The Best Choice for the Most Benefit!

LS ELECTRIC always tries its best to bring the greatest benefit to its customers.

AC SERVO DRIVE

Xmotion

L7SB Series(400V) User Manual

Safety Precautions

- Read all safety precautions before using this product.
- After reading this manual, store it in a readily accessible location for future reference.

LS ELECTRIC

Introduction

Hello. Thank you for choosing LS ELECTRIC L7 Series.

This user manual describes how to use this product safely and efficiently.

Failure to comply with the guidelines outlined in this manual may cause personal injury or damage to the product. Be sure to read this manual carefully before using this product and follow all guidelines contained therein.

- The contents of this manual are subject to change without notice.
- The reproduction of part or all of the contents of this manual in any form, by any means or for any purpose is strictly prohibited without the explicit written consent of LS ELECTRIC.
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Safety precautions are categorized as either Warnings or Cautions, depending on the severity of the precaution.

Precautions	Definition
Danger	Failure to comply with these guidelines may cause serious injury or death.
Caution	Failure to comply with these guidelines may cause personal injury or property damage.

- Precautions listed as Cautions may also result in serious injury .

■ Electric Safety Precautions

Danger
▪ Before wiring or inspection tasks, turn off the power. Wait 15 minutes until the charge lamp goes off, and then check the voltage. ▪ Ground both the servo drive and the servo motor. ▪ Only specially trained technicians may perform wiring on this product. ▪ Install both the servo drive and servo motor before performing any wiring. ▪ Do not operate the device with wet hands. ▪ Do not open the servo drive cover during operation. ▪ Do not operate the device with the servo drive cover removed. ▪ Even if the power is off, do not remove the servo drive cover.

■ Fire Safety Precautions

Caution
▪ Install the servo drive, the servo motor, and the regenerative resistor on non-combustible materials. ▪ Disconnect the input power if the servo drive malfunctions.

■ Installation Precautions

Store and operate this product under the following environmental conditions.

<table>
<tr><th rowspan="2">Environment</th><th colspan="2">Conditions</th></tr>
<tr><th>Servo drive</th><th>Servo motor</th></tr>
<tr><td>Operating temp.</td><td>0 ~ 50 ℃</td><td>0 ~ 40 ℃</td></tr>
<tr><td>Storage temp.</td><td>-20 ~ 65 ℃</td><td>-10 ~ 60 ℃</td></tr>
<tr><td>Operating humidity</td><td rowspan="2">Below 90% RH (no condensation)</td><td>20~80% RH(no condensation)</td></tr>
<tr><td>Storage humidity</td><td>20~80% RH(no condensation)</td></tr>
<tr><td>Altitude</td><td colspan="2">1000 m or lower</td></tr>
<tr><td>Spacing</td><td>▪ When installing 1 unit:
• More than 40 mm at the top and bottom of the control panel
• More than 10 mm on the left and right sides of the control panel
▪ When installing 2 or more units:
• More than 100 mm at the top of the control panel
• More than 40 mm at the bottom of the control panel
• More than 30 mm on the left and right sides of the control panel
• More than 2 mm between units
• Refer to Section 2.2.2, "Wiring the Control Panel."</td><td></td></tr>
<tr><td>Other</td><td colspan="2">▪ Ensure the installation location is free from dust, iron, corrosive gas, and combustible gas.
▪ Ensure the installation location is free from vibrations or the potential for hard impacts.</td></tr>
</table>

⚠ Caution

- Install the product with the correct orientation.
- Do not drop the product or expose it to hard impact.
- Install this product in a location that is free from water, corrosive gas, combustible gas, or flammable materials.
- Install this product in a location capable of supporting the weight of this product.
- Do not stand on the product or place heavy objects on top of it.
- Always maintain the specified spacing when installing the servo drive.
- Ensure that there are no conductive or flammable debris inside the servo drive or the servo motor.
- Firmly attach the servo motor to the machine.
- Install the servo motor with a correctly oriented decelerator.
- Do not touch the rotating unit of the servo motor during operation.
- Do not apply excessive force when connecting the couplings to the servo motor shaft.
- Do not place loads on the servo motor shaft that exceed the specified amount.

■ Wiring Precautions

⚠ Caution

- Always use an AC 380-480 V power input for the servo drive.
- Always connect the servo drive to a ground terminal.
- Do not connect commercial power directly to the servo motor.
- Do not connect commercial power directly to the U, V, W output terminals of the servo drive.
- Connect the U, V, W output terminals of the servo drive directly to the U, V, W input terminals of the servo motor, but do not install magnetic contactors between the wires.
- Always use pressurized terminals with insulation tubes when connecting the servo drive power terminal.
- When wiring, be sure to separate the U, V, and W cables for the servo motor power and encoder cable.
- Always use the robot cable if the motor moves.
- Before you perform power line wiring, turn off the input power of the servo drive, and then wait until the charge lamp goes off completely.
- Be sure to use shielded twisted-pair wire for the pulse command signal (PF+, PF-, PR+, PR-), speed command signal (SPDCOM), and torque command signal (TRQCOM).
- Use N terminals to connect the external capacitor. The product may burn if a commercial power supply is connected to N terminals. Always contact the customer center or agency when it is necessary to connect the external capacitor.

■ Startup Precautions

⚠ Caution

- Check the input voltage (AC 380-480 V) and power unit wiring before supplying power to the device.
- The servo must be in the OFF mode when you turn on the power.
- Before you turn on the power, check the motor's ID and the encoder pulse for L7 □B □□□□.
- Set the motor ID ([P0-00]) and the encoder pulse ([P0-02]) for L7 □B □□□A first after you turn on the power.
- After you complete the above settings, set the drive mode for the servo drive that is connected to the upper level controller in [P0-03].
- Refer to Chapter 1.2 "System Configuration" to perform CN1 wiring for the servo drive according to each drive mode.
- You can check the ON/OFF state for each input terminal of CN1 at [St-14].

■ Handling and Operating Precautions

⚠ Caution

- Check and adjust each parameter before operation.
- Do not touch the rotating unit of the motor during operation.
- Do not touch the heat sink during operation.
- Be sure to attach or remove the CN1 and CN2 connectors when the power is off.
- Extreme change of parameters may cause system instability.

■ Usage Precautions

⚠ Caution
▪ Install an emergency cut-off switch which immediately stops operation in an emergency. ▪ Reset the alarm when the servo is off. Be warned that the system restarts immediately if the alarm is reset while the servo is on. ▪ Use a noise filter or DC reactor to minimize electromagnetic interference. This prevents nearby electrical devices from malfunctioning due to interference. ▪ Only use approved servo drive and servo motor combinations. ▪ The electric brake on the servo motor stops operation. Do not use it for ordinary braking. ▪ The electric brake may malfunction if the brake degrades or if the mechanical structure is improper (for example, if the ball screw and servo motor are combined via the timing belt). Install an emergency stop device to ensure mechanical safety.

■ Malfunction Precautions

⚠ Caution
▪ Install a servo motor with an electric brake or separate the brake system for use during emergencies or device malfunctions. ▪ If an alarm occurs, solve the underlying cause of the problem. After solving the problem and ensuring safe operation, deactivate the alarm and resume operation. ▪ Do not approach the machine until the problem is solved.

■ Repair/Inspection Precautions

⚠ Caution
▪ Before performing servicing tasks, turn off the power. Wait 15 minutes until the charge lamp goes off, and then check the voltage. Enough voltage may remain in the condenser after the power is off to cause an electric shock. ▪ Only authorized personnel may repair and inspect the device or replace its parts. ▪ Do not modify this device in any way.

■ General Precautions

⚠ Caution
▪ This user manual is subject to change due to product modification or changes in standards. If such changes occur, we issue a new user manual with a new product number.

■ Product Application

⚠ Caution
▪ This product is not designed or manufactured for machines or systems intended to sustain human life. ▪ This product is manufactured under strict quality control conditions. Nevertheless, install safety devices if installing the device in a facility where product malfunctions may result in a major accident or a significant loss.

■ EEPROM Lifespan

⚠ Caution
▪ The EEPROM is rewritable up to 1 million times for the purpose of recording parameter settings and other information. The servo drive may malfunction if the total number of the following tasks exceeds 1 million, depending on the lifespan of the EEPROM. • EEPROM recording as a result of parameter changes • EEPROM recording as a result of an alarm

Table of Contents

1. Product Components and Signals

1.1 Product Components

1.1.1 Product Verification

1. Check the name tag to verify that the product received matches the model ordered

- Does the servo drive's name plate match?
- Does the servo motor's name plate match?

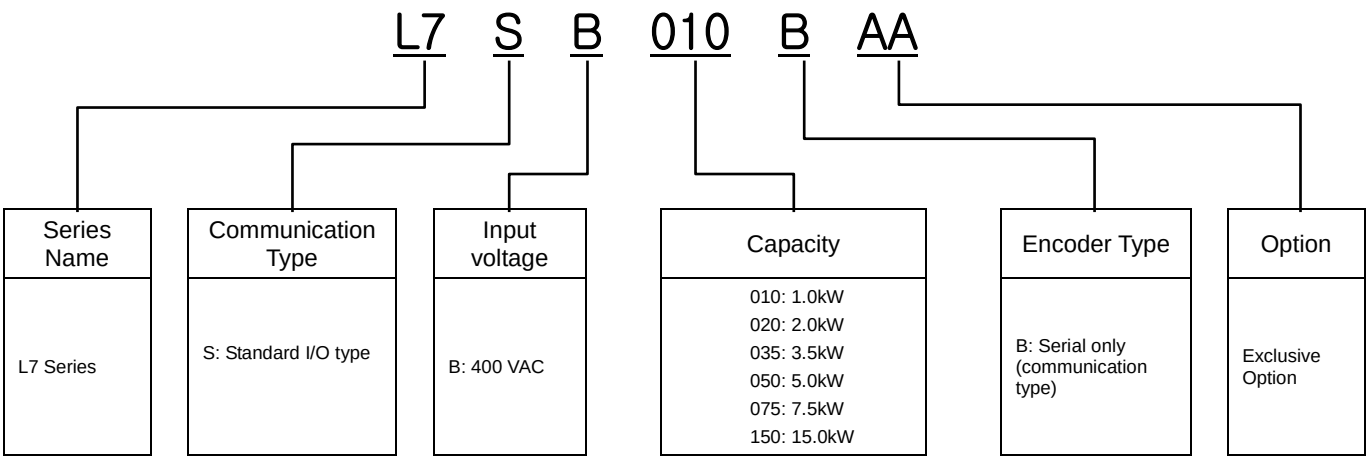
2. Check the product components and options.

- Are the type and length of cables correct?
- Does the regenerative resistor conform to the required standard?
  - Is the shape of the shaft correct?
  - Are there any abnormalities after mounting the oil seal or brake?
  - Are the gearbox and the gear ratios correct?
  - Is the encoder format correct?

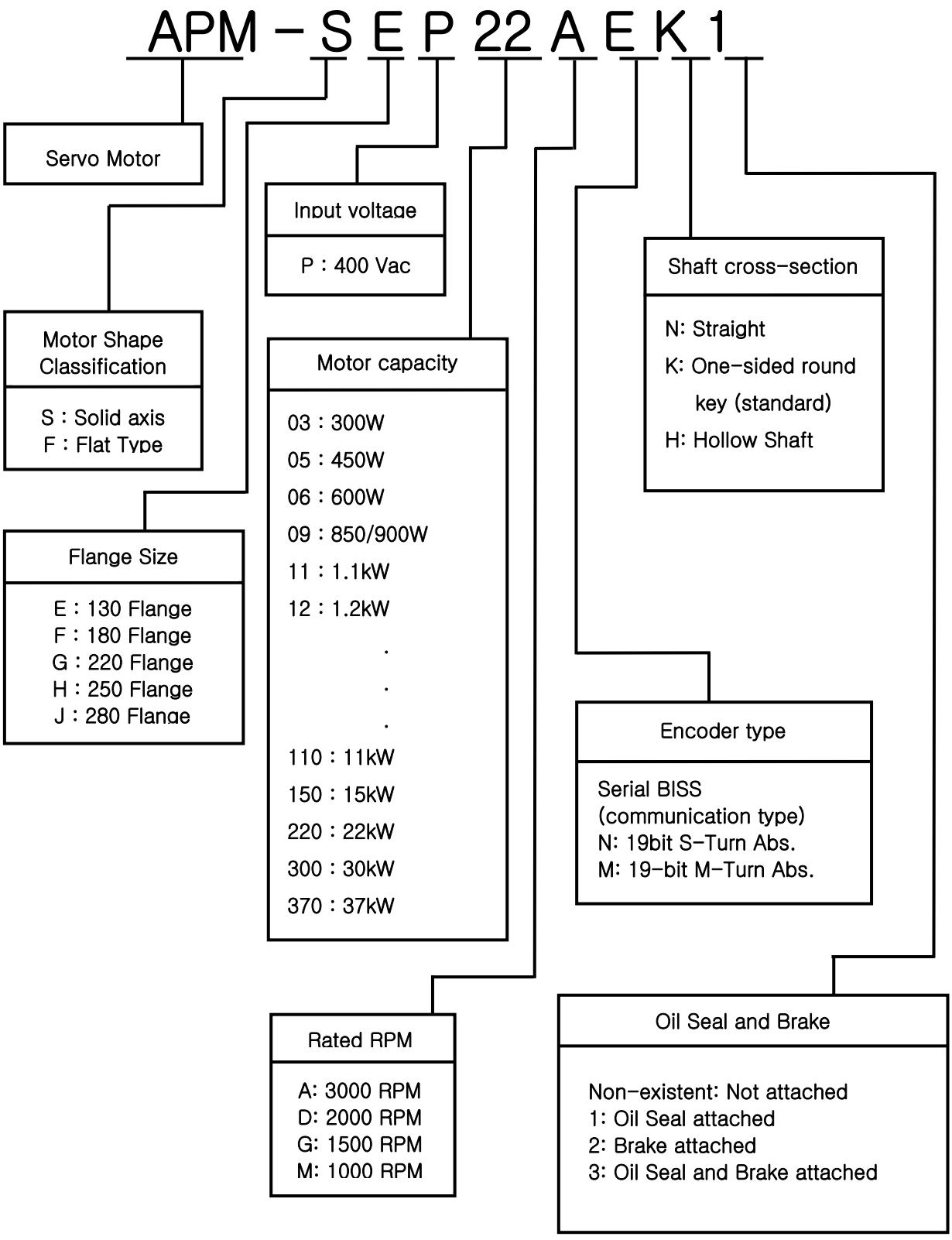
3. Check the exterior of the device.

- Are there any foreign substances or humidity in the device?
- Is there any discoloration, contaminant, damage or disconnected wire?
- Are the bolts tightly fastened to the joints?
- Is there any abnormal sound or excessive friction during operation?

■ The Servo Drive Product Format



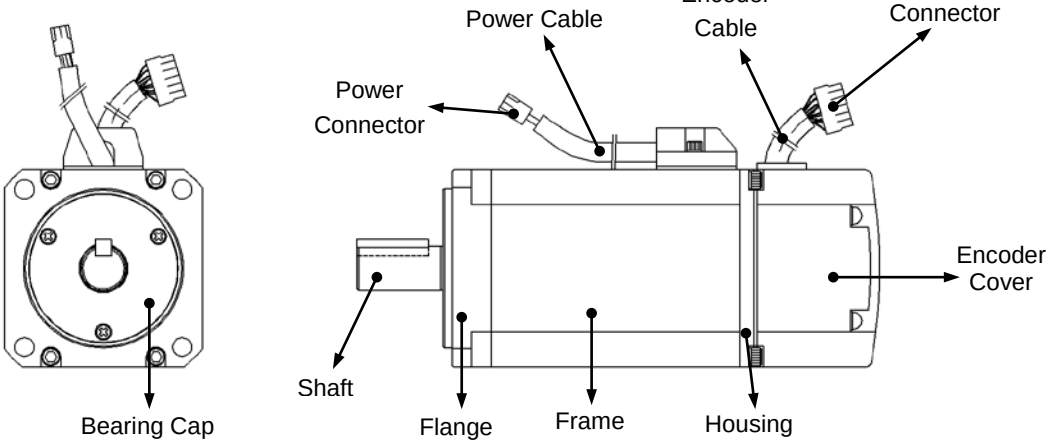
■ Servo Motor Product Format



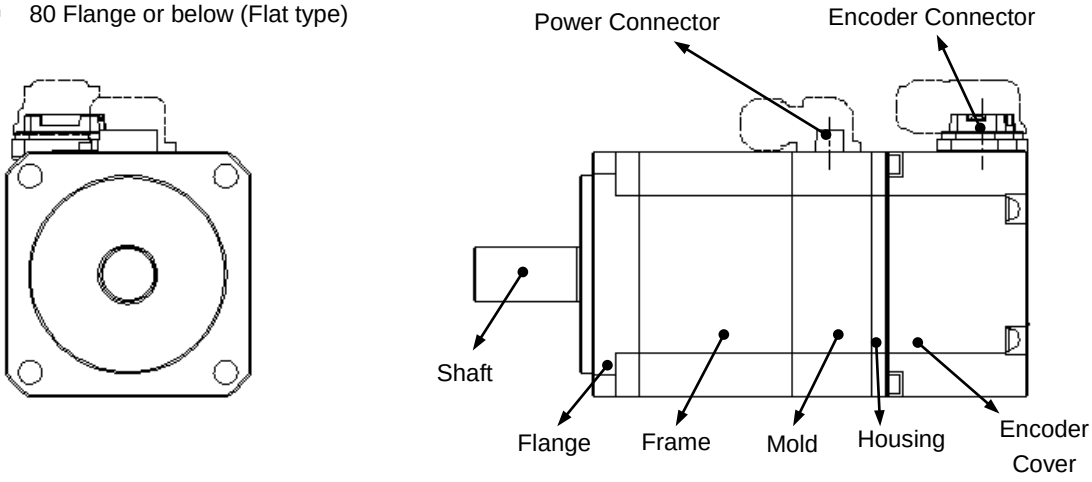
1.1.2 Part Names

■ Servo motor

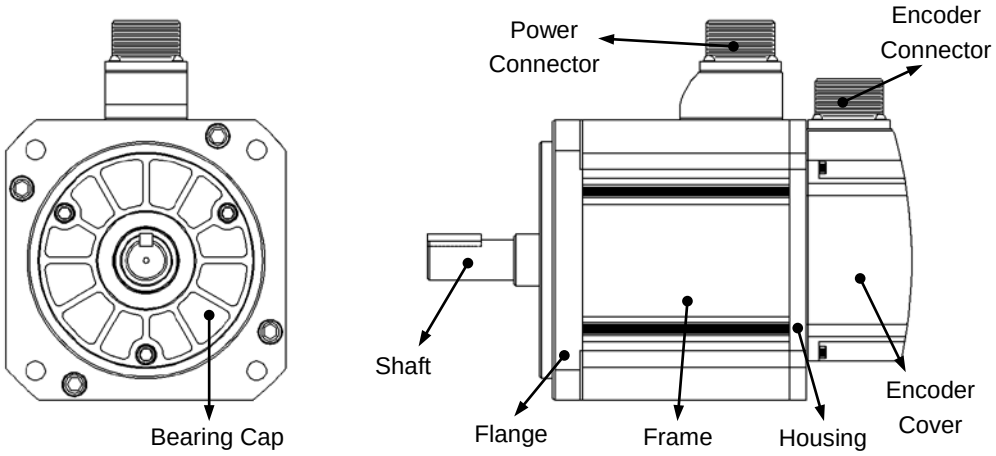
- 80 Flange or below



- 80 Flange or below (Flat type)

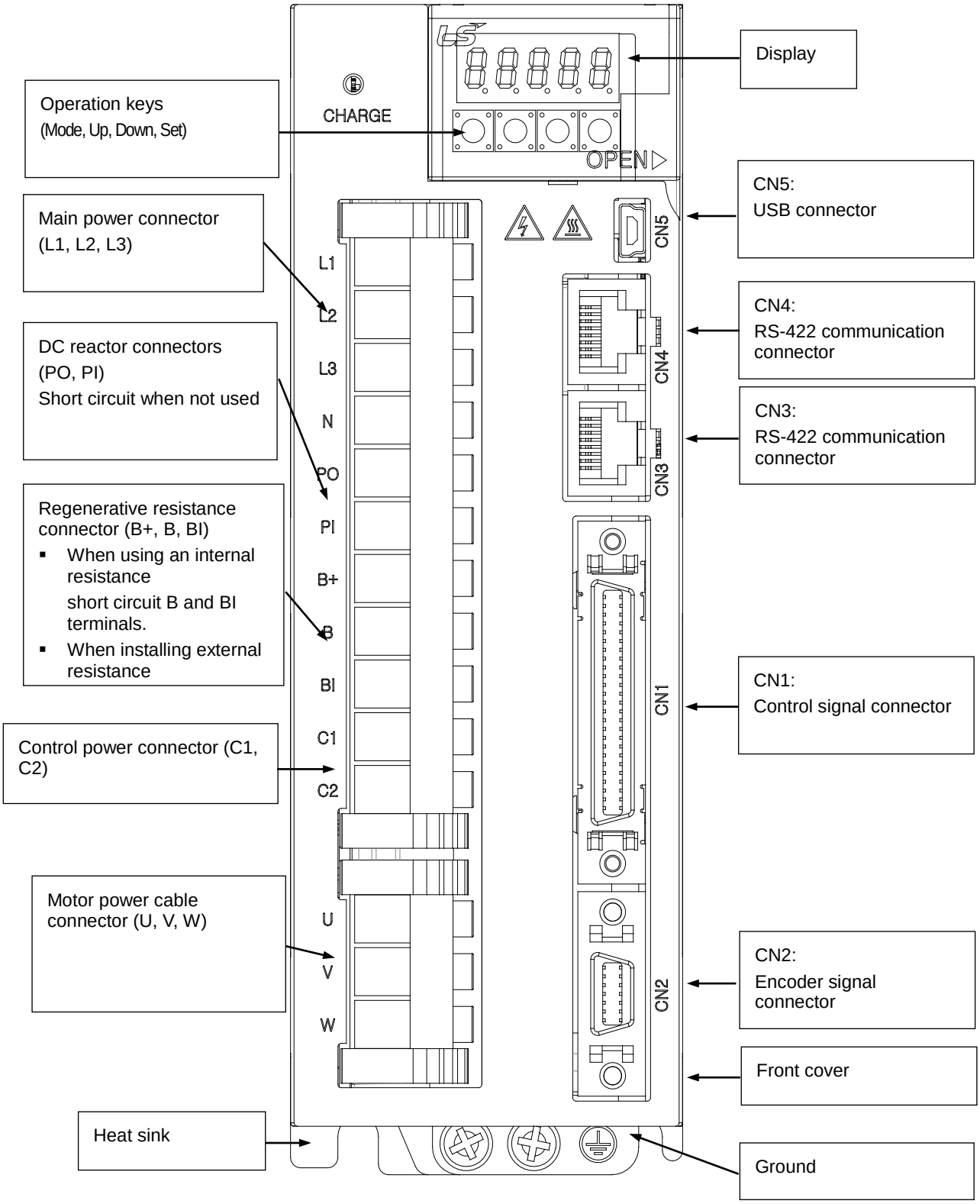


- 130 Flange or higher

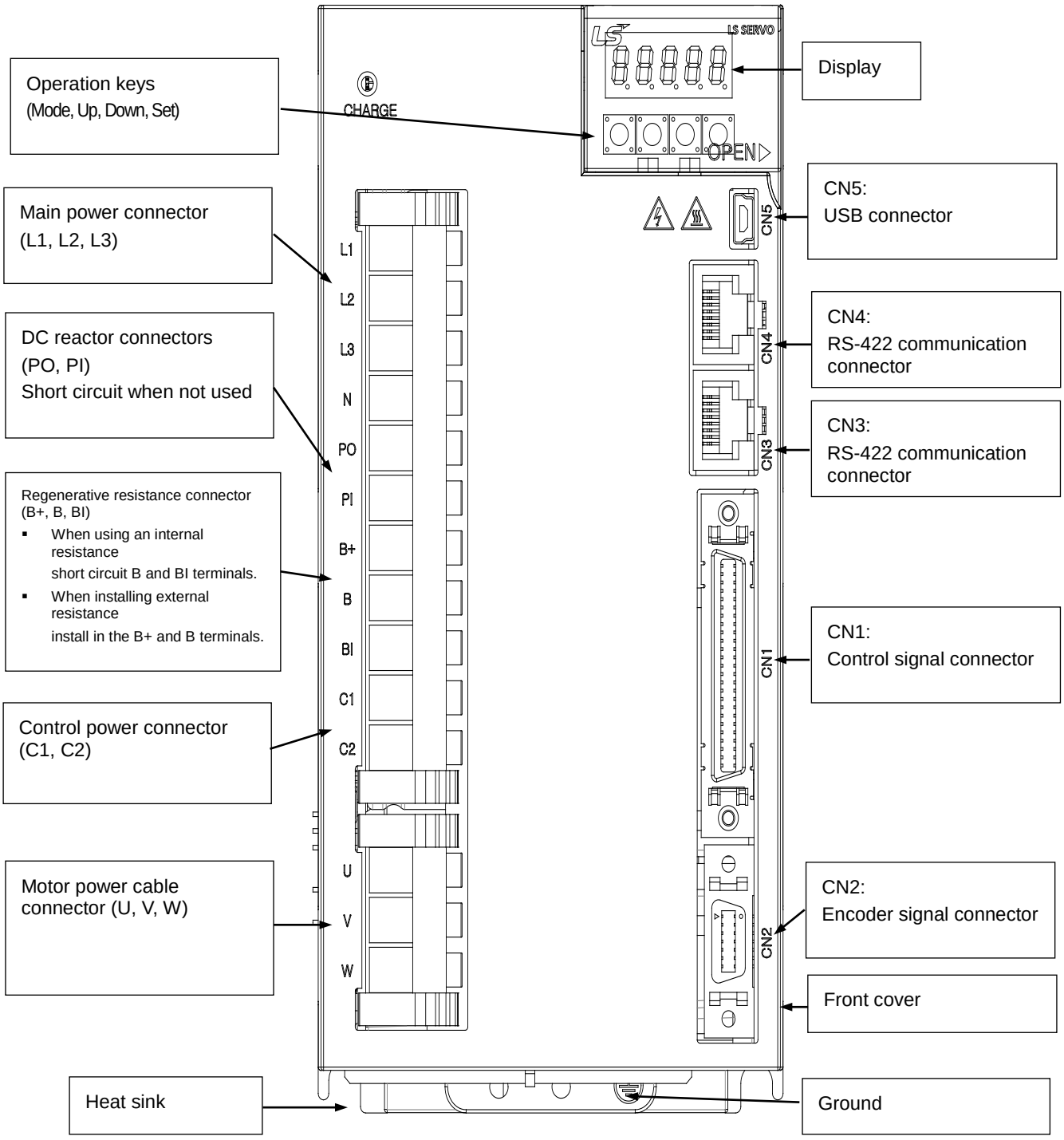


■ Servo drive

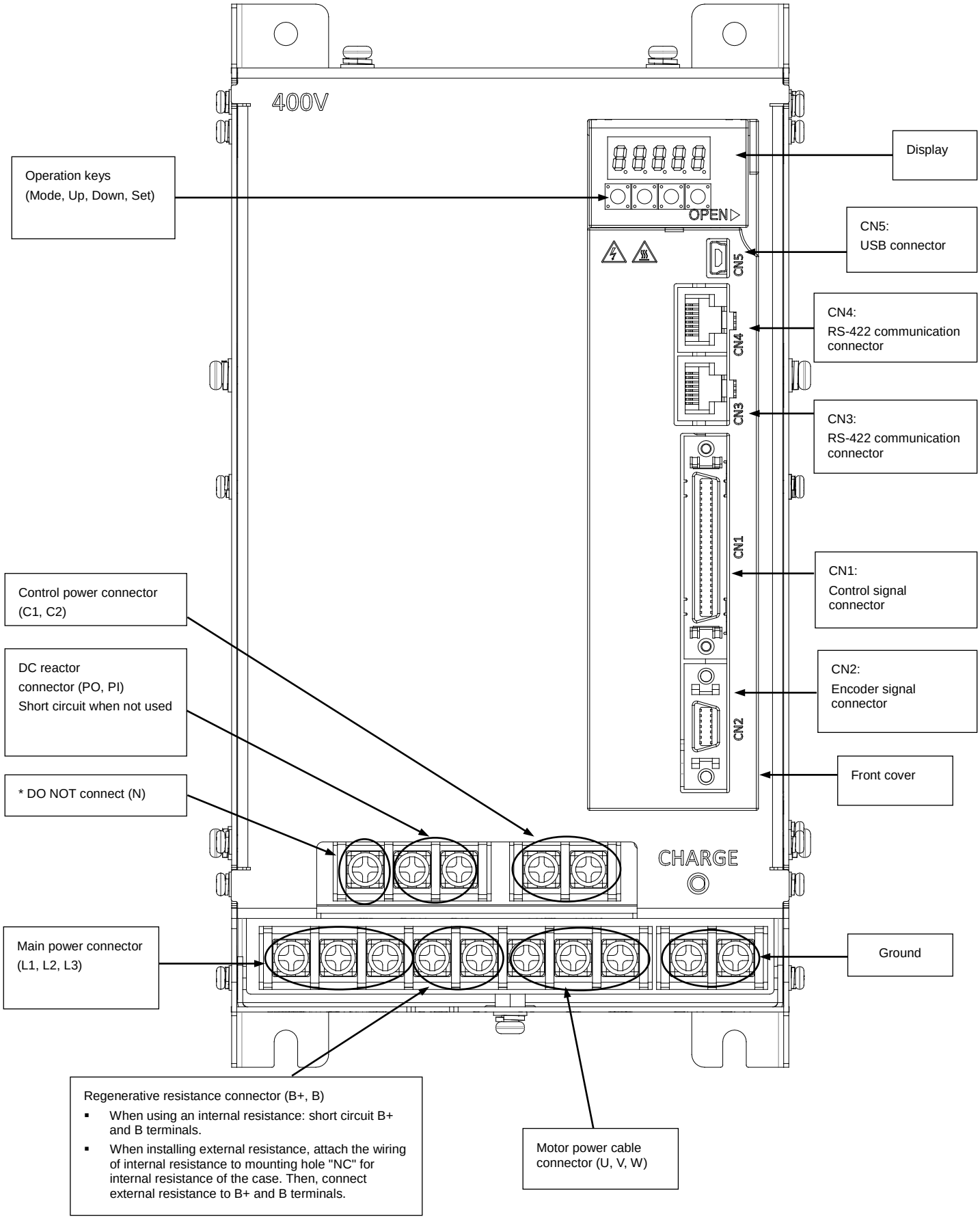
- L7SB 010□



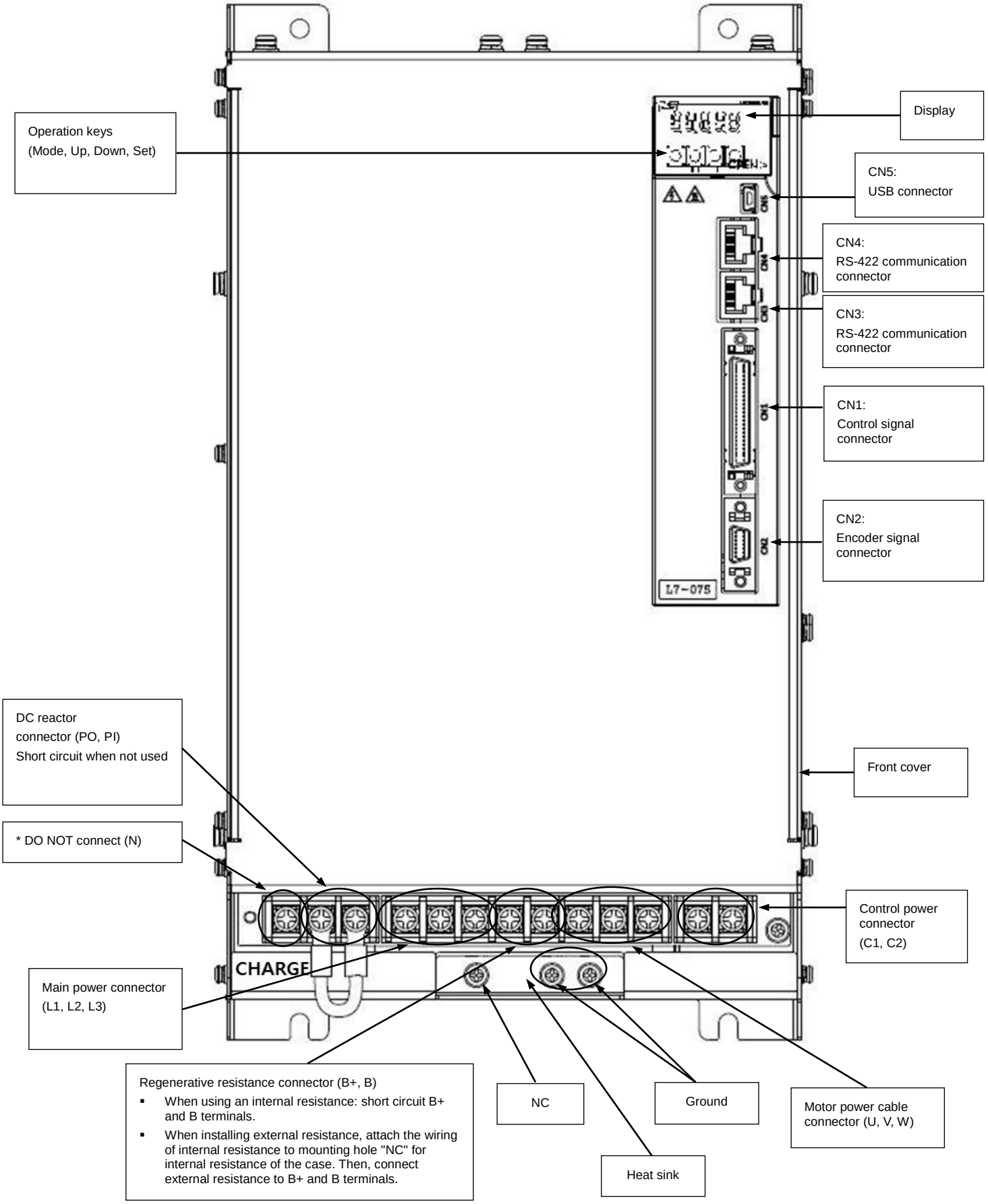
- L7SB 020□ / L7SB 035□



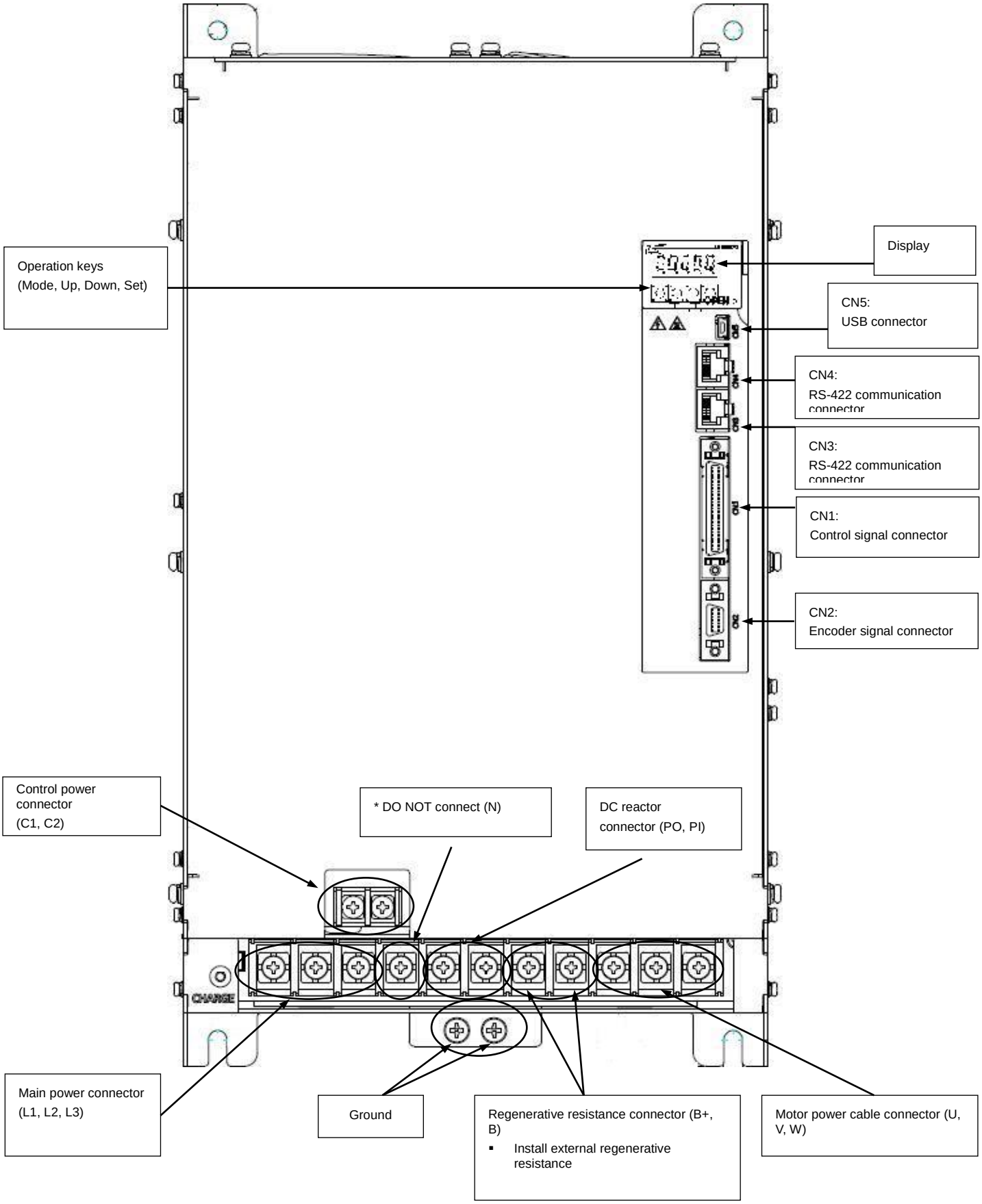
- L7SB 050□


400V
Operation keys
(Mode, Up, Down, Set)
Display
OPEN
CN5:
USB connector
CN5
CN4:
RS-422 communication connector
CN4
CN3:
RS-422 communication connector
CN3
CN1:
Control signal connector
CN1
CN2:
Encoder signal connector
CN2
Front cover
Control power connector
(C1, C2)
DC reactor
connector (PO, PI)
Short circuit when not used
* DO NOT connect (N)
CHARGE
Main power connector
(L1, L2, L3)
Ground
Regenerative resistance connector (B+, B)
When using an internal resistance: short circuit B+ and B terminals.
When installing external resistance, attach the wiring of internal resistance to mounting hole "NC" for internal resistance of the case. Then, connect external resistance to B+ and B terminals.
Motor power cable connector (U, V, W)

- L7SB 075□


Operation keys
(Mode, Up, Down, Set)
Display
CN5:
USB connector
CN4:
RS-422 communication connector
CN3:
RS-422 communication connector
CN1:
Control signal connector
CN2:
Encoder signal connector
L7-075
DC reactor
connector (PO, PI)
Short circuit when not used
* DO NOT connect (N)
Front cover
Control power connector
(C1, C2)
CHARGE
Main power connector
(L1, L2, L3)
Regenerative resistance connector (B+, B)
When using an internal resistance: short circuit B+ and B terminals.
When installing external resistance, attach the wiring of internal resistance to mounting hole "NC" for internal resistance of the case. Then, connect external resistance to B+ and B terminals.
NC
Ground
Motor power cable connector (U, V, W)
Heat sink

- L7SB 150□


Operation keys
(Mode, Up, Down, Set)
Display
CN5:
USB connector
CN4:
RS-422 communication connector
CN3:
RS-422 communication connector
CN1:
Control signal connector
CN2:
Encoder signal connector
Control power connector
(C1, C2)
* DO NOT connect (N)
DC reactor
connector (PO, PI)
CHARGE
Main power connector
(L1, L2, L3)
Ground
Regenerative resistance connector (B+, B)
Install external regenerative resistance
Motor power cable connector (U, V, W)

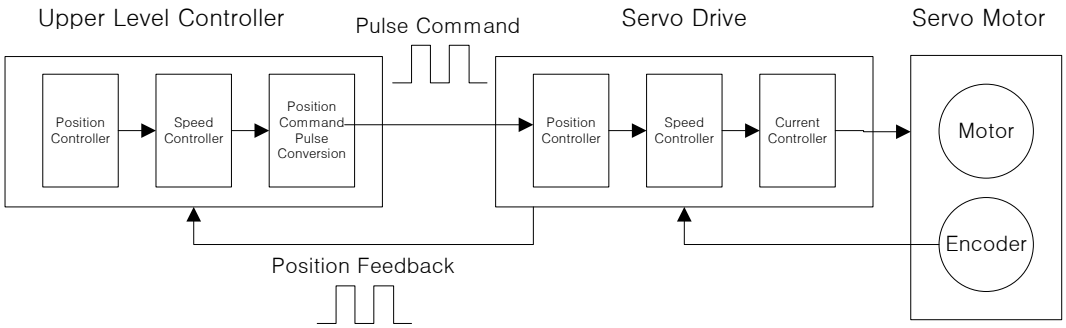
1.2 System Configuration

1.2.1 Overview

The L7 servo system can be configured in various ways depending on its interface with the upper level controller.

(1) Position Operation System

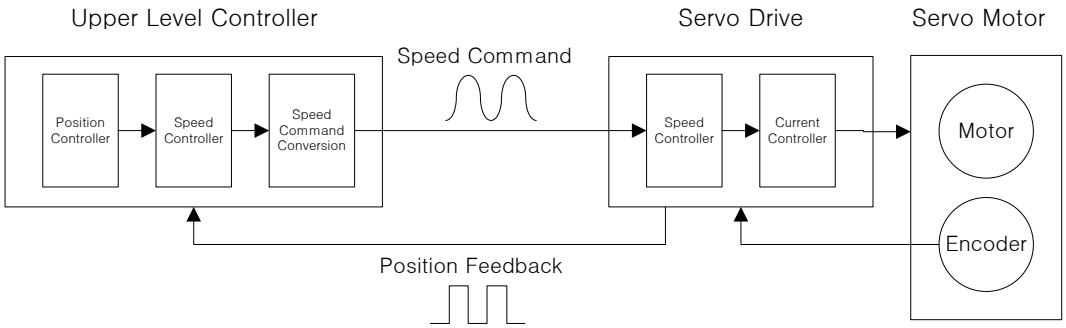
The servo is run by pulse commands. You can change the location of the servo motor by changing command pulses based on a certain transfer unit.



- Advantages: The structure of the upper level controller is simple because pulse input is linked to transfer units.
- Disadvantage:
  - Fast rotation is compromised when a precise transfer unit is used.
  - Response is low because multiple levels of controllers are used.

(2) Speed Operation System

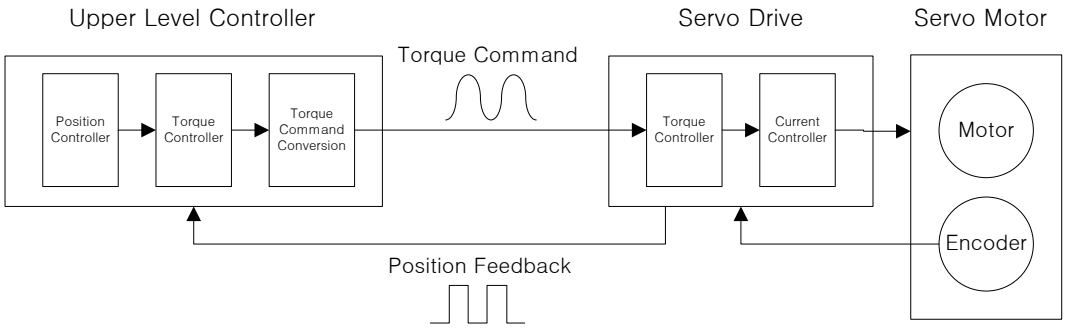
The servo is run by speed commands. There are two types of speed commands: analog voltage command and digital speed command.



- Advantages:
  - The servo responds quickly.
  - Precision control is easy.
- Disadvantage: The upper level controller is complex.

(3) Torque Operation System

The servo is run by torque commands. Analog voltage-based commands are used.



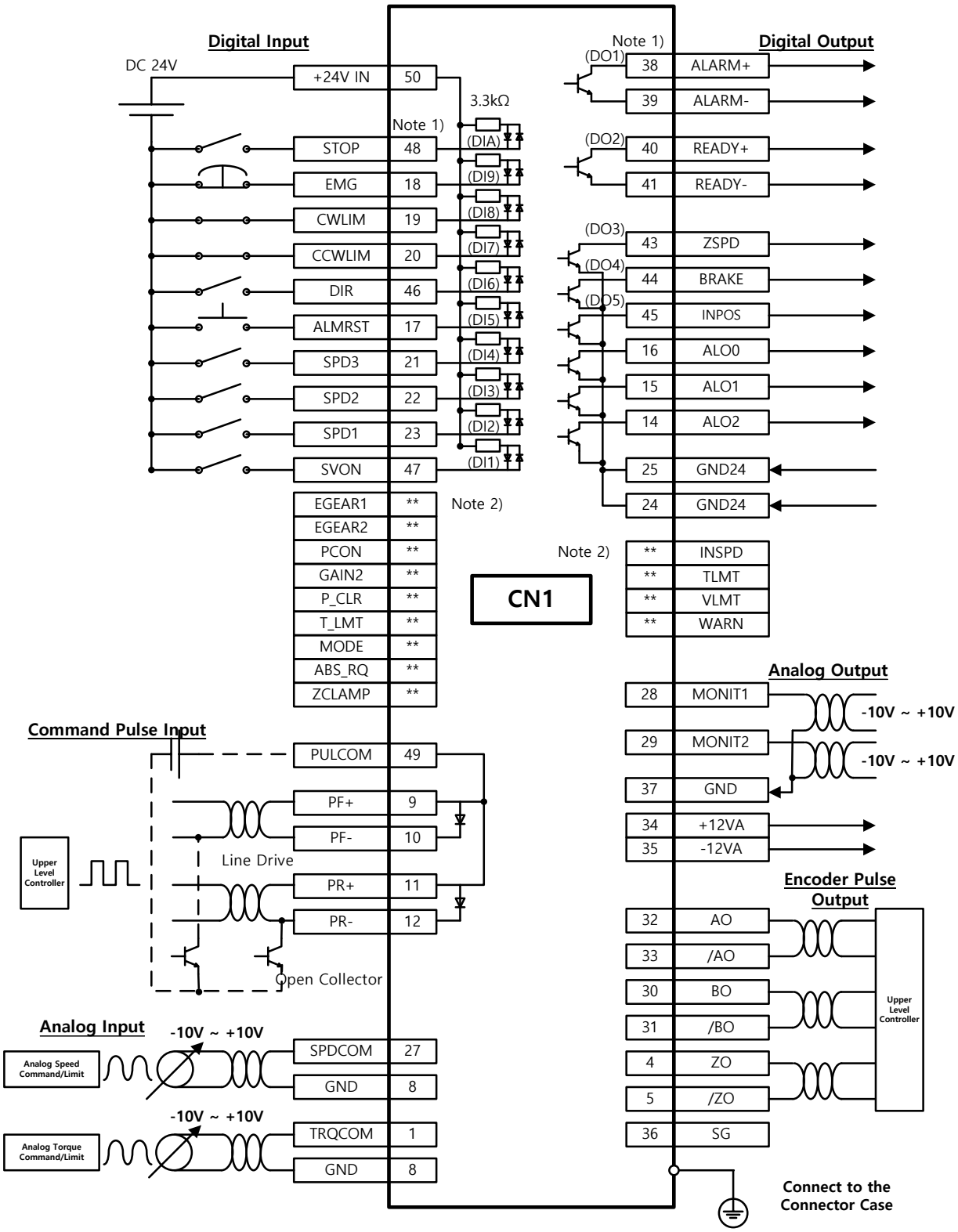
- Advantages:
  - The servo responds quickly.
  - Precision control is easy.
- Disadvantage: The upper level controller is complex.

(4) Modes of Operation

The L7 servo drive can be run in torque, speed, and location modes, depending on its interface with the upper level controller. The operation modes can be switched by parameters or digital input contact point.

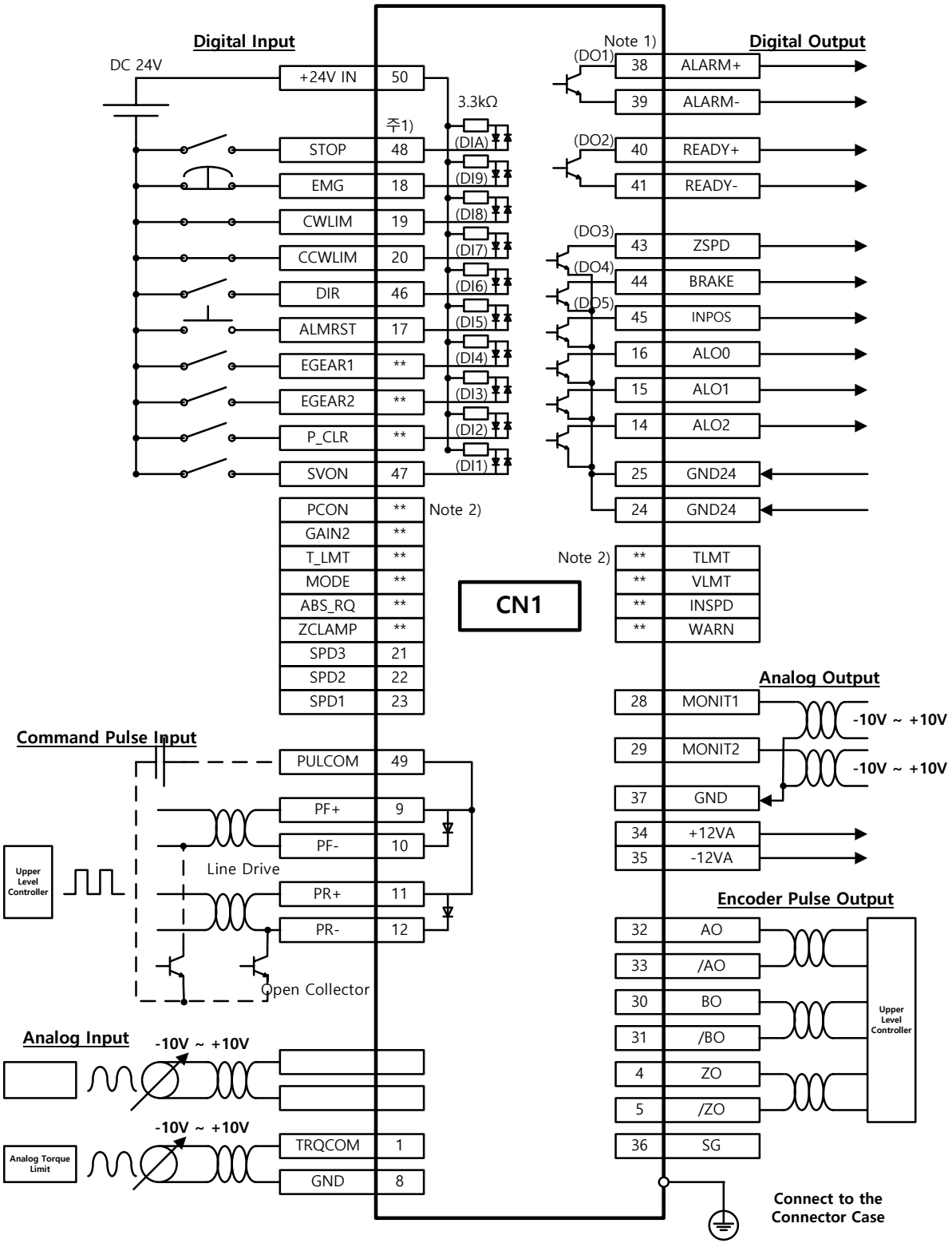
Modes of Operation	System Configuration
0	The servo is run on the torque operation system.
1	The servo is run on the speed operation system.
2	The servo is run on the position operation system.
3	The servo is run with the speed and position operation systems as points of contact.
4	The servo is run with the speed and torque operation systems as points of contact.
5	The servo is run with the location and torque operation systems as points of contact.

1.2.2 Wiring Diagram of the Entire CN1 Connector



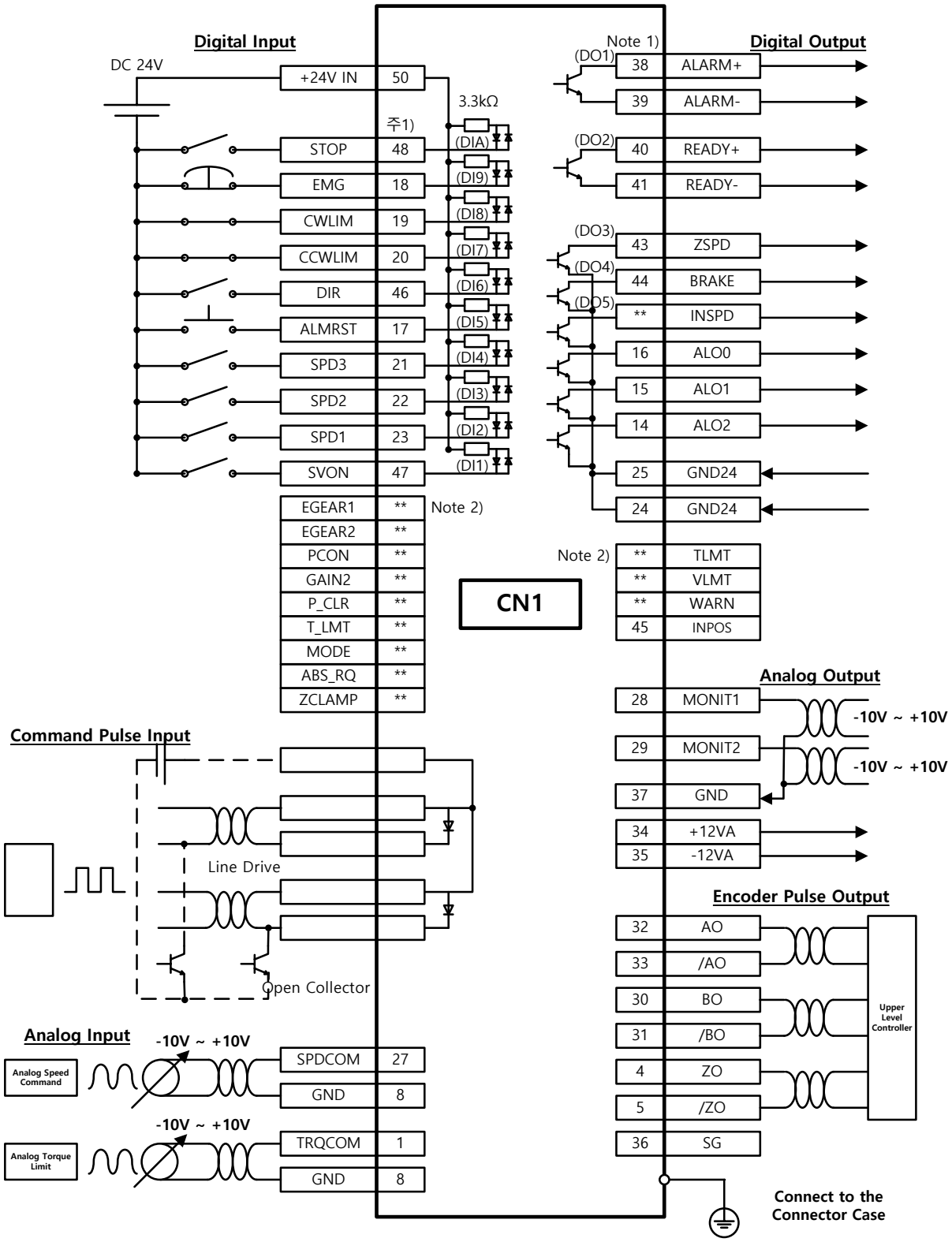
Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.

1.2.3 Example of Location Drive Mode Wiring



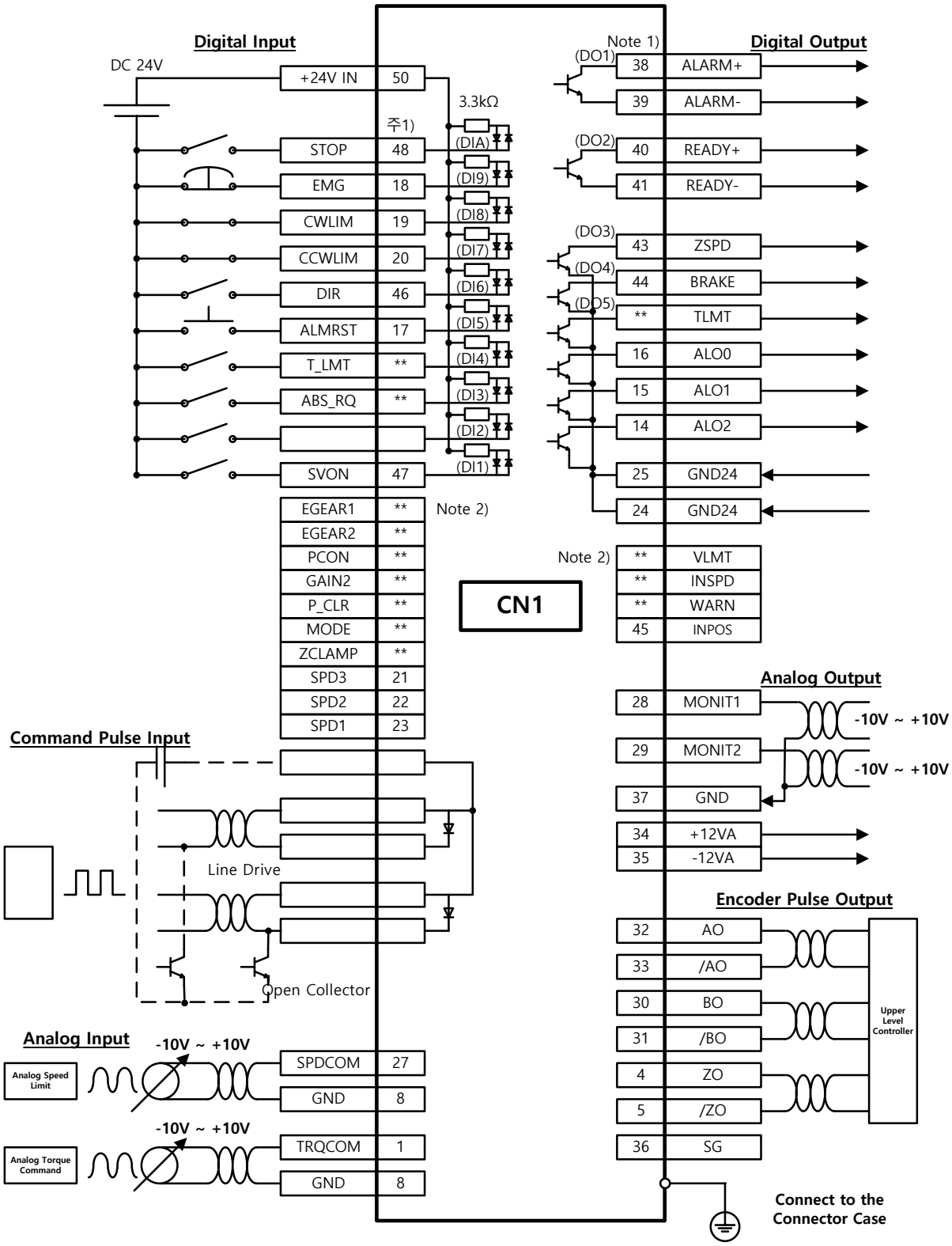
Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.

1.2.4 Example of Speed Drive Mode Wiring



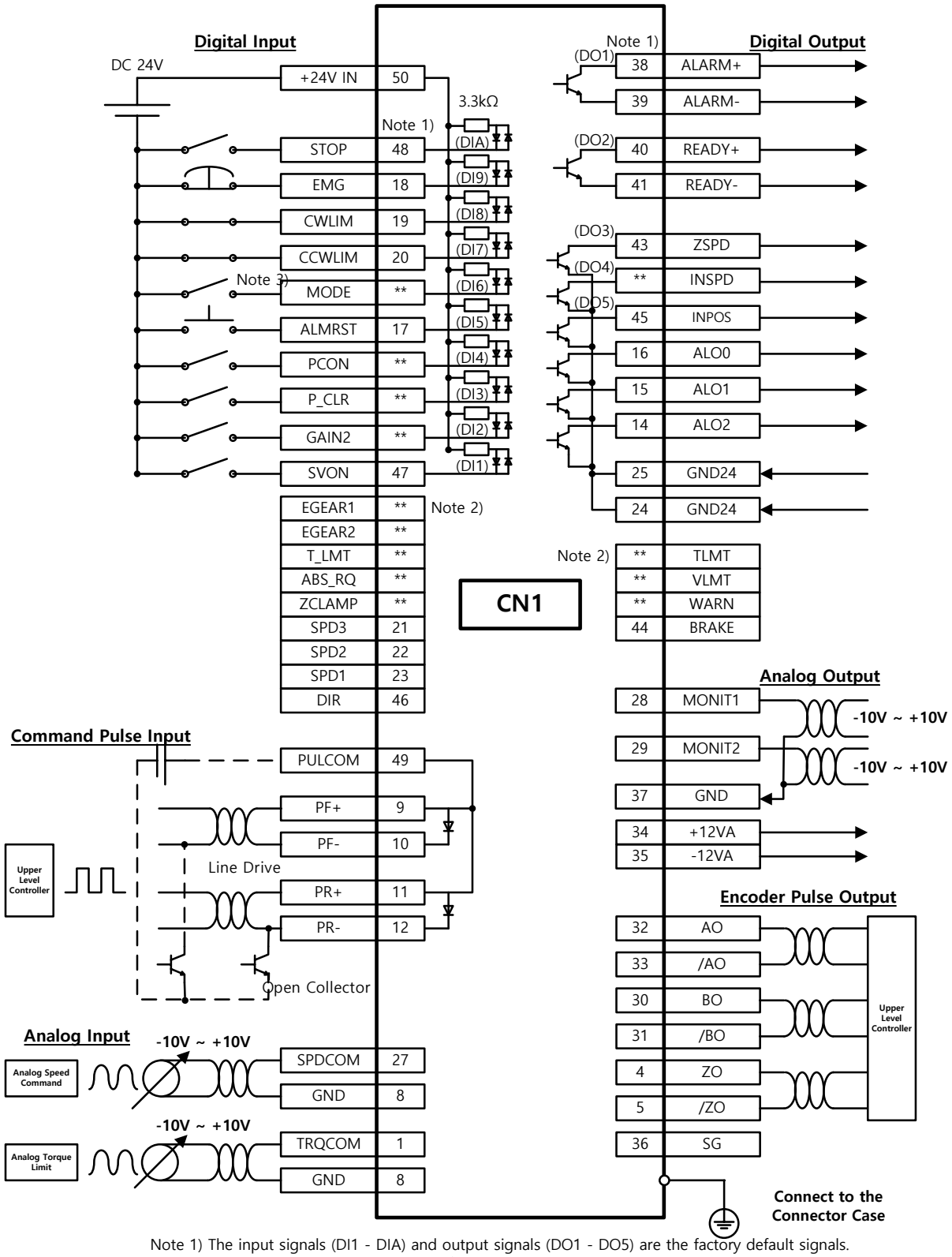
Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.

1.2.5 Example of Torque Drive Mode Wiring



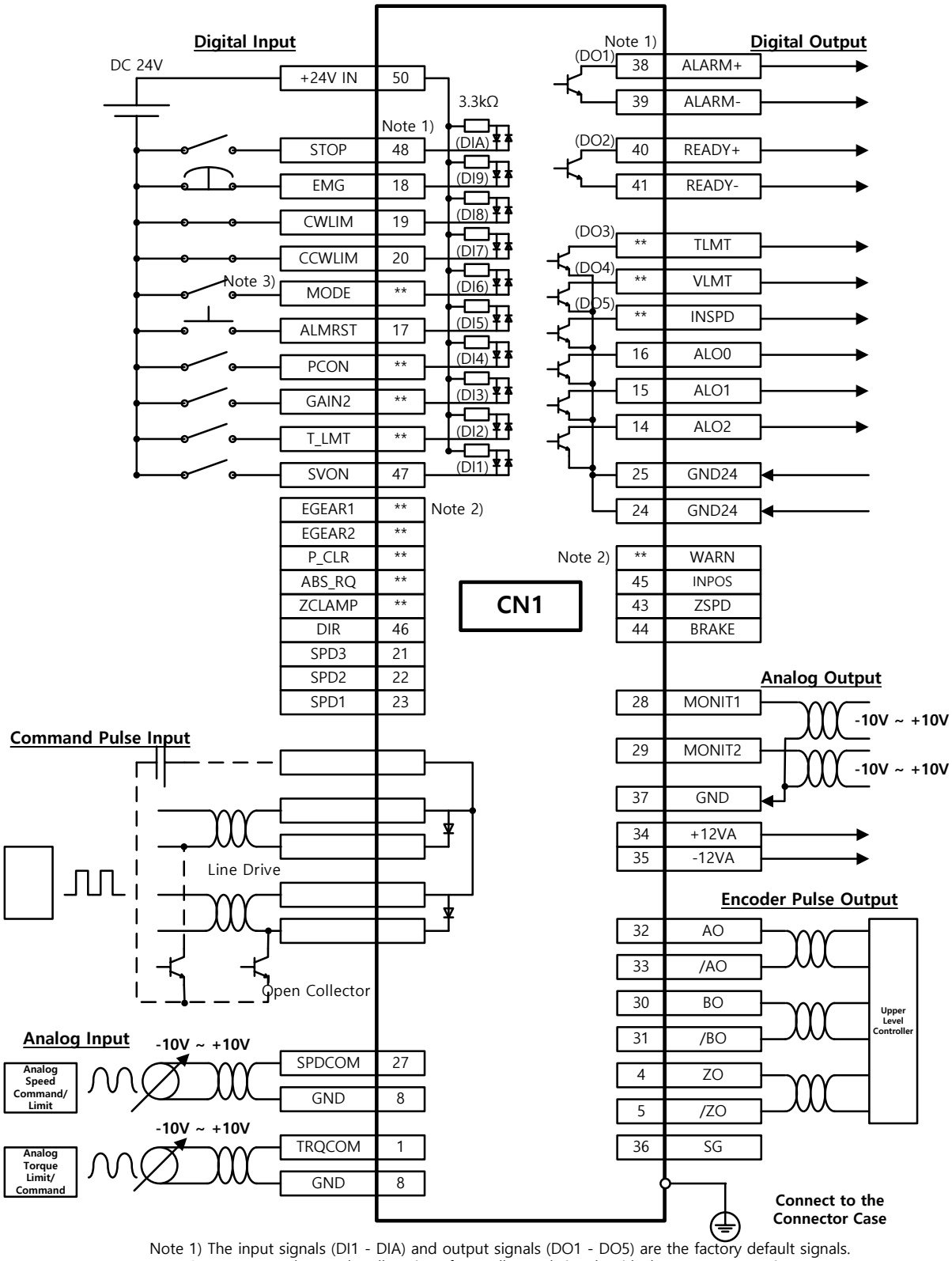
Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.

