The right choice for the ultimate yield!

LS ELECTRIC strives to maximize your profits in gratitude for choosing us as your partner.

Xmotion

User Manual

L7S Series

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS ELECTRIC

Introduction

Hello. Thank you for choosing LS ELECTRIC L7S 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.
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Safety Precautions

Safety precautions are categorized as either Danger or Cautions, depending on the severity of the precaution.

Precautions	Meaning
⚠ **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.

Environment	Conditions	
	Servo Drive	Servo Motor
Ambient temperature	0~50[℃]	0~40[℃]
Storage temp.	-20~65[℃]	-10~60[℃]
Ambient humidity	90% RH or less (no condensation)	80% RH or less (no condensation)
Storage humidity		90% RH or less (no condensation)
Altitude	Up to 1000m	
Spacing	▪ 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 40 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 2mm between units • Refer to “3.2.2 Installation in the Control panel”	
Etc	▪ 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.	

⚠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
▪ Be sure to use the input power of the servo drive after checking the product. L7S**A**□□□A/B: AC 200[V]~230[V], L7S**B**□□□B: AC 380[V]~480[V] ▪ Be sure to connect the ground terminal of the servo drive to the 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 Twisted Pair Shield wire for the pulse command signal (PF+, PF-, PR+, PR-), speed command signal (SPDCOM) and torque command signal (TRQCOM). ▪ The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

■ Startup Precautions

⚠Caution
▪ Check the input voltage (AC 380-480 V) and power unit wiring before supplying power to the device. L7S**A**□□□A/B: AC 200[V]~230[V], L7S**B**□□□B: AC 380[V]~480[V] ▪ The servo must be in the OFF mode when you turn on the power. Confirm the motor ID [P0-00], encoder type, [P0-01] and the encoder pulse [P0-02] for L7SA/B □□□A/B first after you turn on the power. ▪ In the case of L7SA □□□A model, set the motor ID of [P0-00] and the encoder pulse of [P0-02] to match the specifications of the motor you want to use. ▪ 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 and perform CN1 wiring of the servo drive for each operation mode. ▪ The ON/OFF status of each input contact point of CN1 can be checked in [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. ▪ When attaching or detaching the CN1 and CN2 connectors, be sure to turn off the power. ▪ 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. ▪ 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 repair and inspect 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

■ Corresponding to overseas standards and laws

The L7 series is a standard specification and complies with overseas standards.

Model	Low Voltage Directive	EMC Directive
L7SA001X, L7SA002X L7SA004X, L7SA008X L7SA010X, L7SA020X L7SA035X, L7SA050X L7SA075B, L7SA150B L7SB010B, L7SB020B L7SB035B, L7SB050B L7SB075B, L7SB150B	EN61800-5-1	EN61800-3

Note 1) X = A or B: A = Quadrature Encoder Type, B = Serial Encoder Type

※1: For details, please contact us.

※2: When exporting, please follow the laws and regulations of the destination.

CE

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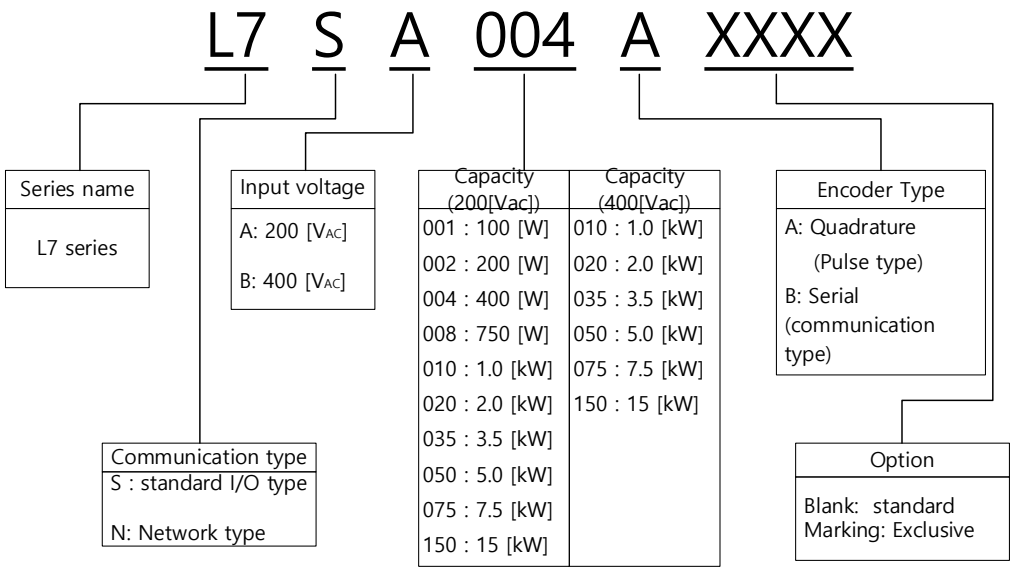
1. Product configuration and signal description

1.1 Product configuration

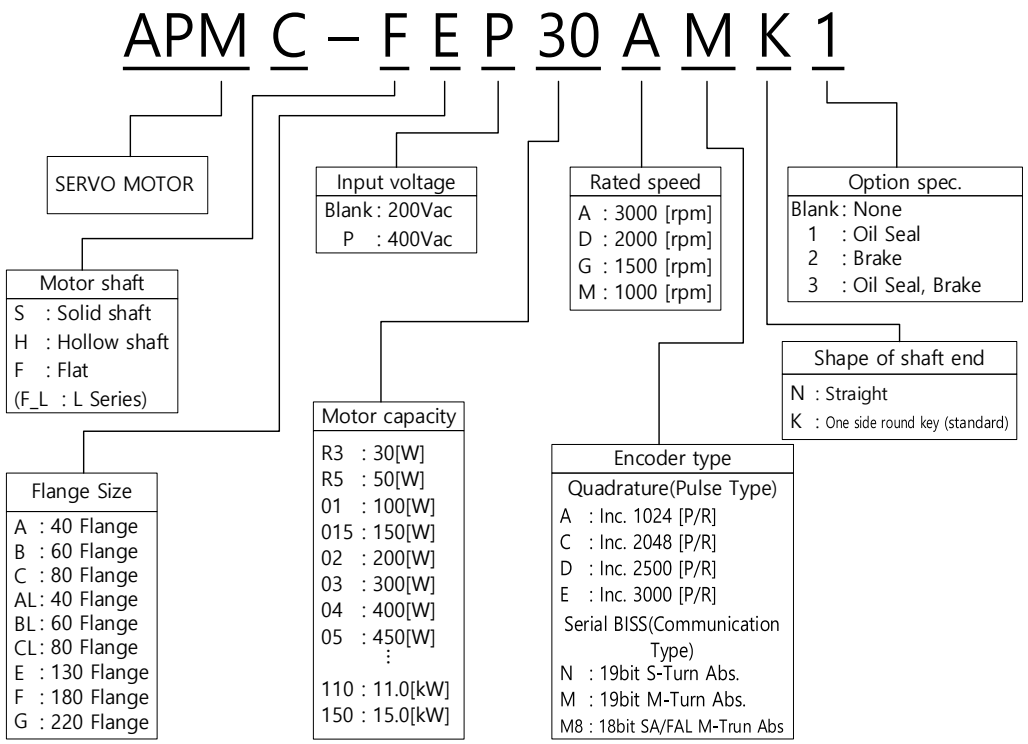
1.1.1 Product Verification

1. Check the name tag to verify that the product received matches the model ordered
   - Does the servo driver'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?

■ **Servo drive product type**



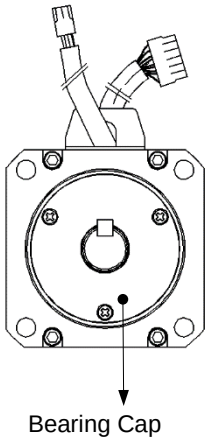
■ Servo motor product type

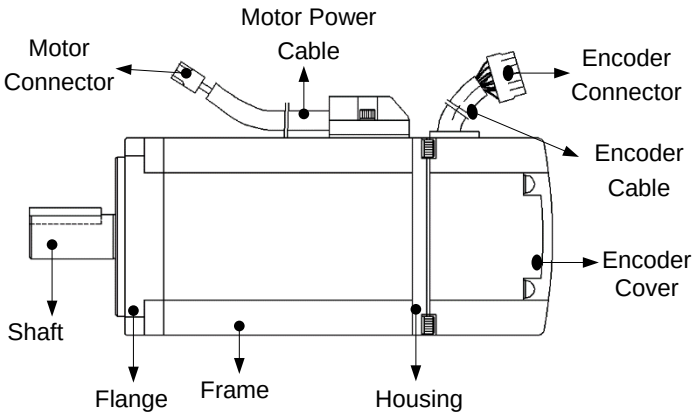


1.1.2 Part Names

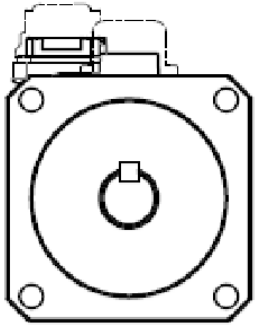
■ Servo Motor

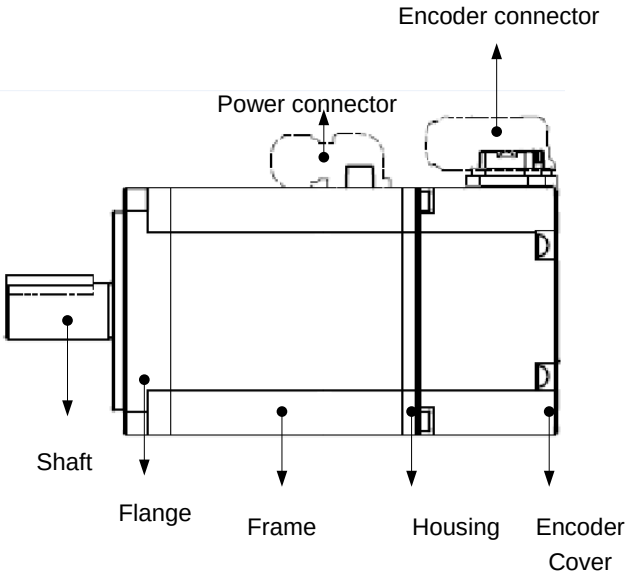
80 Flange or below



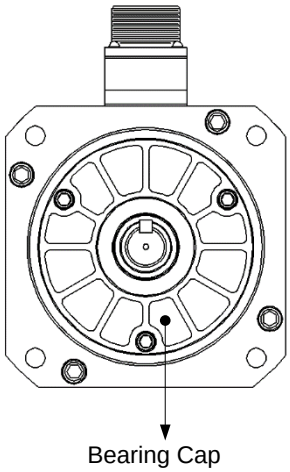


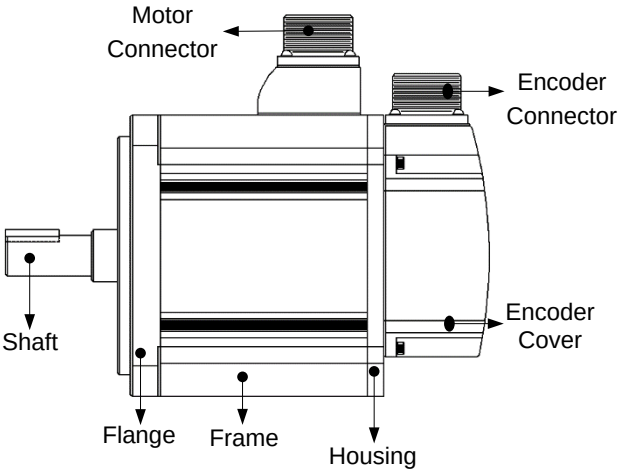
•80 Flange or less (L series)





