before using.
- Store this manual in a safe place so that you can take it out and read it whenever necessary.
- As for products under development, specifications are subject to change without notice.

## Preface

Incorrect operation and handling, couldn't have a full display of the various performance that designed, and may cause hazardous conditions and shorten the service life. Please operate the product correctly before you have read through the instruction manual correctly.

### 1. About the instruction manual

① We make an effort to perfect this instruction manual, but if you have found some mistakes or uncertain points, please contact HCFA at any time.

② Please note the following items on the instruction manual

- Danger exists as it's the high-voltage device.
- There are some residual voltage on the terminals or the units after power OFF and it is dangerous.
- High temperature locally
- Disassembling is prohibited.

③ The product specifications and functions may change and increase, as the product performance upgraded. They are subject to change without notice.

④ Plan to obtain the Certificate of safety specification for the product's device, please consult our sales representative.

⑤ To extend the service life of motor and drive, it is necessary to use it under the correct conditions. Please follow the instruction manual for details.

⑥ The latest information should be recorded in the instruction manual and manual will be updated accordingly. If you need the latest version, please contact the HCFA .

⑦ Without the approval of company, it is forbidden to reprint some or all of the instruction manual.

### 2. Confirm the following items before unpacking.

- Check if the products are the ones you ordered.
- Check if there are some damage to the products during transportation.
- Any questions, please contact the HCFA Corporation.

### 3. Safety precautions

Please pay attention to the flowing safety precautions anywhere and any time during acceptance inspection, installation, wiring, operation and maintenance.

 Indicates that incorrect handling may result in death or severe injury.

 Indicates that incorrect handling may result in medium or slight personal injury or physical damage.

 Indicates "Prohibitions"(Indicates what must not be done.)

 Indicates "Forced".(Indicates what must be done.)

		
<b>Installing and wiring</b>		
	Do not connect the motor to the commercial power.	To prevent fire or malfunction.
	Do not place the combustibles around the servo motor and drive.	To prevent fire.
	Be sure to protect the drives through the case, and leave specified clearances between the case or other equipment and the drive.	To prevent electric shock, fire or malfunction.
	Install it at the place free from excessive dust and dirt, water and oil mist	To prevent electric shock, fire , malfunction or damage
	Install the equipment to incombustibles, such as metal.	To prevent fire.
	Any person who is involved in wiring and inspection should be fully competent to do the work.	To prevent electric shock.
	FG terminal of motor and drive must be grounded.	To prevent electric shock.
	Perform the wiring correctly after cut off the breaker.	To prevent electric shock, injury, malfunction or damage
	Have the insulation processing when connecting cables.	To prevent electric shock, fire or malfunction.
<b>Operation and running</b>		
	During operation, never touch the internal parts of the drive.	To prevent burns or electric shock.
	The cables should not be damaged, stressed loaded, or pinched.	To prevent electric shock, malfunction or damage.
	During operation, never touch the rotating parts of the servo motor.	To prevent injury.
	Do not install the equipment under the conditions with water, corrosive and flammable gas.	To prevent fire.
	Do not use it at the location with great vibration and shock.	To prevent electric shock, injury or fire.
	Do not use the servo motor with its cable soaked in oil or water.	To prevent electric shock, malfunction or damage
	Operate the switches and wiring with dry hand.	To prevent electric shock, injury or fire.
	Do not touch the keyway directly when using the motor with shaft-end keyway	To prevent injury.
	Do not touch the motor and drive heat sink, as they are very hot.	To prevent burns or parts damaged.
Do not drive the motor by external drive.	To prevent fire.	
<b>Other safety instructions</b>		
	Confirm the equipment's safety after the earthquake happens.	To prevent electric shock, injury or fire.
	Installing and setting correctly to prevent the fire and personal injury when earthquake happens.	To prevent injury, electric shock, fire, malfunction or damage.
	Provide an external emergency stop circuit to ensure that operation can	To prevent injury, electric shock, fire,

	be stopped and power switched off immediately.	malfunction or damage.
	Before wiring or inspection, turn off the power and wait for 5 minutes or more.	To prevent electric shock.

 CAUTION		
<b>Installing and wiring</b>		
	Please follow the specified combination of the motor and drive.	To prevent fire or malfunction.
	Do not touch the terminals of connector directly.	To prevent electric shock or malfunction.
	Do not block intake and prevent the foreign matters from entering into the motor and drive.	To prevent electric shock or fire.
	Fix the motor and have the test run away from the mechanical system. After confirming the operation, the motor can be securely mounted to mechanical system.	To prevent injury.
	The servo motor must be installed in the specified direction.	To prevent injury or malfunction.
	Install the equipment correctly in accordance with its weight and rated output.	To prevent injury or malfunction.
<b>Operation and running</b>		
	Do not climb or stand on servo equipment. Do not put heavy objects on equipment.	To prevent electric shock, injury, fault or damage.
	The parameter settings must not be changed excessively. Operation will be instable.	To prevent injury.
	When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly (design the machine so that it is secured against hazard if restarted).	To prevent injury.
	Keep it away from the direct sunlight.	To prevent malfunction.
	Do not put strong impact on the motor, drive and motor shaft.	To prevent malfunction.
	The electromagnetic brake on the servo motor is designed to hold the servo motor shaft and should not be used for ordinary braking.	To prevent injury or malfunction.
	Do not install or operate a faulty servo motor or drive.	To prevent injury, electric shock or fire
	Check the power specification.	To prevent fault.
	The electromagnetic brake may not hold the servo motor shaft. To ensure safety, install a stopper on the machine side.	To prevent injury.
	A sudden restart is made if an alarm is reset with the run signal on.	To prevent injury.
	Connect the relay for emergency stop and for brake in series.	To prevent injury or malfunction.
<b>Transportation and storage</b>		
	Do not subject the equipment to the place with rain, waterdrop, poisonous gases or liquids.	To prevent malfunction.
	Do not carry the servo motor by the cables, shaft or encoder during transportation.	To prevent injury or malfunction.
	Do not drop or dump the motor during transportation and installation.	To prevent injury or malfunction.
	Store the unit in a place in accordance with the instruction manual.	To prevent malfunction.

Other safety instructions		
!	Please dispose the battery according to your local laws and regulations.	
	When disposing of the product, handle it as industrial waste.	
Maintenance and inspection		
⊘	Do not disassemble and/or repair the equipment on customer side.	To prevent malfunction.
	Do not turn on or switch off the main power frequently.	To prevent malfunction.
!	Do not touch the servo drive heat sink, regenerative resistor, servo motor etc. Their temperatures may be high while power is on or for some time after power-off.	To prevent burns or electric shock.
	When the drive become faulty, switch off the control circuit and main power.	To prevent fire.
	If the servo motor is to be stored for a long time, switch off the power.	To prevent mis-operation and injury.

### Warranty period

The term of warranty for the product is 18 months from the date of manufacture. It's exceptional to brake motors as they are warranted when acceleration / deceleration times is not beyond the specified service life.

### Warranty coverage

This warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are stated in the instruction manual and user manual for the Product.

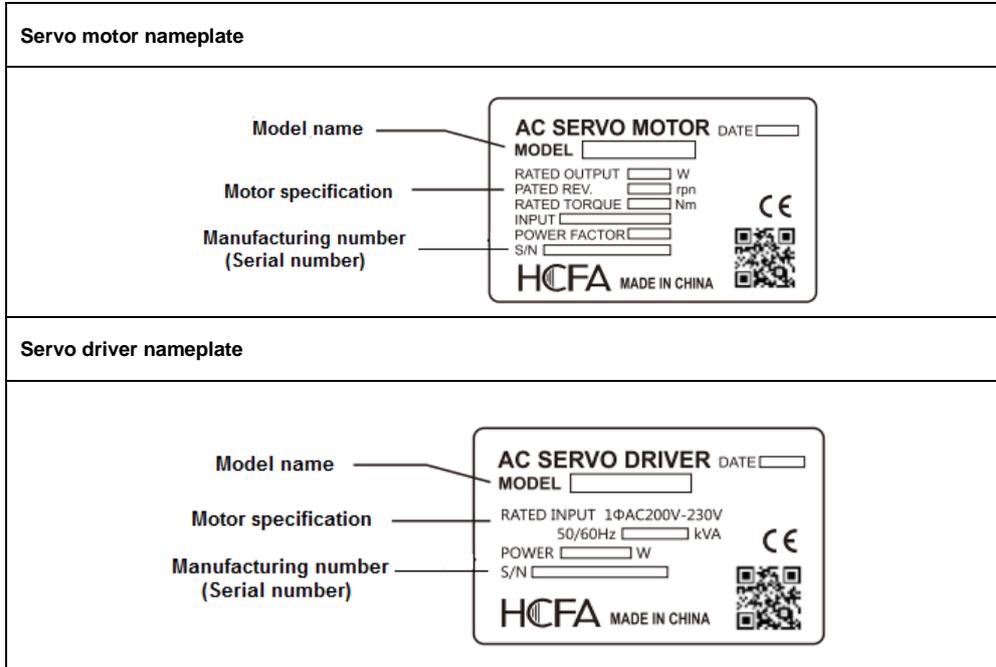
However, even during warranty period, the repair cost will be charged on customer in the following cases.

- 1) A failure caused by improper storing or handling, repair and modification.
- 2) A failure caused by the parts which have dropped down or damaged during transportation
- 3) A failure caused when the products have been used beyond the product specification
- 4) A failure caused by external factors such as inevitable accidents, including but not limited to fire, earthquake, lightning stroke, windstorm disaster, flood, salt damage, abnormal fluctuation of voltage and other natural disaster.
- 5) A failure caused by the intrusion of water, oil, metal and other foreign matters.

The warranty coverage is only for the product itself. We assume no responsibilities for any losses of opportunity and/or profit incurred by you due to a failure of the Product.

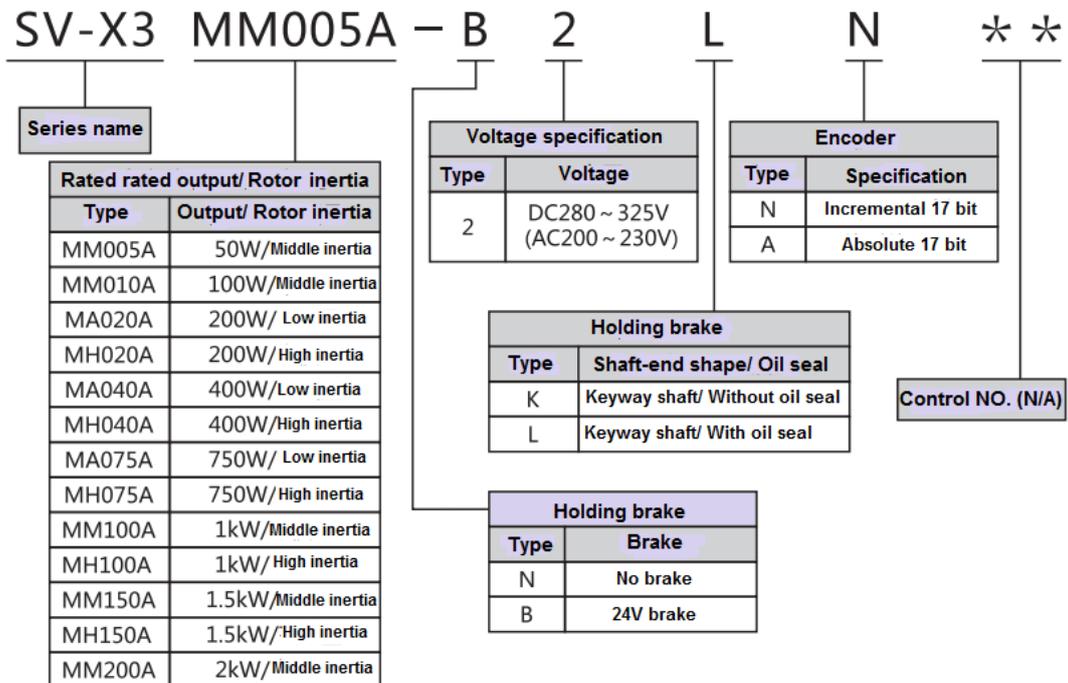
## 1. Product introduction and model selection

### 1.1 Introduction of nameplate and model name (For servo motor and drive)

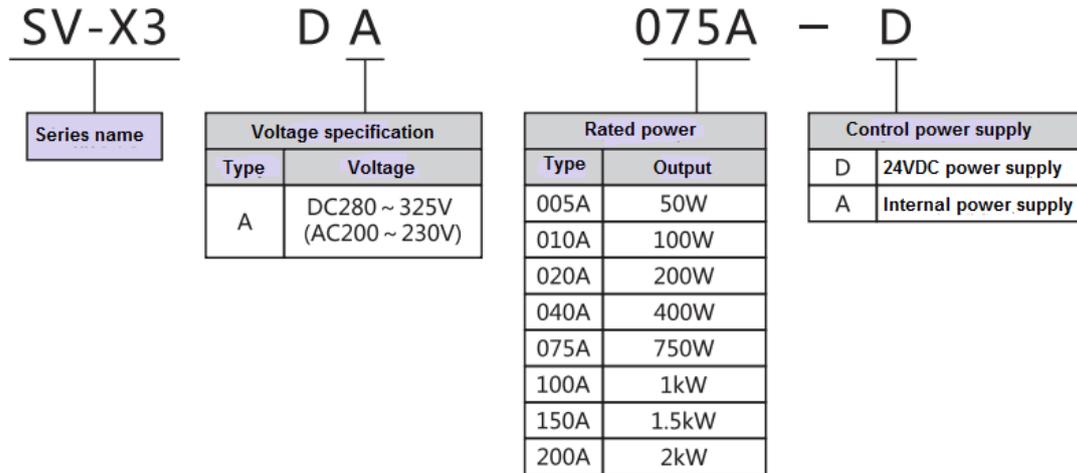


#### Model name

##### 1) Servo motor



## 2) Servo drive



### 1.2 Parts name of servo motor and drive

Figure 1.2.1 Parts name of servo motor

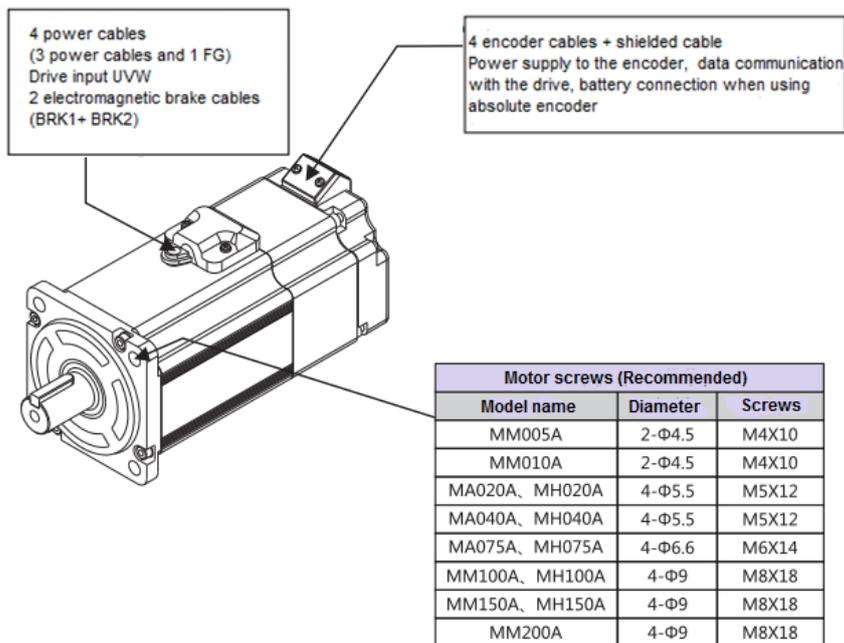
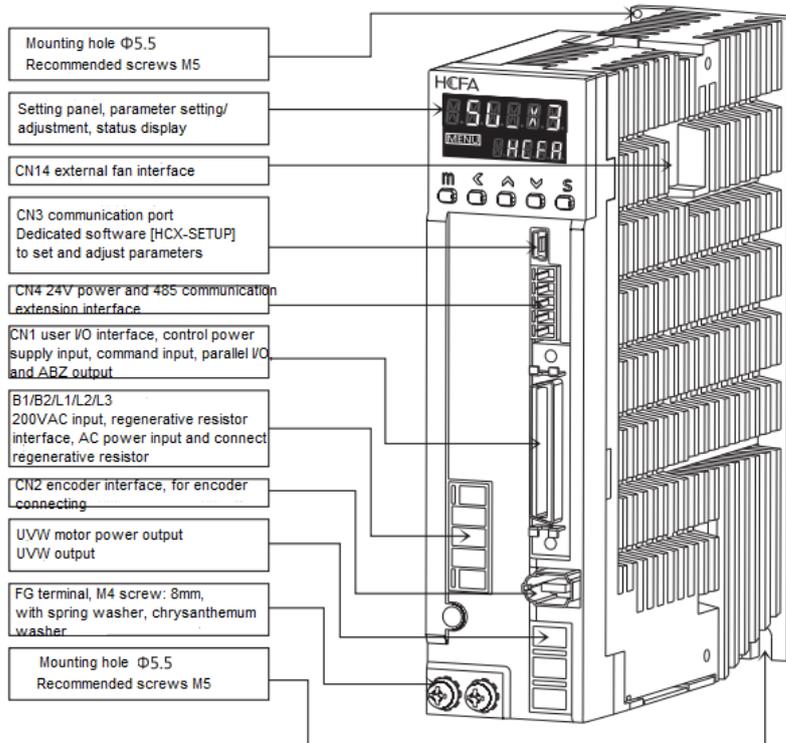


Figure 1.2.2 Parts name of servo drive



### 1.3 Model name of servo drive and motor

Capacity	Motor model SV-X3□□□□□-2**		Motor size (Flange installation size)	Drive model	Drive size
50W	Middle inertia	MM005A	40	SV-X3DA005A-D	Frame A
100W	Middle inertia	MM010A		SV-X3DA010A-D	
200W	Low inertia	MA020A	60	SV-X3DA020A-D	
	High inertia	MH020A			
400W	Low inertia	MA040A	80	SV-X3DA040A-D	
	High inertia	MH040A			
750W	Low inertia	MA075A	130	SV-X3DA075A-D	
	High inertia	MH075A			
1kW	Middle inertia	MM100A	130	SV-X3DA100A-A	Frame B
	High inertia	MH100A			
1.5kW	Middle inertia	MM150A	130	SV-X3DA150A-A	
	High inertia	MH150A			
2kW	Middle inertia	MM200A	130	SV-X3DA200A-A	

## 1.4 Model selection of peripheral braking resistor

<b>Rated output</b>	50W	100W	200W	400W	750W	1kW	1.5 kW	2 kW
<b>Resistance</b>	40~50 Ω	30 Ω	30 Ω	20 Ω				
<b>Allowable power</b>	20W	20W	20W	20W	20W	40W	40W	60W

The Status monitoring mode on the setting panel can be used to confirm whether a regenerative resistor is needed. Select 「St\_REG」 on the setting panel to display 「in00\_-」. When the display changes from 「in00\_-」 to 「in00\_A」, it means the regenerative resistor is needed. For details, refer to [5.4 Status display mode [Regenerative resistor]].

Starting from low speed operation (20% of the max. speed) to the desired operation and observing if the display value changes from 「in00\_-」 to 「in00\_A」. If 「in00\_A」 displays, a regenerative resistor is needed.

If the regenerative resistor is needed, refer to the installation of regenerative resistor. The use of regenerative resistor cannot necessarily guarantee the performance. When heating temperature is too high, please increase the resistance, or the permissible power.

## 1.5 Selection of cables and connector accessories for SV products

### ● For 750W or less

Items	Usage	Model name	Remark
1	Connector for drive and motor	Power connector X5CON-4P-M75A (for 750W or less)	
2	Cable for drive and motor	Power cable -X5CAB-PWR75A-0.5M	Length: 0.5m
		Power cable -X5CAB-PWR75A-1.5M	Length: 1.5m
		Power cable -X5CAB-PWR75A-3M	Length: 3m
		Power cable -X5CAB-PWR75A-5M	Length: 5m
		Power cable -X5CAB-PWR75A-10M	Length: 10m
3	Brake connector	X5CON-2P-BK (for 750W or less)	
4	Encoder cable terminal	SM-6P+172160-1 (for 750W or less)	
5	Encoder cable	-X5CAB-ENC75A-0.5M	Length: 0.5m
		-X5CAB-ENC75A-1.5M	Length: 1.5m
		-X5CAB-ENC75A-3M	Length: 3m
		-X5CAB-ENC75A-5M	Length: 5m
		-X5CAB-ENC75A-10M	Length: 10m
6	Encoder cable for absolute	-X5CAB-ENC75A-ABS-0.5M	Length: 0.5m
		-X5CAB-ENC75A-ABS-1.5M	Length: 1.5m
		-X5CAB-ENC75A-ABS-3M	Length: 3m
		-X5CAB-ENC75A-ABS-5M	Length: 5m
		-X5CAB-ENC75A-ABS-10M	Length: 10m

### ● 1KW or more

Items	Usage	Model name	Remark
-------	-------	------------	--------

1	Connector for drive and motor	Power connector X5CON-4P-M100A (for 1KW or more)	
2	Cable for drive and motor	Power cable -X5CAB-PWR100A-0.5M	Length: 0.5m
		Power cable -X5CAB-PWR100A-1.5M	Length: 1.5m
		Power cable -X5CAB-PWR100A-3M	Length: 3m
		Power cable -X5CAB-PWR100A-5M	Length:5m
		Power cable -X5CAB-PWR100A-10M	Length: 10m
3	Brake connector	SM10-AP2S-S-C (for 1KW or more)	
4	Encoder cable terminal	SM-6P+SM10-SP10S-M-C (for 1KW or more)	
5	Encoder cable	-X5CAB-ENC100A-0.5M	Length: 0.5m
		-X5CAB-ENC100A-1.5M	Length: 1.5m
		-X5CAB-ENC100A-3M	Length: 3m
		-X5CAB-ENC100A-5M	Length:5m
		-X5CAB-ENC100A-10M	Length: 10m
6	Encoder cable for absolute	-X5CAB-ENC100A-ABS-0.5M	Length: 0.5m
		-X5CAB-ENC100A-ABS-1.5M	Length: 1.5m
		-X5CAB-ENC100A-ABS-3M	Length: 3m
		-X5CAB-ENC100A-ABS-5M	Length:5m
		-X5CAB-ENC100A-ABS-10M	Length: 10m
7	50P pulse connector	Pulse connector X5CON-50P	

## 2. Installation and size of servo motor and drive

### 2.1 Installation environment conditions

About the environmental conditions, make sure to follow the company's instructions. If you need to use the product outside the scope of the environmental conditions, please consult HCFA Corporation in advance.

- ① Keep it away from the direct sunlight.
- ② Drive must be installed in the cabinet.
- ③ Keep it away from the water, oil (cutting oil, oil mist) and moisture.
- ④ Do not install the equipment under the conditions with water, corrosive and flammable gas.
- ⑤ Free from the dust, iron powder, cutting powder and so on.
- ⑥ Keep it away from the area with high temperature, excessive vibration and shock.

### 2.2 Dustproof and waterproof

The servo drive is non-waterproof structure. Protection level of motor (excluding the connector) is IP65 according to IEC 34-5(International Electrotechnical Commission).

### 2.3 Installation method and space

#### Impact & load

- ① The impact that the motor can stand should be less than 200m/s<sup>2</sup> (20G) . Don't apply excessive impact load to the motor

during transporting, installing and disassembling. And do not hold encoder, cable and connector to transport the motor.

②The pull claw device must be used when removing the belt pulley and coupler from the motor

#### Combination with mechanical system

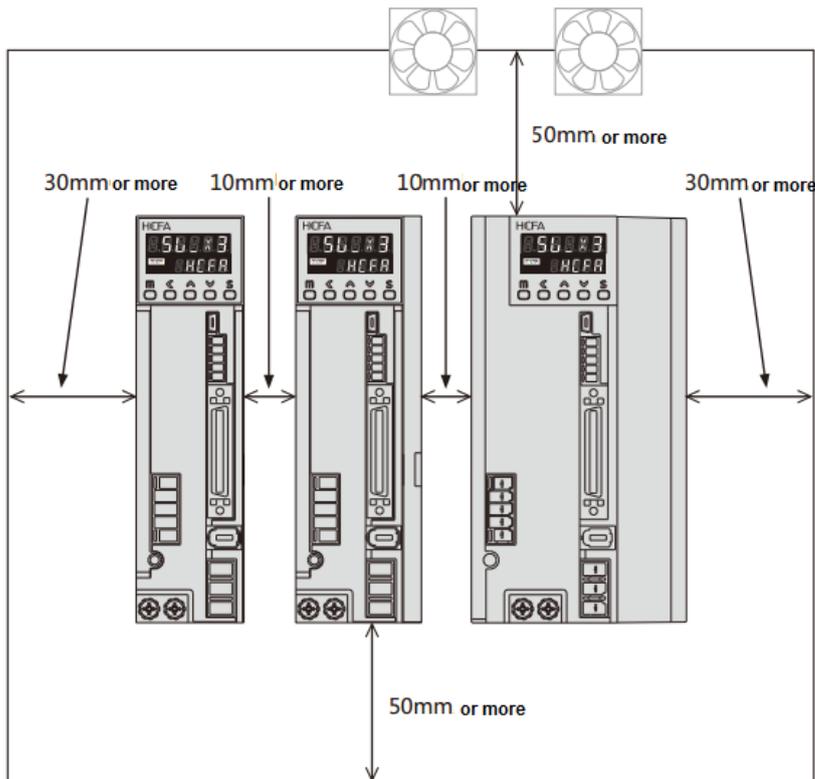
①The motor specification in the user manual has specified the permissible load to the motor shaft. Exceeding the permissible load will shorten the shaft life and cause damage to the shaft. Please use coupling which could fully absorb eccentric load.

②The stress on the encoder cable should be less than 6kgf during assembling.

③The bending radius of power cable and encoder cable should be R20mm and more.

#### Installation direction and clearance of drives

Leave sufficient space around the drive to ensure the heat dissipation and convection in the cabinet when installing the drive.