1.2.6 Example of Speed/Location Drive Mode Wiring



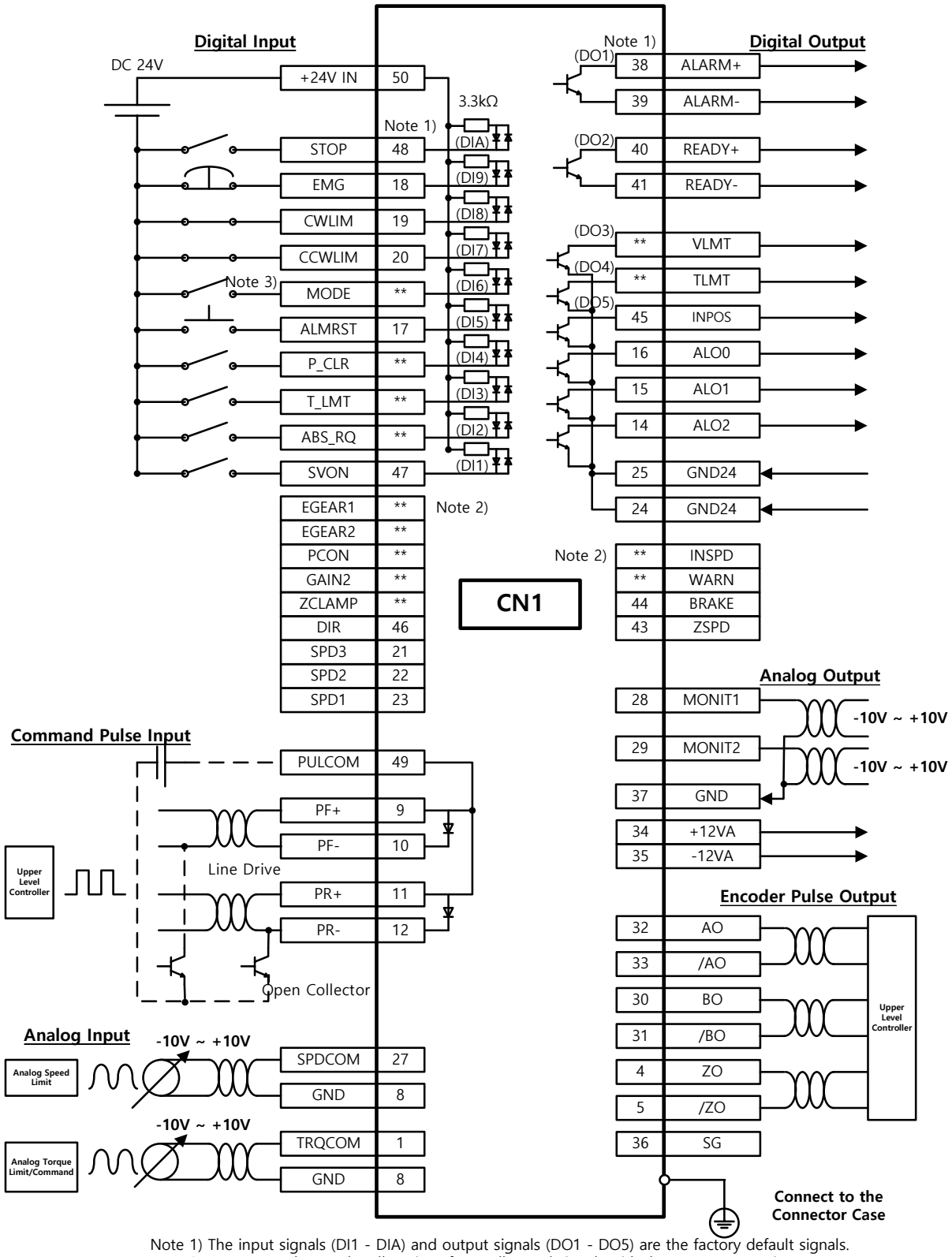
Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.
Note 3) Input Contact Mode = ON: Speed Control Mode, Mode = OFF: Position Operation Mode

1.2.7 Example of Speed/Torque Drive Mode Wiring



Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.
Note 3) Input Contact Mode = ON: Speed Control Mode, Mode = OFF: Torque Operation Mode

1.2.8 Example of Location/Torque Drive Mode Wiring



Note 1) The input signals (DI1 - DIA) and output signals (DO1 - DO5) are the factory default signals.
Note 2) ** You can change the allocations for unallocated signals with the parameter settings.
Refer to sections 4.1.6, "External Input Signals and Logic Definitions," and 4.1.8, "External Output Signals and Logic Definitions," for more information.
Note 3) Input Contact Mode = ON: Position Control Mode, Mode = OFF: Torque Operation Mode

1.3 Signals

1.3.1 Digital Input Contact Signal

Default pin number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
50	+24 V IN	Input contact +24 V power	O	O	O	O	O	O
47	SVON	Servo ON	O	O	O	O	O	O
23	SPD1	Multi-speed 1	X	O	X	O/X	O/X	X
22	SPD2	Multi-speed 2	X	O	X	O/X	O/X	X
21	SPD3	Multi-speed 3	X	O	X	O/X	O/X	X
17	ALMRST	Reset upon alarm	O	O	O	O	O	O
46	DIR	Select rotation direction	O	O	O	O	O	O
20	CCWLMT	Counter-clockwise limit	O	O	O	O	O	O
19	CWLMT	Clockwise limit	O	O	O	O	O	O
18	EMG	Emergency stop	O	O	O	O	O	O
48	STOP	Stop	O	O	O	O	O	O
assignment	EGEAR1	Electronic gear ratio 1	O	X	X	X/O	X	O/X
assignment	EGEAR2	Electronic gear ratio 2	O	X	X	X/O	X	O/X
assignment	PCON	P control action	O	O	X	O	O/X	O/X
assignment	GAIN2	Select gain 2	O	O	X	O	O/X	O/X
assignment	P_CLR	Input pulse clear	O	X	X	X/O	X	O/X
assignment	T_LMT	Control torque with TRQCOM	O	O	O	O	O	O
assignment	MODE	Change operation modes	X	X	X	O	O	O
assignment	ABS_RQ	Request absolute location data	O	O	O	O	O	O
assignment	ZCLAMP	Zero clamp	X	O	X	O/X	O/X	O

1.3.2 Analog Input Contact Signal

Pin Number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
27	SPDCOM	Analog speed command (-10-+10 V)	X	O	X	O/X	O/X	X
		Analog Speed Limit (-10-+10 V)	X	X	O	X	X/O	X/O
1	TRQCOM	Analog Torque Command (-10-+10 V)	X	X	O	X	X/O	X/O
		Analog torque limit (-10-+10 V)	O	O	X	O	O/X	O/X
8 37	GND	Ground for analog signals	O	O	O	O	O	O

1.3.3 Digital Output Contact Signal

Default pin number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
16	ALO0	Alarm group contact output 1	O	O	O	O	O	O
15	ALO1	Alarm group contact output 2	O	O	O	O	O	O
14	ALO2	Alarm group contact output 3	O	O	O	O	O	O
38 / 39	ALARM +/-	Alarm	O	O	O	O	O	O
40 / 41	READY +/-	Ready for operation	O	O	O	O	O	O
43	ZSPD	Zero speed reached	O	O	O	O	O	O
44	BRAKE	Brake	O	O	O	O	O	O
45	INPOS	Location reached	O	X	X	X/O	X	O/X
assignment	TLMT	Torque limit	O	O	O	O	O	O
assignment	VLMT	Speed limit	O	O	O	O	O	O
assignment	INSPD	Speed reached	X	O	X	O/X	O/X	X
assignment	WARN	Warning	O	O	O	O	O	O
24 25	GND24	Input/output contact Ground of drive power (24 V)	O	O	O	O	O	O

1.3.4 Monitor Output Signal and Output Power

Pin Number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
28	MONIT1	Analog monitor output 1 (-10-+10 V)	O	O	O	O	O	O
29	MONIT2	Analog monitor output 2 (-10-+10 V)	O	O	O	O	O	O
8 37	GND	Ground for analog signals	O	O	O	O	O	O
34	+12V	Terminal for +12 V power output	O	O	O	O	O	O
35	-12V	Terminal for -12 V power output	O	O	O	O	O	O

1.3.5 Pulse Train Input Signal

■ Line Drive (5 V)

Pin Number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
9	PF+	F+ pulse input	O	X	X	X/O	X	O/X
10	PF-	F- pulse input	O	X	X	X/O	X	O/X
11	PR+	R+ pulse input	O	X	X	X/O	X	O/X
12	PR-	R- pulse input	O	X	X	X/O	X	O/X
49	PULCOM	Not for use	X	X	X	X	X	X

■ Open Collector (24 V)

Pin Number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
9	PF+	Not for use	X	X	X	X	X	X
10	PF-	F pulse input	O	X	X	X/O	X	O/X
11	PR+	Not for use	X	X	X	X	X	X
12	PR-	R pulse input	O	X	X	X/O	X	O/X
49	PULCOM	+24 V power input	O	X	X	X/O	X	O/X

1.3.6 Encoder Output Signal

Pin Number	name	Details	Applicable Modes					
			Position	Speed	Torque	Speed /Location	Speed /Torque	Position /Torque
32 33 30 31	AO /AO BO /BO	Outputs encoder signals received from the motor as signals pre-scaled according to the ratio defined by [P0-14]/[P0-15]. (5 V line drive method)	O	O	O	O	O	O
4 5	ZO /ZO	Outputs encoder Z signals received from the motor. (5 V line drive method)	O	O	O	O	O	O

2. Installation

2.1 Servo motor

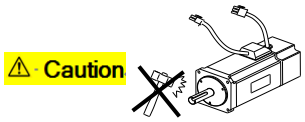
2.1.1 Operating Environment

Item	Requirements	Notes
Ambient temperature	0 ~ 40[℃]	Consult with our technical support team to customize the product if temperatures in the installation environment are outside this range.
Ambient humidity	80% RH or lower	Do not operate this device in an environment with steam.
External vibration	Vibration acceleration 19.6 ㎨ or below on both the X and Y axis.	Excessive vibrations reduce the lifespan of the bearings.

*** Products in this manual have been passed the standards(EN 60034-1) for Industrial purpose(Class A), so they are eligible to use in industrial environment.**

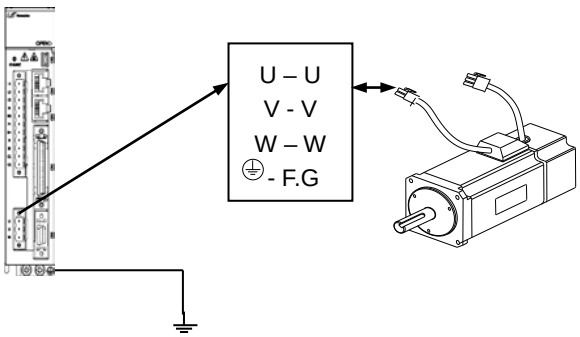
2.1.2 Preventing Impact

Impact to the motor during installation or handling may damage the encoder.



2.1.3 Motor Connection

- The motor might burn out if it is connected directly to commercial power.
  Always connect the motor via the specified drive.
- Connect the ground terminals of the motor to either of the two ground terminals inside the drive, and attach the remaining terminal to the type-3 ground.

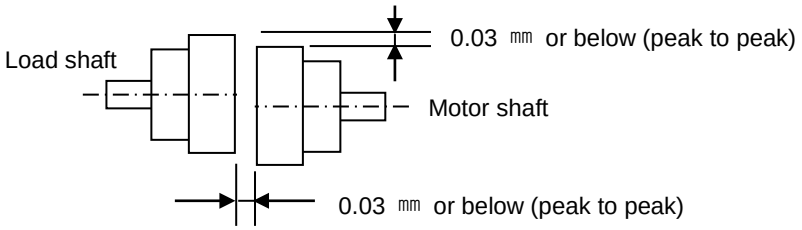


- Connect the U, V, and W terminals of the motor in the same way as the U, V, and W terminals of the drive.

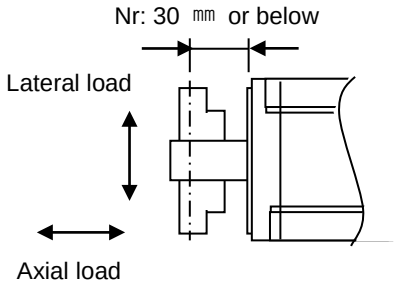
- Ensure that the pins on the motor connector are securely attached.
- In order to protect against moisture or condensation in the motor, make sure that insulation resistance is 10 ㏁ (500 V) or higher before installation.

2.1.4 The Load Device Connection

For coupling connections: Ensure that the motor shaft and load shaft are aligned within the tolerance range.

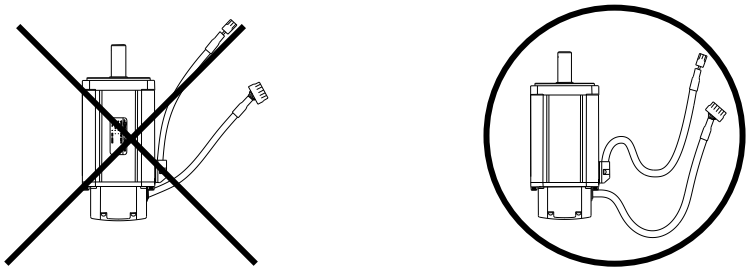


■ For pulley connections:

Flange	Lateral Load		Axial Load		Notes
	N	kgf	N	kgf	
40	148	15	39	4	
60	206	21	69	7	
80	255	26	98	10	
130	725	74	362	37	
180	1548	158	519	53	
220	1850	189	781	90	

2.1.5 Cable Installation

- For vertical installations, make sure that no oil or water flows into the connecting parts.



- Do not apply pressure to or damage the cables.

  Use robot cables to prevent swaying when the motor moves.

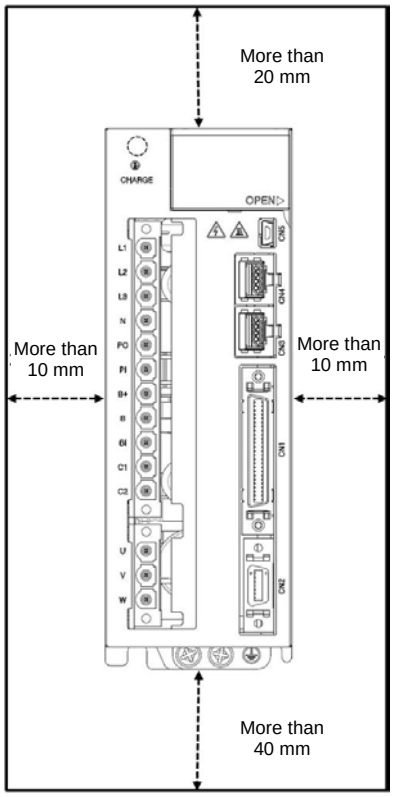
2.2 Servo drive

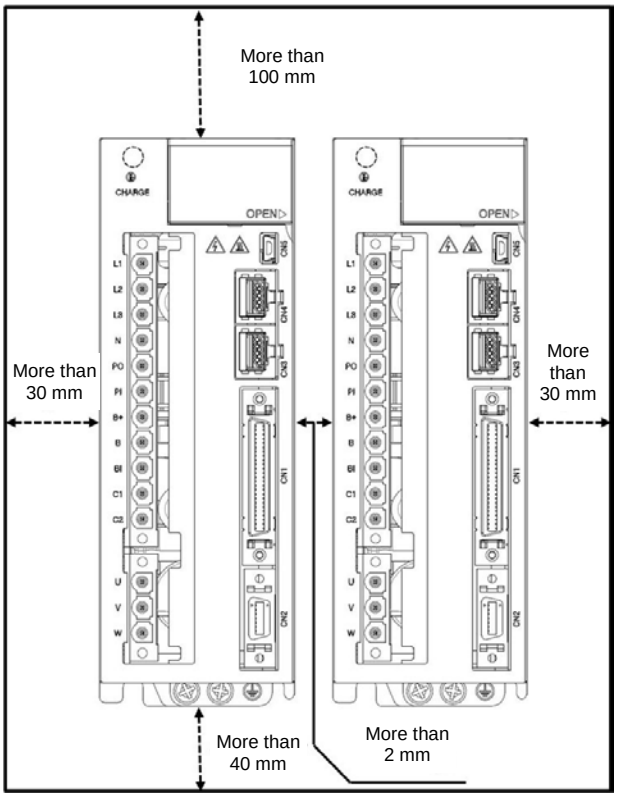
2.2.1 Operating Environment

Item	Environmental conditions	Notes
Ambient temperature	0～50[℃]	⚠ **Caution** Install a cooling fan on the control panel to maintain an appropriate temperature.
Ambient humidity	90% RH or lower	⚠ **Caution** Condensation or moisture may develop inside the drive during prolonged periods of inactivity and damage it. Remove all moisture before operating the drive after a prolonged period of inactivity.
External vibration	Vibration acceleration 4.9 ㎨ or lower	Excessive vibration reduces the lifespan of the machine and may cause malfunctions.
Ambient conditions	▪ Do not expose the device to direct sunlight. ▪ Do not expose the device to corrosive or combustible gases. ▪ Do not expose the device to oil or dust. ▪ Ensure that the device receives sufficient ventilation.	

2.2.2 Wiring the Control Panel

Comply with the spacing specified in the following figures when installing the control panel.





⚠ Caution

- Ensure that during installation the heat from the external regenerative resistor does not affect the drive.
- Ensure that the servo drive control panel is flat against the wall during installation.
- Ensure that the metal powder from drilling does not enter the drive when assembling the control panel.
- Ensure that oil, water, and metal dust do not enter the drive through gaps in the casing.
- Protect the control panel by spraying compressed air in areas which accumulate harmful gases or dust.

2.2.3 Power Supply Wiring

- Ensure that the input power voltage is within the acceptable range.

⚠ Caution
Overvoltages can damage the drive.

- Connecting commercial power to the U, V and W terminals of the drive may damage the drive. Always supply power via the L1, L2 and L3 terminals.
- When using an internal regenerative resistor, connect short-circuit pins to the B and BI terminals. For external regenerative resistors, remove the short-circuit pins and use standard resistors for the B+ and B terminals.

Model	Resistance value	Standard Capacity	* Notes
L7SB010□	100 Ω	Built-in 100 W	⚠ **Caution** For information about resistance during regenerative capacity expansion, refer to Section 7.3, "Optional and Peripheral Devices."
L7SB020□	40 Ω	Built-in 150 W	
L7SB035□	40 Ω	Built-in 150 W	
L7SB050□	27Ω	Built-in 120 W	
L7SB075□	27 Ω	Built-in 240 W	
L7SB150□	13.4 Ω	External 2000 W	

- Configure the system so that the main power (L1, L2, L3) is supplied after the control power (C1, C2). (Refer to Chapter 3, "Wiring.")
- High voltages may remain in the device for sometime even after the main power is disconnected.

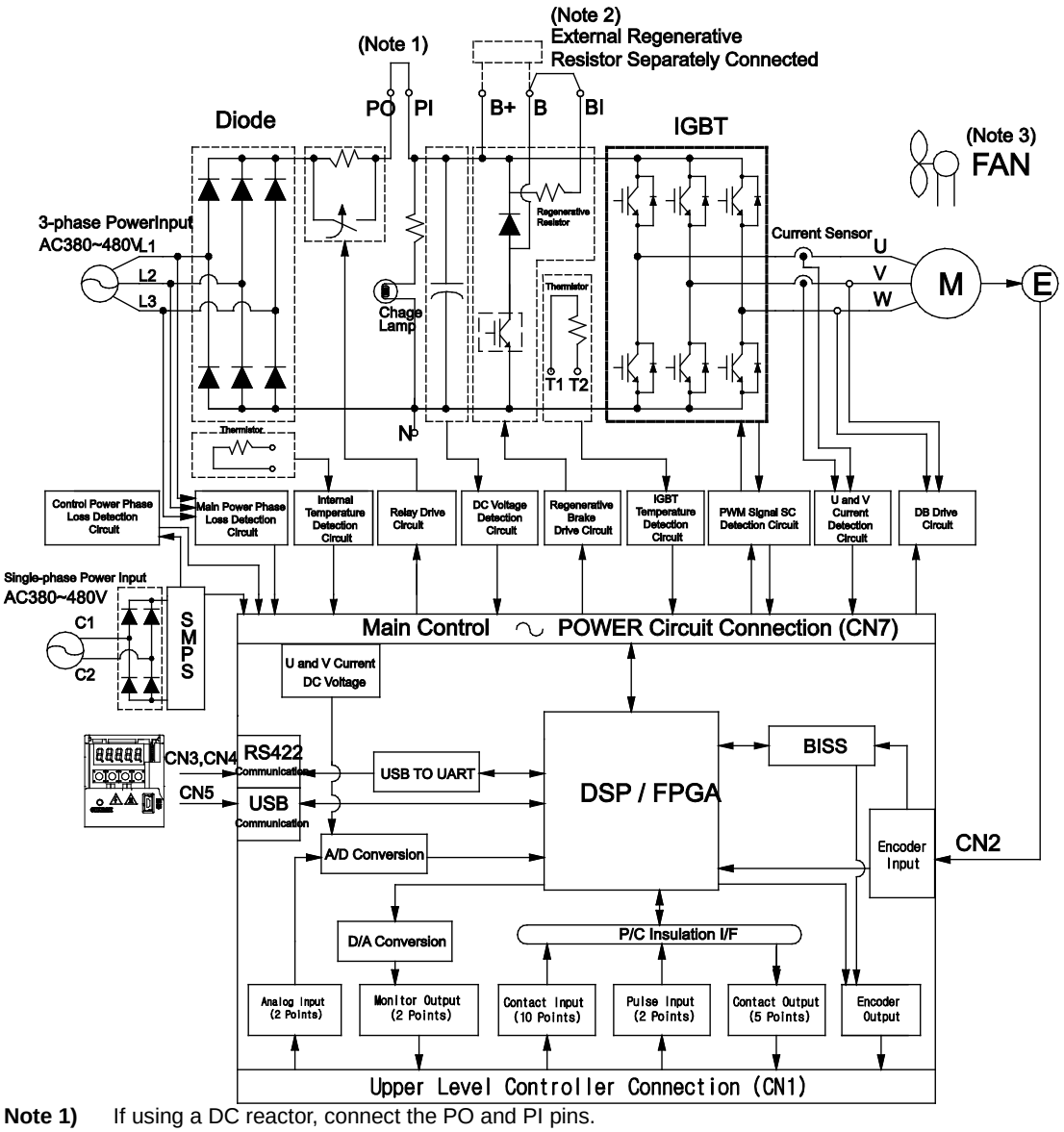
⚠ Warning
After disconnecting the main power, ensure that the charge lamp is off before you start wiring. Failure to do so may result in electric shock.

- Always ground the device over the shortest possible distance.
  Long ground wires are susceptible to noise which may cause the device to malfunction.

3. Wiring

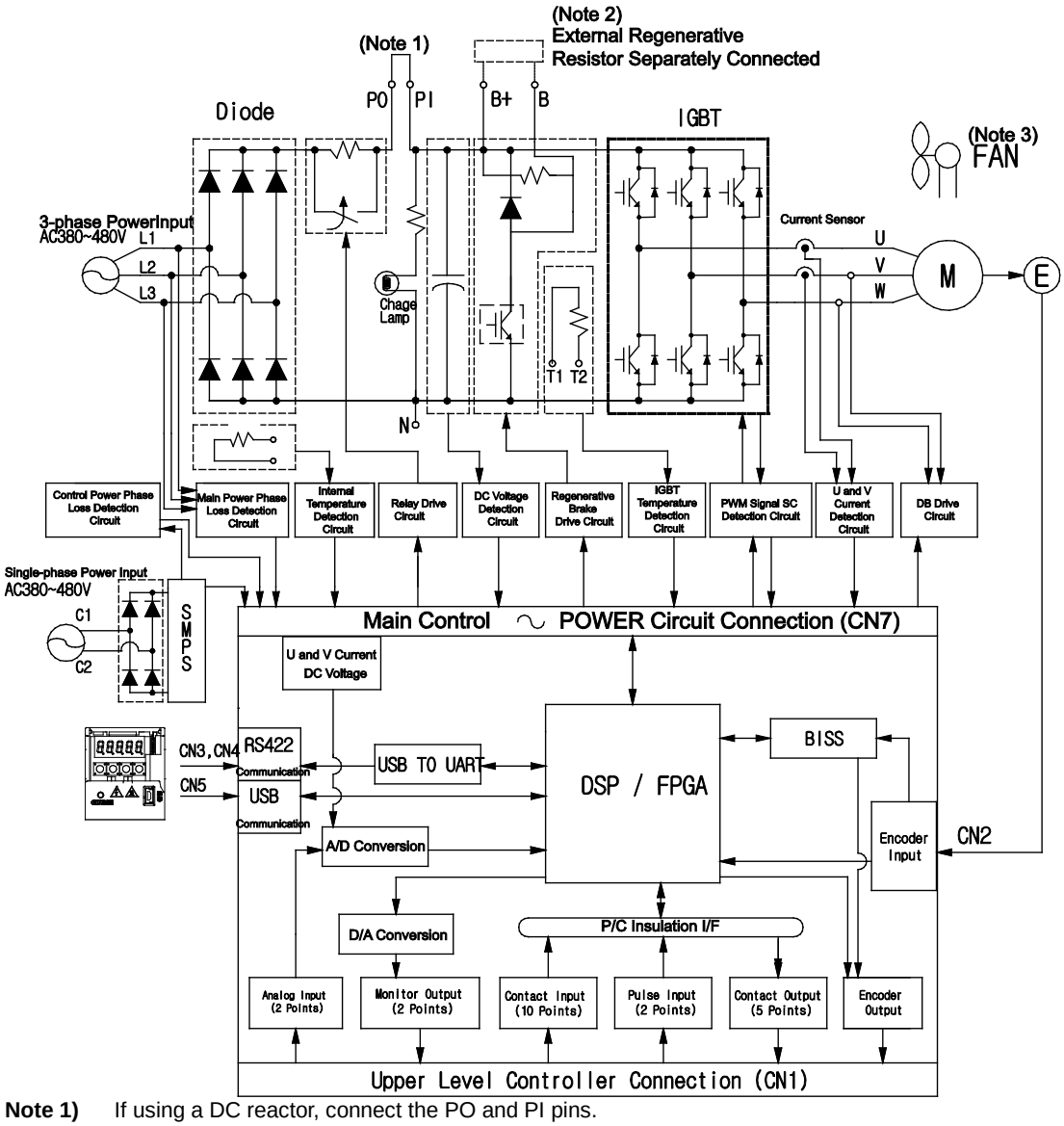
3.1 Internal Diagram

3.1.1 L7 Drive Block Diagram [L7SB010□ - L7**SB035□**]



Note 1) If using a DC reactor, connect the PO and PI pins.
Note 2) If using an external regenerative resistor, remove the B and BI short-circuit pins and connect the B+ and B pins.
Note 3) Models ranging from L7SB010□ to L7SB035□ are cooled by a DC 24 V cooling fan.
Note 4) Use N terminals to connect the external capacitor. The product may burn if a commercial power supply is connected to N terminals. Always contact the customer center or agency when it is necessary to connect the external capacitor.

3.1.2 L7 Drive Block Diagram [L7SB050□ - L7**SB075□**]



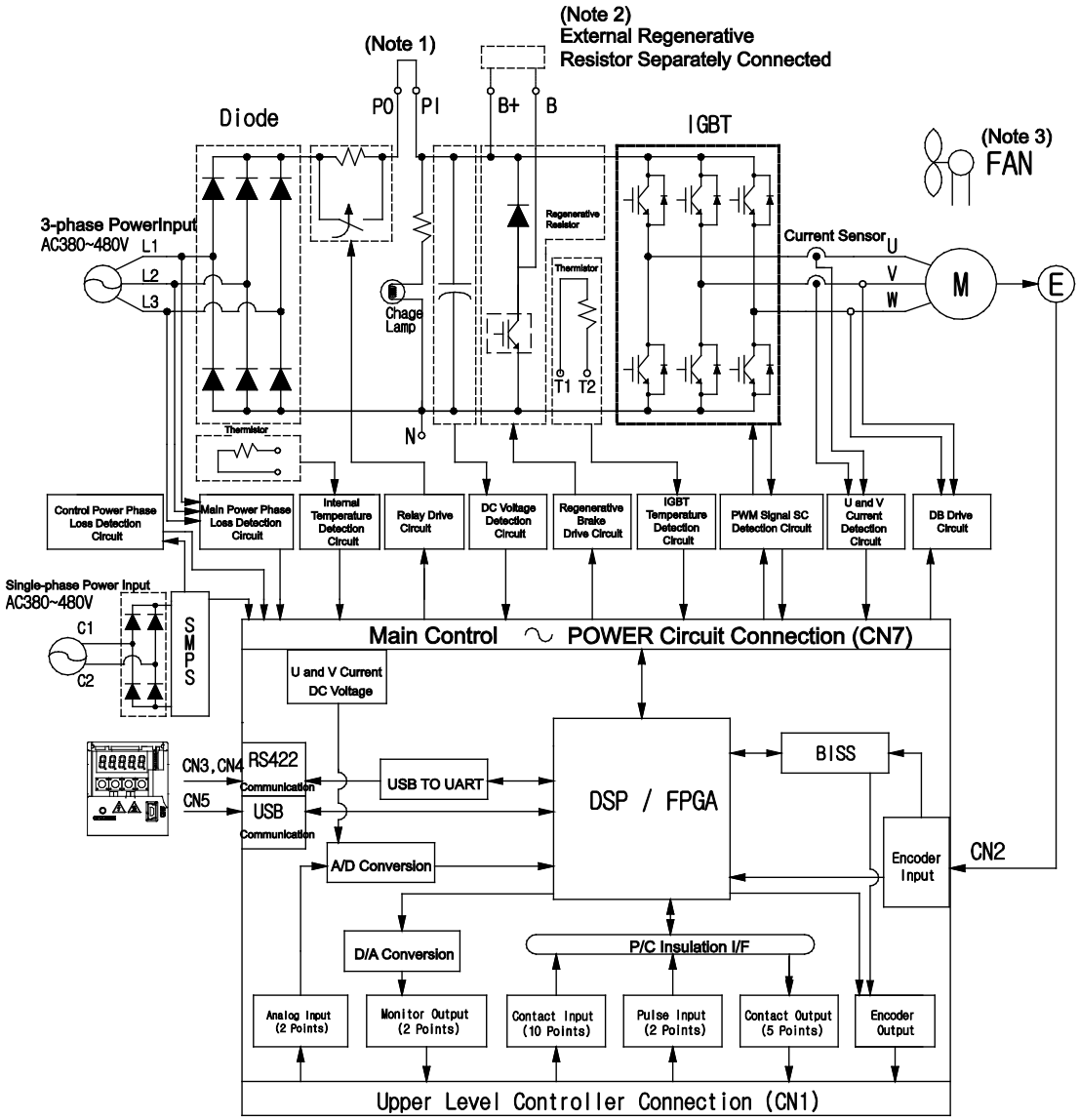
Note 1) If using a DC reactor, connect the PO and PI pins.

Note 2) If using an external regenerative resistor, attach the wiring of internal resistance to mounting hole "NC" for internal resistance of the case. Then, connect external regenerative resistance to B+ and B terminals.

Note 3) Models ranging from L7SB050□ to L7SB075□ are cooled by a DC 24 V cooling fan.

Note 4) Use N terminals to connect the external capacitor. The product may burn if a commercial power supply is connected to N terminals. Always contact the customer center or agency when it is necessary to connect the external capacitor.

3.1.3 L7 Drive Block Diagram [L7**SB150□**]



Note 1) If using a DC reactor, connect the PO and PI pins.

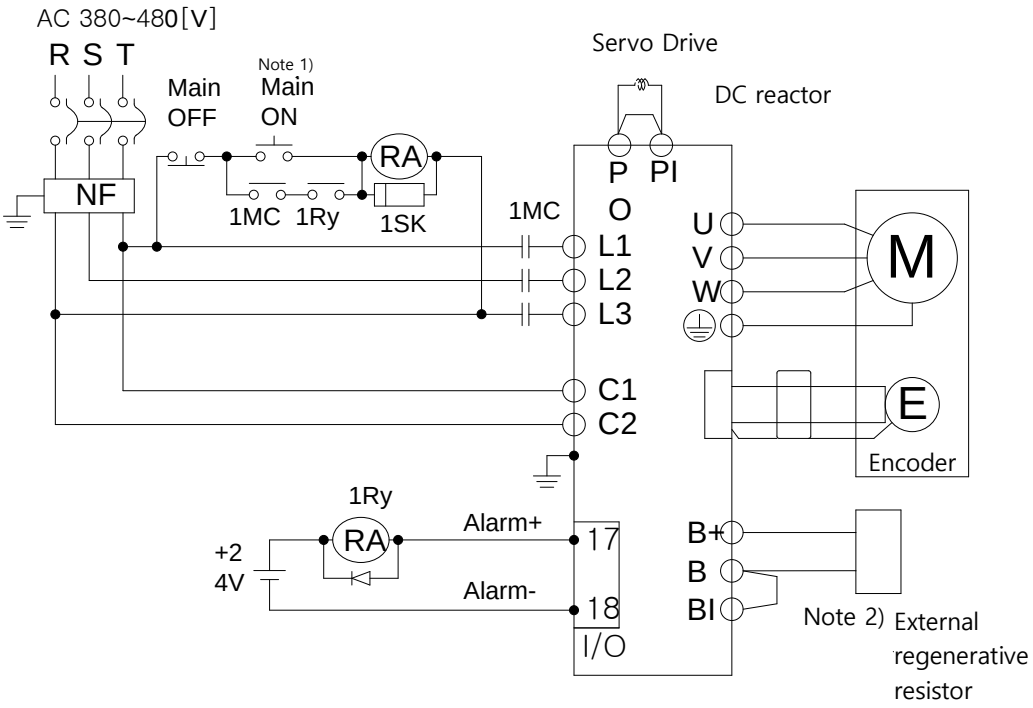
Note 2) L7SB150□ model has no internal regenerative resistance. By default, use external regenerative resistance. When attaching the resistance, connect it to B+, and B terminals.

Note 3) L7SB150□ Model is cooled by a DC 24 V cooling fan.

Note 4) Use N terminals to connect the external capacitor. The product may burn if a commercial power supply is connected to N terminals. Always contact the customer center or agency when it is necessary to connect the external capacitor.

3.2 Power Supply Wiring

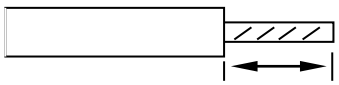
3.2.1 L7 Drive Wiring Diagram [L7**SB010**□ - L7**SB035**□]



Note 1) It takes approximately one to two seconds until alarm signal is output after you turn on the main power. Accordingly, push and hold the main power ON switch for at least two seconds.

Note 2) Short-circuit B and BI terminals before use, because L7SB010□ (100 W, 100 Ω) and L7SB035□ (150 W, 40 Ω) have internal regenerative resistance. If the regenerative capacity is high because of frequent acceleration and deceleration, open the short-circuit pins (B , BI) and connect an external regenerative resistor to B and B+.

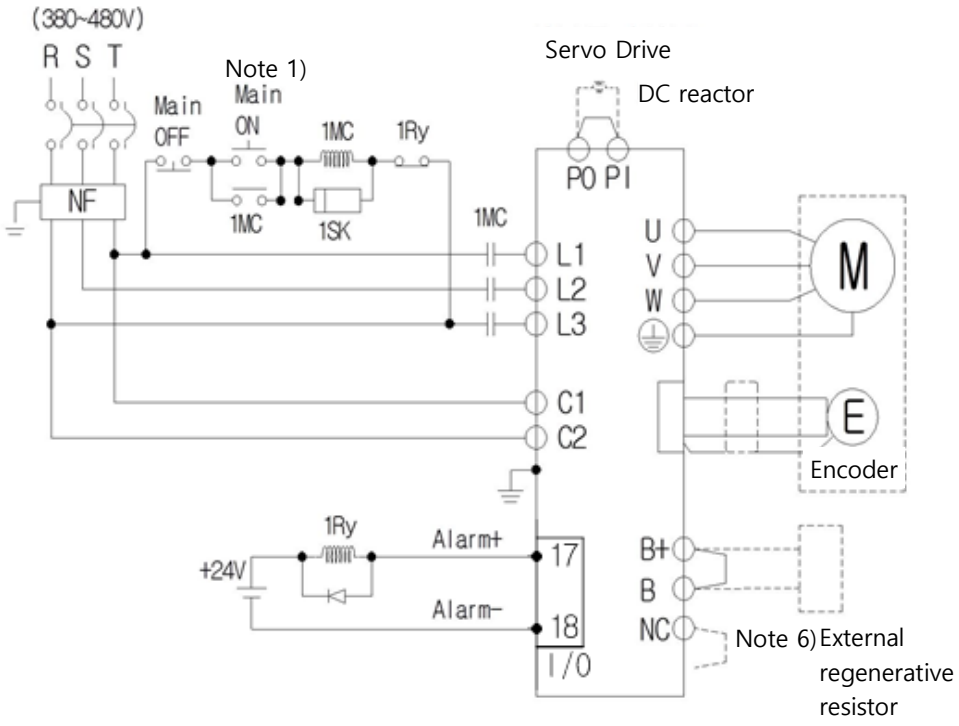
Note 3) Remove approximately 7-10 ㎜ of the sheathing from the cables for the main circuit power and attach crimp terminals. (Refer to Section 3.2.2, "Power Circuit Electrical Components.")



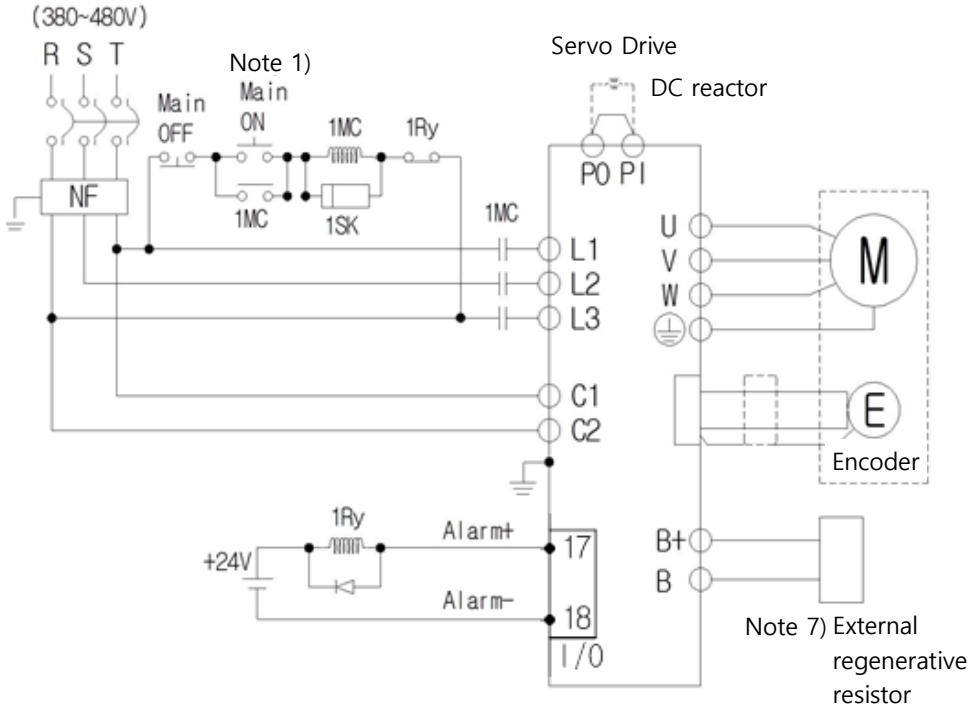
Note 4) Use a (-) flathead screwdriver to connect or remove the main circuit power unit wiring.

Note 5) Use N terminals to connect the external capacitor. The product may burn if a commercial power supply is connected to N terminals. Always contact the customer center or agency when it is necessary to connect the external capacitor.

3.2.2 L7 Drive Wiring Diagram [L7SB050□ - L7SB075□]



3.2.3 L7 Drive Wiring Diagram [L7SB150□]



Note 1) It takes approximately one to two seconds until alarm signal is output after you turn on the main power. Accordingly, push and hold the main power ON switch for at least two seconds.

Note 2) Short-circuit B and BI terminals before use, because L7SB075□ (120 W, 27 Ω) has internal regenerative resistance. If the regenerative capacity is high because of frequent acceleration and deceleration, attach the short-circuit pins (B+, B) to NC terminal and connect an external regenerative resistor to B+ and B before use.

Note 3) By default, use external regenerative resistance for L7SB150□ (2000 W, 13.4 Ω), and short-circuit B+ and B terminals before use.

Note 4) For the cables for the main circuit and control power unit, you must use crimp terminals compliant with electrical component standards (L7-075 : GP110028_KET, L7-150 : GP110732_KET). (Refer to Section 3.2.3, "Power Circuit Electrical Components.")

Note 5) Both L7-075 and L7-150 use terminal block, so use (+) and (-) screwdriver to connect or remove the terminals.

Note 6) Use N terminals to connect the external capacitor. The product may burn if a commercial power supply is connected to N terminals. Always contact the customer center or agency when it is necessary to connect the external capacitor.

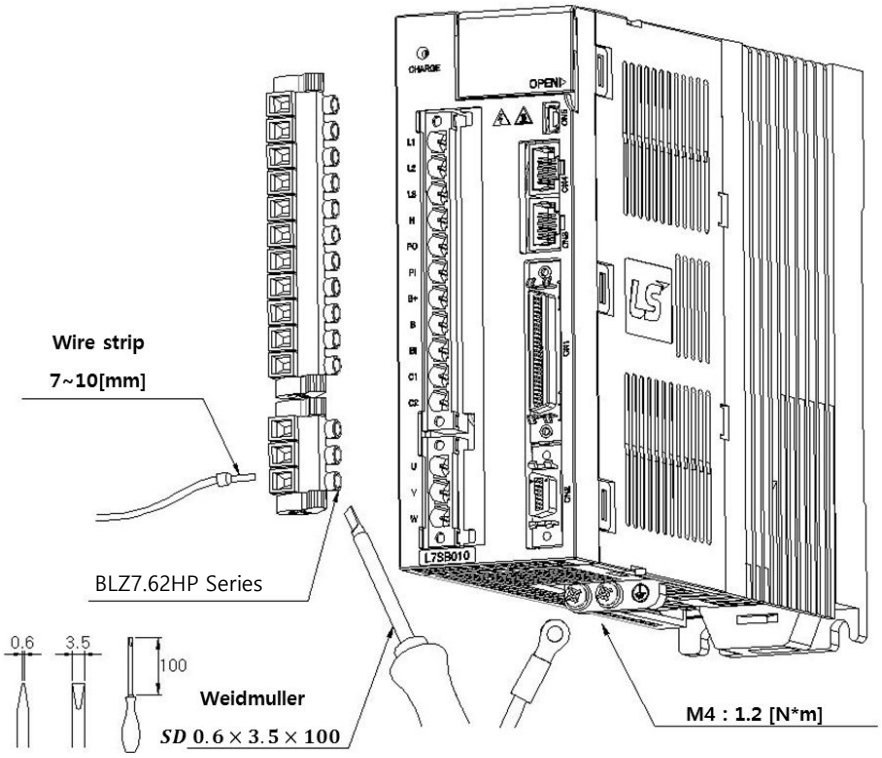
3.2.4 Power Circuit Electrical Components

Name		L7SB010□	L7SB020□	L7SB035□	L7SB050□	L7SB075□	L7SB150□
MCCB		30A Frame 10A (ABE33b/10)	30A Frame 20A (ABE33b/20)		30A Frame 30A (ABE33b/30)	30A Frame 30A (ABE33b/30)	50A Frame 50A (ABE53b/50)
Noise Filter (NF)		TB6-B010LBEI (10A)	TB6-B020NBDC (20A)		TB6-B030NBDC (30A)	TB6-B040A (40A)	TB6-B060LA (60A)
DC reactor		10 A	20 A		30A	30 A	50 A
MC		9A / 550V (GM□-12)	18A / 550V (GM□-22)		26A / 550V (GM□-40)	26A / 550V (GM□-40)	38A / 550V (GM□-50)
Wire Note 1)	L1, L2 ,L3 PO, PI, N B+, B U, V, W	AWG14 (2.08 ㎟)			AWG10 (5.5 ㎟)		AWG8 (8.0 ㎟)
	C1, C2	AWG14 (2.08 ㎟)					
Crimp terminal		UA-F4010, SEOIL (10 mm Strip & Twist)			GP110028 KET	GP110028 KET	GP110732 KET
Regenerative resistor (Default)		100 W 100 Ω	150 W 40 Ω		120 W 27 Ω	240 W 27 Ω	
Connector (Default)		BLZ 7.62HP/3/180LR SN OR BX SO BLZ 7.62HP/11/180LR SN OR BX SO					

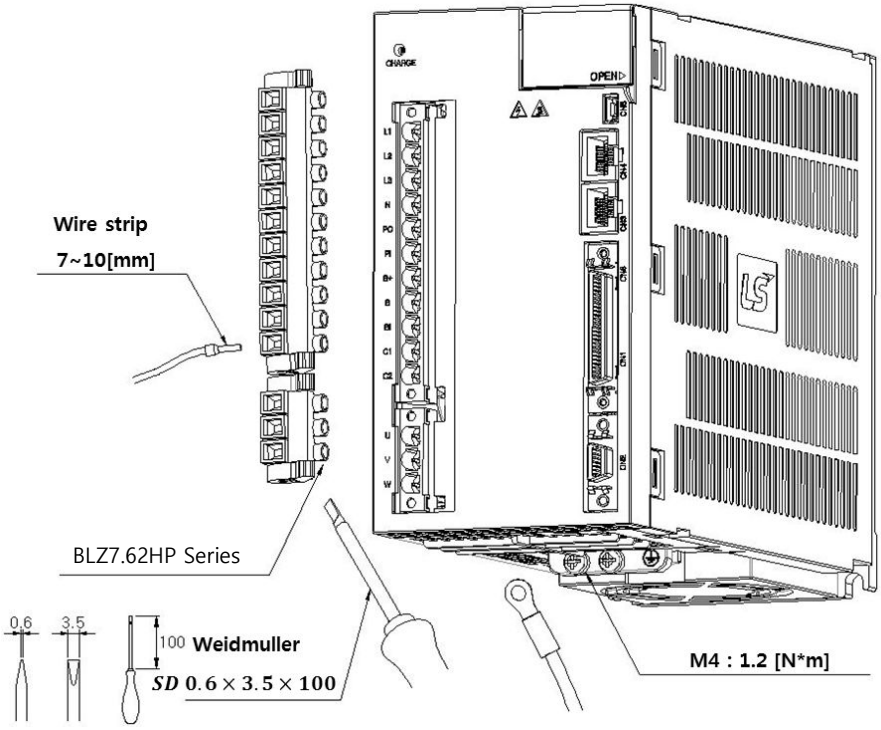
Note 1)

- When you select a wire, please use 600V, PVC-insulated wire.
- To comply with UL(CSA) standards, use UL-certified wire (heat resistant temperature 75℃ or above).
- To comply with other standards, use proper wires that meet applicable standards.
- For other special specifications, use wires equivalent or superior to those in this section.

- **L7□B010□**



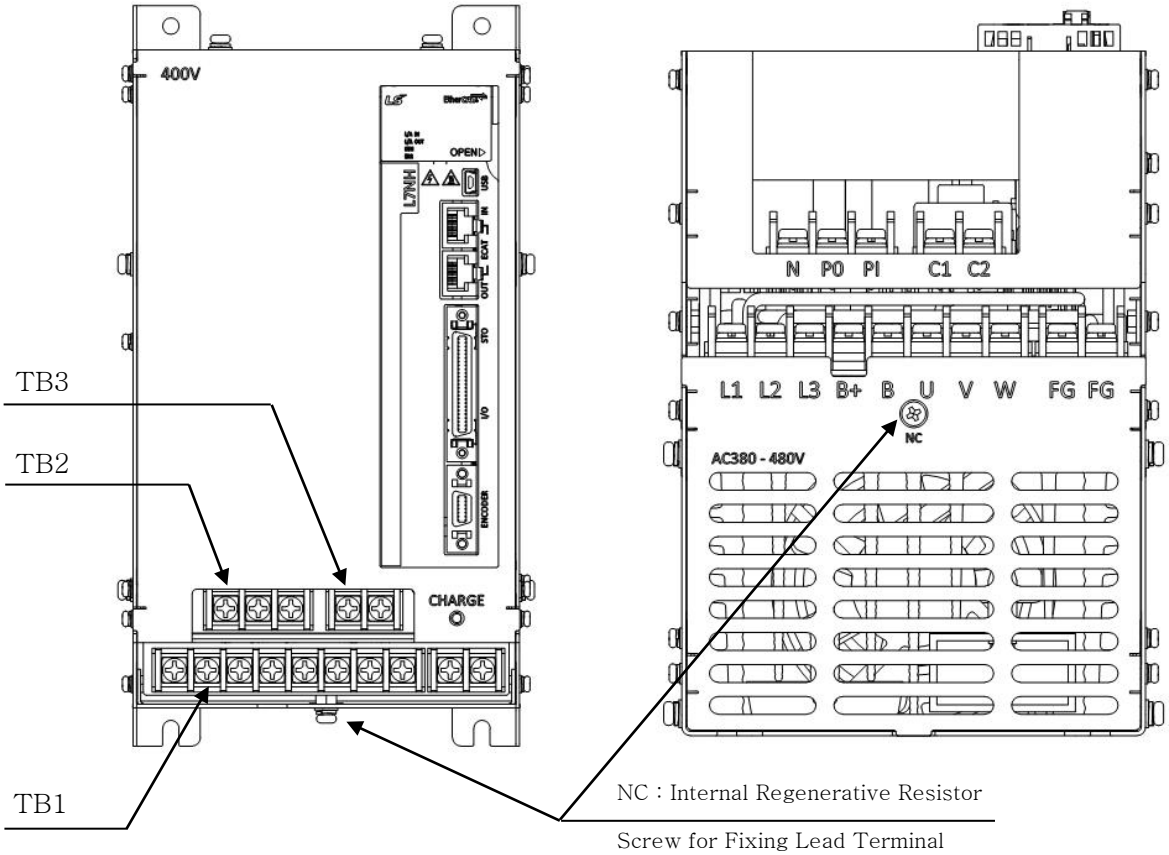
- **L7SB020□ / L7SB035□**



For information on wiring to BLZ7.62HP Series connector, refer to the above procedures.

1. Insert electric wire into insert hole with upper locking screw loosened, and use applicable flathead (-) driver for each model to fully tighten screw to 0.4-0.5 N·m.
2. Otherwise, insufficient torque of locking screw may cause vibration-induced disconnection, system malfunction and contact-induced fire accident.
3. After you connect a wire to connector, place the connector as closely to servo drive as possible and use both locking hooks to fully lock it.
4. Use FG locking screw of M4 size (shown in bottom of product) to tighten it to 1.2 N·m.
5. Insufficient torque of locking screw may cause FG contact failure and even malfunctioning drive.
6. Recommended (-) driver: Use Weidmuller flathead driver (SD 0.6×3.5×100).

- **L7□B050**



Terminal signal

TB1

L1	L2	L3	B+	B	U	V	W	FG	FG

Terminal screw: M4
Tightening torque: 1.2 N·m

TB2

N	PO	P1

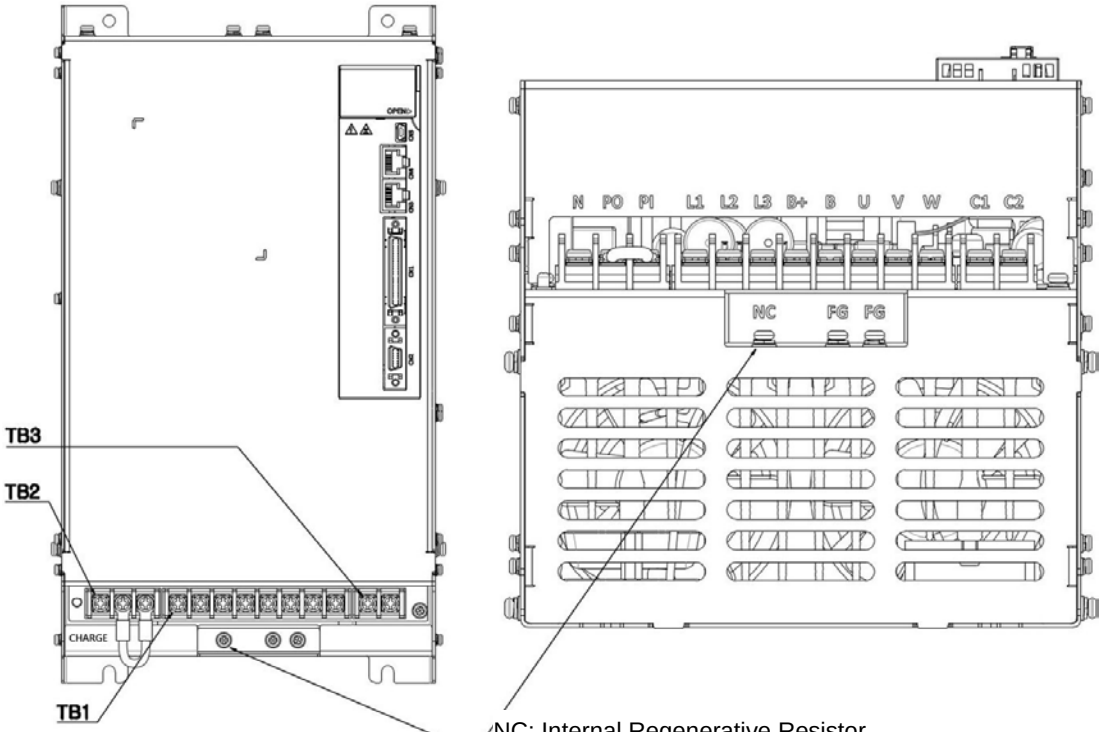
Terminal screw: M4
Tightening torque: 1.2 N·m

TB3

C1	C2

Terminal screw: M4
Tightening torque: 1.2 N·m

- **L7□B075□**



Layout of the Terminal Signals

TB1

L1	L2	L3	B+	B	U	V	W

Terminal screw: M4
Tightening torque: 1.2 N•m

TB2

N	P0	PI

Terminal screw: M4
Tightening torque: 1.2 N•m

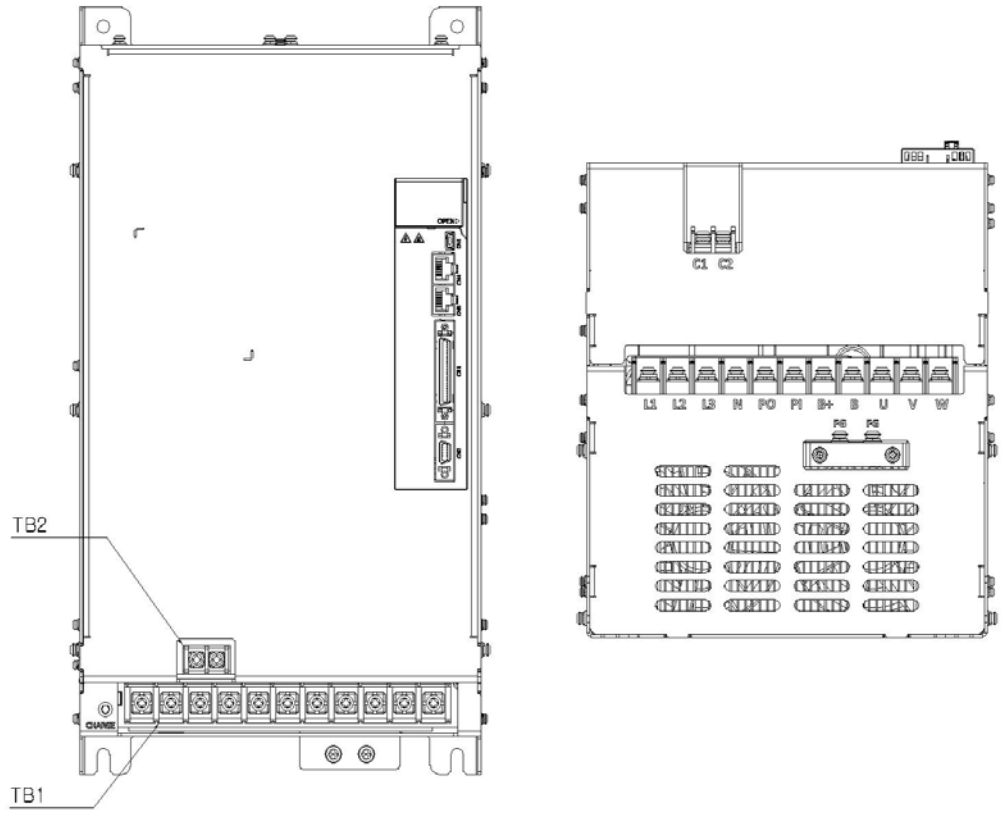
TB3

C1	C2

Terminal screw: M4
Tightening torque: 1.2 N•m

Note 1) Otherwise, insufficient torque of locking screw may cause vibration-induced disconnection, system malfunction and contact-induced fire accident.
Note 2) Use FG locking screw of M4 size (shown in bottom of product) to tighten it to 1.2 N·m.

- **L7□B150□**



TB1

L1	L2	L3	N	PO	PI	B+	B	U	V	W

Terminal screw: M5
Tightening torque: 3.24 N·m

TB2

C1	C2

Terminal screw: M4
Tightening torque: 1.2 N·m

Terminal screw: M5
Tightening torque: 3.24 N·m

FG

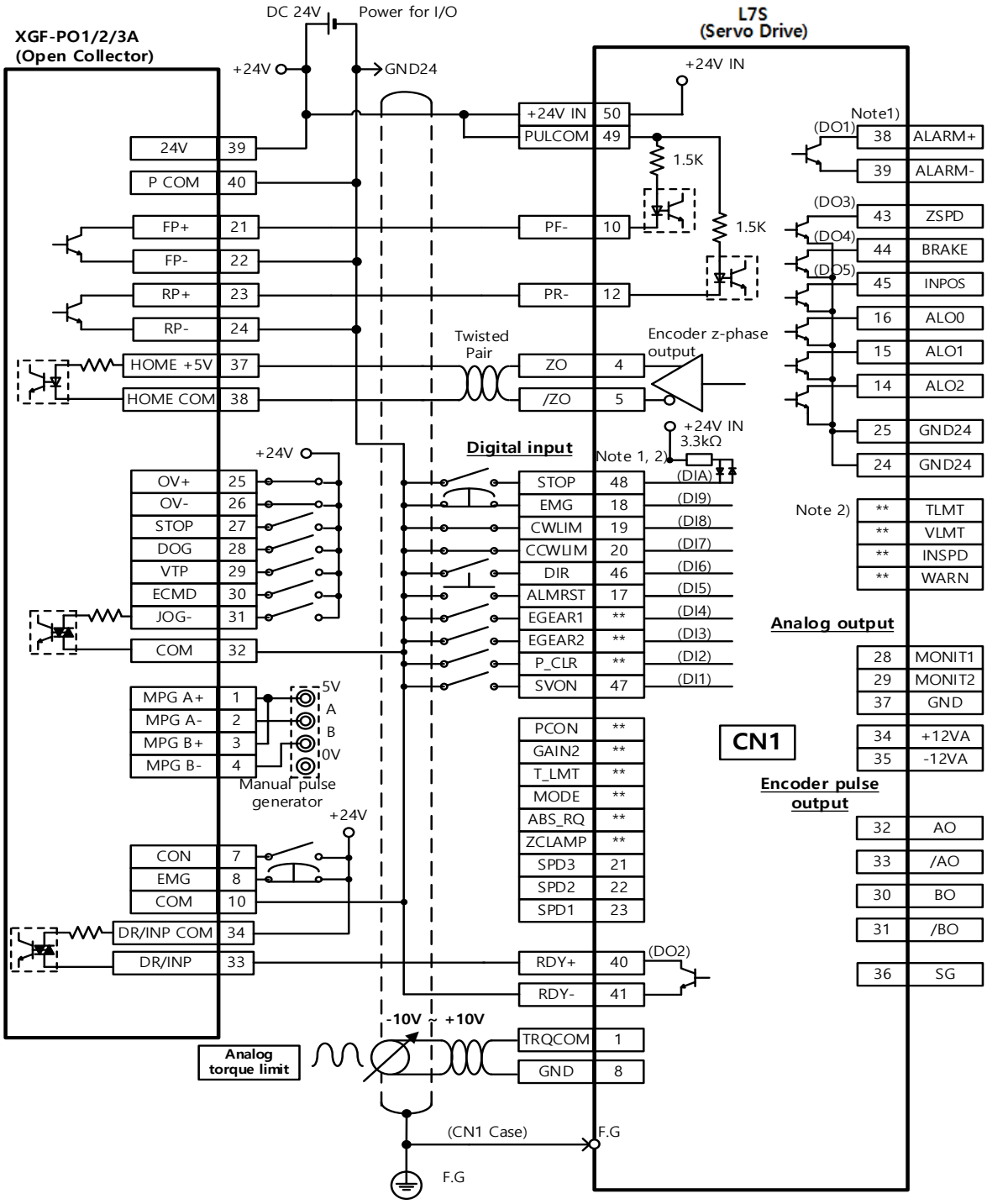
Note 1) Otherwise, insufficient torque of locking screw may cause vibration-induced disconnection, system malfunction and contact-induced fire accident.

Note 2) Use FG locking screw of M4 size (shown in bottom of product) to tighten it to 1.2 N·m.

3.3 Example of wiring with PLC

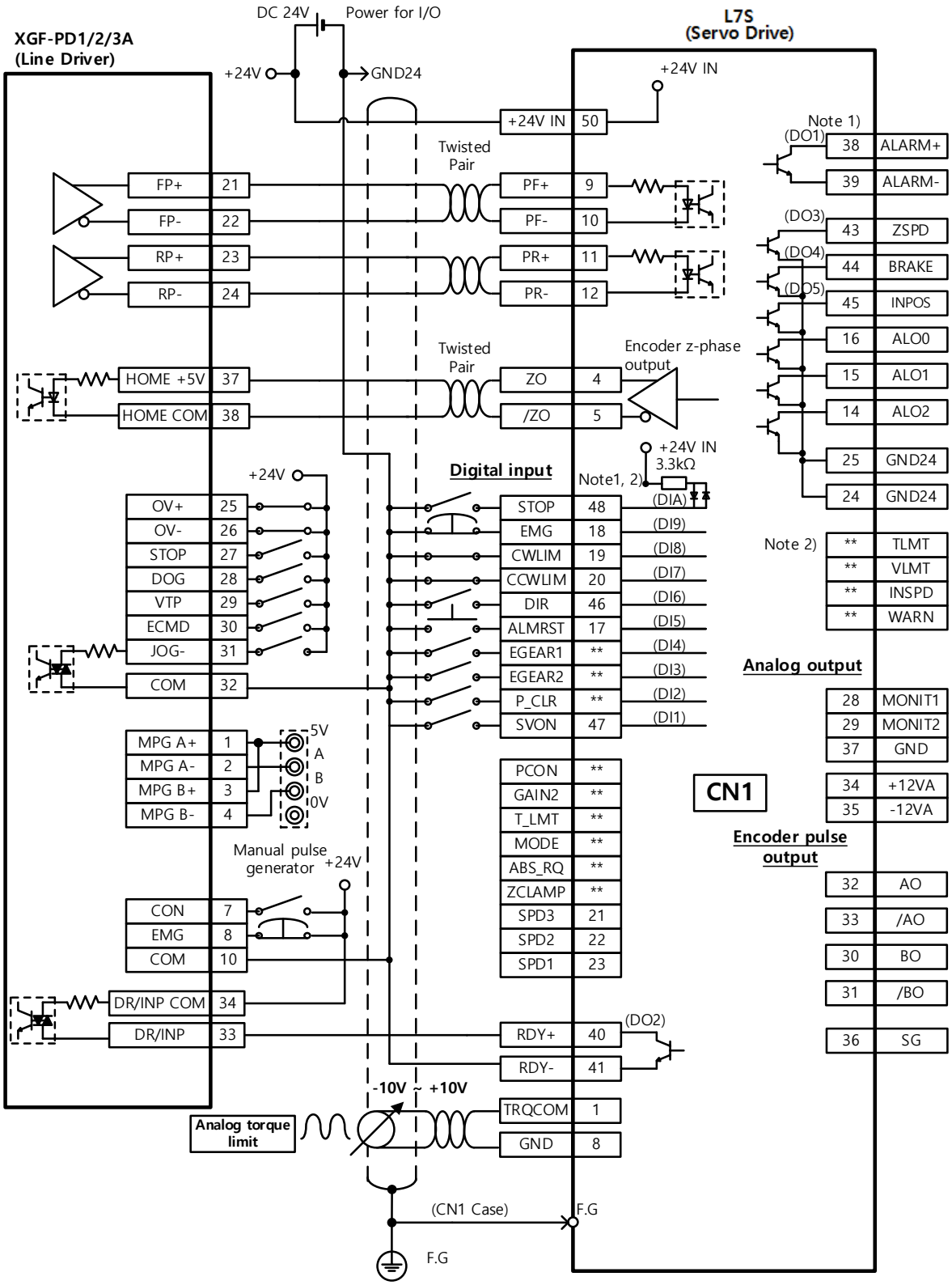
3.3.1 XGT PLC

1. XGF-PO1/2/3A (Open Collector)



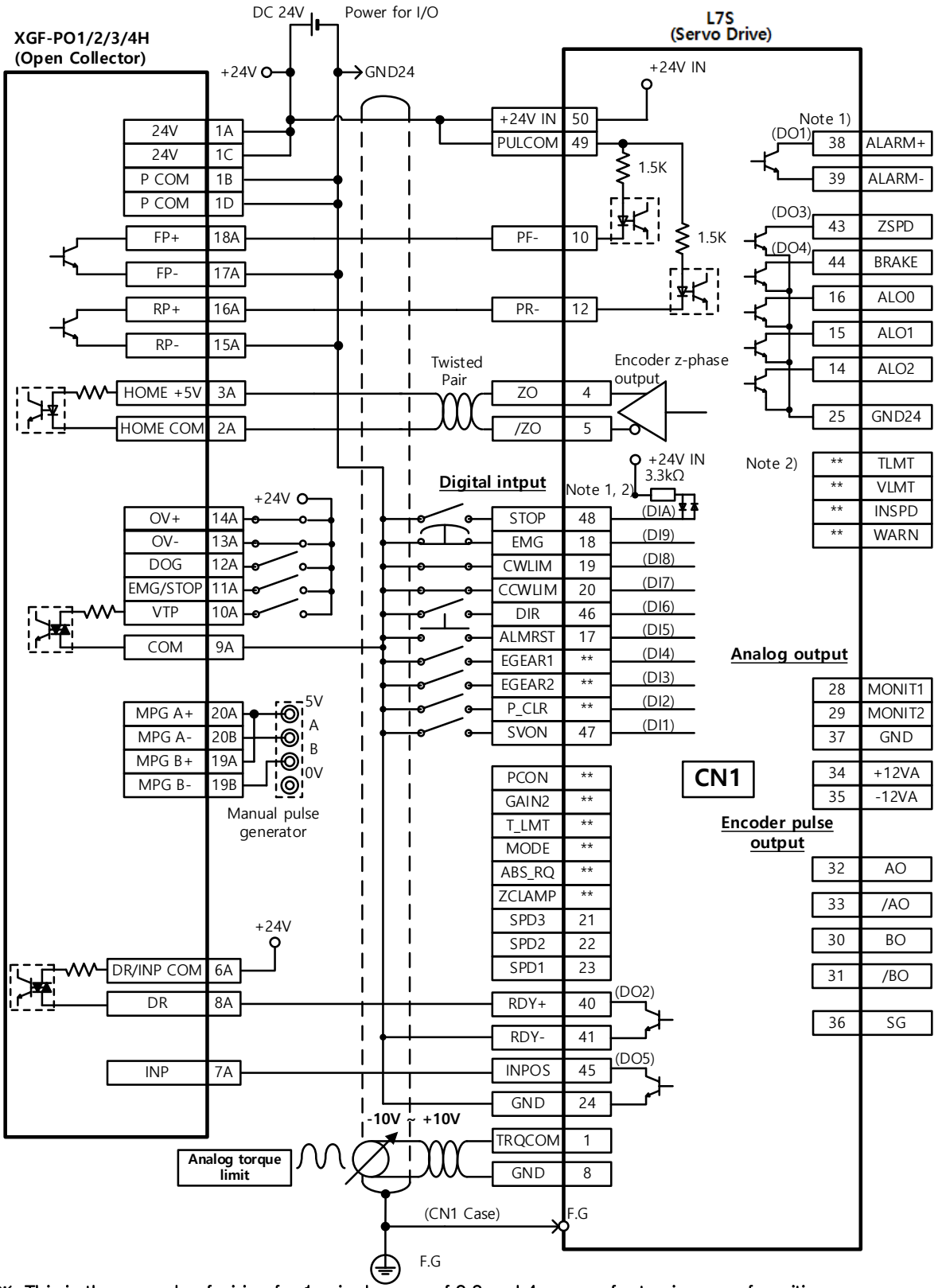
※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

2. XGF-PD1/2/3A (Line Driver)



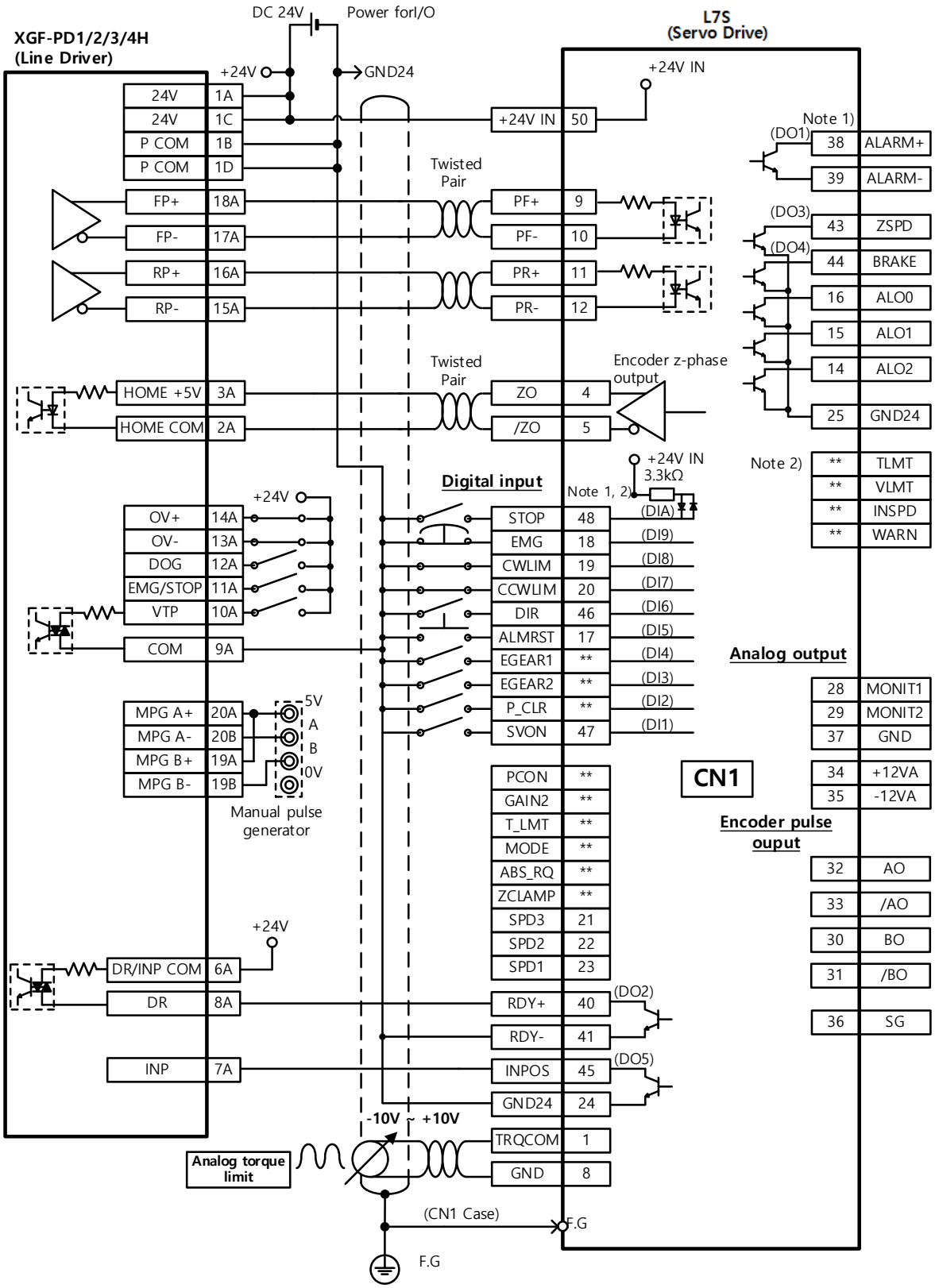
※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

3. XGF-PO1/2/3/4H (Open Collector)



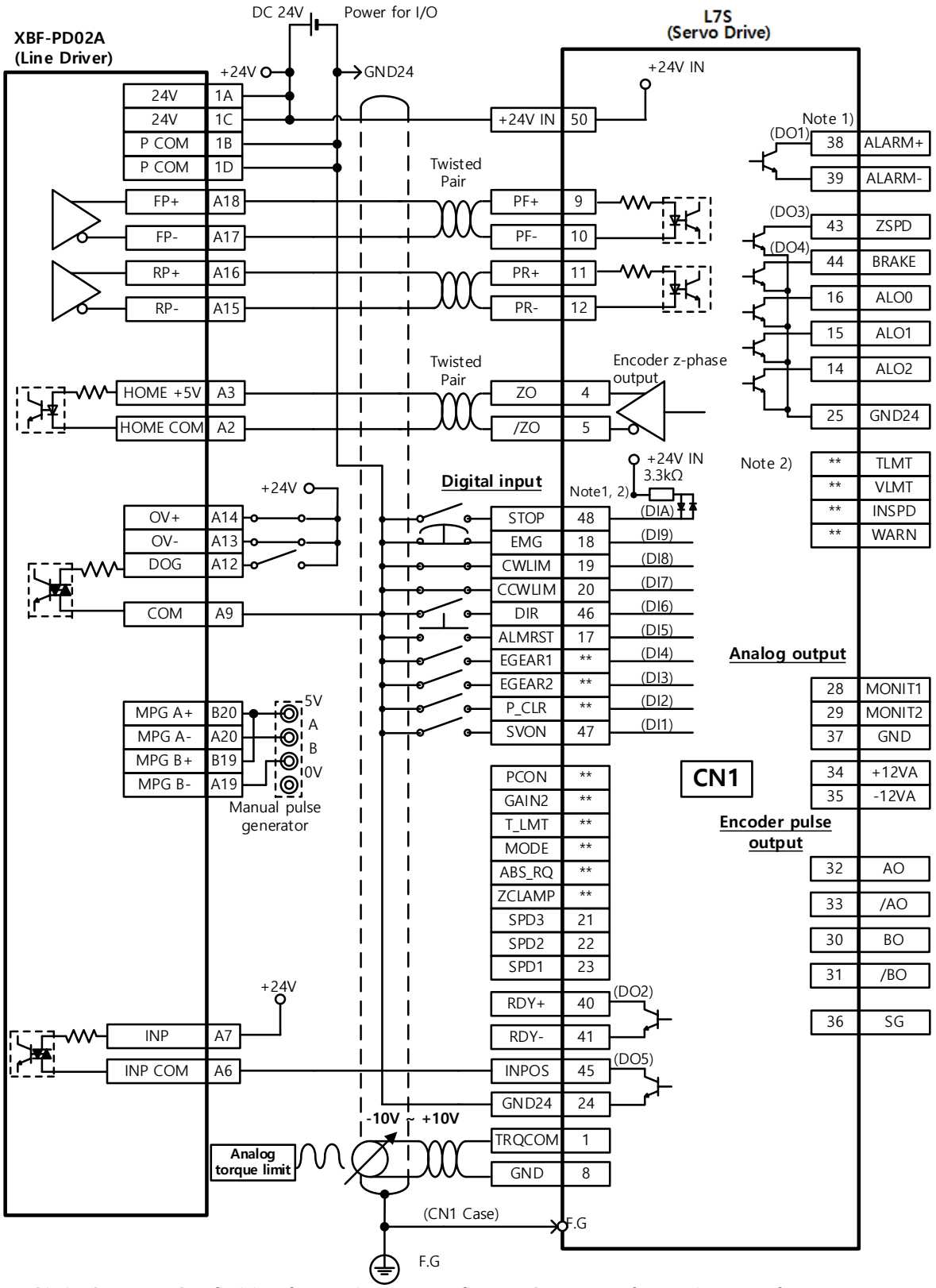
※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