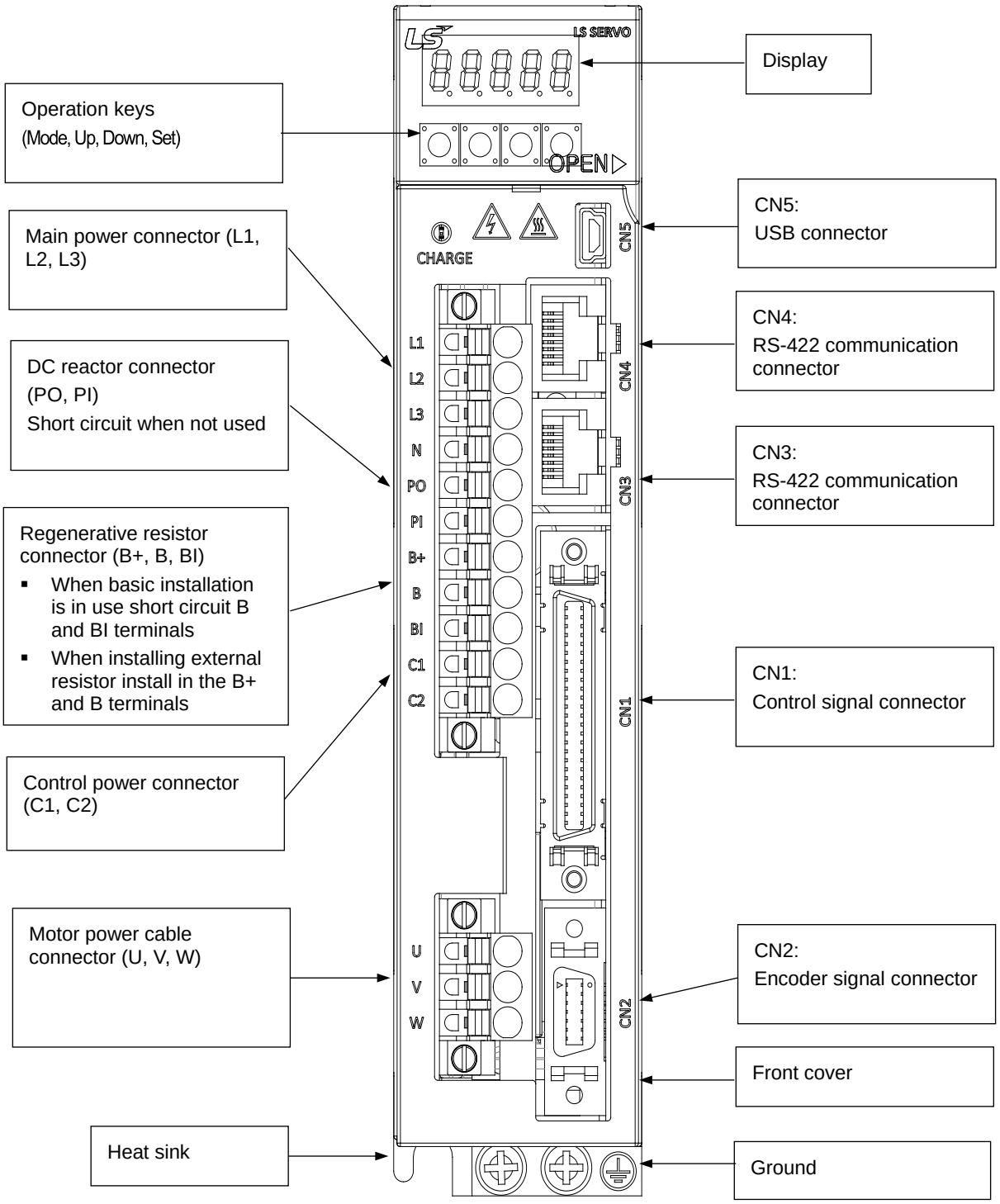
130 Flange or higher



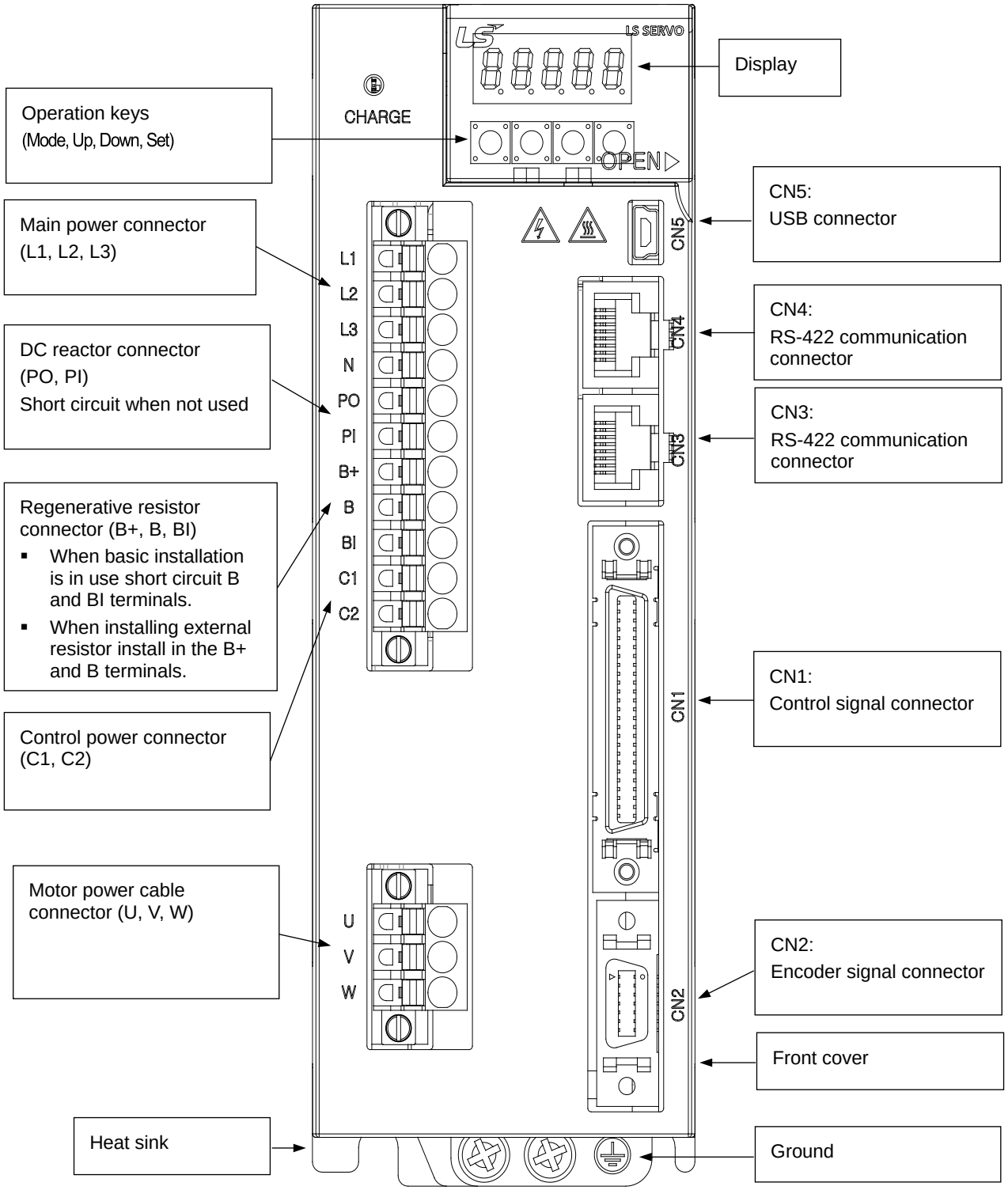


■ Servo Drive

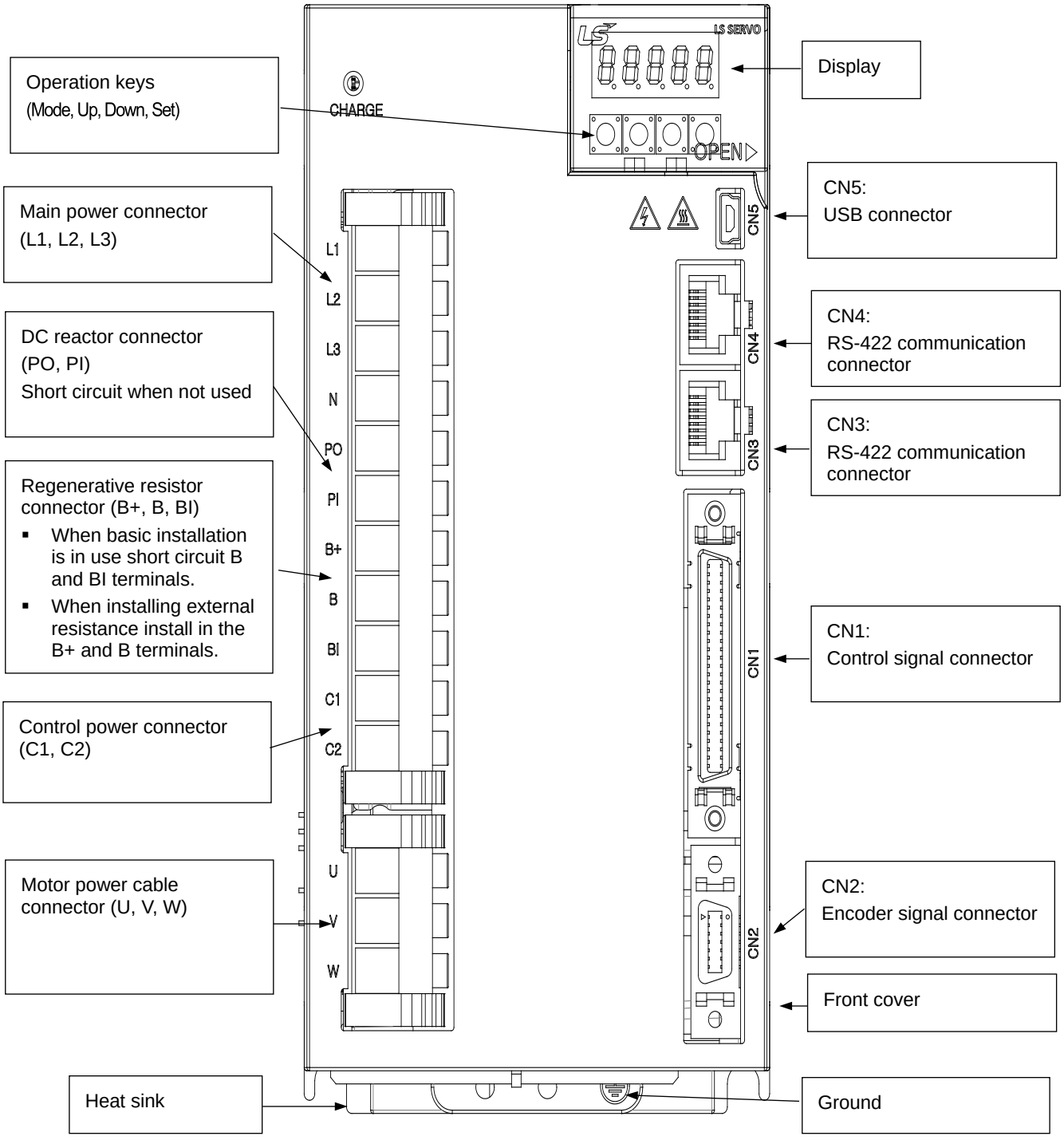
- L7SA 001□, L7SA 002□, L7SA 004□



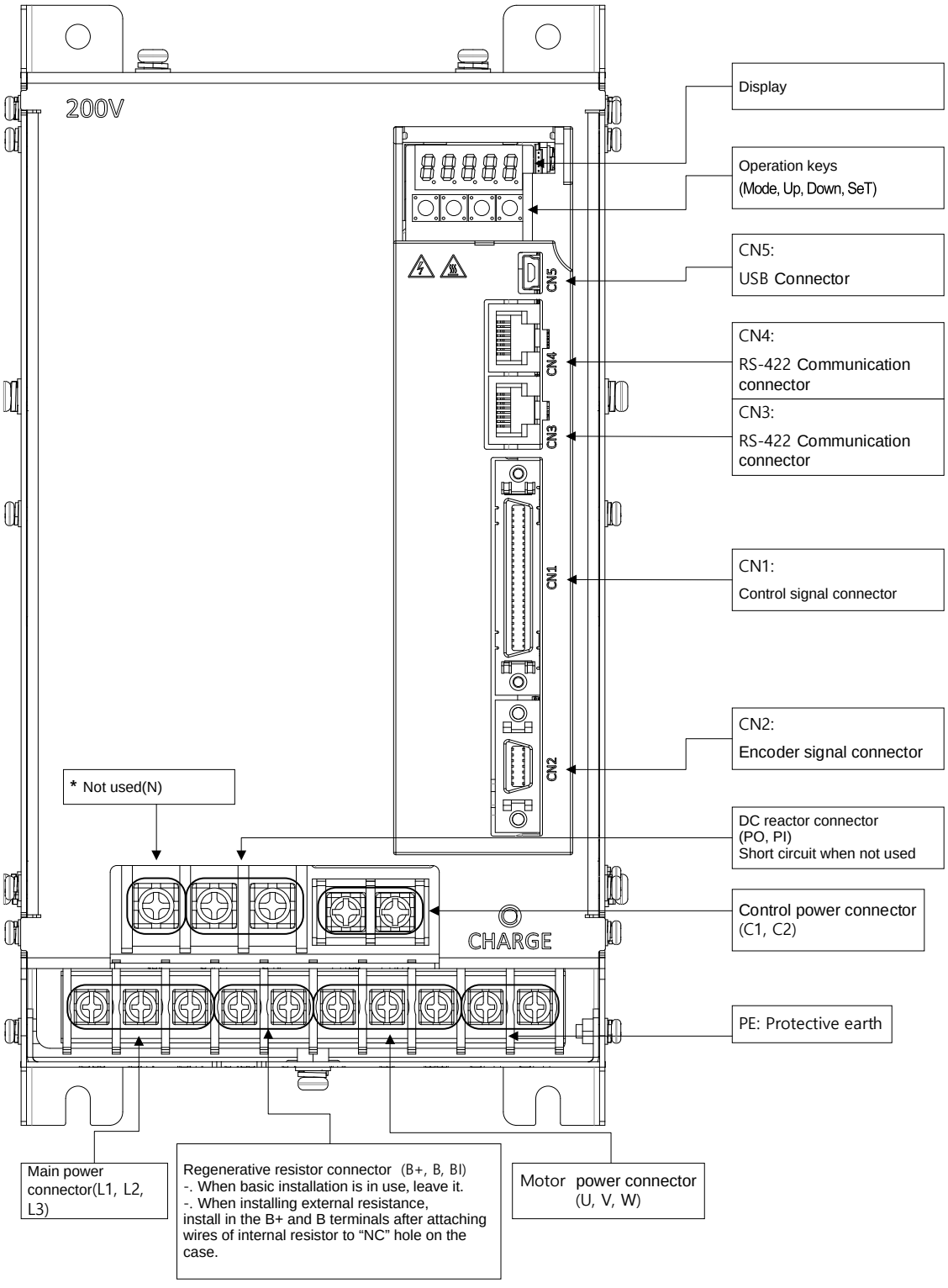
- L7SA 008□, L7SA 010□



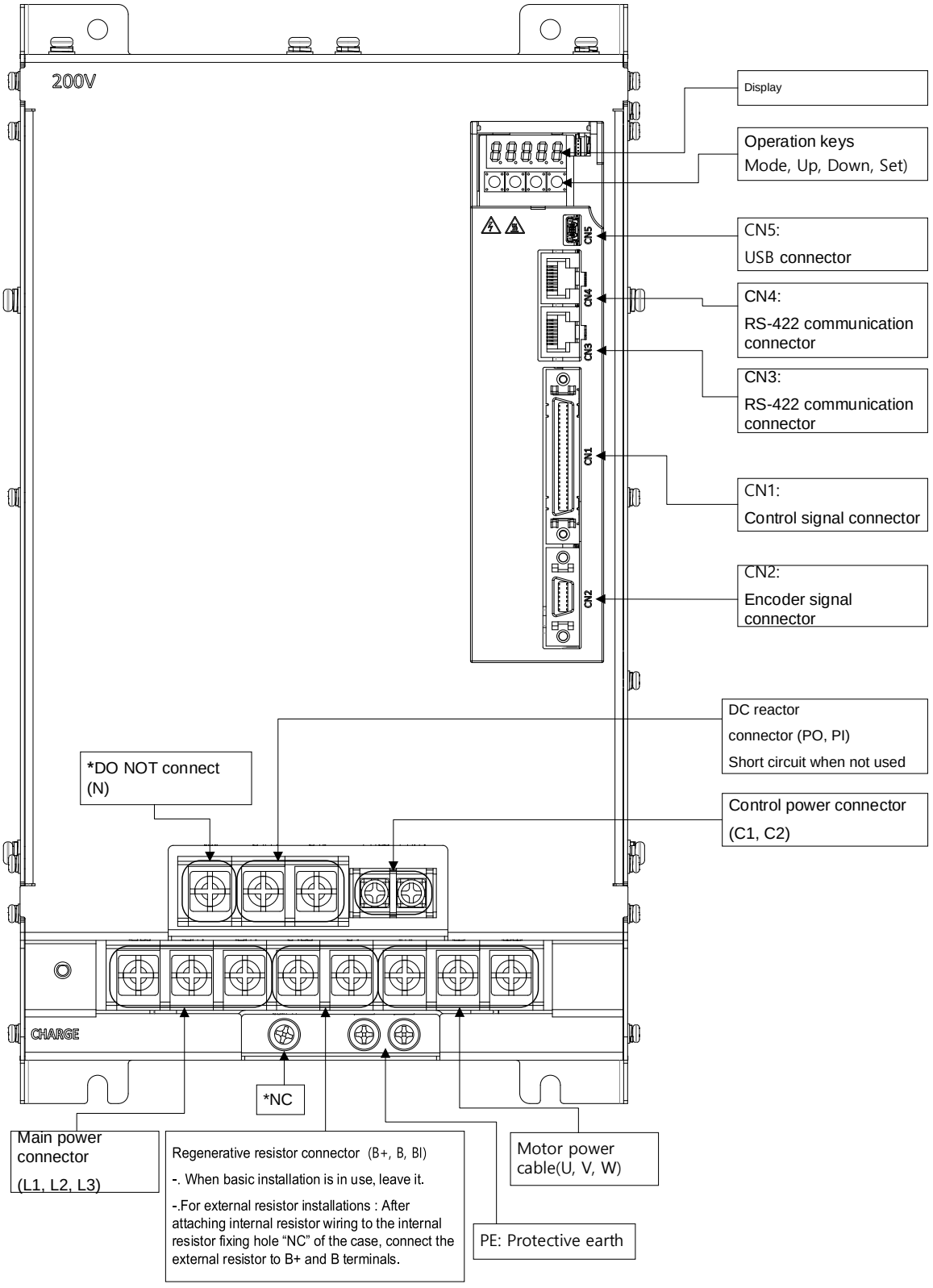
- L7SA 020□, L7SA 035□



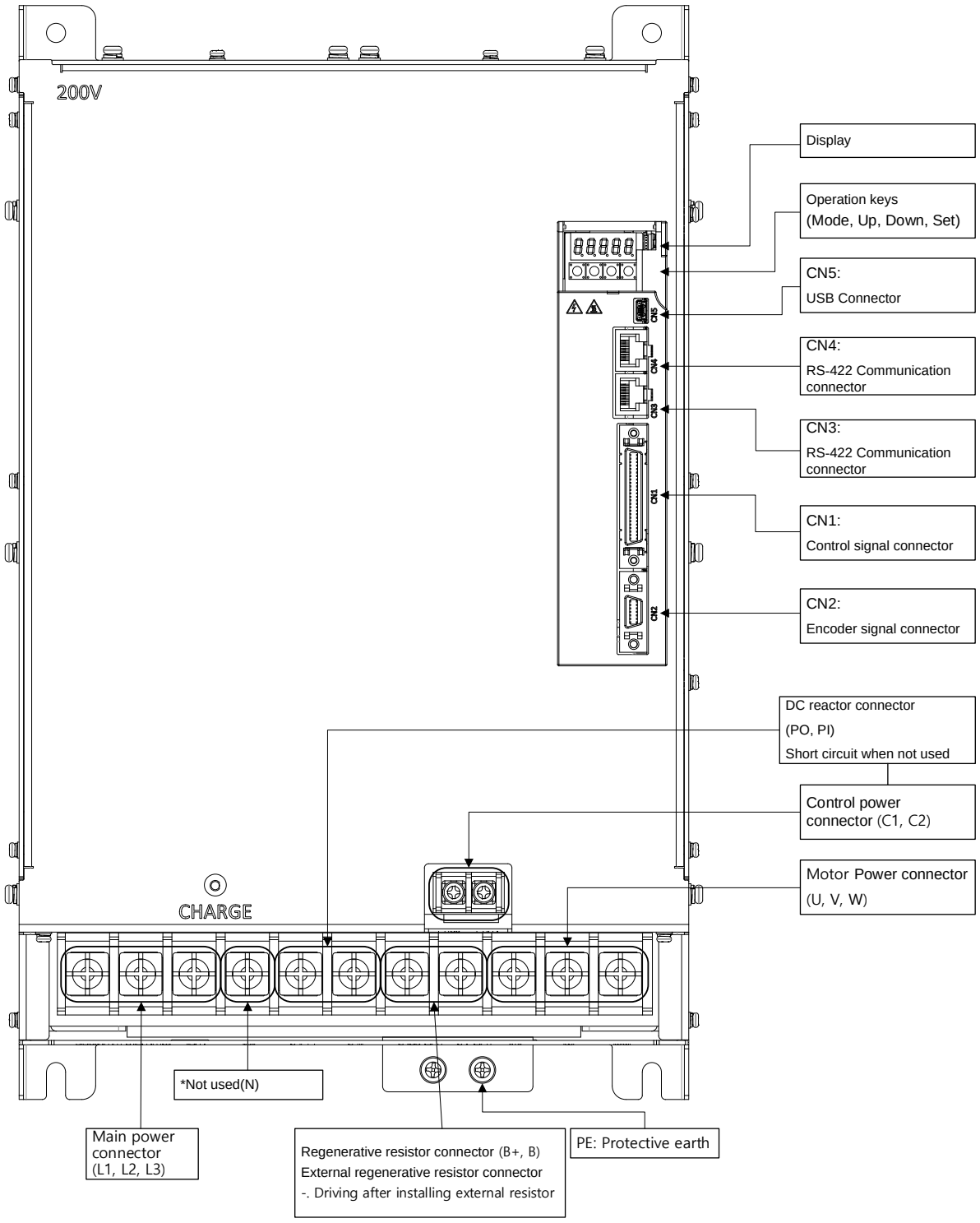
- L7SA 050□


200V
CN5
CN4
CN3
CN1
CN2
CHARGE
Display
Operation keys
(Mode, Up, Down, SeT)
CN5:
USB Connector
CN4:
RS-422 Communication connector
CN3:
RS-422 Communication connector
CN1:
Control signal connector
CN2:
Encoder signal connector
* Not used(N)
DC reactor connector
(PO, PI)
Short circuit when not used
Control power connector
(C1, C2)
PE: Protective earth
Main power connector(L1, L2, L3)
Regenerative resistor connector (B+, B, BI)
-. When basic installation is in use, leave it.
-. When installing external resistance, install in the B+ and B terminals after attaching wires of internal resistor to “NC” hole on the case.
Motor power connector
(U, V, W)