- Install the drives in the vertical direction. Please use two M5 screws to fix the drive, master drive and slave drive respectively which is less than 800W. Please use three M5 screws to fix the drive and master drive respectively which is more than 1kW.

- In order to ensure that surrounding temperature between internal boards is not more than 55°C, cooling fan or cooler need to be installed to reduce the temperature, when the drives are installed in the sealed cabinet.

- The temperature on the surface of cooling plate would be 30°C higher than the surrounding temperature.

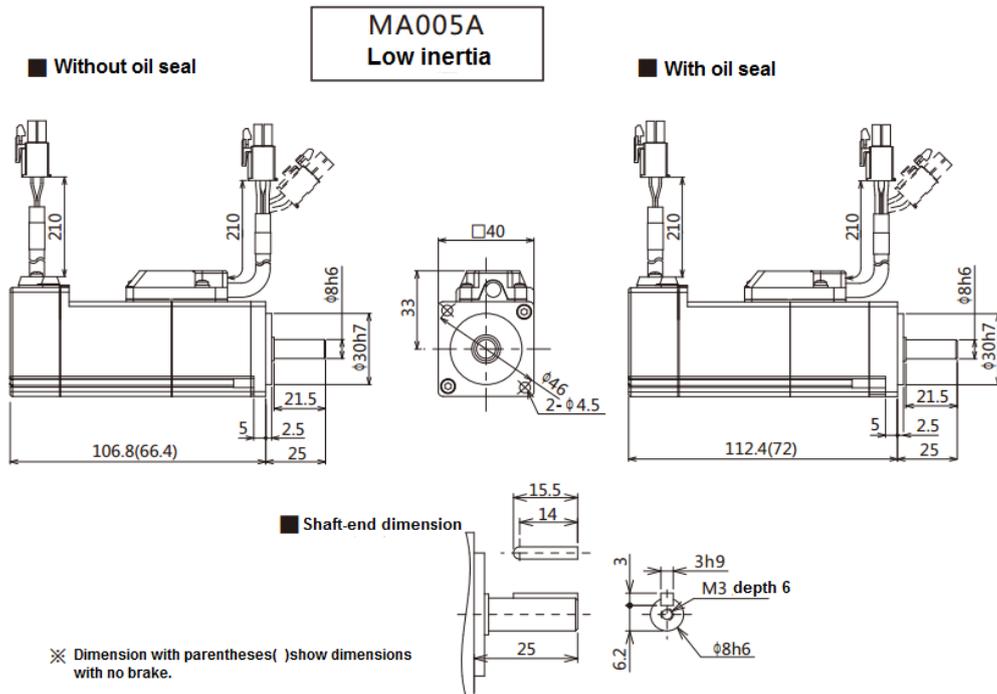
- Use heat-resistant material for the wiring and isolate wiring from the machine and other cables which are easily affected by the temperature.

- The service life of servo drive depends on the temperature around the electrolytic capacitor. When the electrolytic capacitor is close to the service life, the static capacity will decrease and internal resistance will increase. Consequently, it will lead to overvoltage alarm, malfunction caused by noise and components damage. The service life of electrolytic capacitor is approx. 5 to 6 years under the condition [average annual temperature 30°C, load rate 80% and operation of less than 20 hours a day on average]

## Additional instructions

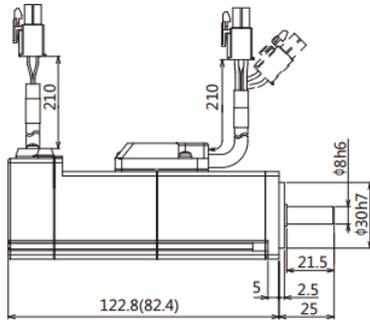
- ① The motor shaft is covered with anti-rust oil before leaving factory. Please have the antirust treatment again to the shaft to prevent it from rust when installing load.
  - ② Never disassemble the encoder or motor.
  - ③ The GND of 24VDC input and the grounding cable of device can be connected to each other.
- ※ Please use the same power supply for control voltage(24V and GND) and upper control device.
- ④ Do not remove or maintain the encoder battery until the main power supply is switched OFF.
  - ⑤ After switching off the main power supply, please note that there is residual voltage of approx. 30 seconds on the power components.
  - ⑥ Do not replace the fuse.
  - ⑦ The servo drives of more than 750W are installed with a cooling fan on the right side. Do not touch or block the ventilation ports of servo drive

## 2.4 Dimensions of servo motor

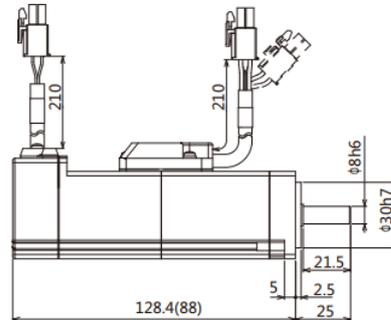


## MA010A Low inertia

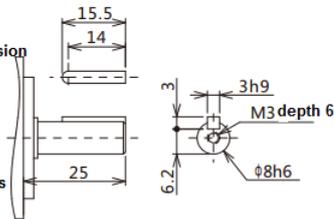
■ Without oil seal



■ With oil seal

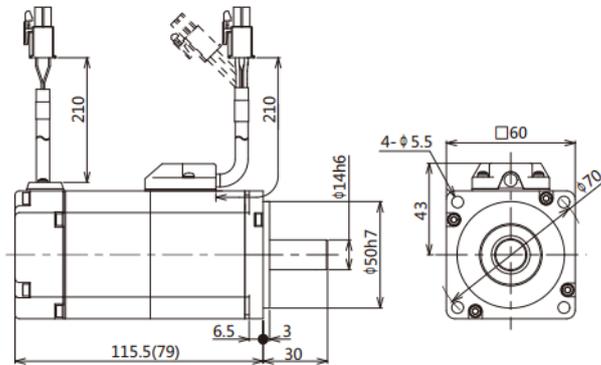


■ Shaft-end dimension

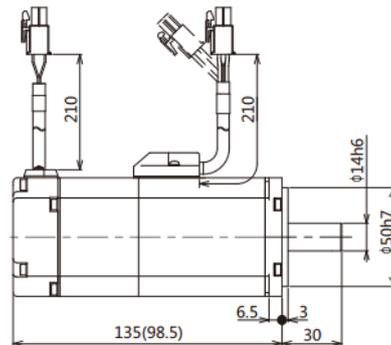


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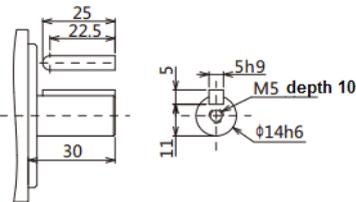
## MA020A Low inertia



## MH020A High inertia



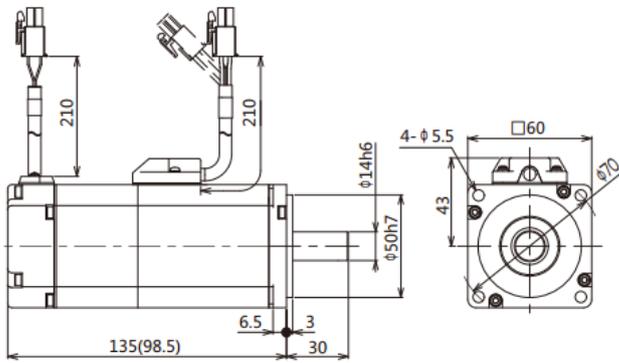
■ Shaft-end dimension



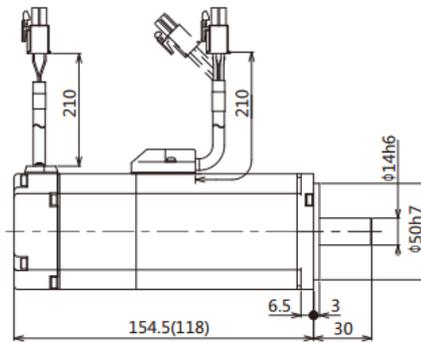
※ For the specification of  $\phi 11$ , please consult HCFA distributor.

※Dimension with parentheses ( ) show dimensions with no brake.

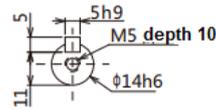
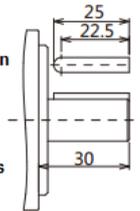
**MA040A**  
Low inertia



**MH040A**  
High inertia

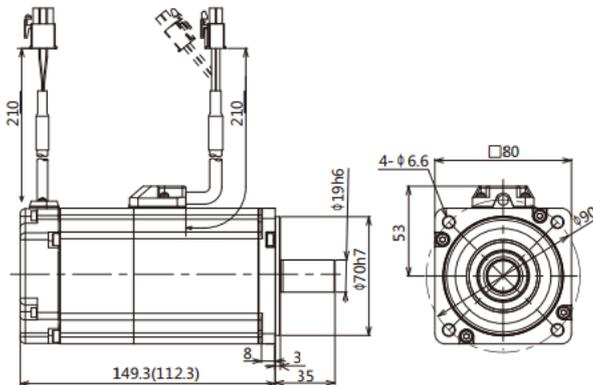


■ Shaft-end dimension

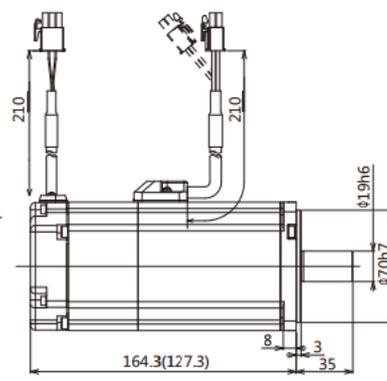


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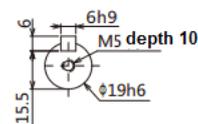
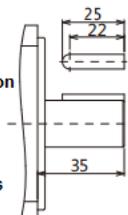
**MA075A**  
Low inertia



**MH075A**  
High inertia

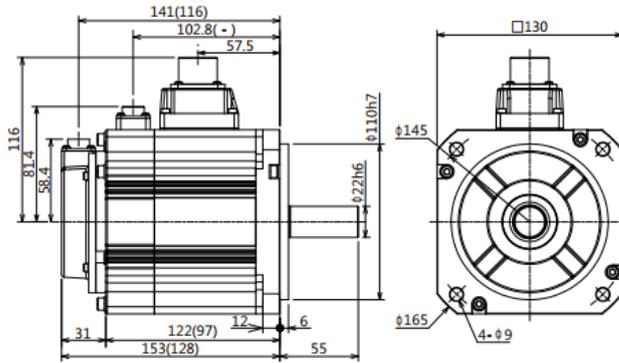


■ Shaft-end dimension

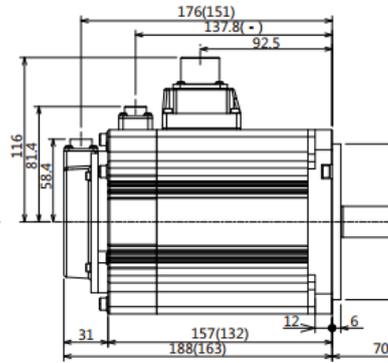


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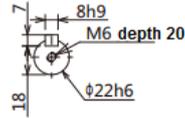
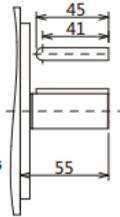
**MM100A**  
Middle inertia



**MH100A**  
High inertia

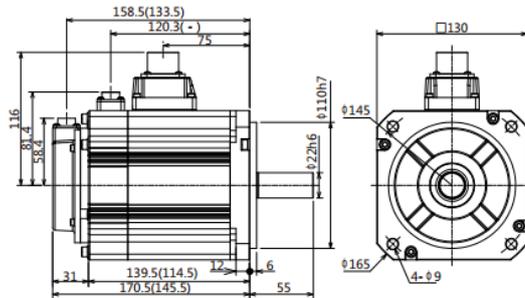


■ Shaft-end dimension

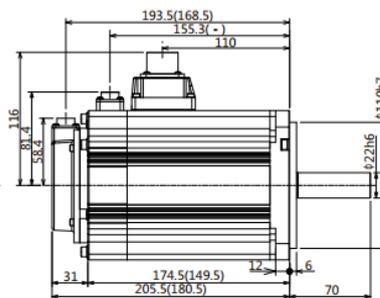


※Dimension with parentheses ( ) show dimensions with no brake.

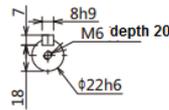
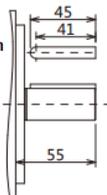
**MM150A**  
Middle inertia



**MH150A**  
High inertia

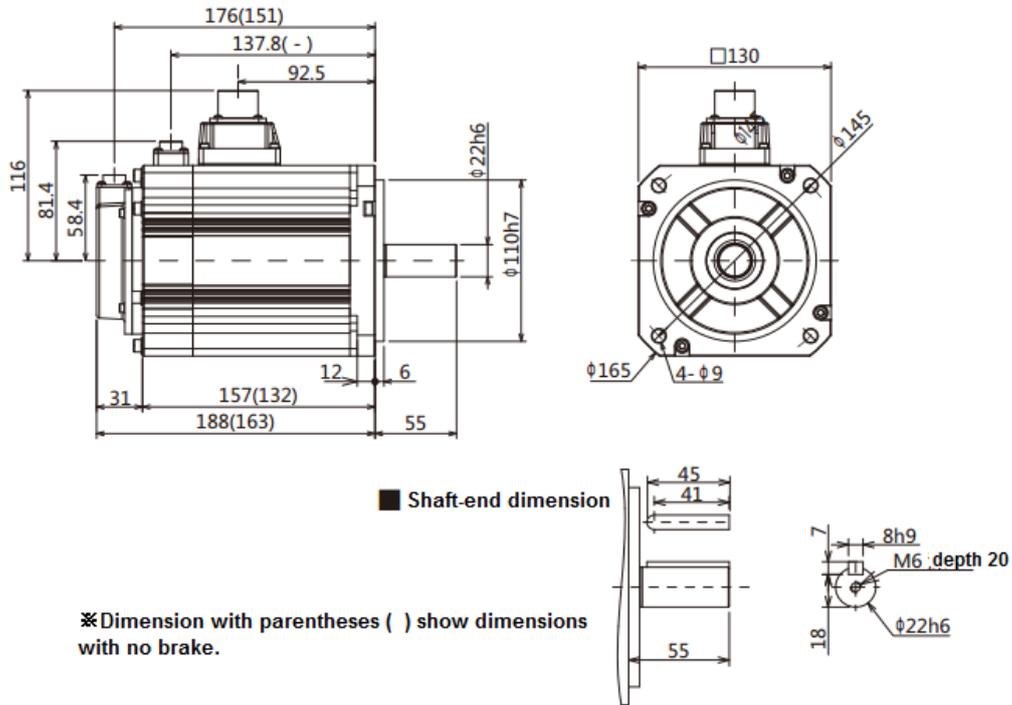


■ Shaft-end dimension



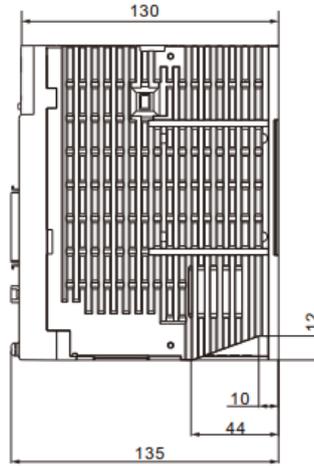
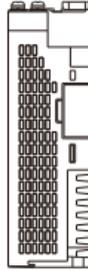
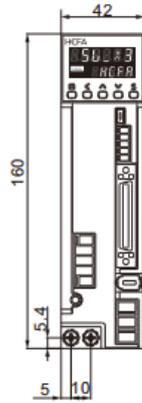
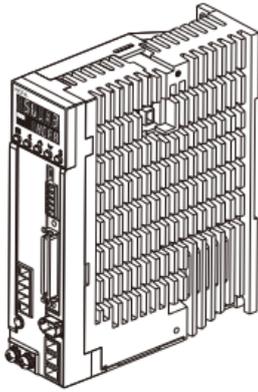
※Dimension with parentheses ( ) show dimensions with no brake

**MM200A**  
**Middle inertia**

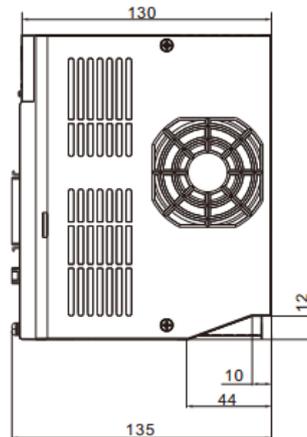
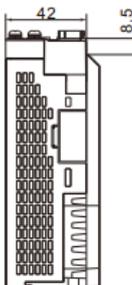
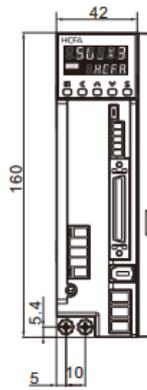
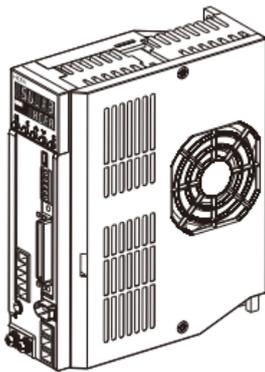


## 2.5 Dimensions of servo drive

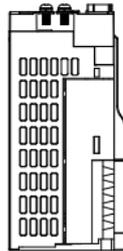
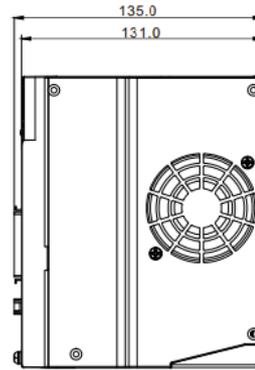
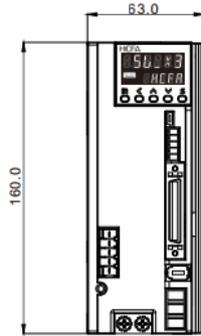
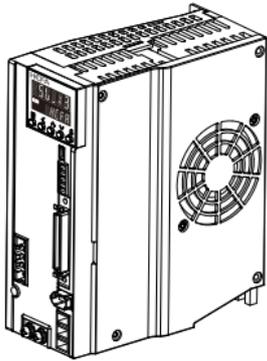
**Drive 200W or less**



**Drive 400W / 750W**

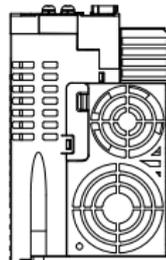
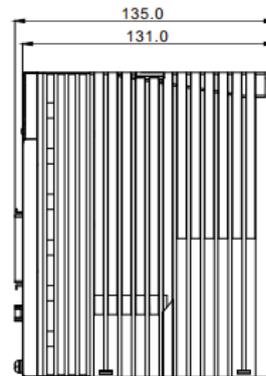
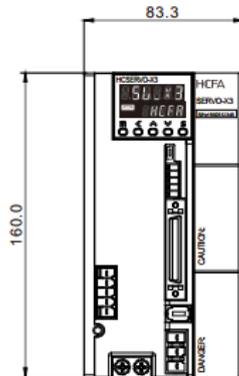
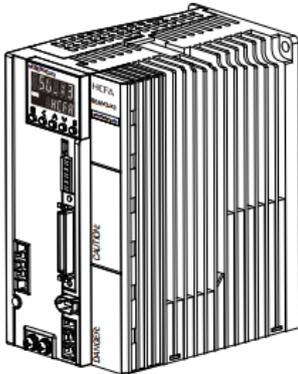


**Drive 1000W**



[In development]

**Drive 1500W or more**

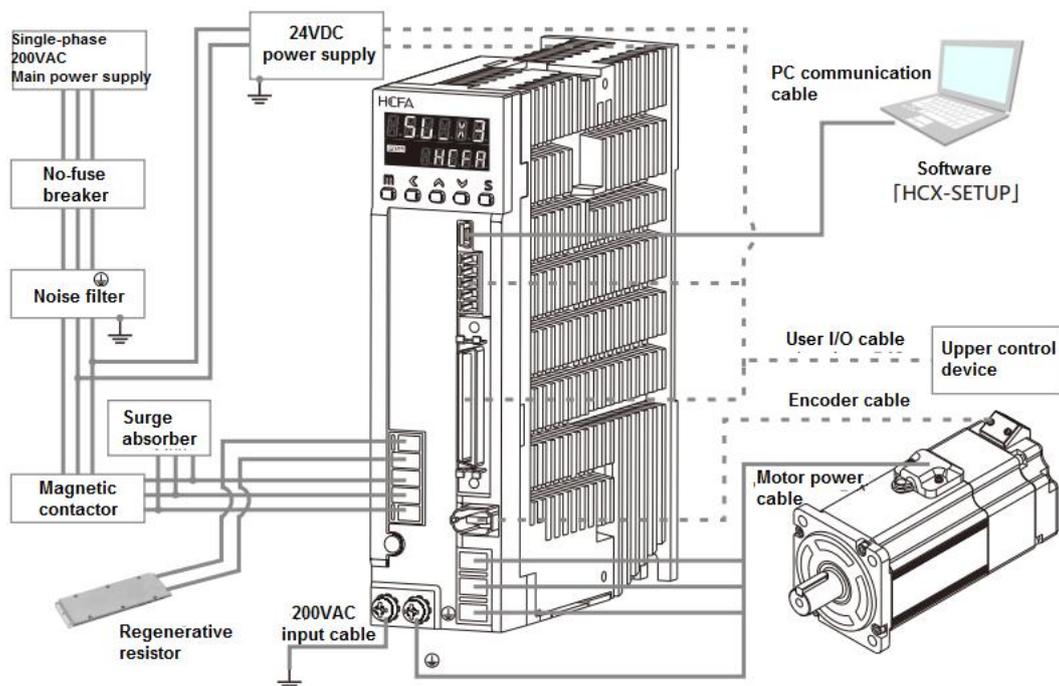


[In development]

## 3. Wiring explanation for servo motor and drive

### 3.1 Wiring diagram

#### 3.1.1 Wiring diagram



#### [Points for correct wiring]

- ※ 24VDC and 200VAC input (main circuit) power supply should be wired from the same 200VAC main power supply.
- ※ Do not access switch between 24VDC power supply and drive. If you need switch, put it on the 200VAC cable of 24VDC input power supply.
- ※ A twisted-pair shielded cable should be used when I/O cable length is over 50cm.
- ※ The encoder cable should be less than 20m.



- ① Please note that there is high voltage in the solid line of wiring diagram when wiring and using.
- ② The broken lines in the wiring diagram indicates the non-dangerous voltage circuit.

#### 3.1.2 Connection of servo drive and motor

Items	Description
Peripheral device	Conform to European EC Directive. Select the device which meets corresponding standards and install them in accordance with User's Manual.
Installation environment	Install the servo drive to the environment which conform to Pollution degree 2 or 1 of IEC60664-1.
Power supply 1: 200~230VAC (main circuit)	This product can be used under the conditions that conform to IEC60664-1 and overvoltage category II.
Power supply 2: 24VDC	The specification of 24VDC external power supply should satisfy the following conditions.