4. XGF-PD1/2/3/4H (Line Driver)



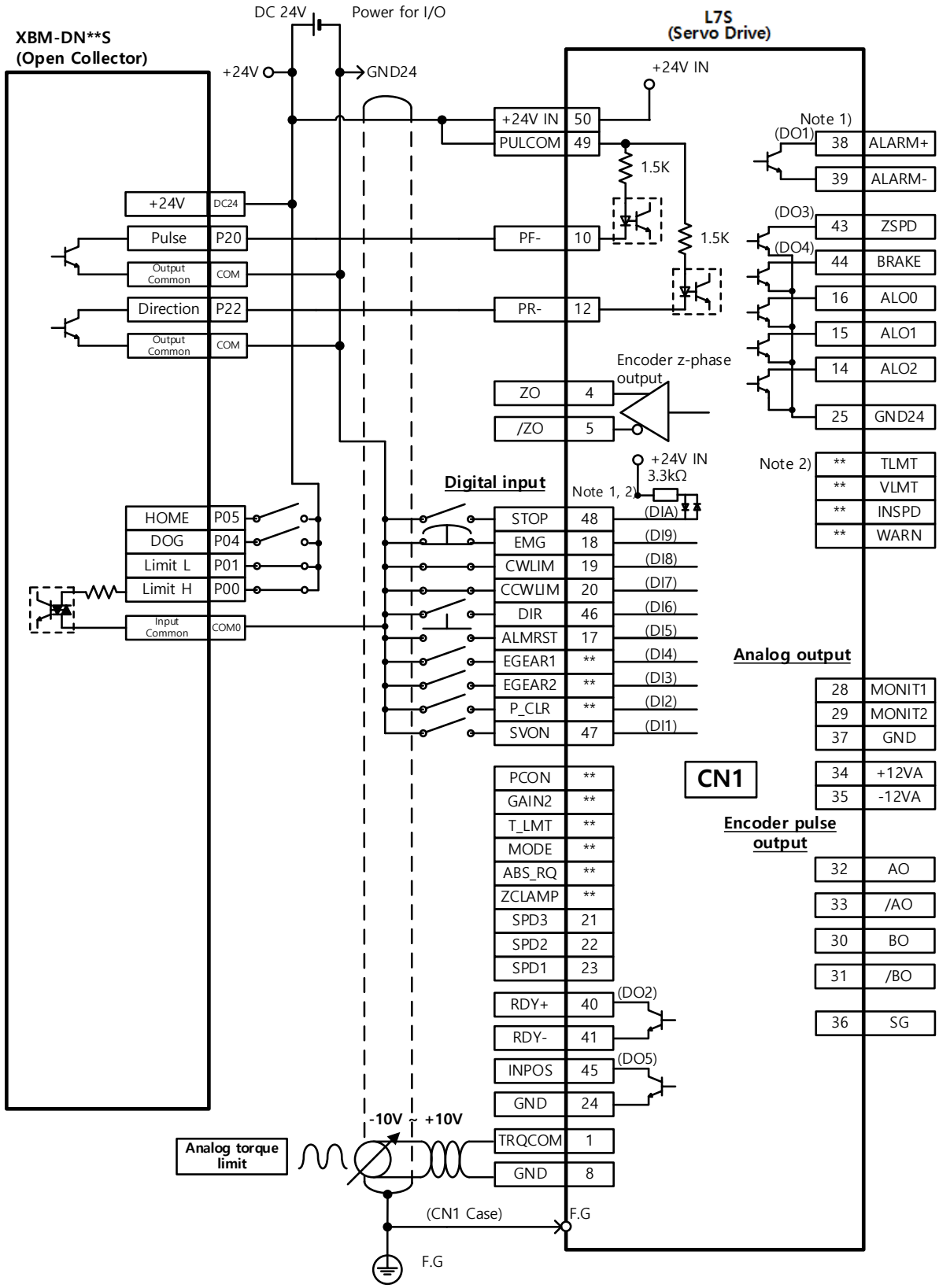
※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

5. XBF-PD02A (Line Driver)



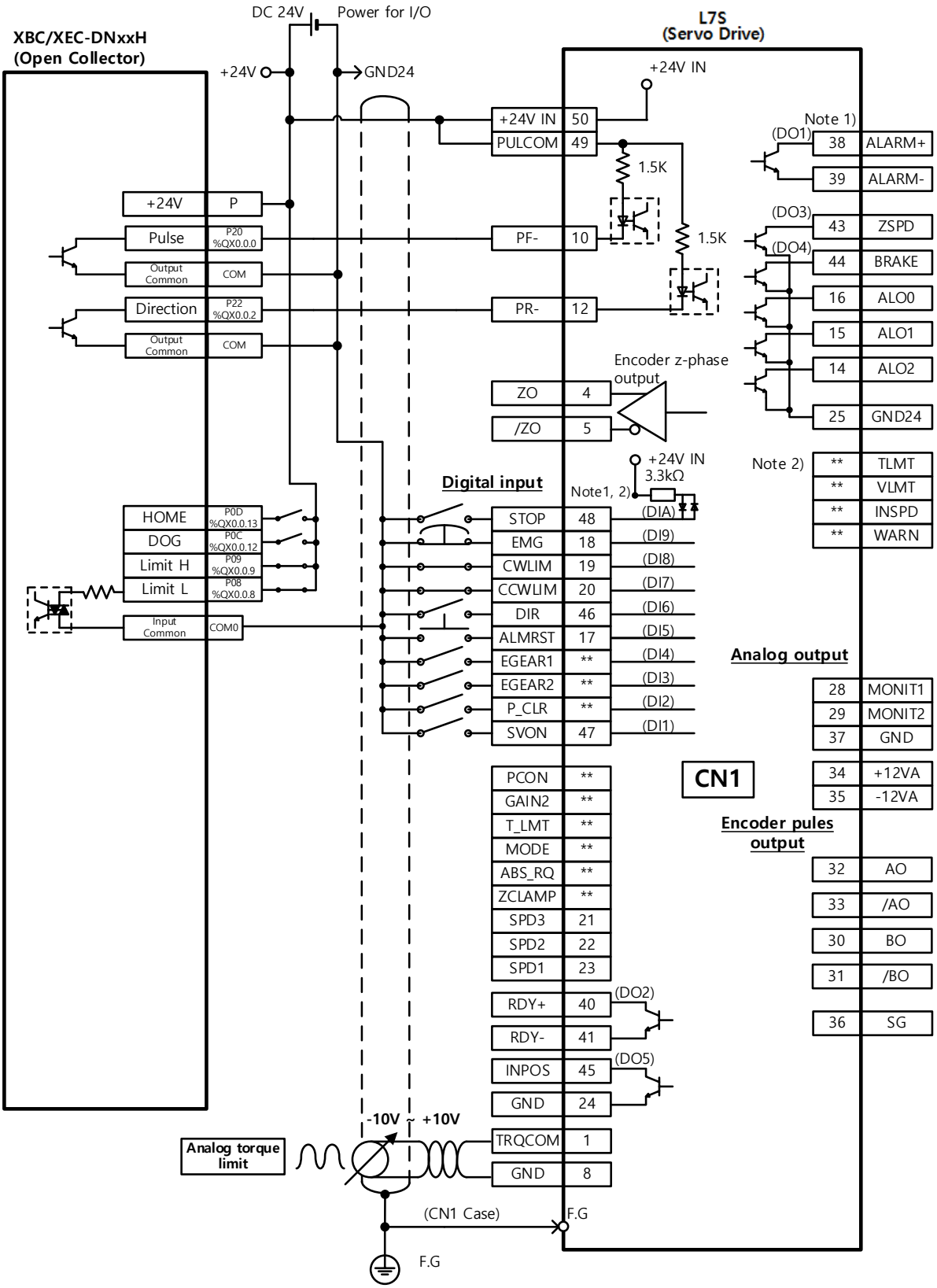
※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

6. XBM-DN**S (Open Collector)



※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

7. XBC/XEC-DNxxH (Open Collector)



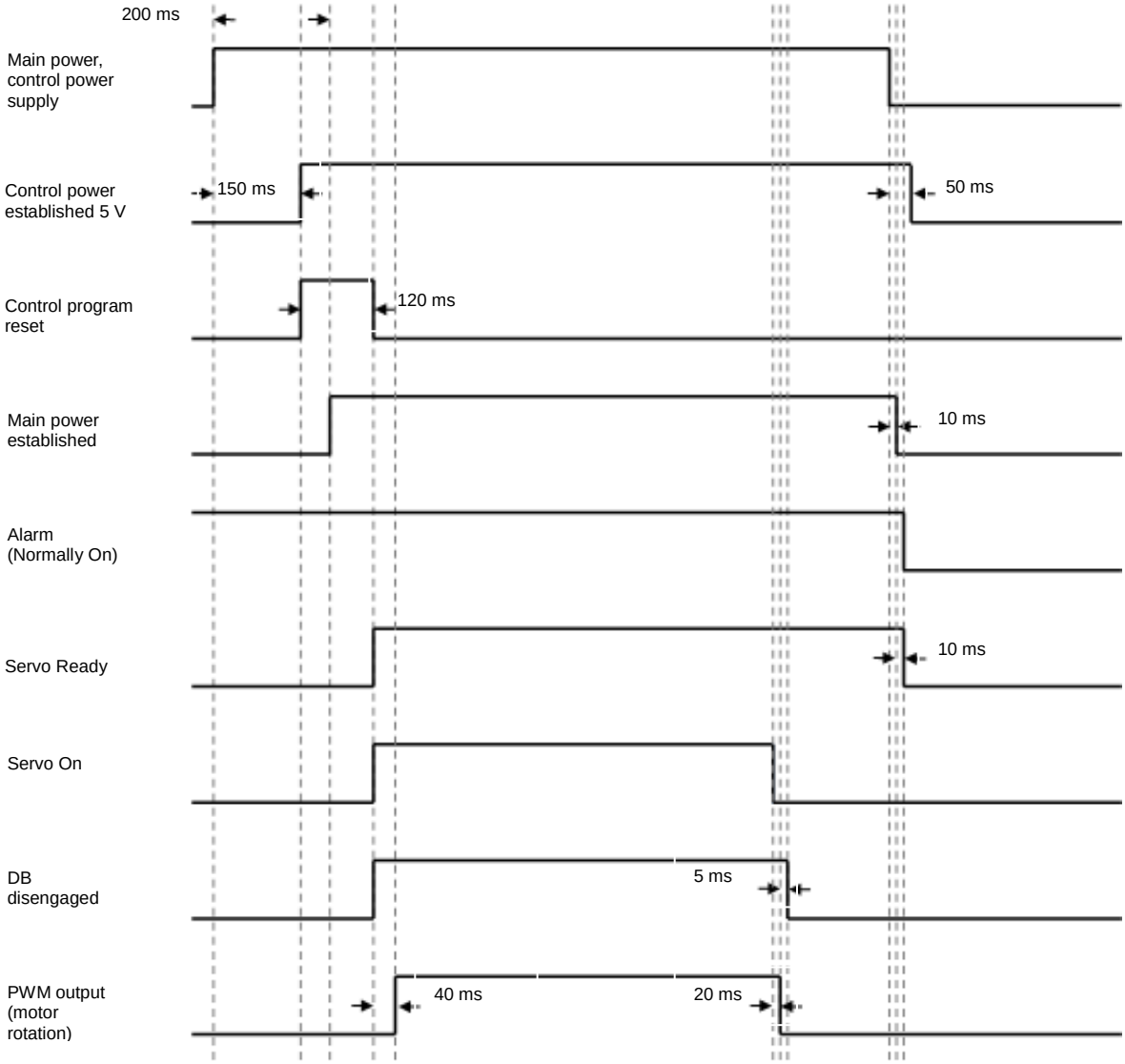
※ This is the example of wiring for 1 axis. In case of 2,3 and 4 axes, refer to pin map of position module on PLC.

3.4 Timing Diagram

3.4.1 Timing Diagram during Power Input

For L7 Series, connect single-phase power to the C1 and C2 terminals to supply power to the control circuit, and three-phase power to L1, L2, and L3 to supply power to the main circuit.

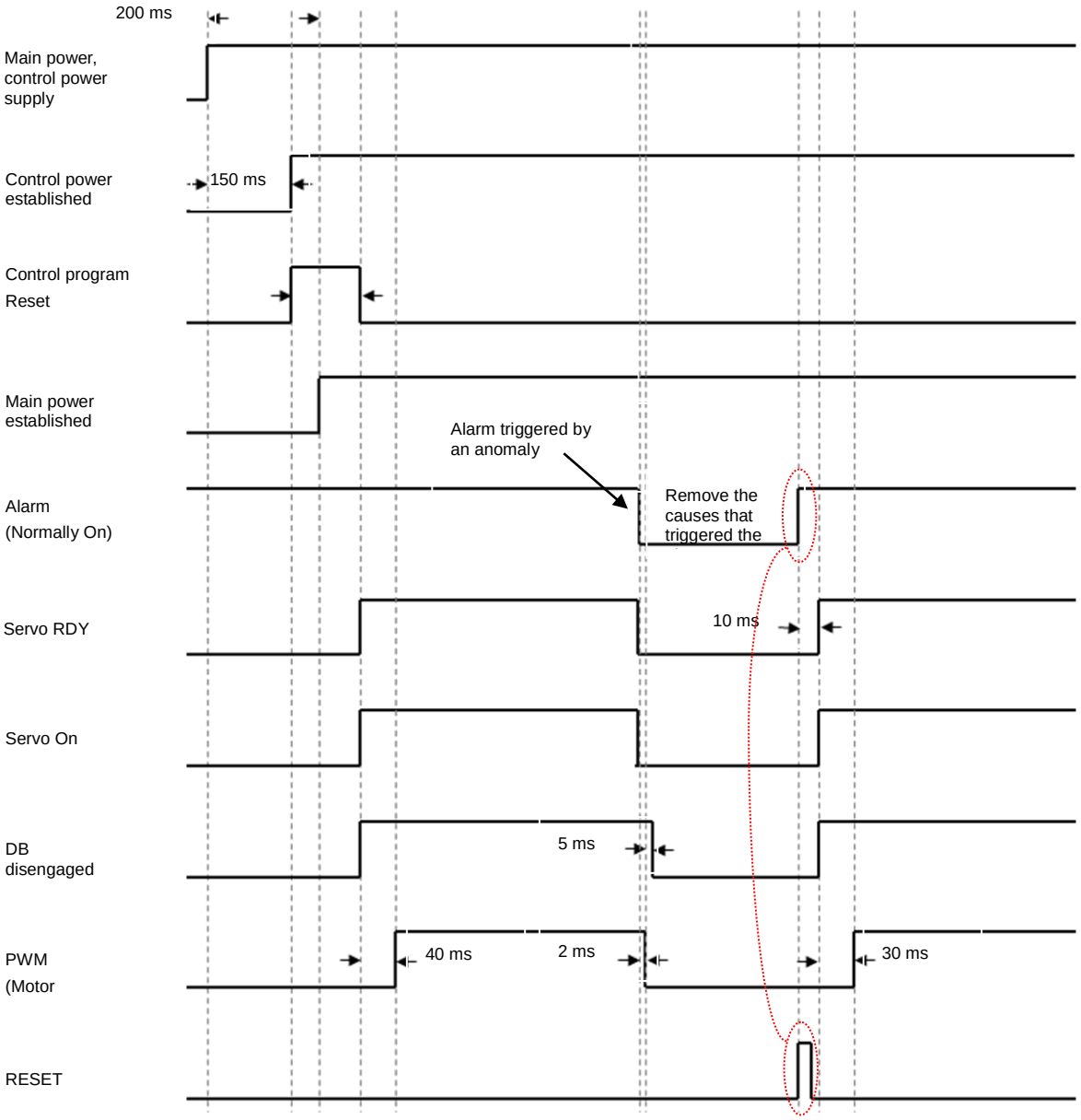
The servo signal becomes ready after the maximum time of 120 ms that is required to reset the inside of the device. If you change the signal to ON, the servo starts operation in 40 ms.



3.4.2 Timing Diagram during an Alarm Trigger

When an alarm is triggered in the servo drive, it blocks the PWM and stops the motor.

⚠ Caution
▪ Never reset the alarm before you solve the problem that triggered the alarm and change the command signal (Servo ON) to OFF.

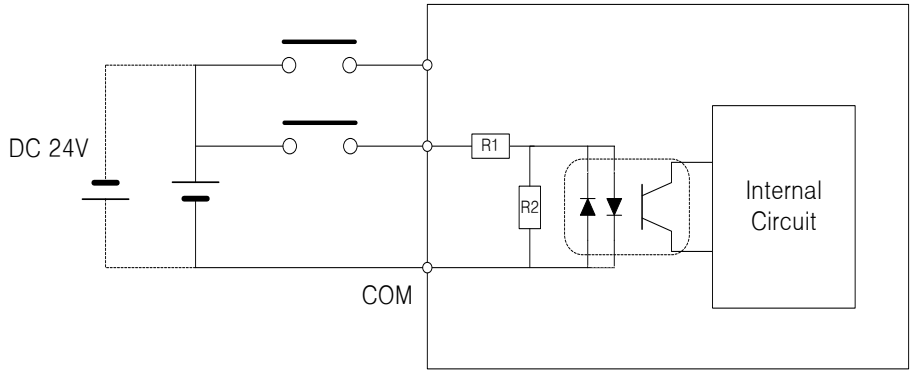


3.5 Wiring the Control Signals

3.5.1 The Contact Input Signal

⚠ Caution

1. There are two input contacts based on the characteristics of individual signals: contact A and contact B. They can be set by [P2-08] and [P2-09].
2. It is possible to turn each contact on or off forcibly with [Cn-07]. Take extra caution, however, because each contact is automatically turned off when power is off.
3. The signal definition of each contact can be modified by [P2-00], [P2-01], [P2-02], [P2-03], and [P2-04].

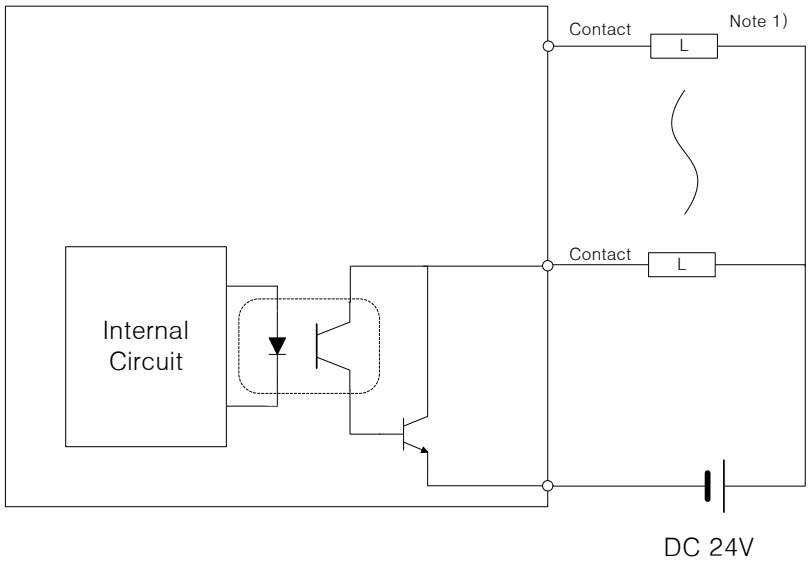


R1: 3.3 KΩ, R2: 680 Ω

3.5.2 The Contact Output Signal

⚠ Caution

4. There are two output contacts based on the characteristics of individual signals: contact A and contact B. They can be set by [P2-10].
5. It is possible to turn each contact on or off forcibly with [Cn-08]. Take extra caution, however, because each contact is automatically turned off when power is off.
6. The signal definition of each contact point can be modified by [P2-05], [P2-06], and [P2-07].
7. Overvoltages or overcurrents may damage the device because it uses an internal transistor switch.
   - Rated voltage and current: DC 24 V ±10%, 120 ㎃



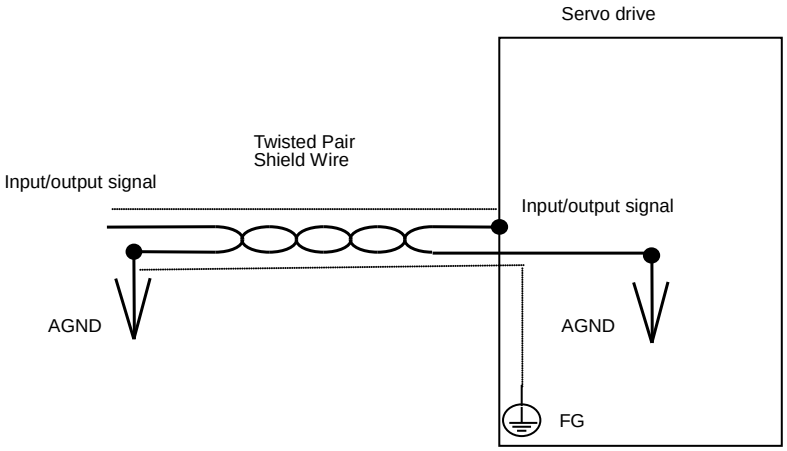
Note 1) For alarm and ready output signals, the GND24 terminal is separated.

3.5.3 Analog Input/Output Signals

1. Keep GND as 0 V of control power.

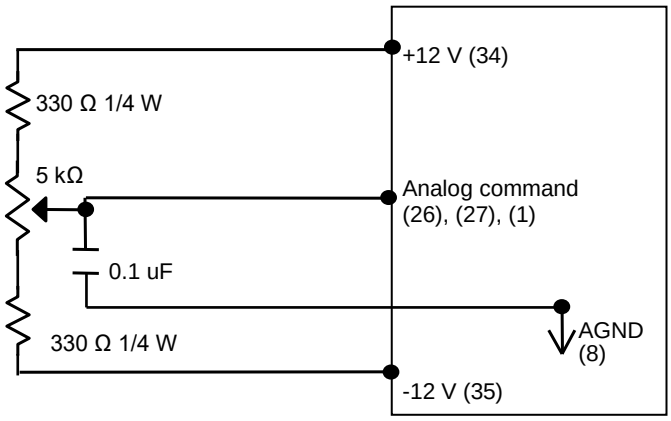
2. Keep the input signal command voltage within ±10 V, and input impedance at 22 kΩ.

3. Output signal voltage for Monitor 1 (No. 28) and Monitor 2 (No. 29) is ±10 V.



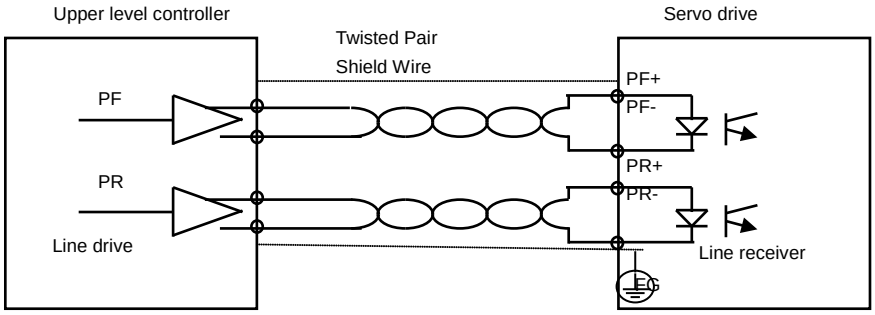
Configure wiring as shown in the following image when you adjust analog input with variable resistance by using power supplied by the drive.

Do not exceed the maximum output capacity of 30 mA.

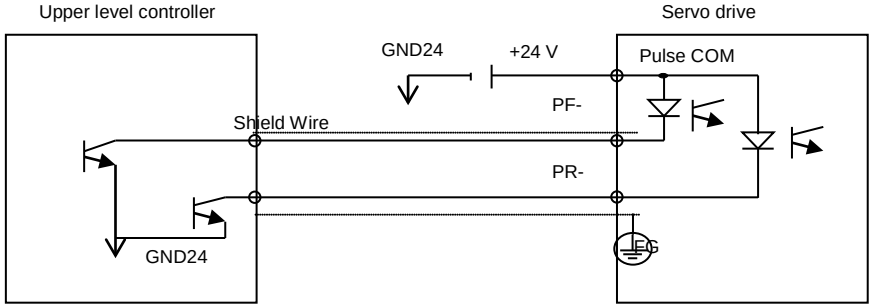


3.5.4 Pulse Train Input Signal

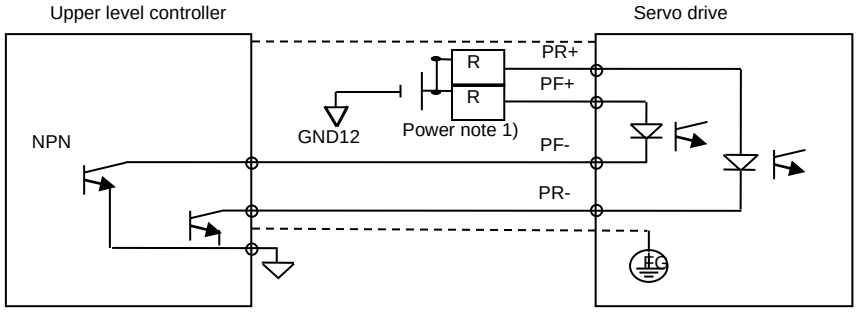
(1) Line Drive (5 V) Pulse Input



(2) Open Collector (24 V) Pulse Input

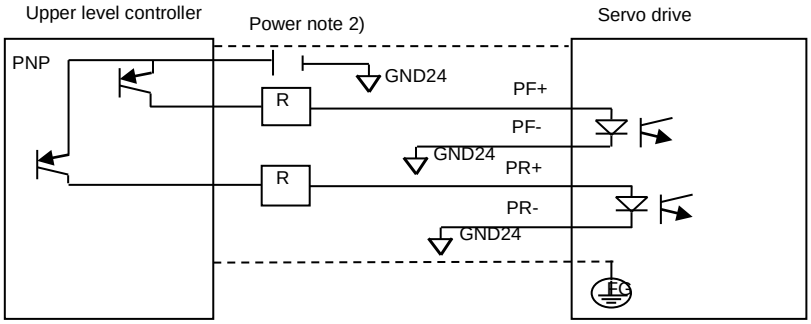


(3) 12 V or 5 V NPN Open Collector Pulse Command



Note 1) When using 5 V power: Resistance R = 100-150 Ω, 1/2 W
When using 12 V power: Resistance R = 560-680 Ω, 1/2 W
When using 24 V power: Resistance R = 1.5 kΩ, 1/2 W

(4) PNP Open Collector Pulse Command

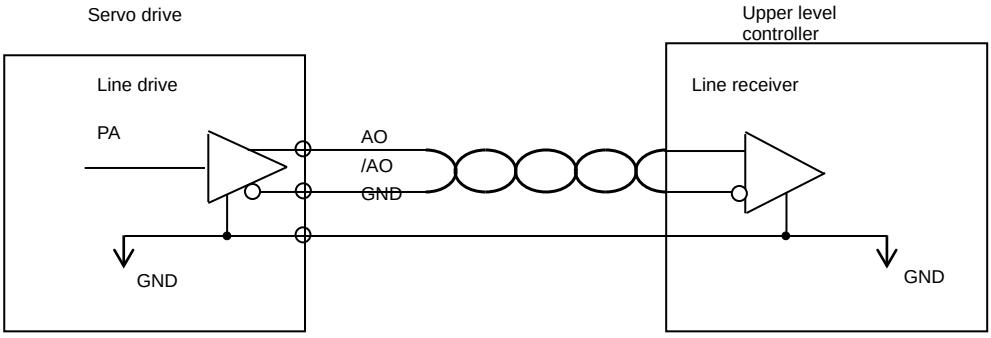


Note 2) When using 24 V power: Resistance R = 1.5 kΩ, 1/2 W
When using 12 V power: Resistance R = 560-680 Ω, 1/2 W
When using 5 V power: Resistance R = 100-150 Ω, 1/2 W

3.5.5 Encoder Output Signal

Connect the GND terminal of the upper level controller and the GND terminal of CN1 because encoder signals are output based on the GND of control power.

Encoder signals for the servo motor received from CN2 are pre-scaled according to the ratio defined by [P0-14] and output in line drive mode.

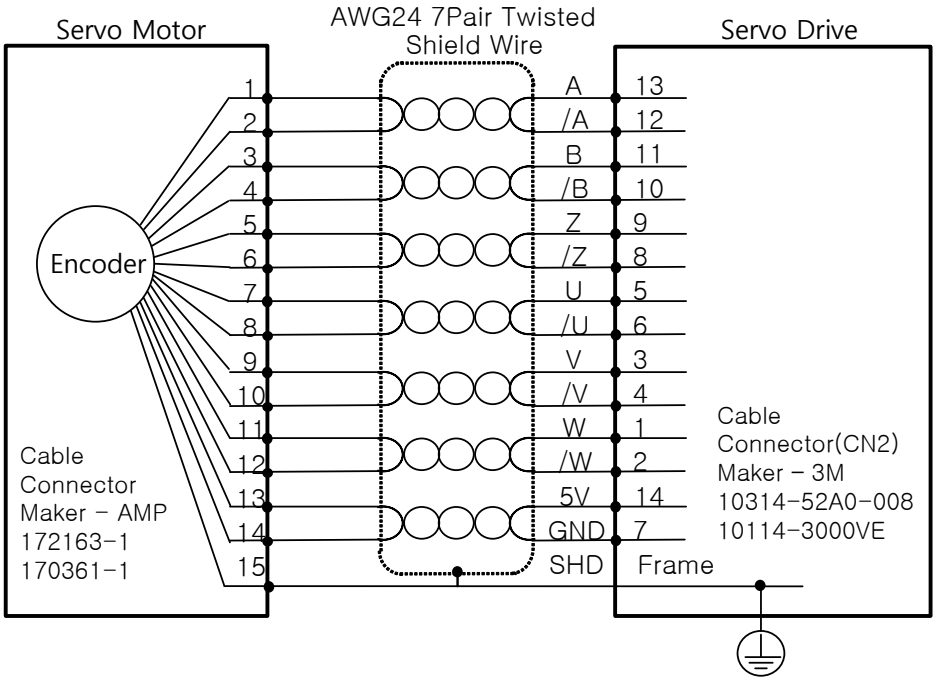


When you set Bit #3 of 'P0-17 Function Select Bit' to '1', Open Collector Phase A, B and Z are output with existing AL0, AL1 and AL2 contact output.

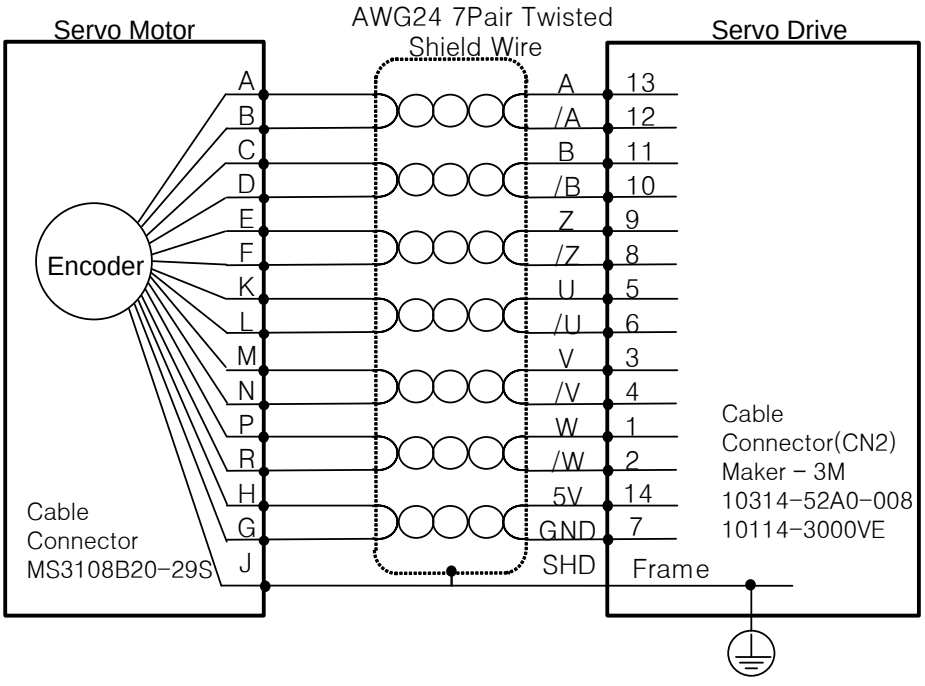
(Output current less than 40 mA, max. frequency = 100 Khz)

3.6 Quadrature Encoder Signaling Unit (CN2) Wiring

3.6.1 APCS-E□AS Cable

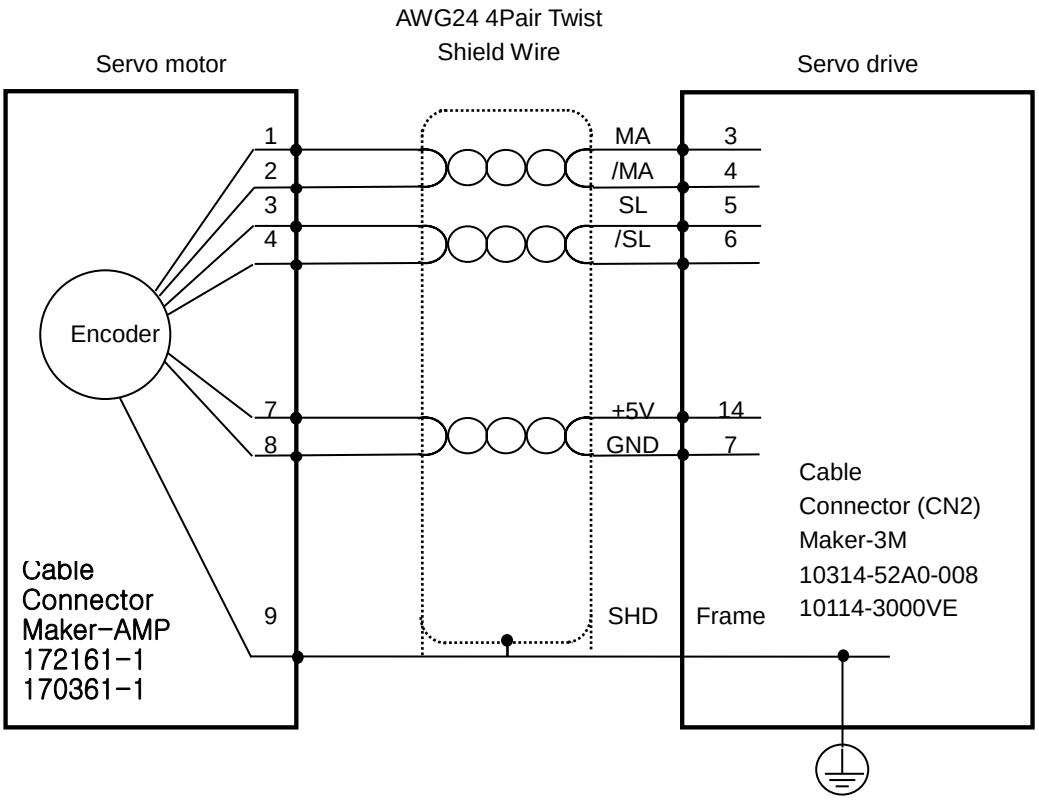


3.6.2 APCS-E□BS Cable

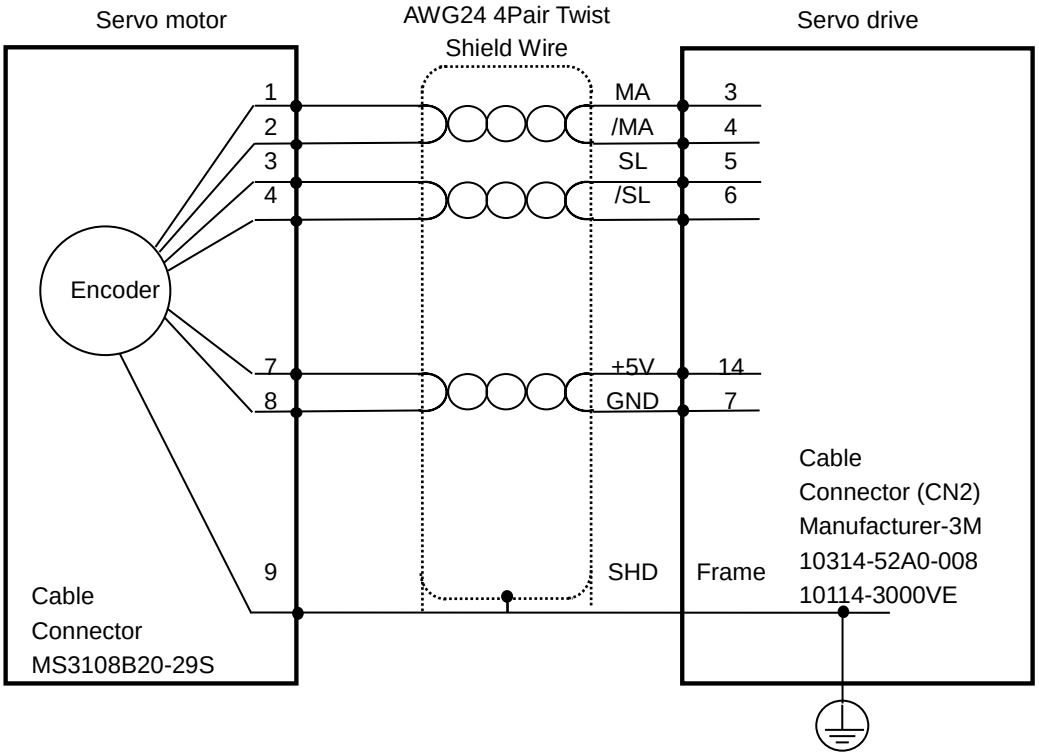


3.7 Connecting the Serial Encoder Signals (CN2)

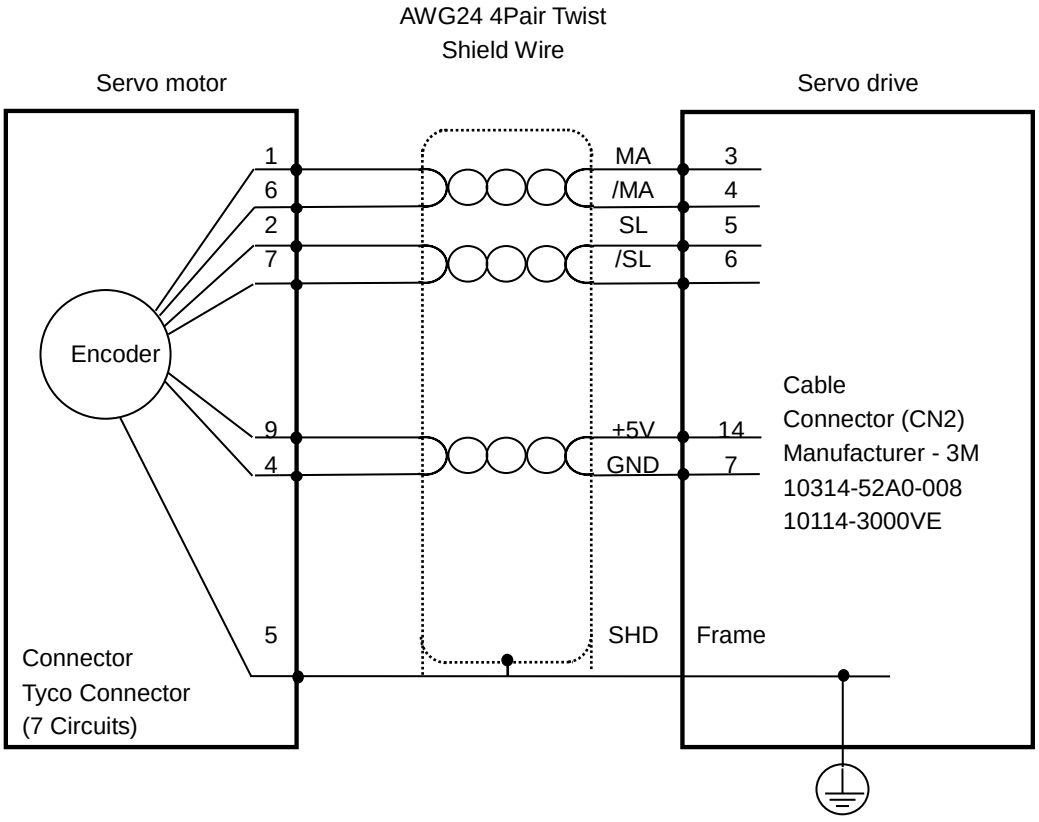
3.7.1 APCS-E□CS Cable



3.7.2 APCS-E□DS Cable

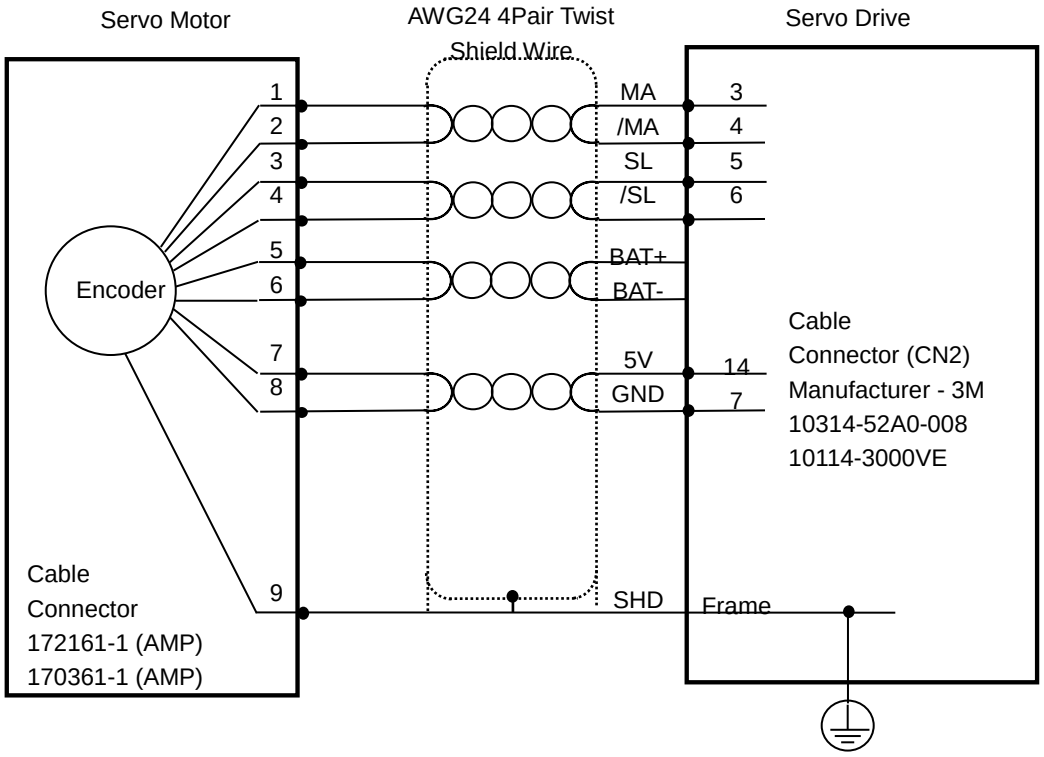


3.7.3 APCS-E□ES Cable

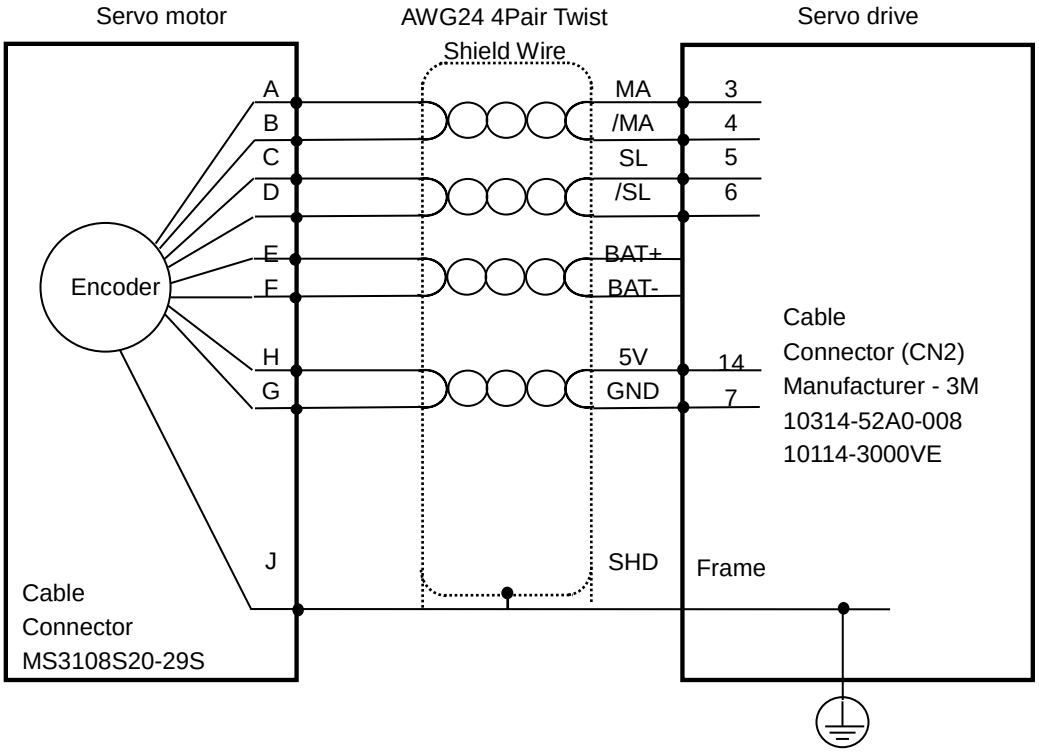


3.8 Multi-turn Encoder Signaling Unit (CN2) Wiring

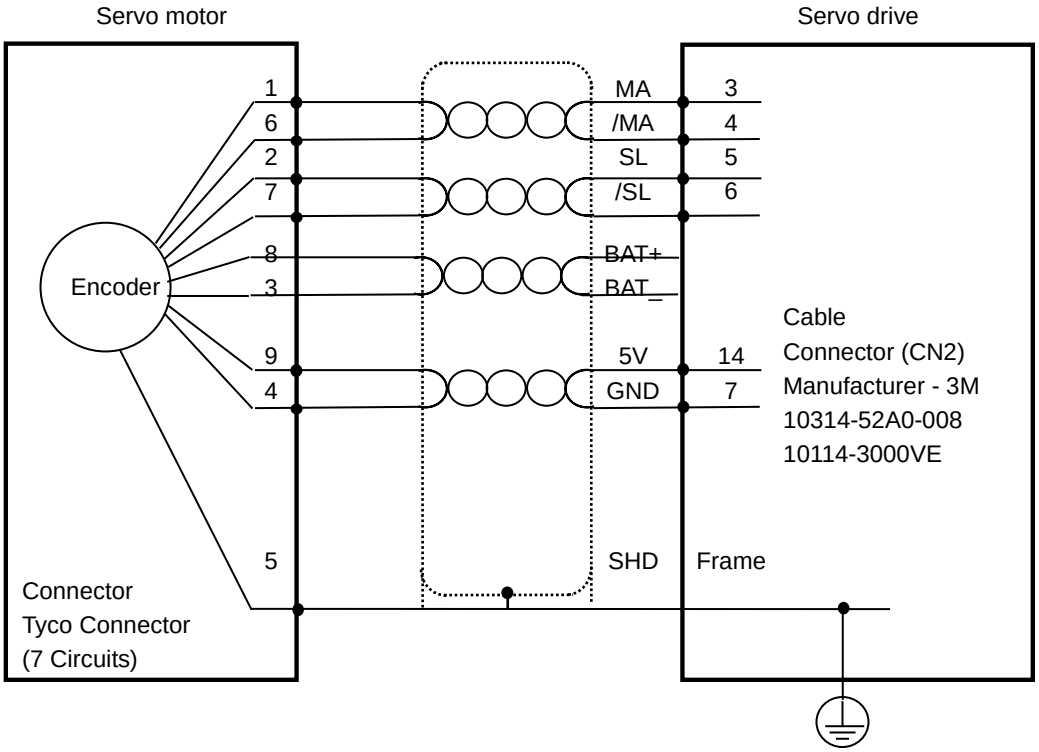
3.8.1 APCS-E□CS1 Cable



3.8.2 APCS-E□DS1 Cable



3.8.3 APCS-E□ES1 Cable



3.9 Transmission of Absolute Value Encoder Data

3.9.1 Transmission of Absolute Value Encoder Data

Upon the absolute value encoder's request for absolute value data, the data of the absolute value encoder are transmitted to the upper level controller in the form of quadrature pulses through the output of the encoder output signals, AO and BO.

In this case, pulses are output at the speed of 500 Kbps.

Among absolute value data, multi-turn data are transmitted first, followed by single-turn data. (Refer to “4.1.6 External Input Signal and Logic Definition" for information on the allocation of the sequence input signal and ABS-RQ signal.)

■ Transmission Sequence of Absolute Value Data

1. When the servo is off, change the ABS_RQ signal on the upper level controller to ON.

2. The servo drive checks the ABS_RQ signal for 10 ms.

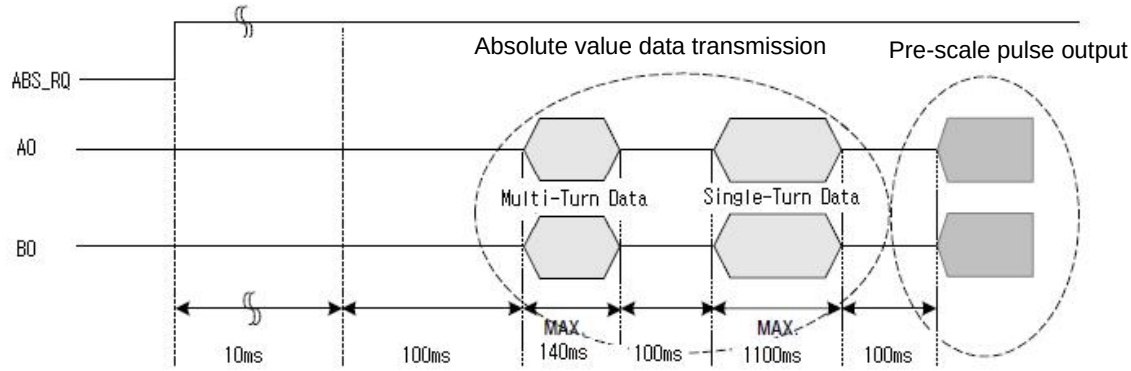
3. The servo drive prepares the transmission of multi-turn data for 100 ms.

4. The servo drive transmits multi-turn data for up to 140 ms (based on 16-bit multi-turn data).

5. The servo drive prepares the transmission of single-turn data for 100 ms.

6. The servo drive transmits single-turn data with the pre-scale ratio applied for up to 1100 ms (based on 19-bit single-turn data).

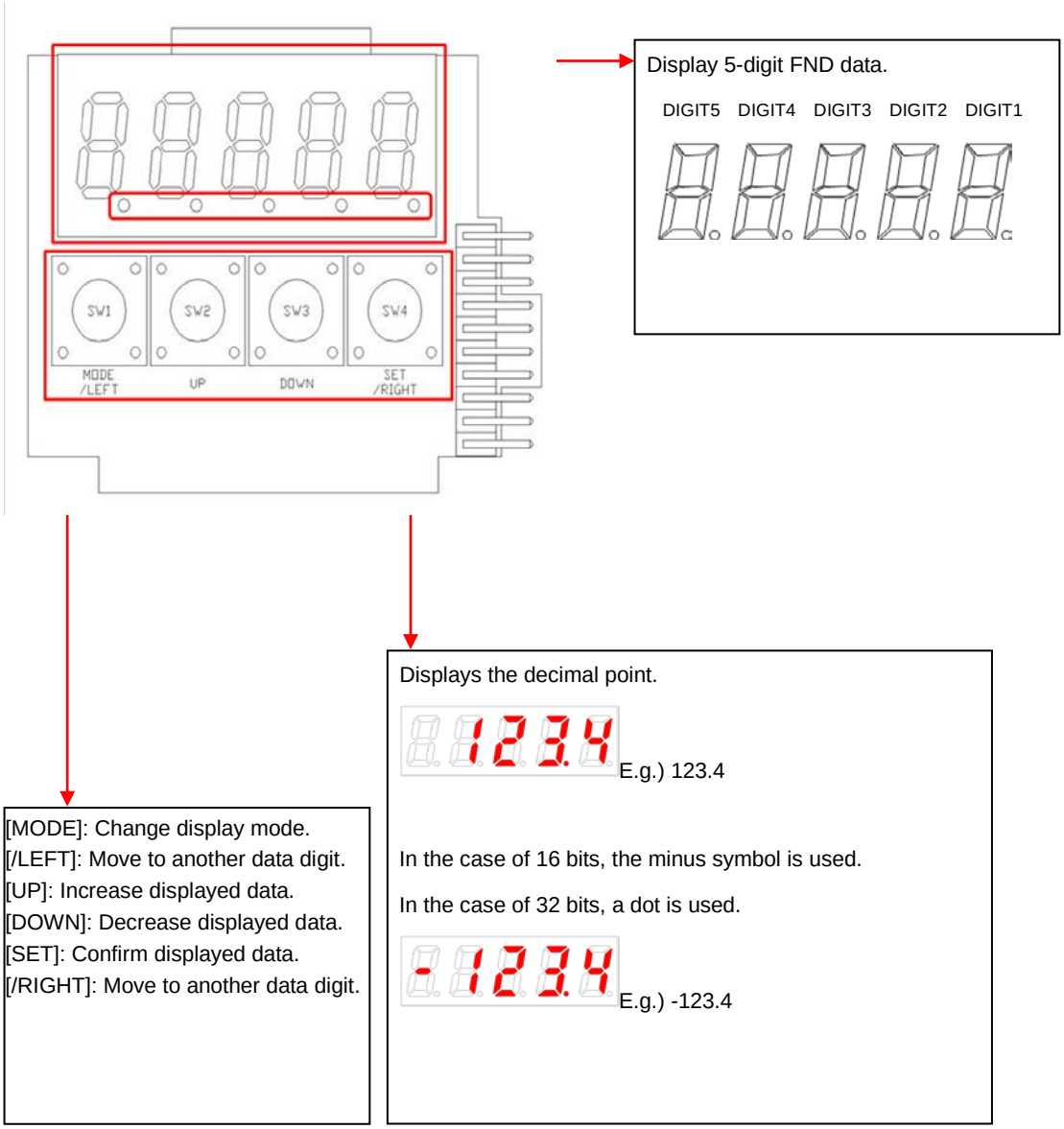
7. The servo drive operates with normal encoder output signals 100 ms after the single-turn data are completely transmitted.



4. Parameters

4.1 How to Use the Loader

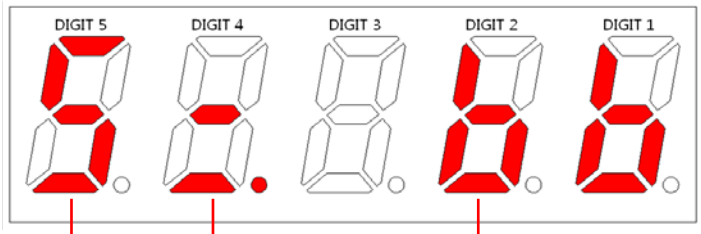
4.1.1 Name and Function of Each Part



4.1.2 Status Summary Display

(1) Status Summary Display in Speed Mode

① Example of the OFF status of the servo in speed control mode



DIGIT 3-1: Displays the current status of the servo.

- bb - Servo OFF
- run - Servo ON
- Pot - CCW Limit
- not - CW Limit

DIGIT 4_High: ZSPD

DIGIT 4_Medium: INSPD or INPOS

DIGIT 4_Low: Command (speed or torque)

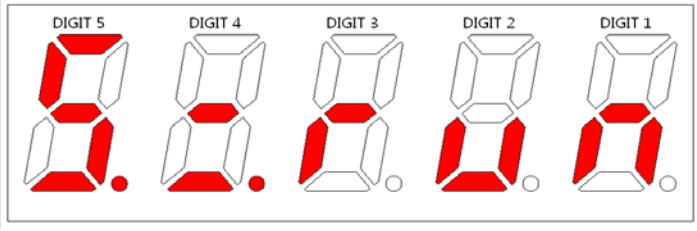
DIGIT 4_DOT: Ready

DIGIT 5: Displays the current control mode.

- P - Position control
- S - Speed control
- T - Torque control

DIGIT 5_DOT: Servo ON

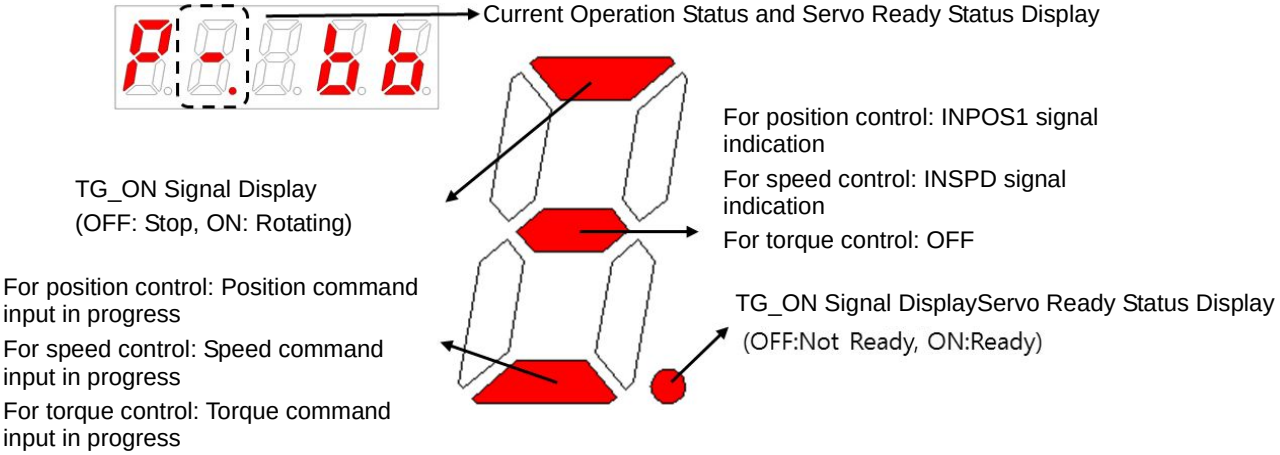
② Example of the ON status of the servo in speed control mode



(2) Servo Operation Status Summary Display List

The following list explains the operation status summary display of different modes of the servo.

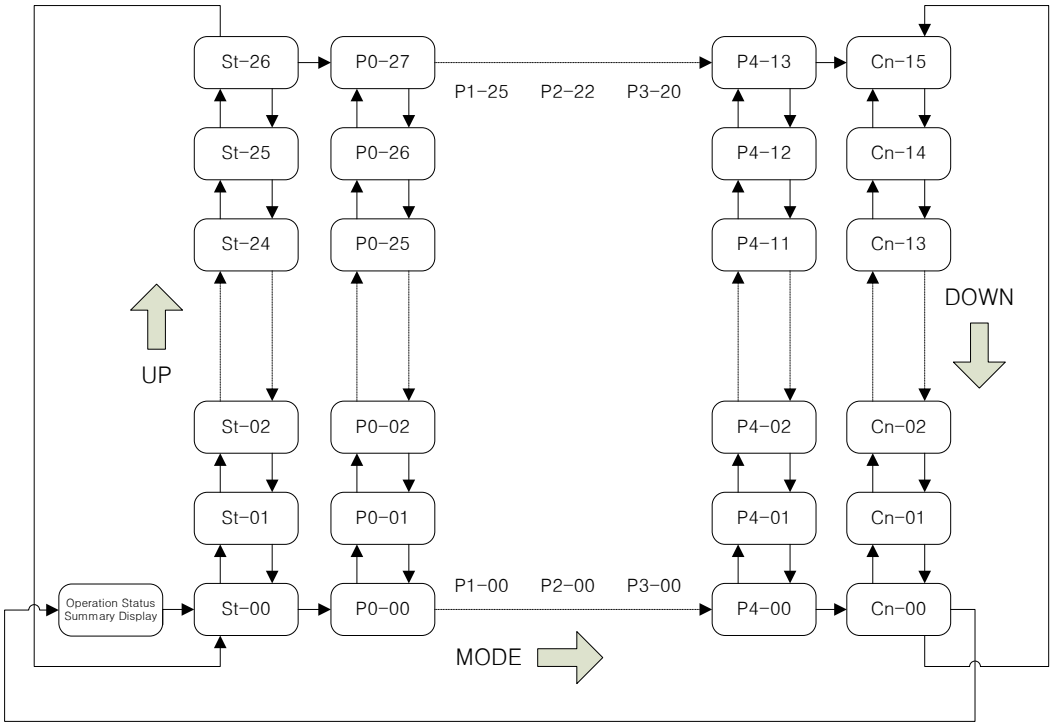
Operation Status Screen	Function	Notes
	Displays the servo's OFF status when in the position mode.	
	Displays the servo's ON status when in position mode.	
	Displays CCW status when in position mode.	
	Displays CW status when in position mode.	
	Displays the servo's OFF status when in speed mode.	
	Displays the servo's ON status when in speed mode.	
	Displays CCW status when in speed mode.	
	Displays CW status when in speed mode.	
	Displays the servo's OFF status when in torque mode.	
	Displays the servo's ON status when in torque mode.	
	Displays CCW status when in torque mode.	
	Displays CW status when in torque mode.	



4.1.3 Parameter Handling

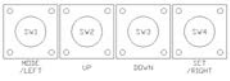
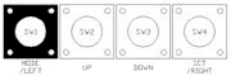
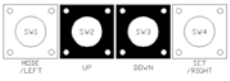
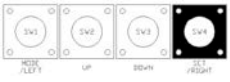
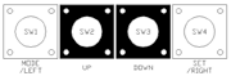
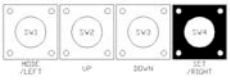
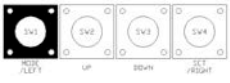
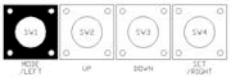
(1) Parameter Movement

Example of changing speed control mode to position control mode ([P0-03]: 00001 → 00002)



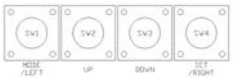
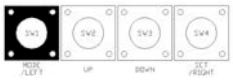
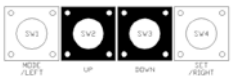
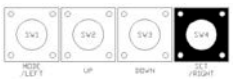
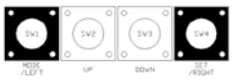
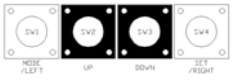
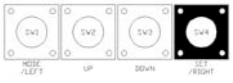
- If the alarm does not go off at the start of operation, the speed operation mode [S=bb] indicating operation status is displayed.
- Editable parameters are from [P0-00] to [Cn-15]. Press SET when a parameter number is displayed and you can see and edit the parameter data.
- In the initial parameter edit status, the number on the far right flickers (ON and OFF for 0.5 seconds respectively) and becomes editable.

(2) Example of changing speed control mode to position control mode ([P0-03]: 00001 -> 00002)

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [P0-00].
3			Press UP or DOWN to move to [P0-03].
4			Press SET to go to the parameter edit window. The parameter is displayed as 00001.
5			Press UP or DOWN at the blinking cursor to change the number to 00002.
6			Press and hold SET for approximately one second. After two flickers, the number will be saved as 00002 in the parameter.
7			Press and hold MODE for approximately one second to return to the P0-03 parameter.
8			Press MODE to change status to position operation [P= bb] status which is the summary display of the current status.

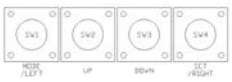
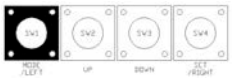
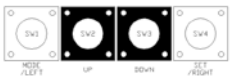
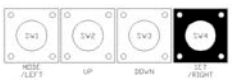
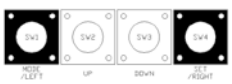
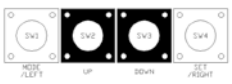
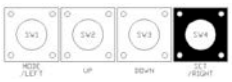
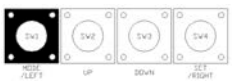
Note 1) "▯" indicates flickering.
Note 2) If you hold down UP / DOWN at the current cursor in the parameter window, the number continues to increase/decrease.

(3) Example of changing speed proportional gain 2 ([P1-07]: 200 rad/s -> 500 rad/s)

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [P1-00].
3			Press UP or DOWN to move to [P1-07].
4			Press SET to enter parameter edit mode. The parameter is displayed as 00200.
5			Press /LEFT or /RIGHT at the blinking cursor to move to the desired digit, DIGIT 3.
6			Press UP or DOWN at the blinking DIGIT 3 position to change the number to 00500.
7			Press and hold SET for approximately one second. After two flickers, the number will be saved as 00500 in the parameter.
8			Press and hold MODE for approximately one second to return to [P1-07].

Note 1) "▯" indicates flickering.
Note 2) If you hold down UP / DOWN at the current cursor in the parameter window, the number continues to increase/decrease.

(4) Example of changing DAC output offset 1 ([P0-19]: 0 Unit/V -> -500 Unit/V)

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [P0-00].
3			Press UP or DOWN to move to [P0-19].
4			Press SET to enter parameter edit mode. The parameter is displayed as 00000.
5			Press /LEFT or /RIGHT at the blinking cursor to move to the desired digit, DIGIT 3.
6			Press UP or DOWN at the blinking DIGIT 3 position to change the number to -0500.
7			Press and hold SET for approximately one second. After two flickers, the number will be saved as -0500 in the parameter.
8			Press and hold MODE for approximately one second to return to [P0-19].

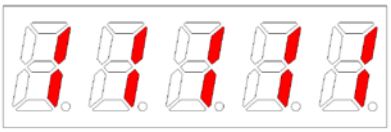
Note 1) "▯" indicates flickering.
Note 2) If you hold down UP / DOWN at the current cursor in the parameter window, the number continues to increase/decrease.

4.1.4 Data Display

(1) Binary

655 Minimum (0b00000)

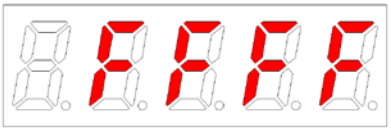
655 Maximum (0b11111)



(2) Hex

655 Minimum (0x0000)

655 Maximum (0xFFFF)



(3) 16-bit Unsigned Integer

655 E.g.) 0

655 E.g.) +1234

(4) 16-bit Signed Integer

655 ex) -1234

655 E.g.) -1234

② ex) +5678

655 E.g.) +5678

(5) 16-bit Decimal Point Display

655 ex) -123.4

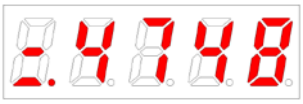
655 E.g.) -123.4

② ex) +123.4

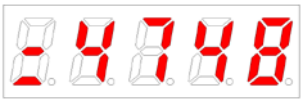
655 E.g.) +123.4

(6) 32-bit Signed Integer Data Display

- Minimum (-2147483648)

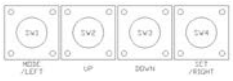
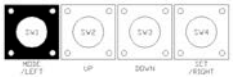
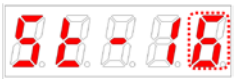
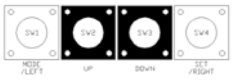
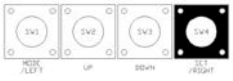
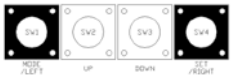
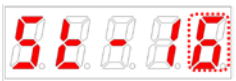
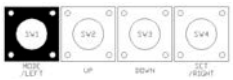
Display upper two digits	Display middle four digits	Display lower four digits
		

- Maximum (2147483647)

Display upper two digits	Display middle four digits	Display lower four digits
		

■ Example

[St-16]: Displayed as Upper = 0, Middle = 0012, and Lower = 2071

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [St-00].
3			Press UP or DOWN to move to [St-16].
4			Press SET to display lower digit data.
5			Each time you press /LEFT or /RIGHT lower, middle, and upper data is displayed.
6			Each time you press /LEFT or /RIGHT lower, middle, and upper data is displayed.
7			Press and hold MODE for approximately one second to return to [St-16].

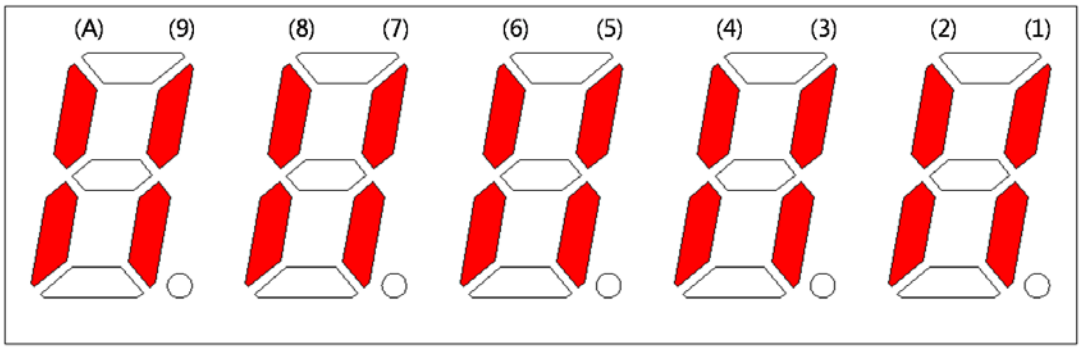
Note 1) " □ " indicates flickering.

4.1.5 External Input Contact Signal Display [St-14]

You can check whether the ON/OFF status of digital input/output signals that access the servo drive are on or off.

(1) External Input Signal Display

The positions of the seven segment LEDs and CN1 connector pins correspond as follows.



If an LED that corresponds to a pin is turned on/off, it indicates ON/OFF accordingly.

- Input Contact Display

Number	(A)	(9)	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)
Contact sign	**DIA**	**DI9**	**DI8**	**DI7**	**DI6**	**DI5**	**DI4**	**DI3**	**DI2**	**DI1**
CN1 Pin Number	48	18	19	20	46	17	21	22	23	47
Initial Allocation Signal Name	STOP	EMG	CWLIM	CCW LIM	DIR	ALM RST	SPD3	SPD2	SPD1	SVON

4.1.6 External Input Signal and Logic Definition

The following describes how to allocate input signals and how to view them.