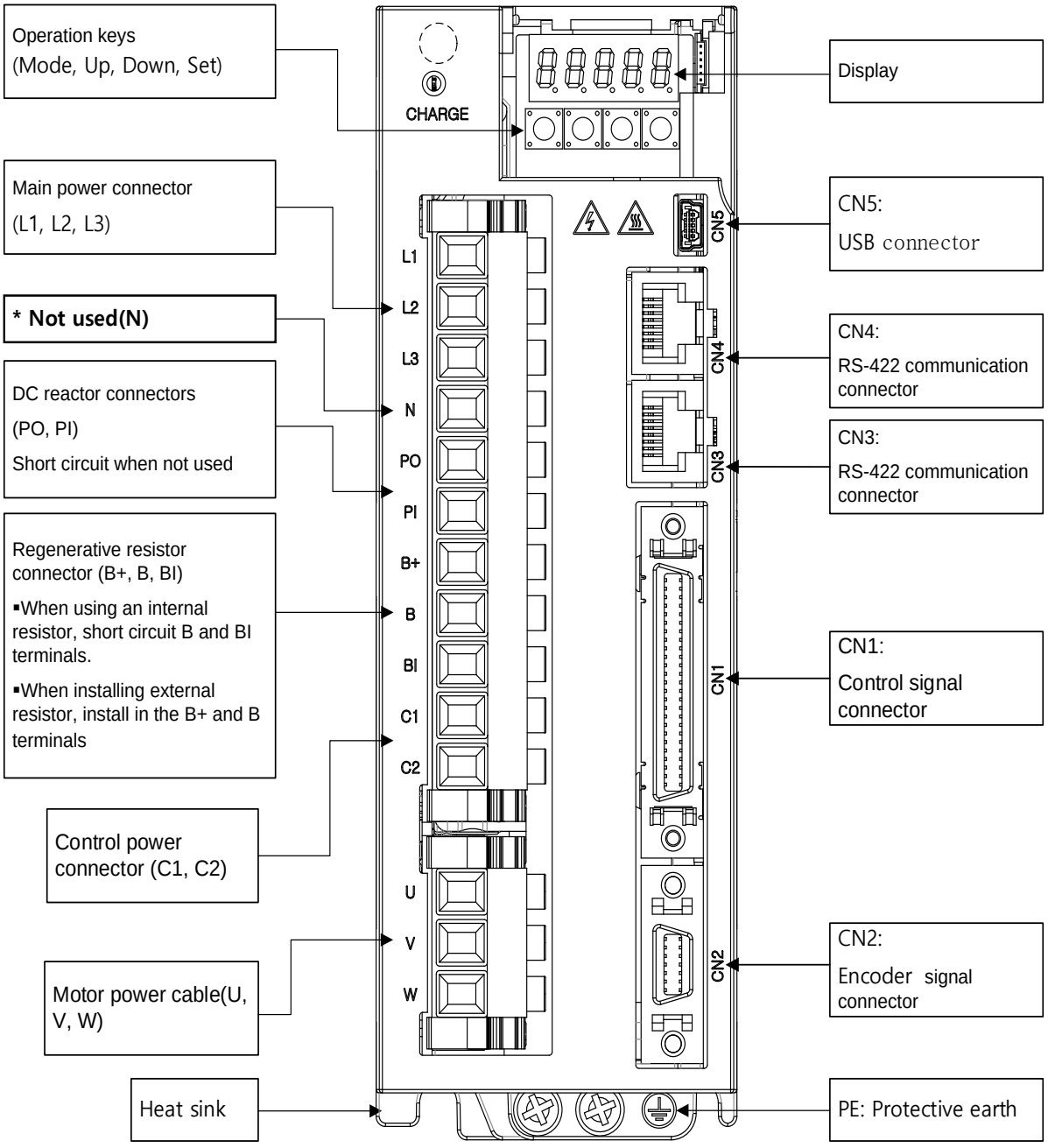
- L7SA 075B


200V
CN5
CN4
CN3
CN1
CN2
CHARGE
Display
Operation keys
Mode, Up, Down, Set)
CN5:
USB connector
CN4:
RS-422 communication connector
CN3:
RS-422 communication connector
CN1:
Control signal connector
CN2:
Encoder signal connector
DC reactor
connector (PO, PI)
Short circuit when not used
Control power connector
(C1, C2)
*DO NOT connect
(N)
*NC
Main power connector
(L1, L2, L3)
Regenerative resistor connector (B+, B, BI)
-. When basic installation is in use, leave it.
-.For external resistor installations : After attaching internal resistor wiring to the internal resistor fixing hole "NC" of the case, connect the external resistor to B+ and B terminals.
Motor power cable(U, V, W)
PE: Protective earth

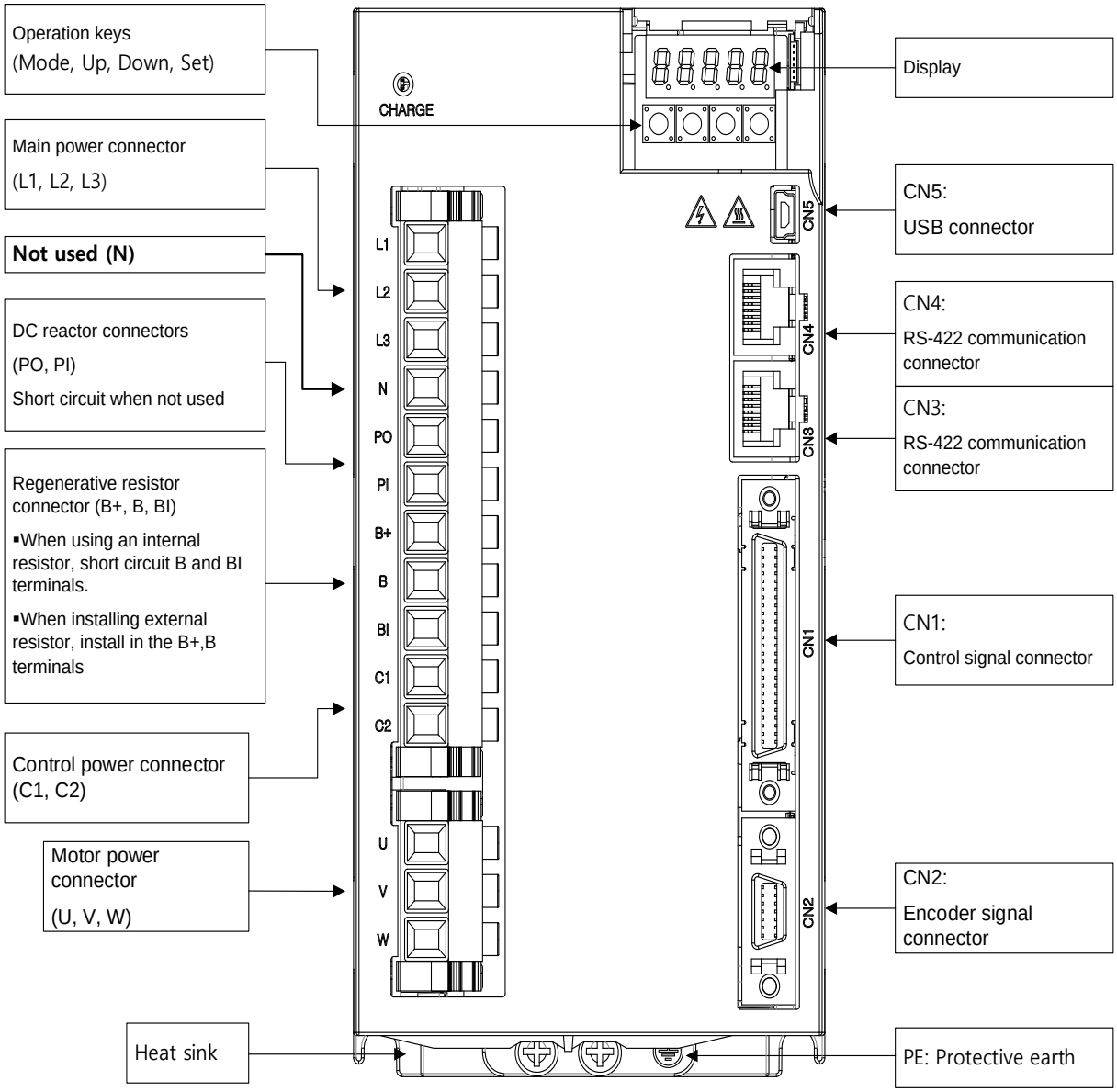
- L7SA 150B


200V
Display
Operation keys
(Mode, Up, Down, Set)
CN5:
USB Connector
CN4:
RS-422 Communication connector
CN3:
RS-422 Communication connector
CN1:
Control signal connector
CN2:
Encoder signal connector
DC reactor connector
(PO, PI)
Short circuit when not used
Control power connector (C1, C2)
Motor Power connector
(U, V, W)
CHARGE
*Not used(N)
Main power connector
(L1, L2, L3)
Regenerative resistor connector (B+, B)
External regenerative resistor connector
-. Driving after installing external resistor
PE: Protective earth

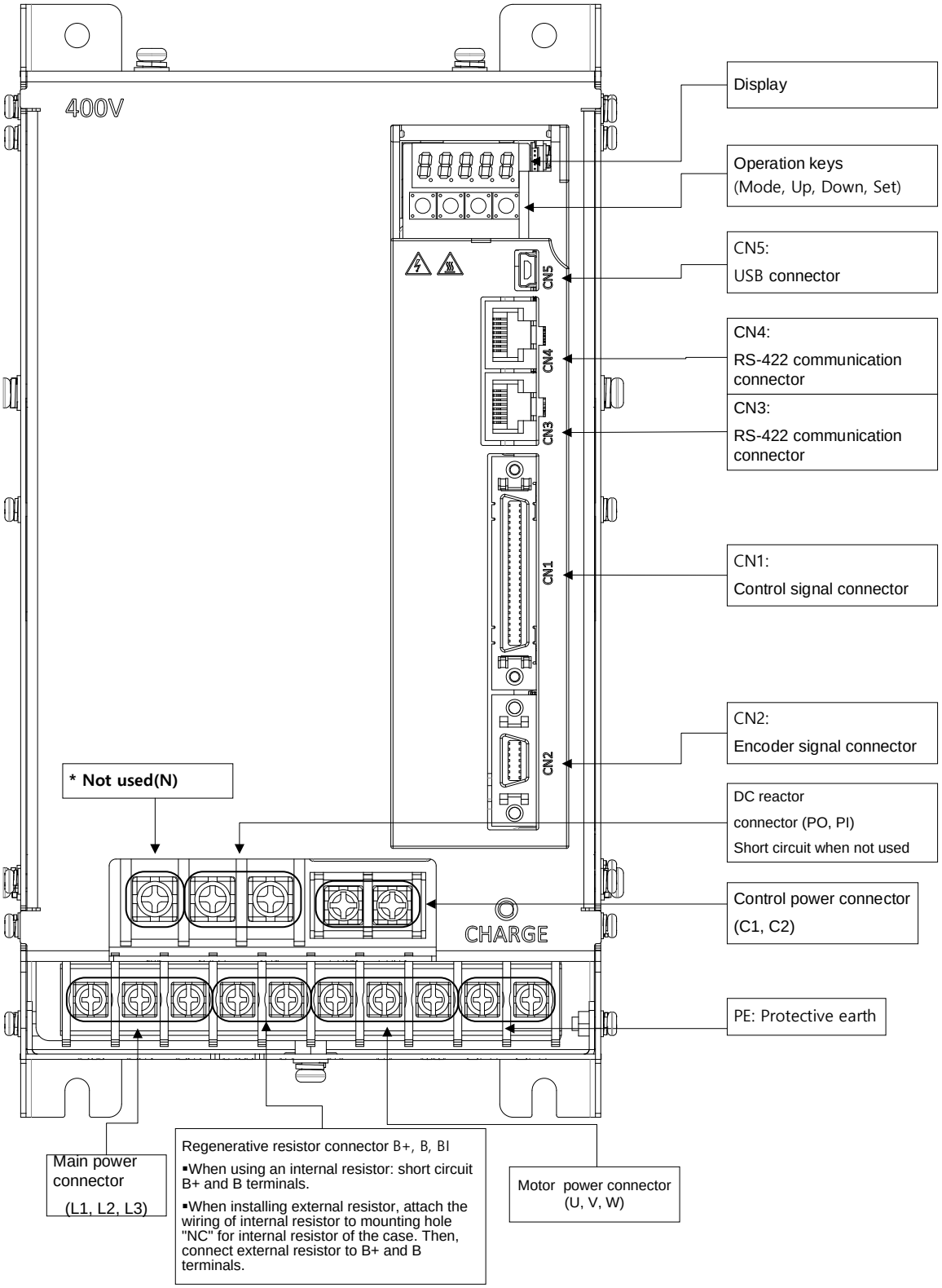
- L7SB 010B


Operation keys
(Mode, Up, Down, Set)
Main power connector
(L1, L2, L3)
* Not used(N)
DC reactor connectors
(PO, PI)
Short circuit when not used
Regenerative resistor connector (B+, B, BI)
▪When using an internal resistor, short circuit B and BI terminals.
▪When installing external resistor, install in the B+ and B terminals
Control power connector (C1, C2)
Motor power cable(U, V, W)
Heat sink
CHARGE
L1
L2
L3
N
PO
PI
B+
B
BI
C1
C2
U
V
W
CN5
CN4
CN3
CN1
CN2
Display
CN5:
USB connector
CN4:
RS-422 communication connector
CN3:
RS-422 communication connector
CN1:
Control signal connector
CN2:
Encoder signal connector
PE: Protective earth