<ul style="list-style-type: none"> <li>◆ control power supply of drive</li> <li>◆ I/O power supply</li> <li>◆ Power supply for brake release</li> </ul>	<p>Using SELV power supply(※) and power less than 150W. This is the CE corresponding conditions.</p> <p>※SELV: safety extra low voltage (Reinforced insulation is needed for safety extra low voltage, non-dangerous voltage and dangerous voltage.)</p>
Wiring	Please use withstand voltage cables which are equivalent to AWG18/600V or AWG14/600V for motor power cable, encoder cable, AC220 input cable, FG cable and main circuit power distribution cable under multi-axis drive structure respectively when drives are less than 750W or more than 1kW .
Breaker	<p>Switch off the power supply to protect power cord when overcurrent occurs.</p> <p>Make sure to use the breaker between power supply and interference filter that conforms to IEC specification and UL recognition in accordance with the User manual.</p> <p>Please use the breaker with leakage function recommended by HCFA in order to meet EMC standards.</p>
Noise filter	<p>To prevent the outside interference from power cables.</p> <p>Please use the interference filter recommended by HCFA in order to meet EMC standards.</p>
Magnetic contactor	Switch main power supply (ON/OFF). And use it after installing a surge absorber.
Surge absorber	Please use the surge absorber recommended by HCFA in order to meet EMC standards.
Interference filter for signal cable / ferrite filter	Please use the interference filter recommended by HCFA in order to meet EMC standards.
Regenerative resistor	<p>This product is not equipped with regenerative resistor.</p> <p>The external regenerative resistor is necessary when the internal capacitor cannot absorb more regenerative power. Confirm the regenerative status on the panel. When the regenerative voltage alarm is ON, a regenerative resistor is needed.</p> <p>For the reference specification of regenerative resistor, please refer to user manual.</p> <p>Use a built-in thermostat and set overheat protect circuit.</p>
Grounding	<p>This product belongs to Class 1 and need grounding protection.</p> <p>Using protection grounding terminal. Grounding should be executed by the case and cabinet that conforms to EMC.</p> <p>The following symbol indicates the protection grounding terminal.</p> 

### 3.2 Drive connector and pins arrangement

#### 3.2.1 Drive connector terminal

Figure 3.2.1 Drive connector terminal

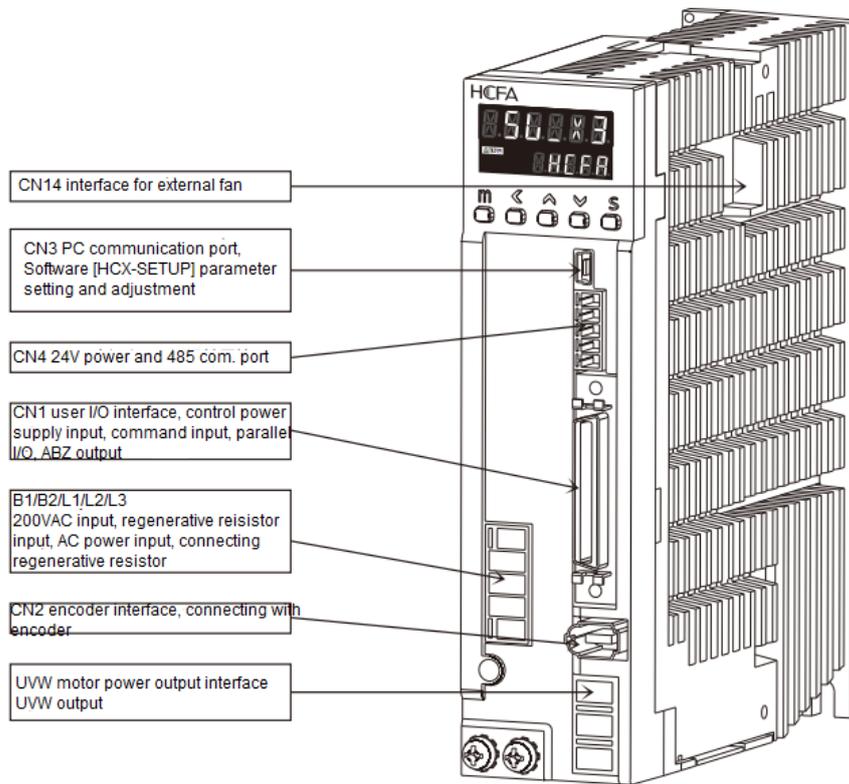


Table 3.2.1 Terminal arrangement of drive connector/ 750W or less

Name	Symbol	Pin No.	Signal name	Contents
Regenerative resistance connection	B1/B2/L1/L2	1	B1	P interface of regenerative resistor
		2	B2	N interface of regenerative resistor
Single-phase 200VAC input		4	Primary-power 1	L
		5	Primary power 2	N
Motor power output	U/V/W	1	U	Motor power U phase output
		2	V	Motor power V phase output
		3	W	Motor power W phase output
Encoder	CN2	1	VCC	Encoder power supply 5V output
		2	GND	Signal grounding
		3	NC	-
		4	NC	-
		5	+D	Encoder signal: data input/output
		6	-D	Encoder signal: data input/output
		-	FG	Connect SHIELD to the connector housing
PC communication	CN3	1	VBUS	USB power supply
		2	D-	USB data-
		3	D+	USB data+
		4	NC	-
		5	GND	USB signal grounding

24V power supply and communication	CN4	1	24V	Drive control power supply 24V input
		2	G24	Drive control power supply GND input
		3	485	485 signal from upper control device Multi-station communication
		4	/485	/485 signal from upper control device Multi-station communication
		5	SG	Communication signal grounding
External fan	CN14	1	24V	24V for external fan
		2	G24	GND for external fan
		3	NC	-
User I/O	CN1	Refer to "Operation"		

Table 3.2.2 Terminal arrangement of drive connector/ 1kW or more

Name	Symbol	Pin No.	Signal name	Contents
Regenerative resistance connection	B1/B2/L1 /L2/L3	1	B1	P interface of regenerative resistor
		2	B2	N interface of regenerative resistor
Three-phase 200VAC input		3	Primary-power 1	L1
		4	Primary-power 2	L2
		5	Primary-power 3	L3 (Do not connect it when single-phase used)
Motor power output	U/V/W	1	U	Motor power U phase output
		2	V	Motor power V phase output
		3	W	Motor power W phase output
Encoder	CN2	1	VCC	Encoder power supply 5V output
		2	GND	Signal grounding
		3	NC	-
		4	NC	-
		5	+D	Encoder signal: data input/output
		6	-D	Encoder signal: data input/output
		-	FG	Connect SHIELD to the connector housing
PC communication	CN3	1	VBUS	USB power supply
		2	D-	USB data-
		3	D+	USB data+
		4	NC	-
		5	GND	USB signal grounding
24V power supply and communication	CN4	1	24V	Drive control power supply 24V input
		2	G24	Drive control power supply GND input
		3	485	485 signal from upper control device Multi-station communication
		4	/485	/485 signal from upper control device Multi-station communication
		5	SG	Communication signal grounding
User I/O	CN1	Refer to "Chapter 5 Operation"		

### 3.3 Terminal arrangement and wiring color of motor connector

#### 3.3.1 Motor connector and pins arrangement (750W or less)

Figure: 3.3.1 Motor connector and pins arrangement

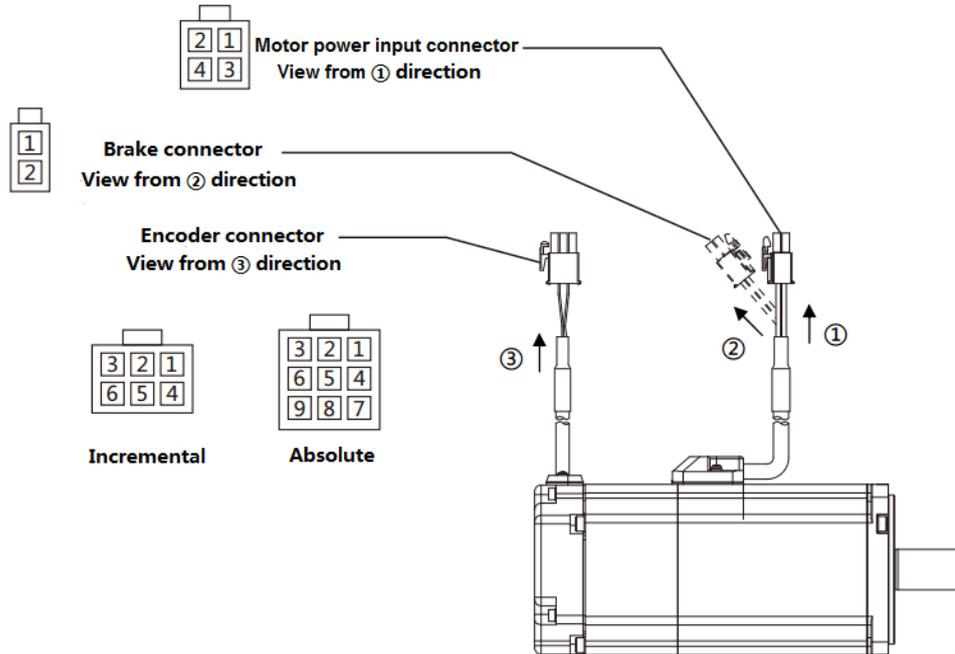


Table 3.3.1 Cable list (For motor of 750W or less)

Name	Cable
Motor power input	AWG18
Brake <sup>note 1</sup>	AWG22
Encoder (Incremental)	Power supply: AWG22 Signal: AWG24
Encoder (Absolute)	Power supply: AWG22 Signal: AWG24

Note 1 For the motor with brake

Table 3.3.2 For the motor of 750W or less

Name	Pin No.	Signal name	Contents	Wiring color
Motor power input	1	U	Motor power U phase	Red
	2	V	Motor power V phase	White
	3	W	Motor power W phase	Black
	4	FG	Motor housing grounding	Green
Brake (※ 1)	1	BRK+	Brake power supply 24VDC	Yellow
	2	BRK-	Brake power supply GND	Blue
Encoder(incr emental)	1	-	NC	-
	2	+D	Serial communication data + data	White (red point)
	3	-D	Serial communication data - data	White (black point)
	4	VCC	Encoder power supply 5V	Orange (red point)

	5	GND	Signal ground	Orange (black point)
	6	SHIELD	Shielded wires	Black
Encoder(Absolute)	1	BAT	External battery (※ 2)	Yellow (black point)
	2	CAP	External capacitor(※ 2)	Yellow (red point)
	3	SHIELD	Shielded wires	Black
	4	+D	Serial communication data + data	White (red point)
	5	-D	Serial communication data - data	White (black point)
	6	IC	Internal connection(※ 3)	Grey (red point)
	7	VCC	Encoder power supply 5V output	Orange (red point)
	8	GND	Signal grounding	Orange (black point)
	9	IC	Internal connection (※ 3)	Grey (black point)

※1 For motor with brake.

※2 External capacitor and battery are taking GND as the reference potential.

※3 Internal connection (IC) has been connected internally. Do not connect it with any other wires.

### 3.3.2 Motor connector and pins arrangement (1kW or more)

Figure 3.3.2 Motor connector and pins arrangement (1kW or more)

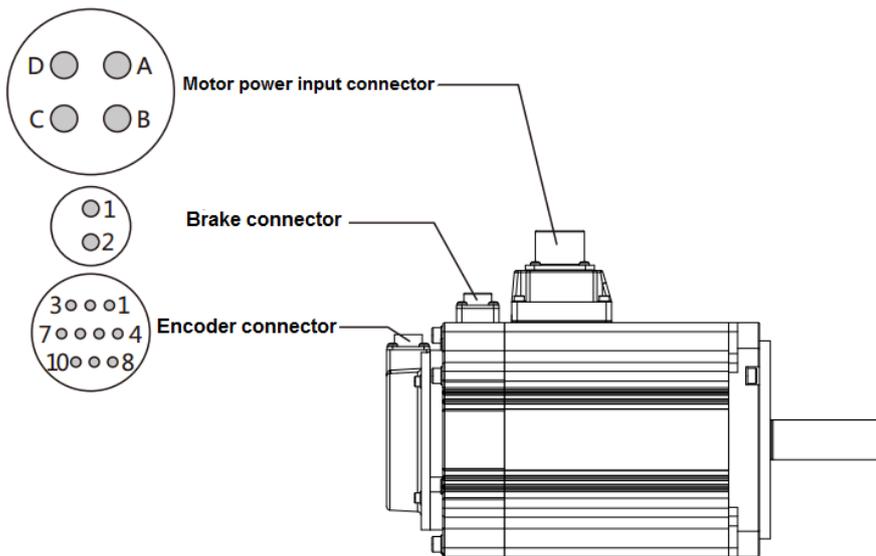


Table 3.3.3 Cable list ( for motor of 1kW or more)

Name	Cable
Motor power input	AWG14
Brake <sup>note 1</sup>	AWG18
Encoder (Incremental)	Power supply: AWG22 Signal: AWG24

Note 1 For the motor with brake

Table 3.3.4 For the motor of 1kW or more

Name	Pin No.	Signal name	Contents	Remark
Motor power input	A	U	Motor power U phase	
	B	V	Motor power V phase	

	C	W	Motor power W phase	
	D	FG	Motor housing grounding	
Brake (※ 1)	1	BRK1	Brake power supply 24VDC	
	2	BRK2	Brake power supply GND	
Encoder(incr emental)	1	VCC	Encoder power supply 5V output	
	2	GND	Signal ground	
	3	-	NC	
	4	-	NC	
	5	+D	Serial communication data + data	
	6	-D	Serial communication data - data	
	7	-	NC	
	8	-	NC	
	9	-	NC	
	10	SHIELD	Shielded wires	
Encoder(Abs olute)	1	VCC	Encoder power supply 5V output	
	2	GND	Signal ground	
	3	CAP	External capacitor (※2)	
	4	BAT	External battery (※2)	
	5	+D	Serial communication data + data	
	6	-D	Serial communication data - data	
	7	IC	Internal connection (※ 3)	
	8	IC	Internal connection (※ 3)	
	9	GND	Signal ground	
	10	-	NC	

※1 For motor with brake.

※2 External capacitor and battery are taking GND as the reference potential.

※3 Internal connection (IC) has been connected internally. Do not connect it with any other wires.

## 4. Parameter Description

### Parameter list

This section gives a detailed description of the displayed parameters on the panel.

The column of 「No.」 is the parameter number. Two numbers separated by “/” are the numerator and denominator number of parameters. Take 034.0/036.0 as the example, 034.0 is the numerator number and 036.0 is the denominator number. [Basic setting] in Parameter list are the initial setting values determined by the device. [Adjustment] indicates gain and other parameters that need to be adjusted to get the expected operation. [Special setting] indicates the parameters set according to the actual needs. The parameters with 「r」 displayed on the right side of parameter number, are the ones that need to restart the drive control power supply after saving. 「Yes」 will be displayed in the parameters of 「Whether to restart 24VDC power supply」. After saving the parameters in 「Parameter saving mode」, 「Whether to restart 24VDC power supply」 will be displayed for the parameters which are valid after restarting 24VDC power supply. For the models of 750W or less, the control

power is supplied from external 24VDC. For the models of 1kW or more, the control power is supplied from internal power and please cut off 220V power of main circuit if restart needed.

<Notice>

Each parameter has its setting range, but it also depends on the setting value of other parameter. There are some parameters unable to set, even though they are in the setting range. The following is the interdependent parameter number.

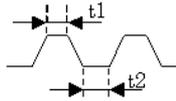
- No.102.0 Inertia ratio
- No.103.0 Damping ratio
- No.104.0 Conversion ratio of inertia ratio
- No.115.0 Control gain 1 (Position control mode)
- No.116.0 Control gain 2 (Position control mode)
- No.117.0 Gain FF compensation 1 (Position control mode)
- No.118.0 Gain FF compensation 2 (Position control mode)
- No.119.0 Integral gain (Position control mode)
- No.131.0 Control gain 1 (Speed control mode)
- No.132.0 Gain FF compensation 1 (Speed control mode)
- No.133.0 Integral gain (Speed control mode)

Table 4.1.1 Parameter list

No	Parameter	Contents	Whether to restart control power supply
002.0	[Basic setting] Control mode	Control mode selection. Note) Do not change when servo is ON. 0= Position control mode 1= Speed control mode 2= Torque control mode [Initial value] 0 (Position control mode) [Setting range] 0 to 2	Yes
003.0	[Basic setting] Command mode selection	Command mode selection 0= Zero command (select in position control/ speed control mode) 1= Pulse command (Used in position control) 2= Analog command (Used in speed control) 3= Internal generation command (Used in speed control) [Initial value] 1 (Pulse train command ) [Setting range] 0 to 3	Yes
004.0	[Basic setting] Communication address	Set the communication address of servo drive. Set to "1" when not using RS-485 multi-station communication. If using multi-station communication, refer to 「RS-485 communication wiring」. Setting different values for each axis.	Yes

		[Initial value] 1 [Setting range] 1 to 32	
008.0	[Basic setting] Selection of host communication mode	Select host communication mode. 0= Disable 1= RS-485 asynchronous serial communication When connecting RS-485 signal cable and using RS-485 asynchronous serial communication, select to "1". If not, select to "0". If the USB is irrelevant to this setting, it can communicate anytime. [Initial value] 0 (Disable) [Setting range] 0 or 1	No
009.0	[Basic setting] Operation mode selection	Select the operation mode. 0=I/O 1=Communication When select "1", the signal assigned to the input port of parallel I/O can be operated by HCX-SETUP. Then, the input of parallel I/O will become invalid. When select "0", the input of parallel I/O will become valid. At this time, the signal assigned to the input port of parallel I/O cannot be operated by HCX-SETUP. [Initial value] 0(I/O) [Setting range] 0 or 1	No
011.0	[Basic setting] RS485 communication minimum response time	Set the minimum response time for RS485 communication The response time of drive can be adjusted according to the minimum response time. For details, refer to [Communication time] of [Communication interface]. [Initial value] 3 [Setting range] 0 to 255	Yes
032.0	[Basic setting] Pulse train command input mode	Select pulse signal type of pulse command input. 0= Pulse and direction: using pulse and direction input 1= Orthogonal phase difference: using orthogonal phase pulse (A-phase/B-phase) input 2= CCW/CW: using positive pulse and negative pulse [Initial value] 0 (Pulse/direction) [Setting range] 0 to 2	Yes
032.1	[Basic setting] Pulse train command Rotation direction	Select rotation direction of pulse command input 0: CCW Negative direction 1: CW Positive direction [Initial value] 1 (CW Positive direction) [Setting range] 0 or 1	Yes
032.2	[Basic setting] With(out) use of automatic command interpolation for division/multiplication	When setting command division/ multiplication, the command will be processed by smoothing interpolation automatically. 0= Disable 1= Enable [Initial setting] 1 (Enable)	Yes



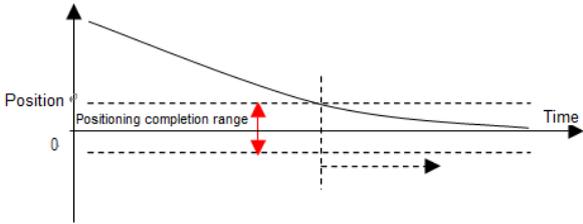
		[Setting range] 0 or 1				
032.3	[Basic setting] Selection of Pulse train input logic	Select the logic for pulse train input. 0= Positive logic : Up counting from Low to High 1= Negative logic: Downing counting from High to Low [Initial setting] 0 (Positive logic) [Setting range] 0 or 1	Yes			
033.0	[Basic setting] Pulse command input filter selection	The function of input filter is to reduce the fault caused by noise. Select the pulse width of passing pulse command input. 0= No filter 1= Pulse width 25ns 2= Pulse width 50ns 3= Pulse width 100ns 4= Pulse width 150ns 5= Pulse width 200ns 6= Pulse width 300ns 7= Pulse width 400ns 8= Pulse width 600ns 9= Pulse width 800ns 10= Pulse width 1000ns 11= Pulse width 1200ns 12= Pulse width 1600ns 13= Pulse width 2000ns 14= Pulse width 2300ns 15= Pulse width 3100ns  When the input frequency is high, please set the small passing pulse width. To improve interference immunity, please set the large passing pulse width. [Initial setting] 4 (Passing pulse width is 150ns or less) [Setting range] 0 to 15	Yes			
034.0	[Basic setting] Division/ multiplication (Numerator / Denominator )	Set the parameters of position command pulse division/ multiplication. When the number of upper command pulse and motor pulse per revolution is different, calculate in terms of [(Numerator) / (Denominator)]= (Number of pulse per servo motor revolution) / (Number of host command pulse per revolution) [Setting example] The number of pulse per motor revolution is 131072[pulse/rev]. Numerator can be set 32768 by a quarter of 131072. Denominator can be set by a quarter of the number of upper command per revolution. The corresponding parameter setting of the number of upper command pulse per revolution is as follows.	Yes			
036.0		<table border="1"> <tr> <td>Number of host</td> <td>Command division/</td> <td>Command division/</td> </tr> </table>	Number of host	Command division/	Command division/	
Number of host	Command division/	Command division/				

		<table border="1"> <thead> <tr> <th>command per revolution</th> <th>multiplication (Numerator)</th> <th>multiplication (Denominator)</th> </tr> </thead> <tbody> <tr> <td>131072</td> <td>1000(Initial value)</td> <td>1000(Initial value)</td> </tr> <tr> <td>16384</td> <td>32768</td> <td>4096</td> </tr> <tr> <td>10000</td> <td>32768</td> <td>2500</td> </tr> <tr> <td>4096</td> <td>32768</td> <td>1024</td> </tr> <tr> <td>4000</td> <td>32768</td> <td>1000</td> </tr> </tbody> </table> <p>[Initial value] (Numerator / Denominator ) =1000/1000            [Setting range] (Numerator) 1 to 65535, (Denominator) 1 to 65535.            Setting range of Division/ multiplication ratio is from 0.001 to 1000.Normal operation is not guaranteed while division/ multiplication ratio is beyond setting range.</p>	command per revolution	multiplication (Numerator)	multiplication (Denominator)	131072	1000(Initial value)	1000(Initial value)	16384	32768	4096	10000	32768	2500	4096	32768	1024	4000	32768	1000	
command per revolution	multiplication (Numerator)	multiplication (Denominator)																			
131072	1000(Initial value)	1000(Initial value)																			
16384	32768	4096																			
10000	32768	2500																			
4096	32768	1024																			
4000	32768	1000																			
048.0 / 049.0	[Adjustment] Analog command input Filter parameter (Numerator / Denominator )	<p>Low-pass filter parameter for smoothing analog speed command input.            It is valid when input filter selection (No.062.1) is set "1",.</p> <p>Parameter decrease→Smoothing effect becomes stronger, command traceability reduces.            Parameter increase→command traceability increases, susceptible to interference</p> <p>(Numerator / Denominator ) the value must be less than 1.            (Numerator / Denominator ) =1, filter invalid</p> <p>[Initial setting] (Numerator / Denominator )= 16000/65535            [Setting range] 0~65535/1~65535</p>	No																		
050.0 / 051.0	[Adjustment] Analog command input Gain (Numerator / Denominator )	<p>Gain of analog speed command input.            When (Numerator) / (Denominator )=1 and ±10V analog command voltage is input, the highest rotation speed of motor can be reached.</p> <p>※As for the highest rotation speed of motor, refer to 「Basic specification」</p> <p>According to different choice of symbol and polarity for analog command voltage, the rotation direction of motor is different.            Decreasing this value has the effect of decreasing proportional gain of position loop at upper controller.</p> <p>[Initial setting] (Numerator / Denominator )=1000/1000            [Setting range] 0~65535/1~65535</p>	No																		
052.0 / 053.0	[Basic setting] Analog speed command CCW speed limit threshold value (Numerator / Denominator )	<p>Analog speed command CCW speed limit threshold value.            Analog command CCW speed limit = (the highest speed of motor) * (threshold value(numerator))/ (threshold value(denominator))</p> <p>[initial setting] (Numerator / Denominator )=5000/5000            [Setting range] 0~65535/1~65535</p>	No																		
054.0 / 055.0	[Adjustment] Analog speed command CW speed limit threshold value (Numerator /	<p>Analog speed command CW speed limit threshold value.            Analog command CW speed limits = (the highest speed of motor) * (threshold value(numerator))/ (threshold value(denominator))</p> <p>[initial setting] (Numerator / Denominator )=5000/5000            [Setting range] 0~65535/1~65535</p>	No																		

	Denominator )		
060.0	[Basic setting] Analog speed command fixed offset value	When using manual adjustment to adjust offset value of analog speed command, set the adjustment value. It's valid when the offset adjustment is selected to "1= manual adjustment". Adjust the corresponding analog speed command input to 0r/min at the 0V input voltage.  <setting method>.  1. Servo ON (motor will rotate if offset exists)  2. When rotating at the speed of $\pm 10$ r/min or less, set the value to $\pm 50$ to confirm the operation.  (CCW direction, set to 「-50」 ; CW direction, set to 「+50」 .  3. Set the offset value while observing the motor operation. (If rotate at CCW direction, setting values change in response to 「-direction」 . If rotate at CW direction, setting values change in response to 「+direction」 .  [Initial value] 0 [Setting range] -32768/32768	No
062.0	[Basic setting] Analog speed command rotation direction	Select rotation direction of analog speed command.  0=Inputting negative voltage, the motor has CCW rotation; Inputting positive voltage, the motor has CW rotation.  1= Inputting positive voltage, the motor has CCW rotation; Inputting negative voltage, the motor has CW rotation.  [Initial value] 1 (Inputting positive voltage, the motor has CCW rotation) [Setting range] 0 or 1	No
062.1	[Basic setting] Select analog speed command input filter	Select analog speed command input filter.  Input filter constant can be set in No.048.0, No.049.0.  0= Disable  1=Enable (one IIR filter)  [Initial value] 1 (Enable) [Setting range] 0 or 1	No
062.2	[Basic setting] Select offset adjustment type of analog speed command	Select offset adjustment of analog speed command.  0=Auto tuning  1=Manual tuning  Auto tuning works under the voltage which corresponds to 0r/min of speed command while servo ON.  Manual tuning means input offset manually to make sure input voltage 0V corresponds to speed command 0r/min. . Offset value can be adjusted by parameter No.60.0(fixed offset value).  [Initial value] 1 (manual tuning) [Setting range] 0 or 1	No
064.0	[Basic setting] Judgment of positioning completion	Select the output form of positioning completion signal.  0=Position difference + speed  1=Position difference+ speed+ pulse command input(speed)  When selecting 0, after the position difference is in the positioning completion range No.68.0 and speed is in the range of positioning completion	No

		<p>speed No.69.0,, positioning completion signal will be output.</p> <p>When selecting 1, after the position difference, speed and pulse command input(speed) are all in the range of positioning completion range No.68.0 , positioning completion speed No.69.0 and positioning pulse train command input(speed) No.70.0 respectively, positioning completion signal will be output.</p> <p>The delay time from positioning completion to output positioning completion signal can be set in No.71.0.</p> <p>[Initial setting] 0</p> <p>[Setting range] 0 or 1</p>	
065.0	[Special setting] With or without use of position difference error detection	<p>Select whether to use position difference error detection. Usually set value to "1". ( Enable)</p> <p>Only when suing torque command limit, set to "0". Set the position deviation value of error detection by No.87.0 and set the delay time from position error occurred to output stop by No.89.0.</p> <p>0=Disable</p> <p>1=Enable</p> <p>[Initial value] 1 (Enable)</p> <p>[Setting range] 0 or 1</p>	No
065.1	[Special setting] With(out) use of speed deviation error detection	<p>Select whether to use speed deviation error detection. Usually set value is "1".( Enable)</p> <p>Only when suing torque command limit, set "0". Set the speed deviation value of error detection by No.90.0 and set delay time from speed error occurred to output stop by No.91.0.</p> <p>0= Disable</p> <p>1=Enable</p> <p>[Initial value] 1 (Enable)</p> <p>[Setting range] 0 or 1</p>	No
066.0 r and 066.1 r	[Adjustment] With(out) use of position command smoothing filter 1 and position command filter 2	<p>Select position command smoothing filter1 (No.66.0) and position command smoothing filter 2 (No.66.1)</p> <p>0=Disable</p> <p>1=Enable</p> <p>Command will be smooth as shown below after using a smoothing filter.</p> <p>[Adjustment method]</p> <p>Used when command acceleration or deceleration are too fast.</p>	Yes