(1) Input Signal Allocation

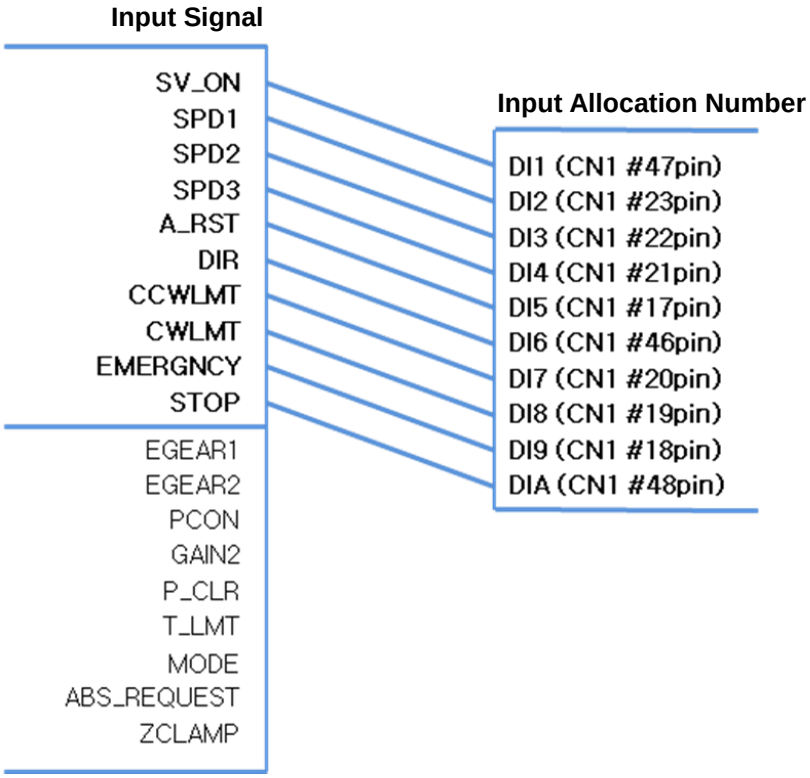
In L7 drive, you can allocate a total of 19 input contact functions to 10 hardware-like contacts.

Each input contact function is positioned at certain DIGIT of parameter [P2-00], [P2-01], [P2-02], [P2-03] and [P2-04], and you can change the value of each DIGIT and allocate it to pin of DI1-DIA.

The default input signal allocation is shown in the figure below:

One number can be allocated to two input signals such as N (input signal): 1 (input allocation number).

E.g.) If SVON and SPD1 are allocated to DI #01, you can use both SVON and SPD1 signals when entering DI #01.



⚠ Caution
If you change the input contact function, Since it is an immediate effect on the drive, you need to be careful for the operation. Before change, recommended to be set 'EEPROM save no use' in DIGIT 5 of [P0-17] parameter ..

Signal Name / Parameter Allocation	Input signal	Always Allocated	CN1 Pin Default Allocation Number										No Allocation	Input Signal Definition	Default Value
			48	18	19	20	46	17	21	22	23	47			
Servo ON [P2-00].DIGIT1 setting	SVON	F	A	9	8	7	6	5	4	3	2	**1**	0	[P2-00]	0x4321
Multi-speed 1 [P2-00].DIGIT2 setting	SPD1	F	A	9	8	7	6	5	4	3	**2**	1	0		
Multi-speed 2 [P2-00].DIGIT3 setting	SPD2	F	A	9	8	7	6	5	4	**3**	2	1	0		
Multi-speed 3 [P2-00].DIGIT4 setting	SPD3	F	A	9	8	7	6	5	**4**	3	2	1	0		
Alarm reset [P2-01].DIGIT1 setting	ALMRST	F	A	9	8	7	6	**5**	4	3	2	1	0	[P2-01]	0x8765
Select rotation direction [P2-01].DIGIT2 setting	DIR	F	A	9	8	7	**6**	5	4	3	2	1	0		
Forward rotation prohibited [P2-01].DIGIT3 setting	CCWLIM	F	A	9	8	**7**	6	5	4	3	2	1	0		
Reverse rotation prohibited [P2-01].DIGIT4 setting	CWLIM	F	A	9	**8**	7	6	5	4	3	2	1	0		
Emergency stop [P2-02].DIGIT1 setting	EMG	F	A	**9**	8	7	6	5	4	3	2	1	0	[P2-02]	0x00A9
Stop [P2-02].DIGIT2 setting	STOP	F	**A**	9	8	7	6	5	4	3	2	1	0		
Electronic gear ratio 1 [P2-02].DIGIT3 setting	EGEAR1	F	A	9	8	7	6	5	4	3	2	1	**0**		
Electronic gear ratio 2 [P2-02].DIGIT4 setting	EGEAR2	F	A	9	8	7	6	5	4	3	2	1	**0**		
P control action [P2-03].DIGIT1 setting	PCON	F	A	9	8	7	6	5	4	3	2	1	**0**	[P2-03]	0x0000
Select gain 2 [P2-03].DIGIT2 setting	GAIN2	F	A	9	8	7	6	5	4	3	2	1	**0**		
Input pulse clear [P2-03].DIGIT3 setting	P_CLR	F	A	9	8	7	6	5	4	3	2	1	**0**		
Torque limit [P2-03].DIGIT4 setting	T_LMT	F	A	9	8	7	6	5	4	3	2	1	**0**		
Change operation modes [P2-04].DIGIT1 setting	MODE	F	A	9	8	7	6	5	4	3	2	1	**0**	[P2-04]	0x0000
Absolute encoder data request [P2-04].DIGIT2 setting	ABS_RQ	F	A	9	8	7	6	5	4	3	2	1	**0**		
Zero clamp [P2-04].DIGIT3 setting	ZCLAMP	F	A	9	8	7	6	5	4	3	2	1	**0**		

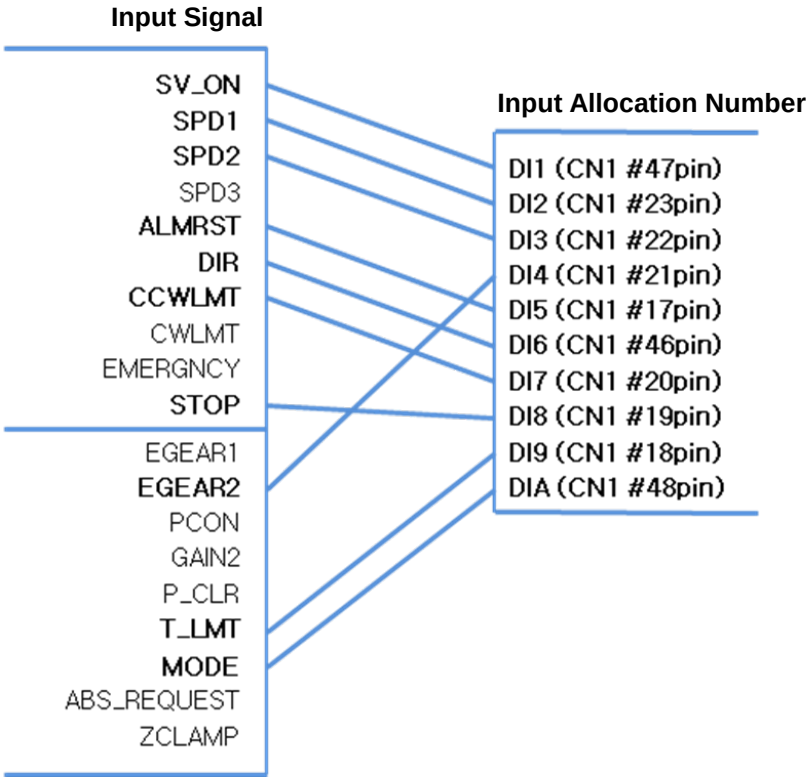
Note 1) No CN1 connector pin is allocated when the default value is "0".

(2) Example of Changing Input Signal Allocation

The input signal definition can be changed in [P2-00], [P2-01], [P2-02], [P2-03], and [P2-04].

The input signal logic definition can be changed in [P2-08] and [P2-09].

Allocate input signals as shown in the following table:



Signal Name Parameter Allocation	Input Signal	Always Allocated	CN1 Pin Default Allocation Number										No Allocation	Input Signal Definition	Value After Changing
			48	18	19	20	46	17	21	22	23	47			
Servo ON [P2-00].DIGIT1 setting	SVON	F	A	9	8	7	6	5	4	3	2	**1**	0	[P2-00]	0x0321
Multi-speed 1 [P2-00].DIGIT2 setting	SPD1	F	A	9	8	7	6	5	4	3	**2**	1	0		
Multi-speed 2 [P2-00].DIGIT3 setting	SPD2	F	A	9	8	7	6	5	4	**3**	2	1	0		
Multi-speed 3 [P2-00].DIGIT4 setting	SPD3	F	A	9	8	7	6	5	4	3	2	1	**0**		
Alarm reset [P2-01].DIGIT1 setting	ALMRST	F	A	9	8	7	6	**5**	4	3	2	1	0	[P2-01]	0x0765
Select rotation direction [P2-01].DIGIT2 setting	DIR	F	A	9	8	7	**6**	5	4	3	2	1	0		
Forward rotation prohibited [P2-01].DIGIT3 setting	CCWLIM	F	A	9	8	**7**	6	5	4	3	2	1	0		
Reverse rotation prohibited [P2-01].DIGIT4 setting	CWLIM	F	A	9	8	7	6	5	4	3	2	1	**0**		
Emergency stop [P2-02].DIGIT1 setting	EMG	F	A	9	8	7	6	5	4	3	2	1	**0**	[P2-02]	0x0080
Stop [P2-02].DIGIT2 setting	STOP	F	A	9	**8**	7	6	5	4	3	2	1	0		
Electronic gear ratio 1 [P2-02].DIGIT3 setting	EGEAR1	F	A	9	8	7	6	5	4	3	2	1	**0**		
Electronic gear ratio 2 [P2-02].DIGIT4 setting	EGEAR2	F	A	9	8	7	6	5	4	3	2	1	**0**		
P control action [P2-03].DIGIT1 setting	PCON	F	A	9	8	7	6	5	4	3	2	1	**0**	[P2-03]	0x9000
Select gain 2 [P2-03].DIGIT2 setting	GAIN2	F	A	9	8	7	6	5	4	3	2	1	**0**		
Input pulse clear [P2-03].DIGIT3 setting	P_CLR	F	A	9	8	7	6	5	4	3	2	1	**0**		
torque limit [P2-03].DIGIT4 setting	T_LMT	F	A	**9**	8	7	6	5	4	3	2	1	0		
Change operation modes [P2-04].DIGIT1 setting	MODE	F	**A**	9	8	7	6	5	4	3	2	1	0	[P2-04]	0x000A
Absolute encoder data request [P2-04].DIGIT2 setting	ABS_RQ	F	A	9	8	7	6	5	4	3	2	1	**0**		
Zero clamp [P2-04].DIGIT3 setting	ZCLAMP	F	A	9	8	7	6	5	4	3	2	1	**0**		

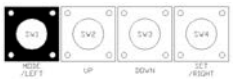
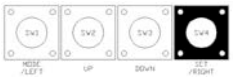
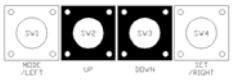
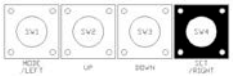
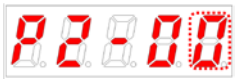
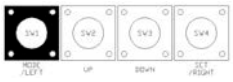
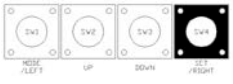
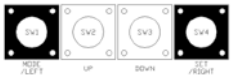
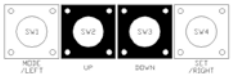
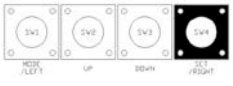
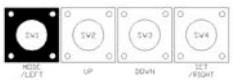
Note 1) No CN1 connector pin is allocated when the default value is "0".

■ Example of Changing Input Signal Allocation

The following is an example of changing input signal allocation.

The allocation signals of SVON (CN1-47) and STOP (CN1-48) can be switched in the following sequence:

	Before Changing	After Changing
[P2-00]:		
[P2-02]:		

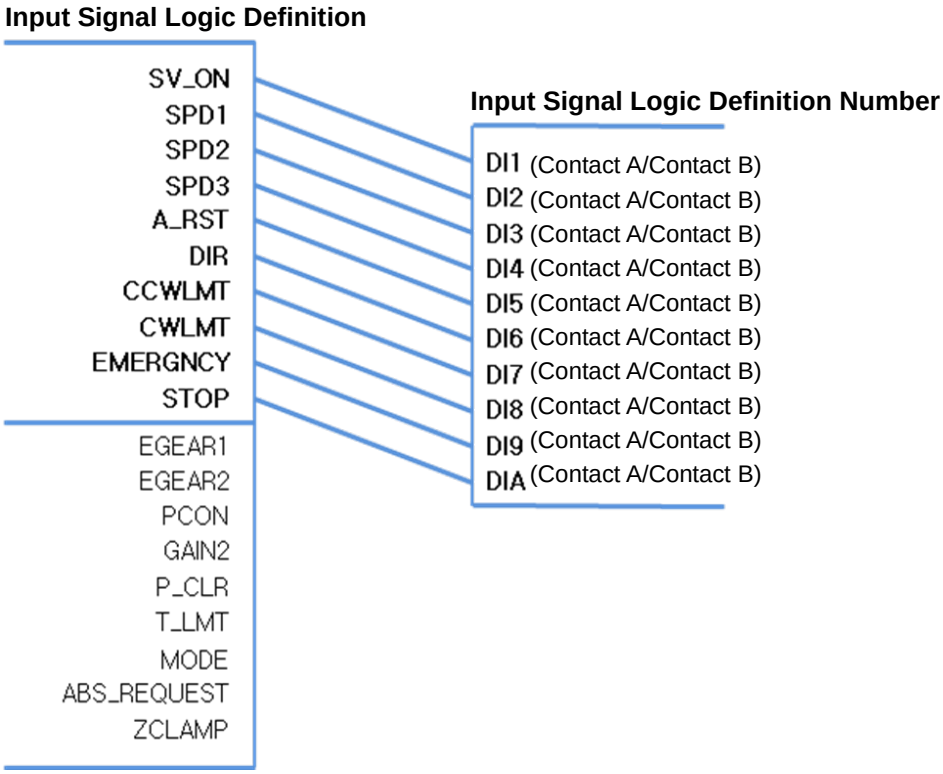
Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to move to [P2-00].
2			Press SET to enter parameter edit mode. The parameter is displayed as 04321.
3			Press UP or DOWN at the blinking cursor to change the number to 0432A.
4			Hold down SET for approximately one second. After two flickers, the number is saved as 0432A for the parameter.
5			Hold down MODE for approximately one second to return to [P2-00].
6			Press UP or DOWN at the blinking cursor to change the number to P2-02.
7			Press SET to enter parameter edit mode. The parameter is displayed as 000A9.
8			Press /LEFT or /RIGHT at the blinking cursor to move to the desired digit, DIGIT 2.
9			Press UP or DOWN at the blinking cursor to change the number to 00019.
10			Hold down SET for approximately one second. After two flickers, the number is saved as 00019 for the parameter.
11			Hold down MODE for approximately one second to return to [P2-02].
12	** Modification is not possible with the servo on. Reset the parameter.		
※	In case of exiting without saving the set value		Hold down MODE for approximately one second to return to the parameter.

Note 1) " " indicates flickering.

(3) Input Signal Logic Definition

In L7 drive, you can define the logic of input signal through parameter [P2-08] and [P2-09], in terms of 10 hardware contacts ranging from DI1 to DIA.

The default logic state of input signal is as follows:



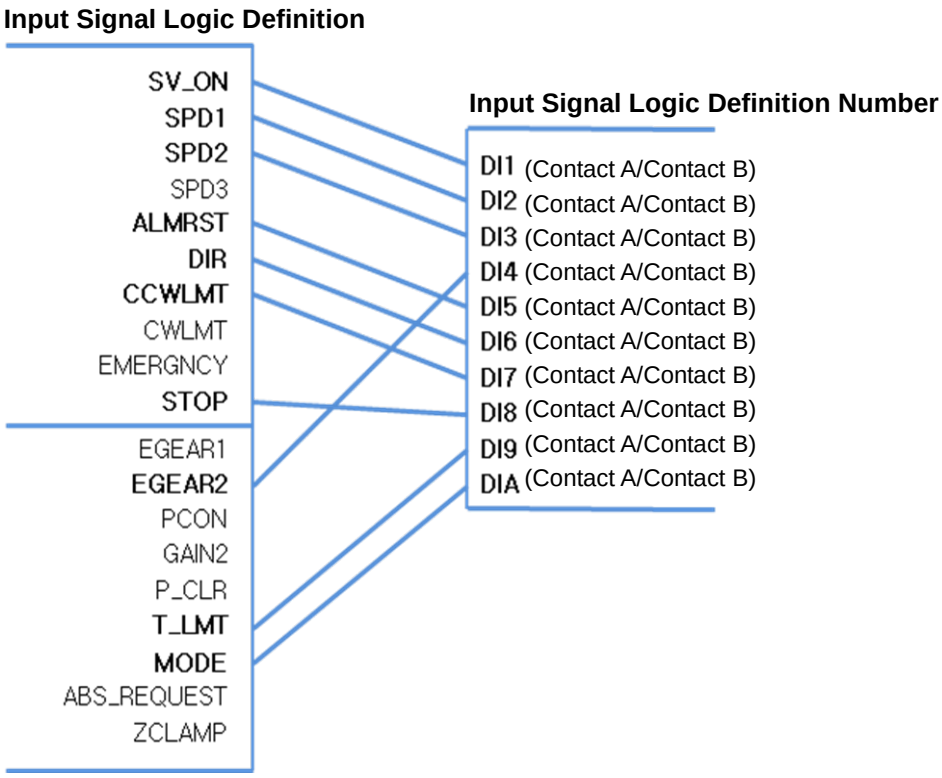
Signal Name / Parameter Allocation	Input Signal (Initial Name)	CN1 Pin Default Allocation Number										Contact B	Input Signal Logic Definition	Default Value
		48	18	19	20	46	17	21	22	23	47			
Servo ON [P2-08].DIGIT1 setting	SVON										1	0	[P2-08]	0x11111
Multi-speed 1 [P2-08].DIGIT2 setting	SPD1									1		0		
Multi-speed 2 [P2-08].DIGIT3 setting	SPD2								1			0		
Multi-speed 3 [P2-08].DIGIT4 setting	SPD3							1				0		
Alarm reset [P2-08].DIGIT5 setting	ALMRST						1					0		
Select rotation direction [P2-09].DIGIT1 setting	DIR					1						0	[P2-09]	0x10001
Forward rotation prohibited [P2-09].DIGIT2 setting	CCWLIM											0		
Reverse rotation prohibited [P2-09].DIGIT3 setting	CWLIM											0		
Emergency stop [P2-09].DIGIT4 setting	EMG											0		
Stop [P2-09].DIGIT5 setting	STOP	1										0		

Note 1) According to the input signal logic definition, contact A is 1 and contact B is 0.

(4) Example of Changing Input Signal Logic Definition

The input signal logic definition can be changed in [P2-08] and [P2-09].

Allocate input signals as shown in the following table:



Signal Name / Parameter Allocation	Input Signal	CN1 Pin Default Allocation Number										Contact B	Input Signal Logic Definition	Default Value
		48	18	19	20	46	17	21	22	23	47			
Servo ON [P2-08].DIGIT 1 setting	SVON										1	0	[P2-08]	0x11111
Multi-speed 1 [P2-08].DIGIT 2 setting	SPD1									1		0		
Multi-speed 2 [P2-08].DIGIT 3 setting	SPD2								1			0		
Multi-speed 3 [P2-08].DIGIT 4 setting	EGEAR2							1				0		
Alarm reset [P2-08].DIGIT 5 setting	ALMRST						1					0		
Select rotation direction [P2-09].DIGIT 1 setting	DIR					1						0	[P2-09]	0x11101
Forward rotation prohibited [P2-09].DIGIT 2 setting	CCWLIM											0		
Reverse rotation prohibited [P2-09].DIGIT 3 setting	STOP			1								0		
Emergency stop [P2-09].DIGIT 4 setting	T_LMT		1									0		
Stop [P2-09].DIGIT 5 setting	MODE	1										0		

Note 1) According to the input signal logic definition, contact A is 1 and contact B is 0.

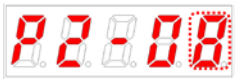
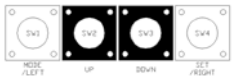
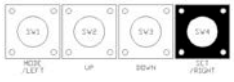
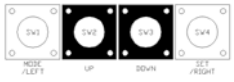
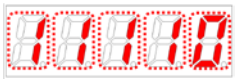
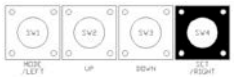
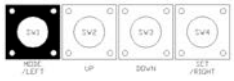
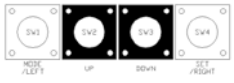
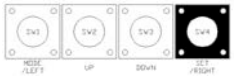
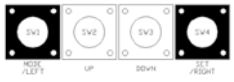
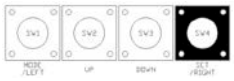
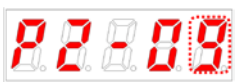
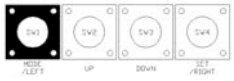
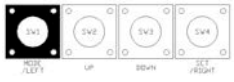
■ Example of Changing Input Signal Logic Definition

The following is an example of changing input signal logic.

You can change logic signal contact A of SVON (CN1-47) to contact B, and

change logic signal contact B of CCWLIM (CN1-20) to contact A in the following sequence:

	Before Changing	After Changing
[P2-08]:		
[P2-09]:		

Order	Loader Displays	Keys to Use	What to Do
1			Press UP or DOWN key at the blinking cursor to move to [P2-08].
2			Press SET to enter parameter edit mode. The parameter is displayed as 11111.
3			Press UP or DOWN key at the blinking cursor to change the number to 11110.
4			Hold down SET key for approximately one second. After two flickers, the number will be saved as 11110 for the parameter.
5			Hold down MODE key for approximately one second to return to [P2-08].
6			Press UP or DOWN key at the blinking cursor to change the number to P2-09.
7			Press SET to enter parameter edit mode. The parameter is displayed as 10001.
8			Press /LEFT or /RIGHT at the blinking cursor to move to the desired digit, DIGIT 2.
9			Press UP or DOWN key at the blinking cursor to change the number to 10011.
10			Press and hold the SET key for approximately one second. After two flickers, the number will be saved as 10011 in the parameter.
11			Hold down MODE key for approximately one second to return to [P2-09].
12	** Modification is not possible with the servo on. Reset the parameter.		
※	In case of exiting without saving the set value		Hold down MODE for approximately one second to return to the parameter.

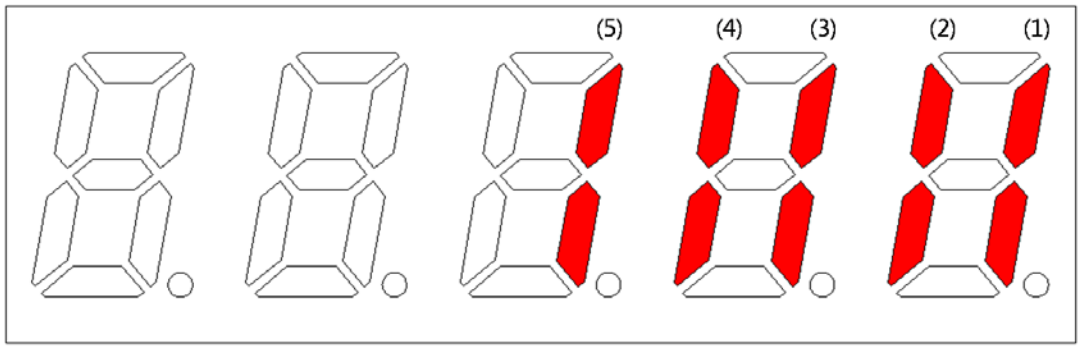
Note 1) " ▯ " indicates flickering.

4.1.7 External Output Contact Signal Display [St-15]

You can check whether the ON/OFF status of digital input/output signals that access the servo drive are on or off.

(1) External Output Signal Display

The positions of the seven segment LEDs and CN1 connector pins correspond as follows.



If an LED that corresponds to a pin is turned on/off, it indicates ON/OFF accordingly.

Output Contact Display

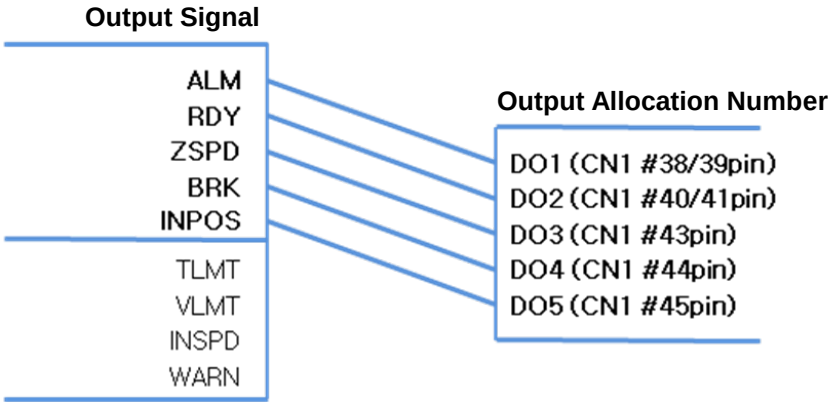
Number						**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
Contact sign						**DO5**	**DO4**	**DO3**	**DO2**	**DO1**
CN1 pin number						45	44	43	40/41	38/39
Initial allocation signal name						INPOS	BRAKE	ZSPD	READY	ALARM

4.1.8 External Output Signal and Logic Definition

The following explains output signal allocation and the method of checking allocation status.

(1) Output Signal Allocation

- Output signal definition: [P2-05], [P2-06], [P2-07]
- Output signal logic definition: [P2-10]
- The default output signal allocation is as follows:

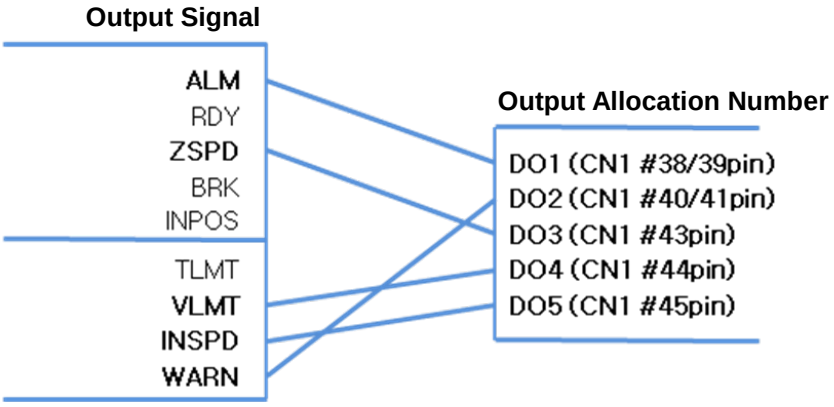


Signal Name / Parameter Allocation	output signal	Always Allocated	CN1 Pin Default Allocation Number					Not Allocated	Internal Parameter	Default Value
			45	44	43	40/41	38/39			
Alarm [P2-05].DIGIT1 setting	ALARM	F	5	4	3	2	1	0	[P2-05]	0x4321
Servo ready [P2-05].DIGIT2 setting	READY	F	5	4	3	2	1	0		
Zero speed achieved [P2-05].DIGIT3 setting	ZSPD	F	5	4	3	2	1	0		
Brake [P2-05].DIGIT4 setting	BRAKE	F	5	4	3	2	1	0		
Position reached [P2-06].DIGIT1 setting	INPOS	F	5	4	3	2	1	0	[P2-06]	0x0005
Torque limit reached [P2-06].DIGIT2 setting	TLMT	F	5	4	3	2	1	0		
Speed limit reached [P2-06].DIGIT3 setting	VLMT	F	5	4	3	2	1	0		
Speed reached [P2-06].DIGIT4 setting	INSPD	F	5	4	3	2	1	0		
Warning [P2-07].DIGIT1 setting	WARN	F	5	4	3	2	1	0	[P2-07]	0x0000

Note 1) No CN1 connector pin is allocated when the default value is "0".

(2) Example of Changing Output Signal Allocation

- The output signal definition can be changed in [P2-05], [P2-06], and [P2-07].
- The output signal logic definition can be changed in [P2-10].
- Allocate output signals as in the following table:



Signal Name / Parameter Allocation	output signal	Always assignment	CN1 Pin Default Allocation Number 45	44	43	40/41	38/39	Not Allocated	Internal Parameter	Value After Changing
Alarm [P2-05].DIGIT1 setting	ALARM	F	5	4	3	2	**1**	0	[P2-05]	0x0301
Servo ready [P2-05].DIGIT2 setting	READY	F	5	4	3	2	1	**0**		
Zero speed achieved [P2-05].DIGIT3 setting	ZSPD	F	5	4	**3**	2	1	0		
Brake [P2-05].DIGIT4 setting	BRAKE	F	5	4	3	2	1	**0**		
Position reached [P2-06].DIGIT1 setting	INPOS	F	5	4	3	2	1	**0**	[P2-06]	0x5400
Torque limit reached [P2-06].DIGIT2 setting	TLMT	F	5	4	3	2	1	**0**		
Speed limit reached [P2-06].DIGIT3 setting	VLMT	F	5	**4**	3	2	1	0		
Speed reached [P2-06].DIGIT4 setting	INSPD	F	**5**	4	3	2	1	0		
Warning [P2-07].DIGIT1 setting	WARN	F	5	4	3	**2**	1	0	[P2-07]	0x0002

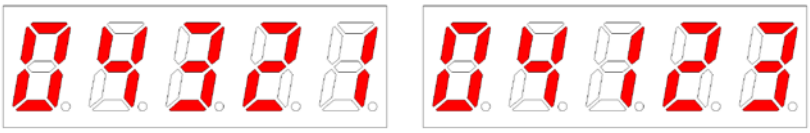
Note 1) No CN1 connector pin is allocated when the default value is "0".

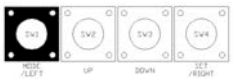
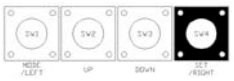
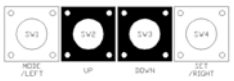
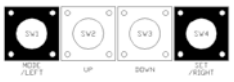
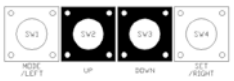
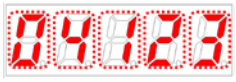
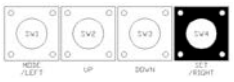
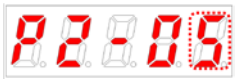
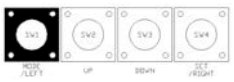
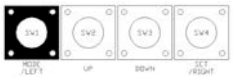
■ Example of Changing Output Signal Allocation

The following is an example of output signal allocation change.

The allocation signals of ALARM (CN1-38/39) and ZSPD (CN1-43) can be switched in the following sequence:

Before Changing After Changing

[P2-05]: 

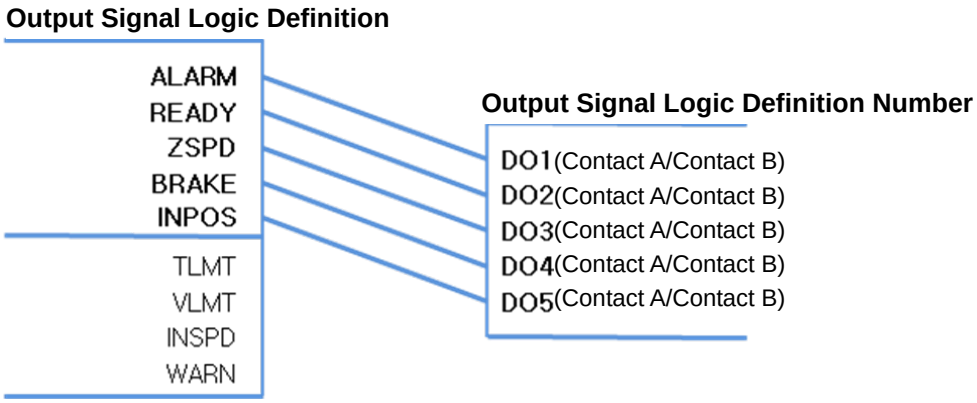
Order	Loader Window Display Result	Keys to Use	What to Do
1			Press MODE to move to [P2-05].
2			Press SET to enter parameter edit mode. The parameter is displayed as 04321.
3			Press UP or DOWN at the blinking cursor to change the number to 04323.
4			Press /LEFT or /RIGHT at the blinking cursor to move to the desired digit, DIGIT 3.
5			Press UP or DOWN at the blinking cursor to change the number to 04123.
6			Hold down SET for approximately one second. After two flickers, the number will be saved as 04123 for the parameter.
7			Hold down MODE for approximately one second to return to [P2-05].
8	** Modification is not possible with the servo on. Reset the parameter.		
※	In case of exiting without saving the set value		Hold down MODE for approximately one second to return to the parameter.

Note 1) " ▯ " indicates flickering.

When two output signals are allocated to one number, the output contact setting error [AL-72] alarm triggers.

(3) Output Signal Logic Definition

- Output signal logic definition: [P2-10]
- The default logic state of output signal is as follows:

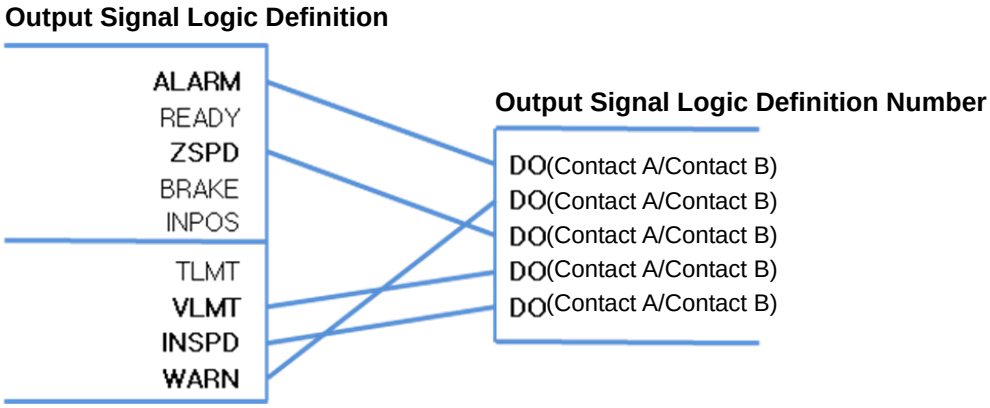


Signal Name Parameter Allocation	Input Signal (Initial Name)	CN1 Pin Default Allocation Number					Contact B	Output Signal Logic Definition	Default Value
		45	44	43	40 /41	38 /39			
Alarm [P2-10]. DIGIT1 setting	ALARM						0	[P2-10]	0x10110
Servo ready [P2-10]. DIGIT2 setting	READY				1		0		
Zero speed achieved [P2-10]. DIGIT3 setting	ZSPD			1			0		
Brake [P2-10]. DIGIT4 setting	BRAKE						0		
Position reached [P2-10]. DIGIT5 setting	INPOS	1					0		

Note 1) According to the input signal logic definition, contact A is 1 and contact B is 0.

(4) Example of Changing Output Signal Logic Definition

- The output signal logic definition can be changed in [P2-10].
- Allocate output signals as in the following table:



Signal Name / Parameter Allocation	Input Signal (Initial Name)	CN1 Pin Default Allocation Number					Contact B	Output Signal Logic Definition	Default Value
		45	44	43	40 /41	38 /39			
Alarm [P2-10]. DIGIT1 setting	ALARM						0	[P2-10]	0x11110
Servo ready [P2-10]. DIGIT2 setting	READY				1		0		
Zero speed achieved [P2-10]. DIGIT3 setting	ZSPD			1			0		
Brake [P2-10]. DIGIT4 setting	BRAKE		1				0		
Position reached [P2-10]. DIGIT5 setting	INPOS	1					0		

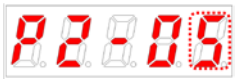
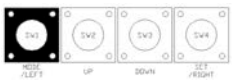
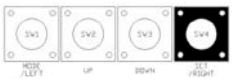
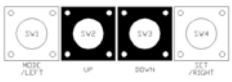
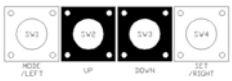
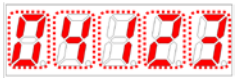
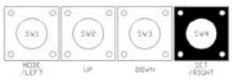
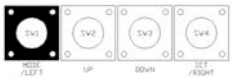
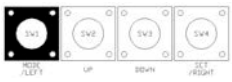
Note 1) According to the input signal logic definition, contact A is 1 and contact B is 0.

■ Example of Changing Output Signal Logic Definition

The following is an example of output signal allocation change.

The allocation signals of ALARM (CN1-38/39) and ZSPD (CN1-43) can be switched in the following sequence:

	Before Changing	After Changing
[P2-05]:		

Order	Loader Window Display Result	Keys to Use	What to Do
1			Press MODE to move to [P2-05].
2			Press SET to enter parameter edit mode. The parameter is displayed as 04321.
3			Press UP or DOWN at the blinking cursor to change the number to 04323.
4			Press /LEFT or /RIGHT at the blinking cursor to move to the desired digit, DIGIT 3.
5			Press UP or DOWN at the blinking cursor to change the number to 04123.
6			Hold down SET for approximately one second. After two flickers, the number will be saved as 04123 for the parameter.
7			Hold down MODE for approximately one second to return to [P2-05].
8	** Modification is not possible with the servo on. Reset the parameter.		
※	In case of exiting without saving the set value		Hold down MODE for approximately one second to return to the parameter.

Note 1) " " indicates flickering.

When two output signals are allocated to one number, the output contact setting error [AL-72] alarm triggers.

4.2 Parameters

4.2.1 Parameter System

There are a total of eight groups of parameters. Each group is explained in the following table:

Parameter Movement	Parameter Number	Initial Screen	Parameter group name	Details
MODE key	-	E.g.) In speed mode 	Status Summary Display	Displays the status summary of the servo.
	St-00 - St-27		Status	Displays the operation status of the servo.
	P0-00 - P0-29		System	Saves system configuration information.
	P1-00 - P1-27		Control	Saves control-related parameters.
	P2-00 - P2-22		IN / OUT	Saves parameters related to analog and digital input/output.
	P3-00 - P3-20		Speed Operation	Saves speed operation parameters.
	P4-00 - P4-14		Position Operation	Saves position pulse operation parameters.
	Cn-00 - Cn-17		Command	Performs operation handling.

The following explains the acronyms related to application mode in the parameter:

- P: Use in position control mode.
- S: Use in speed control mode.
- T: Use in torque control mode.

Press MODE once to move to the next display mode.

4.2.2 Operation Status Display Parameter

For detailed information, refer to "4.3 Operation Status Display

"**" Parameter that cannot be modified with the servo ON but can reset power

."*" Parameter that cannot be modified with the servo ON

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
St-00	Current Operation Status	-	-	Displays the current operation status. DIGIT 5: DIGIT 4: ZSPD, INPOS/INSPD, Command, READY DIGIT 3-1: Run Status (Details: Refer to "4.1.2 Status Summary Display.")	PST
		0	0		
St-01	Current Operation Speed	RPM	0	Displays the current operation speed. (Details: Refer to "4.3.2 Speed Display.")	PST
		-10000	10000		
St-02	Current Command Speed	RPM	0	Displays the current command speed. (Details: Refer to "4.3.2 Speed Display.")	ST
		-10000	10000		
St-03	Following Position Pulse	Pulse	0	Displays the accumulated number of tracked position command pulses. ▪ Displays the accumulated number of position command pulses that followed as a result of rotation of the servo motor because the servo was turned on. ▪ If a number is lower than the minimum or higher than the maximum, it is displayed as the minimum or maximum. (Details: Refer to "4.3.3 Position Display.")	P
		-2^30	2^30		
St-04	Position Command Pulse	Pulse	0	Displays the accumulated number of position command pulses. ▪ Displays the accumulated number of position command pulses that have been entered since the servo turned on. (Details: Refer to "4.3.3 Position Display.")	P
		-2^30	2^30		
St-05	Remaining Position Pulse	Pulse	0	Displays the remaining position pulses that the servo has to operate. ▪ This displays the difference between command pulses and tracking pulses and the remaining position pulses for the servo to run. ▪ The remaining position pulses, which are displayed when the servo is off, are ignored when the servo turns on. (Details: Refer to "4.3.3 Position Display.")	P
		-2^30	2^30		
St-06	Input Pulse Frequency	Kpps	0.0	Displays input pulse frequency.	P
		-1000.0	1000.0		
St-07	Current Operation Torque	[%]	0.0	Displays the current load factor against the rated load factor. ▪ Displays the load currently output by the servo motor as a percentage against the rated output.	T
		-300.0	300.0		
St-08	Current Command Torque	[%]	0.0	Displays the command load factor against the rated load factor. ▪ Displays the load currently output by the servo motor as a percentage against the rated output. (Details: Refer to "4.3.4 Torque and Load Display.")	T
		-300.0	300.0		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
St-09	Accumulated Overload Rate	[%]	0.0	Displays the currently accumulated load factor against the maximum accumulated load factor as a percentage. (Details: Refer to “4.3.4 Torque and Load Display.”)	PST
		-300.0	300.0		
St-10	Instantaneous Maximum Load Factor	[%]	0.0	Displays the instantaneous maximum load factor against the rated load factor. ▪ Displays, as a percentage, the maximum overload between the current time and the start of control set off when the servo turned on. (Details: Refer to “4.3.4 Torque and Load Display.”)	PST
		-300.0	300.0		
St-11	Torque Limit	[%]	-	Displays the torque limit value. ▪ Displays, as a percentage, the maximum torque that the servo motor can output, against the rated torque. (T_LMT contact ON: Analog torque input. T_LMT contact OFF: [P1-13] and [P1-14] values)	PST
		-300.0	300.0		
St-12	DC Link Voltage	V	0.0	Displays the current DC link voltage of the main power. ▪ The DC link voltage of the standard drive that uses 380 V is approximately 537 V. ▪ The maximum DC link voltage allowed for the standard drive that uses 380 V is 800 V. ▪ The excessive voltage alarm [AL-41] triggers when the DC link voltage threshold is exceeded because there is either too much or too little regenerative resistance. ▪ The normal DC link voltage in the regenerative section is 747 V or below. (Details: Refer to “4.3.4 Torque and Load Display.”)	PST
		0.0	900.0		
St-13	Regenerative Overload	[%]	0.0	Displays the regenerative overload rate.	PST
		0.0	20.0		
St-14	Input Contact Status	-	-	Displays the input contact status that the servo recognizes. (Details: Refer to “4.1.5 External Input Contact Signal Display.”)	PST
		-	-		
St-15	Output Contact Status	-	-	Displays the output contact status that the servo outputs. (Details: Refer to “4.1.6 External Input Contact Signal Display.”)	PST
		-	-		
St-16	SingleTurn Data (Single Turn Data)	Pulse	0	Displays the single-turn data of the encoder in pulses.	PST
		0	2^30		
St-17	Single-turn data (Degrees)	[°]	0.0	This displays the single-turn data of the encoder in degrees.	PST
		0.0	360.0		
St-18	Multi-Turn Data	rev	0	This displays the multi-turn data for the encoder.	PST
		-32768	32767		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
St-19	Internal Temperature	[℃]	0	Displays the internal temperature sensor value.	PST
	Room temperature	0	200		
St-20	Rated Motor Speed	RPM	0	Displays the rated speed of the currently installed motor.	PST
		0	10000		
St-21	Peak Motor Speed	RPM	0	Displays the maximum speed of the currently installed motor.	PST
		0	10000		
St-22	Rated Motor Current	A	0.00	Displays the rated current of the currently installed motor.	PST
		0.00	655.35		
St-23	Phase U Current Offset	mA	0	Displays the phase U current offset.	PST
		-200	200		
St-24	Phase V Current Offset	mA	0	Displays the phase V current offset.	PST
		-200	200		
St-25	Program Version	-	-	Displays the version of the currently installed program. (Details: Refer to “4.3.7 Software Version Display.”)	PST
		-	-		
St-26	FPGA Version	-	-	This displays the version of the FPGA.	PST
		-	-		
St-27	Analog Command Torque	%	0	Displays current analog command torque.	T
		-3000	3000		

4.2.3 System Parameters

For detailed information, refer to "4.4.1 System Parameter Setting."

"**" Parameter that cannot be modified with the servo ON but can reset power.

"*" Parameter that cannot be modified with the servo ON

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
**P0-00	Motor ID	-	999	▪ Serial Type Encoder: Reads the motor ID from the encoder and displays it. ▪ Quadrature Type Encoder: Sets motor ID directly. ▪ If the attempt to read motor data fails, the initial value is set to 999. (Details: Refer to "4.4.1 System Parameter Setting.")	PST
		0	999		
**P0-01	Encoder Type	-	0	▪ Serial Type Encoder: Reads and displays from the encoder. ▪ Quadrature Type Encoder: Sets the value directly. • 0: Quadrature type encoder • 1: Serial encoder (-) • 2: Serial encoder (12 bit) • 3: Serial encoder (16 bit) • 4: Serial encoder (20 bit) • 5: Serial encoder (24 bit) (Details: Refer to "4.4.1 System Parameter Setting.")	PST
		0	5		
**P0-02	Encoder Pulse	ppr	3000	▪ Serial Type Encoder: Reads the number of bits per turn from the encoder and displays it. ▪ Quadrature Type Encoder: Sets the number of encoder pulses directly. (Details: Refer to "4.4.1 System Parameter Setting.")	PST
		1	30000		
*P0-03	Select operation mode	-	1	Sets operation mode. (0: Torque operation. 1: Speed operation. 2: Position operation. 3: Speed/position operation. 4: Torque/speed operation. 5: Torque/position operation.) (Details: Refer to "4.4.1 System Parameter Setting.")	PST
		0	5		
**P0-04	RS422 Communication Speed	bps	0	Sets communication speed for RS-422 communication. ▪ 0 : 9600 bps ▪ 1 : 19200 bps ▪ 2 : 38400 bps ▪ 3 : 57600 bps (Details: Refer to "4.4.1 System Parameter Setting.")	PST
		0	3		
**P0-05	System ID	-	0	Sets drive ID for communication. ▪ An ID can be given to the servo if USB communication, RS422 communication and BUS communication are used for communication with the servo. ▪ A unique ID can be given to the servo and used for individual communication with it. (Details: Refer to "4.4.1 System Parameter Setting.")	PST
		0	99		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
P0-06	Main Power Input Mode	-	0b00	Sets main power input. DIGIT 1-> 0: Single-phase power 1: 3-phase power input ⚠ Caution: Using single-phase power may lower motor output. ⚠ DIGIT2 -> 0: Error in case of phase loss 1: Warning in case of phase loss	PST
		0b00	0b11		
P0-07	RST checking time	ms	20	Sets the time to check main power phase loss.	PST
		0	5000		
P0-08	Start-up Parameter	-	0	Sets the number for the operation status parameter that is displayed at the start. (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		0	25		
*P0-09	Regenerative Overload Derating	[%]	100	This specifies the derating factor which checks for regenerative resistance overloads. The overload alarm triggers quickly when the derating value is set to 100% or below.	PST
		1	200		
**P0-10	Regenerative Resistance Value	Ω	0	This specifies the resistance value for regenerative braking resistance. If set to 0, the default resistance value of the drive is used.	PST
		0	1000		
**P0-11	Regenerative Resistance Capacity	W	0	This specifies the current capacity for regenerative resistance. If set to 0, a default resistance capacity embedded in the drive is used.	PST
		0	30000		
*P0-12	Overload Check Base Load Factor	[%]	100	This indicates the load factor which triggers a continuous overload check. If it is set to 100 or less, then the overload check starts early and the overload alarm triggers early.	PST
		10	100		
P0-13	Continuous Overload Warning Level	[%]	50	Indicates the level of continuous overload warning signal output. Outputs the warning signal when the percentage value against alarm trigger load factor is reached.	PST
		10	100		
*P0-14	Encoder Output Pre-scale	-	12000	Sets the prescale for encoder output when the servo outputs an encoder signal to the outside. (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		-2^21	2^21		
*P0-15	PWM OFF Delay Time	ms	10	Sets the time to delay until the PWM signal actually goes off after the servo is turned off. (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		0	1000		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
*P0-16	DB Control Mode	-	0x0	Specifies the DB control mode. ▪ 0: Hold after a DB stop ▪ 1: Release after a DB stop ▪ 2: Release after free run stop ▪ 3: Hold after a free run stop (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		0x0	0x3		
*P0-17	Function Setting Bit	-	0b00000	Sets drive function per digit. DIGIT 1 -> Sets the operation direction of the servo. • 0: Foward (CCW), Reverse (CW) • 1: Forward (CW), Reverse (CCW) DIGIT 2 -> Sets the Servo Lock. • 0: Do not use • 1: Interpolation DIGIT 3 -> Sets Open Collector Output. • 0: Do not use • 1: Interpolation DIGIT 4 -> Sets Monitor Output Voltage. • 0: -10V - +10V • 1: 0-10V DIGIT 5 -> Sets saving EEPROM communication. • 0: Do not use • 1: Interpolation (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		0b00000	0b11111		
P0-18	DAC Output Mode	-	0x3210	Sets output mode for 1-2 analog output channels. Sets CH0-CH1 from the bottom, HEX Code, in order. ▪ Output CH0 and CH1 as MONIT1 and MONIT2. • 0 : Speed feedback [RPM] • 1 : Speed command [RPM] • 2 : Torque feedback [%] • 3 : Torque command [%] • 4 : Position command frequency [0.1 Kpps] • 5 : Following error [pulse] • 6 : DC link voltage [V] • D: Speed command (user) [RPM] • E: Torque command (user) [%] (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		0x0000	0xFFFF		
P0-19	DAC Output Offset 1	Unit/V	0	Sets offset for 1-2 analog output channels. • Speed: RPM • Torque: [%] • Position command frequency: 0.1 Kpps • Position: Pulse • DC Link: V • Offset (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		-1000	1000		
P0-20	DAC Output Offset 2	Unit/V	0		
		-1000	1000		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
P0-21	Reserved	-	-		
		-	-		
P0-22	Reserved	Unit/V	0		
		-1000	1000		
P0-23	DAC Output Scale 1	Unit/V	500	Sets magnification for 1-2 analog output channels. Sets magnification as setting Unit/V. E.g.) Channel 1 scale 100 RPM: Output 100 RPM as 1 V. (Details: Refer to “4.4.1 System Parameter Setting.")	PST
		1	10000		
P0-24	DAC Output Scale 2	Unit/V	500		
		1	10000		
P0-25	Reserved				
P0-26	Encoder Function Bit		0	Multi turn encoder function setting *0: Using as Multi turn mode with multi turn encoder. *1: Using as Single turn mode with multi turn encoder.	PST
		0	1		
P0-27	Phase U Current Offset Value	mA	0	Saves phase U current offset value.	PST
		-9999	9999		
P0-28	Phase V Current Offset Value	mA	0	Saves phase V current offset value.	PST
		-9999	9999		
P0-29	Phase W Current Offset Value	mA	0	Saves phase W current offset value.	
		-9999	9999		

4.2.4 Control Setting Parameter

For detailed information, refer to "4.4.2 Control Parameter Setting."

"**" Parameter that cannot be modified with the servo ON but can reset power.

"*" Parameter that cannot be modified with the servo ON

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
P1-00	Inertia Ratio	[%]	100	Sets inertia ratio for load. ▪ Inertia ratio is considered 100 percent when there is no load from the motor. Because setting inertia ratio against load is an important control parameter for the operation of the servo, inertia ratio shall be set by calculating load inertia by the machine system and rotor inertia from the motor specification table. ▪ Setting an accurate inertia ratio is crucial for optimal servo operation. (Details: Refer to "4.4.2 Control Parameter Setting.")	PST
		0	20000		
P1-01	Position proportional gain 1	Hz	50	Sets position control proportional gain 1. (Details: Refer to "4.4.2 Control Parameter Setting.")	P
		0	500		
P1-02	Position proportional gain 2	Hz	70	Sets position control proportional gain 2. (Details: Refer to "4.4.2 Control Parameter Setting.")	P
		0	500		
P1-03	Position Command Filter Time Constant	ms	0	Sets the filter time constant for internal position command that reflects electronic gear ratio. (Details: Refer to "4.4.2 Control Parameter Setting.")	P
		0	1000		
P1-04	Position Feedforward Gain	[%]	0	Sets position feedforward control ratio. (Details: Refer to "4.4.2 Control Parameter Setting.")	P
		0	100		
P1-05	Position Feedforward Filter Time Constant	ms	0	Sets position feedforward control filter time constant. (Details: Refer to "4.4.2 Control Parameter Setting.")	P
		0	1000		
P1-06	Speed proportional gain 1	rad/s	400	Sets speed control proportional gain 1. (Details: Refer to "4.4.2 Control Parameter Setting.")	PS
		0	5000		
P1-07	Speed proportional gain 2	rad/s	700	Sets speed control proportional gain 2. (Details: Refer to "4.4.2 Control Parameter Setting.")	PS
		0	5000		
P1-08	Speed Integral Time Constant 1	ms	50	Sets speed control integral time constant 1. (Details: Refer to "4.4.2 Control Parameter Setting.")	PS
		1	1000		
P1-09	Speed Integral Time Constant 2	ms	15	Sets speed control integral time constant 2.	PS
		1	1000		
P1-10	Speed Command Filter Time Constant	ms	10	Sets filter time constant for speed command values.	PS
		0	1000		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
P1-11	Speed Feedback Filter Time Constant	0.1ms	5	Sets filter time constant for speed search values. (Details: Refer to “4.4.2 Control Parameter Setting.”)	PS
		0	1000		
P1-12	Torque Command Filter Time Constant	ms	10	Sets filter time constant for torque command values. (Details: Refer to “4.4.2 Control Parameter Setting.”)	PST
		0	1000		
P1-13	Positive Torque Limit	[%]	300	Sets positive torque limit. (Details: Refer to “4.4.2 Control Parameter Setting.”)	PST
		0	300		
P1-14	Negative Torque Limit	[%]	300	Sets negative torque limit. (Details: Refer to “4.4.2 Control Parameter Setting.”)	PST
		0	300		
P1-15	Switching Mode	-	0x00	Sets gain switching mode. [0x0F (DIGIT 1)] ▪ 0: Only uses gain 1. ▪ 1: ZSPD automatic gain switching In case of zero speed, switch from gain 1 to gain 2. In the opposite case, switch from gain 2 to gain 1. ▪ 2: INPOS automatic gain switching In case of IN position, switch from gain 1 to gain 2. In the opposite case, switch from gain 2 to gain 1. ▪ 3: Manual gain switching When the gain 2 contact is on, switch from gain 1 to gain 2. In the opposite case, switch from gain 2 to gain 1. Sets P and PI control switching modes. [0xF0 (DIGIT 2)] 0: Only control PI. ▪ 1: Control P if the command torque is higher than the set torque [P1-24]. ▪ 2: Control P if the command speed is higher than the set speed [P1-25]. ▪ 3: Control P if the current acceleration is higher than the set torque [P1-26]. ▪ 4: Control P if the current position error is higher than the set position error [P1-27]. ▪ Control P if the PCON contact is on (highest priority). (Details: Refer to “4.4.2 Control Parameter Setting.”) (Details: Refer to “4.4.4 Input/Output Contact Parameter Setting.”)	PS
		0x00	0x43		
P1-16	Gain Switching Time	ms	1	Sets gain switching time during operation. When switching from gain 1 to gain 2 and from gain 2 to gain 1, switching is scheduled according to the set time.	PS
		1	100		
P1-17	Resonance Aoidance Operation	-	0	Select whether to use the notch filter or not. 0: Do not use. 1: Interpolation (Details: Refer to “4.4.2 Control Parameter Setting.”)	PST
		0	1		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
P1-18	Resonance Avoidance Frequency	Hz	300	Sets resonance avoidance frequency. (Details: Refer to “4.4.2 Control Parameter Setting.”)	PST
		0	1000		
P1-19	Resonance Avoidance Range	Hz	100	Sets the scope of resonance avoidance frequency. (Details: Refer to “4.4.2 Control Parameter Setting.”)	PST
		0	1000		
P1-20	Auto Gain Tuning Speed	100 RPM	8	Sets speed for automatic gain tuning run.	PST
		1	10		
P1-21	Auto Gain Tuning Distance	-	3	Sets round-trip distance for automatic gain tuning run.	PST
		1	5		
P1-22	Torque Control Speed Limiting Mode	-	0	Sets speed limit mode during torque control. ▪ 0: Limit to [P1-23]. 1: Motor Maximum Speed ▪ 2: Analog speed command ▪ 3: Limited to the smaller value between the value of [P1-23] and the analog speed command.	T
		0	3		
P1-23	Speed Limit	RPM	2000	Sets speed limit when speed limit mode [P1-22] is 0 during torque control.	T
		0	10000		
P1-24	P Control Switching Torque	%	200	When setting P and PI control switching mode [P1-15], sets [0x10 (DIGIT 2)] P control switching torque.	PS
		0	300		
P1-25	P Control Switching Speed	rpm	50	When setting P and PI control switching mode [P1-15], sets [0x20 (DIGIT 2)] P control switching speed.	PS
		0	6000		
P1-26	P Control Switching Acceleration	rpm/s	1000	When setting P and PI control switching mode [P1-15], sets [0x30 (DIGIT 2)] P control switching acceleration.	PS
		0	5000		
P1-27	P Control Switching Position Error	pulse	2000	When setting P and PI control switching mode [P1-15], sets [0x40 (DIGIT 2)] P control switching position error.	PS
		0	10000		

4.2.5 Input/Output Setting Parameter

For detailed information, refer to "4.4.3 Analog Input/Output Parameter Setting" and "4.4.4 Input/Output Contact Parameter Setting."

"**" Parameter that cannot be modified with the servo ON but can reset power.
"*" Parameter that cannot be modified with the servo ON

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
**P2-00	Input signal definition 1	-	0x4321	Allocates a CN1 connector pin for a digital input signal. ▪ State of initial input signal allocation • [P2-00]DIGIT1 = SVON (DI1) • [P2-00]DIGIT2 = SPD1 (DI2) • [P2-00]DIGIT3 = SPD2 (DI3) • [P2-00]DIGIT4 = SPD3 (DI4) • [P2-01]DIGIT1 = ALMRST(DI5) • [P2-01]DIGIT2 = DIR (DI6) • [P2-01]DIGIT3 = CCWLIM (DI7) • [P2-01]DIGIT4 = CWLIM (DI8) • [P2-02]DIGIT1 = EMG (DI9) • [P2-02]DIGIT2 = STOP (DIA) • [P2-02]DIGIT3 = EGEAR1(**) • [P2-02]DIGIT4 = EGEAR2(**) • [P2-03]DIGIT1 = PCON(**) • [P2-03]DIGIT2 = GAIN2(**) • [P2-03]DIGIT3 = P_CLR(**) • [P2-03]DIGIT4 = T_LMT(**) • [P2-04]DIGIT1 = MODE(**) • [P2-04]DIGIT2 = ABS_RQ(**) • [P2-04]DIGIT3 = ZCLAMP(**) (**) Unallocated signals (Details: Refer to "4.1.6 External Input Signal and Logic Definition.")	PST
		0	0xFFFF		
**P2-01	Input signal definition 2	-	0x8765		
		0	0xFFFF		
**P2-02	Input signal definition 3	-	0x00A9		
		0	0xFFFF		
**P2-03	Input signal definition 4	-	0x0000		
		0	0xFFFF		
**P2-04	Input signal definition 5	-	0x0F00		
		0	0xFFFF		
**P2-05	Output signal definition 1	-	0x4321	Allocate a CN1 connector pin for a digital output signal. ▪ State of initial output signal allocation • [P2-05]DIGIT1 = ALARM (DO1) • [P2-05]DIGIT2 = READY(DO2) • [P2-05]DIGIT3 = ZSPD(DO3) • [P2-05]DIGIT4 = BRAKE(DO4) • [P2-06]DIGIT1 = INPOS(DO5) • [P2-06]DIGIT2 = TLMT(**) • [P2-06]DIGIT3 = VLMT(**) • [P2-06]DIGIT4 = INSPD(**) • [P2-07]DIGIT1 = WARN(**) (**) Unallocated signals (Details: Refer to "4.1.8 External Output Signal and Logic Definition.") In case of dual allocation, the output contact setting error [AL-72] occurs.	PST
		0	0xFFFF		
**P2-06	Output signal definition 2	-	0x0005		
		0	0xFFFF		
**P2-07	Output signal definition 3	-	0x0000		
		0	0xFFFF		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
**P2-08	Input signal logic definition 1	-	0b11111	Define CN1 connector logic for a digital input signal. (0: Contact B. 1: Contact A) ▪ Definition of initial input logic • [P2-08]DIGIT1 = DI1(CN1 #47) (Contact A) • [P2-08]DIGIT2 = DI2(CN1 #23) (Contact A) • [P2-08]DIGIT3 = DI3(CN1 #22) (Contact A) • [P2-08]DIGIT4 = DI4(CN1 #21) (Contact A) • [P2-08]DIGIT5 = DI5(CN1 #17) (Contact A) (Details: Refer to “4.1.6 External Input Signal and Logic Definition.”)	PST
		0	0b11111		
**P2-09	Input signal logic definition 2	-	0b10001	Define CN1 connector logic for a digital input signal. (0: Contact B. 1: Contact A) ▪ Definition of initial input logic • [P2-09]DIGIT1 = DI6(CN1 #46) (Contact A) • [P2-09]DIGIT2 = DI7(CN1 #20) (Contact A) • [P2-09]DIGIT3 = DI8(CN1 #19) (Contact A) • [P2-09]DIGIT4 = DI9(CN1 #18) (Contact A) • [P2-09]DIGIT5 = DIA(CN1 #48) (Contact A) (Details: Refer to “4.1.6 External Input Signal and Logic Definition.”)	PST
		0	0b11111		
**P2-10	Output Signal Logic Definition	-	0b10110	Define CN1 connector logic for a digital output signal. (0 : Contact B. 1: Contact A) • [P2-10]DIGIT1 = DO1(CN1 #38/39) (Contact B) • [P2-10]DIGIT2 = DO2(CN1 #40/41) (Contact A) • [P2-10]DIGIT3 = DO3(CN1 #43) (Contact A) • [P2-10]DIGIT4 = DO4(CN1 #44) (Contact B) • [P2-10]DIGIT5 = DO5(CN1 #45) (Contact A) (Details: Refer to “4.1.8 External Output Signal and Logic Definition.”) (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	PST
		0	0b11111		
P2-11	Range of Output for Position Reached	Pulse	10	Sets remaining pulse range for position reached output in position operation mode. (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	P
		1	65535		
P2-12	Zero Speed Output Range	RPM	10	Sets speed range for zero speed output during a stop. (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	PST
		1	500		
P2-13	Range of Output for Speed Reached	RPM	10	Sets speed range for command speed reached output. (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	S
		1	500		
P2-14	Brake Output Action Speed	RPM	100	Sets speed for turning on the brake output contact. (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	PST
		0	6000		

Parameter		Unit	Initial	Details	Applicable Mode
Code	Name	Minimum	Maximum		
P2-15	Brake Output Delay Time	ms	500	Sets how much time to delay until the brake output contact turns on when the servo is off or stops. (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	PST
		0	1000		
P2-16	Position Pulse Clear Mode	-	1	Select operation type for position pulse clear (PCLR) mode. • 0: Operate in edge mode. • 1: Operate in level mode. (Details: Refer to “4.4.4 Input/Output Parameter Setting.”)	P
		0	1		
*P2-17	Analog Speed Scale	RPM	2000	Sets speed scale when the analog speed command is 10 V. (Details: Refer to “4.4.3 Analog Input/Output Parameter Setting.”)	S
		1	6000		
P2-18	Analog Speed Offset	mV	0	Sets offset for analog speed commands. (Details: Refer to “4.4.3 Analog Input/Output Parameter Setting.”)	S
		-1000	1000		
P2-19	Zero Speed Clamp Speed	RPM	0	Sets speed range for the clamp operation of the analog zero speed command. (Details: Refer to “4.4.3 Analog Input/Output Parameter Setting.”)	S
	Zero speed	0	1000		
*P2-20	Analog Torque Scale	[%]	100	Sets torque scale when the analog torque command is 10 V. (Details: Refer to “4.4.3 Analog Input/Output Parameter Setting.”)	T
		1	350		
P2-21	Analog Torque Command Offset	mV	0	Sets offset for analog torque commands. (Details: Refer to “4.4.3 Analog Input/Output Parameter Setting.”)	T
		-1000	1000		
P2-22	Zero Torque Clamp Voltage	mV	75	Sets voltage range for the clamp operation of the analog zero torque command. (Details: Refer to “4.4.3 Analog Input/Output Parameter Setting.”)	T
		0	1000		

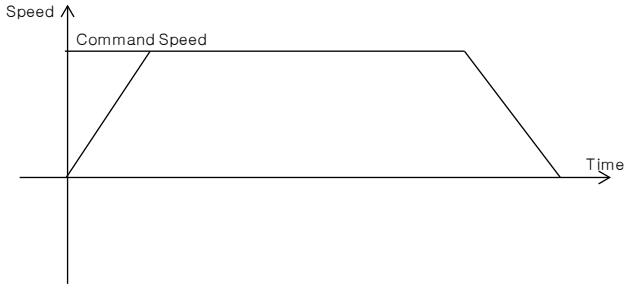
4.2.6 Speed Operation Setting Parameter

For detailed information, refer to "4.4.5 Speed Operation Parameter Setting."

"**" Parameter that cannot be modified with the servo ON but can reset power.

"*" Parameter that cannot be modified with the servo ON

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Initial</th><th rowspan="2">Details</th></tr>
<tr><th>Code</th><th>Name</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td rowspan="2">P3-00</td><td>Speed Command 1</td><td>RPM</td><td>10</td><td rowspan="2">Sets 1-6 speed commands based on the speed command input contact.
<table><tr><th>SPD</th><th>SD2</th><th>SPD3</th><th>Speed Control</th></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Analog speed command</td></tr><tr><td>ON</td><td>OFF</td><td>OFF</td><td>Digital speed command 1</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>Digital speed command 2</td></tr><tr><td>ON</td><td>ON</td><td>OFF</td><td>Digital speed command 3</td></tr><tr><td>OFF</td><td>OFF</td><td>ON</td><td>Digital speed command 4</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>Digital speed command 5</td></tr><tr><td>OFF</td><td>ON</td><td>ON</td><td>Digital speed command 6</td></tr><tr><td>ON</td><td>ON</td><td>ON</td><td>Digital speed command 7</td></tr></table>(Details: Refer to "4.4.5 Speed Operation Parameter Setting.")</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-01</td><td>Speed Command 2</td><td>RPM</td><td>100</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-02</td><td>Speed Command 3</td><td>RPM</td><td>500</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-03</td><td>Speed Command 4</td><td>RPM</td><td>1000</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-04</td><td>Speed Command 5</td><td>RPM</td><td>1500</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-05</td><td>Speed Command 6</td><td>RPM</td><td>2000</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-06</td><td>Speed Command 7</td><td>RPM</td><td>3000</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-07</td><td>Phase Z Detection Operation Speed</td><td>RPM</td><td>10</td><td rowspan="2">Sets phase Z detection operation speed.</td></tr>
<tr><td></td><td>1</td><td>300</td></tr>
<tr><td rowspan="2">P3-08</td><td>Speed Command Acceleration Time</td><td>ms</td><td>0</td><td rowspan="2">Sets acceleration time for speed commands.
(Details: Refer to "4.4.5 Speed Operation Parameter Setting.")</td></tr>
<tr><td></td><td>0</td><td>10000</td></tr>
<tr><td rowspan="2">P3-09</td><td>Speed Command Deceleration Time</td><td>ms</td><td>0</td><td rowspan="2">Sets deceleration time for speed commands.
(Details: Refer to "4.4.5 Speed Operation Parameter Setting.")</td></tr>
<tr><td></td><td>0</td><td>10000</td></tr>
<tr><td rowspan="2">P3-10</td><td>Speed Command S-Curve Time</td><td>ms</td><td>10</td><td rowspan="2">Sets S-Curve time for speed commands.</td></tr>
<tr><td></td><td>1</td><td>100</td></tr>
<tr><td rowspan="2">*P3-11</td><td>Speed Operation Pattern</td><td>-</td><td>0</td><td rowspan="2">Sets acceleration/deceleration type for speed commands.
(0;Trapezoidal, 1;Sinusoidal)
(Details: Refer to "4.4.5 Speed Operation Parameter Setting.")</td></tr>
<tr><td></td><td>0</td><td>1</td></tr>
<tr><td rowspan="2">P3-12</td><td>Manual JOG operation speed</td><td>RPM</td><td>500</td><td rowspan="2">Sets operation speed for manual JOG operation [Cn-00].</td></tr>
<tr><td></td><td>-6000</td><td>6000</td></tr>
</table>

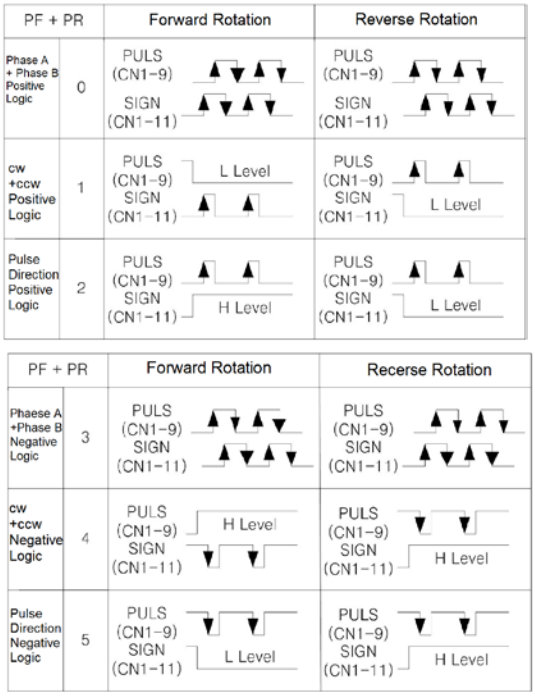
Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
P3-13	Program JOG operation speed 1	RPM	0	Sets operation speed/operation time for programs 1 to 4 during program JOG operation [Cn-01]. A test drive repeats step 1 to 4. Sets operation speed ([P3-13]-[P3-16]) and operation time ([P3-17]-[P3-20]) for each step. E.g.) Step 1 operation 
		-6000	6000	
P3-14	Program JOG operation speed 2	RPM	3000	
		-6000	6000	
P3-15	Program JOG operation speed 3	RPM	0	
		-6000	6000	
P3-16	Program JOG operation speed 4	RPM	-3000	
		-6000	6000	
P3-17	Program JOG operation time 1	ms	500	
		0	65535	
P3-18	Program JOG operation time 2	ms	5000	
		0	65535	
P3-19	Program JOG operation time 3	ms	500	
		0	65535	
P3-20	Program JOG operation time 4	ms	5000	
		0	65535	

4.2.7 Position Operation Setting Parameter

For detailed information, refer to "4.4.6 Position Operation Parameter Setting."

“**” Parameter that cannot be modified with the servo ON but can reset power.