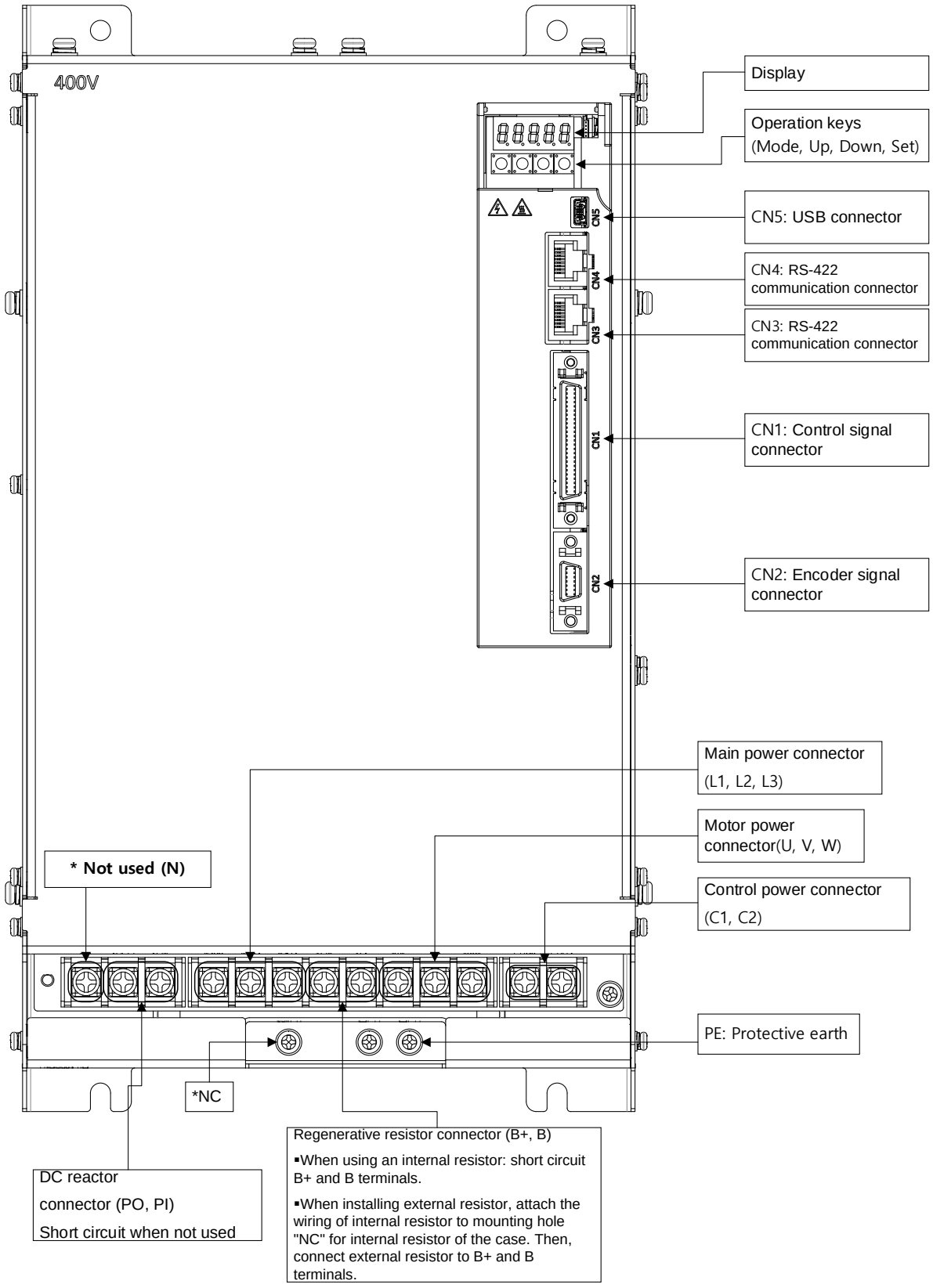
- L7SB 020B, L7SAB035B



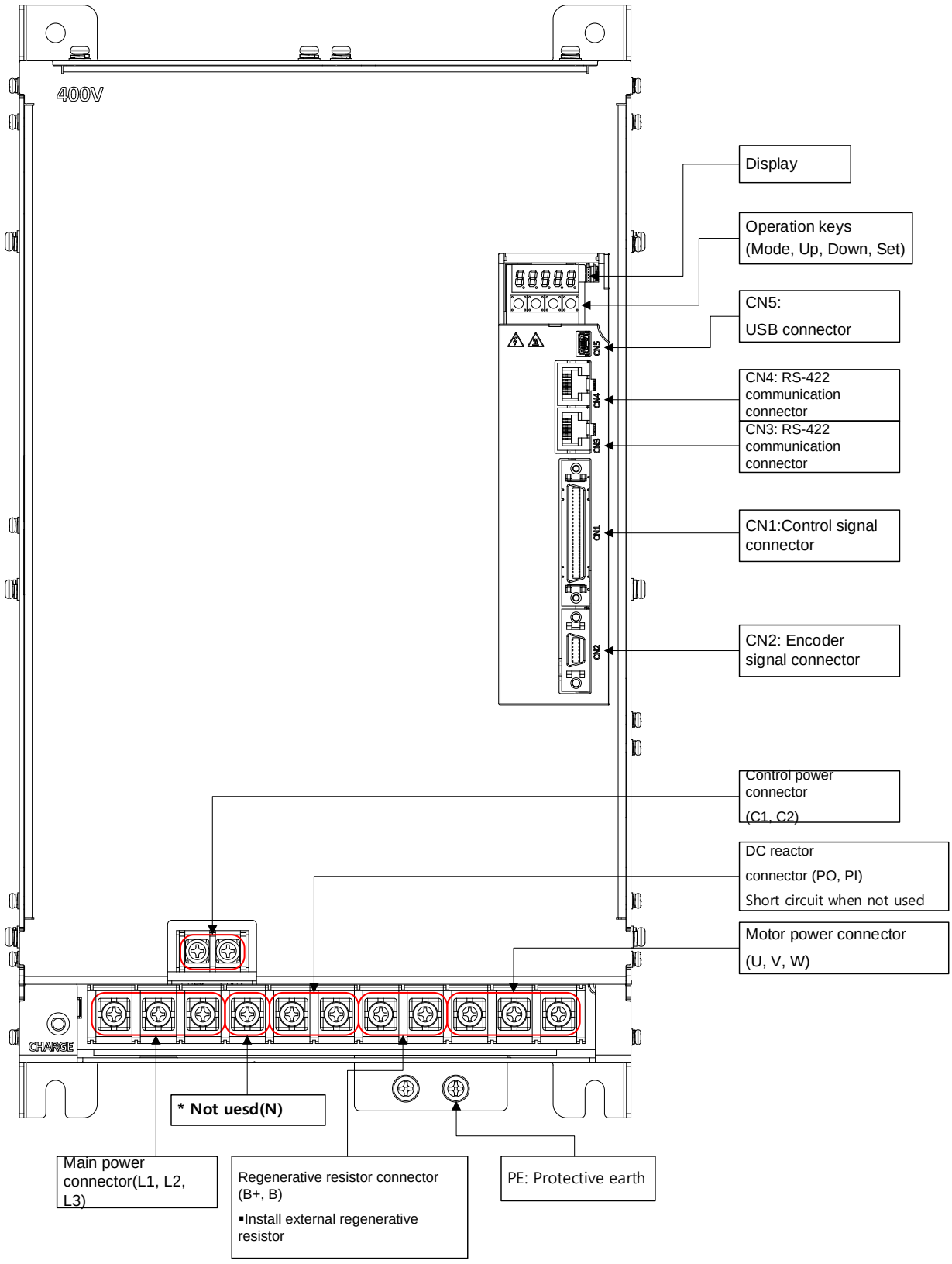
- L7SB 050B


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

- L7SB 075B


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

- L7SB 150B


400V
Display
Operation keys
(Mode, Up, Down, Set)
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)
DC reactor
connector (PO, PI)
Short circuit when not used
Motor power connector
(U, V, W)
CHARGE
* Not uesd(N)
Main power
connector(L1, L2,
L3)
Regenerative resistor connector
(B+, B)
▪Install external regenerative
resistor
PE: Protective earth

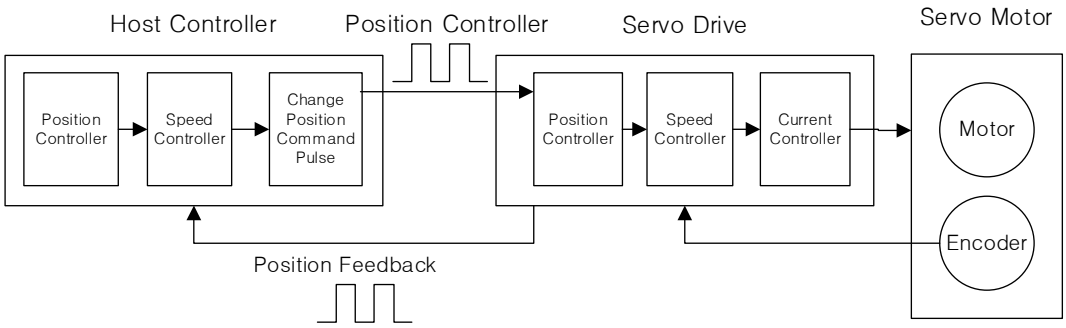
1.2 System Configuration

1.2.1 Overview

The L7 servo system can be configured and used in various ways according to the interface method with the host controller.

(1) Position operation system

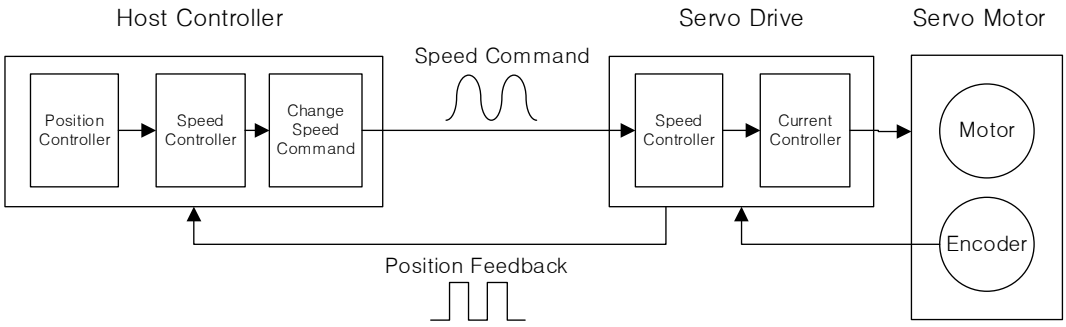
As a method of driving the servo with a pulse command, the position of the servo motor is operated by converting the command pulse according to the constant feed unit.



- Advantages: The host controller structure is simple with pulse input according to the transfer unit.
- Disadvantage:
  - High-speed rotation is difficult when using a precise transfer unit.
  - Responsiveness deteriorates as a multi-level controller is used.

(2) Speed driving system

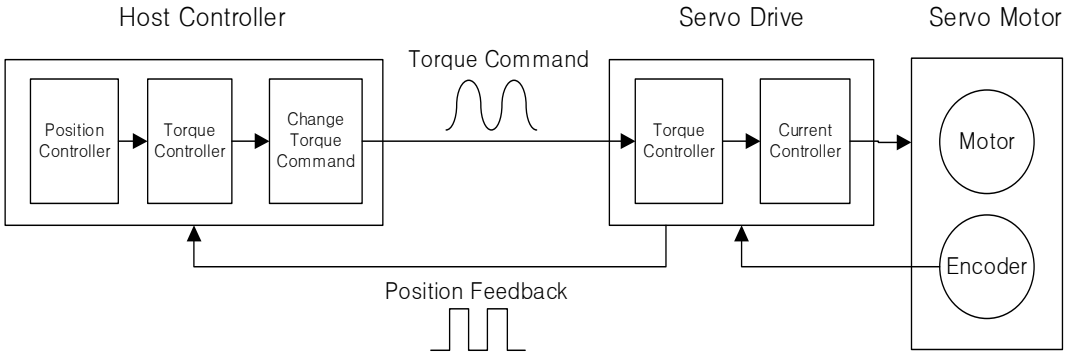
As a method of driving the servo with speed command, there is a method of inputting an analog voltage command or a digital speed command.



- Advantages:
  - Servo response is fast.
  - Precise control is easy.
- Disadvantages: The host controller is complicated.

(3) Torque operation system

As a way to drive servo with torque command, torque command by analog voltage is used.



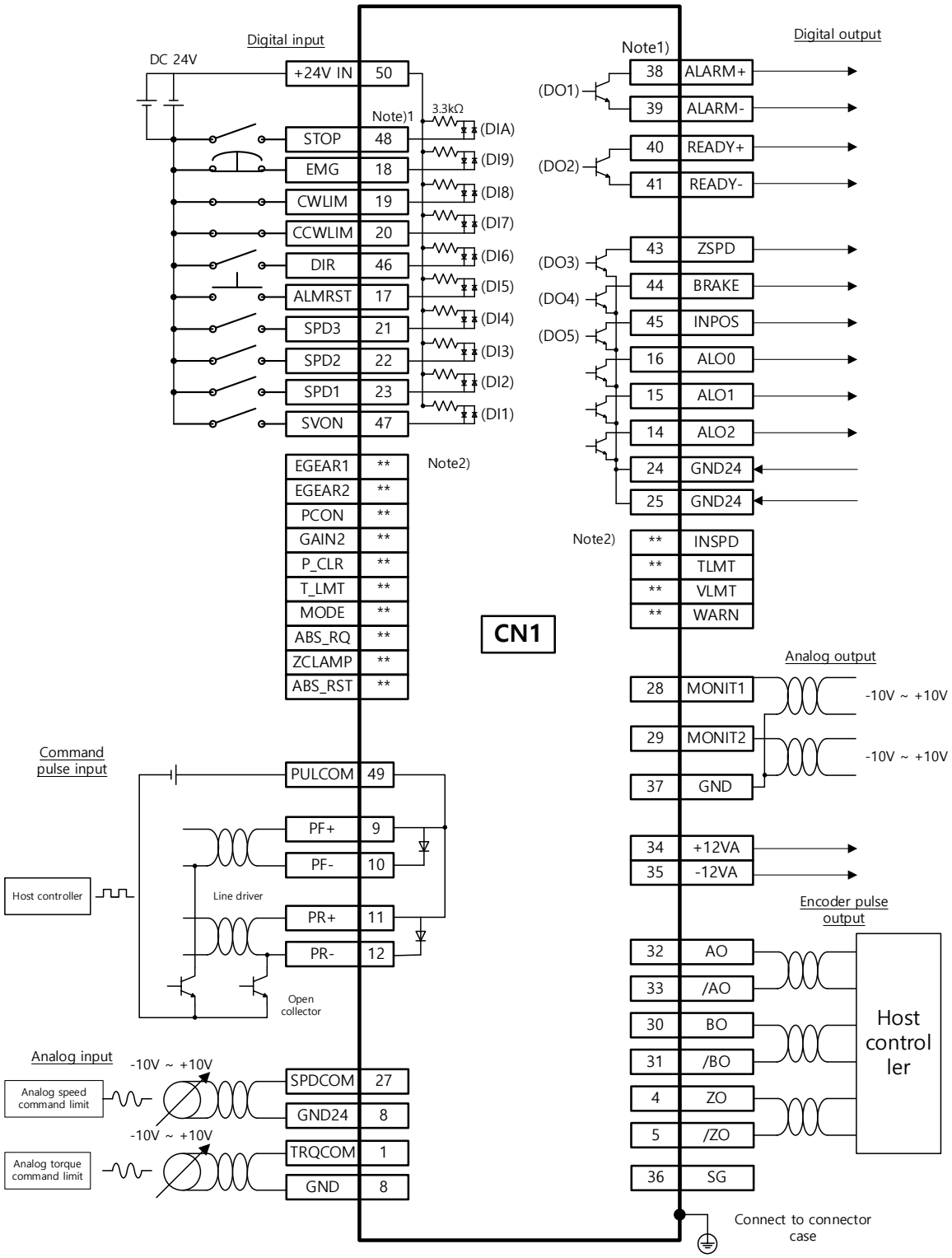
- Advantage:
  - Servo response is fast.
  - Precise control is easy.
- Disadvantages: The host controller is complicated.

(4) Operation mode

The L7 servo drive can be operated in torque, speed, and position modes according to the interface method with the host controller, and the operation mode can be switched by parameters and digital input contacts.

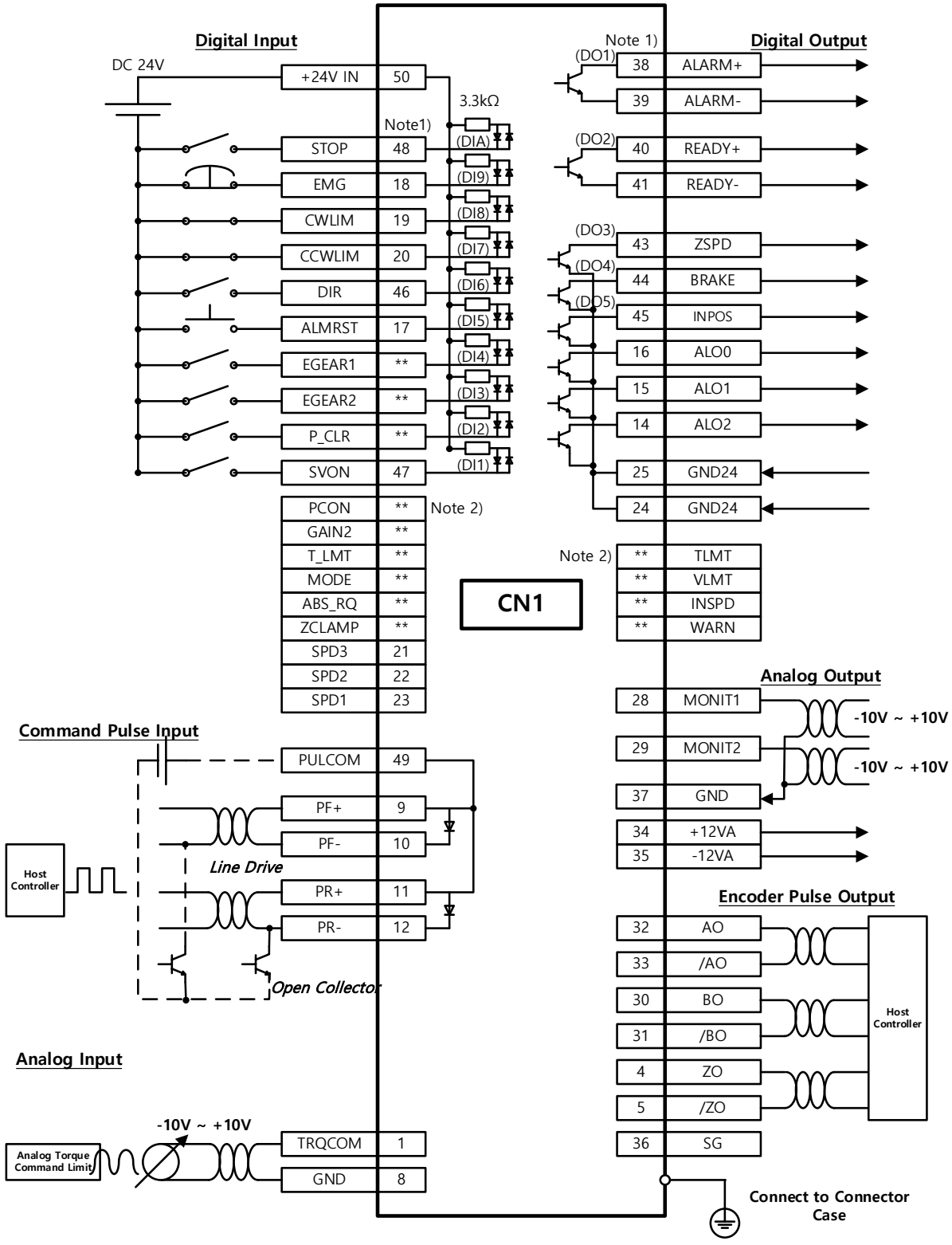
Operation mode	System Configuration
0	It operates with a torque operation system.
1	It operates with a speed operation system.
2	It operates with a position operation system.
3	It operates by selecting the speed and position operation system as a contact point.
4	It operates by selecting the speed and torque operation system as a contact point.
5	It operates by selecting the position and torque operation system as a contact point.