		<p>Used to suppress device resonance when positioning. Measuring the resonant frequency in torque command curve and setting a corresponding average movement number in position command smoothing filter1 moving average time No.80 or position command smoothing filter2 average movement number No.81, may inhibit resonance. The relation between resonant frequency and average movement number is stated under parameter specification of No.80 and No.81.</p> <p>[Notes] This parameter can be set after more than 1.5s when the command pulse input is 0. And the servo must be off while setting. If there is pulse input or residual pulse setting, position difference will occur.</p> <p>[Initial setting] Command smoothing filter 1 is '0'. (Not used) Command smoothing filter 2 is '1'.(Used)</p> <p>[Setting range] 0 or 1</p>										
066.3	[Special setting] With(out) the Feed forward delay compensation in position control mode	<p>Enable/Disable Feed forward delay compensation in position control mode.</p> <p>0=Disable 1= Enable</p> <p>&lt;Note&gt; Generally set to "1". Do not make the changes and cannot be done on setting panel.</p> <p>[Initial setting] 1 (Enable)</p> <p>[Setting range] 0 or 1</p>	Yes									
067.0	[Adjustment] Selection of drive restriction options	<p>Select the drive restriction options</p> <p>Note) Do not modify the parameter while the servo is ON.</p> <p>0=Invalid 1=CW restriction. 2=CCW restriction. 3= CW/CCW restriction.</p> <p>[Initial setting] 0 (Invalid)</p> <p>[Setting range] 0 to 3</p>	Yes									
067.1	[Basic setting] Selection of deceleration method at drive restriction input	<p>Select deceleration method at drive restriction input.</p> <p>Note) Do not modify the parameter while the servo is ON.</p> <p>When using deceleration method No.67.1 and stopping method No.67.2, please follow the following combination methods.</p> <p>0=Free-run 1=Short brake 2= Prompt stop</p> <table border="1" data-bbox="571 1697 1264 1971"> <thead> <tr> <th>Combination</th> <th>Deceleration method No.67.1</th> <th>Stopping method No.67.2</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0: Free-run</td> <td>0: Free-run</td> </tr> <tr> <td>2</td> <td>1: Short brake</td> <td>0; Free-run</td> </tr> </tbody> </table>	Combination	Deceleration method No.67.1	Stopping method No.67.2	1	0: Free-run	0: Free-run	2	1: Short brake	0; Free-run	No
Combination	Deceleration method No.67.1	Stopping method No.67.2										
1	0: Free-run	0: Free-run										
2	1: Short brake	0; Free-run										

		<table border="1"> <tr> <td>3</td> <td>2: Prompt stop</td> <td>1: zero clamp</td> </tr> <tr> <td>4</td> <td>2: Prompt stop</td> <td>0: Free-run</td> </tr> </table> <p>[Initial setting] 1 [Setting range] 0 to 2</p>	3	2: Prompt stop	1: zero clamp	4	2: Prompt stop	0: Free-run	
3	2: Prompt stop	1: zero clamp							
4	2: Prompt stop	0: Free-run							
067.2	[Basic setting] Selection of stop status at drive restriction	<p>Select stop status at drive restriction.</p> <p>Note) Do not modify the parameter while the servo is ON.</p> <p>When using deceleration method No.67.1 and stopping method No.67.2, please follow the above combination methods.</p> <p>0= Free-run 1= zero clamp</p> <p>[Initial setting] 1 [Setting range] 0 or 1</p>	No						
067.3	[Basic setting] Selection of position difference counter status at drive restriction	<p>Select position difference counter status at drive restriction</p> <p>Note) Do not modify the parameter while the servo is ON.</p> <p>0= Keep 1=Clear</p> <p>[Initial setting] 1 [Setting range] 0 or 1</p>	No						
068.0	[Basic setting] Positioning completion range	<p>As the reference of outputting positioning completion signal to upper controller, this parameter is the pulse width for judging positioning completion.</p> <p>The setting value should be less than the number of positioning judge pulse of upper controller.</p> <p>[Initial value] 40[Pulse] (±40[pulse]) [Setting range] 0 to 32767</p> 	No						
069.0	[Basic setting] Positioning completion speed	<p>As the reference of outputting positioning completion signal to upper controller, this parameter is the speed limit for judging positioning completion.</p> <p>The setting value should be less than the number of speed limit of upper controller.</p> <p>[Initial value] 750W or less: 2 [pulse/160 μs] (±2 [pulse/160 μs]) · · · 5.72[r/min] 1kW or more : 2 [pulse/200 μs] (±2 [pulse/200 μs]) · · · 4.58[r/min]</p> <p>[Setting range] 0 to 32767</p>	No						

070.0	<p>[Basic setting]</p> <p>Positioning completion pulse command input (speed)</p>	<p>As the reference of outputting positioning completion signal to upper controller, this parameter is the pulse command input(speed) for judging positioning completion</p> <p>[Initial setting]</p> <p>750W or less: 0 [pulse/160 μ s] ( ± 0 [pulse/160 μ s])</p> <p>1kW or more: 0 [pulse/200 μ s] ( ± 0 [pulse/200 μ s])</p> <p>[Setting range] 0 to 32767</p>	No
071.0	<p>[Basic setting]</p> <p>Delay time of positioning completion detection</p>	<p>Select the delay time from positioning completion to output signal to upper controller.</p> <p>[Initial value]</p> <p>750W or less: 20 [160 μ s] · · · 3.2ms</p> <p>1kW or more: 16 [200 μ s] · · · 3.2ms</p> <p>[Setting range] 0 to 65000</p>	No
077.0	<p>[Adjustment]</p> <p>With(out) the use of speed command smoothing filter</p>	<p>Choose whether to use speed command smoothing filter. The average movement time can be set in No.78.0.</p> <p>0=Disable</p> <p>1=Enable</p> <p>[Initial value] 0</p> <p>[Setting range] 0 or 1</p>	No

078.0	[Adjustment] Average movement time of speed command smoothing filter	Set the average movement time of speed command smoothing filter. It can be used when No.77.0 is effective. [Initial value] 100 [ms] [Setting range] 1 to 1000	No															
080.0 r and 081.0 r	[Adjustment] Average movement number of position command smoothing filter 1 and average movement number of position command smoothing filter 2	<p>Set the position command smoothing filter 1 to "1(Used)" in No.66.0 to make No.80.0 valid.</p> <p>Set the position command smoothing filter 2 to "1(Used)" in No.66.1 to make No.81.0 valid.</p> <p>When the setting value of average movement number increases, the acceleration/ deceleration will be smooth, but the response will be slow.</p> <p>Setting filter 1, the average movement number can be set between 1 and 6250; setting filter 2, the average movement number can be set between 1 and 1250.</p> <p>The average movement time can be represented by the following formula.</p> <p>200 ~ 750W : (average movement time)=(average movement number) ×0.16ms</p> <p>1k~2kW: (average movement time)=(average movement number) ×0.2ms</p> <p>[Adjustment method]</p> <ul style="list-style-type: none"> <li>●Smoothing will make positioning time longer in response to above average movement time. Please have settings within the permissible range..</li> <li>●When resonant occurs at constant move after acceleration or positioning after deceleration, measuring the resonant frequency in torque command curve and setting a corresponding average movement number in position command smoothing filter1 moving average time No,80 or position command smoothing filter2 average movement number No.81, may inhibit resonance.</li> </ul> <p>The calculation of average movement number and its corresponding suppressed resonance frequency is shown below.</p> <p>750W or less: Setting value of smoothing filter=6250/(suppressed vibration frequency[Hz])</p> <p>1kW or more: Setting value of smoothing filter=5000/(suppressed vibration frequency[Hz])</p> <table border="1" data-bbox="576 1534 1265 1787"> <tr> <td>Average movement number No.080.0, No.081.0</td> <td>64</td> <td>256</td> <td>1024</td> <td>4096</td> </tr> <tr> <td>750W or less: suppressed vibration frequency(Hz)</td> <td>100</td> <td>23</td> <td>6</td> <td>1.5</td> </tr> <tr> <td>1kW or more: suppressed vibration frequency(Hz)</td> <td>80</td> <td>20</td> <td>5</td> <td>1.2</td> </tr> </table> <ul style="list-style-type: none"> <li>●The vibration caused by gain FF compensation 2 can be suppressed by position command smoothing filter 2.</li> </ul> <p>When using gain FF compensation 2 No.117.0, vibration can be reduced by using the average movement number of position command smoothing filter 1 and filter 2.</p> <p>[Notes] This parameter can be set when the command pulse input is "0" for</p>	Average movement number No.080.0, No.081.0	64	256	1024	4096	750W or less: suppressed vibration frequency(Hz)	100	23	6	1.5	1kW or more: suppressed vibration frequency(Hz)	80	20	5	1.2	Yes
Average movement number No.080.0, No.081.0	64	256	1024	4096														
750W or less: suppressed vibration frequency(Hz)	100	23	6	1.5														
1kW or more: suppressed vibration frequency(Hz)	80	20	5	1.2														

		<p>more than 1.5s and there is no command pulse input. If possible, it is recommended to turn off the servo. If you set the parameter when there is pulse input or residual pulse, position shift will occur.</p> <p>[Initial value] Filter 1: 25 for 200~750W, 20 for 1k~2kW Filter 2: 10 for 200~750W, 10 for 1k~2kW</p> <p>[Setting range] 1 to 6250 for filter 1, 1 to 1250 for filter 2.</p>	
087.0	[Special setting] Position deviation error detection value	<p>When set No.65.0 to "1(enable)", it is valid to detect the position deviation errors. Normally it's effective.</p> <p>When the position deviation exceeds the setting value, the output position deviation errors occur.</p> <p>It is more difficult to detect the position deviation if the value is greater.</p> <p>[Initial value] 196608[pulse] (※Equivalent to the number of 1.5 turns pulse)</p> <p>[Setting range] 0 to 2147483647.</p>	No
089.0	[Special setting] Delay time of position deviation error detection	<p>When set No.65.0 to "1(enable)", it is valid to detect the position deviation errors.</p> <p>The time is from exceeding setting value 「Position deviation error detection value」 to outputting position deviation error signal.</p> <p>It takes longer from error occurred to error output when the value is greater.</p> <p>[Initial value] 200~750W: 250 [160 μs] . . . 40ms 1k~2kW: 200 [200 μs] . . . 40ms</p> <p>[Setting range] 0~32767</p>	No
090.0	[Basic setting] Speed deviation error detection value	<p>When set No.65.1 to "1(enable)", it is valid to detect the speed deviation errors.</p> <p>Normally it's effective. When the speed deviation exceeds setting detection value, speed deviation error occurs.</p> <p>It is more difficult to detect speed deviation error if the value is greater.</p> <p>[Initial value] 200~750W: 524[pulse/160 μs] . . . 1499[r/min] 1k~2kW: 655[pulse/200 μs] . . . 11499[r/min]</p> <p>[Setting range] 0 to 32767</p>	No
091.0	[Special setting] Delay time of speed deviation error detection	<p>When set No.65.1 to "1(enable)", it is valid to detect the speed deviation error.</p> <p>Normally it is effective.</p> <p>The time is from exceeding setting value 「Speed deviation error detection value」 to output speed deviation error signal.</p> <p>It takes longer from error occurred to error output stopped when the value is greater.</p> <p>[Initial value] 200~750W: 250 [160 μs] . . . 40ms 1k~2kW: 200 [200 μs] . . . 40ms</p> <p>[Setting range] 0 to 32767</p>	No
102.0	[Adjustment] Inertia ratio	<p>Set Inertia ratio by the device load .</p> <p>[Initial value] 250 [%]</p> <p>[Setting range] 100 to 3000</p>	No
103.0	[Adjustment]	<p>Set Damping ratio on the device side. When the friction and inertia ratio is very</p>	No

	Damping ratio	big, the change of damping ratio value may shorten the setting time. [Initial setting] 100 [%] [Setting range] 10 to 5000	
110.0	[Adjustment] With or without the use of estimated inertia ratio	Setting of auto tuning mode. If the movement direction of machine connected to the motor is horizontal, select "standard mode". If vertical, select "Unbalanced mode". 1=Standard mode 1=Unbalanced mode [Initial value] 1 (Standard mode) [Setting range] 1 to 2	No
110.1	[Adjustment] With(out) the use of real-time auto tuning	Select whether to use real-time auto tuning. 0 = Disable 1 = Enable and Apply Inertia ratio 2 = Enable and Apply Inertia ratio and Dumping ratio [Initial value] 0 (Disable) [Setting range] 0 to 2	No
113.0	[Adjustment] Control gain level (position control)	Set the control gain level in position control mode. If traceability to command is slow or rigidity of drive system is low, set a lower value; If traceability to command is rapid or rigidity of drive system is high, set a higher value. When setting this parameter, No. 115.0~119.0 will be set automatically and No.114.0 becomes invalid. [Initial value] 15 [Setting range] 5 to 45	No
113.1	[Adjustment] Inertia condition	Set the inertia condition of position control mode. 0= Can interchange with F/W version of 2.0.4.0 or prior 1= For the device of heavy load and low rigidity, or large load changes 2= Standard setting 3= For the device of light load and CW/CCW frequently [Initial value] 2 (Standard) [Setting range] 0 to 3	No
114.0	[Adjustment] Control level (position control)	Set control level of position control mode. If traceability to command is slow or rigidity of drive system is low, set the lower value; If traceability to command is rapid or rigidity of drive system is high, set the higher value. When setting this parameter, No. 115.0, No.116.0 will be set automatically and No.113.0 becomes invalid. When the inertia condition No.113.1 is set to "0"(servo drive version 2.0.4.0 or prior), the setting range is from 1 to 46. [Initial value] 15 [Setting range] 5 to 45	No
115.0	[Adjustment] Control gain 1 (position control)	Set the Control gain 1 at position control mode. Higher setting value can shorten the setting time. Set the Control gain 2 as the following values. [Initial value] 50 [rad/s] [Setting range] 5 to 1000	No

116.0	[Adjustment] Control gain 2 (position control)	Set the Control gain 2 at position control mode. Higher setting value can improve the traceability to the command. Too high setting value can cause overshoot and vibration.  When No.113.0 control gain level or No.114.0 control level is adjusted to set automatically, sometimes the setting values will exceed the setting range.  [Initial value] 200[rad/s] [Setting range] 80 to 5000	No
117.0	[Adjustment] Gain FF compensation 1 (position control)	Set feed forward compensation ratio (speed) of the Control gain 1 in position control mode. After confirming inertia ratio, adjusting this parameter will shorten the setting time. Too high setting value will lead to overshoot. And too low setting value will make setting time longer.  [Initial value] 10000[0.01%] [Setting range] 0 to 15000	No
118.0	[Adjustment] Gain FF compensation 2 (position control)	Set feed forward compensation ratio (torque) of the control gain 2 in position control mode. It is suitable to adjust this parameter when it requires small following error and precise trajectory. After Gain FF compensation 1 shortens setting time, please increase this parameter value. If vibration occurs, adjusting No.81.0 position command smoothing filter 2 average movement times may suppress the vibration.  [Initial setting] 0 [0.01%] [Setting range] 0 to 15000	No
119.0	[Adjustment] Integral gain (position control)	Setting integral gain in position control mode can suppress external interference. When the setting value is higher, the position deviation convergence of positioning setting will become fast. But if setting value is too high, vibration will occur.  When No.113.0 control gain level or No.114.0 control level is adjusted to set automatically, sometimes the setting values will exceed the setting range.  [Initial value] 160[rad/s] [Setting range] 45 to 5000	No
129.0	[Adjustment] Control gain level (speed control)	Select control gain level in speed control mode. If traceability to command is slow or rigidity of drive system is low, set the lower value; If traceability to command is rapid or rigidity of drive system is high, set the higher value.  When setting this parameter, No. 131.0~133.0 will be set automatically and No.130.0 becomes invalid.  [Initial value] 15 [Setting range] 1 to 46	No
130.0	[Adjustment] Control level (speed control)	Select control level in speed control mode. If traceability to command is slow or rigidity of drive system is low, set the lower value; If traceability to command is rapid or rigidity of drive system is high, set the higher value.  When setting this parameter, No. 131.0 will be set automatically and No.129.0 becomes invalid.  [Initial value] 15 [Setting range] 1 to 46	No

131.0	[Adjustment] Control gain 1 (speed control)	Set the control gain in speed control mode. It corresponds to proportional gain of speed control loop. [Initial value] 399[rad/s] [Setting range] 100 to 6000	No
132.0	[Adjustment] Gain FF compensation 1 (speed control)	Set feed forward compensation in speed control mode. The higher the setting value, the better the traceability to command. But Too high setting value may lead to overshoot or vibration [Initial value] 0 [0.01%] [Setting range] 0 to 15000	No
133.0	[Adjustment] Integral gain(speed control)	Select integral gain in speed control mode. The higher the setting value, the smaller the speed change caused by external disturbance. [Initial value] 300[rad/s] [Setting range] 45 to 5000	No
144.0	[Basic setting] With or without the use of torque command limit override	Select torque command limit value in No.147.0, No.148.0 Confirm the following items when using torque limit. ① 「No.65.0 Selection of Position deviation error detection」, please set it to "0=Disable" ② 「No.65.1 Selection of Speed deviation error detection」, please set it to "0=Disable" When the command deviation value is small, even though the torque limit is set to be valid, it will be OK to set ① or ② to "1(enable)". 0= Disable 1= Enable [Initial setting] 0 (Disable) [Setting range] 0 or 1	No
144.1	[Basic setting] Torque limit state output mode	Select the output condition for torque limit. 0= All conditions (Torque is limited by torque command limit value 1 (No.147.0), max. torque limit value of motor and torque limit value of home position return (No. 656.0), not limited by speed in torque control mode) 1= Torque command limit Override 1 (No.147.0) or 2 (No.148.0) 2= Torque command limit Override 2 (No.148.0) [Initial setting] 0 (All conditions) [Setting range] 0 to 2	No
147.0 148.0	[Basic setting] Torque command limit override 1, 2	It is valid when No.144.0 torque command limit override is set to "1(enable)". Set torque command limit override relative to rated torque ratio. Tow torque limits could be set. [Initial value] 3000[0.1%] for torque limit 1; 2000[0.1%] for torque limit 2 [Setting range] 0 to 65535	No

151.0	[Basic setting] Torque command limit override at prompt stop	Set the torque command limit override relative to rated torque, if the stop type in No.224.0 is set to "2=prompt stop" when servo is OFF.  [Initial value] 5000[0.1%] (When set 3000 or more, the limit value of max. torque command is 300%. If the setting value is bigger than 1000 , overload error will occur according to overload characteristics specified time.  [Setting range] 0 to 65535	No
152.0	[Basic setting] Analog torque command speed limit value	Set Speed limit value of analog torque control mode.  [Initial value] Max. speed of the motor  [Setting range] 0 to 10000	No
160.0	[Adjustment] Selection of torque command low-pass filter	Select torque command low-pass filter.  0=No filter 1= Preliminary IIR filter  [Initial value] 1 (Preliminary IIR filter)  [Setting range] 0 or 1	No
160.1	[Adjustment] Torque command Selection of whether to use notch filter	Whether the notch filter is used to set the torque command.  0=Disable 1=Enable  [Initial value] 0 (Disable)  [Setting range] 0 or 1	No
160.2	[Adjustment] Auto setting ON/OFF for Torque command Low-pass filter	Select whether to use the auto setting for torque command low-pass filter in control gain level (No. 113 and No. 129).  0 = Auto setting OFF 1 = Auto setting ON  [Initial value] 1 (Auto setting ON)  [Setting range] 0 or 1	No
162.0	[Adjustment] Torque command preliminary filter time constant for Low-pass filter	Set the torque command preliminary filter time constant for Low-pass filter  [Initial value] 20 [0.01ms]  [Setting range] 0 to 65535	No
168.0	[Adjustment] Torque command notch filter frequency	Set Notch filter notch frequency of Torque command  [Initial value] 5000[Hz]  [Setting range] 0 to 5000	No
169.0	[Adjustment] Torque command Notch filter width	Set notch filter width of torque command.  Set the ratio relative to a frequency band with 0 notch depth and -3[dB] attenuation rate. The larger the value, the greater the width of the notch  [Initial value] 8  [Setting range] 0 to 16	No
170.0	[Adjustment] Torque command Notch filter depth	Set the notch depth at the notch frequency of torque command notch filter,  Set the I/O ratio of notch frequency. When the setting value is 0, the notch frequency input is completely cut off. When the setting value is 256, the notch frequency input is completely through. The notch depth becomes shallow	No

		when the value is bigger. [Initial value] 0 [Setting range] 0 to 256	
224.0	[Basic setting] Type selection deceleration stop at servo OFF	Select the deceleration stop type when the alarm occurs or servo ON signal is off in motor revolution. 0=No brake 1=Short brake mode 2= Prompt stop [Initial value] 1 (Short brake mode) [Setting range] 0 to 2	No
224.1	[Basic setting] Deceleration stop at Servo off: cancelation reasons	Select cancellation reasons for deceleration stop at servo OFF 0 = Operating time 1 = Rotations of cancelation or operating time [Initial value] 1 (Rotations of cancelation or operating time) [Setting range] 0 or 1	No
224.2	[Basic setting] Use of a deceleration stop in case of control power supply voltage drop	Enable/Disable Deceleration Stop when the voltage from a control power supply drops by No. 228.0. 0 = Disable 1 = Enable [Initial value] 1 (Enable) [Setting range] 0 or 1	No
226.0	[Basic setting] Deceleration stop : operating time at servo off	Set the operating time for deceleration stop at servo OFF. (If "0(No brake)" is set to No.224, this parameter is invalid.) [Initial value] 200W~750W: 313 [160 μ s] . . . 50ms, 1 kW~2kW: 250 [200 μ s] . . . 50ms [Setting range] 0 to 16383	No
227.0	[Basic setting] Cancellation speed of deceleration stop and brake cancellation OFF at servo OFF.	Set the cancellation speed of deceleration stop at servo OFF. It sets the speed of brake OFF cancellation. (If "0(No brake)" is set to No.224.0 and "0(Operation time)" set to No.224.1, this parameter is invalid.) [Initial value] 200W~750W: 17[pulse/160 μ s] . . . 50r/min, 1 kW~2kW: 22[pulse/200 μ s] . . . 50r/min [Setting range] 0 to 32767	No
228.0	[Basic setting] Operating time of deceleration stop at control power supply voltage drop	Set the operating time of deceleration stop at control power supply voltage drop in motor rotation. [Initial value] 62 [160μs] . . . 10ms [Setting range] 0 to 16383 [ms]	No
237.0	[Basic setting] Delay time at servo OFF	Set the delay time between getting the input signal of Servo OFF and motor excitation OFF. (The disconnection of COM2 and SVON terminal indicates the servo ON input signal is OFF.) [Initial value] 200W~750W: 0[160 μ s] . . . 0ms,	No

		1 kW~2kW: 0[200 μs] · · · 0ms [Setting range] 0 to 3125	
238.0	[Basic setting] Delay time of brake release	Set the delay time from motor excitation start to brake release output signal (MBRK) ON. (The connection of COM2 and SVON terminal indicates the brake release output signal is ON.) [Initial value] 200W~750W: 25[pulse/160 μs], 1 kW~2kW: 20[pulse/200 μs] [Setting range] 0 to 3125	No
257.0	[Basic setting] Selection of an encoder system	Select an option for Absolute system or Incremental system. 0 = Incremental system 1 = Absolute system (multi-rotation counter overflow detection disabled) 2 = Absolute system (multi-rotation counter overflow detection enabled) [Initial value] 0 (Incremental system) [Setting range] 0 to 2	Yes
272.1	[Basic setting] Encoder output rotation direction	Set the rotation direction of encoder output. 0 = Down counting in the case of CCW rotation 1 = Up counting in the case of CCW rotation [Initial value] 1 (Up counting in the case of CCW rotation) [Setting range] 0 or 1	Yes
276.0 r / 278.0 r	[Basic setting] Division and multiplication of encoder pulse output(Numerator / Denominator )	Set the division and multiplication of encoder pulse output. When the 1-rotation pulse number of encoder and the motor is different, set it to 'Numerator / Denominator =1-rotation pulse number of encoder/ 1-rotation pulse number of motor.' If the output Z-phase pulse width is narrow and the upper control device cannot identify it correctly, we can reduce the division and multiplication ratio or speed to increase the pulse width by encoder pulse output division and multiplication No. 276. 0 and 278. 0. [Pulse width]= 1/ rotation speed (division/ multiplication ratio × 217) [Initial value] (Numerator )/ (Denominator )=1000/8000 [Setting range] (Numerator ) 1~65535; (Denominator )1~65535 Frequency division/multiplication could be set to 1/32768 to 1. But it's necessary that [encoder resolution] × [Frequency division/multiplication] = [multiples of 4] and output frequency must less than 4Mpps(Maximum value).	Yes
288.0 / 289.0	[Adjustment] Analog torque command input filter (Denominator /Numerator)	This parameter is for the low-pass filter that smooths analog torque command input. It's valid when No.302.1 =1(enable). When the value is small, the smoothing becomes stronger, but the traceability to command drops. When the value is bigger, the traceability to command improves, but it is easy to be disturbed. Numerator / Denominator cannot exceed "1". If Numerator / Denominator=1, no filtering. [Initial value] Numerator / Denominator= 16000/65535	No

		[Setting range] 0 to 65535/1 to 65535	
290. 0 / 291. 0	[Adjustment] Analog torque command input gain (Denominator /Numerator)	Set Analog torque command input gain. Input of Analog command voltage =-10V or +10V with (Numerator)/(Denominator)=1 attains motor peaks torque. Motor rotation direction differs according to the selection of analog command voltage symbols and characteristics. ※For the details of peaks torque, refer to [Basic specification]. [Initial value] (Numerator) / (Denominator) = 3100/3100 (Varies with different motor models) [Setting range] 0 to 65535/1 to 65535	No
292. 0/ 293. 0	[Basic setting] Analog torque command CCW torque limit Override (Denominator/ Numerator)	Set Analog torque command CCW torque limit Override Analog command CCW torque limit =motor peak torque × (Override (Numerator)/Override(Denominator)) [Initial value] (Numerator) / (Denominator) = 3100/3100 (Varies with motor models) [Setting range] 0 to 65535/1 to 65535	No
294. 0/ 295. 0	[Basic setting] Analog torque command CW torque limit Override	Set Analog torque command CW torque limit Override Analog command CW torque limit =motor peak torque × (Override (Numerator)/Override(Denominator)) [Initial value] (Numerator) / (Denominator) = 3100/3100 (Varies with motor models) [Setting range] 0 to 65535/1 to 65535	No
300. 0	[Basic setting] Analog torque command Fixed offset value	Set Analog torque command Fixed offset value. This parameter is valid when No.302.2 =1. If the input voltage is 0V, the state of analog torque command input is 0%. <Setting method> 1. Servo ON (The motor rotates automatically if offset deviation occurs) 2. Observe the torque command value, and set offset value. [Initial value] 0 [Setting range] -32768 to 32767	No
302. 0	[Basic setting] Analog torque command Rotation direction	Set Rotation direction of Analog torque command input. 0 = CCW rotation by negative input voltage, CW rotation by Positive input voltage 1 = CCW rotation by positive input voltage, CW rotation by negative input voltage [Initial value] 1 (CCW rotation by positive input voltage) [Setting range] 0 or 1	No
302. 1	[Basic setting] Analog torque command Input filter option	Enable/Disable Input filter for Analog torque command. It can be done by No. 288. 0 and No. 289. 0. 0 = Disable 1 = Enable [Initial value] 1 [Setting range] 0 or 1	No