“*” Parameter that cannot be modified with the servo ON

Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
**P4-00	Position Input Pulse Logic	-	0	Sets logic for position operation input pulses. - The type of position command input pulses and rotation direction per logic are as follows:  E.g.) Relation between direction signals and rotation directions when the position pulse input logic is set to 2. When the direction signal is low: Reverse rotation (CW/clockwise) When the direction signal is high: Forward rotation (CCW/counterclockwise) (Details: Refer to “4.4.6 Position Operation Parameter Setting.”)
		0	5	

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Initial</th><th rowspan="2">Details</th></tr>
<tr><th>Code</th><th>Name</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td rowspan="2">*P4-01</td><td>Electronic Gear Ratio Numerator 1</td><td>-</td><td>1000</td><td rowspan="16">Sets electronic gear ratio numerator/denominator 0, 1, 2, and 3.
<table><tr><th>EGEAR1</th><th>EGEAR 2</th><th>Electric Gear Ratio Numerator / Denominator</th><th>Electric Gear Ratio</th></tr><tr><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td>Electronic gear ratio numerator 0</td><td rowspan="2">Electronic gear ratio 1</td></tr><tr><td>Electronic Gear Ratio Denominator 0</td></tr><tr><td rowspan="2">ON</td><td rowspan="2">OFF</td><td>Electronic gear ratio numerator 1</td><td rowspan="2">Electronic gear ratio 2</td></tr><tr><td>Electronic gear ratio denominator 1</td></tr><tr><td rowspan="2">OFF</td><td rowspan="2">ON</td><td>Electronic gear ratio numerator 2</td><td rowspan="2">Electronic gear ratio 3</td></tr><tr><td>Electronic gear ratio denominator 2</td></tr><tr><td rowspan="2">ON</td><td rowspan="2">ON</td><td>Electronic gear ratio numerator 3</td><td rowspan="2">Electronic gear ratio 4</td></tr><tr><td>Electronic gear ratio denominator 3</td></tr></table>▪ The electronic gear ratio is the numerator/denominator form of the relation between the position command input pulse and the motor encoder pulse. It is important to set the ratio so that there is no error during position operation.
(Details: Refer to “4.4.6 Position Operation Parameter Setting.”)</td></tr>
<tr><td></td><td>1</td><td>2^21</td></tr>
<tr><td rowspan="2">*P4-02</td><td>Electronic Gear Ratio Numerator 2</td><td>-</td><td>1000</td></tr>
<tr><td></td><td>1</td><td>2^21</td></tr>
<tr><td rowspan="2">*P4-03</td><td>Electronic Gear Ratio Numerator 3</td><td>-</td><td>1000</td></tr>
<tr><td></td><td>1</td><td>2^21</td></tr>
<tr><td rowspan="2">*P4-04</td><td>Electronic gear ratio numerator 4</td><td>-</td><td>1000</td></tr>
<tr><td></td><td>1</td><td>2^21</td></tr>
<tr><td rowspan="2">*P4-05</td><td>Electronic Gear Ratio Denominator 1</td><td>-</td><td>1000</td></tr>
<tr><td></td><td>1</td><td>32767</td></tr>
<tr><td rowspan="2">*P4-06</td><td>Electronic Gear Ratio Denominator 2</td><td>-</td><td>2000</td></tr>
<tr><td></td><td>1</td><td>32767</td></tr>
<tr><td rowspan="2">*P4-07</td><td>Electronic Gear Ratio Denominator 3</td><td></td><td>3000</td></tr>
<tr><td></td><td>1</td><td>32767</td></tr>
<tr><td rowspan="2">*P4-08</td><td>Electronic Gear Ratio Denominator 4</td><td>-</td><td>4000</td></tr>
<tr><td></td><td>1</td><td>32767</td></tr>
<tr><td rowspan="2">P4-09</td><td>Electronic Gear Ratio Mode</td><td>-</td><td>0</td><td rowspan="2">Select an electronic gear ratio mode.
▪ 0: Select electronic gear ratio 1-4.
▪ 1: Override offset [P4-10] on the electronic gear ratio numerator 0.
(Details: Refer to “4.4.6 Position Operation Parameter Setting.”)</td></tr>
<tr><td></td><td>0</td><td>1</td></tr>
<tr><td rowspan="2">P4-10</td><td>Electric Gear Ratio Numerator Offset</td><td>-</td><td>0</td><td rowspan="2">Sets the offset of the electronic gear ratio numerator 0.
The offset will be set on the electronic gear ratio numerator 0.
▪ EGEAR1 contact LOW -> HIGH
: Increase the electronic gear ratio numerator by 1.
▪ EGEAR2 contact LOW -> HIGH
: Decrease the electronic gear ratio numerator by 1)
(Details: Refer to “4.4.6 Position Operation Parameter Setting.”)</td></tr>
<tr><td></td><td>-32767</td><td>32767</td></tr>
<tr><td rowspan="2">P4-11</td><td>Position Error</td><td>Pulse</td><td>90000</td><td rowspan="2">Sets range for triggering the position error alarm.
(Details: Refer to “4.4.4 Input/Output Contact Parameter Setting.”)</td></tr>
<tr><td></td><td>1</td><td>2^30</td></tr>
<tr><td rowspan="2">P4-12</td><td>Limit Contact Function</td><td>-</td><td>0</td><td rowspan="2">Select the operation type of position command pulse clear for CWLIM and CCWLIM contacts.
▪ 0: When the CCWLIM / CWLIM contact is on, receive an input pulse and save it to buffer.
▪ 1: Ignore any input pulse when the CCWLIM / CWLIM contact is on.</td></tr>
<tr><td>Function</td><td>0</td><td>1</td></tr>
</table>

Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
P4-13	Backlash Compensation	-	0	Sets backlash compensation in position operation. Sets backlash compensation by converting the amount of backlashes to number of pulses if the position changes because of backlashes caused by position operation. Sets in the opposite direction according to the amount of backlashes. (Details: Refer to “4.4.6 Position Operation Parameter Setting.”)
		0	10000	
P4-14	Pulse Input Filter	-	3	Sets filter frequency according to pulse input. ▪ 0: Do not use any filter. ▪ 1 : 500Khz (Min) ▪ 2 : 750Khz ▪ 3 : 1Mhz (Default) ▪ 4 : 1.25Mhz Determination of the above frequency bands is based on input pulse width in terms of digital filter's characteristics.
		0	4	

4.2.8 Operation Handling Parameter

"**" Parameter that cannot be modified with the servo ON but can reset power.
"*" Parameter that cannot be modified with the servo ON

Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
Cn-00	Manual JOG Operation	-	-	The drive performs manual JOG operation by itself. (Refer to "Chapter 5 Handling and Operation.") ▪ [MODE]: Finish ▪ [UP]: Forward rotation (CCW) ▪ [DOWN]: Reverse rotation (CW) ▪ [SET]: Servo ON/OFF Related parameters are as follows. ▪ [P3-08]: Speed command acceleration time ▪ [P3-09]: Speed command deceleration time ▪ [P3-10]: Speed command S-curve ▪ [P3-11]: Speed operation pattern ▪ [P3-12]: JOG operation speed Operate regardless of the contact input status of CN1. (Details: Refer to "4.4.5 Speed Operation Parameter Setting.") (Details: Refer to "5.2 Handling.")
		-	-	
Cn-01	Program JOG Operation	-	-	Continuously operates according to the program already set. ▪ [SET]: Program JOG run or stop Related parameters are as follows: ▪ [P3-08]: Speed command acceleration time ▪ [P3-09]: Speed command deceleration time ▪ [P3-10]: Speed command S-curve ▪ [P3-11]: Speed operation pattern ▪ [P3-13~16]: Program operation speed 1 to 4 ▪ [P3-17~20]: Program operation time 1 to 4 Operate regardless of the contact input status of CN1. (Details: Refer to "4.4.5 Speed Operation Parameter Setting.") (Details: Refer to "5.2 Handling.")
		-	-	
Cn-02	Alarm Reset	-	-	Reset the alarm that went off. (Details: Refer to "5.2 Handling.")
		-	-	

Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
Cn-03	Get Alarm History	-	-	Check the saved alarm code history. [UP] or [DOWN]: Reads alarm codes. ▪ E.g.) Recent first history [AL-42]: RST_PFAIL occurs. • 01: Latest alarm • 20: 20th previous alarm (Details: Refer to "5.2 Handling.")
		-	-	
Cn-04	Alarm History Reset	-	-	Deletes the entire saved alarm code history. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-05	Auto Gain Tuning	-	-	Performs automatic gain tuning operation. Related parameters are as follows. ▪ [P1-22]: Auto gain tuning speed ▪ [P1-23]: Auto gain tuning distance (Details: Refer to "5.2 Handling.")
		-	-	
Cn-06	Phase Z Detection Operation	-	-	Perform phase Z detection. ▪ [SET]: Mode entering and servo ON status ▪ [UP]: Phase Z forward search ▪ [DOWN]: Phase Z reverse search Related parameters are as follows. ▪ [P3-07]: Sets Z-phase detection operation speed [RPM]. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-07	Input Contact Forced ON/OFF	-	-	Forcibly turns on/off the input contact temporarily. ▪ [UP]: (A),(8),(6),(4), and (2) signals forced ON/OFF ▪ [DOWN]: (9),(7),(5),(3), and (1) signals forced ON/OFF ▪ [MODE]: Move to another digit. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-08	Output Contact Forced ON/OFF	-	-	Forcibly turns on/off the output contact temporarily. ▪ [UP]: (4) and (2) signals forced ON/OFF ▪ [DOWN]: (5),(3), and (1) signals forced ON/OFF ▪ [MODE]: Move to another digit. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-09	Parameter Initialization	-	-	Reset parameter data. (Details: Refer to "5.2 Handling.")
		-	-	

Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
Cn-10	Auto Speed Command Offset Correction	-	-	Calibrates the offset of analog speed commands automatically. The possible voltage setting ranges from -1V to 1V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction. You can check the calibrated offset in the analog speed command offset [P2-18]. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-11	Auto Torque Command Offset Correction	-	-	Calibrates the offset of analog torque commands automatically. The possible voltage setting ranges from -1V to 1V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction. You can check the calibrated offset in the analog torque command offset [P2-21]. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-12	Manual Speed Command Offset Correction	-	-	Calibrates the offset of analog speed commands manually. The possible voltage setting ranges from -1V to 1V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction. You can check the calibrated offset in the analog speed command offset [P2-18]. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-13	Manual Torque Command Offset Correction	-	-	Calibrate the offset of analog torque commands manually. The possible voltage range is from +1 V to -1 V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction. You can check the corrected offset in the analog torque command offset [P2-21]. (Details: Refer to "5.2 Handling.")
		-	-	

Parameter		Unit	Initial	Details
Code	Name	Minimum	Maximum	
Cn-14	Absolute Encoder Reset	-	-	Resets the absolute encoder. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-15	Instantaneous Maximum Load Factor Reset	-	-	Reset the instantaneous maximum load factor to 0. ▪ [UP]: Displays the + forward maximum load factor. ▪ [DOWN]: Displays the - direction maximum load factor. ▪ [SET]: Initializes the maximum load factor. (Details: Refer to "5.2 Handling.")
		-	-	
Cn-16	Parameter Lock	-	-	Sets parameter lock. [UP]: UnLock [DOWN]: Lock (Details: Refer to "5.2 Handling.")
		-	-	
Cn-17	Current Offset	-	-	Saves current offset value to parameter P0-27 - P0-28. (Details: Refer to "5.2 Handling.")
		-	-	

4.3 Operation Status Display

4.3.1 Status Display [St-00]

Refer to "4.1.2 Status Summary Display."

4.3.2 Speed Display

1. Current operation speed [St-01]

This displays the current operation speed in RPM.

2. Current command speed [St-02]

Displays the current command speed in RPM.

4.3.3 Position Display

1. Tracking position pulse [St-03]

Displays the accumulated number of position command pulses that followed as a result of rotation of the servo motor because the servo was turned on.

2. Position command pulse [St-04]

Displays the accumulated number of position command pulses that have been entered since the servo turned on.

3. Remaining position pulse [St-05]

- This displays the difference between command pulses and tracking pulses and the remaining position pulses for the servo to run.
- The remaining position pulses delayed while the servo is off are ignored when it is turned on.

4. Input pulse frequency [St-06]

This displays the input pulse frequency.

4.3.4 Torque and Load Display

1. Current operation torque [St-07]

This displays the energy (load) output by the servo motor as a percentage of the rated output.

2. Current command torque [St-08]

This uses the servo's control algorithm to calculate the internal torque command and display it as a percentage of the rated torque.

3. Accumulated overload rate [St –09]

This displays the current energy (load) as a percentage of the rated energy (load) of the servo motor.

4. Instantaneous maximum load factor [St–10]

   Displays the maximum (peak) load between the current time and the start of control after the servo is turned on as a percentage of the rated output.

5. Torque limit [St –11]

   This displays the maximum torque that the servo motor can output as a percentage of the rated torque.

6. DC link voltage [St–12]

   - The DC link voltage of the standard drive that uses 380 V is approximately 537 V.
   - The maximum DC link voltage allowed for the standard drive that uses 380 V is 800 V.
   - The overvoltage alarm [AL-41] triggers when the DC link voltage threshold is exceeded because there is either too much or too little regenerative resistance.
   - The normal DC link voltage in the regenerative section is 747 V or below.

7. Regenerative overload [St–13]

   This displays the overload rate relative to the regenerative capacity of the servo drive.

4.3.5 I/O Status Display

1. CN1 I/O input contact point status [St-14]

   Refer to "4.1.4 External Input Contact Point Signal Display [St-14]."

2. CN1 I/O output contact status [St-15]

   Refer to "4.1.6 External Output Contact Signal Display [St-15]."

4.3.6 Miscellaneous Status and Data Display

1. Single-turn data (pulse) display [St-16]

   Displays the single-turn data of the encoder in pulses.

2. Single-turn data (degree) display [St-17]

   Displays the single-turn data of the encoder in degrees.

3. Multi-turn data display [St-18]

   This displays the multi-turn data for the encoder.

4. Inside temperature display [St-19]

   This displays the temperature sensor value of the servo drive in ℃.

5. Rated motor speed display [St-20]

   This displays the rated speed of the motor in RPM.

6. Peak motor speed display [St-21]

   This displays the peak speed of the motor in RPM.

7. Rated motor current display [St-22]

   This displays the rated current of the motor in A.

8. U phase current offset display [St-23]

This displays the U phase current offset in mA.

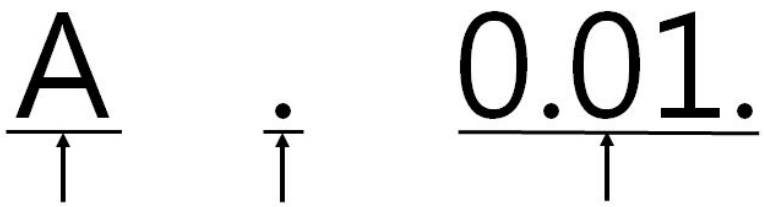
9. V phase current offset display [St-24]

This displays the V phase current offset in mA.

4.3.7 Version Display

1. Software version display [St-25]

Displays the version of the currently installed software.



Encoder Type | Rated Voltage | Version Number | Drive Capacity

Character	Encoder Type
A	Quad
B	Serial

Display	Rated Voltage Type
Dot	400V
None	200V

Number	Drive Capacity
0	Default
1	100 [W]
2	200 [W]
3	400 [W]
4	750 [W]
5	1 [kW]
6	2 [kW]
7	3.5 [kW]
8	5 [kW]
9	7.5 [kW]
A	15 [kW]

4.4 Parameter Setting

4.4.1 Setting System Parameters

1. Motor ID setting [P0-00]

- Serial encoder: Reads the motor ID from the encoder and displays it.
- Incremental encoder: Sets motor ID directly.

2. Encoder settings

- Encoder type [P0-01]

Number	Encoder Type		Encoder Type
0	Quadrature type incremental encoder	1	Serial type encoder (-)
2	Serial type abs encoder (12 bit)	3	Serial type abs encoder (16 bit)
4	Serial type abs encoder (20 bit)	5	Serial type abs encoder (24 bit)

※ The bits in parentheses in the previous table indicate peak multi-turn data.

- Encoder pulse [P0-02]

  Set this pulse when using an incremental encoder. Set the number of pulses per turn for a signal. For a serial encoder, encoder data are set directly.

3. Operation mode setting [P0-03]: Sets operation mode of the servo.

Operation Modes	Operation Method
0	Torque control operation
1	Speed control operation
2	Position control operation
3	Mode contact ON: Position control operation Mode contact OFF: Speed control operation
4	Mode contact ON: Speed control operation Mode contact OFF: Torque control operation
5	Mode contact ON: Position control operation Mode contact OFF: Torque control operation

4. System ID setting

An ID can be given to the servo if RS422 communication and BUS communication are used for communication with the servo. Communication-related options are required in this case.

- Communication speed setting [P0-04]

  You can select the baud rate, the communication speed of RS422.

  - 0: 9600 bps
  - 1: 19200 bps
  - 2: 38400 bps
  - 3: 57600 bps

- System ID [P0-05]

  A unique ID can be given to the servo and used for individual communication with it.

5. Main power input mode setting [P0-06]

Specifies the main power input mode and the processing mode if phase loss occurs.

- DIGIT 1: Sets the main power input type.

  (0: Single-phase power input. 1: Three-phase power input.)

- DIGIT 2: Sets how to handle errors and warnings in case of main power phase loss.

  (0: Error in case of main power phase loss. 1: Warning in case of main power phase loss.)

6. RST checking time setting [P0-07]

Specifies the monitoring interval for main power phase losses.

7. Start-up display parameter setting [P0-08]

- You can set the parameter applicable initially when the servo is turned on.
- There are 26 values available for setting, from [St-00] to [St-25]. Choose one for a specific parameter.

8. Regenerative overload derating factor setting [P0-09]

This specifies the derating factor which checks for regenerative resistance overloads. If the derating value is 100% or less, then the overload alarm trigger time is proportional to the set value.

9. Regenerative resistance value setting [P0-10]

This specifies the resistance value for regenerative braking resistance. If it is set to 0, then it uses the default resistance capacity embedded in the drive.

10. Regenerative resistance capacity setting [P0-11]

This specifies the current capacity for regenerative resistance. If it is set to 0, then it uses the default resistance capacity embedded in the drive.

11. Overload check default load factor setting [P0-12]

This indicates the load factor which triggers a continuous overload check. If it is set to 100 or less, then the overload check starts early and the overload alarm triggers early.

12. Overload warning level setting [P0-13]

This specifies the level for the continuous overload warning signal output. The warning signal is issued when it reaches the setting of the percentage value relative to the alarm trigger value.

13. Encoder pulse pre-scale output (Encoder output pre-scale [P0-14])

When an encoder signal is output from the servo to the outside, its output pulse is pre-scaled as a pre-defined value

(encoder output prescale [P0-14]) before output.

- E.g.) In a motor with encoder 3,000 ppr

  Set pre-scale value (pulse output pre-scale [P0-14] = 12000)

  => Encoder pulse output: 3,000 ppr × 4 = 12,000 ppr

14. PWM OFF delay time setting [P0-15]

Sets the time span between servo OFF command and actual PWM OFF. This is to prevent the motor from slipping down the vertical axis until the motor brake comes into effect after receiving the

servo off command and then the brake signal. Set a PWM off delay when operating the motor brake with the output contact point brake signal. (range: 0-1000 ms, initial value: 10).

15. DB control mode [P0-16]: Specifies the DB control mode.

- 0: Hold after DB stop
- 1: Release after a DB stop
- 2: Release after free run stop
- 3: Hold after a free run stop

16. Servo function setting bit [P0-17]

Sets drive function per digit.

- DIGIT 1 -> Sets the operation direction of the servo.
  - 0: CCW (Clockwise), CW (Counterclockwise)
  - 1: CW (Clockwise), CCW (Counterclockwise)
- DIGIT 2 -> Sets servo lock.
  - 0: Do not use
  - 1: Use (When analog speed command is 0 in speed operation mode, the operation mode switches to position operation mode temporarily to ensure that motor remains stopped firmly.)
- DIGIT 3 -> Sets Open Collector Output
  - 0: Do not use
  - 1: Use (AL0, AL1, AL2 output contact -> Open Collector A, B, Z output)
- DIGIT 4 -> Sets Monitor Output Voltage. (Applicable to both Monitor 1 and 2)
  - 0 : -10-+10V
  - 1: 0-+10V
- DIGIT 5 -> Sets saving EEPROM communication.
  - 0 : Do not use
  - 1: Use (No parameter is saved to EEPROM when you write the parameter via communication.)

17. DAC Output Setting

There are four kinds of DAC output, each of which is made every 200 usec according to the condition of used data.

- DAC output type [P0-18 DIGIT 1, DIGIT 2]

Type	Data Content	Type	Data Content
0	Speed feedback [RPM]	5	Following error [pulse]
1	Speed command [RPM]	6	DC link voltage [V]
2	Torque feedback [%]	D	Speed command (user) [RPM]
3	Torque command [%]	E	Torque command (user) [%]
4	Position command frequency [0.1 Kpps]		

- DAC output scale [P0-23], [P0-24]

  If the output value is too low or too high, output ratio can be adjusted.

  Sets magnification [Unit/V] for analog output channels 1 to 2.

  (Speed [RPM], torque [%], position command frequency [0.1 Kpps], position [pulse], DC link [V])

  Example: Channel 1 scale 100 =>100 RPM is output as 1 V.

- DAC output offset [P0-19], [P0-20]

  Sets offset [Unit/V] for 1-2 analog output channels.

  (Speed [RPM], torque [%], position command frequency [0.1 Kpps], position [pulse], DC_Link [V])

4.4.2 Control Parameters

The control parameter setting sequence is as follows:

- Load inertia ratio [P1-00] setting: Refer to “5.2.6 Auto Gain Tuning [Cn-05].”
- Position proportional gain [P1-01] and [P1-02] adjustment:

  Increase the gain so that the servo motor does not overshoot or lose control (do not use during speed operations or torque operations).

- Speed proportional gain [P1-06] and [P1-07] adjustment:

  Increase the gain so that the servo motor does not vibrate.

- Speed integral time constant [P1-08] and [P1-09] adjustment:

  Refer to the following table and set it according to the speed proportional gain.

(1) Inertia Ratio Setting [P1-00]

This sets the inertia ratio by calculating the load inertia from the machine system and rotor inertia listed on the motor specification table.

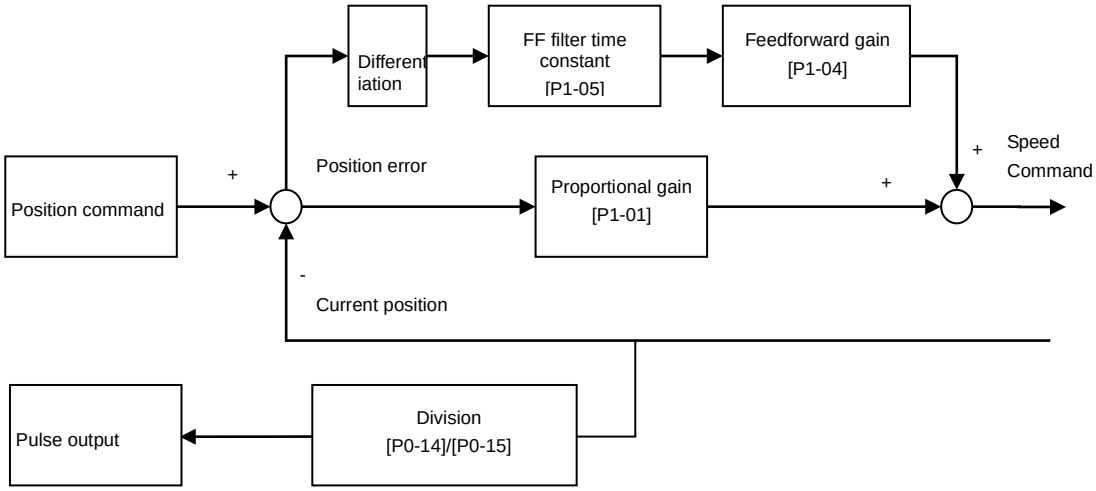
The inertia/load ratio is an important control parameter for the operation of the servo. It is crucial to set the correct inertia ratio for optimal servo operation.

- The following table outlines the recommended control gain for different inertia ratios:

Motor Flange	Inertia Ratio		Gain Range		
	Category	Inertia (Multiple)	Position Proportional Gain	Speed Proportional Gain	Speed Integral Gain
40 ~ 80	Low inertia	1 ~ 5	40 ~ 90	400 ~ 1000	10 ~ 40
	Medium inertia	5 ~ 20	20 ~ 70	200 ~ 500	20 ~ 60
	High inertia	20 ~ 50	10 ~ 40	100 ~ 300	50 ~ 100

* You can tune the inertia ratio during a test drive if it is too hard to calculate the inertia ratio before operation.

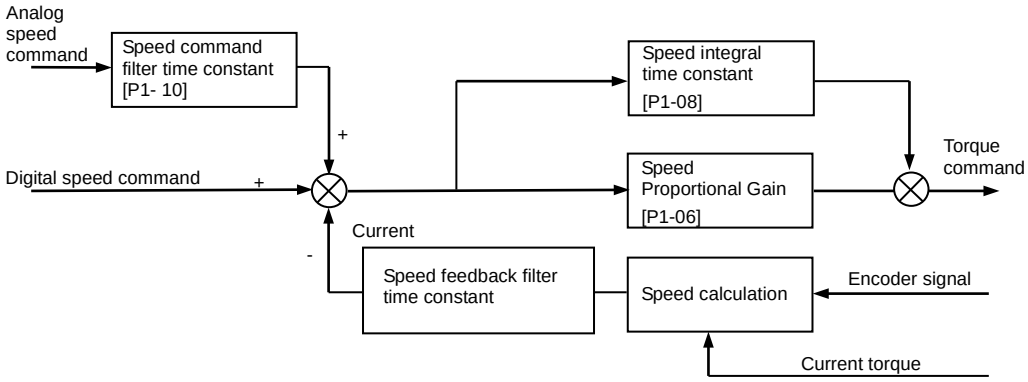
(2) Position Control Gain



- Position command: Counts the position command pulses entering from outside and converts them into position command values. Next, it applies electronic gear ratio to those values and uses them as internal position commands by way of [P1-03] position command filter. In case the electronic gear ratio has a large numerator, change of external input position command pulse has increasing effects on change of internal position command, so you need to adjust [P1-03] position command filter time constant to reduce the effects.
- Current position: Counts the pulse signals received from the encoder and uses the electronic gear ratio settings to convert them to the current position.
- Position proportional gain [P1-01] and [P1-02]: Converts the difference between the position command and the current position into a speed command by multiplying it by the position proportional gain.

  * Recommended value = Speed proportional gain [P1-06] / 10
- Feedforward gain [P1-04]: Uses the differences in value to the position command to calculate the gradient. Adds the speed command to the gradient to reduce the time needed to reach the target position. If the value which results is too large, then the position controller may overshoot or become unstable. It is important to gradually increase the value from a small value while monitoring the test drive.
- Feedforward filter [P1-05]: The feed-forward control filter vibrates if the position command changes too drastically. If this occurs, configure the filter value until the vibrations disappear.

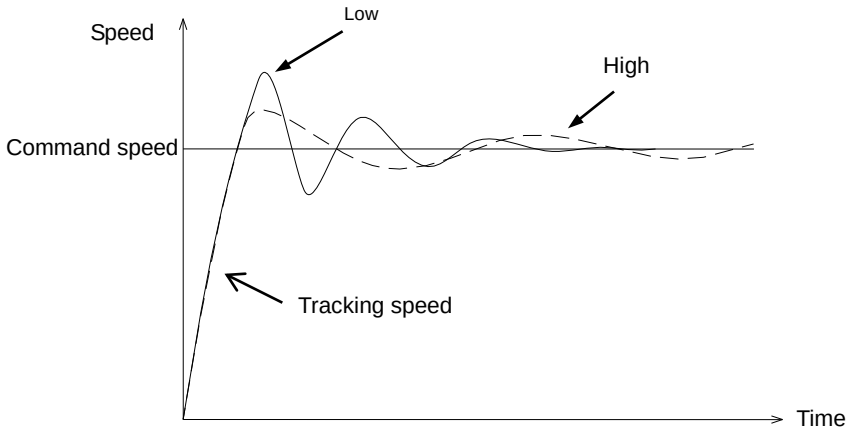
(3) The Speed Control Gain



- Speed command: Use an analog speed signal entering from outside as a speed command after running it through the speed command filter [P1-10], or use a digital speed command and [RPM] set in the internal parameter.
- Current speed: Calculates the speed by counting the number of encoder signals as time progresses. Filters the speed to calculate the current speed. The algorithm uses the current torque and inertia to project the speed and compensate for errors which occur when calculating the speed at very low speeds. Therefore, an accurate motor constant and inertia ratio are closely related to the stability of the motor speed control.
- Speed integral time constant [P1-08]: Calculates the integral value of the speed error. The speed error is the difference between the command speed and the current speed. The speed integral time constant converts the speed error into a torque command by multiplying it by the integral time constant.

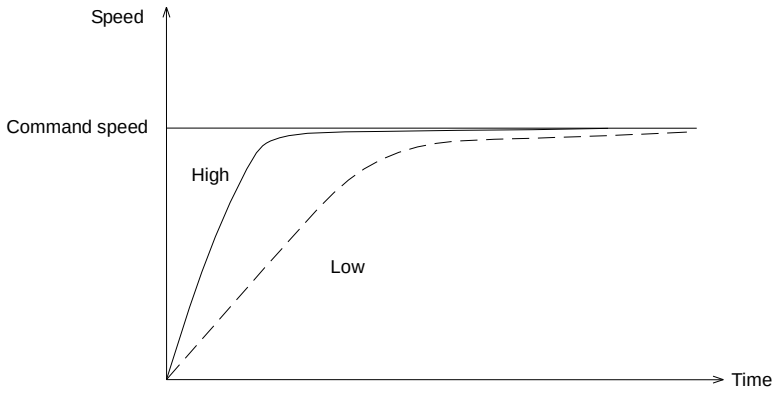
  A decreased integral time constant solves transient response issues and improves speed tracking. If the integral time constant is too small, however, an overshoot occurs. On the other hand, if the integral time constant is too large, an excessive response drop occurs and proportional control takes over.

  *** Recommended value = 10000 / speed proportional gain [P1-06]**



- Speed proportional gain [P1-06]: Converts the speed error into a torque command by multiplying it by the proportional gain.

  If the resulting value is large, then the speed response accelerates and speed tracking increases. However, vibrations occur if the value is too large. If the value is too small, then speed response slows down and speed tracking decreases. This may cause the servo to lose power.



- Speed feedback filter time constant [P1-11]: Filters the speed feedback to control vibrations when the speed of the motor changes due to drive system vibrations or vibrations due to gain and too much load inertia. If the value is too high, it reduces speed responsiveness and control power may be compromised.

  *** Recommended value = 0 - Speed integral time constant [P1-08]/10**

(4) Torque Command Filter Time Constant Setting [P1-12]

Use a digital filter for the analog torque command voltage to improve the stability of command signals. If the filter value is set too high, responsiveness to torque commands will be reduced. It is important to set a value that is appropriate for your system.

(5) Torque Limit Setting [P1-13], [P1-14]

You can set maximum torque limits for forward rotation [P1-13] and for reverse rotation [P1-14] separately. The setting is displayed as a percentage of the rated torque and the standard is 300 %.

(6) Gain 1<->Gain 2 Switching Mode Setting [P1-15] 0x0F (DIGIT 1)

Set speed gain switching mode. [0x0F (DIGIT 1)]

- 0: Only uses gain 1.
- 1: ZSPD auto gain switching

  In case of zero speed, switch from gain 1 to gain 2.

  In the opposite case, switch from gain 2 to gain 1.
- 2: INPOS auto gain switching

  In case of IN position, switch from gain 1 to gain 2.

  In the opposite case, switch from gain 2 to gain 1.
- 3: Manual gain switching

  When the gain 2 contact is on, switch from gain 1 to gain 2.

  In the opposite case, switch from gain 2 to gain 1.

(7) Gain 1<->Gain 2 Switching Time Setting [P1-16]

- Configure the gain switching time during operation.
- When switching from gain 1 to gain 2 or gain 2 to gain 1, the switching occurs according to the set time.

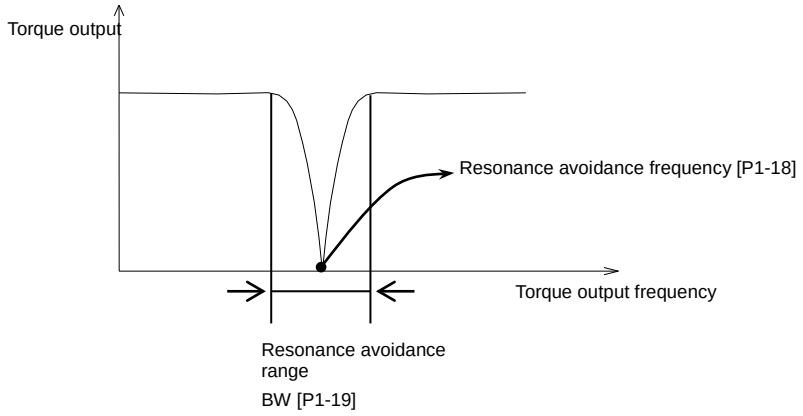
(8) P / PI Switching Mode Setting [P1-15 DIGIT 2]

Set P and PI control switching modes. [0xF0 (DIGIT 2)]

- 0: Only control PI.
- 1: Control P if the command torque is higher than the set torque [P1-24].
- 2: Control P if the command speed is higher than the set speed [P1-25].
- 3: Control P if the current acceleration is higher than the set torque [P1-26].
- 4: Control P if the current position error is higher than the set position error [P1-27].
- Control P if the PCON contact is on (highest priority).

These functions allow you to improve position operations by applying the P control operation stop function after PI control operation.

(9) Resonance Avoidance Operation Setting [P1-17], [P1-18], [P1-19]



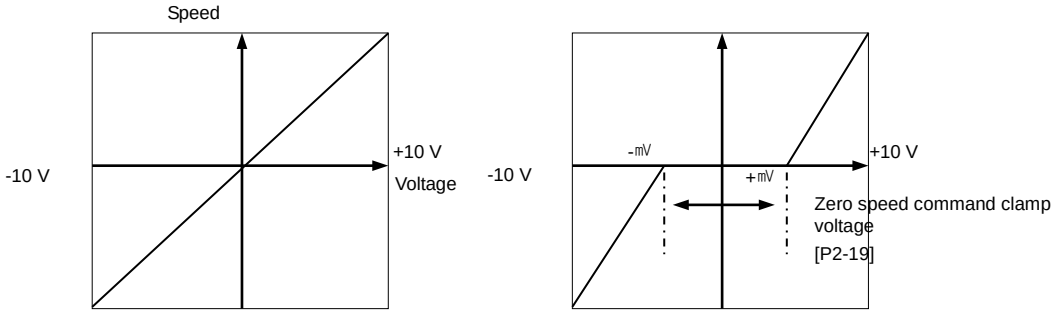
Mechanical resonance causes vibrations to occur at certain frequencies in certain systems. You can control the vibrations by controlling the torque output for specific frequencies.

- Resonance avoidance operation [P1-17]
  - 0: Do not use
  - 1: Interpolation

4.4.3 Analog Input/Output Parameter Setting

(1) Analog Speed Scale Setting

- Analog speed scale [P2-17]: Set the analog speed command of 10 [V] in the unit of [RPM]. The maximum value is the maximum motor speed.
- Analog speed command offset [P2-18]: There are cases where a certain level of voltage remains on the analog signal access circuit, even at the 0 speed command. In this case, you can compensate it by setting the voltage as offset. The unit is ㎷.
- Zero speed command clamp setting

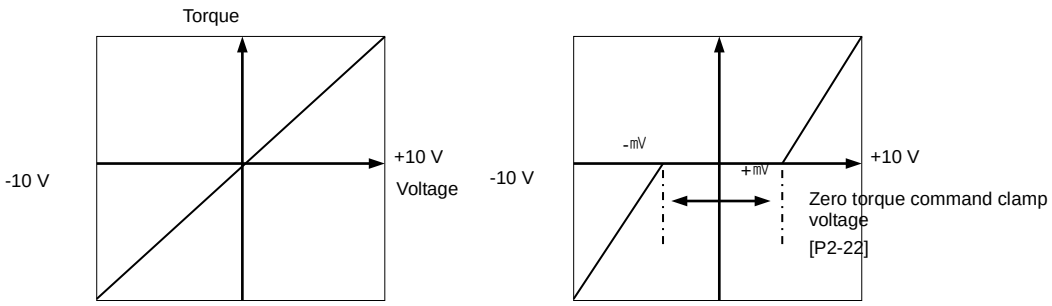


Zero speed command clamp voltage
[P2-19] = 0

Zero speed command clamp voltage
[P2-19] = Not 0 mV

(2) Analog Torque Scale Setting

- Analog torque command scale [P2-20]: Set the analog torque command of 10 [V] as a percentage of the rated torque. The setting should be within the torque limit [P1-13] and [P-14] of system parameter setting.
- Torque command offset [P2-21]: There are cases in which a certain level of voltage remains on the analog circuit, even at the 0 torque command, because of problems with the circuit. You can compensate this by setting the voltage as offset. The unit is ㎷.
- Zero torque command clamp



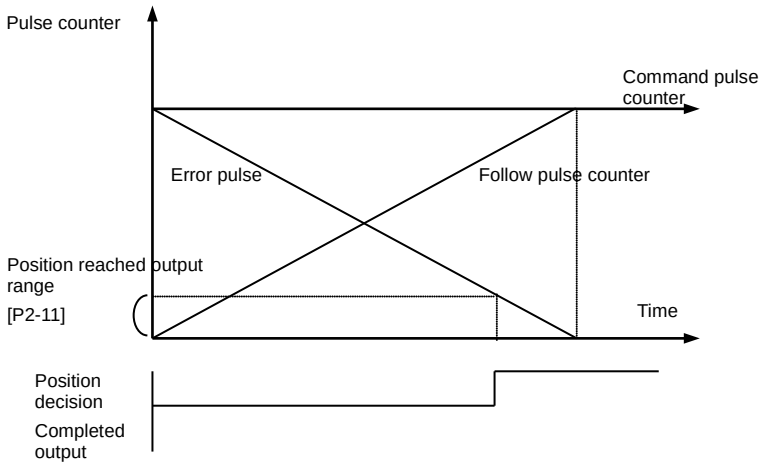
Zero torque command clamp voltage
[P2-22] = 0

Zero torque command clamp voltage
[P2-22] = Not 0 mV

4.4.4 Setting the Input/Output Contact Point Parameters

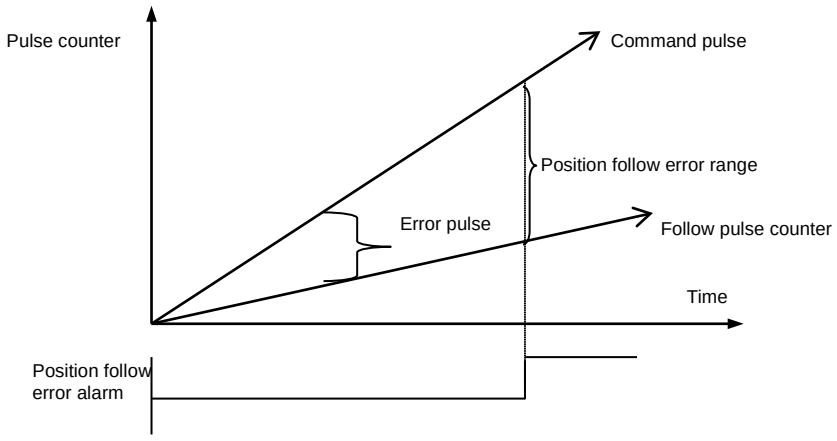
(1) Position Operation Parameter Setting

- Position reached output range [P2-11]: If the error pulse, which is the difference between the command position pulse and the follow position pulse, reaches this range, a signal is output to indicate that the position has been decided.



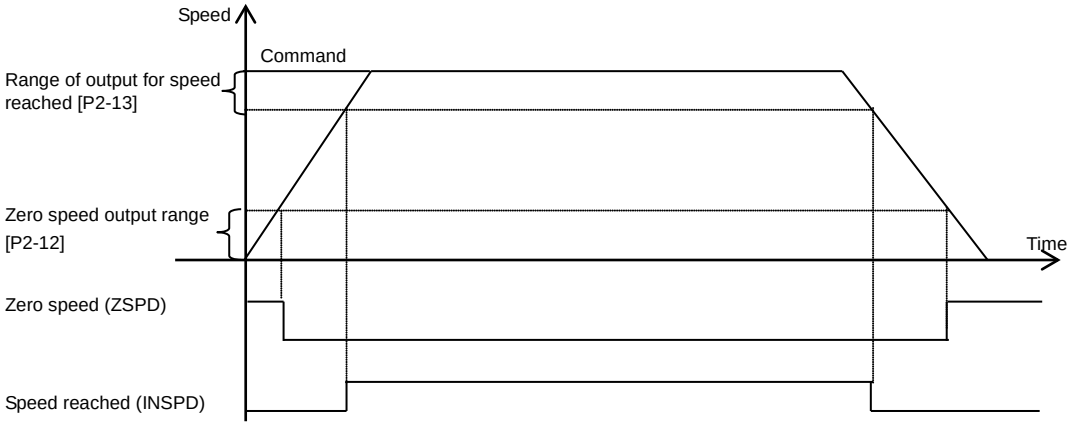
If you set too great a value, the target position complete output signal might occur during operation depending on the position command pulse. Therefore, It is important to set an appropriate value.

- Position operation follow error range [P4-11]



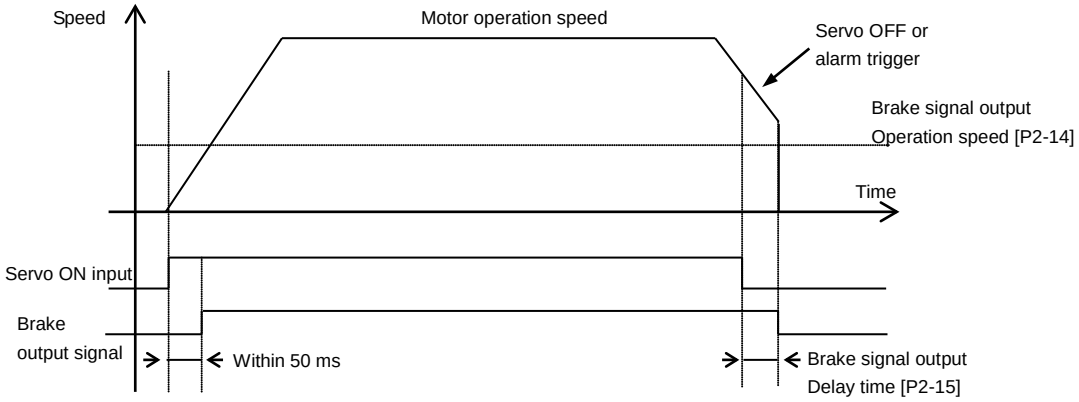
If the error pulse is greater than the position operation tracking error range, the position tracking error alarm [AL-51] triggers.

(2) Speed Operation Parameter Setting



- Zero speed output range [P2-12]: A zero speed signal is output if the current speed drops below the set speed.
- Speed-reached output range [P2-13]: The speed-reached signal is output.

(3) Brake Signal Output Parameter Setting



- Brake signal output operation speed [P2-14], brake signal output delay time [P2-15]

  In the event that an alarm triggers when the servo's built-in brake is applied to the vertical axis for the operation of the motor by the servo, this feature is activated to prevent the vertical axis from falling to the motor brake. This may occur as a result of the brake signal's turning off, which is triggered by first of either the brake signal output operation speed [P2-14] or the brake signal output delay time [P2-15].

(4) Position Pulse Clear Mode [P2-16]

Set the operation of position pulse clear mode in position operation mode.

Setting	Operation
0	Operate only on the edge where the contact point turns on. (Do not operate when it is off or on.) 
1	Operate immediately at contact point on_ Level.

(5) Output Signal Logic Definition Setting [P2-10]

You can change the output condition of the current output contact point to initial status ON or initial status OFF.

4.4.5 Setting Speed Operation Parameters

(1) Speed Command [P3-00]-[P3-06]

You can adjust operation speed in [RPM]. Operation speed is determined by speed command input contact points.

SPD1	SPD2	SPD3	Speed Control
OFF	OFF	OFF	Analog speed command
ON	OFF	OFF	Digital speed command 1
OFF	ON	OFF	Digital speed command 2
ON	ON	OFF	Digital speed command 3
OFF	OFF	ON	Digital speed command 4
ON	OFF	ON	Digital speed command 5
OFF	ON	ON	Digital speed command 6
ON	ON	ON	Digital speed command 7

(2) Acceleration/Deceleration Time

- Acceleration time [P3-08]: Specifies the time required, in ms, for the motor to reach the rated motor speed from zero speed.
- Deceleration time [P3-09]: Specifies the time, in ms, required for the motor to stop after running at the rated motor speed.

(3) S-Curve Operation [P3-11]

You can configure the acceleration/deceleration operation in an S-curve pattern for smooth acceleration/deceleration.

- 0: Trapezoidal -> Set acceleration/deceleration time [P3-08] and [P3-09].
- 1: Sinusoidal -> Set acceleration/deceleration time [P3-08] and [P3-09] + S-curve time [P3-10].

(4) Manual JOG Operation [Cn-00]

Press RIGHT for forward rotation at JOG operation speed [P3-12]. Press LEFT for reverse rotation at JOG operation speed [P3-12]. This ignores the CN1 contact point input status.

(5) Program JOG Operation [Cn-01]

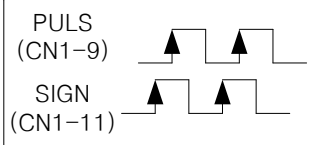
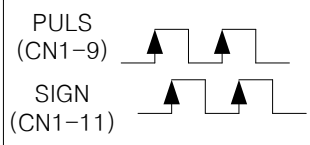
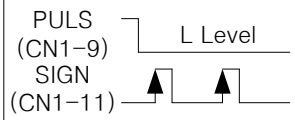
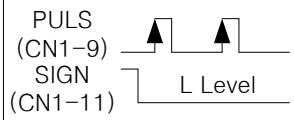
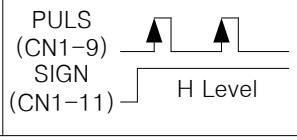
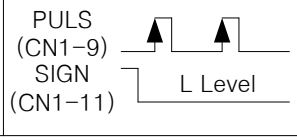
A test drive repeats step 1 to 4.
Set operation speed [P3-13]-[P3-16]) and operation time ([P3-17]-[P3-20]) for each step.

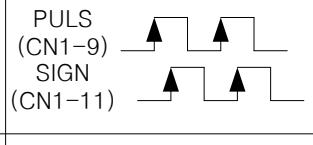
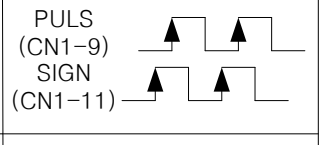
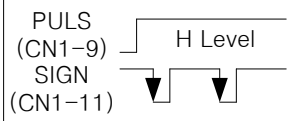
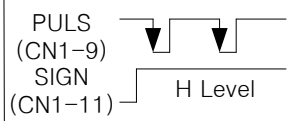
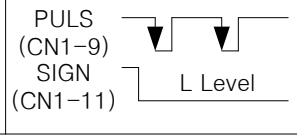
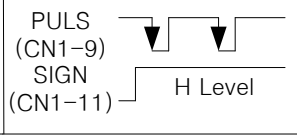
4.4.6 Position Operation Parameter Setting

(1) Input Pulse Logic [P4-00]

Set type of the position command input pulse and rotation method per logic.

- 0: A+B
- 1: CW+CCW, positive logic
- 2: Pulse + sign, positive logic
- 3: A+B
- 4: CW + CCW, negative logic
- 5: Pulse + sign, negative logic

PF + PR		Forward Rotation	Reverse Rotation
Phase A +Phase B Positive Logic	0		
CW +CCW Positive Logic	1		
Pulse +Direction Positive Logic	2		

PF + PR		Forward Rotation	Reverse Rotation
Phase A +Phase B Negative Logic	3		
CW +CCW Negative Logic	4		
Pulse +Direction Negative Logic	5		

(2) Electronic Gear Ratio [P4-01]-[P4-08]

The electronic gear ratio is the numerator/denominator form of the relation between the position command input pulse and the motor encoder pulse. It is important to set the ratio so that there is no error during position operation. The following describes how to set it:

*** Electronic gear ratio = transmission per input pulse x number of pulses per motor rotation / transmission per motor rotation**

e.g.) If deceleration ratio is 1/2, ball screw lead is 10 ㎜, and encoder pulse is 3000 in the unit of commands that control each pulse in 1 ㎛.

1. Transmission per input pulse = 1 × 10 - 3 = 0.001 ㎜

2. Number of pulses per motor rotation = number of encoder pulses × 4 = 3000 × 4 = 12000

3. Transmission per motor rotation = 10 × 1/2 = 5 ㎜

4. Electronic gear ratio = 12000×0.001/5 = 12/5

Therefore, the numerator and denominator of electronic gear ratio are 12 and 5 respectively.

Note 1) There are 12,000 pulses per rotation for a 3,000-pulse encoder because the servo drive controls pulses by multiplying them by four in quadrature type encoder signals.

Note 2) Here, motor speed can be calculated in the following equation:
Motor speed = 60 × electronic gear ratio × input pulse frequency / number of pulses per motor rotation

Note 3) Also, you can calculate error pulse [St-05], that is, the difference between command pulse and following pulse during operation, in the following equation:
Error pulse = command pulse frequency × electronic gear ratio × {1 - (0.01 × [P1-05])} / [P1-01]

Note 4) Series type encoder signal system applies 524288 pulses per revolution without a multiple of 4.

(3) Backlash Compensation [P4-13]

If the position operation causes backlashes which change the position, then this setting converts backlash amount into a number of pulses to compensate for the backlash.

(4) Electronic Gear Ratio Offset Adjustment [P4-09]

If the operation distance per rotation changes due to wear and tear on the machine during position pulse command operation, you can adjust the change caused by wear and tear with offset.

- Electronic gear ratio setting mode [P4-09]
  - 0: Use electronic gear ratio 0-3.
  - 1: Use electronic gear ratio 0. Override the value on the electronic gear ratio numerator.
- Electronic gear ratio numerator offset setting

  In the above example, if you enter 12,000 for the numerator and 5,000 for the denominator and turn on the EGEAR1 contact point, the numerator increases by one. If you turn on the EGEAR2 contact, the numerator decreases by one. The change is saved in the [P4-10] parameter.

  If the offset is two, the electronic gear ratio for operation changes from 12000/5000 to 12002/5000. Also, if the offset is -2, the electronic gear ratio for operation changes from 12000/5000 to 11998/5000.

4.5 Alarms and Warnings

4.5.1 Servo Alarm Status Summary Display List

If an alarm triggers, the malfunction signal output contact point (ALARM) turns off and the dynamic brake stops the motor.

Alarm code	Name	Details	What to check
AL-10	IPM Fault	Overcurrent (H/W)	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-11	IPM temperature	IPM overheat	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-14	Over current	Overcurrent (S/W)	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-15	Current offset	Abnormal current offset	Replace the drive if [St-23] and [St-24] are 10% or higher of the rated current.
AL-16	Overcurrent (/CL)	Overcurrent (H/W)	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-21	Continuous overload	Continuous overload	Determine whether there is a conflict or binding in the equipment. Check the load and the condition of the brake. Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings.
AL-22	Room temperature	Drive overheat	Check the temperature inside the drive [St-19]. the cooling fan installation, and the load condition.
AL-23	Regen. Overload	Regenerative overload	Check the input voltage, regenerative braking resistance, and wiring. Replace the drive.
AL-24	Motor cable open	Motor disconnection	Check the wiring of the motor.
AL-30	Encoder comm.	Serial encoder communication error	Check for incorrect wiring of the serial encoder.
AL-31	Encoder cable open	Encoder cable disconnection	Check whether the encoder cable is disconnected.

Alarm code	Name	Details	What to check
	Encoder data error	Encoder data error	Check the [P0-02] setting and encoder wiring.
	Motor setting error	Motor ID setting error	Check the [P0-00] setting.
	Encoder Z PHASE Open	Encoder Z phase disconnected	Check whether the encoder cable is disconnected.
	Low Battery Error	Low voltage error	BackUp battery has not enough voltage, Change battery. ※After replacing battery, Power “ON” and Homing operation are absolutely needed (apply from S/W Ver 1.28)
	Under voltage	Low voltage	Check input voltage and power unit wiring.
	Overvoltage	Overvoltage	Check the input voltage and wiring. Check the braking resistance for damage. Check for excessive regenerative operation. Check the regenerative resistance.
	RST power fail	Main power failure	Check the power unit wiring and power supply.
	Control power fail	Control power failure	Check the power unit wiring and power supply.
	Over speed limit	Overspeed	Check the encoder, encoder settings, encoder wiring, gain settings, motor wiring, motor ID, electric gear ratio, and speed command scale.
	Position following	Excessive positional error	Check the excessive position command pulse setting [P4-11], wiring, limit contact point, gain setting, encoder setting, and electric gear ratio. Check the load on the equipment and whether there is binding on the equipment.
	Over pulse CMD	Pulse command frequency error	Check the pulse command frequency on the upper level controller, and check the command pulse type.
	Speed deviation	Excessive speed error	Check for incorrect wiring in the drive output and encoder. Also, check the connection and load status of the equipment.
	Motor overrun	Motor overrun	Check for incorrect wiring in the drive output and encoder. Also, check the connection and load status of the equipment.
	Parameter checksum	Parameter error	Factory reset [Cn-21].
	Parameter range	Parameter range error	Factory reset [Cn-21].
	Invalid factory setting	Factory setting error	Factory reset [Cn-21].
	GPIO setting	Output contact point setting error	Factory reset [Cn-21].

4.5.2 Servo Warning Status Summary Display List

If a warning code is displayed as the current operation status [St-00], the servo drive is operating abnormally. Check what needs to be inspected for the issue.

Warning State (CODE)	Name	Details and causes	What to check
	RST_PFAIL	Main power phase loss	If the [P0-06] DIGIT 2 is set to 1, the main power fails.
	LOW_BATT	Battery low	BackUp battery has not enough voltage
	OV_TCMD	Excessive Torque Command	You have entered a command that exceeds the maximum set torque.
	OV_VCMD	Excessive speed command	You have entered a command that exceeds the maximum set speed.
	OV_LOAD	Overload warning	The maximum overload [P0-13] has been reached.
	SETUP	Capacity settings	The electric current capacity of the motor is larger than that of the drive.
	UD_VTG	Low voltage warning	When [P0-06] DIGIT 2 is set to 1, the DC link voltage is 190 V or below.
	EMG	EMG contact	Check I/O wiring and [P2-09] value

Warning code is displayed in hexadecimal, but it is displayed as the sum of respective warning codes when two or more warnings occur at once. For example, warning code is displayed as [W-0C] when both [W-04] Excessive Torque Command and [W-08] Excessive Speed Command occur at once.

If [W-80] occurs, SVON turns from ON to OFF. And when you turn on I/O power or change contact logic, [W-80] code is automatically deactivated.

4.6 Motor Types and IDs

Model Name	ID	Watt	Notes
SEP09A	461	900	
SEP15A	462	1500	
SEP22A	463	2200	
SEP30A	464	3000	
SEP06D	465	600	
SEP11D	466	1100	
SEP16D	467	1600	
SEP22D	468	2200	
SEP03M	469	300	
SEP06M	470	600	
SEP09M	471	900	
SEP12M	472	1200	
SEP05G	473	450	
SEP09G	474	850	
SEP13G	475	1300	
SEP17G	476	1700	
SFP30A	481	3000	
SFP50A	482	5000	
SFP22D	485	2200	
SFP35D	486	3500	
SFP55D	487	5500	
SFP75D	488	7500	
SFP12M	489	1200	
SFP20M	490	2000	
SFP30M	491	3000	
SFP44M	492	4400	
SFP20G	493	1800	
SFP30G	494	2900	
SFP44G	495	4400	
SFP60G	496	6000	
SFP75G	497	7500	
SGP22D	511	2200	

Model Name	ID	Watt	Notes
SGP35D	512	3500	
SGP55D	513	5500	
SGP75D	514	7500	
SGP110D	515	11000	
SGP12M	521	1200	
SGP20M	522	2000	
SGP30M	523	3000	
SGP44M	524	4400	
SGP60M	525	6000	
SGP20G	531	1800	
SGP30G	532	2900	
SGP44G	533	4400	
SGP60G	534	6000	
SGP85G	535	8500	
SGP150G	537	15000	

Model Name	ID	Watt	Notes
FEP09A	261	900	
FEP15A	262	1500	
FEP22A	263	2200	
FEP30A	264	3000	
FEP06D	265	600	
FEP11D	266	1100	
FEP16D	267	1600	
FEP22D	268	2200	
FEP03M	269	300	
FEP06M	270	600	
FEP09M	271	900	
FEP12M	272	1200	
FEP05G	273	450	
FEP09G	274	850	
FEP13G	275	1300	
FEP17G	276	1700	
FFP30A	281	3000	
FFP50A	282	5000	
FFP22D	285	2200	
FFP35D	286	3500	
FFP55D	287	5500	
FFP75D	288	7500	
FFP12M	289	1200	
FFP20M	290	2000	
FFP30M	291	3000	
FFP44M	292	4400	
FFP20G	293	1800	
FFP30G	294	2900	
FFP44G	295	4400	

Model Name	ID	Watt	Notes
FFP60G	296	6000	
FFP75G	297	7500	
FGP22D	311	2200	
FGP35D	312	3500	
FGP55D	313	5500	
FGP75D	314	7500	
FGP12M	321	1200	
FGP20M	322	2000	
FGP30M	323	3000	
FGP44M	324	4400	
FGP20G	331	1800	
FGP30G	332	2900	
FGP44G	333	4400	
FGP60G	334	6000	

5. Handling and Operation

5.1 Operation Checklist

Thoroughly check the following items during the test drive to prevent injuries or damage to the servo motor.

5.1.1 Wiring Checklist

1. Is the voltage (AC 200 V) appropriate for the power input terminals?
2. Are the power cables (U, V, W, and FG) between the drive and the motor connected correctly?
3. Is the voltage (24 V) connected to the control signal correctly?
4. Is the regenerative resistance appropriate for the capacity and correctly connected?
5. Are the wiring cables free from bends or kinks?
6. Is the ground and wire insulation free from defects?

5.1.2 the Drive Signal (CN1) Wiring Checklist

Confirm that the wire and contacts for the drive signals are in the state listed on the following table.

Pin Number	Pin Name	State of Contact	Pin Number	Pin Name	State of Contact
18	EMG	ON	19	CWLIM	ON
47	SVON	OFF	20	CCWLIM	ON
48	STOP	OFF	17	ALMRST	OFF

The above is factory-initialized status. Different functions may be allocated according to input signal allocations ([P2-00], [P2-01], [P2-02], [P2-03], and [P2-04]).

5.1.3 Surrounding Environment Checklist

Are there any metal filings or water around the wires?

5.1.4 Machine Status Checklist

1. Is the servo motor coupling in good condition?
2. Are the locking bolts fastened tightly?
3. Are there any obstacles that may prohibit operation of the machine?

5.1.5 System Parameter Checklist

1. Is the motor ID setting [P0-00] in good condition?
2. Are the encoder type [P0-01] and the encoder pulse [P0-02] in good condition?
3. Is control gain set to an appropriate value?

*Note: Refer to "Appendix 2 Test Drive Procedure."

5.2 Handling

5.2.1 Manual JOG Operation [Cn-00]

The drive performs manual JOG operation by itself.

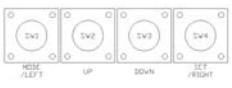
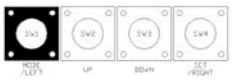
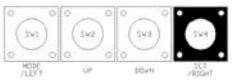
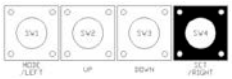
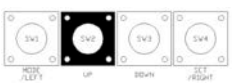
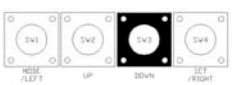
1. Press SET in [Cn-00] and [JoG] is displayed.
2. Press SET and [SV-on] is displayed and the servo turns on for operation.

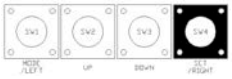
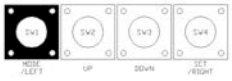
   If an alarm triggers, check wiring and other possible causes before restarting.
3. Press and hold UP and the motor turns forward (CCW) at the JOG operation speed [P3-12].
4. Press and hold DOWN and the motor turns counterclockwise at the JOG operation speed [P3-12].
5. Press SET again and the manual JOG operation finishes and the servo turns off.
6. Press down [MODE] to return to the parameter screen [Cn-00].

Related Parameters	Speed	Initial
[P3-08]	Speed command acceleration time ms	0
[P3-09]	Speed command deceleration time ms	0
[P3-10]	Speed command S-curve time ms	10
*[P3-11]	Speed operation pattern	0
[P3-12]	JOG operation speed [RPM]	500

The parameter marked with "*" cannot be modified when the servo is on.

[Example of handling manual JOG operation]

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].
3			Press SET to enter manual JOG operation.
4			Press SET to turn on the servo.
5			Press and hold UP when the servo is on and the motor turns forward (CCW). Lift your hand off the key and the motor stops.
6			Press and hold DOWN when the servo is on and the motor turns counterclockwise. Lift your hand off the key and the motor stops.

Order	Loader Displays	Keys to Use	What to Do
7			Press DOWN and the servo changes to OFF.
8			Press MODE for a second and you return to the menu screen [Cn-00].

※ “ ” indicates flickering.

5.2.2 Program JOG Operation [Cn-01]

Continuously operates according to the program already set.

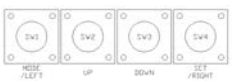
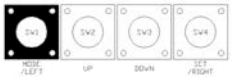
1. Press the SET key in [Cn-01] parameter. Then, [P-JoG] is displayed.
2. Press SET and [run] is displayed. The program JOG operation starts after the servo is turned on.

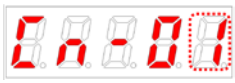
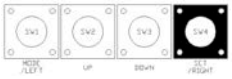
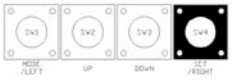
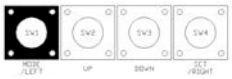
   (If an alarm triggers at this moment, check the wiring of the servo and other possible causes before restarting.)
3. Press SET again and the program JOG operation finishes and the servo is turned off.
4. Press down [MODE] to return to the parameter screen [Cn-00].
5. Four operation steps repeat continuously from 0 to 3. Operation speed and time can be set in the following parameters:

Related Parameters	Speed	Initial
[P3-08]	Speed command acceleration time [ms]	100
[P3-09]	Speed command deceleration time [ms]	100
[P3-10]	Speed command S-curve time [ms]	10
[P3-11]	Speed operation pattern	0

Step	Program Operation Speed	Program Operation Time
0	[P3-13]	[P3-17]
1	[P3-14]	[P3-18]
2	[P3-15]	[P3-19]
3	[P3-16]	[P3-20]

[Example of handling program JOG operation]

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].

Order	Loader Displays	Keys to Use	What to Do
3			Press UP or DOWN to move to [Cn-01].
4			Press SET to enter program Jog operation.
5			Press SET and the motor starts operating according to the predefined program.
6			Press the SET key again and the operation ends. [done] is displayed.
7			Hold down MODE for approximately one second to return to [Cn-01].

※ “ ” indicates flickering.

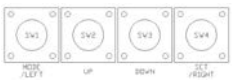
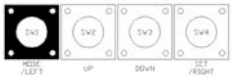
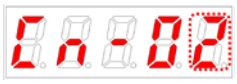
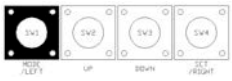
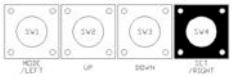
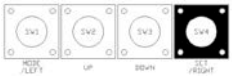
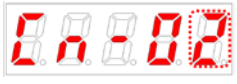
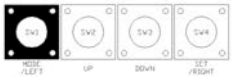
5.2.3 Alarm Reset [Cn-02]

Reset the alarm that went off.

1. Contact alarm reset: If you turn on ALMRST among input contacts, the alarm is reset and becomes normal.
2. Operation alarm reset: If you press SET in the alarm reset [Cn-02] parameter among operation handling parameters, [ALrst] is displayed. If you press SET again, the alarm is reset and becomes normal.

   ※ If the alarm keeps ringing after the reset, check and remove possible causes and then repeat the process.

[Example of alarm reset]

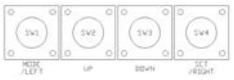
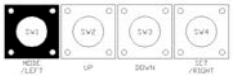
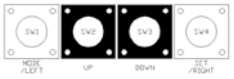
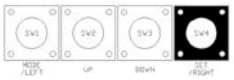
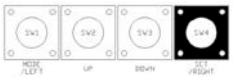
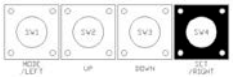
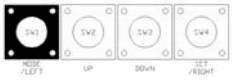
Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].
3			Press UP or [DOWN] to move to [Cn-02].
4			Press SET to enter alarm reset mode.
5			Press SET to reset the alarm. [done] is displayed.
6			Press MODE for a second to return to [Cn-02].

※ “ ” indicates flickering.

5.2.4 Reading Alarm History [Cn-03]

Check the saved alarm history.

[Example of getting alarm history]

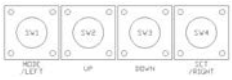
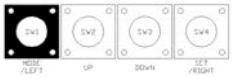
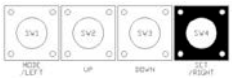
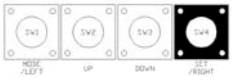
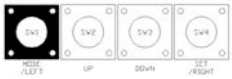
Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].
3			Press UP or DOWN to move to [Cn-03].
4			Press SET to start reading alarm history.
5			Press SET and the most recent alarm code is displayed. Example: Recent first history [AL-42]: Main power failure occurred. 01: Latest alarm 20: 20th previous alarm
6			Press UP or DOWN to read alarm history. Example: The second previous history [AL-10]: Overcurrent (HW) occurred. 01: Latest alarm 20: 20th previous alarm
7			Press SET to finish reading alarm history. [done] is displayed.
8			Press MODE for a second to return to [Cn-03].

※ “ ” indicates flickering.

5.2.5 Alarm History Reset [Cn-04]

Delete all currently stored alarm history.

[Example of alarm history reset]

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].
3			Press UP or DOWN to move to [Cn-04].
4			Press SET to enter alarm history reset.
5			Press SET to delete alarm history. [done] is displayed.
6			Press MODE for a second to return to [Cn-04].

※ "▯" indicates flickering.

5.2.6 Auto Gain Tuning [Cn-05]

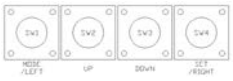
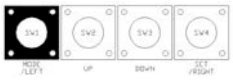
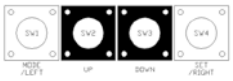
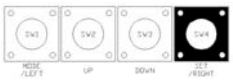
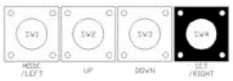
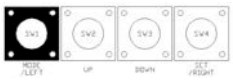
Perform automatic tuning operation.

1. Press SET from the [Cn-05] parameter and [Auto] is displayed.
2. Press SET and [run] is displayed and automatic gain tuning starts.

   If an alarm triggers at this moment, check the wiring of the servo and other possible causes before restarting.
3. When gain adjustment is completed, inertia ratio [%] is displayed, and [P1-00], [P1-06] and [P1-08] are automatically changed and saved.

Related Parameters	name	Initial
[P1-20]	Auto gain tuning speed [100 RPM]	8
[P1-21]	Auto gain tuning distance	3

[Example of handling auto gain tuning]

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].
3			Press UP or DOWN to move to [Cn-05].
4			Press SET to enter automatic gain tuning.
5			Press SET to start three cycles of forward rotation and reverse rotation.
6		-	Upon completion of automatic tuning, the tuning result will be displayed on the loader. Press SET for retuning.
7			Press MODE for a second to return to [Cn-05].

※ "▯" indicates flickering.

5.2.7 Phase Z Search Operation [Cn-06]

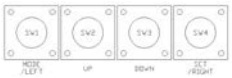
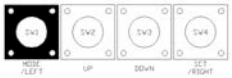
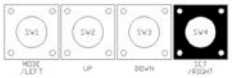
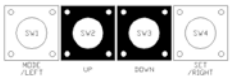
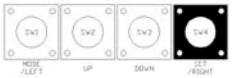
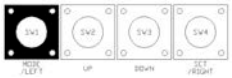
Perform phase Z search operation.

1. Press SET in [Cn-06] and [Z-rtn] is displayed.
2. Press SET and [run] is displayed and the servo turns on.
3. While you hold down UP, the motor keeps turning forward (CCW) until it finds the phase Z position of the encoder.
4. While you hold down DOWN, the motor keeps turning counterclockwise until it finds the phase Z position of the encoder.
5. Press SET and [done] is played and the phase Z search ends.

※ This function is useful for finding the Z position and assembling it by a specific standard.

Related Parameters	name	Initial
[P3-07]	Phase Z search operation speed setting [RPM]	10

[Example of handling phase Z search operation]

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
2			Press MODE to move to [Cn-00].
3			Press UP or DOWN to move to [Cn-06].
4			Press SET to enter phase Z search operation.
5			Press SET to turn on the servo.
6			Press UP and the motor turns forward (CCW) until it finds phase Z. Press DOWN and the motor turns reverse (CW) until it finds phase Z.
7			Press SET to end the phase Z search operation mode. The servo turns off and [done] is displayed.
8			Press MODE for a second to return to the menu screen [Cn-06].

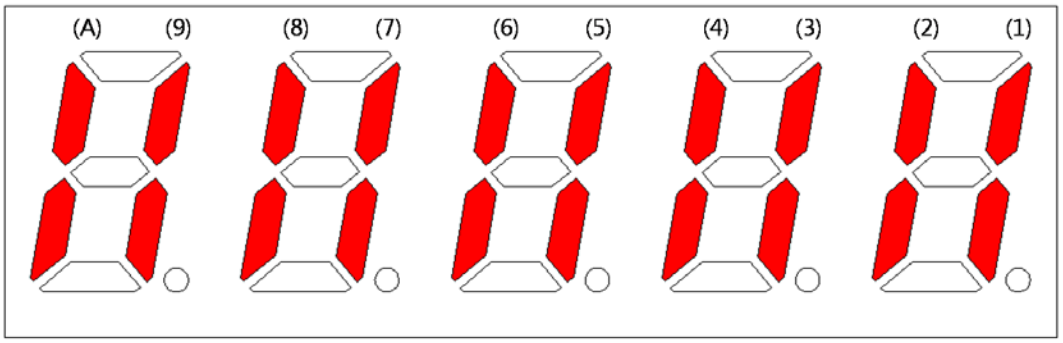
※ "▯" indicates flickering.

5.2.8 Input Contact Forced ON/OFF [Cn-07]

The drive forcibly turns on/off the input contact without an upper level controller or I/O jig.

(1) Input Contact Forced ON/OFF Setting

The positions of the seven segment LEDs and CN1 contacts correspond as follows.



If an LED that corresponds to a contact is turned on/off, it indicates ON/OFF accordingly.

[Input Contact Setting]

Number	(A)	(9)	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)
CN1 pin number	48	18	19	20	46	17	21	22	23	47
Allocated default signal name	STOP	EMG	CWLIM	CCWLIM	DIR	ALMRST	SPD3	SPD2	SPD1	SVON

Press UP on each digit and the (A), (8), (6), (4), and (2) signals turn on or off forcibly.