1.2.2 CN1 connector overall wiring diagram



Note1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.
Note2) ** Unassigned signals. You can change their allocation by setting parameters.
For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

1.2.3 Position Operation Mode Wiring Example

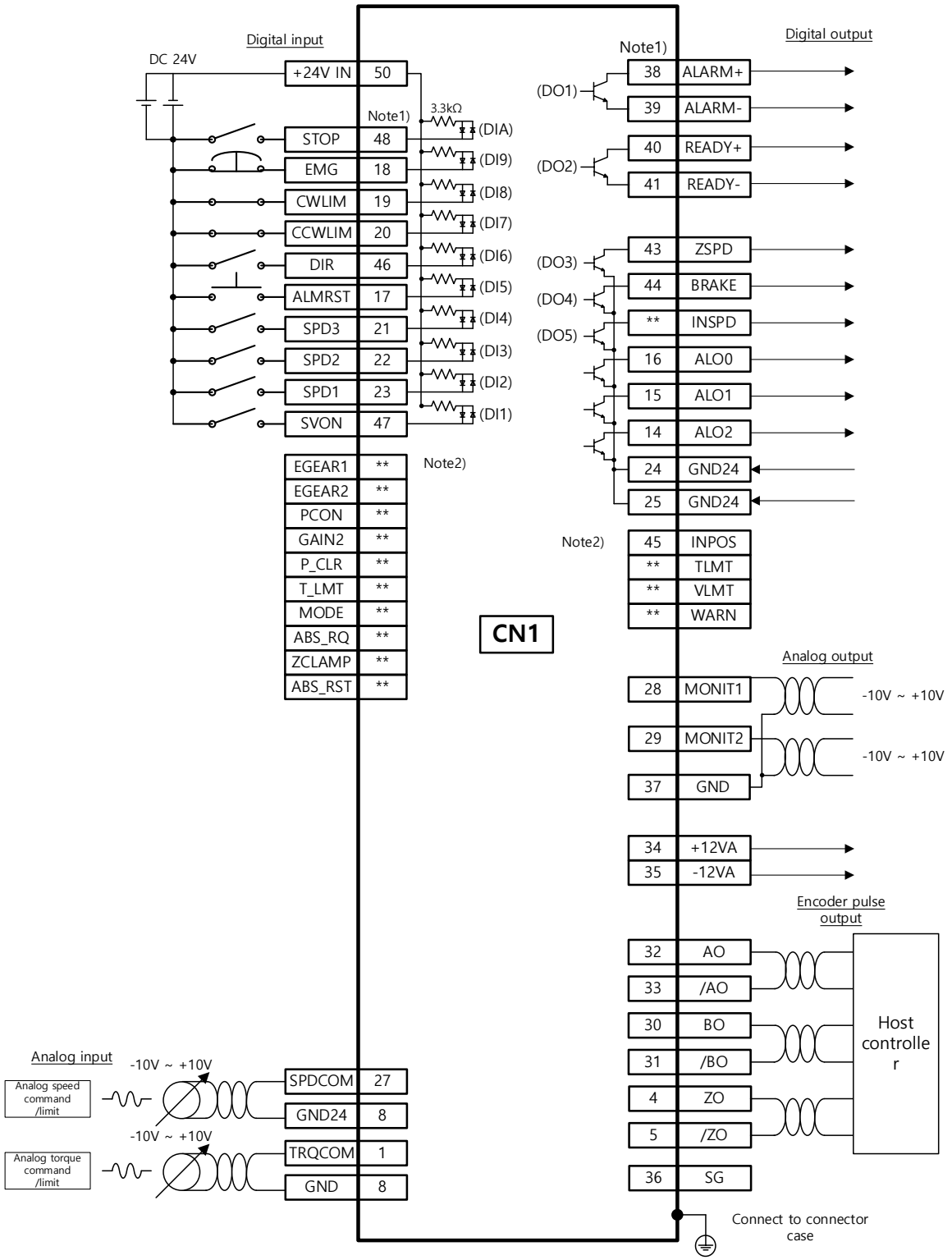


Note1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.

Note2) ** Unassigned signals. You can change their allocation by setting parameters.

For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

1.2.4 Speed Operation Mode Wiring Example



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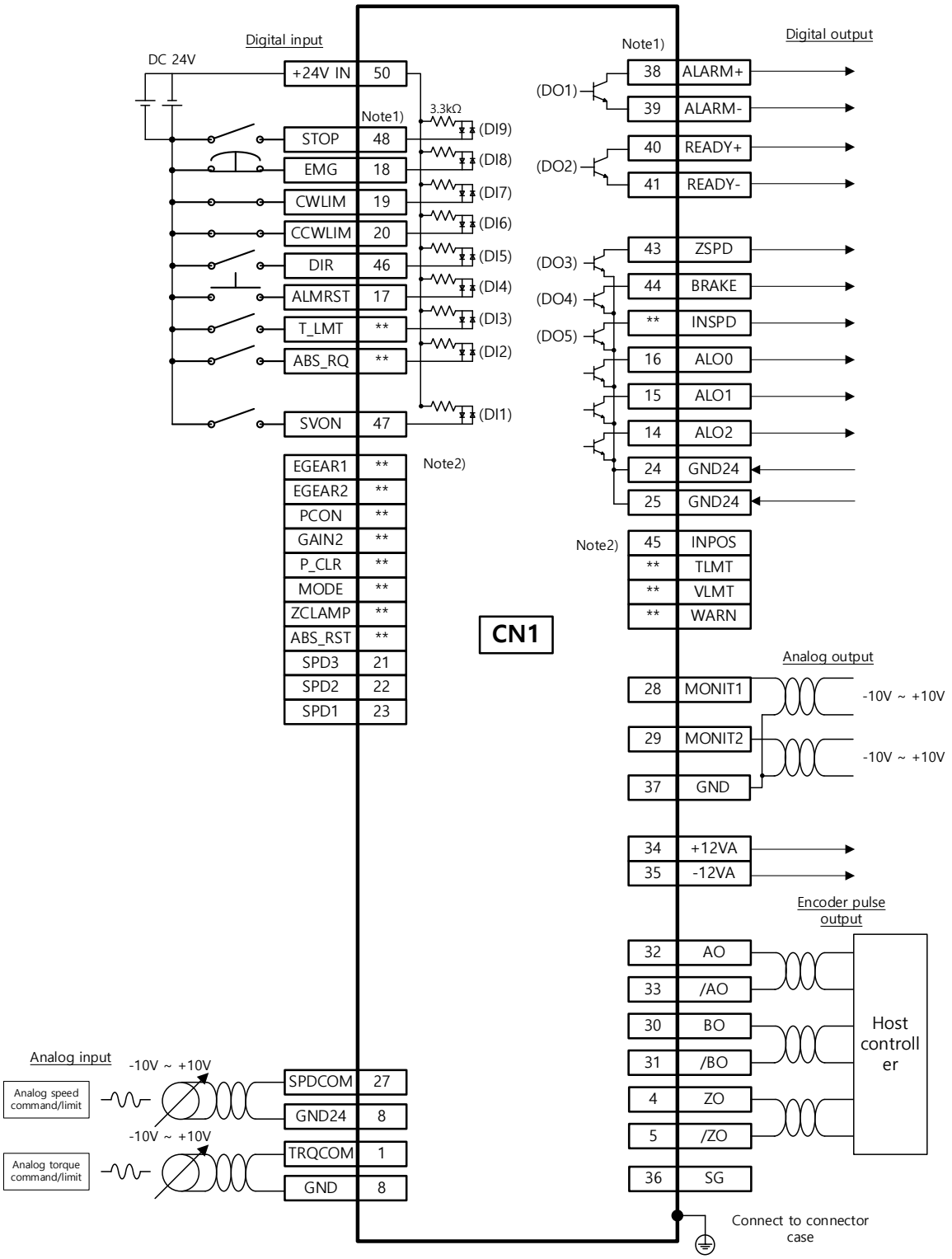
Note2) ** Unassigned signals. You can change their allocation by setting parameters.
For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

1.2.5 Torque Operation Mode Wiring Example



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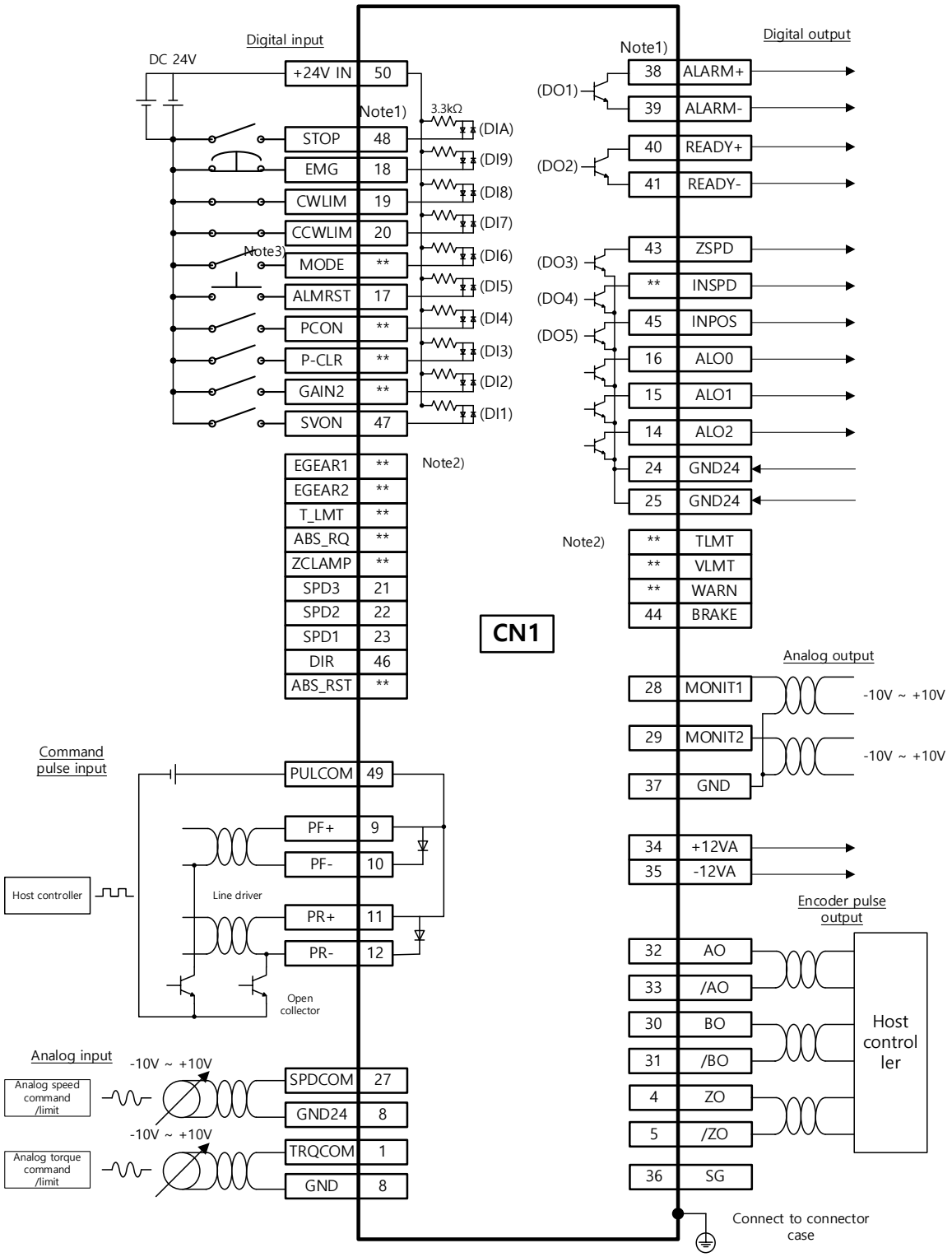
For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

1.2.6 Speed/Position Operation Mode Wiring Example



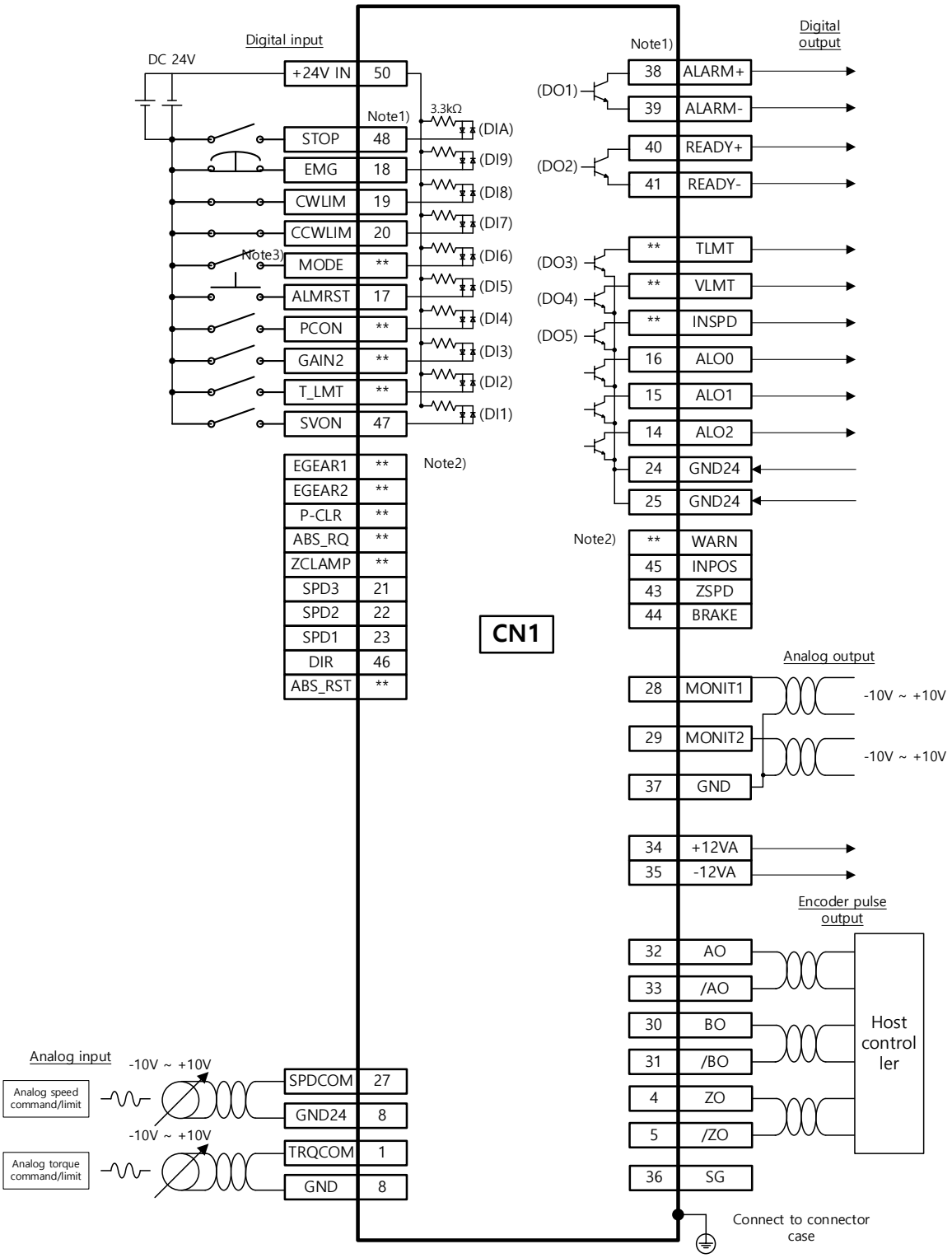
Note1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.

Note2) ** Unassigned signals. You can change their allocation by setting parameters.

For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

Note3) Input contacts MODE=ON: Speed control mode, MODE=OFF: Position operation mode

1.2.7 Speed/Torque Operation Mode Wiring Example



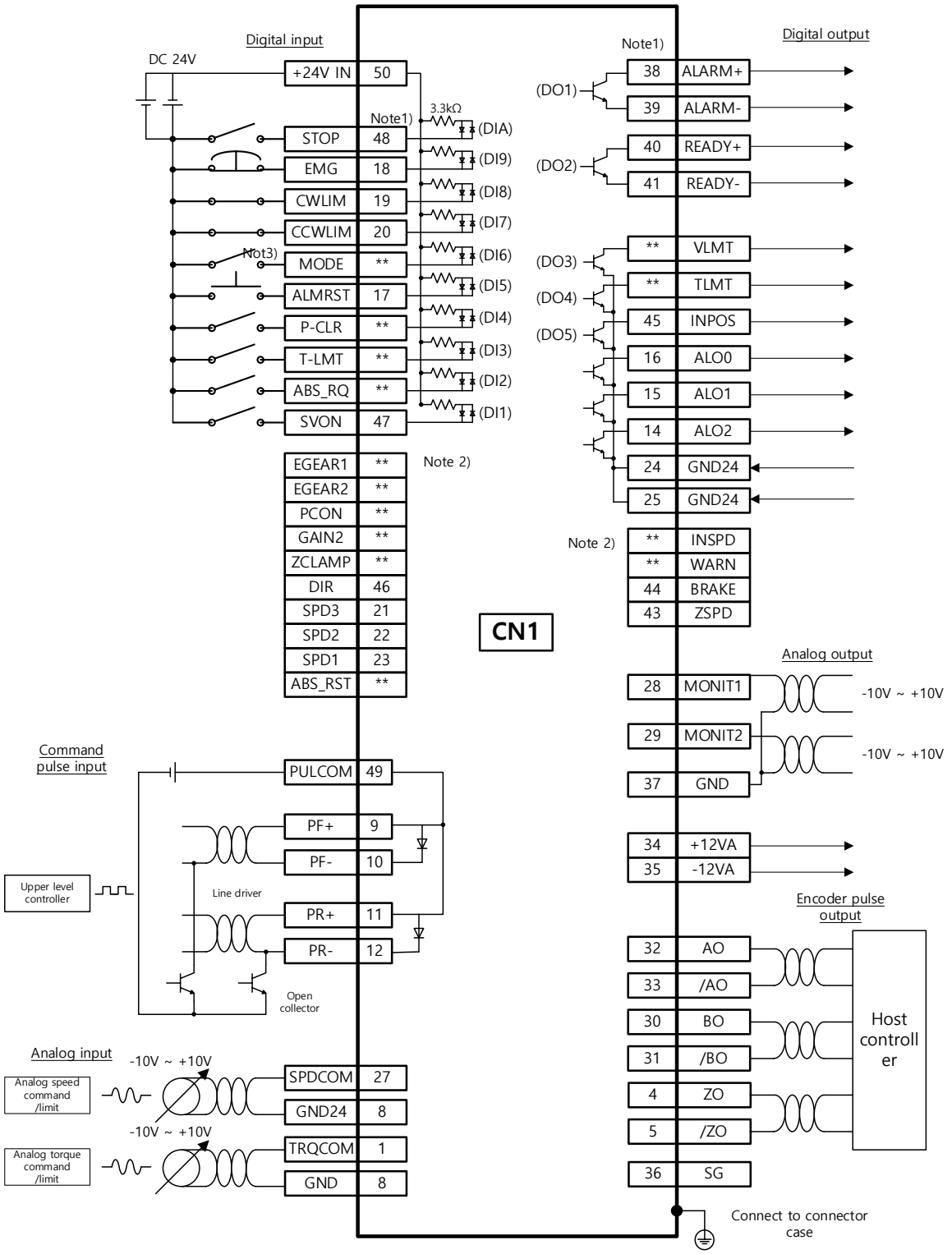
Note1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.