302.2	[Basic setting] Analog torque command Offset adjustment method	Select Offset adjustment method of Analog torque command.  Auto tuning is that the input voltage can make the torque command 0% at servo ON. Manual tuning is to input offset value by manual to make torque command 0% at input voltage 0V. Offset value can be adjusted by No.300.0 (Analog torque command Fixed offset value)  0 = Auto tuning 1 = Manual tuning [Initial value] 1 (Manual tuning) [Setting range] 0 or 1	No
385.0	[Basic setting] JOG operation: Acceleration time	Set Acceleration time for the JOG operation  This parameter set a duration for the speed command to accelerate from 0 rpm to 1000rpm.  [Initial value] 1000[ms] [Setting range] 0 to 60000[ms]	No
386.0	[Basic setting] JOG operation: Deceleration time	Set Deceleration time for the JOG operation  This parameter set a duration for the speed command to accelerate from 1000 rpm to 0rpm.  [Initial value] 1000[ms] [Setting range] 0 to 60000[ms]	No
387.0	[Basic setting] JOG operation: Target speed	Set a target speed of the JOG operation.  [Initial value] 300[ r/mi n] [Setting range] For 50W~100W: 0~6300[ r/mi n] For 200W~400W: 0~5000[ r/mi n] For 750W: 4500[ r/mi n] For 1kW~2kW: 0~3000[ r/mi n]  Note) Alarm occurs when it exceeds max. speed. Do not exceed the max.speed.	No
388.0	[Basic setting] Selection of Internal speed command type	It is valid when control mode No.2.0 is set to "1=speed control mode" and command mode selection No.3.0 is set to "3=Internal generation command" .  Select command type of internal speed command. No.390.0 and No.391.0 are used to set acceleration/deceleration time of internal speed command. No.392.0~399.0 are used to set the target speed.  0 = zero command input 1 = internal speed command(trapezoid speed command with 8 phases) [Initial value] 0 [Setting range] 0 or 1	No
390.0	[Basic setting] Internal speed command Acceleration time	It is valid when control mode No.2.0 is set to "1=speed control mode" , command mode selection No.3.0 is set to "3=Internally generated command" , and internal speed command type No.388.0 is set to "1=trapezoidal speed command" . Set the acceleration time of internal speed command input. Set the time of speed command from 0rpm to 1000rpm. No.391.0 is used to set internal speed command deceleration time. No.392.0~399.0 are used to set the target speed.	No



0	Internal speed command - Operation mode	command. 0 = Point Table 1 = Communication operation 2 = Manual pulse input [Initial value] 1 (Communication operation) [Setting range] 0 to 2	
643. 0	[Special setting] Internal speed command - Overflow detection option	Enable/Disable Internal position command Overflow detection function. 0 = Disable 1 = Enable To prevent the absolute position from disappearing when the target position exceeds the absolute position range in Point table or communication operation. When "1 = Enable" is set and the target position (ABS position command) in operation command exceeds absolute position, the alarm of internal position command overflow will occur. When "0 = Disable" is set and the target position exceeds absolute position, it can implement relative operation, not the absolute operation. The relative operation is that the point table operation command method is set to the operation of relative value and test-run. The absolute operation is that the point table operation command method is set to the operation of absolute value. [Initial value] 1 [Setting range] 0 to 1	Yes
644. 0	[Special setting] Point No. output method	Set Point No. output method from user I/O output to PM1...3 in positioning operation. 0 = Output Operation start point at Operation start 1 = Output Operation start point at Operation end 2 = Output each point No.at each operation start [Initial value] 1 (Output Operation start point at Operation end) [Setting range] 0 to 2	No
645. 0	[Special setting] Base signal 1 selection for Home position	Select Base signal 1 at determine Home position. 0 = Arbitrary position 1 = Stopper 2 = Home position DOG front end [Initial value] 2 (Home position DOG front end) [Setting range] 0 to 2	No
645. 1	[Special setting] Base signal 2 selection for Home position	Set another base signal(Base signal 2)for home position after detecting Base signal 1. 0 = None 1 = Encoder Phase Z [Initial value] 0 (None) [Setting range] 0 to 1	No

645.3	[Special setting] Home position Base signal 1 redetection	Set the Base signal 1 redetection in creep speed after detecting home position DOG front end. 0 = Disable 1 = Enable [Initial value] 0 (None) [Setting range] 0 to 1	No
646.0	[Special setting] Home position return direction	Set Home position return direction. 0 = CCW direction 1 = CW direction [Initial value] 0 (CCW direction) [Setting range] 0 to 1	No
646.1	[Basic setting] Home position sensor input polarity	Set Home position sensor input polarity. 0 = When OFF, detect Home position DOG front end 1 = When ON, detect Home position DOG front end [Initial value] 0 (When OFF, detect Home position DOG front end) [Setting range] 0 to 1	No
646.2	[Basic setting] Home position return Timeout option	Enable/Disable Home position return Timeout. 0 = Disable 1 = Enable [Initial value] 1 (Enable) [Setting range] 0 to 1	No
646.3	[Basic setting] Point No.0 function selection	Select a function for Point No.0 when PCSTART1 is put into user I/O in forward start. 0 = Return to home position 1 = Point table operation [Initial value] 0 (Return to home position) [Setting range] 0 to 1	No
647.0	[Basic setting] Home position return Torque limit option	Select whether to switch the torque limit value of home position return to home position return limit value. 0 = Disable 1 = Enable The torque limit detected by stopper is irrelative to the setting of this parameter in using home position return of stopper. [Initial value] 0 (Disable) [Setting range] 0 to 1	No
647.1	[Basic setting] Action at home position return completion	Select " 1= Move" from home position base signal 1 detection to home position completion. 0 = No move 1 = Move [Initial value] 0 (No move) [Setting range] 0 to 1	No
648.	[Basic setting]	Set the speed after the home position base signal 1 is detected.	No

0	Home position return Speed	[Initial value] 500[rpm] [Setting range] 1 to Max. speed of motor	
649. 0	[Basic setting] Home position return Creep speed	Set the creep speed after the home position base signal 1 is detected. [Initial value] 10[rpm] [Setting range] 1 to Max. speed of motor	No
650. 0	[Basic setting] Home position return Acceleration/Deceleration time	Set Acceleration/Deceleration time for Home position return This parameter sets Acceleration time and Deceleration time per 1000rpm. If the load inertia ratio is 10 times or more, set up a value more than the initial value of 30. Otherwise, vibration will occur. [Initial value] 30[ms/1000rpm] [Setting range] 0~to 5000	No
651. 0	[Special setting] Home position Return Shift-to-home-position quantity	Set shift quantity from the position where the Base signal was detected to the home position. [Initial value] 0 [Command unit] [Setting range] 0 to 1,000,000,000	No
653. 0	[Special setting] Home position return Home position data	Set a position at the time of home position return complete. [Initial value] 0 [Command unit] [Setting range] -1,000,000,000 to 1,000,000,000	No
655. 0	[Special setting] Home position return Press detection time	Set Torque limit detection at the time of press home position return. [Initial value] 100 [ms] [Setting range] 5 to 1,000	No
656. 0	[Special setting] Home position return Torque limit value	Set Torque limit value at the time of home position return. This value is measured in terms of proportion to rated torque. This setting value is the torque limit value of press home position return. [Initial value] 500[0.1%] [Setting range] 10 to 3,000	No
657. 0	[Special setting] Home position return Phase Z invalidation distance	Set a distance from the position where Base signal 1 for home position is detected to the position where Phase Z detection starts. [Initial value] 0 [Command unit] [Setting range] 0 to 1,000,000,000	No
659. 0	[Special setting] Home position return Timeout Time	Set Home position return Timeout Time. [Initial value] 60,000[10ms] [Setting range] 0 to 60,000	No

## 5. Operation

### 5.1 Preface

#### 5.1.1 Preface

This product can drive the motor by 5 operation modes of combination of control mode and command mode.

This chapter describes the operation method of different operation modes.

■ Position control mode (Pulse position command input)

1) Wiring for user I/O (CN1) connector

The following three kinds of signals can be input in position control mode.

- Differential input
- 24V open collector input
- 5V open collector input

2) The setting of basic parameter

3) Test run

■ Speed control mode(Analog speed command input)

1) Wiring for user I/O (CN1) connector

2) The setting of basic parameter

3) Test run

■ Speed control mode(Internal speed command)

1) Wiring for user I/O (CN1) connector

2) The setting of basic parameter

3) Test run

■ Torque control mode (Analog torque command input)

1) Wiring for user I/O (CN1) connector

2) The setting of basic parameter

3) Test run

■ Position control mode (Internal position command)

#### 5.1.2 Precautions

Table 5.1.2 Precautions

	Make sure to cut off all phases of power supply before wiring.	To .prevent electric shock, fire, malfunction and injury
	The wiring should be performed by the professional electrical engineer.	To .prevent electric shock, fire, malfunction and injury
	Make sure all the wiring should be connected properly before power ON.	To .prevent electric shock, fire, malfunction and injury

#### 5.1.3 Common parameters



Point

The common parameters in the following table should be set in all the operation modes.

Set the following parameters according to the using status.

For details, refer to [Chapter 4 Parameter list].

Table 5.1.2 Common parameter list

Parameter NO.	Description
2.0	Parameters of control mode and command mode
3.0	
4.0	Parameters of RS-485 and absolute encoder
8.0	
11.0	
257.0	
67.0	Parameters of drive input restriction
67.1	
67.2	
67.3	
144.0	Parameters of torque limit
144.1	
147.0	
148.0	
151.0	Parameters of safety stop
224.0	
224.1	
224.2	
226.0	
227.0	
228.0	
237.0	
272.1	Parameters of encoder pulse output
276.0	
278.0	

#### 5.1.4 Setting method for basic parameter

To drive the motor in the different operation modes, the setting and operation of the related basic parameter should be done necessarily. Here are the steps of parameter setting and change by using 'setting panel' and HCX-SETUP'.

##### ■By setting panel

1. Switch on the power supply to the drive
2. Set the basic parameter according to the following steps.

Table 5.1.3 Change of the basic parameter (By setting panel)

Display and operation	Description
	Initial display at the start.
Press <b>MODE</b> button four times	Switch to the mode of setting panel.

P002.0r	Switch to the parameter mode. You can change the parameter No. here. (Display parameter 2.0)
Press <b>SET</b> button once	Display the setting value of parameter 2.0.
F00000	Display the setting value of parameter 2.0. The flickering bit is changeable.
Press <b>▲</b> , <b>▼</b> button	Press the UP or DOWN to input the parameters.
F00001	Confirm the parameter value. (Display in 'Speed control mode'.)
Press <b>SET</b> button once	After setting the parameter on the RAM of the drive, the display changes from flickering to light.
Press <b>MODE</b> button once	Return to the display of parameter No.
P002.0r	Return to the display to change the parameter No. (Display parameter 2.0)
Press <b>▲</b> button	Press UP button to change the parameter No.
P003.0r	Display parameter 3.0.
Press <b>SET</b> button once	Display the setting value of parameter 3.0.
Press <b>▲</b> , <b>▼</b> button to set the related parameters. We can go to the next step after all the parameters are set.	
Press <b>MODE</b> three times	Switch to the mode of setting panel.
SAVE P	Switch to parameter saving mode.
Press <b>SET</b> button once	Save the parameter to the EEPROM in drive. (When saving, [P] in [SAVE_P] will flicker.)
Pr End	To the end.
-	Please cut off the power supply to the drive and restart. After restart the power, the setting will be effective.

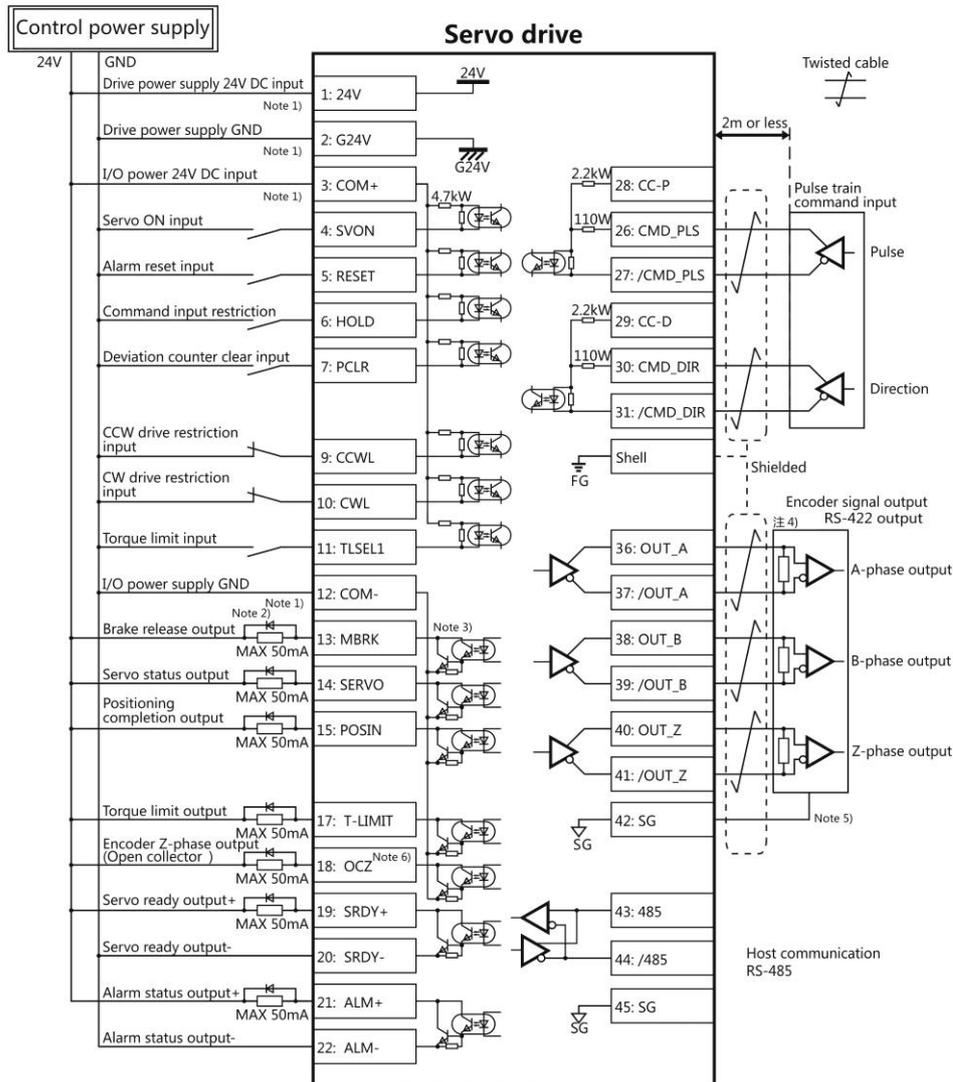
## 5.2 Position control mode (Pulse position command input)

### 5.2.1 Wiring for user I/O connector (CN1) (Differential input)

Name	Symbol	Terminal No.	Signal name	Contents
User I/O •24V power supply input •Parallel I/O •Pulse command input •ABZ output	CN1	1	24V	Drive control power supply 24V input
		2	G24V	Drive control power supply GND
		3	COM+	I/O power supply 24V input
		4	SVON	Servo ON input
		5	RESET	Alarm reset input
		6	HOLD	Command input restriction
		7	PCLR	Deviation counter clear input

		8	-	Reserved
		9	CCWL	CCW drive input restriction
		10	CWL	CW drive input restriction
		11	TLSEL1	Torque limit input
		12	COM-	I/O power supply GND
		13	MBRK	Brake release output
		14	SERVO	Servo status output
		15	POSIN	Position completion output
		16	-	Reserved
		17	T-LIMIT	Torque limit output
		18	OCZ	Encoder Z-phase output (open collector)
		19	SRDY+	Servo ready output +
		20	SRDY-	Servo ready output -
		21	ALM+	Servo alarm output+
		22	ALM-	Servo alarm output-
		23	NC1	Reserved (Disconnected)
		24	-	Reserved
		25	-	Reserved
		26	CMD_PLS	Pulse command, pulse, orthogonal phase difference A-phase, CCW
		27	/CMD_PLS	Pulse command, /pulse, orthogonal phase difference /A-phase, /CCW
		28	-	Reserved
		29	-	Reserved
		30	CMD_DIR	Pulse command, direction, orthogonal phase difference B-phase, CW
		31	/CMD_DIR	Pulse command, /direction, orthogonal phase difference /B-phase, /CW
		32	-	Reserved
		33	-	Reserved
		34	-	Reserved
		35	-	Reserved
		36	OUT_A	Encoder A phase output
		37	/OUT_A	Encoder /A phase output
		38	OUT_B	Encoder B phase output
		39	/OUT_B	Encoder /B phase output

		40	OUT_Z	Encoder Z phase output
		41	/OUT_Z	Encoder /Z phase output
		42	SG	Signal ground
		43	485	RS-485 communication data
		44	/485	RS-485 communication /data
		45	SG	Signal ground
		46	NC2	Reserved(Disconnected)
		47	-	Reserved
		48	-	Reserved
		49	-	Reserved
		50	-	Reserved



Note 1 ) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).

Note 2 ) If there is drive inductive load(relay), please use protective circuits(diode).

Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.

Note 4) Terminal resistance must be connected as shown in the wiring diagram.

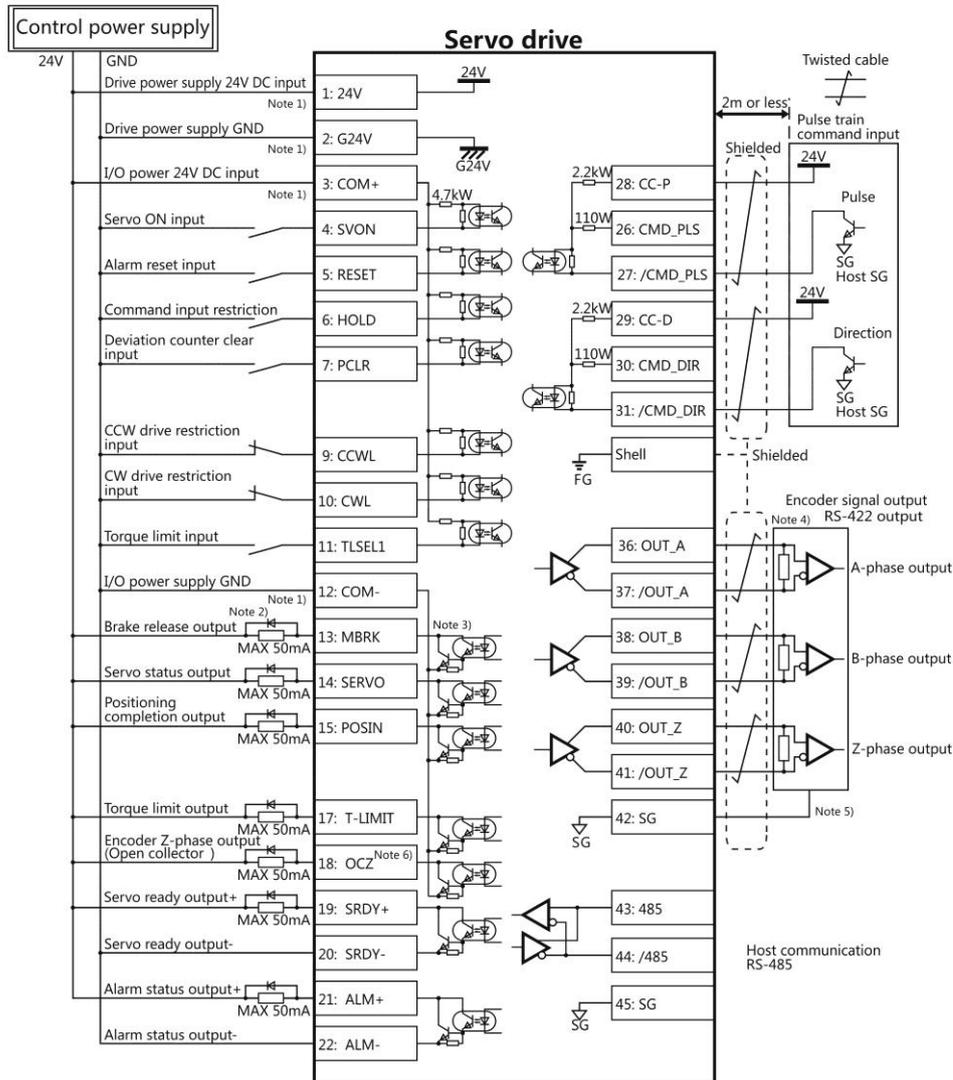
Note 5) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.

Note 6) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication×2<sup>17</sup>).

## 5.2.2 Pulse position command input (24V open collector input)

Name	Symbol	Terminal No.	Signal name	Contents
User I/O •24V power supply input •Parallel I/O •Pulse command input •ABZ output	CN1	1	24V	Drive control power supply 24V input
		2	G24V	Drive control power supply GND
		3	COM+	I/O power supply 24V input
		4	SVON	Servo ON input
		5	RESET	Alarm reset input
		6	HOLD	Command input restriction
		7	PCLR	Deviation counter clear input
		8	-	Reserved
		9	CCWL	CCW drive input restriction
		10	CWL	CW drive input restriction
		11	TLSEL1	Torque limit input
		12	COM-	I/O power supply GND
		13	MBRK	Brake release output
		14	SERVO	Servo status output
		15	POSIN	Position completion output
		16	-	Reserved
		17	T-LIMIT	Torque limit output
		18	OCZ	Encoder Z-phase output (open collector)
		19	SRDY+	Servo ready output +
		20	SRDY-	Servo ready output -
		21	ALM+	Servo alarm output+
		22	ALM-	Servo alarm output-
		23	NC1	Reserved (Disconnected)
		24	-	Reserved
		25	-	Reserved
		26	CMD_PLS	Reserved
		27	/CMD_PLS	Pulse command, pulse, orthogonal phase difference A-phase, CCW
		28	CC-P	24V for pulse command PSL
		29	CC-D	24V for pulse command DIR
		30	CMD_DIR	Reserved
		31	/CMD_DIR	Pulse command, direction, orthogonal phase difference B-phase, CW

		32	-	Reserved
		33	-	Reserved
		34	-	Reserved
		35	-	Reserved
		36	OUT_A	Encoder A phase output
		37	/OUT_A	Encoder /A phase output
		38	OUT_B	Encoder B phase output
		39	/OUT_B	Encoder /B phase output
		40	OUT_Z	Encoder Z phase output
		41	/OUT_Z	Encoder /Z phase output
		42	SG	Signal ground
		43	485	RS-485 communication data
		44	/485	RS-485 communication /data
		45	SG	Signal ground
		46	NC2	Reserved(Disconnected)
		47	-	Reserved
		48	-	Reserved
		49	-	Reserved
		50	-	Reserved



Note 1 ) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).

Note 2 ) If there is drive inductive load(relay), please use protective circuits(diode).

Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.

Note 4) Terminal resistance must be connected as shown in the wiring diagram.

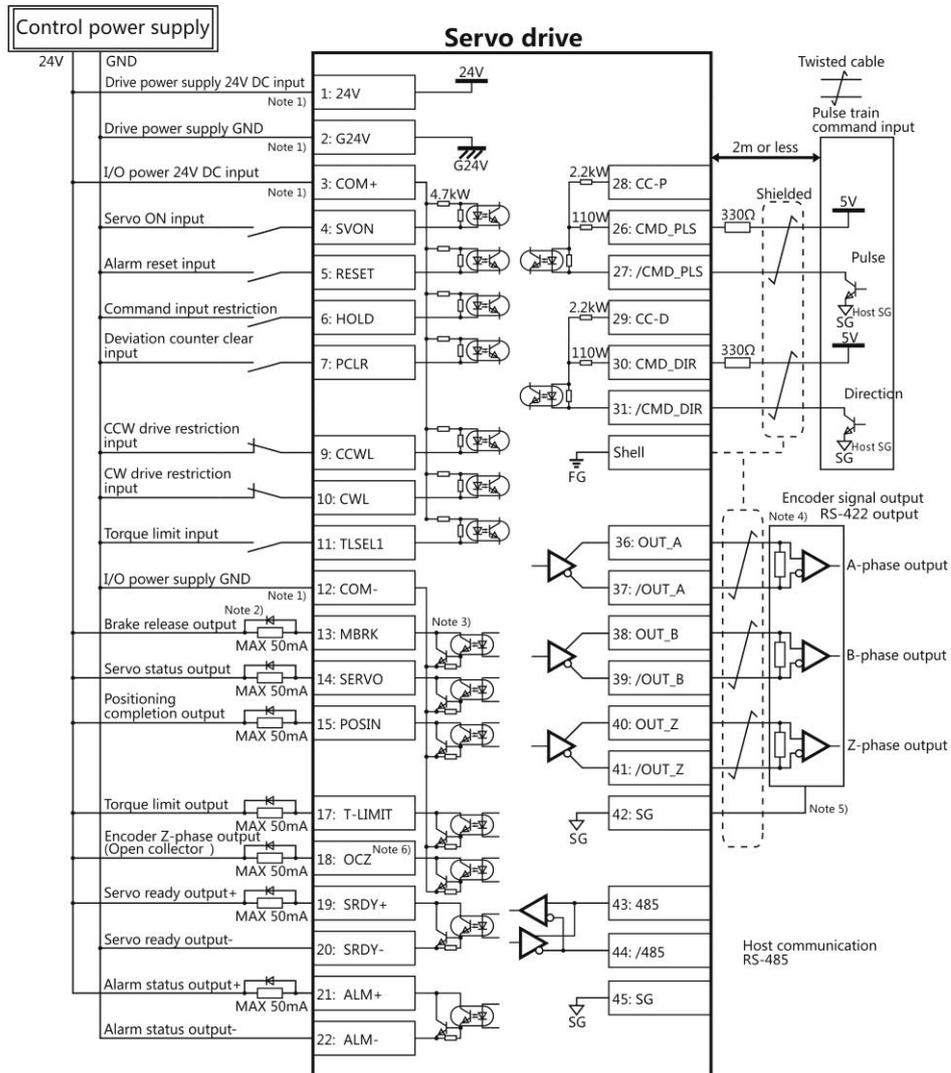
Note 5) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.