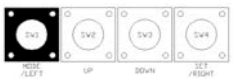
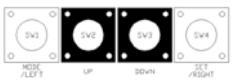
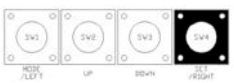
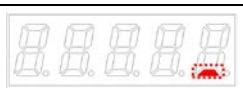
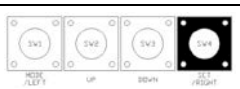
Press DOWN on each digit and the (9), (7), (5), (3), and (1) signals turn on or off forcibly.

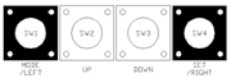
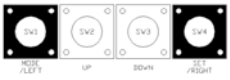
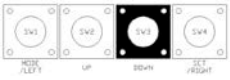
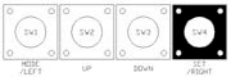
Press MODE to move to another digit.

(2) Example of Input Contact Forced ON/OFF

(SVON ON → EMG ON → EMG OFF → SVON OFF)

[Example of handling input contact forced ON/OFF]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to move to [Cn-00].
2			Press UP or DOWN to move to [Cn-07].
3			Press SET to enter input forced ON/OFF mode.
4			Press SET to enter forced input bit setting.

Order	Loader Displays	Keys to Use	What to Do
5			Press DOWN to turn on the servo forcibly.
6			Press MODE at the blinking cursor to move to the desired digit, DIGIT 5.
7			Press DOWN to turn on EMG forcibly.
8			Press DOWN to turn off EMG forcibly.
9			Press MODE at the cursor to move to the desired digit, DIGIT 1.
10			Press DOWN to turn off the servo forcibly.
11			Press SET to end input forced ON/OFF mode. [done] is displayed.
12			Press MODE for a second to return to [Cn-07].

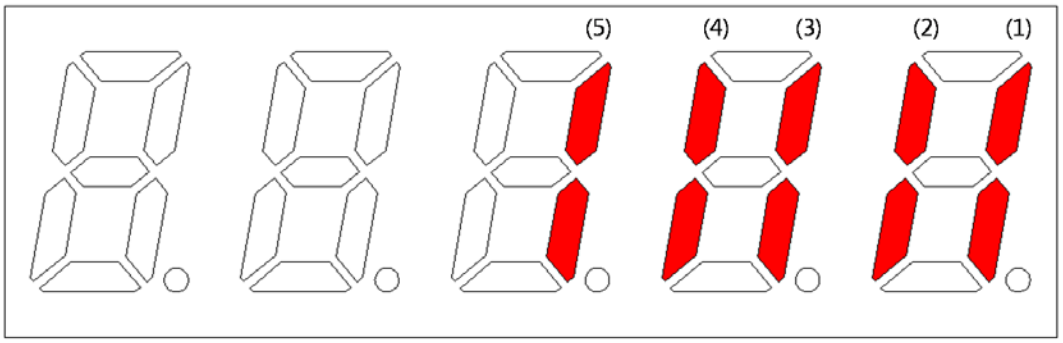
※ “ ” indicates flickering.

5.2.9 Output Contact Forced ON/OFF [Cn-08]

Without an upper level controller or I/O jig, the drive forcibly turns on/off the output contact.

(1) Output Contact Forced ON/OFF Setting

The positions of the seven segment LEDs and CN1 contacts correspond as follows.



If an LED that corresponds to a contact is turned on/off, it indicates ON/OFF accordingly.

[Output Contact Setting]

Number	(5)	(4)	(3)	(2)	(1)
CN1 - pin number	45	44	43	40 /41	38 / 39
Allocated default signal name	INPOS	BRAKE	ZSPD	READY	ALARM

Press UP on each digit and the (4) and (2) signals are turned on or off for forced output.

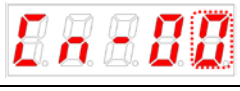
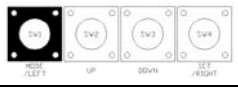
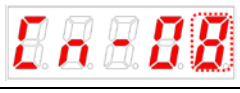
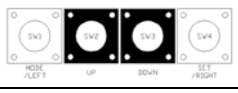
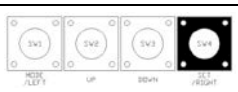
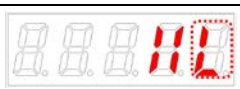
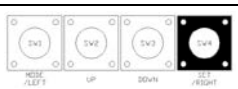
Press DOWN on each digit and the (5), (3) and (1) signals are turned on or off for forced output.

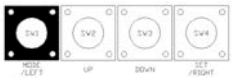
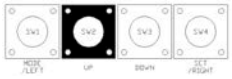
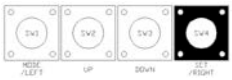
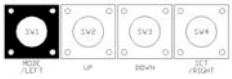
Press MODE to move to another digit.

(2) Example of Output Contact Forced ON/OFF

(BRAKE OFF)

[Example of handling output contact forced ON/OFF]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to move to [Cn-00].
2			Press UP or DOWN to move to [Cn-08].
3			Press SET to enter input forced ON/OFF setting.
4			Press SET to enter forced output bit setting.

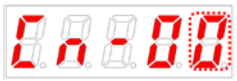
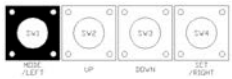
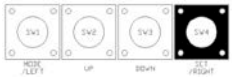
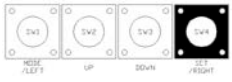
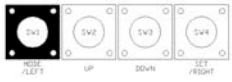
Order	Loader Displays	Keys to Use	What to Do
5			Press MODE at the blinking cursor to move to the desired digit, DIGIT 2, and it rotates.
6			Press UP to turn off the brake signal.
7			Press SET to end input forced ON/OFF mode. [done] is displayed.
8			Press MODE for a second to return to [Cn-08].

※ “ ” indicates flickering.

5.2.10 Parameter Reset [Cn-09]

Reset parameter data.

[Example of initializing parameters]

Order	Loader Displays	Keys to Use	What to Do
1			Displays the speed control mode with main power and control power permitted.
			Press MODE to move to [Cn-00].
2			Press UP or DOWN to move to [Cn-09].
3			Press SET to enter parameter reset.
4			Press SET to reset data. [done] is displayed.
5			Press MODE for a second to return to [Cn-09].

※ “ ” indicates flickering.

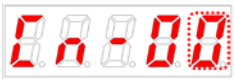
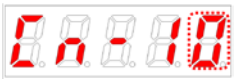
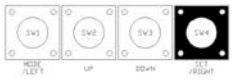
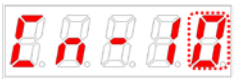
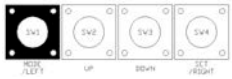
5.2.11 Automatic Speed Command Offset Correction [Cn-10]

Correct the offset of analog speed commands automatically.

The range of adjustable speed command analog voltage is from +1 V to -1 V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction.

You can check the corrected offset value in the analog speed offset [P2-18].

[Example of handling automatic speed command offset calibration]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-10].
3			Press SET to enter offset correction.
4	 or 		Press SET to compensate offset. [done] is displayed. If the value exceeds the allowed range, oVrnG is displayed.
5			Press MODE for a second to return to [Cn-10].

※ "▯" indicates flickering.

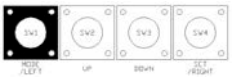
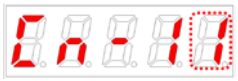
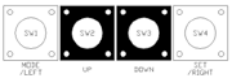
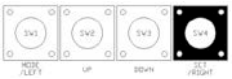
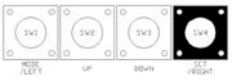
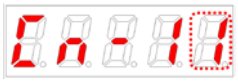
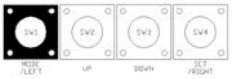
5.2.12 Automatic Torque Command Offset Correction [Cn-11]

Corrects the offset of analog torque commands automatically.

The range of adjustable torque command analog voltage is from +1 V to -1 V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction.

You can check the corrected offset value in the analog torque offset [P2-21].

[Example of handling automatic torque command offset correction]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-11].
3			Press SET to enter offset correction.
4	 or 		Press SET to compensate offset. [done] is displayed. If the value exceeds the allowed range, oVrnG is displayed.
5			Press MODE for a second to return to [Cn-11].

※ "▯" indicates flickering.

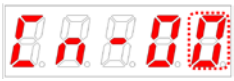
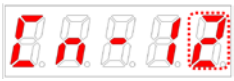
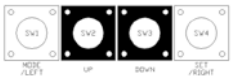
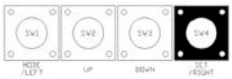
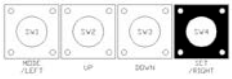
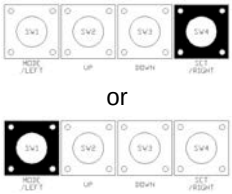
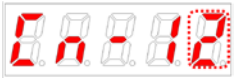
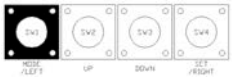
5.2.13 Manual Speed Command Offset Correction [Cn-12]

Calibrates the offset value of analog speed commands manually. Example: -10

The range of adjustable speed command analog voltage is from +1 V to -1 V. If offset voltage exceeds this range, [oVrnG] Over Range is displayed and there is no compensation.

You can check the corrected offset value in the analog speed offset [P2-18].

[Example of handling manual speed command offset correction]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-12].
3			Press SET to enter offset correction.
4			Press SET to enter offset correction setting. The current offset value displayed.
5			Press UP or DOWN to adjust the value.
6			Press SET to save the adjusted offset value. [done] is displayed. Press MODE and it will not be saved.
7			Press MODE for a second to return to [Cn-12].

※ "▯" indicates flickering.

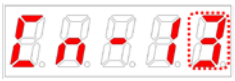
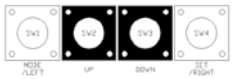
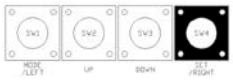
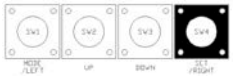
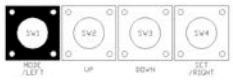
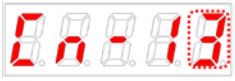
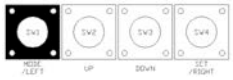
5.2.14 Manual Torque Command Offset Correction [Cn-13]

Correct the offset value of analog torque commands manually.

The range of adjustable torque command analog voltage is from +1 V to -1 V. If offset voltage exceeds this range, oVrnG is displayed and there is no correction.

You can check the corrected offset value in the analog torque command offset [P2-21].

[Example of handling manual torque command offset correction]

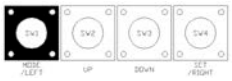
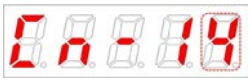
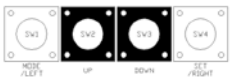
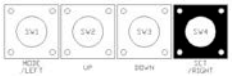
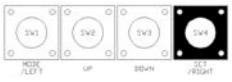
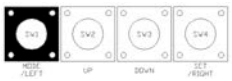
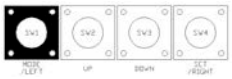
Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-13].
3			Press SET to enter offset correction.
4			Press SET to enter offset correction setting. The current offset value displayed.
5			Press UP or DOWN to adjust the value.
6		 or 	Press SET to save the adjusted offset value. [done] is displayed. Press MODE and it will not be saved.
7			Press MODE for a second to return to the menu screen [Cn-13].

※ “ ” indicates flickering.

5.2.15 Absolute Encoder Value Reset [Cn-14]

Resets encoder multi-turn data to zero (0).

[Example of absolute encoder reset]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-14].
3			Press the SET key to enter the state of encoder reset.
4		 or 	Press the SET key to reset the data value for absolute encoder multi-turn. [done] is displayed. Press MODE and it is not reset.
7			Press MODE for a second to return to the menu screen [Cn-14].

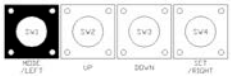
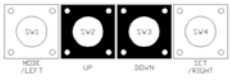
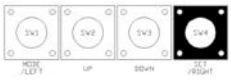
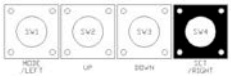
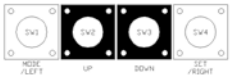
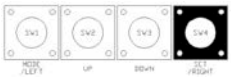
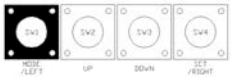
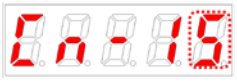
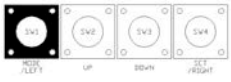
※ "▯" indicates flickering.

※ After you reset absolute encoder value, you can see the reset value in [st-18].

5.2.16 Instantaneous Maximum Load Factor Initialization [Cn-15]

Reset the instantaneous maximum load factor to 0.

[Example of initializing the instantaneous maximum load factor]

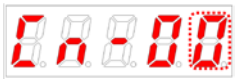
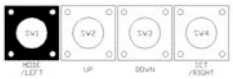
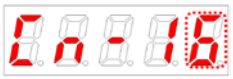
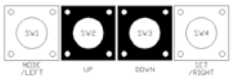
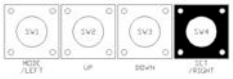
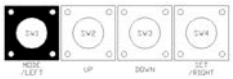
Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-15].
3			Press SET to enter instantaneous maximum load factor initialization.
4			Press SET and the current maximum load factor is displayed.
5	 or 		Press UP and the clockwise maximum load factor is displayed. Press DOWN and the counterclockwise maximum load factor is displayed.
6		 or 	Press SET and the instantaneous maximum load factor is reset. [done] is displayed. Press MODE and it is not reset.
7			Press MODE for a second to return to [Cn-15].

※ "▯" indicates flickering.

5.2.17 Parameter Lock [Cn-16]

Sets parameter lock.

[Example of parameter lock setting]

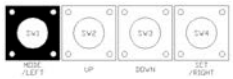
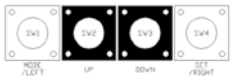
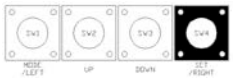
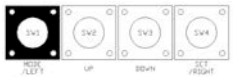
Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-16].
3			Press the SET key to enter the state of parameter lock.
4	 or 		Press the UP key. Then, parameter lock is disabled. Press the DOWN key. Then, parameter lock is enabled.
5			Press MODE for a second to return to [Cn-16].

※ "▯" indicates flickering.

5.2.18 Current Offset [Cn-17]

Saves current offset value to parameter [P0-28]-[P0-29].

[Example of handling current offset value]

Order	Loader Displays	Keys to Use	What to Do
1			Press MODE to display [Cn-00].
2			Press UP or DOWN to move to [Cn-17].
3			Press the SET key to enter the state of current offset setting.
6			Press the SET key. Then, phase U current offset value is saved to [P0-28] and phase V current offset value is saved to [P0-29].
7			Press MODE for a second to return to [Cn-17].

※ "▯" indicates flickering.

6. Communication Protocol

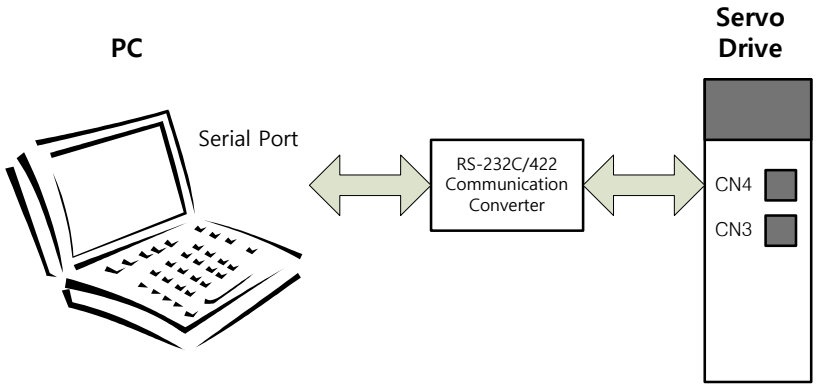
6.1 Overview and Communication Specifications

6.1.1 Overview

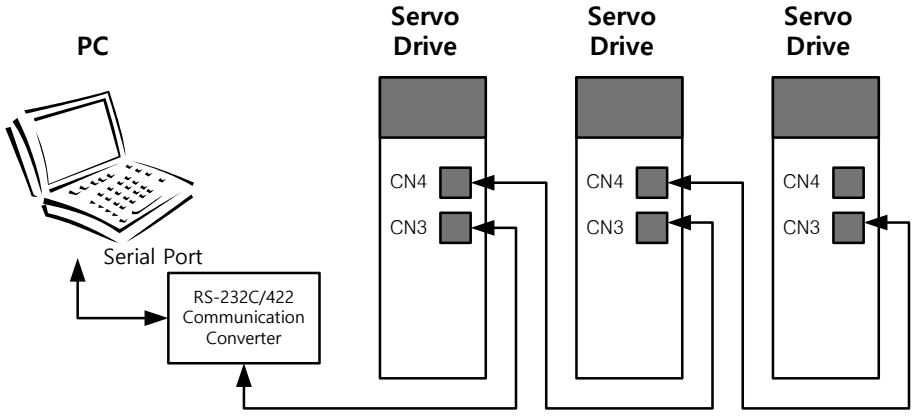
The L7 servo drive is RS-422 serial communication. By connecting it to a PC or an upper level controller, you can test drive it or change gain tuning parameters.

You can also operate or handle communication of up to 32 axes by connecting multiple L7 servo drives via a multi-drop method.

(1) Serial Communication Access through RS422



(2) Multi-Drop Access through RS422 (up to 32 machines)



Note 1) When using a PC as the upper level controller, you have to use the RS232/RS485 communication converter.

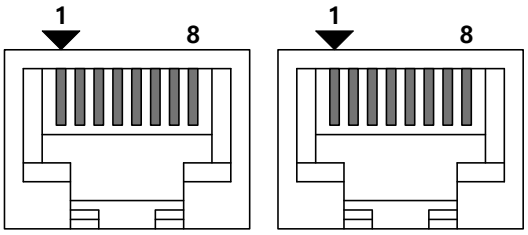
Note 2) The CN3 and the CN4 connector pins of the servo drive are connected on an one-to-one basis internally, making multi-drop wiring easy.

6.1.2 Communication Specifications and Cable Access Rate

(1) Communication Specifications

Item		Specifications
Communication standard		ANSI/TIA/EIA-422 standard
Communication protocol		MODBUS-RTU
Data Type	Data bit	8 bits
	Stop bit	1 bits
	Parity	None
Synchronous method		Asynchronous
Transmission speed		9600 /19200/38400/57600 [bps] [P0-04] can be selected.
Transmission distance		Up to 200 m
Current consumption		100 ㎃ or below

(2) Connection of CN3 and CN4 Connector Pins



Pin Number	Pin Function
1	Not for use.
2	Terminating resistance connection note 1)
3	RXD+
4	TXD-
5	TXD+
6	RXD-
7	Not for use.
8	GND

Note 1) In case of multi access connection, apply terminating resistance by connecting Pin 2 of the last drive to Pin 6 (RXD-).
Note 2) Connect TXD+ and TXD-, and RXD+ and RXD- in twisted pairs.
Note 3) The TXD and RXD in the above table are based on the servo drive.

6.2 Communication Protocol Base Structure

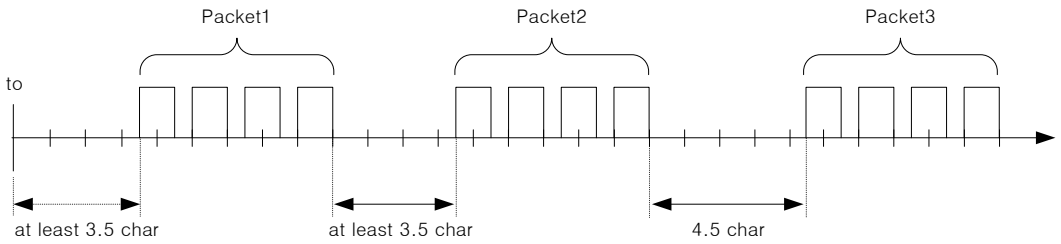
The communication of the L7 servo drive complies with the international standard MODBUS-RTU protocol. For information about items not covered in this manual, refer to the following standard. (Related standard: Modbus application protocol specification 1.1b, 2006.12.28)

Also, the concept of sending and receiving in this manual is based on the host.

6.2.1 Sending/Receiving Packet Structure

The maximum sending/receiving packet length of the MODBUS-RTU protocol is 256 bytes. Make sure that the total length of the sending/receiving packet does not exceed 256 bytes.

The MODBUS-RTU communication mode requires space of at least 3.5 char between the end of the previous packet and the beginning of the next packet as show in the following image to distinguish packets.



(1) Sending Packet Structure

	Additional Address	Function Code	Data			Error Check	
Bytes	**0**	**1**	**2**	**.**	**.**	**n-1**	**n**
Details		Function	Data	.	.	CRC (MSB)	CRC (LSB)

(2) Receiving Packet Structure

[Normal Response]

	Additional Address	Function Code	Data			Error Check	
Bytes	**0**	**1**	**2**	**.**	**.**	**n-1**	**n**
Details		Function	Data	.	.	CRC (MSB)	CRC (LSB)

[Abnormal Response]

	Additional Address	Function Code	Data	Error Check	
Bytes	**0**	**1**	**2**	**3**	**4**
Details		Function+0x80	Exception code	CRC (MSB)	CRC (LSB)

(3) Protocol Packet Code

- Node ID

  Indicates the exchange number of the servo drive to send.

  Set the exchange number of the servo drive to [P0-05].

- Function Code

  The following are the Modbus-RTU standard function codes supported by the L7 servo drive.

Category	Command code	Details	Purpose	
			Read	Write
Public function code	0x03	Read single register	○	
	0x03	Read multi register	○	
	0x06	Write single register		○
	0x10	Write multi register		○
User defined function code	0x6A	Read each block register	○	

- Data

  [Sending]: For read register commands, the Modbus address, the number of registers, and the number of bytes will be set. For write register commands, the Modbus address, the number of bytes, and other necessary values will be set.

  [Receiving]: In the case of read register commands, normal responses are received with the same node ID and function code as they are sent. In terms of data, registers are received according to the order of sent registers.

  In the case of write single register commands, the same data as those sent are received. In the case of write multi registers, the start address of the register, whose data were to be used with the write multi register command, and the number of registers are received.

  Abnormal responses consist of node ID, error code, and exception code. The packet structure is the same for all abnormal responses regardless of their function codes.

(4) CRC

Enter the 16-bit CRC check sum. Send 1 byte of MSB and LSB each.

(5) Exception Code

The followings are the exception codes for all abnormal responses of all function codes supported in the L7 servo drive.

Exception Code	Description
0x01	Unsupported function codes
0x02	Invalid register address
0x03	Non-matching node IDs or CRC check errors
0x04	Command handling failure
0x05	Waiting (Preparing data)
0x06	State of parameter lock

6.2.2 Protocol Command Codes

(1) Read Single Register (0x03)

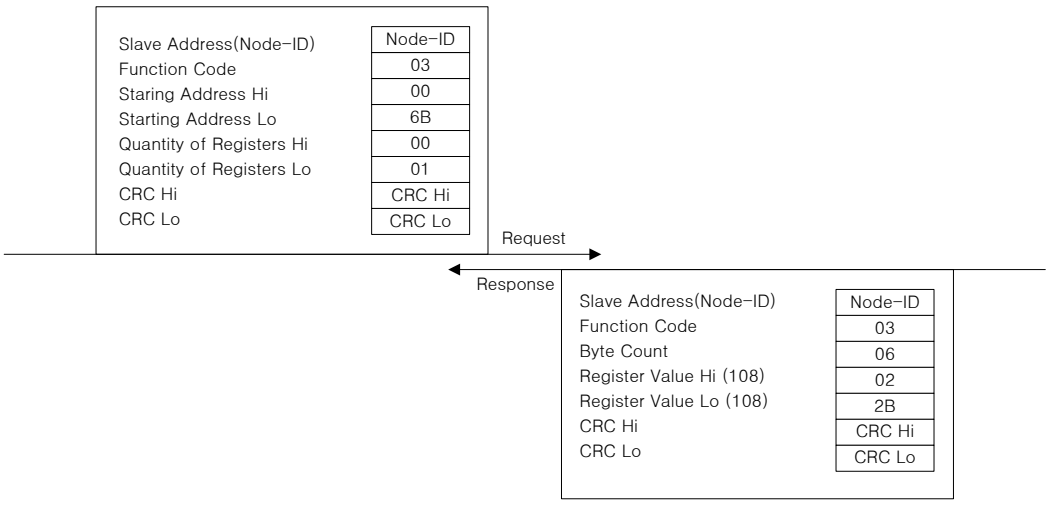
Read the single register (16-bit data) value.

Sending Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x03
2	Starting Address Hi	0x00
3	Starting Address Lo	0x6B
4	Quantity of Register Hi	0x00
5	Quantity of Register Lo	0x01
6	CRC Hi	
7	CRC Lo	

Normal Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x03
2	Byte Count	0x02
3	Register Value Hi	0x02
4	Register Value Lo	0x2B
5	CRC Hi	
6	CRC Lo	

Error Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1		0x03 + 0x80
2	Exception Code	0x01 - 0x04
3	CRC Hi	
4	CRC Lo	

Ex)



(2) Read Multi Register (0x03)

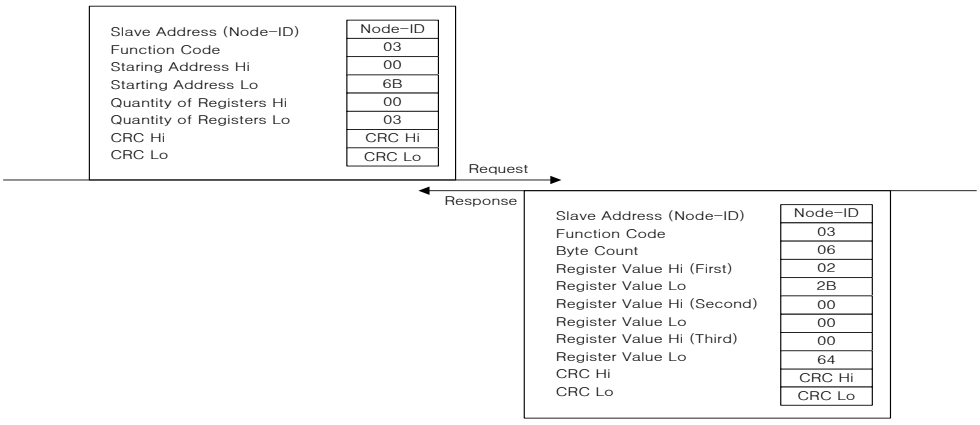
Read the continuous register block (16-bit data) value.

Sending Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x03
2	Starting Address Hi	0x00
3	Starting Address Lo	0x6B
4	Quantity of Register Hi	0x00
5	Quantity of Register Lo	0x03
6	CRC Hi	
7	CRC Lo	

Normal Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x03
2	Byte Count	0x06
3	Register Value Hi	0x02
4	Register Value Lo	0x2B
5	Register Value Hi	0x00
6	Register Value Lo	0x00
7	Register Value Hi	0x00
8	Register Value Lo	0x64
9	CRC Hi	.
10	CRC Lo	

Error Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1		0x03 + 0x80
2	Exception Code	0x01 - 0x04
3	CRC Hi	
4	CRC Lo	

Ex)



(3) Write Single Register (0x06)

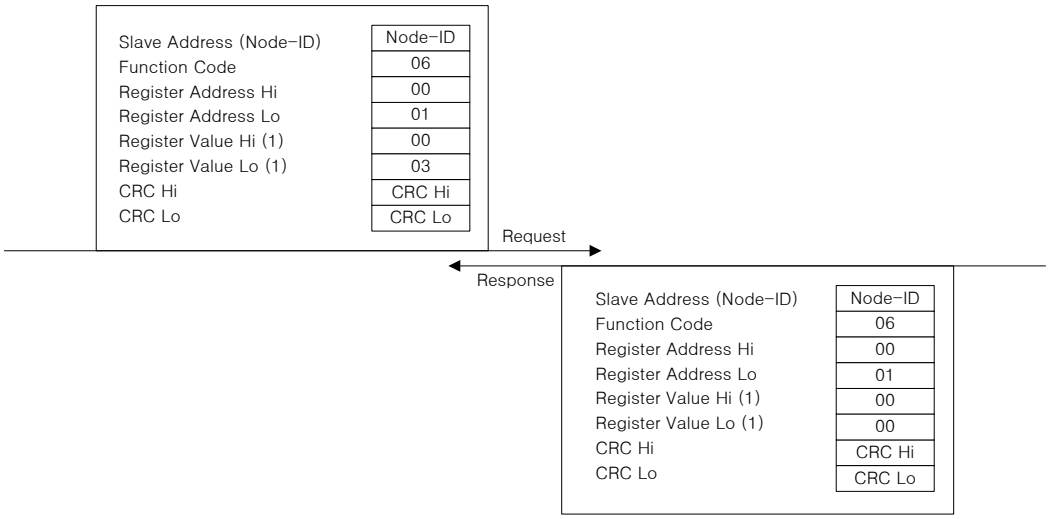
Write values on the single register (16-bit data).

Sending Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x06
2	Register Address Hi	0x00
3	Register Address Lo	0x01
4	Register Value Hi	0x00
5	Register Value Lo	0x03
6	CRC Hi	
7	CRC Lo	

Normal Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x06
2	Register Address Hi	0x00
3	Register Address Lo	0x01
4	Register Value Hi	0x00
5	Register Value Lo	0x03
6	CRC Hi	
7	CRC Lo	

Error Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1		0x06 + 0x80
2	Exception Code	0x01 - 0x06
3	CRC Hi	
4	CRC Lo	

Ex)



(4) Write Multi Register (0x10)

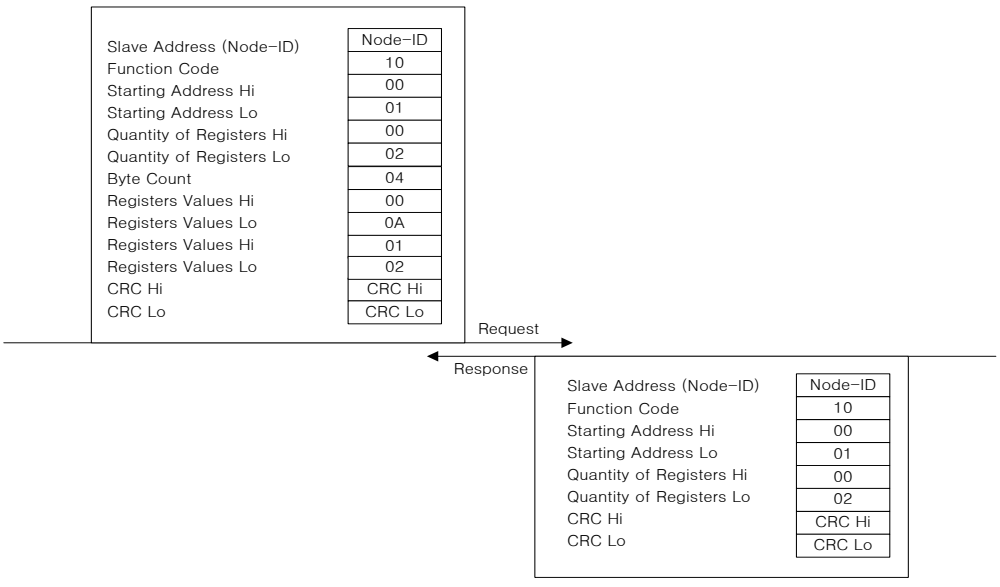
Writes values on the continuous register block (16-bit data).

Sending Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x10
2	Starting Address Hi	0x00
3	Starting Address Lo	0x01
4	Quantity of Registers Hi	0x00
5	Quantity of Registers Lo	0x02
6	Byte Count	0x04
7	Register Value Hi	0x00
8	Register Value Lo	0x0A
9	Register Value Hi	0x01
10	Register Value Lo	0x02
11	CRC Hi	
12	CRC Lo	

Normal Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x10
2	Starting Address Hi	0x00
3	Starting Address Lo	0x01
4	Quantity of Registers Hi	0x00
5	Quantity of Registers Lo	0x02
6	CRC Hi	
7	CRC Lo	

Error Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1		0x10 + 0x80
2	Exception Code	0x01 - 0x04
3	CRC Hi	
4	CRC Lo	

Ex)



(5) Read Each Block Register (0x6A)

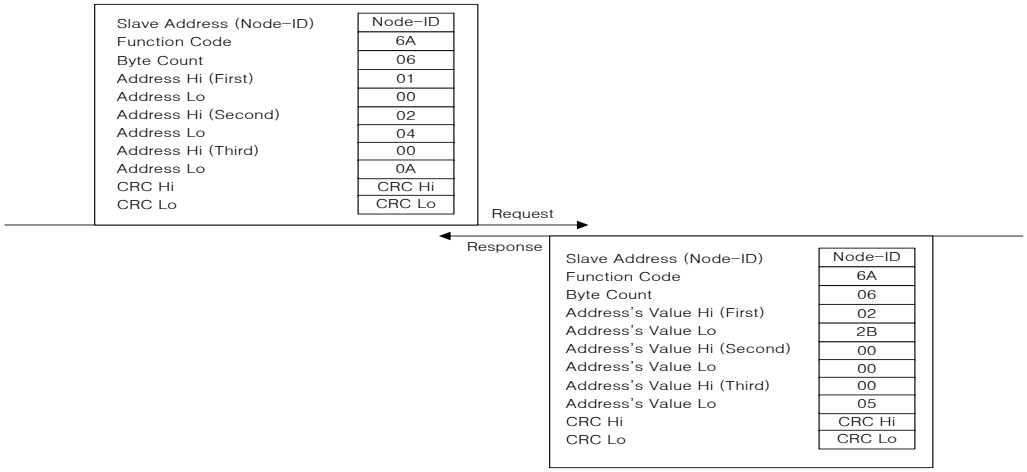
Read values on the discontinuous register block (16-bit data).

Sending Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x6A
2	Byte Count	0x06
3	Address Hi	0x00
4	Address Lo	0x01
5	Address Hi	0x00
6	Address Lo	0x04
7	Address Hi	0x00
8	Address Lo	0x08
9	CRC Hi	
10	CRC Lo	

Normal Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1	Function	0x6A
2	Byte Count	0x06
3	Register Value Hi	0x02
4	Register Value Lo	0x2B
5	Register Value Hi	0x00
6	Register Value Lo	0x00
7	Register Value Hi	0x00
8	Register Value Lo	0x64
9	CRC Hi	.
10	CRC Lo	

Error Receiving Packet		
Byte	**Content**	**Value**
0		0x00
1		0x6A + 0x80
2	Exception Code	0x01 - 0x04
3	CRC Hi	
4	CRC Lo	

Ex)



6.3 L7 Servo Drive Communication Address Table

6.3.1 Operation Status Parameter Communication Address Table

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	**Operation Status Display Parameter**		
0	Current operation status	St - 00	INT16 BIT0: Alarm BIT1: Servo on BIT2: Warning BIT3: CCW limit BIT4: CW limit BIT5: Zero speed BIT6: In speed BIT7: In position BIT8: Power ready BIT9: Analog command active BIT10 - BIT13: Control mode (0: Trq, 1: Spd, 2: Pos, 3: Spd/Pos, 4: Trq/Spd, 5: Trq/Pos)
2	Current operation speed	St - 01	INT16
4	Current command speed	St - 02	INT16
6	Tracking position pulse - L	St - 03	INT32
8	Tracking position pulse - H		
10	Position command pulse - L	St - 04	INT32
12	Position command pulse - H		
14	Remaining position pulse - L	St - 05	INT32
16	Remaining position pulse - H		
18	Input pulse frequency – L	St - 06	INT32
20	Input pulse frequency - H		
22	Current operation torque	St - 07	INT16
24	Current command torque	St - 08	INT16
26	Accumulated overload rate	St - 09	INT16
28	Instantaneous maximum load factor	St - 10	INT16
30	Torque limit value	St - 11	INT16
32	DC link voltage	St - 12	UINT16
34	Regenerative overload	St - 13	UINT16
36	Input contact status	St - 14	UINT16

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	**Operation Status Display Parameter**		
38	Output contact status	St - 15	UINT16
40	Single-turn data - L	St - 16	INT32
42	Single-turn data - H		
44	Single-turn data (degrees)	St - 17	UINT16
46	Multi-turn data - L	St - 18	INT32
48	Multi-turn data - H		
50	Temperature in the servo drive	St - 19	INT16
52	Rated motor speed	St - 20	UINT16
54	Maximum motor speed	St - 21	UINT16
56	Rated motor current	St - 22	UINT16
58	Phase U current offset	St - 23	INT16
60	Phase V current offset	St - 24	INT16
62	Software Version	St - 25	UINT16 BIT0 - BIT4: Drive capacity (1: 100w, 2: 200w, 3: 400w, 4: 750w, 5: 1Kw, 6: 3.5Kw) BIT5 - BIT14: Version number BIT15: Encoder type (0: Quadrature, 1: Serial)
64	FPGA Version	St - 26	UINT16
66	Analog torque command value	St - 27	INT16
68	Reserved		

6.3.2 System Parameter Communication Address Table

The following table lists Modbus communication addresses for the system parameter group [P0-xx]:

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	System Parameter		
70	Motor ID	P0 - 00	UINT16
72	Encoder Type	P0 - 01	UINT16
74	Encoder pulse	P0 - 02	UINT16
76	Select operation mode	P0 - 03	UINT16
78	RS-422 communication speed	P0 - 04	UINT16
80	System ID	P0 - 05	UINT16
82	Main power input mode	P0 - 06	UINT16
84	RST checking time	P0 - 07	UINT16
86	Start-up display parameter	P0 - 08	UINT16
88	Regenerative overload derating	P0 - 09	UINT16
90	Regenerative resistance value	P0 - 10	UINT16
92	Regenerative resistance capacity	P0 - 11	UINT16
94	Overload detection base load factor	P0 - 12	UINT16
96	Continuous overload warning level	P0 - 13	UINT16
98	Encoder output pre-scale - L	P0 - 14	INT32
100	Encoder output pre-scale - H		
102	PWM OFF delay time	P0 - 15	UINT16
104	Dynamic brake control mode	P0 - 16	UINT16
106	Function setting bit	P0 - 17	UINT16
108	DAC output mode	P0 - 18	UINT16
110	DAC output offset 1	P0 - 19	INT16
112	DAC output offset 2	P0 - 20	INT16
114	Reserved	P0 - 21	INT16
116	Reserved	P0 - 22	INT16
118	DAC output scale 1	P0 - 23	UINT16
120	DAC output scale 2	P0 - 24	UINT16
122	Reserved	P0 - 25	UINT16
124	Reserved	P0 - 26	UINT16

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	System Parameter		
126		P0 - 27	INT16
128		P0 - 28	INT16
130		P0 - 29	INT16
132	Reserved		
134	Reserved		
136	Reserved		
138	Reserved		

6.3.3 Control Parameter Communication Address Table

The following table lists Modbus communication addresses for the control parameter group [P1-xx]:

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	Control parameter		
140	Inertia ratio	P1 - 00	UINT16
142	Position proportional gain 1	P1 - 01	UINT16
144	Position proportional gain 2	P1 - 02	UINT16
146	Position command filter time constant	P1 - 03	UINT16
148	Position feedforward gain	P1 - 04	UINT16
150	Position feedforward filter time constant	P1 - 05	UINT16
152	Speed proportional gain 1	P1 - 06	UINT16
154	Speed proportional gain 2	P1 - 07	UINT16
156	Speed integral time constant 1	P1 - 08	UINT16
158	Speed integral time constant 2	P1 - 09	UINT16
160	Speed command filter time constant	P1 - 10	UINT16
162	Speed feedback filter time constant	P1 - 11	UINT16
164	Torque command filter time constant	P1 - 12	UINT16
166	Forward rotation torque limit	P1 - 13	UINT16
168	Counterclockwise rotation torque limit	P1 - 14	UINT16
170	Gain switching mode	P1 - 15	UINT16
172	Gain switching time	P1 - 16	UINT16
174	Resonance avoidance operation	P1 - 17	UINT16
176	Resonance avoidance frequency	P1 - 18	UINT16
178	Resonance avoidance range	P1 - 19	UINT16
180	Auto gain tuning speed	P1 - 20	UINT16
182	Auto gain tuning distance	P1 - 21	UINT16
184	Torque control speed limiting mode	P1 - 22	UINT16
186	Speed limit	P1 - 23	UINT16
188	Control P switching torque	P1 - 24	UINT16

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	Control parameter		
190	Control P switching speed	P1 - 25	UINT16
192	Control P switching acceleration	P1 - 26	UINT16
194	Control P switching position error	P1 - 27	UINT16
196	Reserved		
198	Reserved		
200	Reserved		
202	Reserved		
204	Reserved		
206	Reserved		
208	Reserved		
210	Reserved		
212	Reserved		
214	Reserved		
216	Reserved		
218	Reserved		

6.3.4 Input/Output Parameter Communication Address Table

The following table lists Modbus communication addresses for the input/output (analog and digital) parameter group [P2-xx]:

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	**Input/Output Parameter**		
220	Input signal definition 1	P2 - 00	UINT16
222	Input signal definition 2	P2 - 01	UINT16
224	Input signal definition 3	P2 - 02	UINT16
226	Input signal definition 4	P2 - 03	UINT16
228	Input signal definition 5	P2 - 04	UINT16
230	Output signal definition 1	P2 - 05	UINT16
232	Output signal definition 2	P2 - 06	UINT16
234	Output signal definition 3	P2 - 07	UINT16
236	Input signal logic definition 1	P2 - 08	UINT16
238	Input signal logic definition 2	P2 - 09	UINT16
240	Output signal logic definition	P2 - 10	UINT16
242	Range of output for position reached	P2 - 11	UINT16
244	Zero speed output range	P2 - 12	UINT16
246	Range of output for speed reached	P2 - 13	UINT16
248	Brake output operation speed	P2 - 14	UINT16
250	Brake output delay time	P2 - 15	UINT16
252	Position pulse clear mode	P2 - 16	UINT16
254	Analog speed command scale	P2 - 17	UINT16
256	Analog speed command offset	P2 - 18	INT16
258	Zero speed clamp speed	P2 - 19	UINT16
260	Analog torque command scale	P2 - 20	UINT16
262	Analog torque command offset	P2 - 21	INT16
264	Zero speed clamp voltage	P2 - 22	UINT16
266	Reserved		
268	Reserved		
270	Reserved		
272	Reserved		
274	Reserved		
276	Reserved		
278	Reserved		

6.3.5 Speed Operation Parameter Communication Address Table

The following table lists Modbus communication addresses for the speed operation parameter group [P3-xx]:

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	**Speed operation parameter**		
280	Digital speed command 1	P3 - 00	INT16
282	Digital speed command 2	P3 - 01	INT16
284	Digital speed command 3	P3 - 02	INT16
286	Digital speed command 4	P3 - 03	INT16
288	Digital speed command 5	P3 - 04	INT16
290	Digital speed command 6	P3 - 05	INT16
292	Digital speed command 7	P3 - 06	INT16
294	Z search operation speed setting	P3 - 07	UINT16
296	Speed command acceleration time	P3 - 08	UINT16
298	Speed command deceleration time	P3 - 09	UINT16
300	Speed command S-Curve time	P3 - 10	UINT16
302	Speed operation pattern	P3 - 11	UINT16
304	Manual JOG operation speed	P3 - 12	INT16
306	Program JOG operation speed 1	P3 - 13	INT16
308	Program JOG operation speed 2	P3 - 14	INT16
310	Program JOG operation speed 3	P3 - 15	INT16
312	Program JOG operation speed 4	P3 - 16	INT16
314	Program JOG operation time 1	P3 - 17	UINT16
316	Program JOG operation time 2	P3 - 18	UINT16
318	Program JOG operation time 3	P3 - 19	UINT16
320	Program JOG operation time 4	P3 - 20	UINT16
322	Reserved		
324	Reserved		
326	Reserved		
328	Reserved		

6.3.6 Position Operation Parameter Communication Address Table

The following table lists Modbus communication addresses for the position operation parameter group [P4-xx]:

Communication Address	Parameter Name	Parameter Number	Material Type
(Decimal Number)	**Position operation parameter**		
330	Position input pulse logic	P4 - 00	UINT16
332	Electronic gear ratio numerator 1 - L	P4 - 01	INT32
334	Electronic gear ratio numerator 1 - H		
336	Electronic gear ratio numerator 2 - L	P4 - 02	INT32
338	Electronic gear ratio numerator 2 - H		
340	Electronic gear ratio denominator 3 - L	P4 - 03	INT32
342	Electronic gear ratio denominator 3 - H		
344	Electronic gear ratio denominator 4 - H	P4 - 04	INT32
346	Electronic gear ratio denominator 4 - L		
348	Electronic gear ratio numerator 1	P4 - 05	UINT16
350	Electronic gear ratio numerator 2	P4 - 06	UINT16
352	Electronic gear ratio numerator 3	P4 – 07	UINT16
354	Electronic gear ratio numerator 4	P4 - 08	UINT16
356	Electronic gear ratio mode	P4 – 09	UINT16
358	Electronic gear ratio numerator offset	P4 - 10	UINT16
360	Position error range - L	P4 - 11	INT32
362	Position error range - H		
364	Limit contact function	P4 – 12	UINT16
366	Backlash compensation	P4 - 13	UINT16
368	Pulse input filter	P4 – 14	UINT16

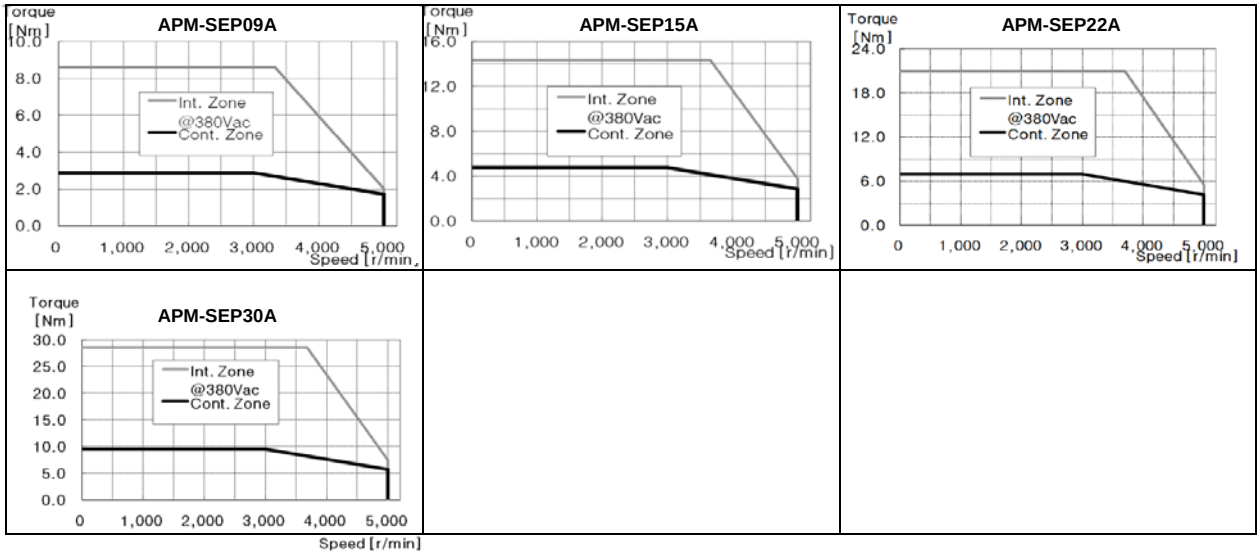
7. Product Specifications

7.1 Servo motor

7.1.1 Product Features

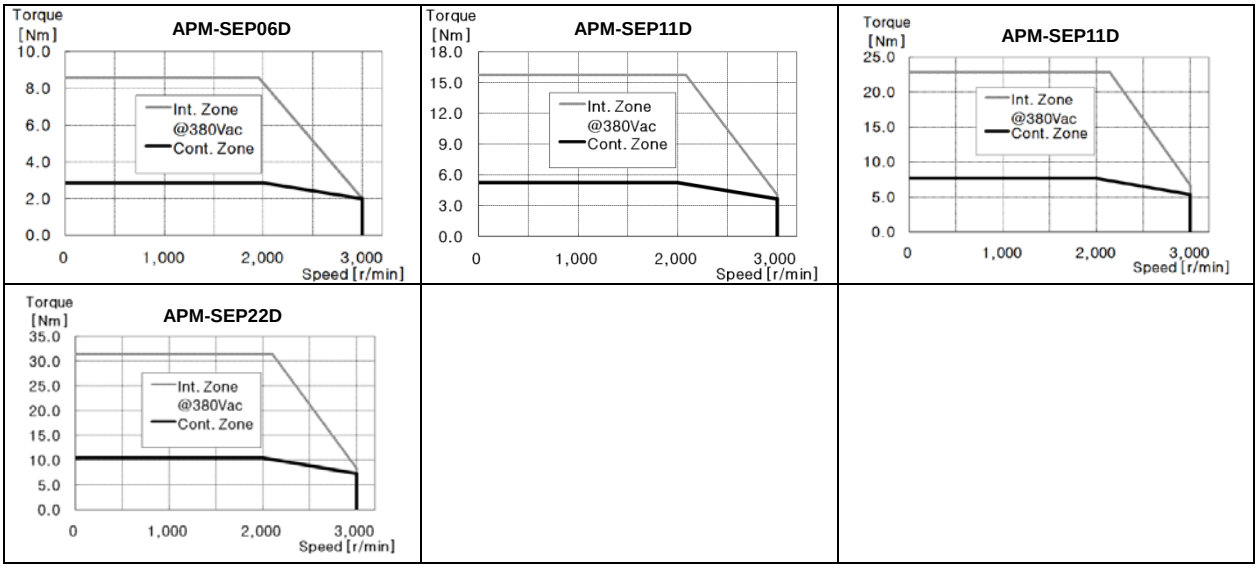
Servo Motor Type (APM-□)		SEP09A	SEP15A	SEP22A	SEP30A		
Applicable Drive (L7□B□)		L7□B010□	L7□B020□	L7□B020□	L7□B035□		
Rated Output	kW	0.9	1.5	2.2	3.0		
Rated torque	N·m	2.86	4.77	7.0	9.55		
	kgf·cm	29.23	48.72	71.46	97.44		
Maximum instantaneous torque	N·m	8.59	14.32	21.01	28.65		
	kgf·cm	87.7	146.16	214.37	292.33		
Rated rotation speed	r/min	3000					
Maximum rotation speed	r/min	5000					
Inertia moment	$kg·m^2x10^{-4}$	6.659	11.999	17.339	22.679		
	$gf·cm·s^2$	6.795	12.244	17.693	23.142		
Permitted load inertia		Motor inertia x10					
Rated power	kW/s	12.32	19.00	28.28	40.21		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



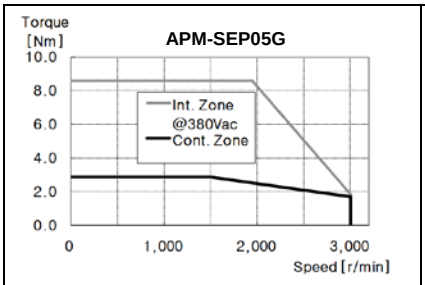
Servo Motor Type (APM-□)		SEP06D	SEP11D	SEP16D	SEP22D		
Applicable Drive (L7□B□)		L7□B010□	L7□B010□	L7□B020□	L7□B020□		
Rated Output	kW	0.6	1.1	1.6	2.2		
Rated torque	N·m	2.86	5.25	7.64	10.5		
	kgf·cm	29.23	53.59	77.95	107.19		
Maximum instantaneous torque	N·m	8.59	15.76	22.92	31.51		
	kgf·cm	87.7	160.78	233.86	321.56		
Rated rotation speed	r/min	2000					
Maximum rotation speed	r/min	3000					
Inertia moment	$kg·m^2x10^{-4}$	6.659	11.999	17.339	22.679		
	$gf·cm·s^2$	6.795	12.244	17.693	23.142		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	12.32	22.99	48.64	91.96		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

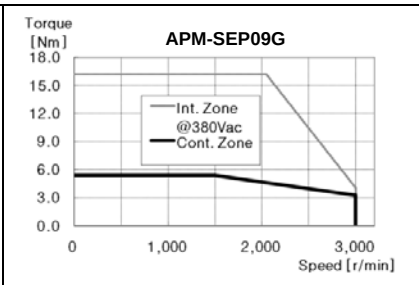
♦Speed-Torque characteristics♦

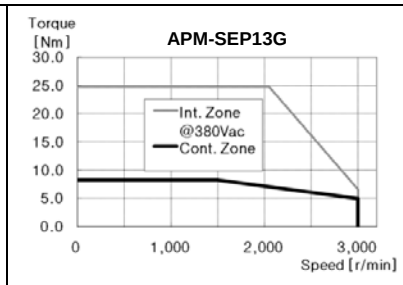


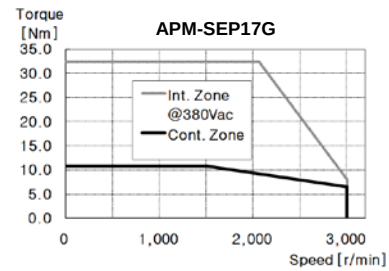
Servo Motor Type (APM-□)		SEP05G	SEP09G	SEP13G	SEP17G		
Applicable Drive (L7□B□)		L7□B010□	L7□B010□	L7□B020□	L7□B020□		
Rated Output	kW	0.45	0.85	1.3	1.7		
Rated torque	N·m	2.86	5.41	8.28	10.82		
	kgf·cm	29.23	55.22	84.45	110.43		
Maximum instantaneous torque	N·m	8.59	16.23	24.83	32.47		
	kgf·cm	87.70	165.65	253.35	331.30		
Rated rotation speed	r/min	1500					
Maximum rotation speed	r/min	3000					
Inertia moment	$kg·m^2x10^{-4}$	6.659	11.999	17.339	22.679		
	$gf·cm·s^2$	6.795	12.244	17.693	23.142		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	12.32	24.4	57.08	97.61		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



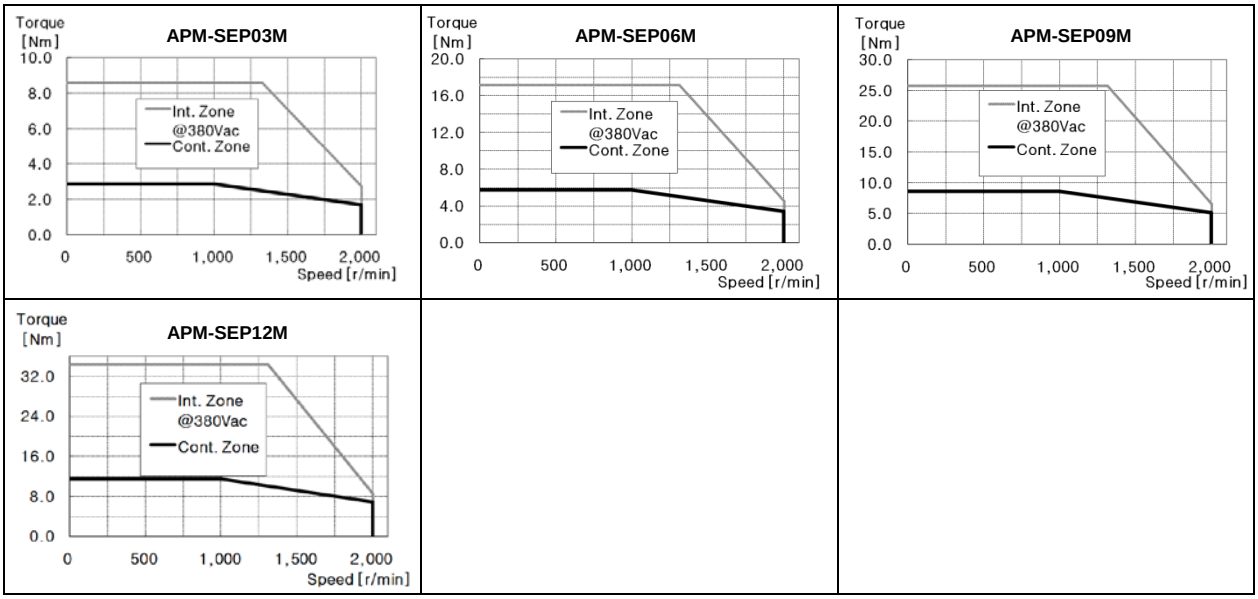






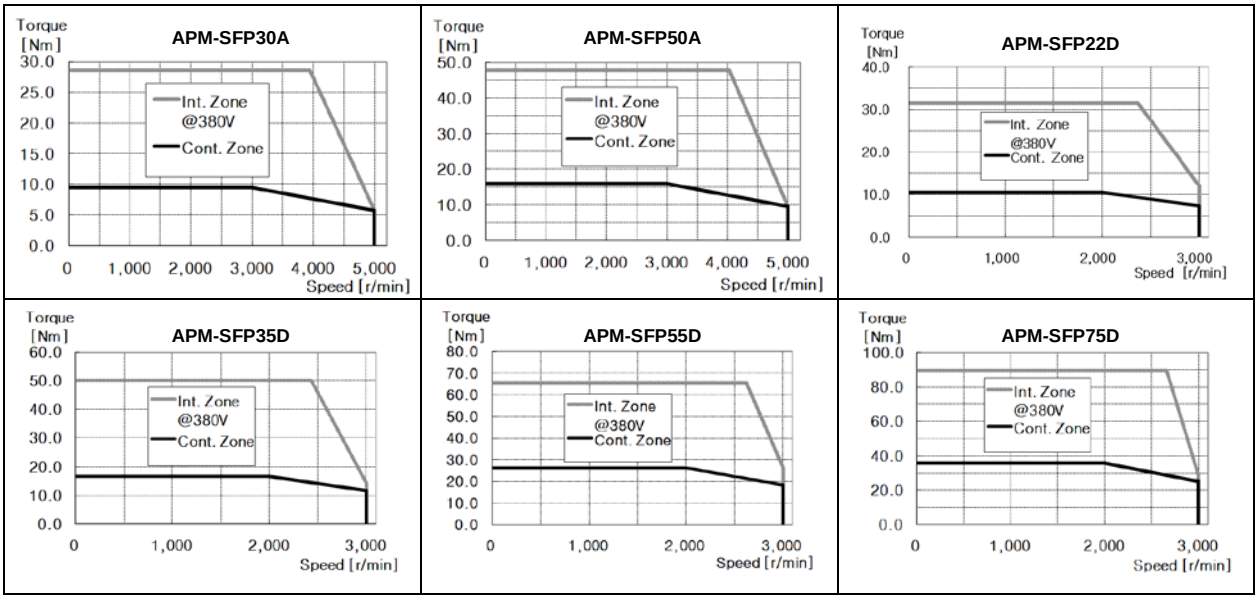
Servo Motor Type (APM-□)		SEP03M	SEP06M	SEP09M	SEP12M		
Applicable Drive (L7□B□)		L7□B010□	L7□B010□	L7□B010□	L7□B020□		
Rated Output	kW	0.3	0.6	0.9	1.2		
Rated torque	N·m	2.86	5.73	8.59	11.46		
	kgf·cm	29.23	58.47	87.70	116.93		
Maximum instantaneous torque	N·m	8.59	17.19	25.78	34.38		
	kgf·cm	87.70	175.40	263.09	350.79		
Rated rotation speed	r/min	1000					
Maximum rotation speed	r/min	2000					
Inertia moment	$kg \cdot m^2 x10^{-4}$	6.659	11.999	17.339	22.679		
	$gf \cdot cm \cdot s^2$	6.795	12.244	17.693	23.142		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	12.32	27.36	42.60	57.90		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



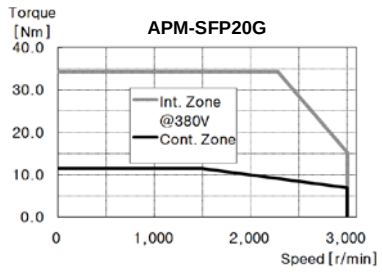
Servo Motor Type (APM-□)		SFP30A	SFP50A	SFP22D	SFP35D	SFP55D	SFP75D
Applicable Drive (L7□B□)		L7□B035□	L7□B075□	L7□B020□	L7□B035□	L7□B075□	L7□B075□
Rated Output	kW	3.0	5.0	2.2	3.5	5.5	7.5
Rated torque	N·m	9.55	15.92	10.50	16.71	26.26	35.81
	kgf·cm	97.44	162.40	107.19	170.52	267.96	365.41
Maximum instantaneous torque	N·m	28.65	39.79	31.51	50.13	65.65	89.52
	kgf·cm	292.33	406.01	321.56	511.57	669.91	913.52
Rated rotation speed	r/min	3000		2000			
Maximum rotation speed	r/min	5000		3000			
Inertia moment	$kg \cdot m^2 x10^{-4}$	30.740	52.130	30.740	52.130	83.600	121.350
	$gf \cdot cm \cdot s^2$	31.367	53.194	31.367	53.194	85.306	123.827
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	29.66	48.59	35.89	53.57	82.49	105.67
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

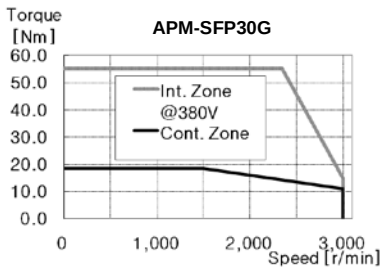
♦Speed-Torque characteristics♦

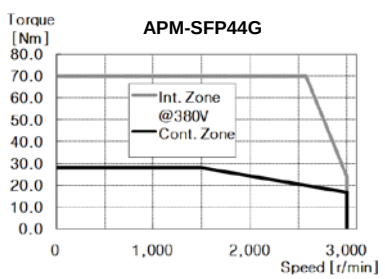


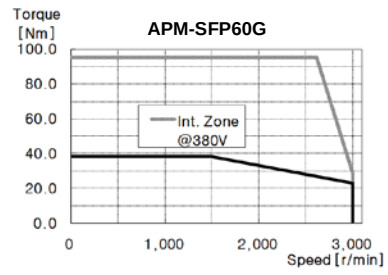
Servo Motor Type (APM-□)		SFP20G	SFP30G	SFP44G	SFP60G	SFP75G	
Applicable Drive (L7□B□)		L7□B020□	L7□B075□	L7□B075□	L7□B075□	L7□B0150□	
Rated Output	kW	1.8	2.9	4.4	6.0	7.5	
Rated torque	N·m	11.46	18.46	28.01	38.20	47.75	
	kgf·cm	116.93	188.39	285.83	389.77	487.21	
Maximum instantaneous torque	N·m	34.38	55.39	70.03	95.49	119.37	
	kgf·cm	350.79	565.16	714.57	974.42	1,218.02	
Rated rotation speed	r/min	1500					
Maximum rotation speed	r/min	3000				2500	
Inertia moment	$kg \cdot m^2 x10^{-4}$	30.740	52.130	83.600	121.350	143.820	
	$gf \cdot cm \cdot s^2$	31.367	53.194	85.306	123.827	146.755	
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	42.72	65.38	93.86	120.23	158.51	
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

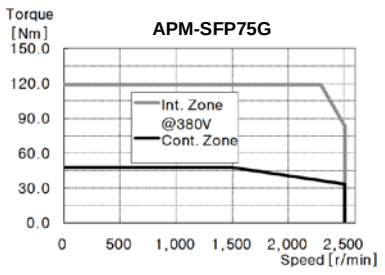
♦Speed-Torque characteristics♦





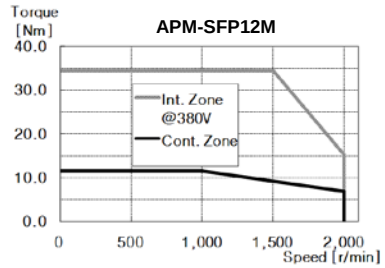


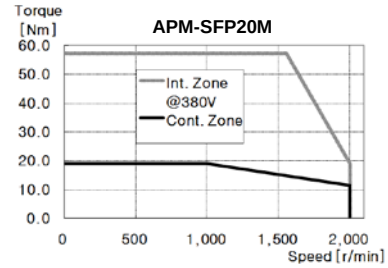


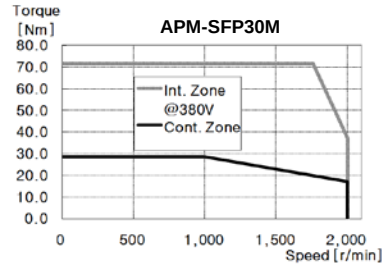


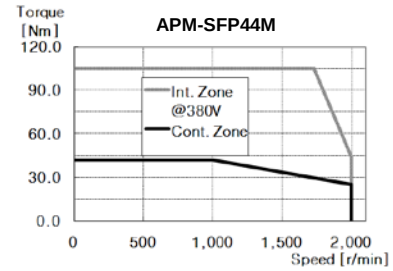
Servo Motor Type (APM-□)		SFP12M	SFP20M	SFP30M	SF44M		
Applicable Drive (L7□B□)		L7□B020□	L7□B020□	L7□B075□	L7□B075□		
Rated Output	kW	1.2	2.0	3.0	4.4		
Rated torque	N·m	11.46	19.10	28.65	42.02		
	kgf·cm	116.93	194.88	292.33	428.74		
Maximum instantaneous torque	N·m	34.38	57.30	71.62	105.04		
	kgf·cm	350.79	584.65	730.81	1,071.86		
Rated rotation speed	r/min	1000					
Maximum rotation speed	r/min	2000					
Inertia moment	$kg·m^2x10^{-4}$	30.740	52.130	83.600	121.350		
	$gf·cm·s^2$	31.367	53.194	85.306	123.827		
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	42.72	69.97	98.17	145.48		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



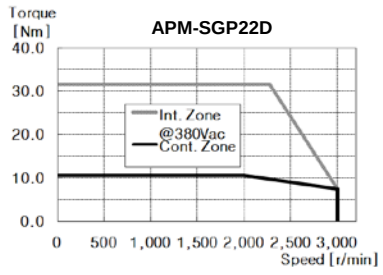


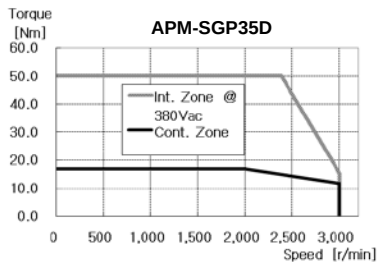


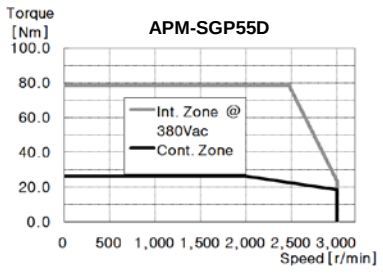


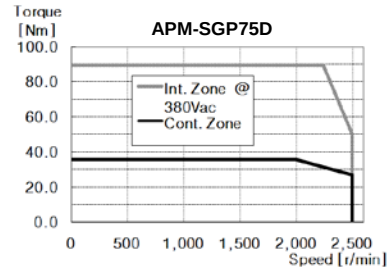
Servo Motor Type (APM-□)		SGP22D	SGP35D	SGP55D	SGP75D	SGP110D	
Applicable Drive (L7□B□)		L7□B020□	L7□B035□	L7□B075□	L7□B075□	L7□B0150□	
Rated Output	kW	2.2	3.5	5.5	7.5	11.0	
Rated torque	N·m	16.71	26.26	35.81	52.52	16.71	
	kgf·cm	170.52	267.96	365.41	535.93	170.52	
Maximum instantaneous torque	N·m	50.13	78.78	89.52	131.30	50.13	
	kgf·cm	511.57	803.89	913.52	1,339.82	511.57	
Rated rotation speed	r/min	2000					
Maximum rotation speed	r/min	3000			2500		
Inertia moment	$kg \cdot m^2 x10^{-4}$	51.42	80.35	132.41	172.91	291.36	
	$gf \cdot cm \cdot s^2$	52.47	81.99	135.11	176.44	297.31	
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	21.46	34.76	52.08	74.16	94.65	
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

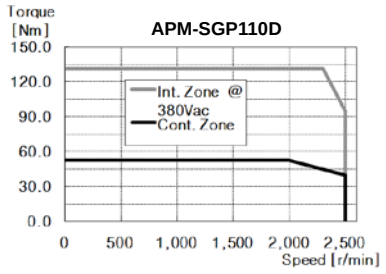
♦Speed-Torque characteristics♦





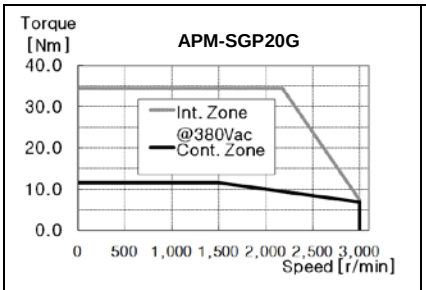


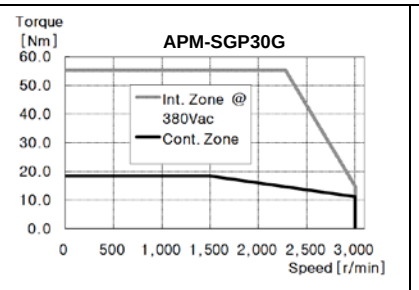


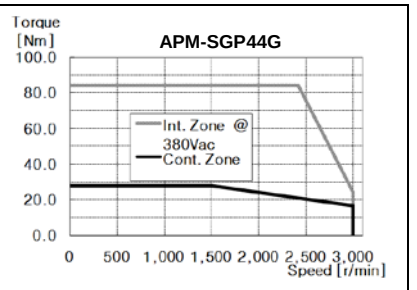


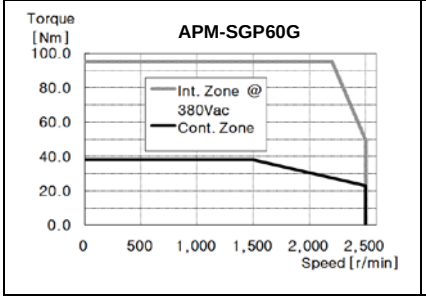
Servo Motor Type (APM-□)		SGP20G	SGP30G	SGP44G	SGP60G	SGP85G	SGP110G
Applicable Drive (L7□B□)		L7□B020□	L7□B075□	L7□B075□	L7□B075□	L7□B150□	L7□B150□
Rated Output	kW	1.8	2.9	4.4	6.0	8.5	11.0
Rated torque	N·m	11.46	18.46	28.01	38.20	54.11	70.03
	kgf·cm	116.93	188.39	285.83	389.77	552.17	714.57
Maximum instantaneous torque	N·m	34.38	55.39	70.03	95.49	135.28	175.07
	kgf·cm	350.79	565.16	714.57	974.42	1,380.43	1,786.43
Rated rotation speed	r/min	1500					
Maximum rotation speed	r/min	3000			2500		2000
Inertia moment	$kg·m^2x10^{-4}$	51.42	80.35	132.41	172.91	291.36	51.42
	$gf·cm·s^2$	52.47	81.99	135.11	176.44	297.31	52.47
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	25.531	42.41	59.25	84.36	100.5	168.3
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