Note2) ** Unassigned signals. You can change their allocation by setting parameters.

For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

Note3) Input contacts MODE=ON: Speed control mode, MODE=OFF: Position operation mode

1.2.8 Position/Torque Operation Mode Wiring Example



Note1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.

Note2) ** Unassigned signals. You can change their allocation by setting parameters.

For details, refer to “5.1.6 External Input Signal and Logic Definition” and “5.1.8 External Output Signal and Logic Definition”.

Note3) Input contacts MODE=ON: Speed control mode, MODE=OFF: Position operation mode

1.3 Signal description

1.3.1 Digital input contact signal

Initial shipment Pin No.	Name	Contents	Application table by operation mode					
			Position	Speed	Torque	Speed/Position	Speed/Torque	Position/Torque
50	+24V IN	+24[V] power Input	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	Alarm reset	O	O	O	O	O	O
46	DIR	Rotation direction selection	O	O	O	O	O	O
20	CCWLMT	Counterclockwise 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	X	O	O	O/X	O	X/O
Assignment	EGEAR1	Electronic gear ratio1	O	X	X	X/O	X	O/X
Assignment	EGEAR2	Electronic gear ratio2	O	X	X	X/O	X	O/X
Assignment	PCON	P control operation	O	O	X	O	O/X	O/X
Assignment	GAIN2	Gain 2 selection	O	O	X	O	O/X	O/X
Assignment	P_CLR	Error pulse clear	O	X	X	X/O	X	O/X
Assignment	T_LMT	Torque limit with TRQCOM	O	O	O	O	O	O
Assignment	Mode	Operation mode switching	X	X	X	O	O	O
Assignment	ABS_RQ	Absolute position data request	O	O	O	O	O	O
Assignment	ZCLAMP	Zero clamp	X	O	X	O/X	O/X	O
Assignment	ABS_RST	Absolute encoder data reset	O	O	O	O	O	O

* ABS_RST has been applied since OS Ver 1.24.

1.3.2 Analog input contact signal

Pin No.	Name	Content	Application table by operation mode					
			Position	Speed	Torque	Speed/Position	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	Analog signal ground	O	O	O	O	O	O

1.3.3 Digital output contact signal

Initial shipment Pin No.	Name	Content	Application table by operation mode					
			Position	Speed	Torque	Speed/Position	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 +/-	Operation ready completion signal	O	O	O	O	O	O
43	ZSPD	Zero speed reached completion	O	O	O	O	O	O
44	BRAKE	Brake	O	O	O	O	O	O
45	INPOS	Position reached completion	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 completion	X	O	X	O/X	O/X	X
Assignment	WARN	Warning	O	O	O	O	O	O
24 25	GND24	Input/output contact driving power (24[V]) Ground	O	O	O	O	O	O

1.3.4 Monitor output signal and output power

Pin No.	Name	Content	Application table by operation mode					
			Position	Speed	Torque	Speed/Position	Speed/Torque	Position/Torque
28	MONIT 1	Analog monitor output1(-10~+10[V])	O	O	O	O	O	O
29	MONIT 2	Analog monitor output2(-10~+10[V])	O	O	O	O	O	O
8 37	GND	Analog signal ground	O	O	O	O	O	O
34	+12V	+12[V] power output terminal	O	O	O	O	O	O
35	-12V	-12[V] power output terminal	O	O	O	O	O	O

1.3.5 Pulse string input signal

■ Line driver(5V)

Pin No.	Name	Content	Application table by operation mode					
			Position	Speed	Torque	Speed/ Position	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	No use	X	X	X	X	X	X

■ Open collector (24V)

Pin No.	Name	Content	Application table by operation mode					
			Position	Speed	Torque	Speed/ Position	Speed/ Torque	Position/Torque
9	PF+	No use	X	X	X	X	X	X
10	PF-	F pulse input	O	X	X	X/O	X	O/X
11	PR+	No use	X	X	X	X	X	X
12	PR-	R pulse input	O	X	X	X/O	X	O/X
49	PULCOM	+24V power input	O	X	X	X/O	X	O/X

1.3.6 ENCODER output signal

Pin No.	Name	Content	Application table by operation mode					
			Position	Speed	Torque	Speed/ Position	Speed/ Torque	Position/Torque
32 33 30 31	AO /AO BO /BO	The encoder signal received from the motor output as a signal divided by the value set in [P0-14]. (5[V] line drive type)	O	O	O	O	O	O
4 5	ZO /ZO	Outputs the encoder Z signal received from the motor (5[V] line drive type)	O	O	O	O	O	O

2. Product specification

2.1 Servo Motor

■ Heat Sink Spec.

Classification	Size(mm)	Classification
AP04	250x250x6	Aluminum
AP06	250x250x6	
AP08	250x250x12	
AP13	350x350x20	
AP18	550x550x30	
AP22	650x650x35	

Note1) In the case of product specifications, it is the data measured after applying the heat sink.

※ In the case of product specifications, it is the data measured after applying the heat sink.

※ In case of IP rating, the shaft penetration part is excluded.

※ When attaching a reducer, the IP grade of the reducer part is not guaranteed.

※ If bending occurs beyond the specifications specified in the cable standard, the indicated IP rating may not be satisfied.

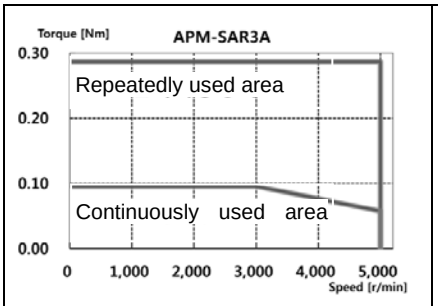
※ The corresponding protection level is satisfied only when the dedicated cable is used.

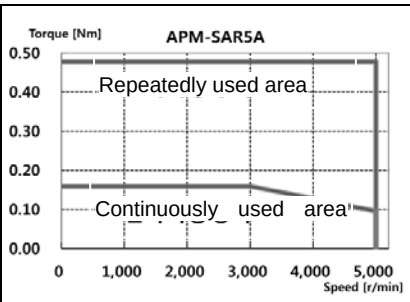
2.1.1 Product Features

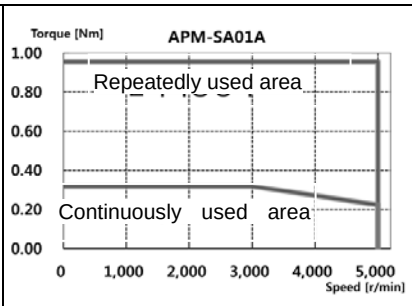
■ [200V]

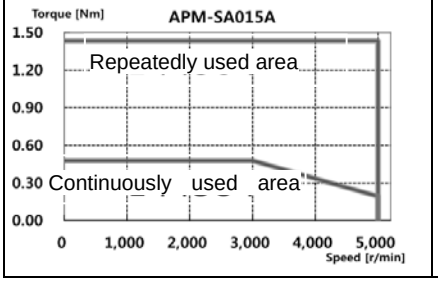
Servo Motor Type (APM-□□□□□)		SAR3A	SAR5A	SA01A	SA015A	-	-
Applicable Drive (L7SAxxx□)		L7SA001□			L7SA002□		
Rated output	[kW]	0.03	0.05	0.10	0.15		
Rated torque	[N·m]	0.10	0.16	0.32	0.48		
	[kgf·cm]	0.97	1.62	3.25	4.87		
Maximum instantaneous torque	[N·m]	0.29	0.48	0.96	1.43		
	[kgf·cm]	2.92	4.87	9.74	14.62		
Rated current	[A]	1.07	1.20	1.38	1.61		
Maximum current	[A]	3.21	3.60	4.14	4.83		
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	0.0164	0.02	0.05	0.06		
	[gf·cm·s²]	0.0167	0.02	0.05	0.07		
Allowed load inertia		Motor inertia x 30			Motor inertia x 20		
Rated power rate	[kW/s]	5.56	10.55	23.78	36.01		
Speed and position detector	Standard	Quadrature Type Incremental 2048P/R					
	Option	-					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	0.3	0.4	0.5	0.7		

♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**





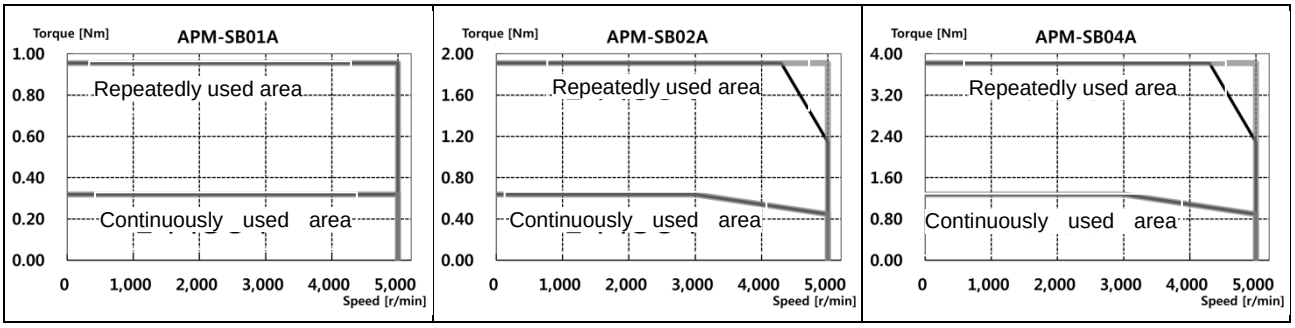




■ [200V]

Servo Motor Type (APM-□□□□□)		SB01A	SB02A	SB04A	-	-	-
Applicable Drive (L7SAxxx□)		L7SA002□		L7SA004□			
Rated output	[kW]	0.10	0.20	0.40			
Rated torque	[N·m]	0.32	0.64	1.27			
	[kgf·cm]	3.25	6.49	12.99			
Maximum instantaneous torque	[N·m]	0.96	1.91	3.82			
	[kgf·cm]	9.74	19.48	38.96			
Rated current	[A]	1.65	1.63	2.89			
Maximum current	[A]	4.95	4.89	8.67			
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	0.11	0.18	0.32			
	[gf·cm·s²]	0.12	0.19	0.33			
Allowed load inertia		Motor inertia x 20					
Rated power rate	[kW/s]	8.89	22.26	50.49			
Speed and position detector	Standard	Quadrature Type Incremental 3000[P/R]					
	Option	Serial Type 19[Bit]					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	0.8	1.1	1.6			

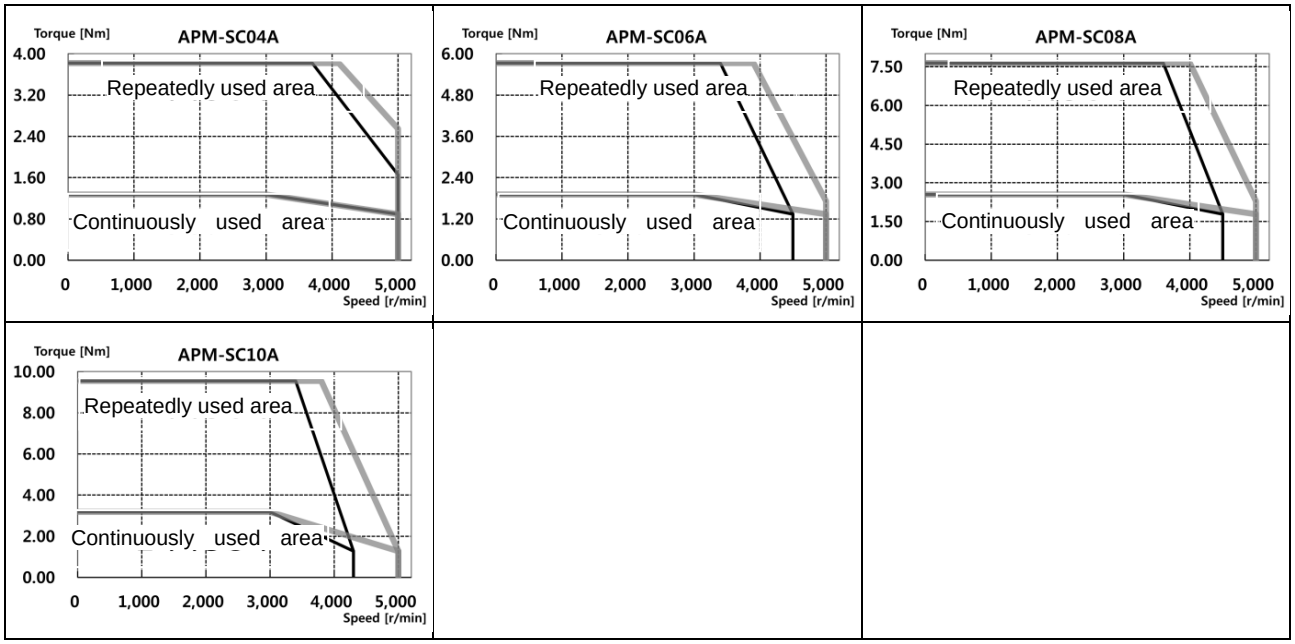
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**



■ [200V]

Servo Motor Type (APM-□□□□□)		SC04A	SC06A	SC08A	SC10A	-	-
Applicable Drive (L7SAxxx□)		L7SA004□	L7SA008□		L7SA010□		
Rated output	[kW]	0.4	0.6	0.8	1.0		
Rated torque	[N·m]	1.27	1.91	2.55	3.19		
	[kgf·cm]	12.99	19.49	25.98	32.48		
Maximum instantaneous torque	[N·m]	3.82	5.73	7.64	9.56		
	[kgf·cm]	38.96	58.47	77.95	97.43		
Rated current	[A]	2.82	3.58	4.83	5.37		
Maximum current	[A]	8.46	10.74	14.49	16.11		
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	0.67	1.09	1.51	1.93		
	[gf·cm·s²]	0.69	1.11	1.54	1.97		
Allowed load inertia		Motor inertia x 15					
Rated power rate	[kW/s]	24.05	33.39	43.02	52.57		
Speed and position detector	Standard	Quad. Type Incremental 3000[P/R]					
	Option	Serial Type 19[Bit]					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	1.9	2.5	3.2	3.8		