Note 6) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication $\times 2^{17}$ ).

## 5.2.3 Pulse position command input (5V open collector input)

Name	Symbol	Terminal No.	Signal name	Contents
User I/O •24V power supply input •Parallel I/O •Pulse command input •ABZ output	CN1	1	24V	Drive control power supply 24V input
		2	G24V	Drive control power supply GND
		3	COM+	I/O power supply 24V input
		4	SVON	Servo ON input
		5	RESET	Alarm reset input
		6	HOLD	Command input restriction
		7	PCLR	Deviation counter clear input
		8	-	Reserved
		9	CCWL	CCW drive input restriction
		10	CWL	CW drive input restriction
		11	TLSEL1	Torque limit input
		12	COM-	I/O power supply GND
		13	MBRK	Brake release output
		14	SERVO	Servo status output
		15	POSIN	Position completion output
		16	-	Reserved
		17	T-LIMIT	Torque limit output
		18	OCZ	Encoder Z-phase output (open collector)
		19	SRDY+	Servo ready output +
		20	SRDY-	Servo ready output -
		21	ALM+	Servo alarm output+
		22	ALM-	Servo alarm output-
		23	NC1	Reserved (Disconnected)
		24	-	Reserved
		25	-	Reserved
		26	CMD_PLS	5V for pulse command PLS
		27	/CMD_PLS	Pulse command, pulse, orthogonal phase difference A-phase, CCW
		28	CC-P	Reserved
		29	CC-D	Reserved
		30	CMD_DIR	5V for pulse command DIR
		31	/CMD_DIR	Pulse command, direction, orthogonal phase difference B-phase, CW

		32	-	Reserved
		33	-	Reserved
		34	-	Reserved
		35	-	Reserved
		36	OUT_A	Encoder A phase output
		37	/OUT_A	Encoder /A phase output
		38	OUT_B	Encoder B phase output
		39	/OUT_B	Encoder /B phase output
		40	OUT_Z	Encoder Z phase output
		41	/OUT_Z	Encoder /Z phase output
		42	SG	Signal ground
		43	485	RS-485 communication data
		44	/485	RS-485 communication /data
		45	SG	Signal ground
		46	NC2	Reserved(Disconnected)
		47	-	Reserved
		48	-	Reserved
		49	-	Reserved
		50	-	Reserved



Note 1 ) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).

Note 2 ) If there is drive inductive load(relay), please use protective circuits(diode).

Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.

Note 4) Terminal resistance must be connected as shown in the wiring diagram.

Note 5) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.

Note 6) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication×2<sup>17</sup>).

## 5.2.4 Setting of basic parameter (Pulse position command input)

The factory setting is 「Pulse position command input」. It is necessary to set the following parameters if the drive is driven by pulse position command input.

Table 5.2.4 Parameter of control mode (Pulse position command input)

Parameter No.	Parameter	Operation • Value
2.0	Control mode selection	Set to "0".
3.0	Command mode selection	Set to "1".
32.0	Pulse command input mode	Select one in the following (Note 1) "0": Pulse / direction "1": Orthogonal phase difference "2": CCW/CW
34.0	Command division and multiplication (Numerator)	Set to "32768"(Note 2)
36.0	Command division and multiplication (Denominator)	Set to "(The number of output pulse of host control mode)/4" (Note 2)

Note 1: Pulse command input list is shown in the following table.

Table 5.2.5 Pulse command input list

Parameter No.32.0 pulse command input mode	Input signal	Signal name	The minimum necessary time range (t1, t2, t3, t4, t5, t6)	
			CW	CCW
0 (Initial value)	Pulse • direction Command pulse	Pulse CMD_PLS Direction CMD_DIR		
1	AB-phase orthogonal phase pulse	A-phase CMD_PLS B-phase CMD-DIR		
2	CW pulse CCW pulse	CCW CMD-PLS CW CMD-DIR		

Note 2: Set when 1-rotation pulse (131,072) of host control device and drive is different. For details, refer to 「Chapter 4 Parameter list」.

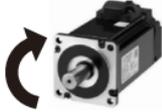
Set the following parameters according to the using status.

Table 5.2.6 Parameter for pulse train position command input

Parameter No.	Parameter	Description
32.1	Pulse train command input Rotation direction	For details, refer to 5.2.7.
32.3	Selection of Pulse train input logic	Select the logic of pulse train
33.0	Pulse train command - Input filter selection	Reduce the misoperation caused by input command pulse interference.
64.0	Positioning completion determination method	Specify the conditions of positioning completion.

68.0	Positioning completion range	
69.0	Positioning completion speed	
70.0	Positioning completion Pulse train command input (speed)	
71.0	Positioning completion Detection delay time	
66.0	Position command smoothing filter 1 selection	
66.1	Position command smoothing filter 2 selection	Set the damping filter. Suppress the resonance of device when the acceleration/ deceleration command is too high or positioning.
80.0	Position command smoothing filter 1 Moving average order	
81.0	Position command smoothing filter 2 Moving average order	

Table 5.2.7 The setting of parameter 32.1 and the rotation direction of motor (Pulse train position command input)

Value of parameter 32.1	Command pulse of host control device	
	CW	CCW
0	 CW	 CCW
1 [Initial value]	 CCW	 CW

### 5.2.5 Test run (Pulse train position command input)

#### ■ Before test run

Table 5.2.8

	Make sure all the wiring are connected properly before switch on the power to the drive and motor.	To prevent electric shock, fire, malfunction and injury.
	Test run after setting the basic parameters.	If set the wrong basic parameters, the motor will not run, run unsteadily or lose control, which may cause some injury or accidents.
	Confirm the operation of the motor alone first before test run. (Remove the other connection to the mechanics.)	The unexpected movements, such as unstable action or lose control, may cause some injury or accidents.
	Drive the motor after release the brake on the motor if the motor is attached with the brake.	If not, it may cause the malfunction to the brake and motor.

#### ■ Test run

Table 5.2.9 Steps for test run (Pulse train position command input)

Steps	Operation
1	Make sure all the wiring are connected properly.
2	Switch on the power to the drive. <sup>Note 1)</sup>
3	Switch on the main circuit power to the drive(200V AC).

4	Make the SVON input of drive ON to start the motor excitation. (Connect the I 1 terminal to the COM-)
5	Input position command pulse at a relatively low speed from host control device to make the motor run at a low speed(100r/min). Make sure the rotation direction of the motor is same to the setting direction.
6	Improve the position command pulse frequency gradually after confirming the safe implementation of actual operation. Then confirm the operation until it comes to the specified speed.

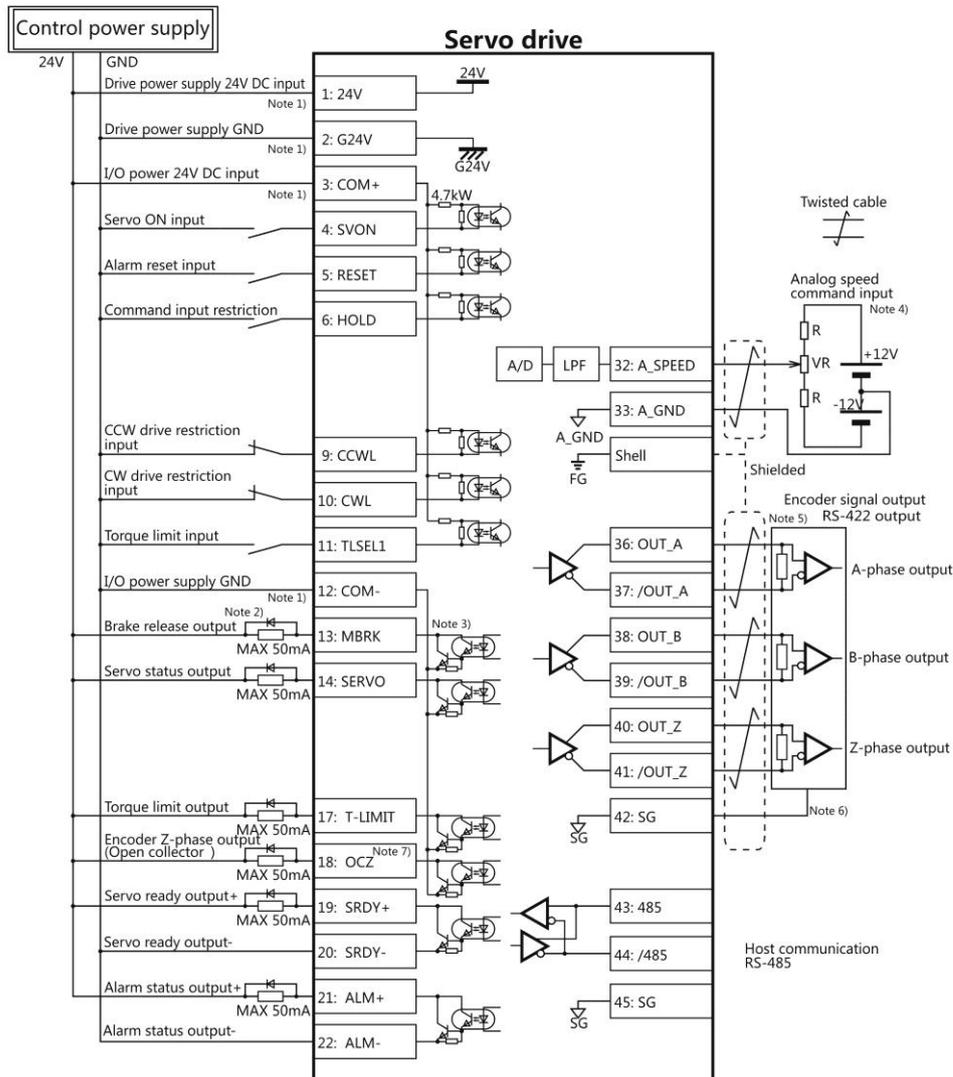
Note1: The control power supply for the models of 750W or less are supplied by external 24V DC. 1kW or more are supplied from internal. So the control power supply of models of 1kW or more can be ON or OFF by switching on or cutting off the main circuit AC power.

### 5.3 Speed control mode (Analog speed command input)

#### 5.3.1 Wiring for user I/O connector(CN1) (Analog speed command input)

Name	Symbol	Pin No.	Signal name	Contents
User I/O •24V power supply input •Parallel I/O •Pulse command input •ABZ output	CN1	1	24V	Drive control power supply 24V input
		2	G24V	Drive control power supply GND
		3	COM+	I/O power supply 24V input
		4	SVON	Servo ON input
		5	RESET	Alarm reset input
		6	HOLD	Command input restriction(Zero speed clamp)
		7	-	Reserved
		8	-	Reserved
		9	CCWL	CCW drive input restriction
		10	CWL	CW drive input restriction
		11	TLSEL1	Torque limit input
		12	COM-	I/O power supply GND
		13	MBRK	Brake release output
		14	SERVO	Servo status output
		15	-	Reserved
		16	-	Reserved
		17	T-LIMIT	Torque limit output
		18	OCZ	Encoder Z-phase output (open collector)
		19	SRDY+	Servo ready output +
		20	SRDY-	Servo ready output -
		21	ALM+	Servo alarm output+
		22	ALM-	Servo alarm output-
		23	NC1	Reserved (Disconnected)
		24	-	Reserved

		25	-	Reserved
		26	-	Reserved
		27	-	Reserved
		28	-	Reserved
		29	-	Reserved
		30	-	Reserved
		31	-	Reserved
		32	A SPEED	Analog speed command input
		33	A_GND	Analog speed command input ground
		34	-	Reserved
		35	-	Reserved
		36	OUT_A	Encoder A phase output
		37	/OUT_A	Encoder /A phase output
		38	OUT_B	Encoder B phase output
		39	/OUT_B	Encoder /B phase output
		40	OUT_Z	Encoder Z phase output
		41	/OUT_Z	Encoder /Z phase output
		42	SG	Signal ground
		43	485	EIA-485 communication data
		44	/485	EIA-485 communication /data
		45	SG	Signal ground
		46	NC2	Reserved(Disconnected)
		47	-	Reserved
		48	-	Reserved
		49	-	Reserved
		50	-	Reserved



Note 1 ) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).

Note 2 ) If there is drive inductive load(relay), please use protective circuits(diode).

Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.

Note 4) Terminal resistance must be connected as shown in the wiring diagram.

Note 5) Terminal resistance must be connected as shown in the wiring diagram.

Note 6) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.

Note 7) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication×2<sup>17</sup>)

### 5.3.2 Setting of basic parameters (Analog speed command input)

Set the basic parameters.

The following parameters must be set if the drive needs to be driven by analog speed command input.

Table 5.3.2 Parameter of control mode change(Analog speed command input)

Parameter No.	Parameter	Description
2.0	Select control mode.	Set to "1".
3.0	Select command mode.	Set to "2".

The parameters from [48. 0] to [78. 0] in the following table can be selected according to the actual usage.

Table 5.3.3 Parameter of analog speed command input

Parameter No.	Parameter	Description
48.0	Analog speed command input -Filter constant ( Numerator )	Filter out the input command voltage interference. Use it with parameter 62.1.
49.0	Analog speed command input -Filter constant (Denominator)	
50.0	Analog speed command input -Gain (Numerator)	Set the speed at the maximum command input voltage ( $\pm 10V$ ). (Note 1)
51.0	Analog speed command input -Gain (Denominator)	
52.0	Analog speed command CCW speed limit override value (Numerator)	Set speed limit value at CCW rotation.(Note 2)
53.0	Analog speed command CCW speed limit override value (Denominator)	
54.0	Analog speed command CW speed limit override value (Numerator)	Set speed limit value at CW rotation.(Note 2)
55.0	Analog speed command CW speed limit override value (Denominator)	
60.0	Analog speed command - Fixed offset value	The motor speed is 0[ r/mi n] by adjusting the command input to 0V. Use it with parameter 62.2.
62.0	Analog speed command - Rotational direction	For details, refer to table 5.3.4.
62.1	Analog speed command - Selection of input filter	Please use it with parameter 48.0 , 49.0.
62.2	Analog speed command - Selection of offset tuning method	Please use it with parameter 60.0.
77.0	Speed command smoothing filter selection	Please use it with parameter 78.0.
78.0	Moving average time for Speed command smoothing filter	Use it when the speed of motor is not stable. And use it with parameter 77.0.

Note 1: Set the maximum speed for the motor in parameter 51.0(Denominator). Set the expected maximum speed in parameter 50.0(Numerator).

Example) Make the following settings if the motor with the maximum speed of 5000 [r /mi n] needs to set to 3000 [r /mi n] at the maximum command input voltage ( $\pm 10V$ ).

Table 5.3.4 Analog speed command input Gain settings

Parameter No.	Parameter	Setting value
50.0	Analog speed command input -Gain (Numerator)	"3000"
51.0	Analog speed command input -Gain (Denominator)	"5000"

Note 2: Set the maximum speed for the motor in parameter 53.0, 55.0(Denominator). Set the expected speed limit value in parameter 52.0, 54.0(Numerator).

Example) Make the following settings if the motor with the maximum speed of 5000 [r /mi n] needs to set to the maximum speed limit value of 3000 [r /mi n].

Table 5.3.5 Analog speed command Speed limit value settings

Rotation direction	Parameter No.	Parameter	Setting value
CCW	52.0	Analog speed command CCW speed limit value(Numerator)	"3000"
	53.0	Analog speed command CCW speed limit value(Denominator)	"5000"
CW	54.0	Analog speed command CW speed limit value(Numerator)	"3000"
	55.0	Analog speed command CW speed limit value(Denominator)	"5000"

Table 5.3.6 Parameter 62.0 settings and rotation direction of the motor (Analog speed command input)

Value of parameter 62.0	Input analog command	
	Positive voltage	Negative voltage
0	 CW	 CCW
1 [Initial value]	 CCW	 CW

### 5.3.3 Test run (Analog speed command input)

#### ■ Before test run

Table 5.3.7

	Make sure all the wiring are connected properly before switch on the power to the drive and motor.	To prevent electric shock, fire, malfunction and injury.
	Test run after setting the basic parameters.	If set the wrong basic parameters, the motor will not run, run unsteadily or lose control, which may cause some injury or accidents.
	Confirm the operation of the motor alone first before test run. (Remove the other connection to the mechanics.)	The unexpected movements, such as unstable action or lose control, may cause some injury or accidents.
	Drive the motor after release the brake on the motor if the motor is attached with the brake.	If not, it may cause the malfunction to the brake and motor.

#### ■ Test run

Table 5.3.8 Steps for test run (Analog speed command input)

Steps	Operation
1	Make sure all the wiring are connected properly.
2	Switch on the power to the drive. <sup>Note 1)</sup>
3	Switch on the main circuit power to the drive(200V AC).

4	Connect SVON terminal of CN1 connector to COM- to make the servo ON.
5	Input the analog speed command voltage at a low voltage to make the motor run at a low speed.
6	Improve the position command pulse frequency gradually after confirming the safe implementation of actual operation. Then confirm the operation until it comes to the specified speed.

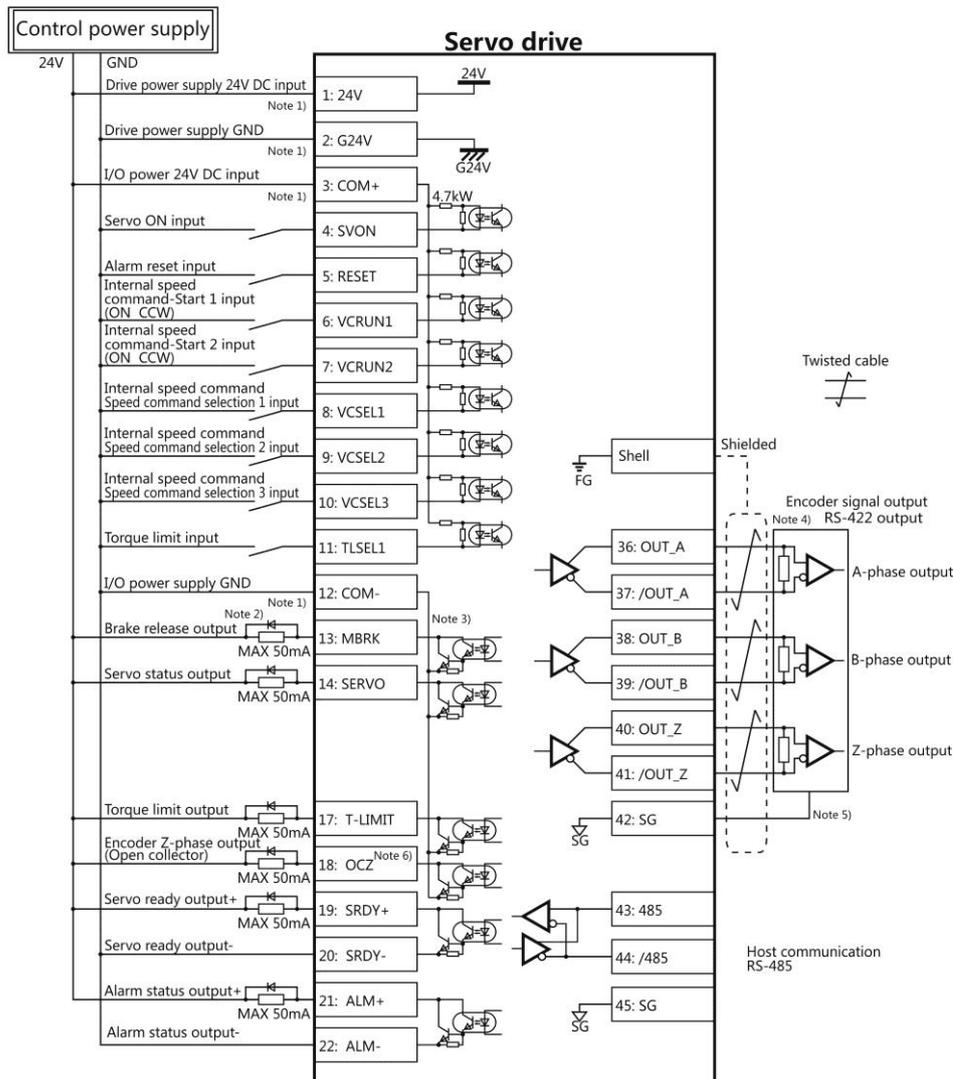
Note1: The control power supply for the models of 750W or less are supplied by external 24V DC. 1kW or more are supplied from internal. So the control power supply of models of 1kW or more can be ON or OFF by switching on or cutting off the main circuit AC power.

## 5.4 Speed control mode (Internal speed command)

### 5.4.1 Wiring for user I/O connector(CN1) (Internal speed command)

Name	Symbol	Pin No.	Signal name	Contents
User I/O •24V power supply input •Parallel I/O •Pulse command input •Analog input •ABZ output	CN1	1	24V	Drive control power supply 24V input
		2	G24V	Drive control power supply GND
		3	COM+	I/O power supply 24V input
		4	SVON	Servo ON input
		5	RESET	Alarm reset input
		6	VCRUN1	Input internal speed command-start 1(CCW ON)
		7	VCRUN2	Input internal speed command-start 1(CW ON)
		8	VCSEL1	Input internal speed command-Speed command selection 1
		9	VCSEL2	Input internal speed command-Speed command selection 2
		10	VCSEL3	Input internal speed command-Speed command selection 3
		11	TLSEL1	Torque limit input
		12	COM-	I/O power supply GND
		13	MBRK	Brake release output
		14	SERVO	Servo status output
		15	-	Reserved
		16	-	Reserved
		17	T-LIMIT	Torque limit output
		18	OCZ	Encoder Z-phase output (open collector)
		19	SRDY+	Servo ready output +
		20	SRDY-	Servo ready output -
		21	ALM+	Servo alarm output+
		22	ALM-	Servo alarm output-

		23	NC1	Reserved (Disconnected)
		24	-	Reserved
		25	-	Reserved
		26	-	Reserved
		27	-	Reserved
		28	-	Reserved
		29	-	Reserved
		30	-	Reserved
		31	-	Reserved
		32	-	Reserved
		33	-	Reserved
		34	-	Reserved
		35	-	Reserved
		36	OUT_A	Encoder A phase output
		37	/OUT_A	Encoder /A phase output
		38	OUT_B	Encoder B phase output
		39	/OUT_B	Encoder /B phase output
		40	OUT_Z	Encoder Z phase output
		41	/OUT_Z	Encoder /Z phase output
		42	SG	Signal ground
		43	485	EIA-485 communication data
		44	/485	EIA-485 communication /data
		45	SG	Signal ground
		46	NC2	Reserved(Disconnected)
		47	-	Reserved
		48	-	Reserved
		49	-	Reserved
		50	-	Reserved



Note 1 ) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).

Note 2 ) If there is drive inductive load(relay), please use protective circuits(diode).

Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.

Note 4) Terminal resistance must be connected as shown in the wiring diagram.

Note 5) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.

Note 6) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication $\times 2^{17}$ )

## 5.4.2 Setting of basic parameters (Internal speed command)

Set the basic parameters.

The following parameters must be set if the drive needs to be driven by internal speed command.

Table 5.4.2 Parameters of control mode change (Internal speed command)

Parameter No.	Parameter	Description
2.0	Select control mode	Set to "1".
3.0	Select command mode	Set to "3".
388.0	Type of internal speed command	Set to "1".

Table 5.4.3 Speed parameter of internal speed command

Parameter No.	Parameter	Description
390.0	Acceleration time (Note 1)	Initial value: 1000 [ms]
391.0	Deceleration time (Note 2)	Initial value: 1000 [ms]
392.0	Target speed 1	Initial value: 500 [r/mi n]
393.0	Target speed 2	Initial value: 1000 [r/mi n]
394.0	Target speed 3	Initial value: 1500 [r/mi n]
395.0	Target speed 4	Initial value: 2000 [r/mi n]
396.0	Target speed 5	Initial value: 2500 [r/mi n]
397.0	Target speed 6	Initial value: 3000 [r/mi n]
398.0	Target speed 7	Initial value: 4000 [r/mi n]
399.0	Target speed 8	Initial value: 5000 [r/mi n]

Note 1) Time for speed command from 0 [r /mi n] to 1000 [r /mi n].

Note 2) Time for speed command from 1000 [r /mi n] to 0 [r /mi n].



Points

The speed setting parameter from [392.0] to [399.0] can be set in the specified range, but some models cannot reach the speed shown on the setting pane. For the target speed setting, please refer to the specification of the motor.

## 5.4.3 Test run (Internal speed command)

### ■ Before test run

Table 5.4.4

	Make sure all the wiring are connected properly before switch on the power to the drive and motor.	To prevent electric shock, fire, malfunction and injury.
	Test run after setting the basic parameters.	If set the wrong basic parameters, the motor will not run, run unsteadily or lose control, which may cause some injury or accidents.
	Confirm the operation of the motor alone first before test run. (Remove the other connection to the mechanics.)	The unexpected movements, such as unstable action or lose control, may cause some injury or accidents.
	Drive the motor after release the brake on the motor if the motor is attached with the brake.	If not, it may cause the malfunction to the brake and motor.