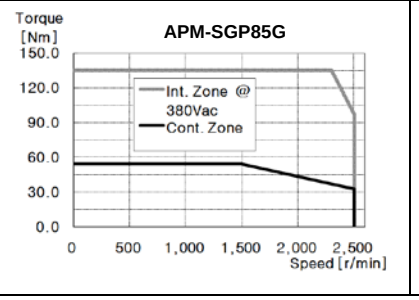
♦Speed-Torque characteristics♦

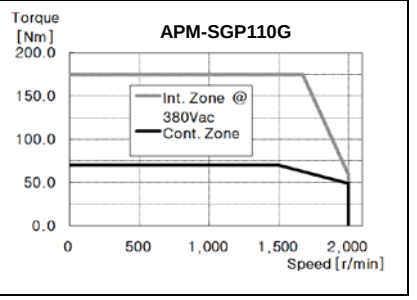






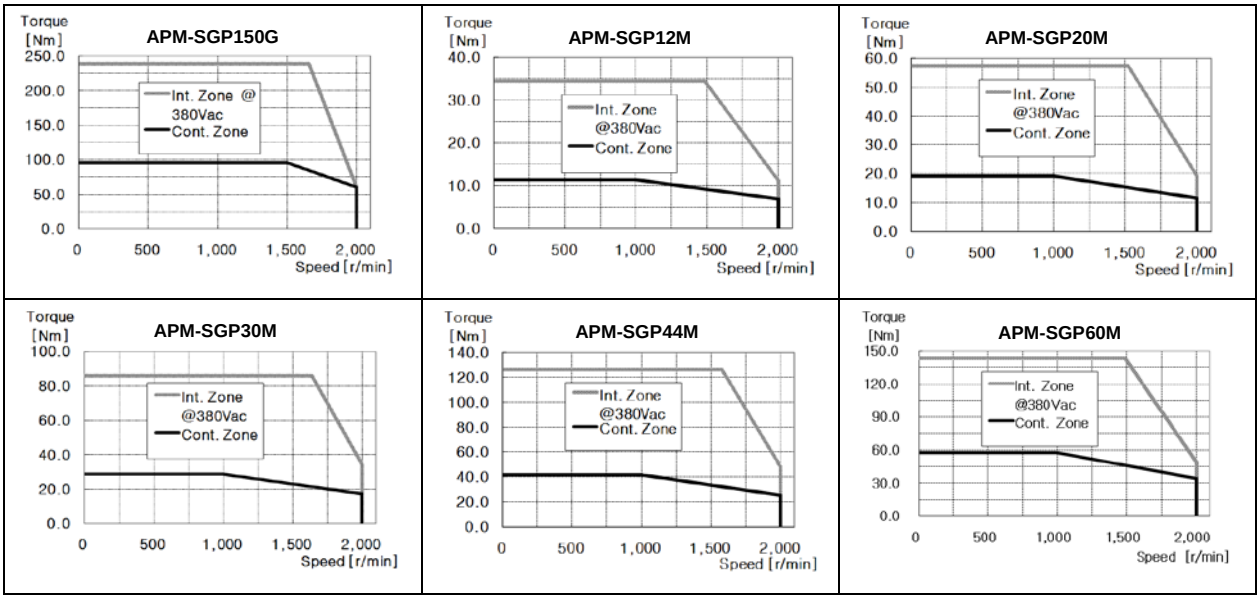






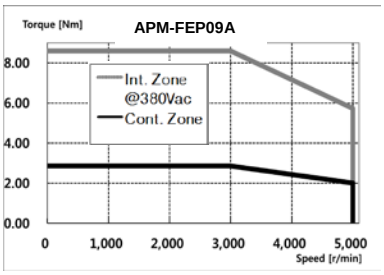
Servo Motor Type (APM-□)		SGP150G	SGP12M	SGP20M	SGP30M	SGP44M	SGP60M
Applicable Drive (L7□B□)		L7□B150□	L7□B020□	L7□B020□	L7□B075□	L7□B075□	L7□B150□
Rated Output	kW	15.0	1.2	2.0	3.0	4.4	6.0
Rated torque	N·m	95.49	11.46	19.10	28.65	42.02	57.30
	kgf·cm	974.42	116.93	194.88	292.33	428.74	584.65
Maximum instantaneous torque	N·m	238.73	34.38	57.30	85.94	105.04	143.24
	kgf·cm	2,436.05	350.79	584.65	876.98	1,071.86	1,461.63
Rated rotation speed	r/min	1500	1000				
Maximum rotation speed	r/min	2000	2000				
Inertia moment	$kg·m^2x10^{-4}$	424.5	51.42	80.35	132.41	172.91	291.36
	$gf·cm·s^2$	433.2	52.47	81.99	135.11	176.44	297.31
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	214.8	25.53	45.39	61.97	102.08	112.64
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

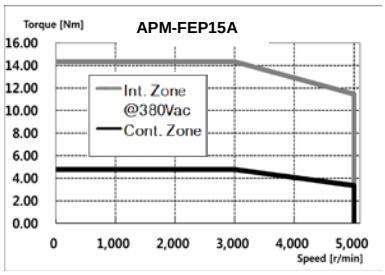
♦Speed-Torque characteristics♦

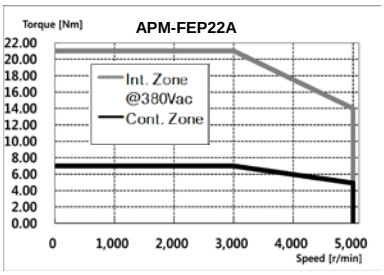


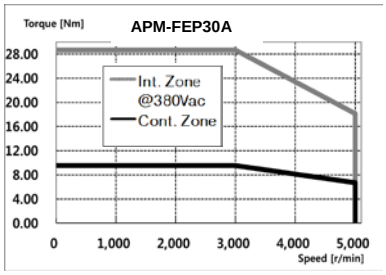
Servo Motor Type (APM-□)		FEP09A	FEP15A	FEP22A	FEP30A		
Applicable Drive (L7□B□)		L7□B010□	L7□B020□	L7□B030□	L7□B030□		
Rated Output	kW	0.9	1.5	2.2	3.0		
Rated torque	N·m	2.86	4.77	7.0	9.55		
	kgf·cm	29.23	48.72	71.46	97.44		
Maximum instantaneous torque	N·m	8.59	14.32	21.01	28.65		
	kgf·cm	87.7	146.16	214.37	292.33		
Rated rotation speed	r/min	3000					
Maximum rotation speed	r/min	5000					
Inertia moment	$kg \cdot m^2 x10^{-4}$	5.659	10.179	14.619	19.040		
	$gf \cdot cm \cdot s^2$	5.774	10.387	14.917	19.429		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	14.50	22.40	33.55	47.89		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



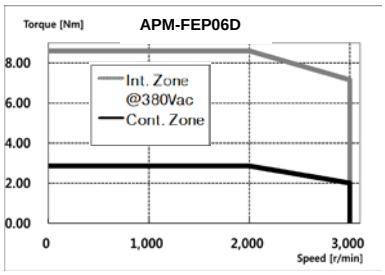


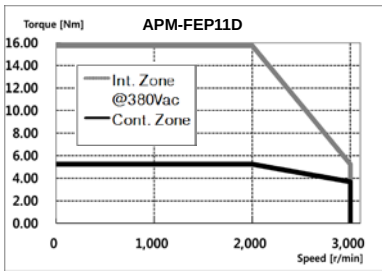


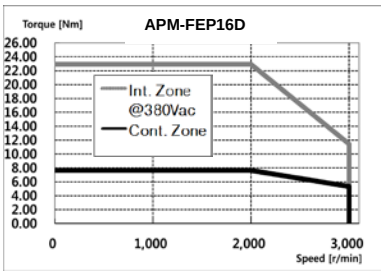


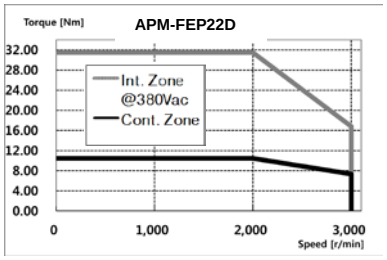
Servo Motor Type (APM-□)		FEP06D	FEP11D	FEP16D	FEP22D		
Applicable Drive (L7□B□)		L7□B010□	L7□B010□	L7□B020□	L7□B020□		
Rated Output	kW	0.6	1.1	1.6	2.2		
Rated torque	N·m	2.86	5.25	7.64	10.5		
	kgf·cm	29.23	53.59	77.95	107.19		
Maximum instantaneous torque	N·m	8.59	15.76	22.92	31.51		
	kgf·cm	87.7	160.78	233.86	321.56		
Rated rotation speed	r/min	2000					
Maximum rotation speed	r/min	3000					
Inertia moment	$kg·m^2x10^{-4}$	5.659	10.179	14.619	19.040		
	$gf·cm·s^2$	5.774	10.387	14.917	19.429		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	14.50	27.10	39.92	57.95		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



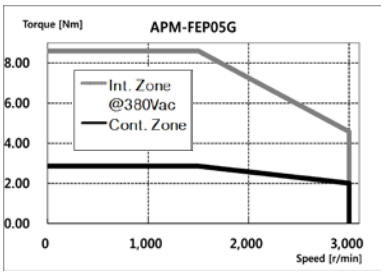


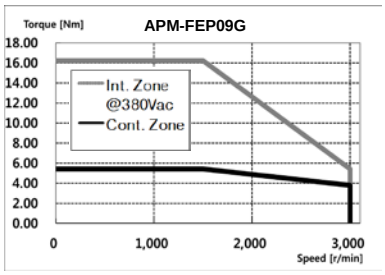


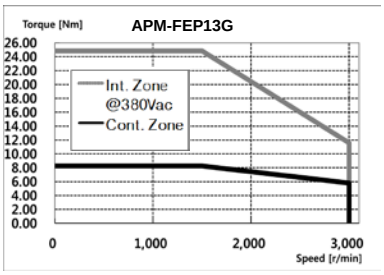


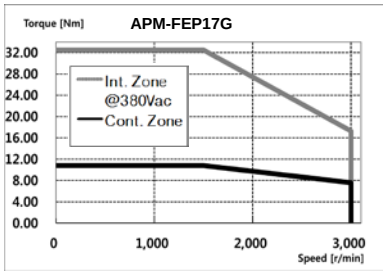
Servo Motor Type (APM-□)		FEP05G	FEP09G	FEP13G	FEP17G		
Applicable Drive (L7□B□)		L7□B010□	L7□B010□	L7□B020□	L7□B020□		
Rated Output	kW	0.45	0.85	1.3	1.7		
Rated torque	N·m	2.86	5.41	8.28	10.82		
	kgf·cm	29.23	55.22	84.45	110.43		
Maximum instantaneous torque	N·m	8.59	16.23	24.83	32.47		
	kgf·cm	87.70	165.65	253.35	331.30		
Rated rotation speed	r/min	1500					
Maximum rotation speed	r/min	3000					
Inertia moment	$kg \cdot m^2 x10^{-4}$	5.659	10.179	14.619	19.040		
	$gf \cdot cm \cdot s^2$	5.774	10.387	14.917	19.429		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	14.50	28.77	46.85	61.52		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



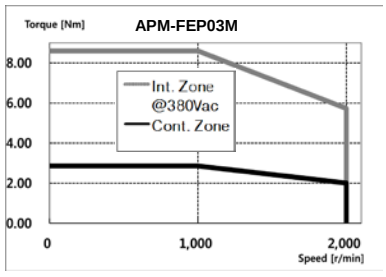


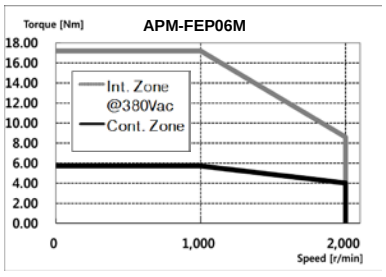


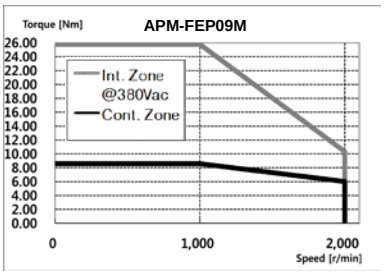


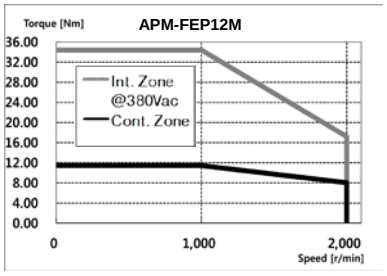
Servo Motor Type (APM-□)		FEP03M	FEP06M	FEP09M	FEP12M		
Applicable Drive (L7□B□)		L7□B010□	L7□B010□	L7□B010□	L7□B020□		
Rated Output	kW	0.3	0.6	0.9	1.2		
Rated torque	N·m	2.86	5.73	8.59	11.46		
	kgf·cm	29.23	58.47	87.70	116.93		
Maximum instantaneous torque	N·m	8.59	17.19	25.78	34.38		
	kgf·cm	87.70	175.40	263.09	350.79		
Rated rotation speed	r/min	1000					
Maximum rotation speed	r/min	2000					
Inertia moment	$kg·m^2x10^{-4}$	5.659	10.179	14.619	19.040		
	$gf·cm·s^2$	5.774	10.387	14.917	19.429		
Permitted load inertia		Motor inertia x10					
Rated power rate	kW/s	14.50	32.25	50.53	68.97		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



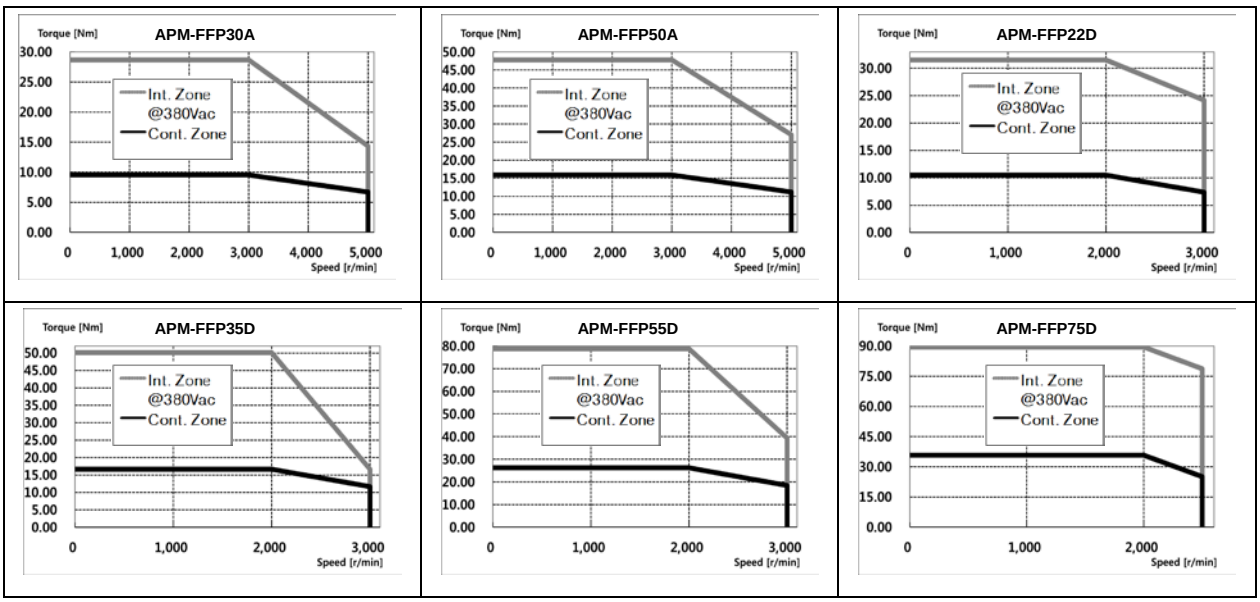






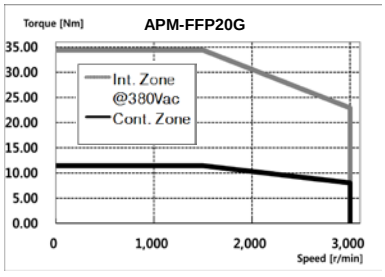
Servo Motor Type (APM-□)		FFP30A	FFP50A	FFP22D	FFP35D	FFP55D	FFP75D
Applicable Drive (L7□B□)		L7□B035□	L7□B075□	L7□B020□	L7□B035□	L7□B075□	L7□B075□
Rated Output	kW	3.0	5.0	2.2	3.5	5.5	7.5
Rated torque	N·m	9.55	15.92	10.50	16.71	26.26	35.81
	kgf·cm	97.44	162.40	107.19	170.52	267.96	365.41
Maximum instantaneous torque	N·m	28.65	39.79	31.51	50.13	65.65	89.52
	kgf·cm	292.33	406.01	321.56	511.57	669.91	913.52
Rated rotation speed	r/min	3000		2000			
Maximum rotation speed	r/min	5000		3000			2500
Inertia moment	$kg \cdot m^2 x10^{-4}$	27.960	46.560	27.960	46.560	73.850	106.730
	$gf \cdot cm \cdot s^2$	28.531	47.510	28.531	47.510	75.357	108.908
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	32.61	54.40	39.46	59.98	93.38	120.15
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

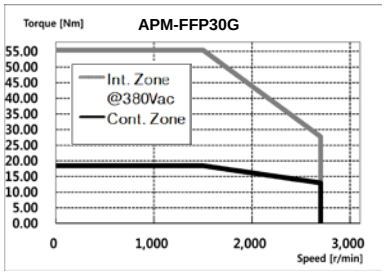
♦Speed-Torque characteristics♦

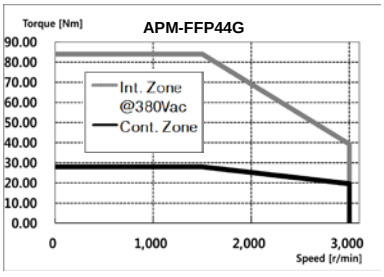


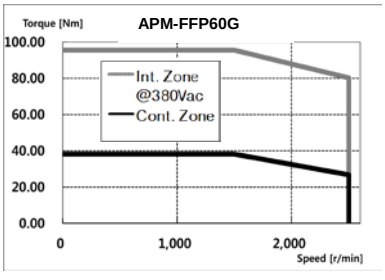
Servo Motor Type (APM-□)		FFP20G	FFP30G	FFP44G	FFP60G	FFP75G	
Applicable Drive (L7□B□)		L7□B020□	L7□B035□	L7□B075□	L7□B075□	L7□B075□	
Rated Output	kW	1.8	2.9	4.4	6.0	7.5	
Rated torque	N·m	11.46	18.46	28.01	38.20	47.75	
	kgf·cm	116.93	188.39	285.83	389.77	487.21	
Maximum instantaneous torque	N·m	34.38	55.39	84.03	95.49	119.37	
	kgf·cm	350.79	565.16	857.49	974.42	1,218.02	
Rated rotation speed	r/min	1500					
Maximum rotation speed	r/min	3000	2700	3000	2500	2200	
Inertia moment	$kg·m^2x10^{-4}$	27.960	46.560	73.850	106.730	131.290	
	$gf·cm·s^2$	28.531	47.510	75.357	108.908	133.969	
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	46.96	73.21	106.25	136.70	173.64	
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

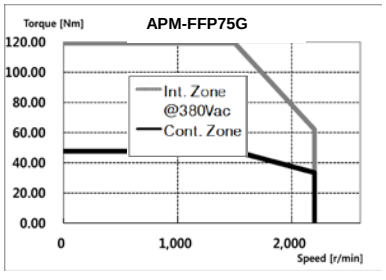
♦Speed-Torque characteristics♦





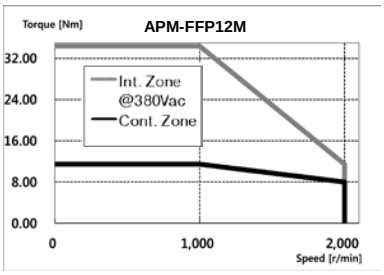


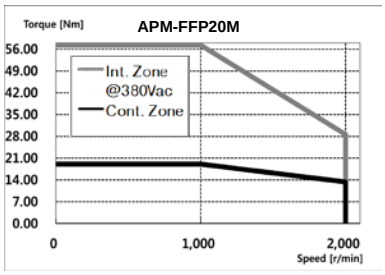


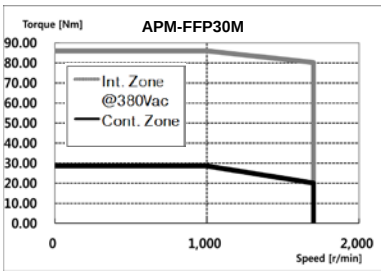


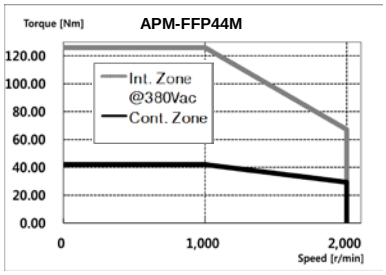
Servo Motor Type (APM-□)		FFP12M	FFP20M	FFP30M	FFP44M		
Applicable Drive (L7□B□)		L7□B020□	L7□B020□	L7□B075□	L7□B075□		
Rated Output	kW	1.2	2.0	3.0	4.4		
Rated torque	N·m	11.46	19.10	28.65	42.02		
	kgf·cm	116.93	194.88	292.33	428.74		
Maximum instantaneous torque	N·m	34.38	57.30	85.94	126.05		
	kgf·cm	350.79	584.65	876.98	1286.23		
Rated rotation speed	r/min	1000					
Maximum rotation speed	r/min	2000		1700	2000		
Inertia moment	$kg·m^2x10^{-4}$	27.960	46.560	73.850	106.730		
	$gf·cm·s^2$	28.531	47.510	75.357	108.908		
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	46.96	78.38	111.13	165.41		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



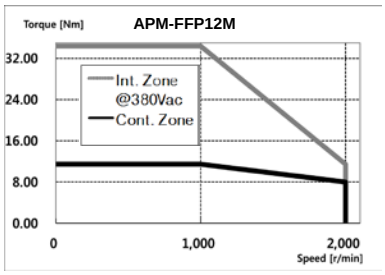


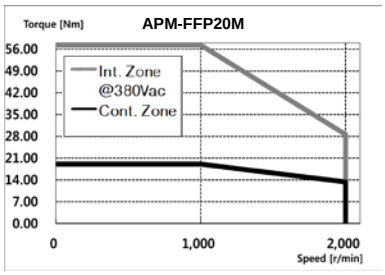


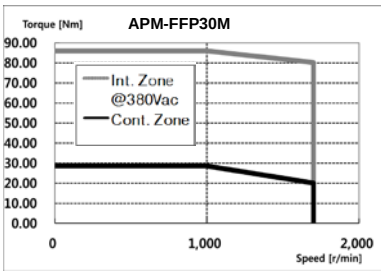


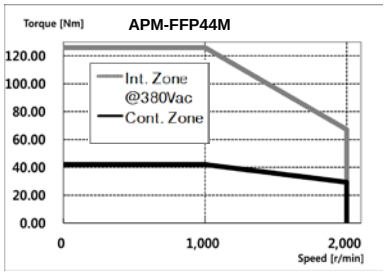
Servo Motor Type (APM-□)		FGP22D	FGP35D	FGP55D	FGP75D		
Applicable Drive (L7□B□)		L7□B020□	L7□B035□	L7□B075□	L7□B075□		
Rated Output	kW	2.2	3.5	5.5	7.5		
Rated torque	N·m	10.50	16.71	26.26	35.81		
	kgf·cm	107.19	170.52	267.96	365.41		
Maximum instantaneous torque	N·m	31.51	50.13	78.78	89.52		
	kgf·cm	321.56	511.57	803.89	913.52		
Rated rotation speed	r/min	2000					
Maximum rotation speed	r/min	3000	2700	3000	2500		
Inertia moment	$kg \cdot m^2 x10^{-4}$	41.13	71.53	117.72	149.40		
	$gf \cdot cm \cdot s^2$	41.67	72.99	120.12	152.45		
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	26.83	39.04	58.58	85.83		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



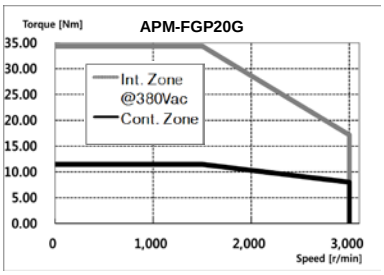


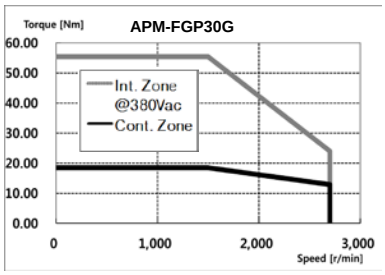


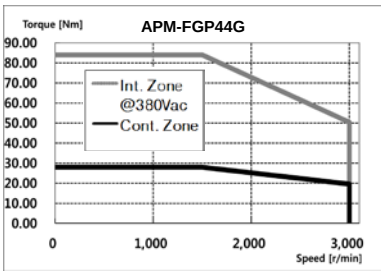


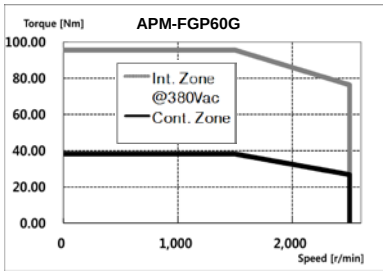
Servo Motor Type (APM-□)		FGP20G	FGP30G	FGP44G	FGP60G		
Applicable Drive (L7□B□)		L7□B020□	L7□B035□	L7□B075□	L7□B075□		
Rated Output	kW	1.8	2.9	4.4	6.0		
Rated torque	N·m	11.46	18.46	28.01	38.20		
	kgf·cm	116.93	188.39	285.83	389.77		
Maximum instantaneous torque	N·m	34.38	55.39	84.03	95.49		
	kgf·cm	350.79	565.16	857.49	974.42		
Rated rotation speed	r/min	1500					
Maximum rotation speed	r/min	3000	2700	3000	2500		
Inertia moment	$kg \cdot m^2 x10^{-4}$	51.42	80.35	132.41	172.91		
	$gf \cdot cm \cdot s^2$	52.47	81.99	135.11	176.44		
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	25.53	45.39	61.97	102.08		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦



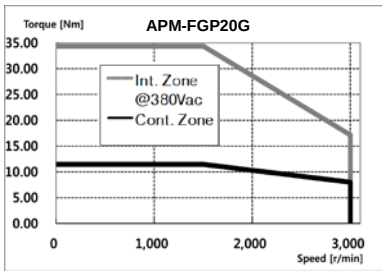


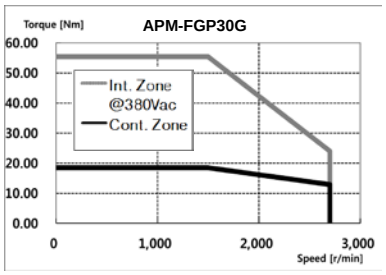


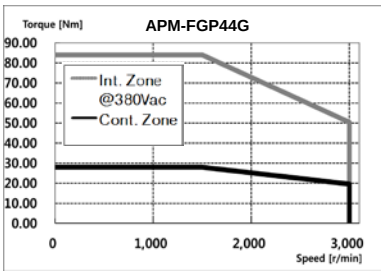


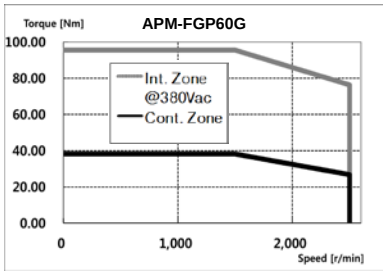
Servo Motor Type (APM-□)		FGP12M	FGP20M	FGP30M	FGP44M		
Applicable Drive (L7□B□)		L7□B020□	L7□B020□	L7□B075□	L7□B075□		
Rated Output	kW	1.2	2.0	3.0	4.4		
Rated torque	N·m	11.46	19.10	28.65	42.02		
	kgf·cm	116.93	194.88	292.33	428.74		
Maximum instantaneous torque	N·m	34.38	57.30	85.94	126.05		
	kgf·cm	350.79	584.65	876.98	1,071.86		
Rated rotation speed	r/min	1000					
Maximum rotation speed	r/min	2000					
Inertia moment	$kg·m^2x10^{-4}$	51.42	80.35	132.41	172.91		
	$gf·cm·s^2$	52.47	81.99	135.11	176.44		
Permitted load inertia		Motor inertia x5					
Rated power rate	kW/s	25.53	45.39	61.97	102.08		
Speed and position detector	Standard	Serial Type 19 bits M-turn					
	Option	Serial Type 19 bits S-turn(to be supported)					
Specifications and features	Protection method	Fully enclosed·self-cooling IP65 (excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Operate : 0~40℃, Storage : -10~60℃					
	Ambient humidity	20-80% RH (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas					
	Anti-vibration	Vibration acceleration of 49 m/s^2 (5G)					

♦Speed-Torque characteristics♦









■ Heat Sink Specifications

Category	Dimension (mm)	Category
AP13	350x350x20	Aluminum
AP18	550x550x30	
AP22	650x650x35	

Note 1) Product specifications are the measurement data after Heat Sink is mounted.

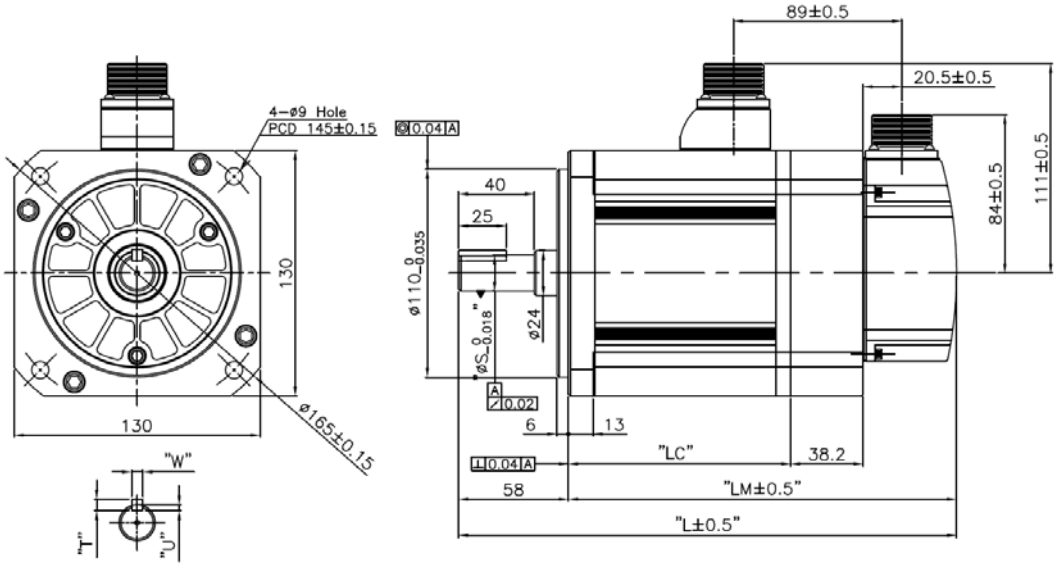
■ Electronic Brake Specifications

Applicable Motor Series	APM-SEP/FEP	APM-SFP/FFP	APM-SGP/FGP
Purpose	Holding after stop.	Holding after stop.	Holding after stop.
Input voltage [V]	DC 24V	DC 24V	DC 90 V
Static friction torque (N•m)	10.4	40	74
Capacity [W]	19.4	25	32
Coil resistance [Ω]	29.6	23	327
Rated current [A]	0.81	1.04	0.28
Braking method	Spring brake	Spring brake	Spring brake
Insulation grade	Grade F	Grade F	Grade F

Note 1) DO NOT apply DC24V power (for interface only) to electronic brake. You MUST use power source only for electronic brake.
Note 2) Electronic brake installed in our servo motor applies same specifications for each series.
Note 3) Electric brakes are designed to maintain a stop. Never use them for absolute braking.
Note 4) The characteristics of the electric brakes were measured at 20°C.
Note 5) These brake specifications are subject to change. Check the voltage specifications on your specific motor.

7.1.2 Outline Diagram

■ SEP Series | APM-SEP09A, SEP06D, SEP05G, SEP03M
APM-SEP15A, SEP11D, SEP09G, SEP06M
APM-SEP22A, SEP16D, SEP13G, SEP09M
APM-SEP30A, SEP22D, SEP17G, SEP12M



<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

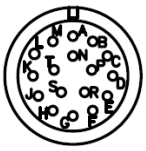
Plug : MS3102A20-4P

<Brake Connector>

Pin No.	Phase	Pin No.	Phase
A	U	D	F/G
B	V	E	BK+
C	W	F	BK-

Plug : MS3102A20-15P

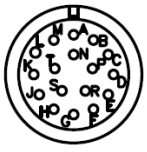
<S-turn Encoder Connector>



Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	$\overline{MA}$	N	-
C	SL	P	-
D	$\overline{SL}$	R	-
E	-	H	+5V
F	-	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

<M-turn Encoder Connector>



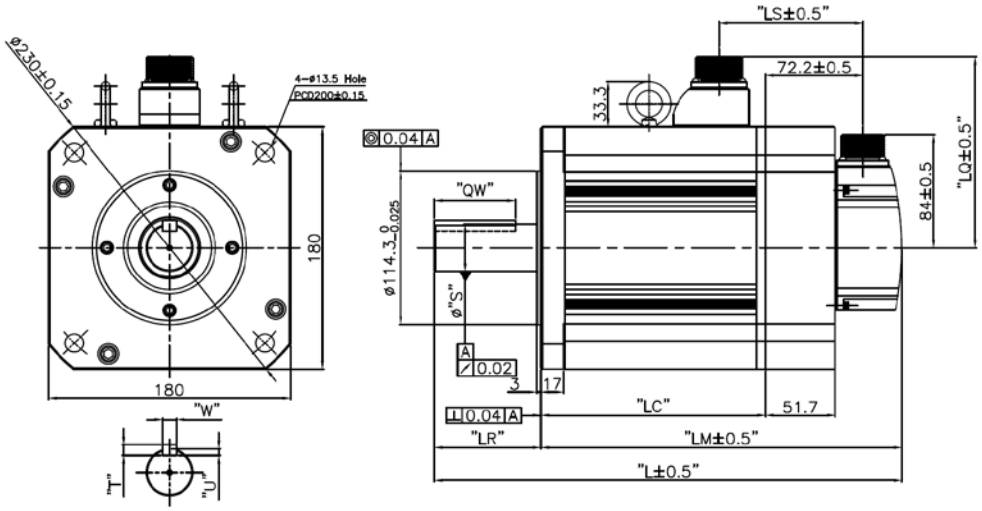
Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	$\overline{MA}$	N	-
C	SL	P	-
D	$\overline{SL}$	R	-
E	VOD_B	H	+5V
F	GND_B	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

Model	External Dimensions			Shaft, Key Dimensions			
	L	LM	LC	S	T	W	U
SE09A,SE06D,SE05G,SE03M	201.3(239.3)	143.3(181.3)	93.8(93.6)	19	5	5	3
SE15A,SE11D,SE09G,SE06M	225.3(263.3)	167.3(205.3)	117.8(117.6)	19	5	5	3
SE22A,SE16D,SE13G,SE09M	249.3(287.3)	191.3(229.3)	141.8(141.6)	22	6	6	3.5
SE30A,SE22D,SE17G,SE12M	273.3(311.3)	215.3(253.3)	165.8(165.6)	22	6	6	3.5

Note 1) Use DC power (24 V) to operate the brake.
Note 2) The sizes in parentheses apply when attached to the brakes.

■ SFP Series | APM-SFP30A, SFP22D, SFP20G, SFP12M
APM-SFP50A, SFP35D, SFP30G, SFP20M
APM-SFP55D, SFP44G, SFP30M
APM-SFP75D, SFP60G, SFP44M
APM-SFP75G



<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

Plug : MS3102A22-22P
MS3102A32-17P

<Brake Type Connector>

Pin No.	Phase	Pin No.	Phase
A	U	D	F/G
B	V	E	BK+
C	W	F	BK-

Plug : MS3102A24-10P

<S-turn Encoder Connector>

Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	-	H	+5V
F	-	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

<M-turn Encoder Connector>

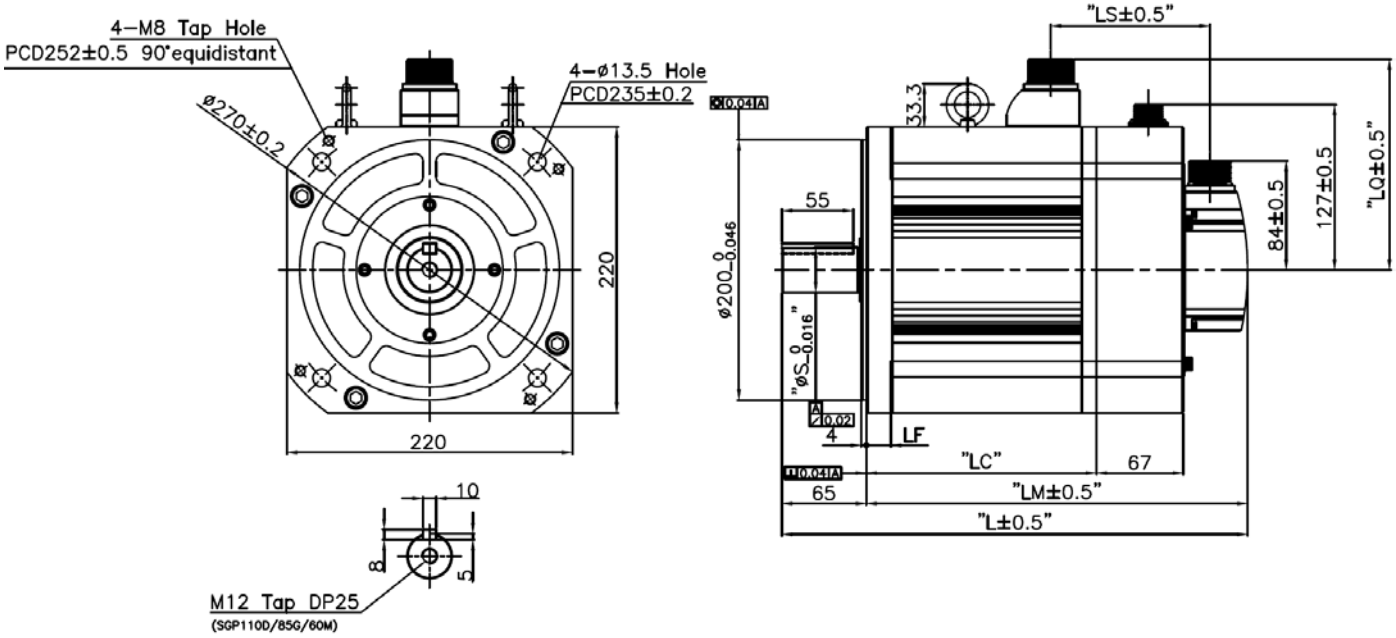
Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	VOD_B	H	+5V
F	GND_B	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

Name	External Dimensions						Shaft, Key Dimensions					Power Connector
	L	LM	LC	LR	LQ	LS	S	QK	T	W	U	
SFP30A, SFP22D, SFP20G, SFP12M	261.5 (312.9)	182.5 (233.9)	133 (132.7)	79	142	53.8 (106.5)	Φ35 [0~+0.01]	60	8	10	5	MS3102A 22-22P
SFP50A, SFP35D, SFP30G, SFP20M	295.5 (346.9)	216.5 (267.9)	167 (166.7)									
SFP55D, SFP44G, SFP30M	345.5 (396.9)	266.5 (317.9)	217 (216.7)									
SFP75D, SFP60G, SFP44M	405.5 (456.9)	326.5 (377.9)	277 (276.7)									
SF75G	457.5	344.5	295	113	152	60.2	Φ42 [-0.016~0]	96	8	12	5	MS3102A 32-17P

Note 1) SFP30M or higher-end models have eye bolts.
Note 2) Use DC power (24 V) to operate the brake.
Note 3) The sizes in parentheses apply when attached to the brakes.

■ SGP Series | APM-SGP22D, SGP20G, SGP12M
APM-SGP35D, SGP30G, SGP20M
APM-SGP55D, SGP44G, SGP30M
APM-SGP75D, SGP60G, SGP44M
APM-SGP110D, SGP85G, SGP60M

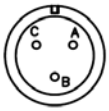


<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

Plug : MS3102A22-22P
MS3102A32-17P

<Brake Connector>



Pin No.	Phase
A	BK+
B	BK-
C	-

Plug : MS3102A14S-7P

<S-turn Encoder Connector>

Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	-	H	+5V
F	-	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

<M-turn Encoder Connector>

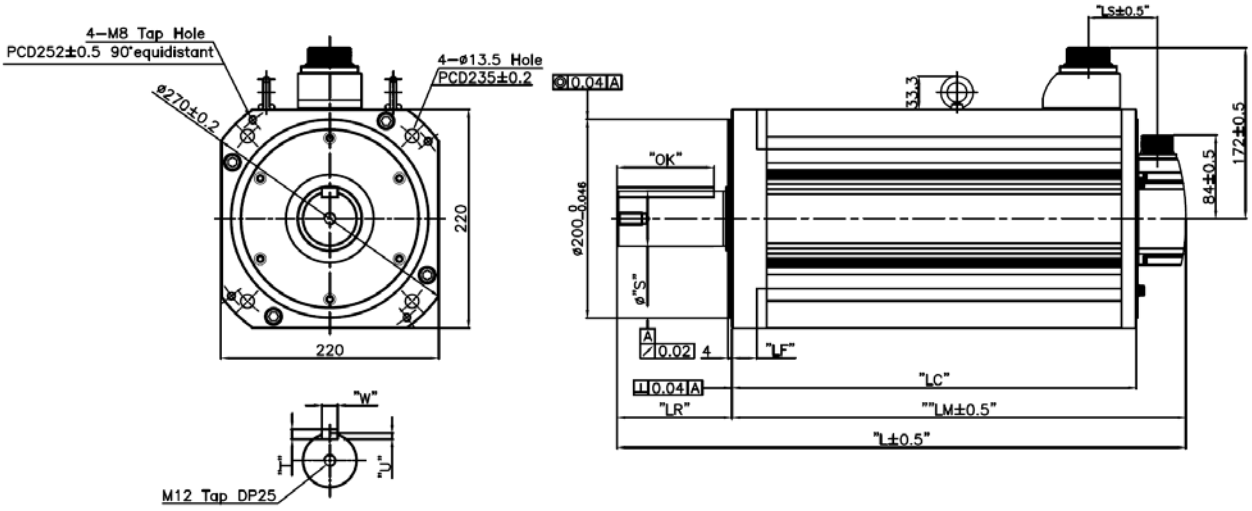
Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	VOD_B	H	+5V
F	GND_B	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

Name	External Dimensions							Power Connector
	L	LM	LC	LF	LQ	LS	S	
SGP22D, SGP20G, SGP12M	236.5(302.7)	171.5(237.7)	122(121.2)	19	162	56.4(122.6)	35	MS3102A 22-22P
SGP35D, SGP30G, SGP20M	256.5(322.7)	191.5(257.7)	142(141.2)					
SGP55D, SGP44G, SGP30M	292.5(358.7)	227.5(293.7)	178(177.2)					
SGP75D, SGP60G, SGP44M	320.5(386.7)	255.5(321.7)	206(205.2)					
SGP110D, SGP85G, SGP60M	418.5(484.7)	353.5(419.7)	304(303.2)	21	172	66(132.2)	45	MS3102A 32-17P

Note 1) Use DC power (90 V) to operate the brake.
Note 2) The sizes in parentheses apply when attached to the brakes.

■ SG Series | APM-SGP110G, SGP150G



<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

Plug : MS3102A32-17P

<S-turn Encoder Connector>

Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	$\overline{MA}$	N	-
C	SL	P	-
D	$\overline{SL}$	R	-
E	-	H	+5V
F	-	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

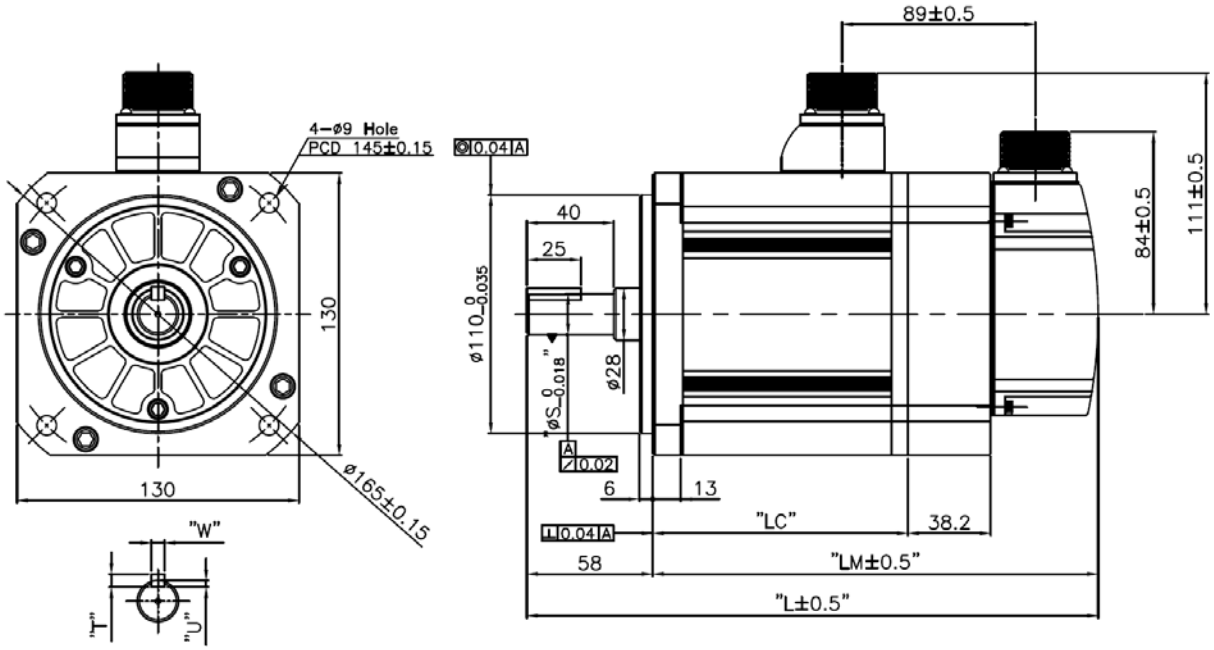
<M-turn Encoder Connector>

Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	$\overline{MA}$	N	-
C	SL	P	-
D	$\overline{SL}$	R	-
E	VOD_B	H	+5V
F	GND_B	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

Name	External Dimensions							Shaft, Key Dimensions			
	L	LM	LC	QK	LR	LF	LS	S	T	W	U
SG110G	468.5	353.5	304	96	115	21	66	42 (-0.016~0)	8	12	5
SG150G	574.5	458.5	409	98	116	25	70	55 (+0.011~+0.030)	10	16	6

■ FEP Series | APM-FEP09A, FEP06D, FEP05G, FEP03M, APM-FEP15A, FEP11D, FEP09G, FEP06M APM-FEP22A, FEP16D, FEP13G, FEP09M APM-FEP30A, FEP22D, FEP17G, FEP12M



<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

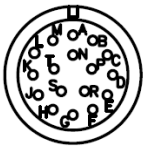
Plug : MS3102A20-4P

<Brake Connector>

Pin No.	Phase	Pin No.	Phase
A	U	D	F/G
B	V	E	BK+
C	W	F	BK-

Plug : MS3102A20-15P

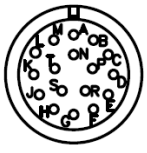
<S-turn Encoder Connector>



Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	-	H	+5V
F	-	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

<M-turn Encoder Connector>



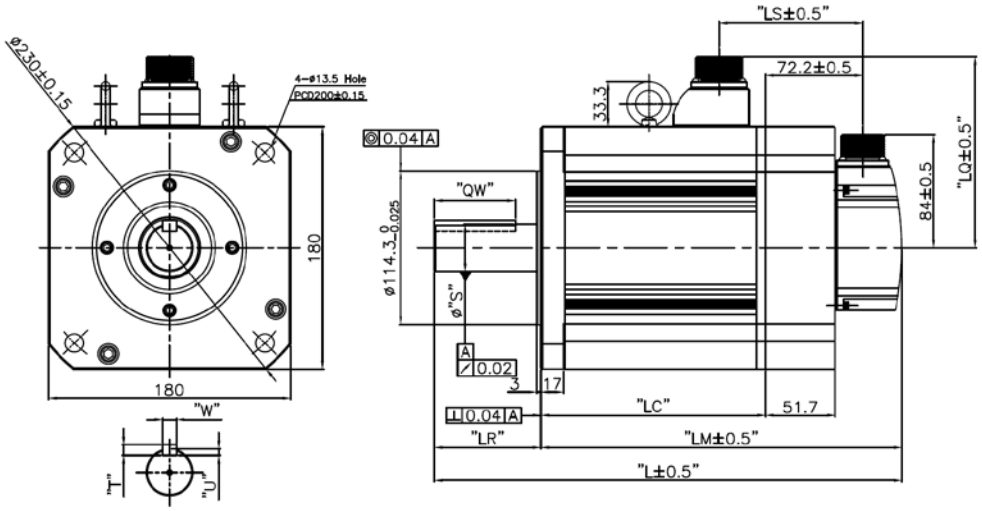
Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	VOD_B	H	+5V
F	GND_B	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

Model	External Dimensions			Shaft, Key Dimensions			
	L	LM	LC	S	T	W	U
FE09A,FE06D,FE05G,FE03M	197.3(235.3)	139.3(177.3)	89.8(89.6)	19	5	5	3
FE15A,FE11D,FE09G,FE06M	217.3(255.3)	159.3(197.3)	109.8(109.6)	19	5	5	3
FE22A,FE16D,FE13G,FE09M	237.3(275.3)	179.3(217.3)	129.8(129.6)	22	6	6	3.5
FE30A,FE22D,FE17G,FE12M	255.3(293.3)	197.3(235.3)	147.8(147.6)	24	7	8	4

Note 1) Use DC power (24 V) to operate the brake.
Note 2) The sizes in parentheses apply when attached to the brakes.

■ FFP Series | APM-FFP30A, FFP22D, FFP20G, FFP12M
APM-FFP50A, FFP35D, FFP30G, FFP20M
APM-FFP55D, FFP44G, FFP30M
APM-FFP75D, FFP60G, FFP44M
APM-FFP75G



<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

Plug : MS3102A22-22P
MS3102A32-17P

<Brake Type Connector>

Pin No.	Phase	Pin No.	Phase
A	U	D	F/G
B	V	E	BK+
C	W	F	BK-

Plug : MS3102A24-10P

<S-turn Encoder Connector>

Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	-	H	+5V
F	-	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

<M-turn Encoder Connector>

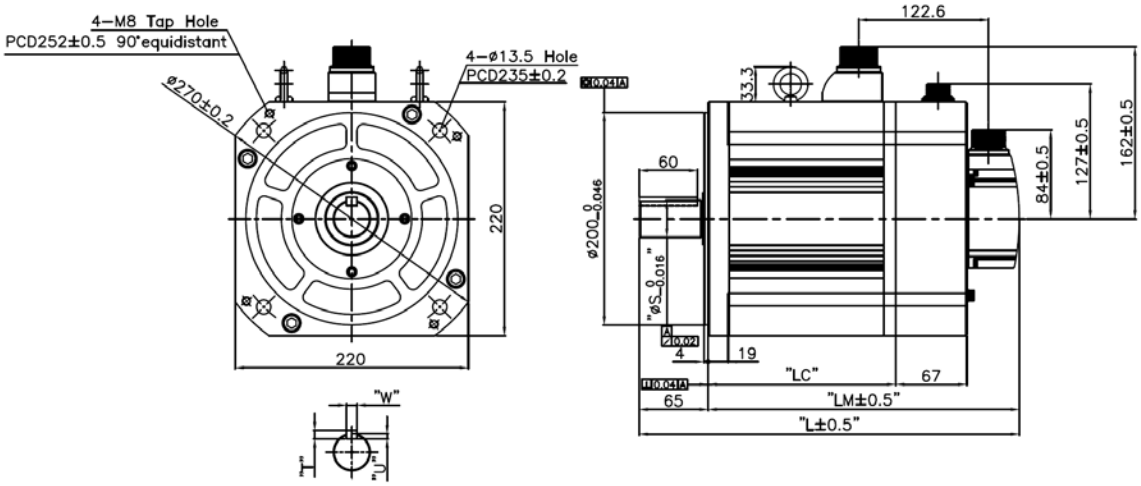
Pin No.	Phase	Pin No.	Phase
A	MA	M	-
B	MA	N	-
C	SL	P	-
D	SL	R	-
E	VOD_B	H	+5V
F	GND_B	G	0V
K	-	J	SHIELD
L	-		

Plug : MS3102A20-29P

Name	External Dimensions						Shaft, Key Dimensions					Power Connector
	L	LM	LC	LR	LQ	LS	S	QK	T	W	U	
FFP30A,FFP22D, FFP20G,FFP12M	257.5 (308.9)	178.5 (229.9)	129 (128.7)	79	142	53.8 (106.5)	Φ35 [0~+0.01]	60	8	10	5	MS3102A 22-22P
FFP50A,FFP35D, FFP30G,FFP20M	287.5 (338.9)	208.5 (259.9)	159 (158.7)									
FFP55D,FFP44G, FFP30M	331.5 (382.9)	252.5 (303.9)	203 (202.7)									
FFP75D, FFP60G, FFP44M	384.5 (435.9)	305.5 (356.9)	256 (255.7)				Φ42 [-0.016~0]			12		
FFP75G	439.5	326.5	277	113	152	60.2		96				MS3102A 32-17P

Note 1) SFP30M or higher-end models have eye bolts.
Note 2) Use DC power (24 V) to operate the brake.
Note 3) The sizes in parentheses apply when attached to the brakes.

■ FGP Series | APM-FGP22D, FGP20G, FGP12M
APM-FGP35D, FGP30G, FGP20M
APM-FGP55D, FGP44G, FGP30M
APM-FGP75D, FGP60G, FGP44M



<Power Connector>

Pin No.	Color	Phase
A	Red	U
B	White	V
C	Black	W
D	Green	FG

Plug : MS3102A22–22P

<Brake Connector>

Pin No.	Phase
A	BK+
B	BK–
C	–

Plug : MS3102A14S–7P

Pin No.	Phase	Pin No.	Phase
A	MA	M	–
B	MA	N	–
C	SL	P	–
D	SL	R	–
E	–	H	+5V
F	–	G	0V
K	–	J	SHIELD
L	–		

Plug : MS3102A20–29P

Pin No.	Phase	Pin No.	Phase
A	MA	M	–
B	MA	N	–
C	SL	P	–
D	SL	R	–
E	VOD_B	H	+5V
F	GND_B	G	0V
K	–	J	SHIELD
L	–		

Plug : MS3102A20–29P

Name	External Dimensions						
	L	LM	LC	S	T	W	U
FGP22D, FGP20G, FGP12M	229.5(295.7)	164.5(230.7)	115(114.2)	35 (0~+0.01)	8	10	5
FGP35D, FGP30G, FGP20M	250.5(316.7)	185.5(251.7)	136(135.2)				
FGP55D, FGP44G, FGP30M	282.5(348.7)	217.5(283.7)	168(167.2)				
FGP75D, FGP60G, FGP44M	304.5(370.7)	239.5(305.7)	190(189.2)	42 (-0.016~0)	8	12	5

Note 1) Use DC power (90 V) to operate the brake.
Note 2) The sizes in parentheses apply when attached to the brakes.

7.2 Servo drive

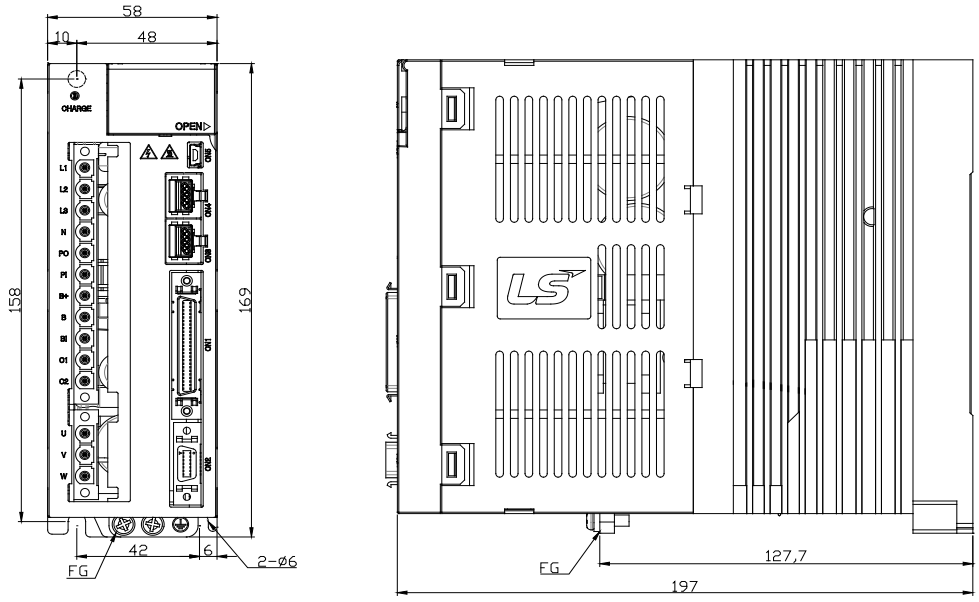
7.2.1 Product Features

Item \ Name		L7SB010	L7SB020	L7SB035	L7SB050	L7SB075	L7SB150
Input power	Main power	3-phase AC 380-480 V (-15-10%), 50-60 Hz					
	Control power	Single-phase AC 380-480 V (-15-10%), 50-60 Hz					
Rated current (A)		3.7		8	10.1	17.5	22.8	39
Peak current (A)		11.1		24	30.3	52.5	57	97.5
Encoder Type		Quad. Type incremental line drive 2000-10000 [P/R] Serial 17 / 19 bit / 21 bit					
Control performance	Speed Control	Speed control range	Maximum 1: 5000				
		Frequency response	Maximum 1 kHz or above (when the 19-bit serial encoder is applied).				
		Speed command	DC –10 V-+10 V (Reverse rotation in case of negative voltage)				
		Acceleration/deceleration time	Straight or S-curve acceleration/deceleration (0-10,000 ms, possible to be set by one ms unit)				
		Speed variation	±0.01% or lower (when the load changes between 0 and 100%) ±0.1% or less (temperature of 25℃ (±10))				
	Position Control	Input frequency	1 Mpps, line drive / 200 kbps, open collector				
		Input pulse Method	Symbol + pulse series, CW+CCW, A/B phase				
		Electric Gear Ratio	Four digital gear ratios can be set, selected and tuned.				
	Torque Control	Torque command	DC –10-+10 V (Reverse direction torque in case of negative voltage)				
		Speed limit	DC 0-10 V, internal speed command within ±1%				
		repetition accuracy	Within ±1%				
Input/output signal	Analog Input	Input range	DC 0-10 V				
		Angular resolution	12 bits*				
	Analog Output	Output range	DC 0-10 V				
		Angular resolution	12 bits				

Item \ Name		L7SB010	L7SB020	L7SB035	L7SB050	L7SB075	L7SB150
	Digital input	A total of 10 input channels (allocable) SVON, SPD1, SPD2, SPD3, ALMRST, DIR, CCWLIM, CWLIM, EMG, STOP, EGEAR1, EGEAR2, PCON, GAIN2, P_CLR, T_LMT, MODE, ABS_RQ, ZCLAMP You can selectively allocate a total of 19 functions. You can set the positive/negative logic of the selected signal.					
	Digital output	A total of 5 channels (allocable), 3 channels (fixed with alarm codes) ALARM, READY, ZSPD, BRAKE, INPOS, TLMT, VLMT, INSPD, WARN You can selectively allocate a total of 9 output types. You can set the positive/negative logic of the selected signal.					
communication	RS422	Accessible to PC software and the RS422 server					
	USB	Status monitoring through PC software, JOG operation, and parameter uploading/downloading are possible.					
Encoder		Serial BiSS encoder and quadrature encoder supported					
Encoder output method		Random pre-scale output through FPGA (maximum 6.4 Mpps)					
Built-in functions	Dynamic braking	Standard built-in (activated when the servo alarm goes off or when the servo is off)					
	Regenerative braking	Both the default built-in brake and an externally installed brake are possible.					
	Displaying	Seven segments (5 DIGIT)					
	Self-setting	Loader (SET, MODE, UP, and DOWN keys)					
	Add-on functions	Auto gain tuning, phase Z detection, manual JOG operation, program JOG operation, automatic analog input calibration					
	Protection functions	Overcurrent, overload, overvoltage, low voltage, main power input error, control power input error, overspeed, motor cable, heating error (power module heating, drive temperature error), encoder error, excessive regeneration, sensor error, communication error					
Environment		Temperature	0 ~ 50[℃]				
		Humidity	90% RH or less (no condensation)				
		Environment	Indoors in an area free from corrosive or combustible gases, liquids, or dust.				

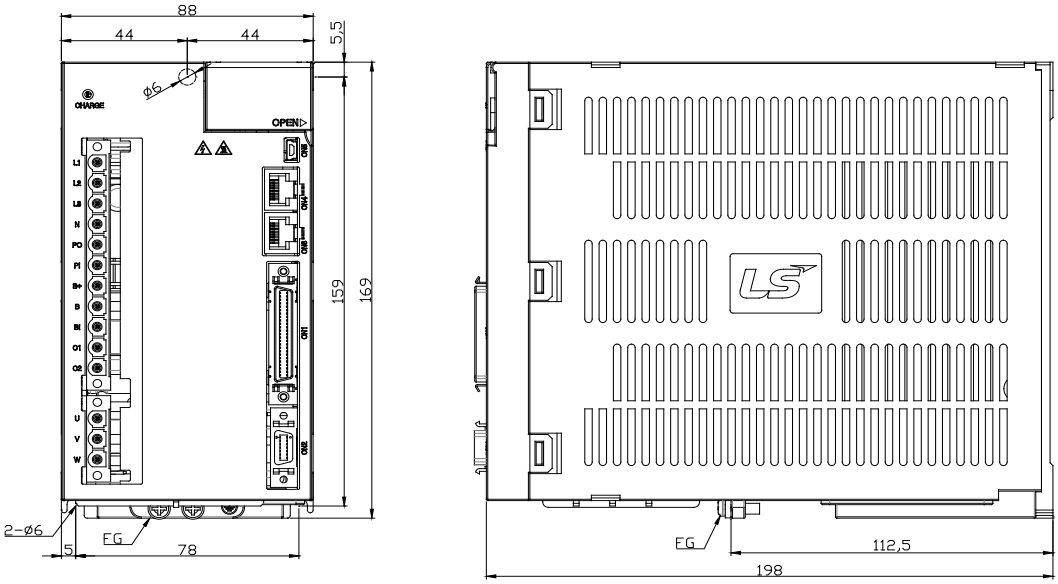
7.2.2 Outline Diagram

■ L7□B010□



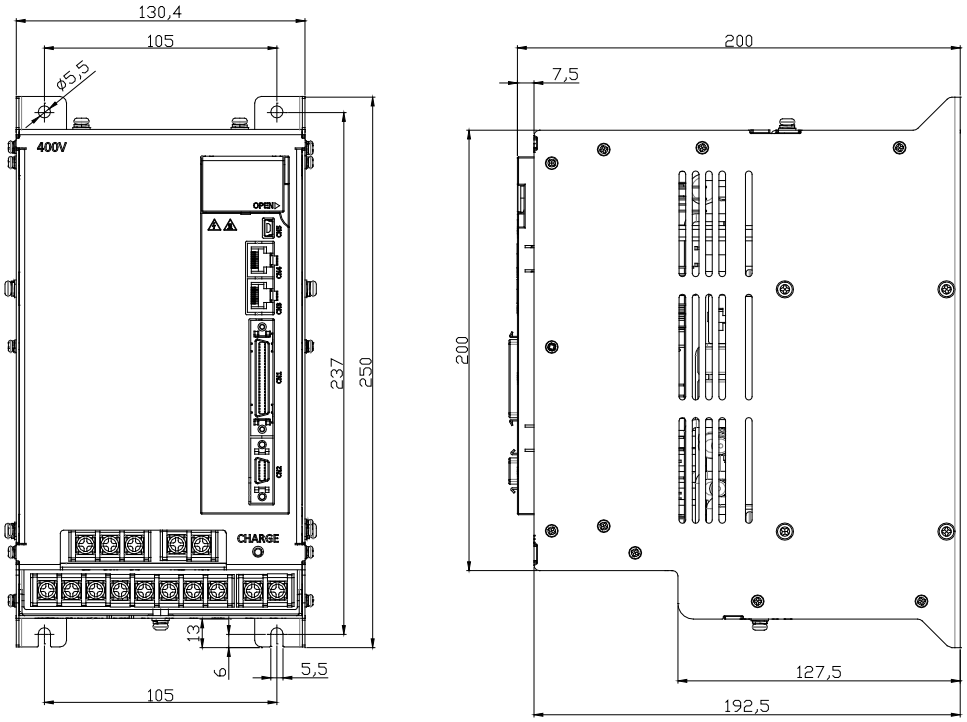
★ Weight: 1.5 kg (including the cooling fan)

■ L7□B020□ / L7□B035□



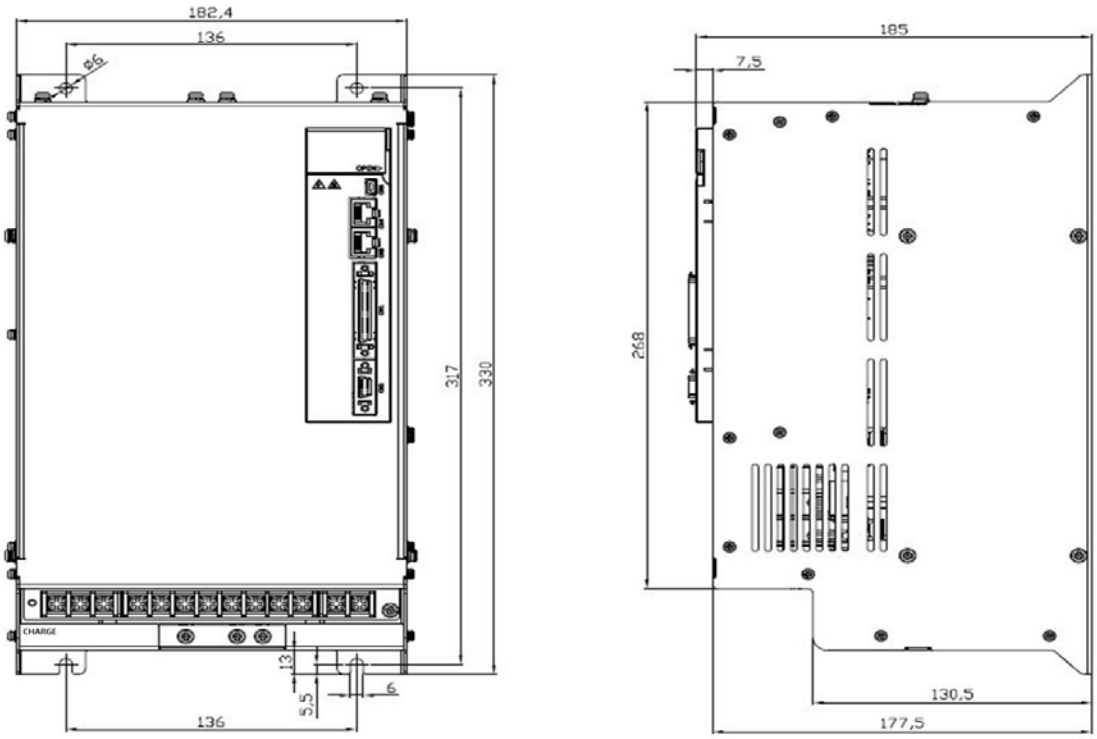
★ Weight: 2.5 kg (including the cooling fan)

■ L7□B050□



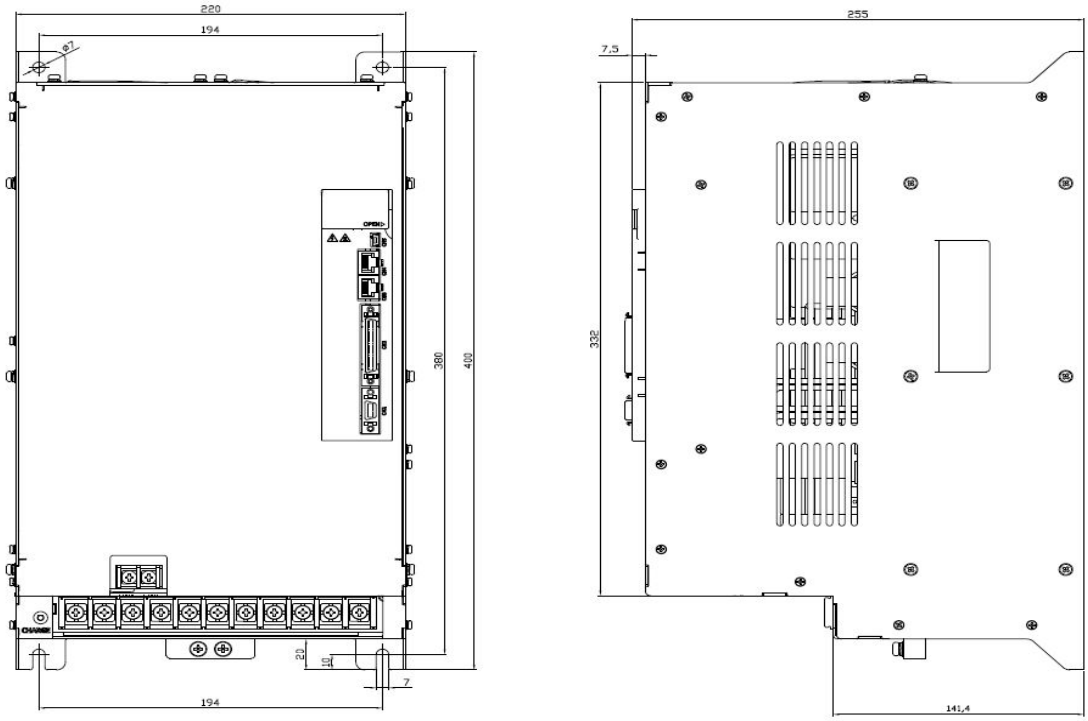
★ Weight: **5.5 kg (including the cooling fan)**

■ L7□B075□



★ **Weight: 8.5 kg (including the cooling fan)**

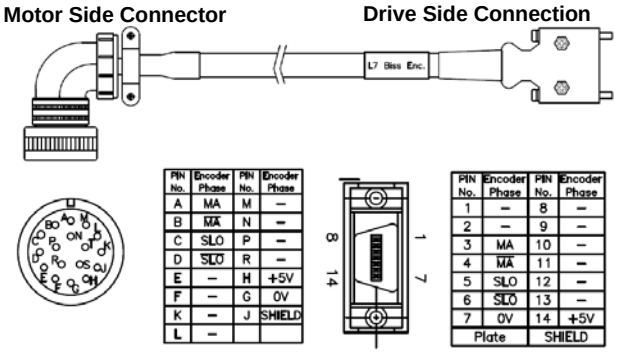
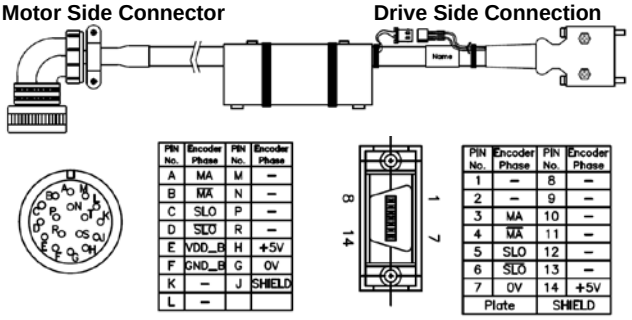
■ L7□B150□



★ Weight: 15.5 kg (including the cooling fan)

7.3 Options and Peripheral Devices

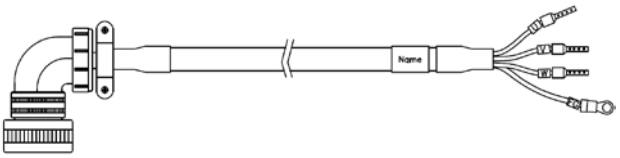
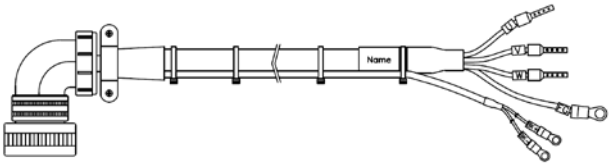
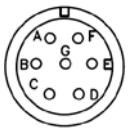
■ **Option (Incremental/serial encoder cable)**

Category	Product Name	Name (Note 1)	Applicable Motors	Specifications
For signaling	Medium capacity Serial type encoder cable (Single turn)	APCS-E□□□DS	All models of FEP/ FFP/ FGP SERIES	 **1. Motor connection (MS: Military Standard)** a. Plug specifications : MS3108A 20-29S **2. Drive connection (CN2)** a. Case : 10314-52A0-008 (3M) or SM-14J(Suntone) b. Connector : 10114-3000VE(3M) or SM-14J(Suntone) **3. Cable specifications : 3Px0.2SQ or 3PxAWG24**
For signaling	Medium capacity Serial type encoder cable (Multi turn)	APCS-E□□□DS1	All models of FEP/ FFP/ FGP SERIES	 **1. Motor connection (MS: Military Standard)** a. Plug specifications : MS3108A 20-29S **2. Drive connection (CN2)** a. Case : 10314-52A0-008 (3M) or SM-14J(Suntone) b. Connector : 10114-3000VE(3M) or SM-14J(Suntone) **3. Cable specifications : 4Px0.2SQ or 4Px AWG24** **4. Battery connection.** a. Connector specifications : 5267-02A(Molex) b. Battery specification : ER6V (TOSHIBA, AA, 3.6V, 2000mAh)

Note 3) The □□□ in the name indicates the type and length of each cable. Refer to the following table for this information.