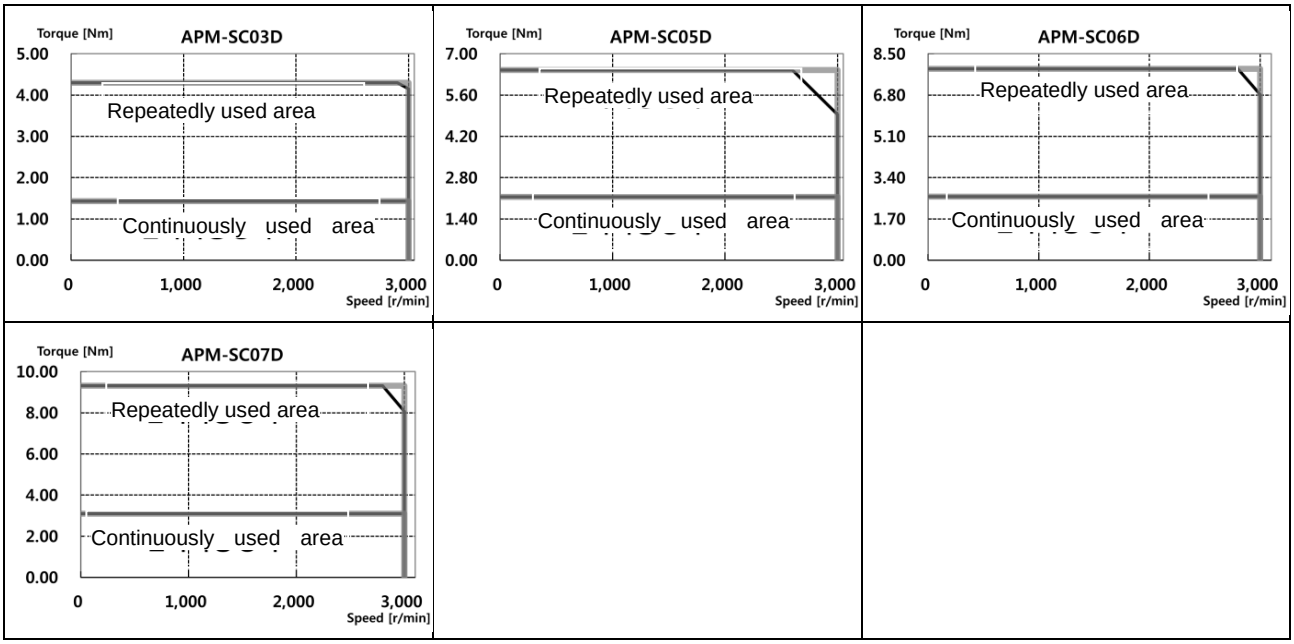
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		SC03D	SC05D	SC06D	SC07D	-	-
Applicable Drive (L7SAxxx□)		L7SA004□	L7SA008□				
Rated output	[kW]	0.30	0.45	0.55	0.65		
Rated torque	[N·m]	1.43	2.15	2.63	3.10		
	[kgf·cm]	14.61	21.92	26.79	31.66		
Maximum instantaneous torque	[N·m]	4.30	6.45	7.88	9.31		
	[kgf·cm]	43.84	65.77	80.38	94.99		
Rated current	[A]	2.59	3.23	3.82	4.42		
Maximum current	[A]	7.77	9.69	11.46	13.26		
Rated rotation speed	[r/min]	2000					
Maximum rotation speed	[r/min]	3000					
Inertia moment	[kg·m²x10⁻⁴]	0.67	1.09	1.51	1.93		
	[gf·cm·s²]	0.69	1.11	1.54	1.97		
Allowed load inertia		Motor inertia x 15					
Rated power rate	[kW/s]	30.43	42.27	45.69	49.97		
Speed and position detector	Standard	Quadrature Type Incremental 3000[P/R]					
	Option	Serial Type 19[Bit]					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	1.9	2.5	3.2	3.9		

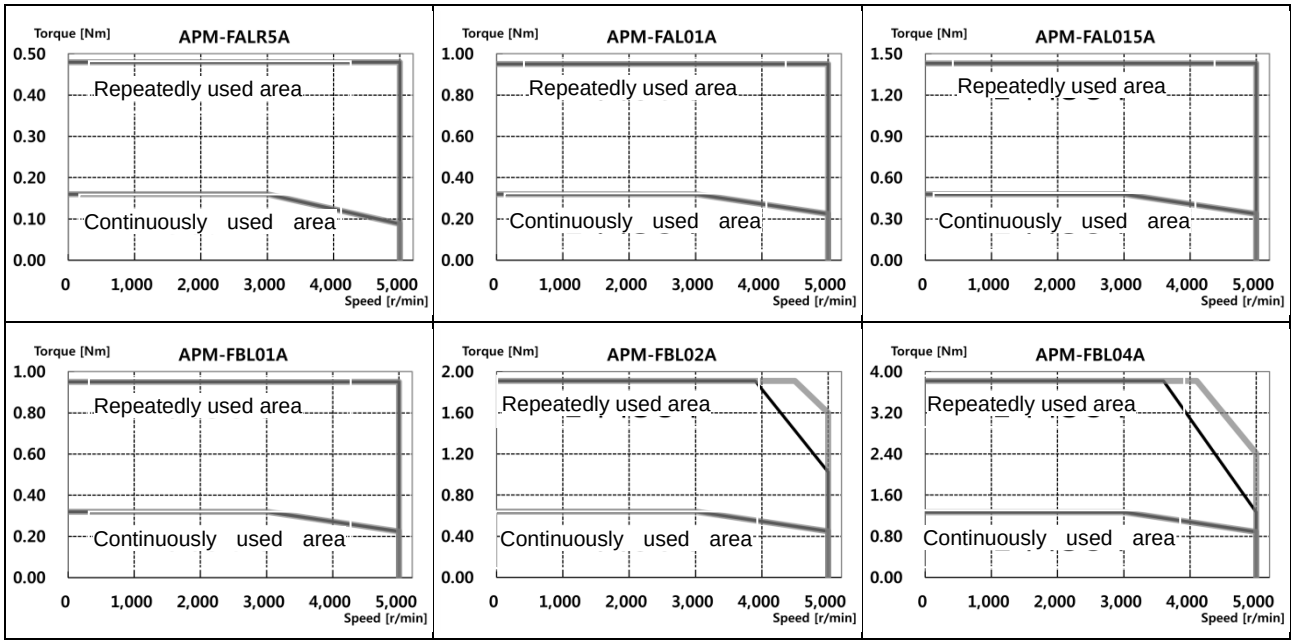
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FALR5A	FAL01A	FAL015A	FBL01A	FBL02A	FBL04A
Applicable Drive (L7SAxxx□)		L7SA001B		L7SA002B	L7SA001B	L7SA002B	L7SA004B
Rated output	[kW]	0.05	0.10	0.15	0.10	0.20	0.40
Rated torque	[N·m]	0.16	0.32	0.48	0.32	0.64	1.27
	[kgf·cm]	1.62	3.25	4.87	3.25	6.49	12.99
Maximum instantaneous torque	[N·m]	0.48	0.96	1.43	0.96	1.91	3.82
	[kgf·cm]	4.87	9.74	14.62	9.74	19.48	38.96
Rated current	[A]	0.95	1.25	1.60	0.95	1.45	2.60
Maximum current	[A]	2.85	3.75	4.80	2.85	4.35	7.80
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	0.023	0.042	0.063	0.091	0.147	0.248
	[gf·cm·s²]	0.024	0.043	0.065	0.093	0.150	0.253
Allowed load inertia		Motor inertia x 30		Motor inertia x 20			
Rated power rate	[kW/s]	10.55	23.78	36.19	11.09	27.60	27.07
Speed and position detector	Standard	Serial Multi-Turn Built-in Type(18bit)			Serial Multi-Turn Built-in Type(19bit)		
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP67(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	0.31	0.45	0.61	0.56	0.74	1.06

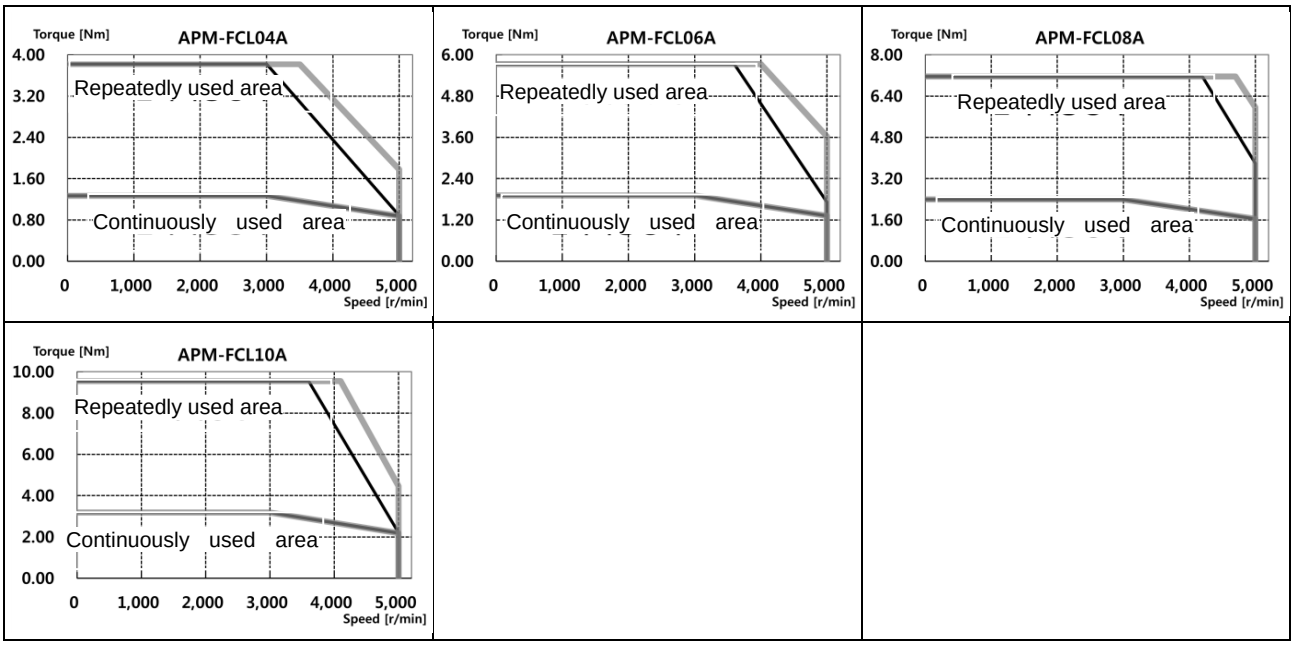
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FCL04A	FCL06A	FCL08A	FCL10A	-	-
Applicable Drive (L7SAxxx□)		L7SA004B	L7SA008B		L7SA010B		
Rated output	[kW]	0.40	0.60	0.75	1.00		
Rated torque	[N·m]	1.27	1.91	2.39	3.18		
	[kgf·cm]	12.99	19.49	24.36	32.48		
Maximum instantaneous torque	[N·m]	3.82	5.73	7.16	9.55		
	[kgf·cm]	38.98	58.47	73.08	97.44		
Rated current	[A]	2.58	3.81	5.02	5.83		
Maximum current	[A]	7.75	11.42	15.07	17.50		
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	0.530	0.897	1.264	1.632		
	[gf·cm·s²]	0.541	0.915	1.290	1.665		
Allowed load inertia		Motor inertia x 15					
Rated power rate	[kW/s]	30.60	40.66	45.09	62.08		
Speed and position detector	Standard	Serial Multi-Turn Built-in Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP67(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	1.52	2.14	2.68	3.30		

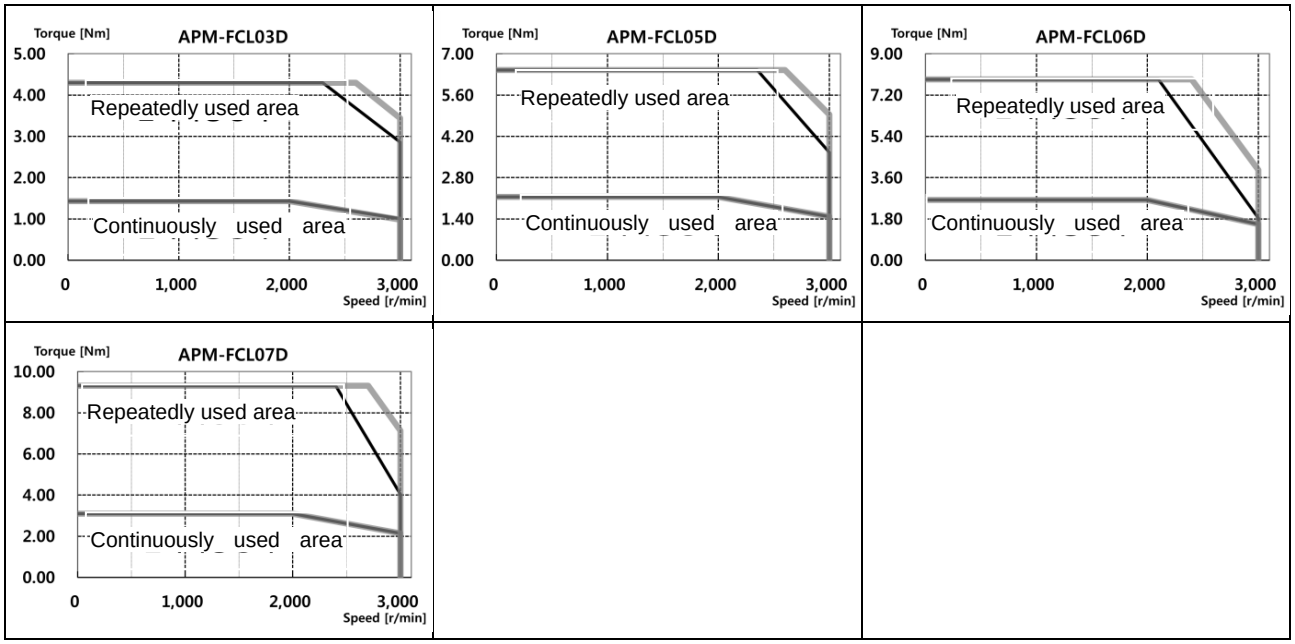
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FCL03D	FCL05D	FCL06D	FCL07D	-	-
Applicable Drive (L7SAxxx□)		L7SA004B	L7SA008B				
Rated output	[kW]	0.30	0.45	0.55	0.65		
Rated torque	[N·m]	1.43	2.15	2.63	3.10		
	[kgf·cm]	14.62	21.92	26.80	31.67		
Maximum instantaneous torque	[N·m]	4.30	6.45	7.88	9.31		
	[kgf·cm]	43.85	65.77	80.39	95.01		
Rated current	[A]	2.50	3.05	3.06	3.83		
Maximum current	[A]	7.51	9.16	9.18	11.50		
Rated rotation speed	[r/min]	2000					
Maximum rotation speed	[r/min]	3000					
Inertia moment	[kg·m²x10⁻⁴]	0.530	0.897	1.264	1.63		
	[gf·cm·s²]	0.541	0.915	1.290	1.66		
Allowed load inertia		Motor inertia x 15					
Rated power rate	[kW/s]	38.73	51.47	54.56	59.03		
Speed and position detector	Standard	Serial Multi-Turn Built-in Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP67(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	1.26	2.12	2.66	2.78		

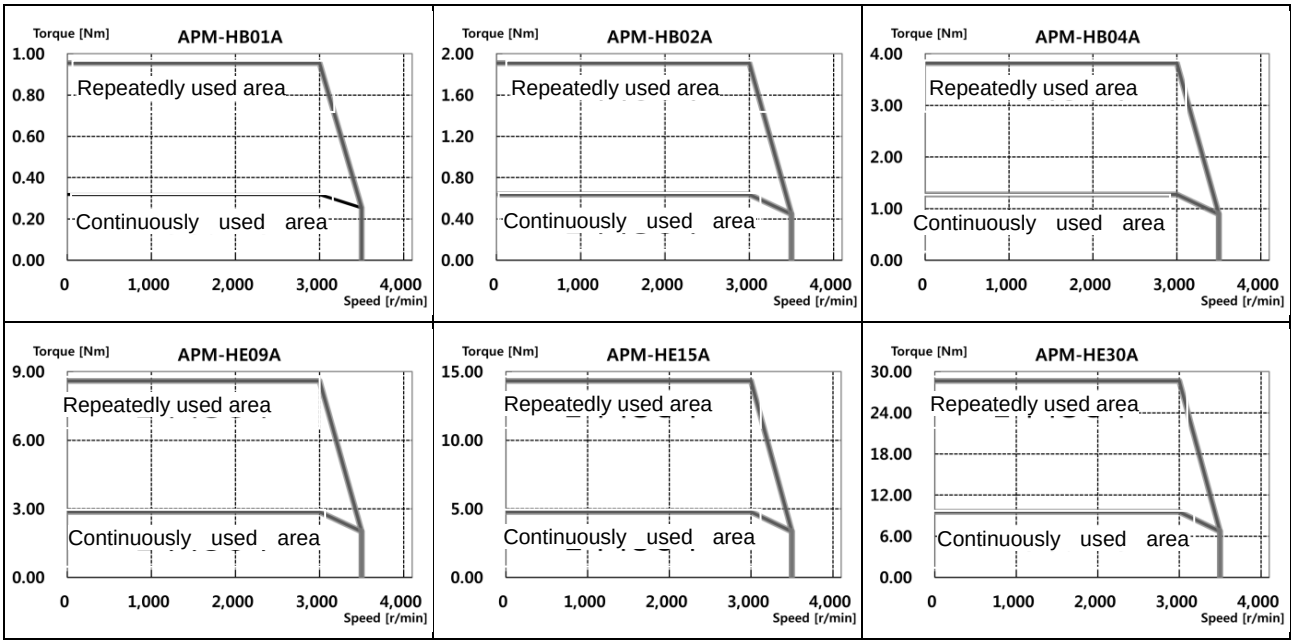
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		HB01A	HB02AA	HB04A	HE09A	HE15A	HE30A
Applicable Drive (L7SAxxx□)		L7SA002A		L7SA002A	L7SA010A	L7SA020A	L7SA035A
Rated output	[kW]	0.1	0.2	0.4	0.9	1.5	3
Rated torque	[N·m]	0.32	0.64	1.27	2.86	4.77	9.55
	[kgf·cm]	3.25	6.49	12.99	29.23	48.72	97.43
Maximum instantaneous torque	[N·m]	0.96	1.91	3.82	8.59	14.32	28.64
	[kgf·cm]	9.74	19.48	38.96	87.69	146.15	292.29
Rated current	[A]	1.65	1.63	2.89	4.95	8.23	17.16
Maximum current	[A]	4.95	4.89	8.67	14.85	24.69	51.48
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	0.27	0.33	0.46	19.56	22.27	31.81
	[gf·cm·s²]	0.27	0.34	0.47	19.96	22.72	32.46
Allowed load inertia		Motor inertia x 20			Motor inertia x 10		
Rated power rate	[kW/s]	3.34	11.98	34.47	4.10	10.01	22.03
Speed and position detector	Standard	Quadrature Type Incremental 1024P/R			Quadrature Type Incremental 2048P/R		
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	0.9	1.2	1.7	5.8	7.4	10.83