## ■ Test run

Table 5.4.5 Steps for test run (Internal speed command)

Steps	Operation
1	Make sure all the wiring are connected properly.
2	Switch on the power to the drive. <sup>Note 1)</sup>
3	Switch on the main circuit power to the drive(200V AC).
4	Make the SVON input of drive ON to start the motor excitation. (Connect the I 1 terminal to the COM-)
5	Select the target speed according to the ON/OFF combination of I 5 (VCSEL1) ,I 6 (VCSEL2) and I 7 (VCSEL3) . When I 3 (VCRUN1) or I 4 (VCRUN2) , it will rotate according to the setting direction. ON: COM- short-circuit OFF: COM- open-circuit

Note1: The control power supply for the models of 750W or less are supplied by external 24V DC. 1kW or more are supplied from internal. So the control power supply of models of 1kW or more can be ON or OFF by switching on or cutting off the main circuit AC power.

Table 5.4.6 Motor rotation direction of internal speed command

Motor rotation direction	Operation	
	(I 3) VCRUN1	(I 4) VCRUN2
CCW	ON	OFF
CW	OFF	ON
Motor stop	OFF	OFF
Motor stop	ON	ON

Table 5.4.7 Motor rotation of internal speed command

Target speed	Operation		
	I 5 (VCSEL1) (CN1 8 pins)	I 6 (VCSEL2) (CN1 9 pins)	I 7 (VCSEL3) (CN1 10 pins)
1	OFF	OFF	OFF
2	ON	OFF	OFF
3	OFF	ON	OFF
4	ON	ON	OFF
5	OFF	OFF	ON
6	ON	OFF	ON
7	OFF	ON	ON
8	ON	ON	ON

## 5.5 Torque control mode (Analog torque command input)

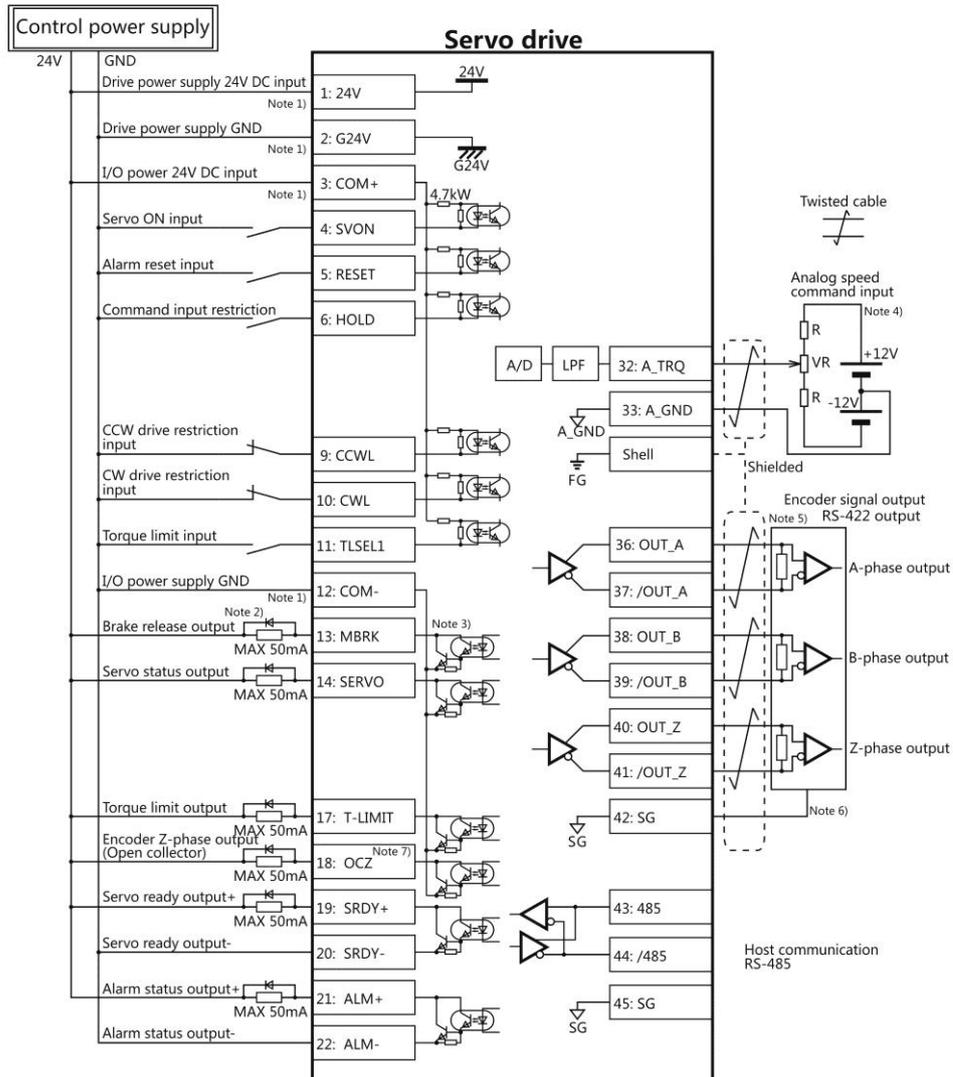
### 5.5.1 Wiring for user I/O connector (CN1)(Analog torque command input)

Table 5.5.1

Name	Symbol	Pin No.	Signal name	Contents
------	--------	---------	-------------	----------

User I/O <ul style="list-style-type: none"> <li>•24V power supply input</li> <li>•Parallel I/O</li> <li>•Pulse command input</li> <li>•Analog input</li> <li>•ABZ output</li> </ul>	CN1	1	24V	Drive control power supply 24V input
		2	G24V	Drive control power supply GND
		3	COM+	I/O power supply 24V input
		4	SVON	Servo ON input
		5	RESET	Alarm reset input
		6	HOLD	Command input restriction(Zero speed clamp)
		7	-	Reserved
		8	-	Reserved
		9	CCWL	CCW drive input restriction
		10	CWL	CW drive input restriction
		11	TLSEL1	Torque limit input
		12	COM-	I/O power supply GND
		13	MBRK	Brake release output
		14	SERVO	Servo status output
		15	-	Reserved
		16	-	Reserved
		17	T-LIMIT	Torque limit output
		18	OCZ	Encoder Z-phase output (open collector)
		19	SRDY+	Servo ready output +
		20	SRDY-	Servo ready output -
		21	ALM+	Servo alarm output+
		22	ALM-	Servo alarm output-
		23	NC1	Reserved (Disconnected)
		24	-	Reserved
		25	-	Reserved
		26	-	Reserved
		27	-	Reserved
		28	-	Reserved
		29	-	Reserved
		30	-	Reserved
		31	-	Reserved
		32	A_TRQ	Analog torque command input
		33	A_GND	Analog speed command input ground
		34	-	Reserved
		35	-	Reserved
		36	OUT_A	Encoder A phase output

	37	/OUT_A	Encoder /A phase output
	38	OUT_B	Encoder B phase output
	39	/OUT_B	Encoder /B phase output
	40	OUT_Z	Encoder Z phase output
	41	/OUT_Z	Encoder /Z phase output
	42	SG	Signal ground
	43	485	EIA-485 communication data
	44	/485	EIA-485 communication /data
	45	SG	Signal ground
	46	NC2	Reserved(Disconnected)
	47	-	Reserved
	48	-	Reserved
	49	-	Reserved
	50	-	Reserved



Note 1 ) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).

Note 2 ) If there is drive inductive load(relay), please use protective circuits(diode).

Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.

Note 4) Terminal resistance must be connected as shown in the wiring diagram.

Note 5) Terminal resistance must be connected as shown in the wiring diagram.

Note 6) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.

Note 7) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication $\times 2^{17}$ )

## 5.5.2 Setting of basic parameter (Analog torque command input)

Set the basic parameters.

The following parameters must be set if the drive needs to be driven by analog torque command input.

Table 5.5.2 Parameters of control mode change (Analog torque command input)

Parameter No.	Parameter	Description
2.0	Select control mode	Set to "2".
3.0	Select command mode	Set to "2".

The user can select the parameter [152.0], [288.0] to [302.0] in the following table according to the actual usage.

For details, refer to 「Chapter 4 Parameter」.

Parameter No.	Parameter	Description
152.0	Analog torque command Speed limit [rpm]	Set the speed limit value.
288.0	Analog torque command input filter (Numerator)	Filter out the input command voltage interference. Use it with parameter 302.1.
289.0	Analog torque command input filter (Denominator)	
290.0	Analog torque command input gain (Numerator)	Set the torque at the maximum command input voltage ( $\pm 10V$ ). (Note 1)
291.0	Analog torque command input gain (Denominator)	
292.0	Analog torque command CCW torque limit Override (Numerator)	Set torque limit value at CCW rotation.(Note 2)
293.0	Analog torque command CCW torque limit Override(Denominator)	
294.0	Analog torque command CW torque limit Override (Numerator)	Set torque limit value at CW rotation.(Note 2)
295.0	Analog torque command CW torque limit Override(Denominator)	
300.0	Analog speed command - Fixed offset value	The motor speed is 0[ 0.1%] by adjusting the command input to 0V. Use it with parameter 302.2..
302.0	Analog speed command - Rotational direction	For details, refer to table 5.5.6.
302.1	Analog speed command - Selection of input filter	Please use it with parameter 288.0, 289.0.
302.2	Analog speed command - Selection of offset tuning method	Please use it with parameter 300.0.

Note 1: Set the maximum torque for the motor in parameter 289.0(Denominator). Set the expected maximum torque in parameter 288.0(Numerator).

Example) Make the following settings if the motor with the maximum torque of 3000 [0.1%] needs to set to 1000 [0.1%] at the maximum command input voltage ( $\pm 10V$ ).

Table 5.5.4 Analog torque command input filter settings

Parameter No.	Parameter	Setting value
288.0	Analog torque command Input filter constant (Numerator)	"1000"
51.0	Analog torque command Input filter constant (Denominator)	"3000"

Note 2: Set the maximum torque for the motor in parameter 293.0, 295.0(Denominator). Set the expected torque limit value in parameter 292.0, 294.0(Numerator).

Example) Make the following settings if the motor with the maximum torque of 3000 [0.1%] needs to set to the maximum

speed limit value of 1000 [0.1%].

Table 5.5.5 Analog torque command input Torque limit value settings

Rotation direction	Parameter No.	Parameter	Setting value
CCW	292.0	Analog torque command CCW torque limit value(Numerator)	"1000"
	293.0	Analog torque command CCW torque limit value (Denominator)	"3000"
CW	294.0	Analog torque command CW torque limit value (Numerator)	"1000"
	295.0	Analog torque command CW torque limit value (Denominator)	"3000"

Table 5.5.6 Parameter 302.0 settings and rotation direction of the motor (Analog torque command input)

Value of parameter 62.0	Input analog command	
	Positive voltage	Negative voltage
0	 CW	 CCW
1 [Initial value]	 CCW	 CW

### 5.5.3 Test run (Analog torque command input)

#### ■ Before test run

Table 5.5.7

	Make sure all the wiring are connected properly before switch on the power to the drive and motor.	To prevent electric shock, fire, malfunction and injury.
	Test run after setting the basic parameters.	If set the wrong basic parameters, the motor will not run, run unsteadily or lose control, which may cause some injury or accidents.
	Confirm the operation of the motor alone first before test run. (Remove the other connection to the mechanics.)	The unexpected movements, such as unstable action or lose control, may cause some injury or accidents.
	Drive the motor after release the brake on the motor if the motor is attached with the brake.	If not, it may cause the malfunction to the brake and motor.

#### ■ Test run

Table 5.5.8 Steps for test run (Analog torque command input)

Steps	Operation
1	Make sure all the wiring are connected properly.
2	Switch on the power to the drive. <sup>Note 1)</sup>
3	Switch on the main circuit power to the drive(200V AC).
4	Set a smaller value about 500 in parameter 152.0(speed limit value) to limit the speed.

5	Make the SVON input of drive ON to start the motor excitation. (Connect the I 1 terminal to the COM-)
6	Input the analog torque command voltage at a low voltage to make the motor run at a low speed.
7	Improve the analog torque command voltage gradually after confirming the safe implementation of actual operation. Set the actual value in parameter 152.0(speed limit value).

Note1: The control power supply for the models of 750W or less are supplied by external 24V DC. 1kW or more are supplied from internal. So the control power supply of models of 1kW or more can be ON or OFF by switching on or cutting off the main circuit AC power.

## 5.6 Position control mode(Internal position command)

Set the following parameter of control mode selection and command mode selection to come into the internal position command mode. Use the locator to test run.

Table 5.6.1 Parameter of control mode change(Internal position command)

Parameter No.	Parameter	Description
2.0	Select control mode	Set to "0".
3.0	Select command mode	Set to "3".

### 5.6.1 Locator function

Execute the positioning according to the I/O command from the host control device, such as PLC. Set the Point Table in HCX-SETUP and have the test run of locator function in HCX-SETUP.

### 5.6.2 Test run

Send the command from PC according to the steps, not the command from host control device(such as PLC), and have the test run, such as back and forth movement.

Use HCX-SETUP to have the test run.

For details, refer to 「HCX-SETUP User's Manual」.

### 5.6.3 Precautions

1) Alarm code No.10 「Position command overflow/ Home position reset failure」 will happen in the following two conditions.

1. Out of the range of -1, 073, 741, 823~+1, 073, 741, 823 「Command unit」
2. 「Internal position command - Overflow detection option」 (Parameter No.643.0) is set to "1=Enable"

Considering the above factors, please set 「Internal position command - Overflow detection option」 (Parameter No.643.0) according to the following table.

Table 5.6.2 Parameter setting of internal position command mode

Operation method(Function)		Internal position command - Overflow detection option (Parameter No.643.0)	
	Command		
Positioning function	Absolute value	0=Disable <sup>Note 1)</sup>	1=Enable
	Relative value	0=Disable	
Test run			

Note 1) The home position in the drive may disappear sometimes. Please reset the home position after parameter setting.

2) Please set 「Selection of Auto interpolation for command division and multiplication」 (Parameter No.32.2) to "1=Enable".

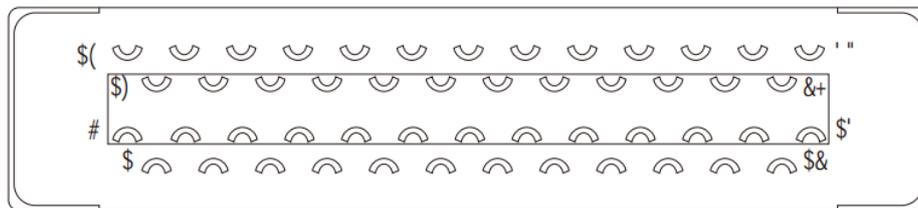
Initial value is "1=Enable". When "0=Disable" is set, the speed change will become large.

## 5.7 Description of User I/O connector (CN1) terminal arrangements

Figure 5.7.1 Terminal arrangements

26 CMD_PLS	28 CC-P	30 CMD_DIR	32 A_SPEED	34 A_TRQ	36 OUT_A	38 OUT_B	40 OUT_Z	42 SG	44 /485	46 G24	48 SP4	50 EDM-
27 /CMD_PLS	29 CC-D	31 /CMD_DIR	33 A_GND	35 A_GND	37 OUT_A	39 OUT_B	41 OUT_Z	43 485	45 SG	47 SP3	49 EDM+	
1 VCC	3 COM1	5 I2(RESET)	7 I4(PCLR)	9 I6(CCWL)	11 I8(TLSEL1)	13 O1(MBRK)	15 O3(POSIN)	17 O5	19 O7+(SRDY+)	21 O8+(ALM+)	23 VCC	25 SP2
2 G24	4 I1(SVON)	6 I3(HOLD)	8 I5	10 I7(CWL)	12 COM2	14 O2(SERVO)	16 O4	18 O6(OCZ)	20 O7-(SRDY-)	22 O8-(ALM-)	24 Sp1	

Figure 5.7.2 Connector



### 5.7.1 Signal description

Signal name	Pin No.	Contents	Function												
24V	1	Drive control power supply 24V input	<ul style="list-style-type: none"> <li>Connect with +24V of 24VDC external power supply</li> <li>The power supply voltage is 24VDC±10%、100mA ( Typ. )</li> <li>24VDC external power supply should meet the following condition: Using SELV power supply(※).</li> <li>※SELV: safety extra low voltage</li> <li>(Reinforced insulation is needed for safety extra low voltage, non-dangerous voltage and dangerous voltage.)</li> </ul>												
G24V	2	Drive control power supply GND	<ul style="list-style-type: none"> <li>Connect to GND of 24VDC external power supply</li> </ul>												
COM+	3	I/O power supply 24V input	<ul style="list-style-type: none"> <li>Connect the common terminal of 24VDC power supply used for I/O and optical coupler circuit used</li> <li>Power voltage: 24VDC±10%、100mA ( Typ. )</li> </ul>												
I1	4	I1 input	<ul style="list-style-type: none"> <li>Parallel I/O input</li> <li>The function varies according to the different control mode/ command mode. For details, refer to 「Table 5.7.2 I/O input signal 」</li> </ul> <table border="1" style="width: 100%; text-align: center;"> <tr> <td>Control mode</td> <td colspan="2">Position control</td> <td colspan="2">Speed control</td> <td>Torque control</td> </tr> <tr> <td>Command mode</td> <td>Pulse train command</td> <td>Internal regeneration command</td> <td>Analog command</td> <td>Internal regeneration command</td> <td>Analog command</td> </tr> </table>	Control mode	Position control		Speed control		Torque control	Command mode	Pulse train command	Internal regeneration command	Analog command	Internal regeneration command	Analog command
Control mode	Position control			Speed control		Torque control									
Command mode	Pulse train command	Internal regeneration command		Analog command	Internal regeneration command	Analog command									
I2	5	I2 input													
I3	6	I3 input													
I4	7	I4 input													
I5	8	I5 input													
I6	9	I6 input													
I7	10	I7 input													
I8	11	I8 input													

			<table border="1"> <tr> <td>I1</td> <td colspan="5">SVON</td> </tr> <tr> <td>I2</td> <td>RESET</td> <td>RESET/PCLR</td> <td>RESET</td> <td>RESET</td> <td>RESET</td> </tr> <tr> <td>I3</td> <td>HOLD</td> <td>PCSTART1</td> <td>HOLD</td> <td>VCRUIN1</td> <td>HOLD</td> </tr> <tr> <td>I4</td> <td>PCLR</td> <td>PCSEL1</td> <td>(Reserved)</td> <td>VCRUIN2</td> <td>(Reserved)</td> </tr> <tr> <td>I5</td> <td>(Reserved)</td> <td>PCSEL2</td> <td>(Reserved)</td> <td>VCS L1</td> <td>(Reserved)</td> </tr> <tr> <td>I6</td> <td>CCW</td> <td>PC EL3</td> <td>CCWL</td> <td>VCSEL2</td> <td>CCWL</td> </tr> <tr> <td>I7</td> <td>CWL</td> <td>PCSEL4</td> <td>CWL</td> <td>VCSEL3</td> <td>CWL</td> </tr> <tr> <td>I8</td> <td>TLSEL1</td> <td>ORG</td> <td>TLSEL1</td> <td>TLSEL1</td> <td>TLSEL1</td> </tr> </table>						I1	SVON					I2	RESET	RESET/PCLR	RESET	RESET	RESET	I3	HOLD	PCSTART1	HOLD	VCRUIN1	HOLD	I4	PCLR	PCSEL1	(Reserved)	VCRUIN2	(Reserved)	I5	(Reserved)	PCSEL2	(Reserved)	VCS L1	(Reserved)	I6	CCW	PC EL3	CCWL	VCSEL2	CCWL	I7	CWL	PCSEL4	CWL	VCSEL3	CWL	I8	TLSEL1	ORG	TLSEL1	TLSEL1	TLSEL1
I1	SVON																																																							
I2	RESET	RESET/PCLR	RESET	RESET	RESET																																																			
I3	HOLD	PCSTART1	HOLD	VCRUIN1	HOLD																																																			
I4	PCLR	PCSEL1	(Reserved)	VCRUIN2	(Reserved)																																																			
I5	(Reserved)	PCSEL2	(Reserved)	VCS L1	(Reserved)																																																			
I6	CCW	PC EL3	CCWL	VCSEL2	CCWL																																																			
I7	CWL	PCSEL4	CWL	VCSEL3	CWL																																																			
I8	TLSEL1	ORG	TLSEL1	TLSEL1	TLSEL1																																																			
COM-	12	I/O power supply GND	●Connected with GND of 24VDC power supply used for I/O																																																					
CMD_ PLS	26	[Differential input] ①Pulse + direction pulse ②Orthogonal phase difference pulse-A ③CCW+CW Pulse CCW [5V open collector circuit] ④5V power supply of input /CMD PLS	[Differential input] Max. command pulse frequency 4Mpps ①Input pulse + direction pulse from host control device (differential input) ②Input A phase of AB phase orthogonal difference pulse signal from host control device (differential input) ③Input CCW+CCW of CW pulse from host control device (differential input) [5V open collector circuit] Max. command pulse frequency 200kpps ④5V power supply input terminal of /CMD_ PLS																																																					
/CMD_ PLS	27	[Differential input] ①Pulse + direction/ pulse ②Orthogonal phase difference pulse /A phase ③CCW+CW Pulse /CCW [5v/24v open collector circuit] ④Pulse + direction pulse ⑤Orthogonal phase difference pulse /A phase ⑥CCW+CW pulse CCW	[Differential input] Max. command pulse frequency 4Mpps ①Input pulse + direction/ pulse from host control device (differential input) ②Input /A phase of AB phase orthogonal difference pulse signal from host control device (differential input) ③Input CCW +/CCW of CW from upper control device (differential input) [5V open collector circuit] Max. command pulse frequency 200kpps ④Input pulse + pulse of direction from host control device ⑤Input A phase of AB phase orthogonal difference pulse signal from host control device ⑥Input CCW +CCW of CW pulse from host control device																																																					
CC-P	28	[24V open collector circuit input] ①24V of /CMD_PLS	[24V open collector circuit] Max. command pulse frequency 200kpps ①24V power supply input terminal of /CMD_PLS																																																					
CC-D	29	[24V open collector circuit input] ①24V of /CMD_DIR	[24V open collector circuit] Max. command pulse frequency 200kpps ①24V power supply input terminal of /CMD_DIR																																																					
CMD_ DIR	30	[Differential input] ①Pulse + direction direction ②Orthogonal phase difference B phase	【Differential input】 Max. command pulse frequency 4Mpps ①Input pulse + direction direction from host control device(differential input) ②Input B phase of AB phase orthogonal phase difference pulse signal from host control device(differential input)																																																					

		③CCW+CW pulse CW [5V open collector circuit] ④5V power supply input of /CMD_DIR	③Input CCW+CW of CW pulse from host control device (differential input) [5V open collector circuit] Max. command pulse frequency 200kpps ④5V power supply input terminal of /CMD_DIR.
/CMD_DIR	31	[Differential input] ①Pulse + direction /direction ②Orthogonal phase difference /B phase ③CCW+CW pulse /CW [5V/24V open collector circuit] ④Pulse + direction direction ⑤Orthogonal phase difference B phase ⑥CCW+CW pulse CW	【Differential input】 Max. command pulse frequency 4Mpps ①Input pulse + direction /direction from host control device(differential input) ②Input /B phase of AB phase orthogonal phase difference pulse signal from host control device(differential input) ③Input CCW+CW pulse /CW from host control device (differential input) [5V/24V open collector circuit] Max. command pulse frequency 200kpps ④Input pulse+ direction of direction from host control device ⑤Input B phase of AB phase orthogonal difference pulse signal from host control device ⑥Input CCW+CW of CW pulse from host control device
A_SPE ED/ A_TR Q	32	Analog speed command input/ Analog torque command input+	●Input speed or torque command in the voltage from -10V to 10V.
A_GN D	33	Signal ground Analog speed command input - / Signal ground Analog torque command input - /	●Connect the signal ground of analog speed input or analog torque input in the servo drive.
SG	42	Signal ground	●Signal ground of ABZ phase output of position feedback
485	43	485 of RS-485 communication	●485 data (+) signal of RS-485 communication with host control device
/485	44	/485 of RS-485 communication	●/485 data (+) signal of RS-485 communication with host control device
SG	45	Signal ground	●Signal ground of RS-485 communication with host control device

Table 5.7.2 I/O input signal

Signal name	Contents	Function	Control mode		
			P	S	T
SVON	Servo ON	●Servo is ON when connecting COM-.	○	○	○
RESET	Alarm reset	●Reset alarms when connecting to COM-.	○	○	○