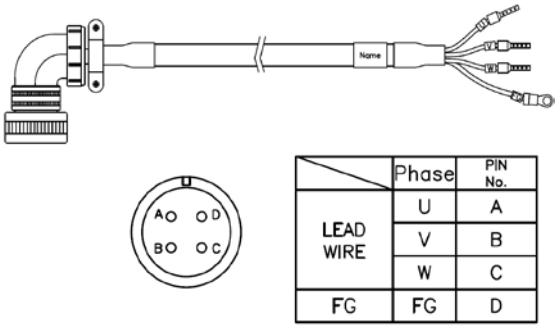
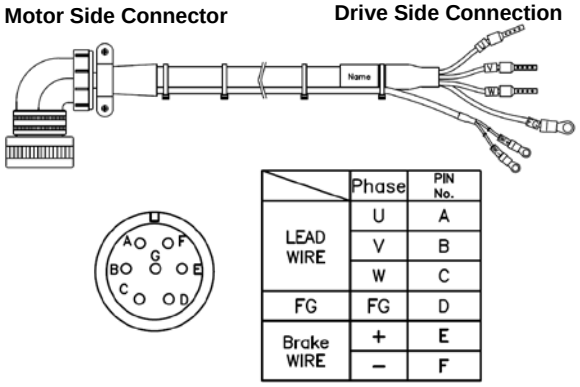
Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20
Regular cable	N03	N05	N10	N20

■ **Optional power cable**

Category	Product Name	Name (Note 1)	Applicable Motors	Specifications
For power	Middle capacity MS Type Power cable (For 400V 130 Flange)	APCS-P□□□HS	All models of SEP/ FEP SERIES	**Motor Side Connector** **Drive Side Connection**   Phase / PIN No.: LEAD WIRE U A; V B; W C; FG FG D **1. Motor connection (MS: Military Standard)** a. Plug specifications : MS3108A 20-4S **2. Drive connection (U,V, W, FG)** a. U, V, W Ferrule specifications : 1512 b. FG PIN specifications: 1.5X4(Ring Terminal) **3. Power Cable specifications** a. 4Cx1.5SQ or 4Cx15AWG
For power (Brake Type)	Middle capacity MS Type Power/ Brake cable (For 400V 130 Flange)	APCF-P□□□NB	All models of SEP/ FEP SERIES All model	**Motor Side Connector** **Drive Side Connection**   Phase / PIN No.: LEAD WIRE U A; V B; W C; FG FG D; Brake WIRE + E; – F **1. Motor connection (MS: Military Standard)** a. Plug specifications : MS3108A 20-15S(MS) **2. Drive connection (U,V, W, FG)** a. U, V, W Ferrule specifications : 1512 b. FG PIN specification : 1.5X4(Ring Terminal) **3. Power Cable specifications** a. 4Cx1.5SQ or 4Cx15AWG **4. Brake power connection** a. Connection pin specification : 1.5 x 3(Ring Terminal) **5. Brake power cable specification** a. 2Cx0.75SQ or 2Cx19AWG

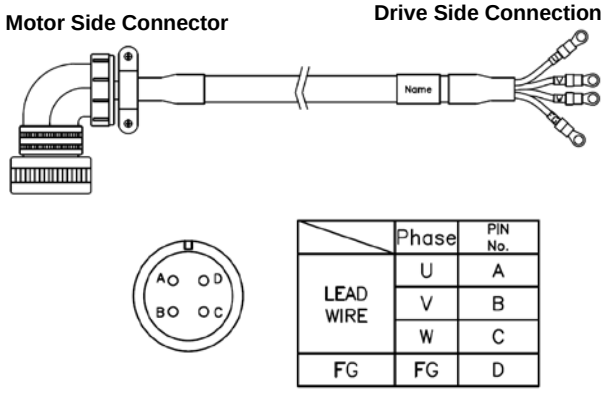
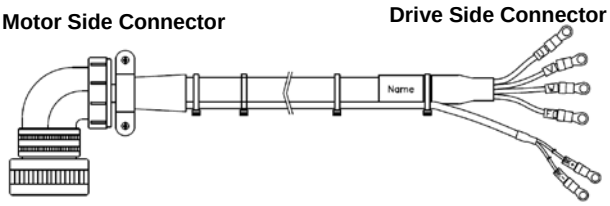
Note 4) The □□□ in the name indicates the type and length of each cable. Refer to the following table for this information.

Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20

<table>
<tr><th>Category</th><th>Product Name</th><th>Name (Note 1)</th><th>Applicable Motors</th><th>Specifications</th></tr>
<tr><td>For power</td><td>Middle capacity MS Type Power cable (400V 3.5kW Drive under 180/220 Flange)</td><td>APCS-P□□□IS</td><td>SFP30A
SFP22D
SFP35D
SFP20G
SFP12M
SFP20M
SGP22D
SGP35D
SGP20G
SGP12M
SGP20M
FFP30A
FFP22D
FFP35D
FFP20G
FFP30G
FFP12M
FFP20M
FGP22D
FGP35D
FGP20G
FGP30G
FGP12M
FGP20M</td><td>Motor Side Connector Drive Side Connection
 
1. Motor connection (MS: Military Standard)
a. Plug specifications: MS3108A 22-22S
2. Drive connection (U,V, W, FG)
a. U, V, W Ferrule specifications : 1512
b. FG PIN specifications : 1.5X4(Ring Terminal)
3. Power Cable specifications : 4Cx1.5SQ or 4Cx15AWG</td></tr>
<tr><td>For power (Brake Type)</td><td>Middle capacity MS Type Power/ Brake cable (400V 3.5kW Drive under 180 Flange)</td><td>APCS-P□□□PB</td><td>SFP30A
SFP22D
SFP35D
SFP20G
SFP12M
SFP20M
FFP30A
FFP22D
FFP35D
FFP20G
FFP30G
FFP12M
FFP20M</td><td>Motor Side Connector Drive Side Connection
 
1. Motor connection (MS: Military Standard)
a. Plug specifications : MS3108A 24-10S(MS)
2. Drive connection (U,V, W, FG)
a. U, V, W Ferrule specifications : 1512
b. FG PIN specification : 1.5X4(Ring Terminal)
3. Power Cable specifications: 4Cx1.5SQ or 4Cx15AWG
4. Brake power connection
a. Connection pin specification : 1.5 x 3(Ring Terminal)
5. Brake power cable specification
a. 2Cx0.75SQ or 2Cx19AWG</td></tr>
</table>

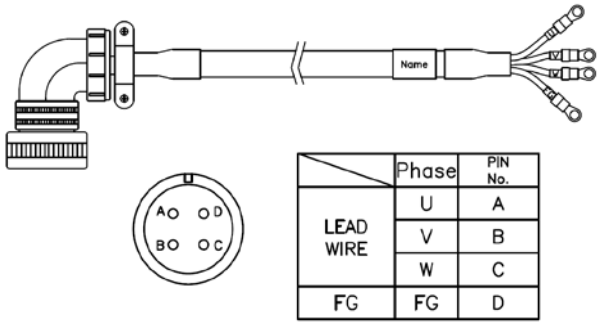
Note 5) The □□□ in the name indicates the type and length of each cable. Refer to the following table for this information.

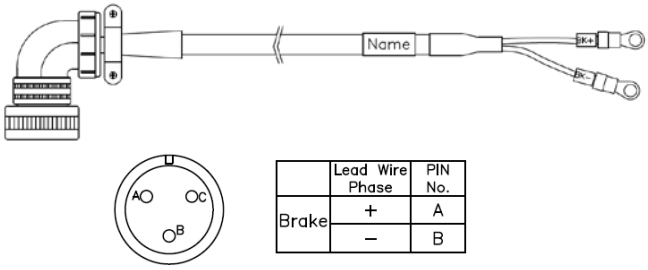
Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20

Category	Product Name	Name (Note 1)	Applicable Motors	Specifications
For power	Middle capacity MS Type Power cable (400V 7.5kW Drive under 180/220 Flange)	APCS-P□□□JS	SFP50A, SFP55D, SFP75D, SFP30G SFP44G, SFP60G, SFP30M, SFP44M SGP55D, SGP75D, SGP30G, SGP44G, SGP60G, SGP30M, SGP44M FFP50A, FFP55D, FFP75D, FFP44G, FFP60G, FFP30M, FFP44M FGP55D, FGP75D, FGP44G, FGP60G, FGP30M, FGP44M	 **1. Motor connection (MS: Military Standard)** a. Plug specifications: MS3108A 22-22S **2. Drive connection (U,V, W, FG)** a. U, V, W, FG Pin specifications : 4.0x5(Ring Termianl) **3. Cable specifications : 4Cx4.0SQ or 4Cx11AWG**
For power (Brake Type)	Middle capacity MS Type Power/ Brake cable (400V 7.5kW Drive under 180Flange)	APCS-P□□□LB	SFP50A, SFP55D, SFP75D, SFP44G, SFP60G, SFP30M, SFP44M FFP50A, FFP55D, FFP75D, FFP44G, FFP60G, FFP75G FFP30M, FFP44M	 **1. Motor connection (MS: Military Standard)** a. Plug specifications : MS3108A 24-10S(MS) **2. Drive connection (U,V, W, FG)** a. U, V, W, FG Pin specifications : 4.0x5(Ring Termianl) **3. Power Cable specifications: 4Cx4.0SQ or 4Cx11AWG** **4. Brake power connection** a. Connection pin specification : 1.5 x 3(Ring Terminal) **5. Brake power cable specification** a. 2Cx0.75SQ or 2Cx19AWG

Note 6) The □□□ in the name indicates the type and length of each cable. Refer to the following table for this information.

Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20

<table>
<tr><th>Category</th><th>Product Name</th><th>Name (Note 1)</th><th>Applicable Motors</th><th>Specifications</th></tr>
<tr><td>For power</td><td>Middle Capacity MS Type Power Cable (400V 15kW Drive under 180/220 Flange)</td><td>APCS-P□□□MS</td><td>SFP75G, SGP110D, SGP85G, SGP110G, SGP150G, SGP60M</td><td>Motor Side Connector Drive Side Connection
 

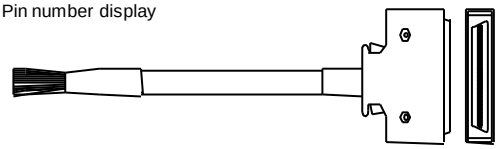
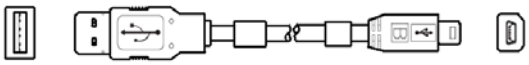
<table>
<tr><th></th><th>Phase</th><th>PIN No.</th></tr>
<tr><td rowspan="3">LEAD WIRE</td><td>U</td><td>A</td></tr>
<tr><td>V</td><td>B</td></tr>
<tr><td>W</td><td>C</td></tr>
<tr><td>FG</td><td>FG</td><td>D</td></tr>
</table>
1. Motor connection (MS: Military Standard)
a. Plug specifications: MS3108A 32-17S
2. Drive connection (U,V, W, FG)
a. U, V, W, FG Pin specifications : 10x5(Ring Termianl)
3. Cable specifications : 4Cx10.0SQ or 4Cx7AWG</td></tr>
<tr><td>For brake</td><td>Middle Capacity MS Type Brake Cable (200V/400V 220 Flange)</td><td>APCS-P□□□MS</td><td>SGP22D
SGP35D
SGP55D
SGP75D
SGP12M
SGP20M
SGP30M
SGP44M
SGP20G
SGP30G
SGP44G
SGP60G
FGP22D
FGP35D
FGP55D
FGP75D
FGP20G
FGP30G
FGP30G
FGP44G
FGP60G
FGP12M
FGP20M
FGP30M
FGP44M</td><td>Motor Side Connector
 

<table>
<tr><th></th><th>Lead Wire Phase</th><th>PIN No.</th></tr>
<tr><td rowspan="2">Brake</td><td>+</td><td>A</td></tr>
<tr><td>–</td><td>B</td></tr>
</table>
1. Motor connection (MS: Military Standard)
a. Plug specifications: MS3108A 14-7S
2. Brake power connection : 1.5x3(Ring Terminal)
3. Brake power cable specification
a. 2Cx0.75SQ or 2Cx19AWG</td></tr>
</table>

Note 7) The □□□ in the name indicates the type and length of each cable. Refer to the following table for this information.

Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20

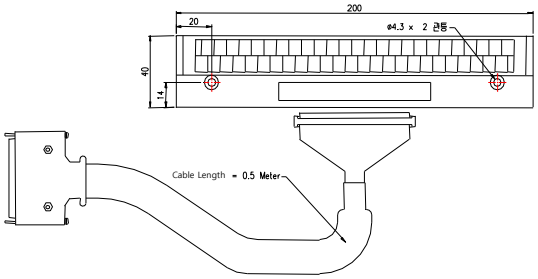
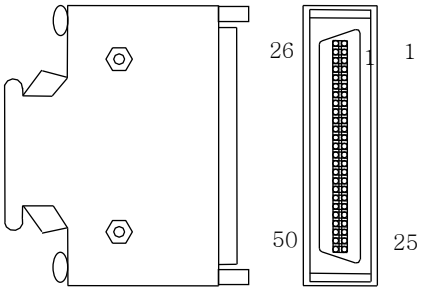
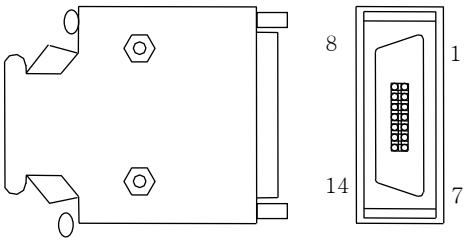
■ **Optional cables**

Category	Product Name	Name (Note 1)	Applicable Drive	Specifications
For signaling	CN1 Cable	APC-CN1□A	L7 SERIES	[Upper level controller] [Drive connection CN1] Pin number display  **1.** Drive connection (CN1) **a.** Case specifications: 10350-52A0-008 (3M) **b.** Connector specifications: 10150-3000VE (3M) **c.** Cable specifications: ROW-SB0.1Cx50C (AWG 28)
For signaling	Communication cable	APCS-CM5L7U	L7 SERIES	[PC - USB port] [Servo drive – CN5]  **1.** PC connection: USB A plug **2.** Drive connection (CN5): Mini USB 5P plug **3.** Electrical requirements: Double shielded, twisted pair, EMI filter installation (similar product: KU-AMB518 by SANWA)

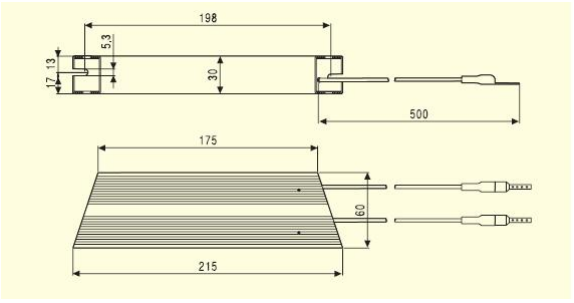
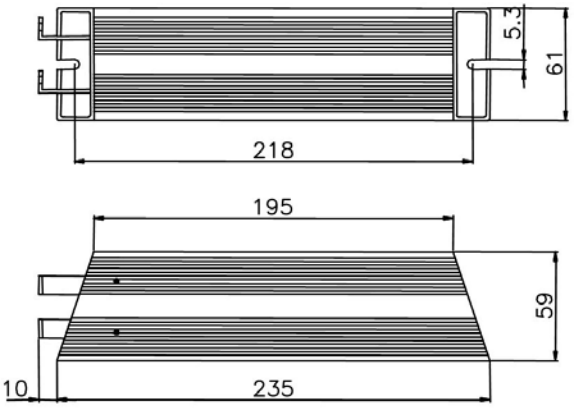
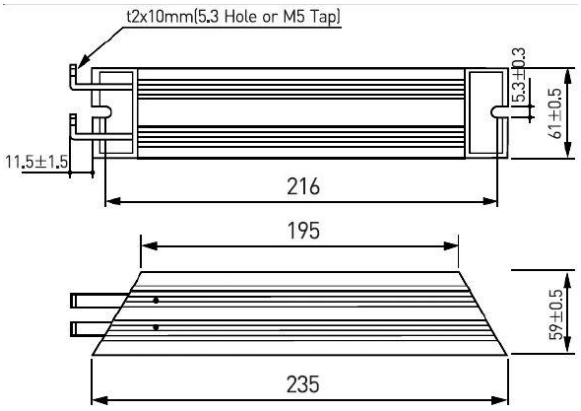
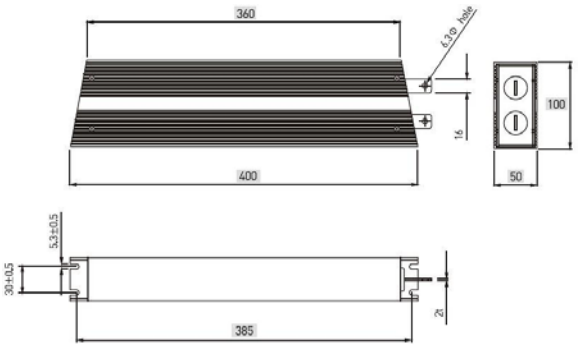
Note 1) The □ in Type Name indicates the length of each cable. Refer to the table below for how to display them.

Cable length (m)	1	2	3	5
Written as	01	02	03	05

■ **Option (connector)**

-	Product Name	Name	Applicable Drive	Specifications
T/B	CN1 T/B	APC-VSCN1T APC-VPCN1T	L7 SERIES	 **1.** APC-VSCN1T: CN1 T/B expansion of APD-VS **2.** APC-VPCN1T: CN1 T/B expansion of APD-VP **3.** The cable length can be changed. **4.** Standard cable length: 0.5 m
CN	CN1 Connector	APC- CN1NNA	L7 SERIES	 **1.** Case specifications: 10350-52A0-008 (3M) **2.** Connector specifications: 10150-3000VE (3M)
CN	CN2 Connector	APC- CN3NNA	L7 SERIES	 **1.** Case specifications: 10314-52A0-008 (3M) **2.** Connector specifications: 10114-3000VE (3M)

■ **Optional braking resistance**

Category	Product Name	Name	Applicable Drive	Specifications
Resistance	Braking resistance	IRV300-82Ω 82[Ω (300W)	L7□B010□	
Resistance	Braking resistance	IRV600-140Ω 140Ω (600W) - Making under review	L7□B035□	
Resistance	Braking resistance	IRV600-75Ω 25[Ω (600W *3P)	L7□B050□ L7□B075□ (3P)	
Resistance	Braking resistance	IRM2000-13.4Ω 13.4[Ω (2000W)	L7□B150□	

8. Maintenance and Inspection

8.1 Maintenance and Inspection

This chapter explains how to perform basic maintenance and inspection tasks as well as diagnose and troubleshoot the servo motor and drive.

8.1.1 Precautions

1. Measuring the motor voltage: The PWM controls the voltage output from the servo amp to the motor. Because of this, the waves take the form of pulses. Use a rectifier voltmeter for accurate measurements because different meters may produce different results.
2. Measuring the motor current: Use a moving iron ammeter and wait for the motor's reactance to smooth the pulse waveform into sine waves.
3. Measuring the electric power: Use an electrodynamometer based on the 3 power meter method.
4. Other gauges: When using an oscilloscope or digital voltmeter, do not allow them to touch the ground. Use a 1 mA or less input current gauge.

8.1.2 What to Inspect

Be sure to start inspection approximately 10 minutes after power is turned off because the charged voltage left in the internal smoothing condenser may cause an accident.

(1) Inspecting the Servo Motor

⚠ Caution
Be sure to start inspection approximately 10 minutes after power is turned off because the charged voltage left in the internal smoothing condenser may cause an accident.

Inspection Item	Inspection Period	Inspection and Handling	Notes
Vibration and sound check	Monthly	Touch the motor and listen for sounds.	The feel and sounds should be the same as usual.
Inspect the exterior of the motor	Depends on the amount of contamination or damage.	Clean the motor with a cloth or air pressure.	-
Measure the insulation resistance	At least once a year	Disconnect the motor from the drive and measure the insulation resistance. A normal resistance level is 10 MΩ or higher. Note 1)	Contact our service center if the resistance is lower than 10 MΩ.
Replace the oil seal	At least once every 5,000 hours	Remove the oil seal from the motor and replace it.	This only applies to motors with an oil seal.
General inspection	At least once every 20,000 hours or after 5 years.	Contact our service center.	Do not disassemble the servo motor yourself.

Note 1) Measure the resistance between the FG and one of the U, V, and W power lines on the servo motor.

(2) Inspecting the Servo Drive

Inspection Item	Inspection Period	Inspection process	What to do if you find an abnormality
Clean the main body and control board	At least once a year	Check if there is any dust or oil on the components.	Clean it with air pressure or a cloth.
Check for loose screws	At least once a year	Check whether the screws are loose on the terminals and connectors.	Tighten the screws.
Check for defective parts on the main body or the control board	At least once a year	Check for discoloration, damage, or disconnection caused by heat.	Contact our company.

8.1.3 Replacing Parts

Mechanical friction and aging may deteriorate the following parts or even cause them to malfunction. This makes it important to conduct regular maintenance checks and replace worn parts.

1. The smoothing condenser: Ripple currents and other factors can cause this part to wear. The lifespan of this part depends on the operating temperature and environment. It normally lasts for 10 years if used continuously in a normal air-conditioned environment. Inspect the condenser at least once each year because it can rapidly age over a short period of time once it starts to deteriorate (inspect it more frequently as it approaches obsolescence).

※ Visual inspection criteria:

a. The condition of the case: Check for deformations on the sides and bottom.

b. The condition of the lid: Check for notable expansion, severe cracks, or broken parts.

c. The relief valve: Check for notable valve expansion and operation.

d. Also regularly check whether the exterior is cracked, discolored, or leaking and whether there are any broken parts. The condenser is obsolete when its capacity degrades to less than 85% of the rated capacity.

2. The relays: Check for bad connections and wear and tear on the contacts caused by switching currents. A relay is obsolete when its accumulated number of switches reaches 100,000, depending on the power capacity.

3. Motor bearings: Replace the bearings after 20,000 to 30,000 hours of operation at the rated speed under the rated load. Replace the bearings if abnormal sounds or vibrations are detected during inspection, depending on the operating conditions.

The Standard Part Replacement Cycle

Part Name	Standard Replacement Cycle	Method
Smoothing condenser	7-8 years	Replace (determine after inspection).
Relays	-	Determine after inspection
Fuses	10 years	Replace
Aluminum electrolytic condensers on printed boards	5 years	Replace with new boards (determined after inspection)
Cooling fans	4-5 years	Replace
Motor bearings	-	Determine after inspection
Motor oil seals	5,000 hours	Replace

8.2 Diagnosing and Troubleshooting Abnormalities

AL-□ appears if a problem occurs during operation. If this happens, try to solve the problem by following the troubleshooting advice given in this section. If the problem persists, contact our service center.

8.2.1 Servo motor

Cause of abnormalities, inspection procedure, and troubleshooting methods

Symptoms	Cause	Inspection process	Remedies
The motor does not move.	The input of CCWLIM and CWLIM is off.	Refer to "1.2 System Configuration."	Turn on the input of CCWLIM and CWLIM.
	The parameters are set incorrectly	Check the parameters of the motor, encoder, and encoder type control mode.	Reset the parameters. (Refer to “Chapter 4 Parameters.”)
	The motor has defects.	Use a resistance tester to measure the resistance to the motor lead terminal (resistance between phases: several ohms).	Replace the motor.
	The locking screws are loose.	Check the locking screws.	Tighten any loose screws.
	The external wiring is incorrect or the cables are disconnected.	Check the wires to the motor and the encoder.	Redo the wiring. Replace the cables.
	The encoder has defects.	Check the output waves.	Replace the encoder. (Contact our service center.)
Motor rotation is unstable.	The connection is bad.	Check the connection of the motor lead terminal.	Fix any bad connections.
	The input voltage is low.	Check the input voltage of the drive.	Change the power source.
	Overloads occur.	Check the condition of the machine.	Remove any foreign substances from the rotating unit and grease or lubricate it.
The motor overheats.	The ambient temperature is too high.	Check the temperature around the motor. (40℃ or lower)	Change heat transfer structure. Install a cooling fan.
	The surface of the motor is contaminated.	Check whether there are any foreign substances on the surface of the motor.	Clean the surface of the motor.
	Overloads occur.	Check the load on the drive. Check the acceleration/deceleration time.	Reduce the load. Increase the acceleration/deceleration time. Use a motor with a greater capacity.
	The magnetic power of the magnets is reduced.	Check the counter voltage and voltage waveforms.	Replace the motor.
The device is making a strange sound.	Coupling is bad.	Tighten the coupling screws and measure the concentricity of the connection.	Readjust the coupling.
	The bearings are abnormal.	Check the bearings for vibrations and sounds.	Contact us.
	The parameters are set incorrectly (the inertia, gain, and time constants).	Check the parameters.	Refer to “Chapter 4 Parameters.”

8.2.2 Servo Drive

If an alarm triggers, the malfunction signal output contact point (ALARM) turns off and the dynamic brake stops the motor.

Alarm code	name	Details	What to check
AL-10	IPM Fault	Overcurrent (H/W)	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-11	IPM temperature	IPM overheat	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-14	Over current	Overcurrent (S/W)	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-15	Current offset	Abnormal current offset	Replace the drive if [St-23] and [St-24] are 10% or higher of the rated current.
AL-16	Overcurrent (/CL)	Overcurrent (H/W)	Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings. Determine whether there is a conflict or binding in the equipment.
AL-21	Continuous overload	Continuous overload	Determine whether there is a conflict or binding in the equipment. Check the load and the condition of the brake. Check for incorrect wiring in the drive output and encoder. Check the motor ID, drive ID, and encoder settings.
AL-22	Room temperature	Drive overheat	Check the temperature inside the drive [St-19]. the cooling fan installation, and the load condition.
AL-23	Regen. Overload	Regenerative overload	Check the input voltage, regenerative braking resistance, and wiring. Replace the drive.
AL-24	Motor cable open	Motor disconnection	Check the wiring of the motor.
AL-30	Encoder comm.	Serial encoder communication error	Check for incorrect wiring of the serial encoder.
AL-31	Encoder cable open	Encoder cable disconnection	Check whether the encoder cable is disconnected.

Alarm code	name	Details	What to check
AL-32	Encoder data error	Encoder data error	Check the [P0-02] setting and encoder wiring.
AL-33	Motor setting error	Motor ID setting error	Check the [P0-00] setting.
AL-34	Encoder Z PHASE Open	Encoder Z phase disconnected	Check whether the encoder cable is disconnected.
AL-40	Under voltage	Low voltage	Check input voltage and power unit wiring.
AL-41	Overvoltage	Overvoltage	Check the input voltage and wiring. Check the braking resistance for damage. Check for excessive regenerative operation. Check the regenerative resistance.
AL-42	RST power fail	Main power failure	Check the power unit wiring and power supply.
AL-43	Control power fail	Control power failure	Check the power unit wiring and power supply.
AL-50	Over speed limit	Overspeed	Check the encoder, encoder settings, encoder wiring, gain settings, motor wiring, motor ID, electric gear ratio, and speed command scale.
AL-51	Position following	Excessive positional error	Check the excessive position command pulse setting [P4-11], wiring, limit contact point, gain setting, encoder setting, and electric gear ratio. Check the load on the equipment and whether there is binding on the equipment.
AL-53	Over pulse CMD	Pulse command frequency error	Check the pulse command frequency on the upper level controller. Check the command pulse type.
AL-54	Speed deviation	Excessive speed error	Check for incorrect wiring in the drive output and encoder. Also, check the connection and load status of the equipment.
AL-55	Motor overrun	Motor overrun	Check for incorrect wiring in the drive output and encoder. Also, check the connection and load status of the equipment.
AL-63	Parameter checksum	Parameter error	Factory reset [Cn-21].
AL-64	Parameter range	Parameter range error	Factory reset [Cn-21].
AL-71	Invalid factory setting	Factory setting error	Factory reset [Cn-21].
AL-72	GPIO setting	Output contact point setting error	Factory reset [Cn-21].

If a warning code is displayed as the current operation status [St-00], the servo drive is operating abnormally. Check what needs to be inspected for the issue.

Warning State (CODE)	name	Details and causes	What to check
	RST_PFAIL	Main power phase loss	If the [P0-06] DIGIT 2 is set to 1, the main power fails.
	LOW_BATT	Battery low	
	OV_TCMD	Excessive Torque Command	You have entered a command that exceeds the maximum set torque.
	OV_VCMD	Excessive speed command	You have entered a command that exceeds the maximum set speed.
	OV_LOAD	Overload warning	The maximum overload [P0-13] has been reached.
	SETUP	Capacity settings	The electric current capacity of the motor is larger than that of the drive.
	UD_VTG	Low voltage warning	When [P0-06] DIGIT 2 is set to 1, the DC link voltage is 190 V or below.
	EMG	EMG contact	Check I/O wiring and [P2-09] value

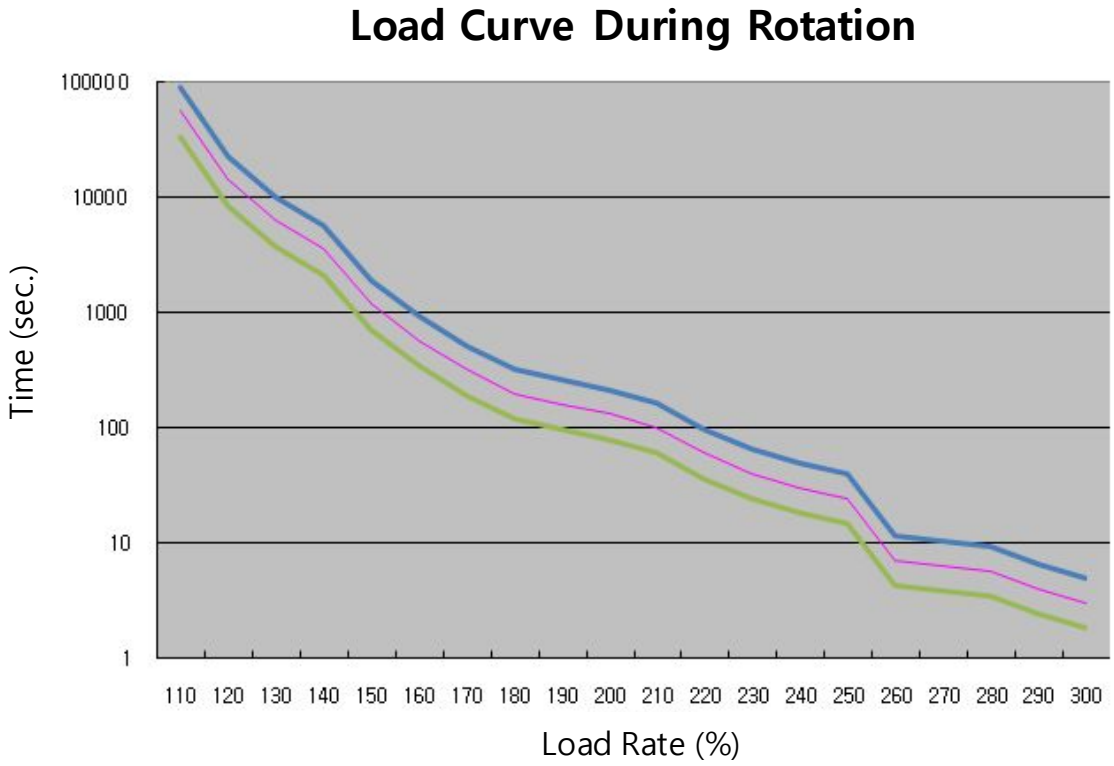
Warning code is displayed in hexadecimal, but it is displayed as the sum of respective warning codes when two or more warnings occur at once. For example, warning code is displayed as [W-0C] when both [W-04] Excessive Torque Command and [W-08] Excessive Speed Command occur at once.

If [W-80] occurs, SVON turns from ON to OFF. And when you turn on I/O power or change contact logic, [W-80] code is automatically deactivated.

■ Servo Drive Overload Graphs (1.0KW)

(1) Rotation overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	55776	89241.6	33465.6	210	100	160.0	60
120	13944	22310.4	8366.4	220	60	96.0	36
130	6197.3	9915.7	3718.38	230	40	64.0	24
140	3486	5577.6	2091.6	240	30.3	48.5	18.18
150	1183	1892.8	709.8	250	24.2	38.7	14.52
160	566	905.6	339.6	260	7	11.2	4.2
170	318	508.8	190.8	270	6.4	10.2	3.84
180	198	316.8	118.8	280	5.7	9.1	3.42
190	160	256.0	96	290	4	6.4	2.4
200	130	208.0	78	300	3	4.8	1.8



(2) Stoppage overload graph

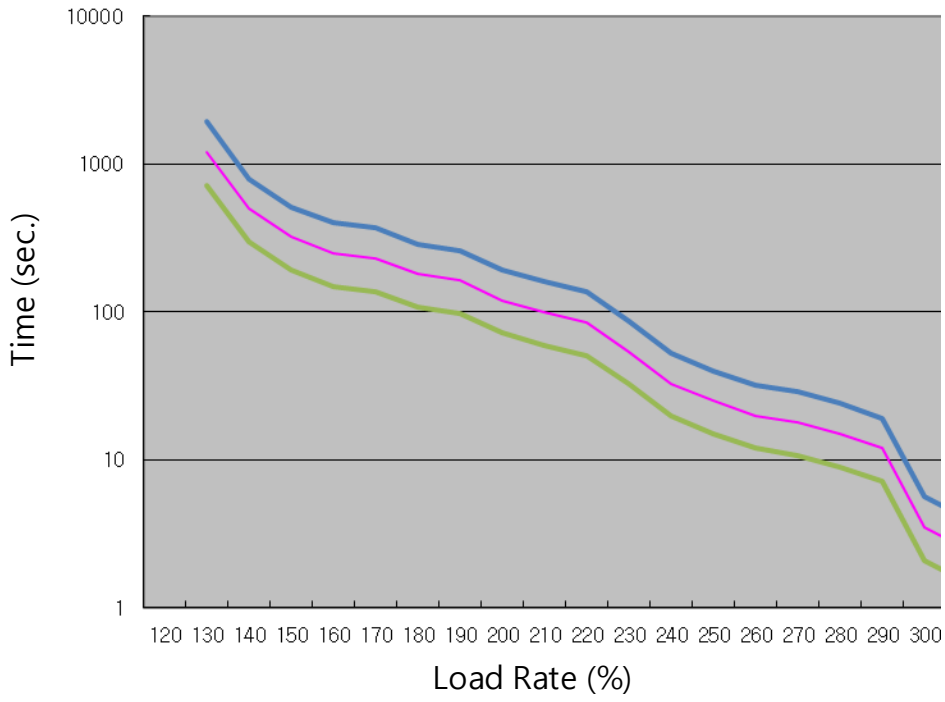
Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	37937.7	60700.3	22762.62	210	50.1	80.2	30.06
120	9483.9	15174.2	5690.34	220	38.5	61.6	23.1
130	4215.1	6744.2	2529.06	230	30.3	48.5	18.18
140	2371.0	3793.6	1422.6	240	9.7	15.5	5.82
150	926.0	1481.6	555.6	250	8.3	13.3	4.98
160	470.0	752.0	282	260	3.8	6.1	2.28
170	273.0	436.8	163.8	270	3.4	5.4	2.04
180	173.0	276.8	103.8	280	3.1	5.0	1.86
190	117.0	187.2	70.2	290	2.7	4.3	1.62
200	66.0	105.6	39.6	300	2.0	3.2	1.2

■ Servo Drive Overload Graphs (3.5KW)

(1) Rotation overload graph

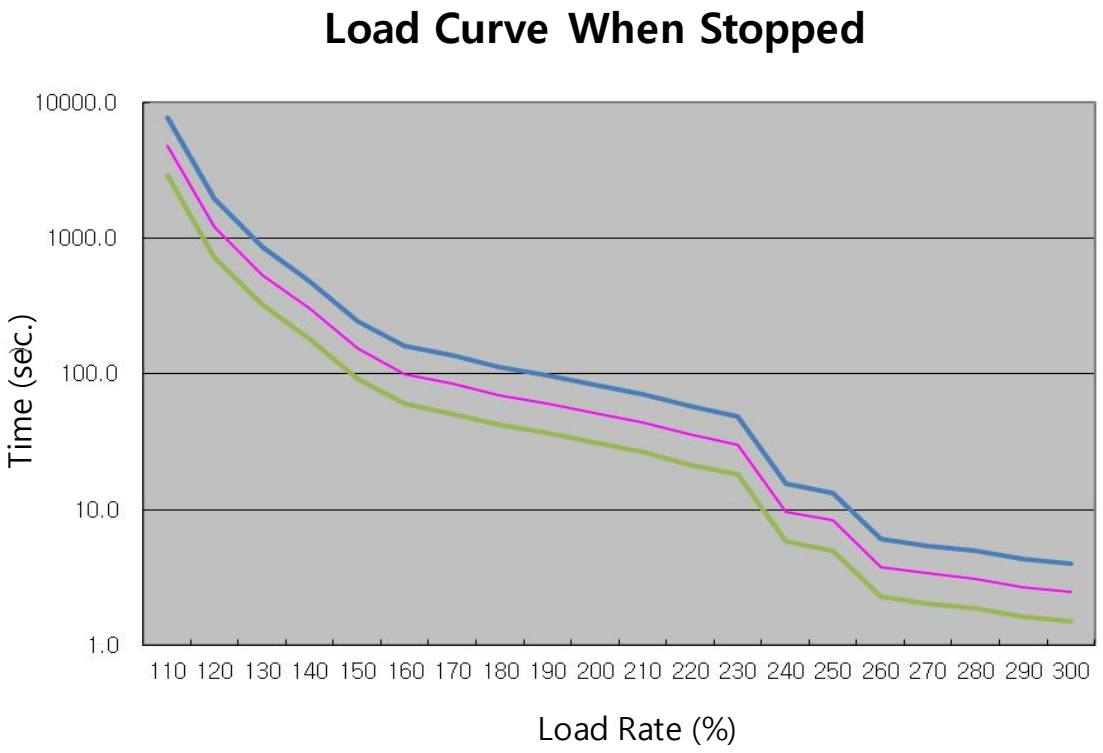
Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
110% or lower	Infinite			210	85	136.0	51
120	1208	1932.8	724.8	220	54	86.4	32.4
130	500	800.0	300	230	33	52.8	19.8
140	323	516.8	193.8	240	25	40.0	15
150	250	400.0	150	250	20	32.0	12
160	231	369.6	138.6	260	18	28.8	10.8
170	180	288.0	108	270	15	24.0	9
180	164	262.4	98.4	280	12	19.2	7.2
190	120	192.0	72	290	3.5	5.6	2.1
200	100	160.0	60	300	85	4.0	1.5

Load Curve During Rotation



(2) Stoppage overload graph

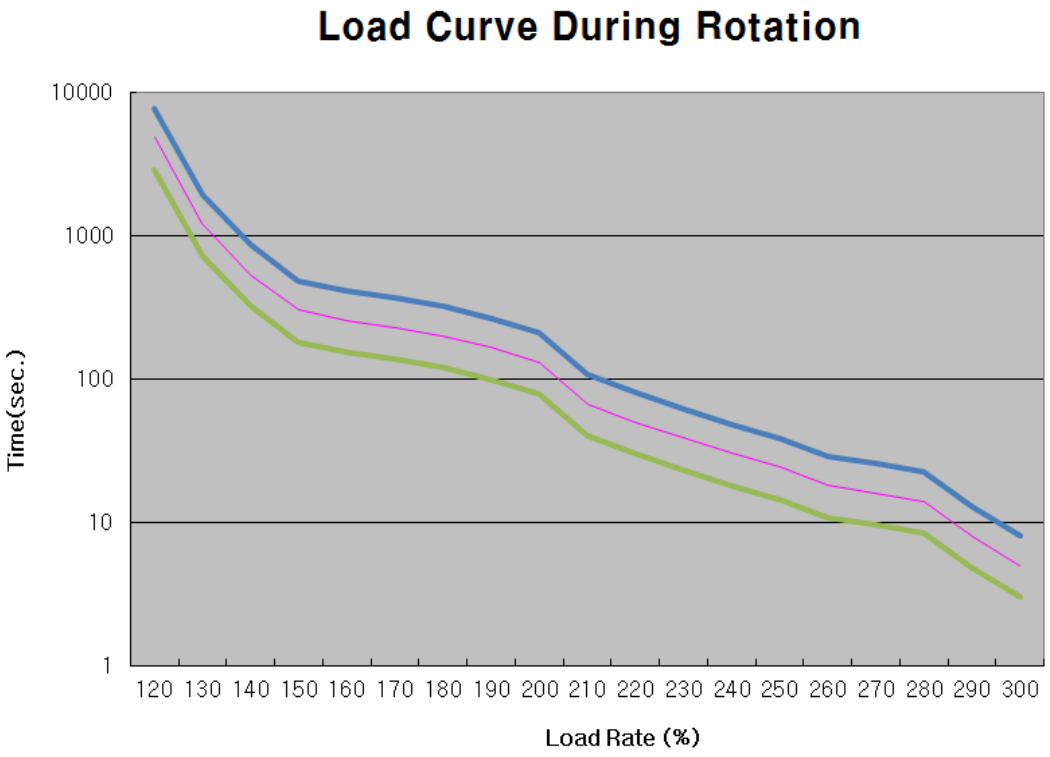
Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	4600	7360.0	2760	210	40	64.0	24
120	1208	1932.8	724.8	220	36	57.6	21.6
130	500	800.0	300	230	25	40.0	15
140	303	484.8	181.8	240	10	16.0	6
150	150	240.0	90	250	7.5	12.0	4.5
160	100	160.0	60	260	3.5	5.6	2.1
170	80	128.0	48	270	3.1	5.0	1.86
180	69	110.4	41.4	280	2.9	4.6	1.74
190	58	92.8	34.8	290	2.5	4.0	1.5
200	52	83.2	31.2	300	2.3	3.7	1.38



■ Servo Drive Overload Graphs (5KW)

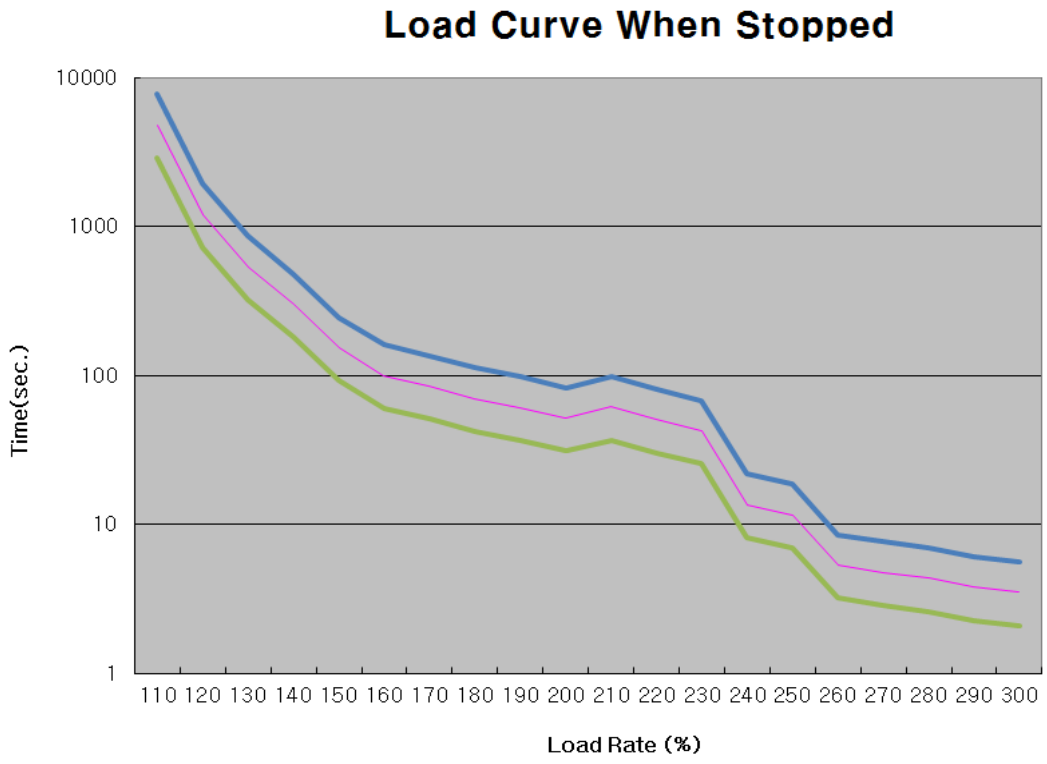
(1) Rotation overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
110%이하	무한대			210	66.8	93.52	40.08
120	4832	6764.8	2899.2	220	50.1	70.14	30.06
130	1208	1691.2	724.8	230	38.5	53.9	23.1
140	536.9	751.66	322.14	240	30.3	42.42	18.18
150	302	422.8	181.2	250	24.2	33.88	14.52
160	257	359.8	154.2	260	18	25.2	10.8
170	229	320.6	137.4	270	16	22.4	9.6
180	200	280	120	280	14	19.6	8.4
190	165	231	99	290	8	11.2	4.8
200	131	183.4	78.6	300	5	7	3



(2) Stoppage overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100%이하	무한대						
110	4832	6764.8	2899.2	210	61.6	26.4	44
120	1208	1691.2	724.8	220	50.4	21.6	36
130	536	750.4	321.6	230	42.42	18.18	30.3
140	302	422.8	181.2	240	13.58	5.82	9.7
150	154	215.6	92.4	250	11.62	4.98	8.3
160	100	140	60	260	5.32	2.28	3.8
170	85	119	51	270	4.76	2.04	3.4
180	70	98	42	280	4.34	1.86	3.1
190	61	85.4	36.6	290	3.78	1.62	2.7
200	52	72.8	31.2	300	3.5	1.5	2.5

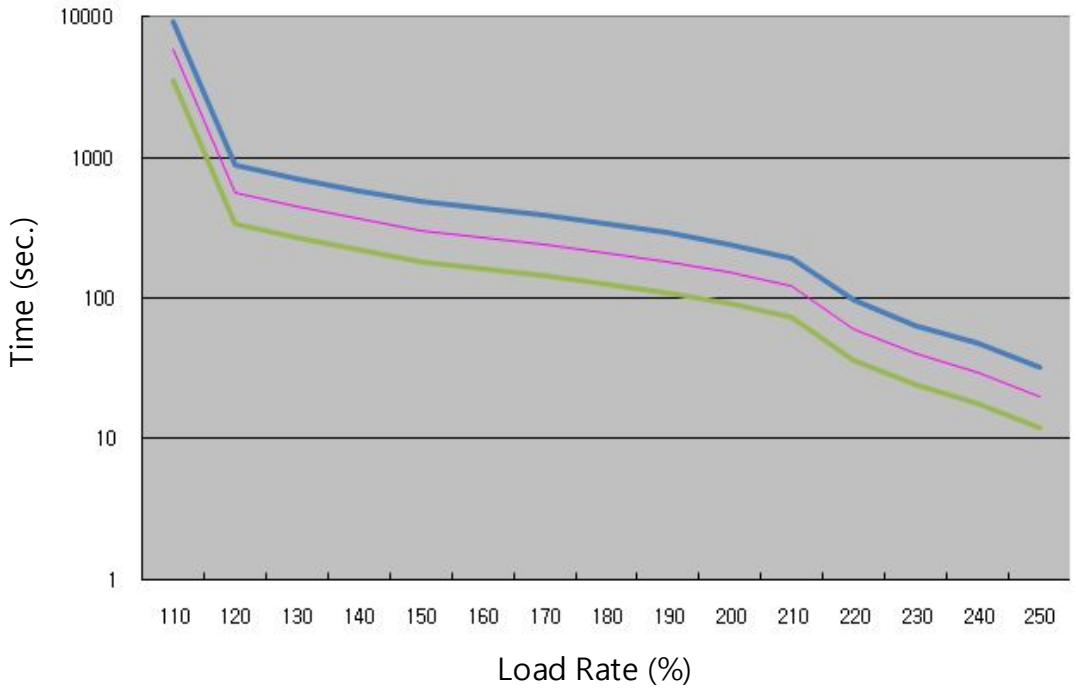


■ Servo Drive Overload Graphs (7.5KW)

(1) Rotation overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	5760	9216.0	3456	210	120	192.0	72
120	550	880.0	330	220	60	96.0	36
130	440	704.0	264	230	40	64.0	24
140	360	576.0	216	240	30	48.0	18
150	300	480.0	180	250	20	32.0	12
160	270	432.0	162				
170	240	384.0	144				
180	210	336.0	126				
190	180	288.0	108				
200	150	240.0	90				

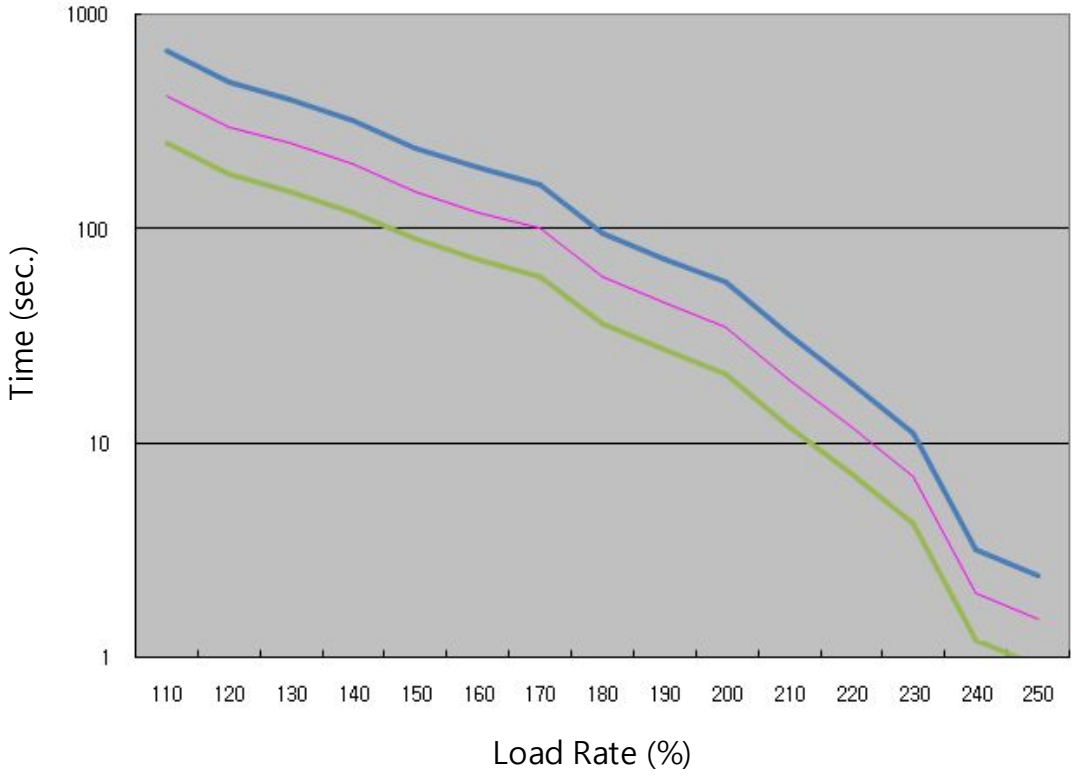
Load Curve During Rotation



(2) Stoppage overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	420	672.0	252	210	20	32.0	12
120	300	480.0	180	220	12	19.2	7.2
130	250	400.0	150	230	7	11.2	4.2
140	200	320.0	120	240	2	3.2	1.2
150	150	240.0	90	250	1.5	2.4	0.9
160	120	192.0	72				
170	100	160.0	60				
180	60	96.0	36				
190	45	72.0	27				
200	35	56.0	21				

Load Curve When Stopped

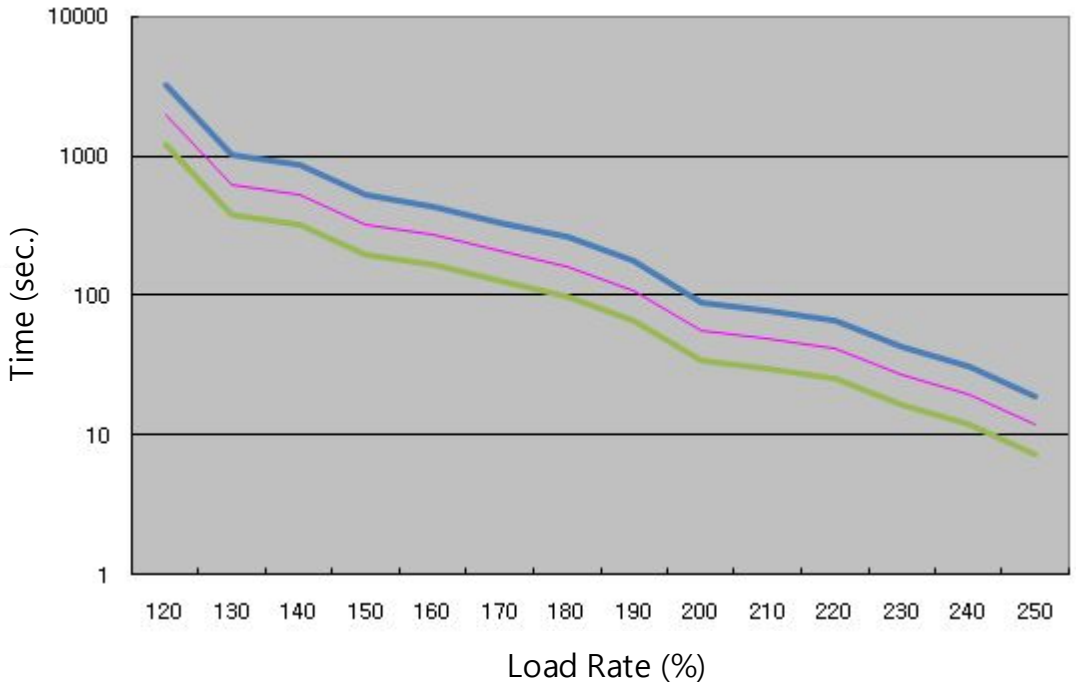


■ Servo Drive Overload Graphs (15KW)

(1) Rotation overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	Infinite	Infinite	Infinite	210	49	78.4	29.4
120	1998	3196.8	1198.8	220	42	67.2	25.2
130	630	1008.0	378	230	27.2	43.5	16.32
140	540	864.0	324	240	19.6	31.4	11.76
150	324	518.4	194.4	250	12	19.2	7.2
160	271.8	434.9	163.08				
170	210.6	337.0	126.36				
180	162.9	260.6	97.74				
190	111	177.6	66.6				
200	56	89.6	33.6				

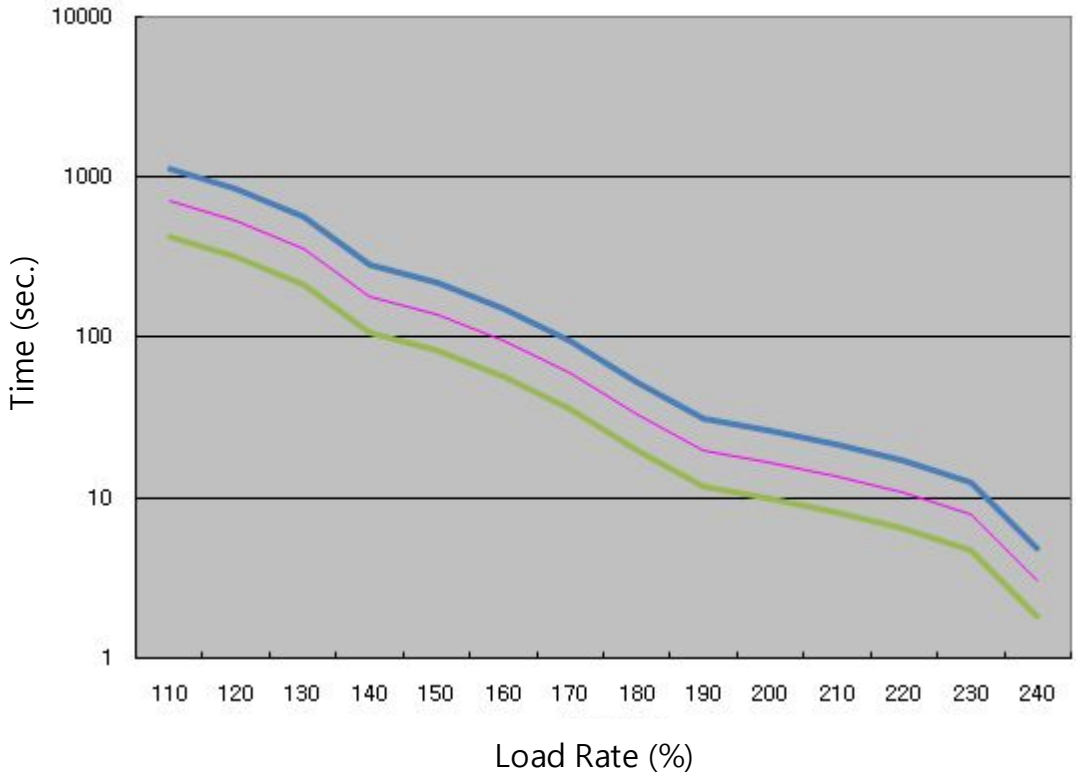
Load Curve During Rotation



(2) Stoppage overload graph

Load (%)	AL-21 Occurring Time (sec)	Max	Min	Load (%)	AL-21 Occurring Time (sec)	Max	Min
100% or lower	Infinite						
110	Infinite	Infinite	Infinite	210	16.4	26.2	9.84
120	698.4	1117.4	419.04	220	13.5	21.6	8.1
130	524.2	838.7	314.52	230	10.6	17.0	6.36
140	350.1	560.2	210.06	240	7.8	12.5	4.68
150	176	281.6	105.6	250	3	4.8	1.8
160	135	216.0	81				
170	94	150.4	56.4				
180	60	96.0	36				
190	32.8	52.5	19.68				
200	19.3	30.9	11.58				

Load Curve When Stopped



9. Appendix

9.1 Motor Types and IDs

Model Name	ID	Watt	Notes
SEP09A	461	900	
SEP15A	462	1500	
SEP22A	463	2200	
SEP30A	464	3000	
SEP06D	465	600	
SEP11D	466	1100	
SEP16D	467	1600	
SEP22D	468	2200	
SEP03M	469	300	
SEP06M	470	600	
SEP09M	471	900	
SEP12M	472	1200	
SEP05G	473	450	
SEP09G	474	850	
SEP13G	475	1300	
SEP17G	476	1700	
SFP30A	481	3000	
SFP50A	482	5000	
SFP22D	485	2200	
SFP35D	486	3500	
SFP55D	487	5500	
SFP75D	488	7500	
SFP12M	489	1200	
SFP20M	490	2000	
SFP30M	491	3000	
SFP44M	492	4400	
SFP20G	493	1800	
SFP30G	494	2900	
SFP44G	495	4400	
SFP60G	496	6000	
SFP75G	497	7500	
SGP22D	511	2200	

Model Name	ID	Watt	Notes
SGP35D	512	3500	
SGP55D	513	5500	
SGP75D	514	7500	
SGP110D	515	11000	
SGP12M	521	1200	
SGP20M	522	2000	
SGP30M	523	3000	
SGP44M	524	4400	
SGP60M	525	6000	
SGP20G	531	1800	
SGP30G	532	2900	
SGP44G	533	4400	
SGP60G	534	6000	
SGP85G	535	8500	
SGP150G	537	15000	

Model Name	ID	Watt	Notes
FEP09A	261	900	
FEP15A	262	1500	
FEP22A	263	2200	
FEP30A	264	3000	
FEP06D	265	600	
FEP11D	266	1100	
FEP16D	267	1600	
FEP22D	268	2200	
FEP03M	269	300	
FEP06M	270	600	
FEP09M	271	900	
FEP12M	272	1200	
FEP05G	273	450	
FEP09G	274	850	
FEP13G	275	1300	
FEP17G	276	1700	
FFP30A	281	3000	
FFP50A	282	5000	
FFP22D	285	2200	
FFP35D	286	3500	
FFP55D	287	5500	
FFP75D	288	7500	
FFP12M	289	1200	
FFP20M	290	2000	
FFP30M	291	3000	
FFP44M	292	4400	
FFP20G	293	1800	
FFP30G	294	2900	
FFP44G	295	4400	

Model Name	ID	Watt	Notes
FFP60G	296	6000	
FFP75G	297	7500	
FGP22D	311	2200	
FGP35D	312	3500	
FGP55D	313	5500	
FGP75D	314	7500	
FGP12M	321	1200	
FGP20M	322	2000	
FGP30M	323	3000	
FGP44M	324	4400	
FGP20G	331	1800	
FGP30G	332	2900	
FGP44G	333	4400	
FGP60G	334	6000	

9.2 Test Drive Procedure

Thank you for purchasing our product. Perform the following process to conduct the initial test drive:

⚠ Caution

In order to prevent accidents, conduct an operation test and test drive in manual JOG operation when there is no load (the motor exists without any coupling or belt) after attaching the servo motor to your equipment. Afterwards, connect the load and conduct the final test drive.

1. Product check: Check the name tag to verify that the product received matches the model ordered (refer to section 1.1).

- A name tag is attached to the right side of the product. (to the right side of the shaft on the motor).
- Main check point: Product capacity and main options

2. Power connection: Wire a single-phase AC 380[V] power supply to control power input C1 and C2, and wire a three-phase AC 380 V-480V power supply to main power input L1, L2, and L3. (refer to section 3.2).

- Make sure that 3-phase AC 380 V-480 V power is input as main power before using our product.

3. Signal cable wiring: Wire CN1 (I/O), CN3, CN4, CN5 (communication), CN2 encoder cable, and motor power cable per operation mode. (refer to section 1.2 and chapter 3).

- Be sure to use robot cables if the motor requires movement.
- Be sure to use twist shield cables as signal and encoder cables.
- Be sure to fasten bolts after locking the connector (drive direction) of the encoder cable.
- Be sure not to change the U, V, and W wiring of the motor power cable.

4. Control power supply: Supply single-phase AC 380 V power to C1 and C2.

- Be sure to check external input voltage before turning on the servo drive.
- Check whether the display is normal. (There should be no break on the seven segments or alarm output.)

5. Motor ID setting: Set motor ID in the parameter [P0-00] and encoder pulse in the parameter [P0-02] respectively. (Refer to "Appendix 1.")

(※ The serial encoder is automatically set.)

- Easy check: Check the motor ID and encoder pulse on the product name tag attached on the right side of the motor.
- Check whether the external control signal input is normal.
- For information on how to handle the keys of the servo drive loader, refer to "4.1 Loader Handling."

6. Main power supply: Supply three-phase AC 380 V-480 V power to L1, L2 and L3.

- Be sure to check external input voltage before turning on the servo drive.
- When power is supplied, the red lamp on the charge LED at the bottom of the loader window comes on.
- If an alarm appears, it indicates that there is an error in the power circuit, servo motor wiring, or encoder wiring.
  Turn off power and fix the error using the information in "[Alarm Codes and Descriptions]."

7. Test drive: Start [Cn-00] by pressing [SET] to conduct test drive manually. (JOG operation speed can be changed in [P3-12].)

- * [Up]: Motor forward rotation (CCW) → Only operate while you hold down the key.
- * [Down]: Reverse motor rotation (CW) → Only operate while you hold down the key.
  - During normal operation, the power input of the servo drive and wiring among motors are verified as normal.
  - If the alarm is displayed, it indicates an error in the power circuit, wiring of the servo motor, or encoder wiring. Turn off power and fix the error using the information in "[Alarm Codes and Descriptions]."

9. Operation mode setting: Set operation mode in [P0-03].

- 0: Torque control operation
- 1: Speed control operation
- 2: Position control operation
- 3: Speed/position control operation
- 4: Speed/torque control operation

Speed operation setting

Position operation setting

10. Perform speed operation with the upper level controller by adjusting the following parameter data.

- **a.** Speed operation parameter: [P3-01]-[P3-20]
- **b.** Input/Output parameter: [P2-00]-[P2-22]
- **c.** Control parameter: [P1-00]-[P1-27] (Refer to “Appendix 1.”)

11. Perform position operation with the upper level controller by adjusting the following parameter data.

- **d.** Position operation parameter: [P4-00]-[P4-14]
- **e.** Input/Output parameter: [P2-00]-[P2-22]
- **f.** Control parameter: [P1-00]-[P1-27] (Refer to “Appendix 1.”)

10-1

- How to Set Control Parameters [Gain Tuning]

  1) Auto gain tuning

  → Perform automatic gain tuning by pressing [SET] in [Cn-05].

  → If the load condition of the equipment is not directly related to motor shaft, it is hard to perform accurate gain tuning because of characteristics of automatic gain tuning. Therefore, manual gain tuning is recommended.

  2) Manual gain tuning

  → Set inertia ratio [P1-00], speed proportional gain [P1-06], and speed integral time constant [P1-08] as the standard gain.

  → Increase inertia ratio [P1-00] gradually until the motor starts vibrating.

  → For more stable control, increase speed proportional gain [P1-06] a little at a time until the motor vibrates slightly. If you increase speed integral time constant [P1-08], the motor stops vibrating.

  → Increase speed integral time constant [P1-08] in the last stage and the motor will stop vibrating. However, it takes as much time to reach normal state as the time constant set in responsiveness. If you set speed proportional gain [P1-06] too big in an effort to attain satisfying responsiveness, overshoot might occur. The allowed range of overshoot is generally 10 percent or below.

11-1

- How to Set Electric Gear Ratio [P4-01]-[P4-05]

  → Electric gear ratio = transmission per input pulse X number of pulses per motor rotation / transmission per motor rotation

User Manual Revision History

Number	Date issued	Revised content	Version	Notes
1	2013.06.20	Modified miss printing and drawing	1.1	
2	2014.03.13	Added functions and precautions	1.2	
3	2014.08.06	Added wiring with PLC, New motor and cables. Indicated applicable mode on the parameter.	1.3	
4	2014.11.06	Added New Model(L7NHB050U)	1.4	
5	2020.05.15	Changed company name to ‘LS ELECTRIC’	1.5	
6	2021.07.15	Add N terminal caution	1.6	
7				
8				
9				

Green Management

LS ELECTRIC considers protecting the environment a high priority. We work hard to protect the Earth.

Product Disposal

The LS ELECTRIC servo drive is environmentally friendly.

You can disassemble the drive and recycle the iron, aluminum, bronze and synthetic resin (cover) components.

www.ls-electric.com

LS ELECTRIC Co., Ltd.

■ Headquarter
LS-ro 127(Hogye-dong) Dongan-gu, Anyang-si, Gyeonggi-Do, 14119, Korea
■ Seoul Office
LS Yongsan Tower, 92, Hangang-daero, Yongsan-gu, Seoul, 04386, Korea
Tel: 82-2-2034-4033, 4888, 4703 Fax: 82-2-2034-4588
E-mail: automation@ls-electric.com

■ Overseas Subsidiaries
• LS ELECTRIC Japan Co., Ltd. (Tokyo, Japan)
Tel: 81-3-6268-8241 E-Mail: japan@ls-electric.com
• LS ELECTRIC (Dalian) Co., Ltd. (Dalian, China)
Tel: 86-411-8730-6495 E-Mail: china.dalian@lselectric.com.cn
• LS ELECTRIC (Wuxi) Co., Ltd. (Wuxi, China)
Tel: 86-510-6851-6666 E-Mail: china.wuxi@lselectric.com.cn
• LS ELECTRIC Middle East FZE (Dubai, U.A.E.)
Tel: 971-4-886-5360 E-Mail: middleeast@ls-electric.com
• LS ELECTRIC Europe B.V. (Hoofddorp, Netherlands)
Tel: 31-20-654-1424 E-Mail: europartner@ls-electric.com
• LS ELECTRIC America Inc. (Chicago, USA)
Tel: 1-800-891-2941 E-Mail: sales.us@lselectricamerica.com
• LS ELECTRIC Turkey Co., Ltd.
Tel: 90-212-806-1225 E-Mail: turkey@ls-electric.com

■ Overseas Branches
• LS ELECTRIC Tokyo Office (Japan)
Tel: 81-3-6268-8241 E-Mail: tokyo@ls-electric.com
• LS ELECTRIC Beijing Office (China)
Tel: 86-10-5095-1631 E-Mail: china.auto@lselectric.com.cn
• LS ELECTRIC Shanghai Office (China)
Tel: 86-21-5237-9977 E-Mail: china.auto@lselectric.com.cn
• LS ELECTRIC Guangzhou Office (China)
Tel: 86-20-3818-2883 E-Mail: china.auto@lselectric.com.cn
• LS ELECTRIC Chengdu Office (China)
Tel: 86-28-8670-3201 E-Mail: china.auto@lselectric.com.cn
• LS ELECTRIC Qingdao Office (China)
Tel: 86-532-8501-2065 E-Mail: china.auto@lselectric.com.cn
• LS ELECTRIC Nanjing Office (China)
Tel: 86-25-8467-0005 E-Mail: china.auto@lselectric.com.cn
• LS ELECTRIC Bangkok Office (Thailand)
Tel: 66-90-950-9683 E-Mail: thailand@ls-electric.com
• LS ELECTRIC Jakarta Office (Indonesia)
Tel: 62-21-2933-7614 E-Mail: indonesia@ls-electric.com
• LS ELECTRIC Moscow Office (Russia)
Tel: 7-499-682-6130 E-Mail: info@lselectric-ru.com
• LS ELECTRIC America Western Office (Irvine, USA)
Tel: 1-949-333-3140 E-Mail: america@ls-electric.com

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