		<ul style="list-style-type: none"> <li>•But if alarm occurs in encoder, model No. and system, this signal cannot be used to reset, and drive control power supply must be restarted(OFF→ON).</li> </ul>			
HOLD	Command input restriction	<ul style="list-style-type: none"> <li>•When COM- connected, command input is restricted.</li> <li>•If not connected, command input are permitted.</li> <li>•Even if pulse is input, the motor cannot operate until the host control device allows command input.</li> <li>•When 「Command input prohibited」, whether to clear pulse counter can be set by parameter No.67.3(the selection of position deviation counter in drive input)</li> <li>•When the speed command value is 0 in speed control mode, the motor will not operate.</li> </ul>	△	△	○
PCLR	Deviation counter clear	<ul style="list-style-type: none"> <li>•When COM- connected, position deviation counter will be cleared.</li> </ul>	△	-	-
CCWL	CCW drive restriction	<ul style="list-style-type: none"> <li>•If COM- disconnected, CCW direction drive is prohibited.</li> <li>•If the value is beyond the CCW direction movement range, please make the wiring which can be disconnected with COM-.</li> <li>•It is effective when 「2: Enable CCW-drive restriction」 or 「3: Enable CW/CCW-drive restriction」 is selected in parameter No.67.0 「Selection of Drive restriction options」. Initial value: 「0: Disable」</li> <li>•The deceleration can be selected in parameter No.67.1 「Deceleration method selection when Drive restriction is enabled」. Initial value: 「1: Short brake」.</li> <li>•After-stop state can be selected in parameter No.67.2 「Selection for Stop condition when Drive restriction is enabled」. Initial value: 「0: Free-run」</li> <li>•Parameter No.67.3 「Selection for Location deviation counter option when Drive restriction is enabled」 can be set to hold the position deviation counter. Initial value: 「0: Keep」</li> </ul>	△	△	○
CWL	CW drive restriction	<ul style="list-style-type: none"> <li>•If COM- disconnected, CW direction drive is prohibited.</li> <li>•If the value is beyond the CW direction movement range, please make the wiring which can be disconnected with COM-.</li> <li>•It is effective when 「2: Enable CW-drive restriction」 or 「3: Enable CW/CCW-drive restriction」 is selected in parameter No.67.0 「Selection of Drive restriction options」. Initial value: 「0: Disable」</li> <li>•The deceleration can be selected in parameter No.67.1 「Deceleration method selection when Drive restriction is enabled」. Initial value: 「1: Short brake」.</li> <li>•After-stop state can be selected in parameter No.67.2 「Selection for Stop condition when Drive restriction is enabled」. Initial value: 「0: Free-run」</li> <li>•Parameter No.67.3 「Selection for Location deviation counter option when Drive restriction is enabled」 can be set to hold the position deviation counter. Initial value: 「0: Keep」</li> </ul>	△	△	○
TLSEL1	Torque limit	<ul style="list-style-type: none"> <li>•Torque limit switch.</li> <li>•It is effective when 「1: Enable」 is selected in parameter No.144.0 「Enable/Disable Torque command limit Override」</li> <li>•At open circuit, the parameter No.147.0 「Torque command limit Override 1」 is preferred. At</li> </ul>	△	○	○

		power On, the parameter No.148.0 「Torque command limit Override 2」 is preferred.																																																																																								
PCSTAR T1	CW start	<ul style="list-style-type: none"> <li>It is effective when the parameter No.642.0 「Internal speed command - Operation mode」 is set to "0=Point table".</li> <li>When PCSEL1 to 4 is specified to point No. and connected to COM-, point table No. and home position reset can execute.</li> </ul>	△	-	-																																																																																					
PCSEL1	Selection 1 of point No.	<ul style="list-style-type: none"> <li>Specify the point No. and home position reset to be executed.</li> <li>According to the setting of parameter No.646.3 「Point No.0 function selection」, when specifying the point No.0, you can select home position reset or point No..</li> </ul> <table border="1"> <thead> <tr> <th>Point No.</th> <th>PCSEL1</th> <th>PCSEL2</th> <th>PCSEL3</th> <th>PCSEL4</th> </tr> </thead> <tbody> <tr> <td>0 or home position reset</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>1</td> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>2</td> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>3</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>4</td> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>5</td> <td>ON</td> <td>OFF</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>6</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>7</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>8</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>9</td> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>10</td> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>11</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>12</td> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>13</td> <td>ON</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>14</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>15</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table>	Point No.	PCSEL1	PCSEL2	PCSEL3	PCSEL4	0 or home position reset	OFF	OFF	OFF	OFF	1	ON	OFF	OFF	OFF	2	OFF	ON	OFF	OFF	3	ON	ON	OFF	OFF	4	OFF	OFF	ON	OFF	5	ON	OFF	ON	OFF	6	OFF	ON	ON	OFF	7	ON	ON	ON	OFF	8	OFF	OFF	OFF	ON	9	ON	OFF	OFF	ON	10	OFF	ON	OFF	ON	11	ON	ON	OFF	ON	12	OFF	OFF	ON	ON	13	ON	OFF	ON	ON	14	OFF	ON	ON	ON	15	ON	ON	ON	ON	△	-	-
Point No.	PCSEL1		PCSEL2	PCSEL3	PCSEL4																																																																																					
0 or home position reset	OFF		OFF	OFF	OFF																																																																																					
1	ON		OFF	OFF	OFF																																																																																					
2	OFF		ON	OFF	OFF																																																																																					
3	ON	ON	OFF	OFF																																																																																						
4	OFF	OFF	ON	OFF																																																																																						
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PCSEL2	Selection 2 of point No.																																																																																									
PCSEL3	Selection 3 of point No.																																																																																									
PCSEL4	Selection 4 of point No.																																																																																									
(HOME) <sup>N</sup> <small>ote 1)</small>	Home position reset start	<ul style="list-style-type: none"> <li>Start home position reset after connecting COM-.</li> </ul>	△	-	-																																																																																					
ORG	Home position sensor	<ul style="list-style-type: none"> <li>Home position reset with home position sensor, input the home position sensor signal.</li> <li>Polarity detection can be changed by parameter No.646.1 「Home position sensor input polarity」. When the initial setting is to be connected to COM- and OFF, the home position sensor is detected.</li> </ul>	△	-	-																																																																																					
VCRUN1	Internal speed command start 1	<ul style="list-style-type: none"> <li>Enable when select "1=Trapezoid speed command" in parameter No.388.0.</li> <li>After connecting to COM-, the motor starts in CCW direction.</li> <li>Set acceleration/deceleration time and target speed in parameter No.390 to No.399.0. There are 8 phases for target speed. The target speed can be switched by the combination of VCSEL1, VCSEL2 and VCSEL3.</li> </ul>	-	△	-																																																																																					

VCRUN2	Internal speed command start 2	<ul style="list-style-type: none"> <li>•Enable when select "1=Trapezoid speed command" in parameter No.388.0.</li> <li>•After connecting to COM-, the motor starts in CW direction.</li> <li>•Set acceleration/deceleration time and target speed in parameter No.390 to No.399.0. There are 8 phases for target speed. The target speed can be switched by the combination of VCSEL1, VCSEL2 and VCSEL3.</li> </ul>	-	△	-																																				
VCSEL1	Internal command selection 1	<ul style="list-style-type: none"> <li>•Enable when select "1=Trapezoid speed command" in parameter No.388.0.</li> <li>•Select the speed command of 8 phases as shown below according to the combination of speed command selection 1 to 3.</li> <li>•Set acceleration/deceleration time and target speed in parameter No.390 to No.399.0.</li> </ul> <table border="1"> <thead> <tr> <th>Target speed</th> <th>VCSEL1</th> <th>VCSEL2</th> <th>VCSEL3</th> </tr> </thead> <tbody> <tr><td>1</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr><td>2</td><td>ON</td><td>OFF</td><td>OFF</td></tr> <tr><td>3</td><td>OFF</td><td>ON</td><td>OFF</td></tr> <tr><td>4</td><td>ON</td><td>ON</td><td>OFF</td></tr> <tr><td>5</td><td>OFF</td><td>OFF</td><td>ON</td></tr> <tr><td>6</td><td>ON</td><td>OFF</td><td>ON</td></tr> <tr><td>7</td><td>OFF</td><td>ON</td><td>ON</td></tr> <tr><td>8</td><td>ON</td><td>ON</td><td>ON</td></tr> </tbody> </table>	Target speed	VCSEL1	VCSEL2	VCSEL3	1	OFF	OFF	OFF	2	ON	OFF	OFF	3	OFF	ON	OFF	4	ON	ON	OFF	5	OFF	OFF	ON	6	ON	OFF	ON	7	OFF	ON	ON	8	ON	ON	ON	-	△	-
Target speed	VCSEL1		VCSEL2	VCSEL3																																					
1	OFF		OFF	OFF																																					
2	ON	OFF	OFF																																						
3	OFF	ON	OFF																																						
4	ON	ON	OFF																																						
5	OFF	OFF	ON																																						
6	ON	OFF	ON																																						
7	OFF	ON	ON																																						
8	ON	ON	ON																																						
VCSEL2	Internal command selection 2																																								
VCSEL3	Internal command selection 3																																								
(RESET/ PCLR) Note 1)	Alarm clear/ deviation counter clear	<ul style="list-style-type: none"> <li>•After connecting with COM-, RESET and PCLR are executed.</li> </ul>	△	-	-																																				

※Control mode:

P: Position control mode, S: Speed control mode, T: Torque control mode indicates it can input signals 「○」 and 「△」 in different control modes. 「△」 can switch signals according to command mode. For details, please refer to user I/O connector CN1 terminal arrangements for each command mode.

Note 1) For I/O of locator function selection 1.

Signal name	Pin No.	Contents	Function				
O1	13	O1 output	<ul style="list-style-type: none"> <li>•Parallel I/O output</li> <li>•O7+, O7-, O8+ and O8- is differential output.</li> <li>•Function varies according to different control modes and command modes. For details, refer to the following table.</li> </ul> <table border="1"> <tr> <td>Control mode</td> <td>Position control</td> <td>Speed control</td> <td>Torque control</td> </tr> </table>	Control mode	Position control	Speed control	Torque control
Control mode	Position control	Speed control		Torque control			
O2	14	O2 output					
O3	15	O3 output					
O4	16	O4 output					
O5	17	O5 output					
O7+	19	O7 output					

		+	Command mode	Pulse train command	Internal regeneration command	Analog command	Internal regeneration command	Analog command	
O7-	20	O7 output -							
O8+	21	O8 output +	O1	MBRK					
			O2	SERVO					
O8-	22	O8 output -	O3	POSIN	MEND	(Reserved)			
			O4	(Reserved)	HEND	(Reserved)			
			O5	T-LIMIT					
			O7+	SRDY					
			O7-						
			O8+	ALM					
			O8-						
O6(OCZ)	18	Encoder Z phase output	<ul style="list-style-type: none"> <li>•Open collector output of encoder Z-phase signal</li> <li>•If the Z-phase pulse width is too narrow to be identified by host control device , we can set parameter No.276.0, 278.0 「Encoder pulse output division and multiplication」 to reduce the division and multiplication. Or reduce the speed to expand the pulse width. [Pulse width]=1/ speed/(division and multiplication ×2<sup>17</sup>).</li> <li>•Note 1)</li> </ul>						
OUT_A	36	Encoder A phase	•Output position A phase signal to host control device(differential output).						
/OUT_A	37	Encoder A phase	•Output position A phase signal to host control device(differential output).						
OUT_B	38	Encoder B phase	•Output position B phase signal to host control device(differential output).						
/OUT_B	39	Encoder B phase	•Output position B phase signal to host control device(differential output).						
OUT_Z	40	Encoder Z phase	<ul style="list-style-type: none"> <li>•Output position Z phase signal to host control device(differential output).</li> <li>•Note 1)</li> </ul>						
/OUT_Z	41	Encoder Z phase	<ul style="list-style-type: none"> <li>•Output position Z phase signal to host control device(differential output).</li> <li>•Note 1)</li> </ul>						

Note 1) Z-phase pulse width: Encoder resolution × Division and multiplication (Parameter No.276.0/No.278.0) and the motor speed. Z-phase pulse and A-phase pulse are output simultaneously.

Table 5.7.3 I/O output signal

Signal name	Contents	Function	Control mode		
			P	S	T
MBRK	Brake release	•After the electromagnetic brake is released, the connection with COM- should is OFF.	○	○	○
SERVO	Servo status	•When the servo is ON, the connection with COM- is OFF.	○	○	○

POSIN	Positioning completion	<ul style="list-style-type: none"> <li>After positioning was completed, the connection with COM- is OFF.</li> </ul>	○	-	-																																				
SRDY	Servo ready	<ul style="list-style-type: none"> <li>OFF at servo ready. When there is voltage in main circuit and no alarm, the servo can be ON.</li> </ul>	○	○	○																																				
ALM	Alarm status	<ul style="list-style-type: none"> <li>Open circuit at alarms and power OFF. Closed circuit at power ON.</li> </ul>	○	○	○																																				
T-LIMIT	Torque limit	<ul style="list-style-type: none"> <li>If the output torque of the motor is limited, the connection with COM- is closed.</li> <li>Select the output condition according to "Selection of Torque limit state output mode".</li> </ul>	○	○	○																																				
MEND	Action completion	<ul style="list-style-type: none"> <li>When the action of point table, communication and home position reset is completed and the next step will start, the connection with COM- is closed circuit.</li> <li>Closed circuit at power OFF.</li> </ul>	△	-	-																																				
HEND	Home position reset completion	<ul style="list-style-type: none"> <li>After the home position reset is completed, the connection with COM- is closed circuit. When the home position disappears or home position reset, the connection with COM- is open circuit.</li> </ul>	△	-	-																																				
(PM1) Note 1)	Point No. output 1	According to the output signal allocated by the special I/O setting "Position control/ Internal regeneration command customized 1).	△	-	-																																				
(PM2) Note 1)	Point No. output 2	<ul style="list-style-type: none"> <li>Output the start or end of the Point NO..</li> <li>Select the time and contents of Point No. according to the setting of Parameter No.644.0 "Point No. output method".</li> </ul>																																							
(PM3) Note 1)	Point No. output 3	<ul style="list-style-type: none"> <li>Open circuit (Point No. 0) when the drive power supply is ON and servo OFF, home position reset.</li> </ul> <table border="1"> <thead> <tr> <th>PM1</th> <th>PM2</th> <th>PM3</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>Point No.0, 8 and so on</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>Point No. 1, 9</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>Point No.2, 10</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>OFF</td> <td>Point No.3, 11</td> </tr> <tr> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>Point No.4, 12</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>ON</td> <td>Point No.5, 13</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>ON</td> <td>Point No.6, 14</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>ON</td> <td>Point No.7, 15</td> </tr> </tbody> </table>				PM1	PM2	PM3	Contents	OFF	OFF	OFF	Point No.0, 8 and so on	ON	OFF	OFF	Point No. 1, 9	OFF	ON	OFF	Point No.2, 10	ON	ON	OFF	Point No.3, 11	OFF	OFF	ON	Point No.4, 12	ON	OFF	ON	Point No.5, 13	OFF	ON	ON	Point No.6, 14	ON	ON	ON	Point No.7, 15
PM1	PM2	PM3				Contents																																			
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OFF	ON	OFF	Point No.2, 10																																						
ON	ON	OFF	Point No.3, 11																																						
OFF	OFF	ON	Point No.4, 12																																						
ON	OFF	ON	Point No.5, 13																																						
OFF	ON	ON	Point No.6, 14																																						
ON	ON	ON	Point No.7, 15																																						
(MEND/ TLIMIT) Note 1)	Action completion/ Torque limit	<ul style="list-style-type: none"> <li>Output signal allocated by special I/O setting "Position control/ Internal regeneration command selection 1".</li> <li>Either MEND or T-LIMIT is ON, the connection with COM- is closed circuit.</li> <li>For details, refer to the function of MEND and T-LIMIT in this table.</li> </ul>	△	-	-																																				

※Control mode:

P: Position control mode, S: Speed control mode, T: Torque control mode indicates it can input signals 「○」 and 「△」 in different control modes. 「△」 can switch signals according to command mode. For details, please refer to user I/O connector CN1 terminal arrangements for each command mode.

Note 1) For I/O of locator function selection 1.

Table 5.7.4 Reserved pins

Signal name	Pin No.	Contents	Function
NC1	23	Reserved	●Reserved(Disconnected)
SP1	24	Reserved	-
SP2	25	Reserved	-
A_TRQ	34	Reserved	-
A_GND	35	Reserved	-
NC2	46	Reserved	●Reserved(Disconnected)
SP3	46	Reserved	-
SP4	48	Reserved	-
EDM+	49	Reserved	-
EDM-	50	Reserved	-

## 6. Troubleshooting and countermeasures

### 6.1 Alarm display

When the alarm occurs, the alarm description can be confirmed according to the alarm code on the panel of servo drive. The alarm code and alarm description are shown in the 「Warning list」.

The alarm description can be confirmed by using [Alarm status] monitor in the dedicated software 「HCX-SETUP」 of SV-X3. For the operation methods, refer to HCX-SETUP user's manual.

If you want to consult with HCFA Corporation, make a record of the alarm and contact with us.

### 6.2 Alarm handling and alarm reset

For alarm handling and resetting, please refer to “Warning List”. There are three ways for alarm reset. It varies according to different alarm items.

- ① The host control device sends reset clear signal (RESET of CN1 5pin)to the drive..
- ② Restart drive control power supply.
- ③ Press SHIFT+UP at the same time.

Table 6.2.1

No	Alarm description	Occurrence time	Cause and handling ways	
0	System alarm	After the control power supply is ON.	●Control circuit error	Restart control power supply
1	EEP data error		●Parameter writing error ●After confirming cables, rewrite the parameters.	RESET signal (※)
2	Model code error		●Model code cannot be read.	Restarting control power

			<ul style="list-style-type: none"> <li>•Confirm the combination of motor and drive.</li> <li>•Please confirm the encoder cable.</li> </ul>	supply
4	Overspeed error	After the servo is ON	<ul style="list-style-type: none"> <li>•Position control and speed control error.</li> <li>•Please adjust the parameters.</li> </ul>	RESET signal (※)
5	Speed deviation error			
6	Position deviation error			
7	Overload error			
8	Command overspeed error			
9	Encoder pulse output frequency error		<ul style="list-style-type: none"> <li>•The encoder pulse output frequency is over 4Mpps</li> <li>•Confirm the value of command division/multiplication frequency</li> <li>•Confirm the number of command pulse</li> </ul>	
12	Overheat error		<ul style="list-style-type: none"> <li>•Overheat error of control circuit</li> <li>•Reduce ambient temperature</li> <li>•Set the drive in accordance with 「Installation direction and clearances」</li> </ul>	
14	Overvoltage error		<ul style="list-style-type: none"> <li>•Overvoltage error of control main circuit</li> <li>•Confirm regenerative resistor warning by setting panel. Please install a regenerative resistor if necessary.</li> </ul>	
15	Power supply error		<ul style="list-style-type: none"> <li>•The voltage on the main circuit power supply is too low or too high. If 200VAC error occurs, there is error after the regenerative power is ON.</li> <li>•Please confirm the 220VAC power supply cable and distribution wiring of main circuit power supply</li> <li>•Adjust 200VAC power input and servo ON time according to timing chart. Confirm the regenerative resistor warning signal on the setting panel. Please install a regenerative resistor if necessary.</li> </ul>	
16	Encoder 1 (communication data error)	After the control power supply is ON.	<ul style="list-style-type: none"> <li>•The encoder data changes significantly in a sudden.</li> <li>•Confirm the contact of encoder cable terminal.</li> <li>•Take measures of grounding , separating layouts of motor power cable and encoder cable.</li> </ul>	Restarting control power supply
17	Encoder communication error 2 (No response)		<ul style="list-style-type: none"> <li>•Encoder communication cut off error.</li> <li>•Confirm the contact of encoder cable terminal.</li> <li>•Take measures of grounding , separating layouts of motor power cable and encoder cable..</li> </ul>	

			<ul style="list-style-type: none"> <li>•Shorten the encoder cable if it's too long.</li> </ul>	
18	Encoder error		<ul style="list-style-type: none"> <li>•Encoder itself error</li> </ul>	
19	Encoder communication error 3 (duplex communication error)		<ul style="list-style-type: none"> <li>•Encoder communication initialization error</li> <li>•Please confirm the wiring for encoder cables.</li> <li>•Shorten the encoder cable if it's too long</li> </ul>	
20	Multi-revolution data error		<ul style="list-style-type: none"> <li>•Multi-revolution data changes significantly in a sudden</li> <li>•Confirm the contact of encoder cable terminal.</li> <li>•Take measures of grounding , separating layouts of motor power cable and encoder cable.</li> </ul>	
21	Encoder error undervoltage		<ul style="list-style-type: none"> <li>•Multi-revolution data changes significantly in a sudden</li> <li>•When using absolute encoder, please confirm whether the battery voltage is too low or battery connection is off.</li> </ul>	After encoder error clear in HCX-SETUP, restart the control power supply.
22	Control power supply undervoltage error	After servo ON	<ul style="list-style-type: none"> <li>•The voltage of control power supply(24VDC) is too low</li> </ul>	RESET signal (✕)
23	Base circuit isolation		<ul style="list-style-type: none"> <li>•There is no power supply for base circuit.</li> </ul>	RESET signal (✕)
24	Overcurrent error		<ul style="list-style-type: none"> <li>•Control circuit error</li> <li>•Please confirm UVW connection of motor power cable and distribution wiring of main circuit.</li> <li>•If there is sudden CCW/CW reverse rotation, extend the acceleration/deceleration time or use smoothing command to slow the reverse rotation.</li> </ul>	RESET signal (✕)
25	Inverter error 1		<ul style="list-style-type: none"> <li>•Control circuit error.</li> </ul>	
26	Inverter error 2 (servo ON overtime)		<ul style="list-style-type: none"> <li>•Please confirm UVW connection of motor power cable and distribution wiring of main circuit.</li> </ul>	
27	Current encoder error		<ul style="list-style-type: none"> <li>•Current sensor error.</li> </ul>	

### 6.3 Troubleshooting

When no alarm occurs, confirm the following items if the drive does not operate and the motor does not rotate.

Status	Description	Reference items
Troubleshooting 1	Switch on the control power supply (24V DC), but on any display	Table 6.3.1

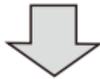
No display on setting panel	「 56.×3 」 on the setting panel.	
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Troubleshooting 2 Servo not ON	Even though 「 56.×3 」 is displayed on the setting panel, the servo cannot start.	Table 6.3.2
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Troubleshooting 3 Motor cannot rotate	The servo is ON, but the motor will not operate.	Table 6.3.3
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Troubleshooting 4 Motor operation not steady	The motor operates unsteadily.	Table 6.3.4
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Troubleshooting 5 Vibration and sound	Vibration and sound occurs when the motor operates.	Table 6.3.5
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### ■Troubleshooting 1 (No display on setting panel)

Switch on the control power supply (24V DC), but on any display 「 56.×3 」 on the setting panel.

Table 6.3.1

Cause	What to do
The user I/O connector is not connected to 24V DC.	Connecting 24V DC to the user I/O connector. Pin1 and 3 is connected to 24V DC. Pin2 and 12 is connected to GND.
The user I/O connector loosens.	Check the connection and make sure it's OK.
24V DC voltage drops.	Check the capacity of 24V DC.
Drive itself failure.	Consult with HCFA Corporation.

### ■Troubleshooting 2 (Servo not ON)

Even though 「 56.×3 」 is displayed on the setting panel, the servo cannot start.

Table 6.3.2

Cause	What to do
There is no servo ON(SVON) signal input.	Input SVON signal of host control device to the user I/O connector.
Alarm No.15 occurs. There is no 200V AC input.	Make sure CHARGE LED is ON. If not, check if the 200V AC input connector(L1/L2/L3) is loosen or the 200V AC is output or not.
Alarm No.15 occurs.	Connect the main circuit power supply.

There is no main circuit power input in multi-axial drive.	
The motor power output connector (U/V/W) loosen.	Check the connection and make sure it's OK. Make sure if it's connected in accordance with the connector installing method in the user's manual.
Drive itself failure.	Consult with HCFA Corporation.

### ■ Troubleshooting 3 (Motor cannot rotate)

The servo is ON, but the motor will not operate.

Table 6.3.3

Cause	What to do
Wrong parameter setting.	For setting all the basic parameters in all control modes, refer to chapter 5 [ Table 5.2.4, Table 5.3.2, Table 5.4.2 and Table 5.5.2 ] .
Do not input correct host commands.	Check the command input from host control device. Confirm the input command is correct or not according to the waveform input by pulse train command (position) or analog speed command in HCX-SETUP. Check the parameter, such as division and multiplication. Sometimes, the motor rotates quite slowly.
The connection of user I/O connector is not correct.	For correct connection, refer to [ Figure 5.2.1, Figure 5.2.2, Figure 5.2.3, Figure 5.3.1, Figure 5.4.1 and Figure 5.5.1 ] .
Command input is restricted.	Disconnect the HOLD and COM- of user I/O connector.
Torque command limit setting is not correct.	Set parameter No.147.0 and 148.0 correctly when using torque command limit.
CCW/CW drive restriction input becomes effective.	Set the parameter No.67.0 to [ 0 ] when not using CCW/CW drive restriction input. CCWL, CWL and COM- of user I/O connector should be closed when using CCW/CW drive restriction input.

### ■ Troubleshooting 4 (Motor operation is not steady)

The motor operates unsteadily.

Table 6.3.4

Cause	What to do
FG and GND connection is wrong.	Connect FG and GND correctly.
Speed and position command is not steady.	Use [Waveform monitor] in HCX-SETUP to check the motor command input. And check the contact of cables and connectors.
Misadjustment	Adjust the parameters.
The motor rotate without host command input.	Set the appropriate values for No.33.0 [ Pulse train command - Input filter selection ] in position control mode. Adjust parameter No.60.0 [ Analog speed command - Fixed offset value ] in speed control mode. Adjust parameter No.300.0 [ Analog torque command Fixed offset value ]

	in torque control mode.
Command is interfered.	The shielded twisted-pair cable is used for I/O cable in a vulnerable environment. So is the encoder cable. The encoder cable should be 20m or less.
Position deviation occurs.	Set the appropriate values for No.33.0 「Pulse train command - Input filter selection」 in position control/pulse train command mode. Check whether the pulse output of host control device (such as PLC) is beyond the limit value. Check whether the product of ①No.33(Pulse command input(position) and host control device output, ②No.65(Position command) and No.67(Position feedback), ③No.67 and parameter No.276.0/278.0(Encoder pulse output division and multiplication) is consistent with the position feedback of host control device. If inconsistent, it may be interfered. Then connect FG correctly and adjust parameter No.33.0. Please use shielded twisted-pair for I/O cable.
Deviation occurs when home position reset.	Check the command input of host control device. Observe the waveform of pulse train command input(position) or analog speed command input in HCX-SETUP to check whether the input command is correct or not. Check whether to get the Z-phase correctly from the host control device. If the Z-phase pulse amplitude is small, adjust No.276.0 and 278.0 「Encoder output division and multiplication」 to increase the pulse amplitude.

## ■Troubleshooting 5(Vibration and sound)

Vibration and sound occurs when the motor operates.

Table 6.3.5

Cause	What to do
Large gain	Adjust the gain.
The machine or devices loosen.	Check the installment of motor, reducer and coupling.
Interference occurs.	Check the cables' length and shielding. The high-voltage cable(motor power cable) should be isolated from the signal cable (encoder cable).
Resonance occurs between motor and device.	Adjust position command smoothing filter at low-vibration; Adjust low-pass filter or notch filter at high-vibration.
The drive and motor do not match.	Confirm the motor model code in HCX-SETUP [Communication setting]. If the drive and motor do not match, clear the EEPROM parameter and change the motor models.

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