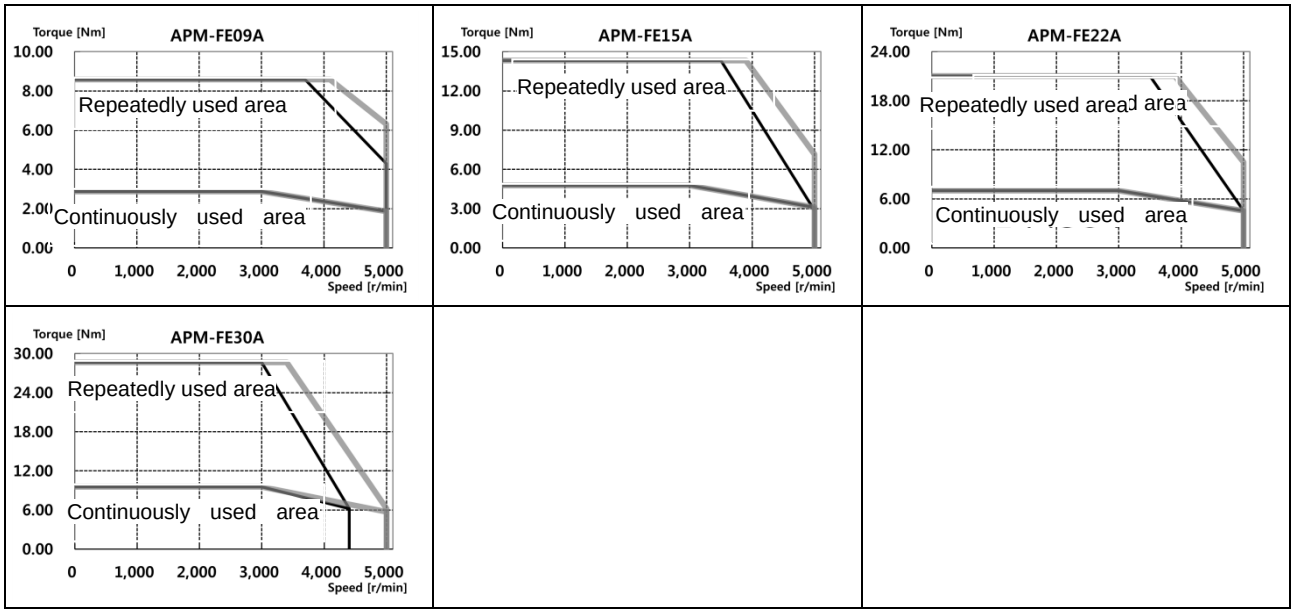
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FE09A	FE15A	FE22A	FE30A	-	-
Applicable Drive (L7SAxxx□)		L7SA010B	L7SA020B		L7SA035B		
Rated output	[kW]	0.9	1.5	2.2	3.0		
Rated torque	[N·m]	2.86	4.77	7.00	9.55		
	[kgf·cm]	29.20	48.70	71.40	97.40		
Maximum instantaneous torque	[N·m]	8.59	14.32	21.01	28.65		
	[kgf·cm]	87.70	146.10	214.30	292.20		
Rated current	[A]	6.45	9.15	13.24	16.09		
Maximum current	[A]	19.35	27.45	39.72	48.27		
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	5.66	10.18	14.62	19.04		
	[gf·cm·s²]	5.77	10.39	14.92	19.43		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.47	22.38	33.59	47.85		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.0	6.7	8.5	10.1		

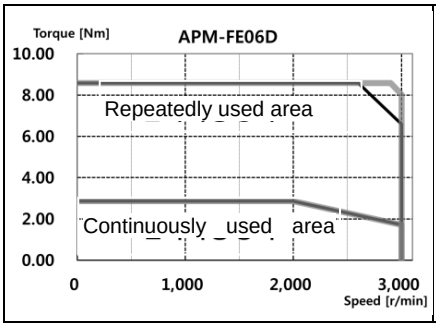
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**

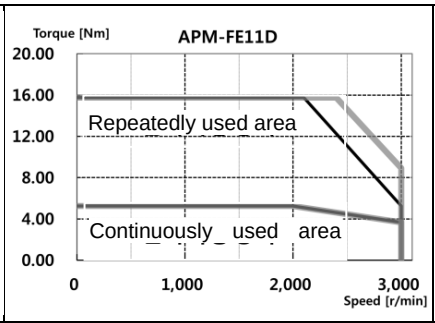


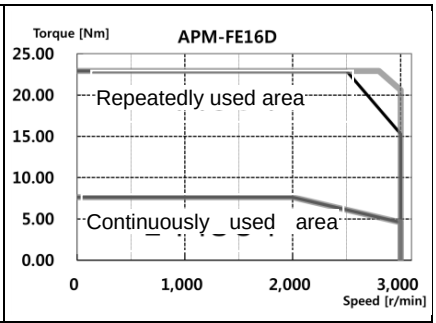
■ [200V]

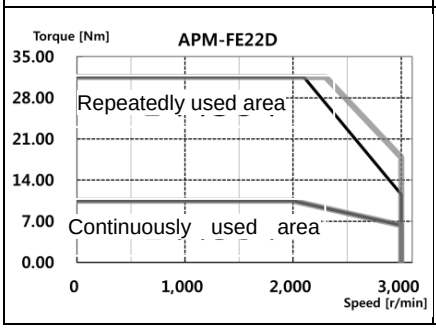
Servo Motor Type (APM-□□□□□)		FE06D	FE11D	FE16D	FE22D	-	-
Applicable Drive (L7SAxxx□)		L7SA008B	L7SA010B	L7SA020B			
Rated output	[kW]	0.6	1.1	1.6	2.2		
Rated torque	[N·m]	2.86	5.25	7.63	10.5		
	[kgf·cm]	29.2	53.60	77.90	107.10		
Maximum instantaneous torque	[N·m]	8.59	15.75	22.92	31.51		
	[kgf·cm]	87.70	160.70	233.80	321.40		
Rated current	[A]	4.56	6.47	10.98	12.97		
Maximum current	[A]	13.68	19.41	32.94	38.91		
Rated rotation speed	[r/min]	2000					
Maximum rotation speed	[r/min]	3000					
Inertia moment	[kg·m²x10⁻⁴]	5.66	10.18	14.62	19.04		
	[gf·cm·s²]	5.77	10.39	14.92	19.43		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.49	27.08	39.89	57.90		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.0	6.7	8.5	10.1		

♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**





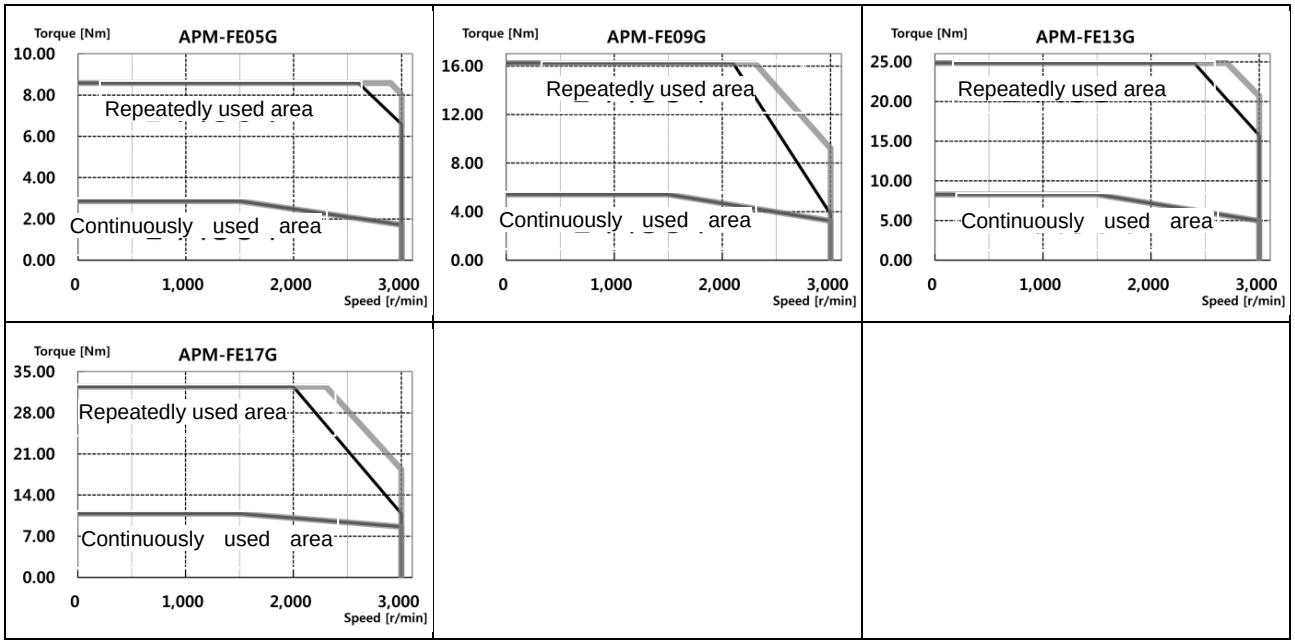




■ [200V]

Servo Motor Type (APM-□□□□□)		FE05G	FE09G	FE13G	FE17G	-	-
Applicable Drive (L7SAxxx□)		L7SA008B	L7SA010B	L7SA020B			
Rated output	[kW]	0.45	0.85	1.3	1.7		
Rated torque	[N·m]	2.86	5.41	8.27	10.82		
	[kgf·cm]	29.22	55.19	84.41	110..38		
Maximum instantaneous torque	[N·m]	8.59	16.23	24.82	32.46		
	[kgf·cm]	87.66	165.57	253.23	331.14		
Rated current	[A]	4.56	6.67	11.90	13.36		
Maximum current	[A]	11.68	20.01	35.70	40.08		
Rated rotation speed	[r/min]	1500					
Maximum rotation speed	[r/min]	3000					
Inertia moment	[kg·m²x10⁻⁴]	5.66	10.18	14.62	19.04		
	[gf·cm·s²]	5.77	10.39	14.92	19.43		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.49	28.74	46.81	61.46		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.0	6.7	8.5	10.1		

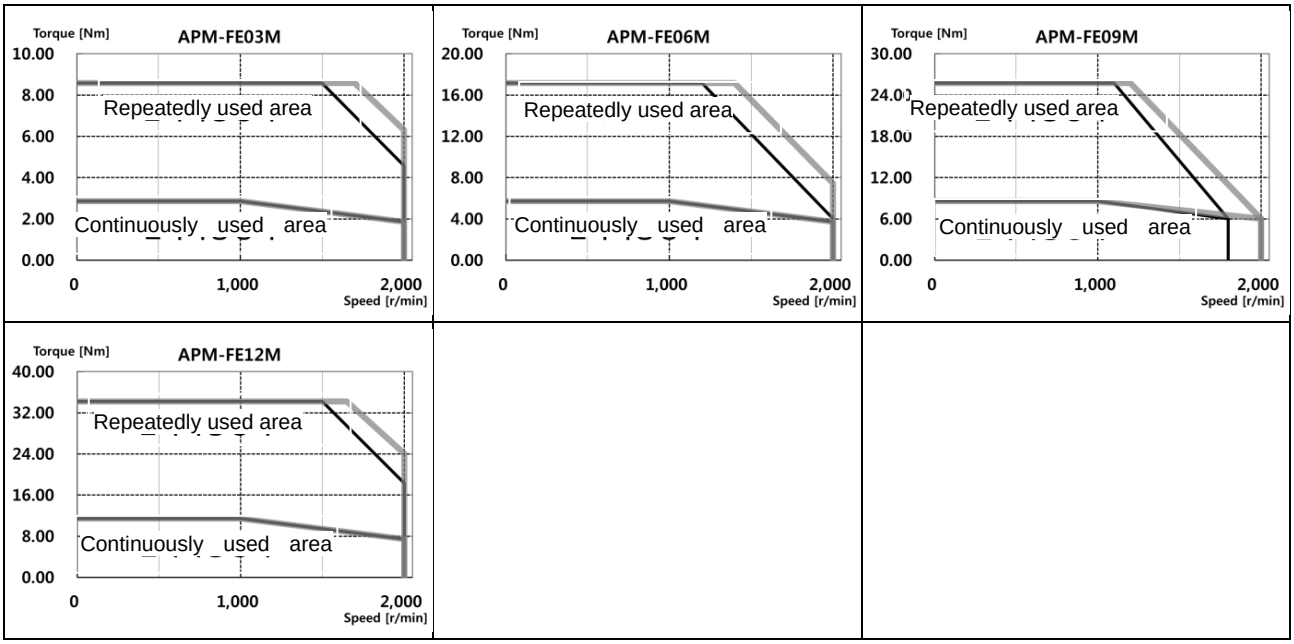
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FE03M	FE06M	FE09M	FE12M	-	-
Applicable Drive (L7SAxxx□)		L7SA004B	L7SA008B	L7SA010B	L7SA020B		
Rated output	[kW]	0.3	0.6	0.9	1.2		
Rated torque	[N·m]	2.86	5.72	8.59	11.46		
	[kgf·cm]	29.22	58.4	87.7	116.9		
Maximum instantaneous torque	[N·m]	8.59	17.18	25.77	34.22		
	[kgf·cm]	87.66	175.3	262.9	349.1		
Rated current	[A]	2.73	4.56	6.18	10.67		
Maximum current	[A]	8.19	13.68	18.54	32.01		
Rated rotation speed	[r/min]	1000					
Maximum rotation speed	[r/min]	2000					
Inertia moment	[kg·m²x10⁻⁴]	5.66	10.18	14.62	19.04		
	[gf·cm·s²]	5.77	10.39	14.92	19.43		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.49	32.22	50.48	68.91		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.0	6.7	8.5	10.1		

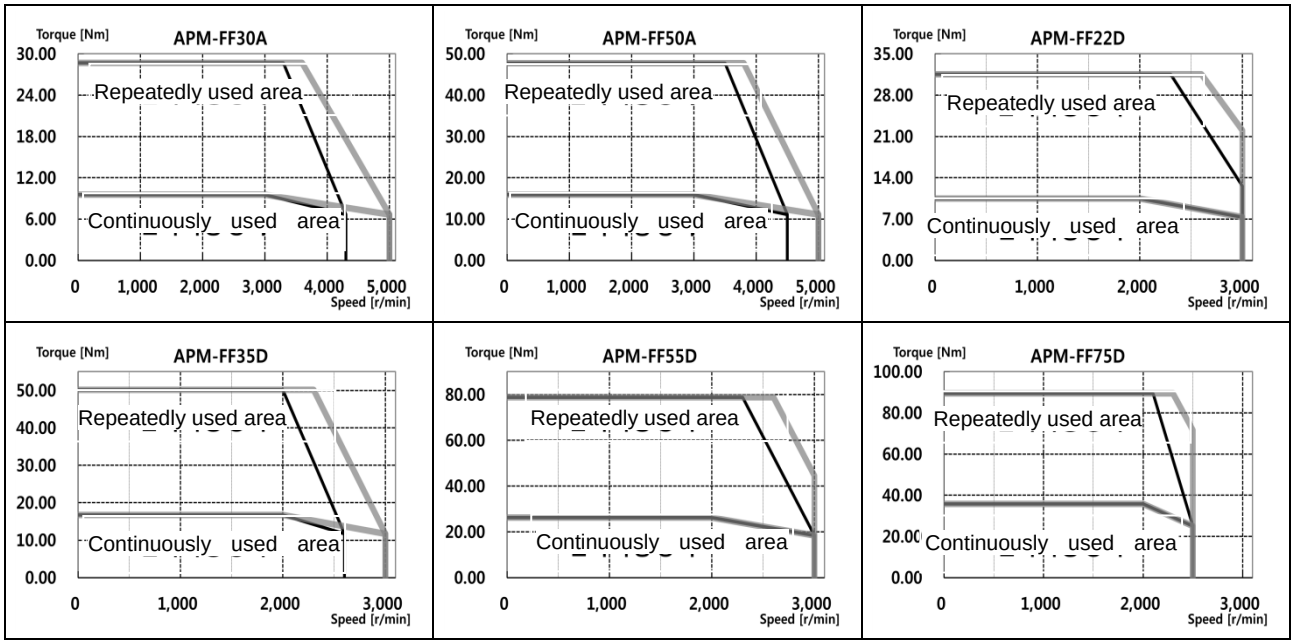
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FF30A	FF50A	FF22D	FF35D	FF55D	FF75D
Applicable Drive (L7SAxxx□)		L7SA035B	L7SA050B	L7SA020B	L7SA035B	L7SA050B	L7SA075B
Rated output	[kW]	3.0	5.0	2.2	3.5	5.5	7.5
Rated torque	[N·m]	9.55	15.91	10.50	16.70	26.25	35.81
	[kgf·cm]	97.40	162.30	107.10	170.40	267.80	365.40
Maximum instantaneous torque	[N·m]	28.65	47.74	35.50	50.10	78.76	89.53
	[kgf·cm]	292.30	487.00	321.30	511.40	803.40	913.50
Rated current	[A]	15.26	26.47	13.07	16.48	28.78	32.95
Maximum current	[A]	45.78	79.41	39.21	49.44	86.34	82.375
Rated rotation speed	[r/min]	3000		2000			
Maximum rotation speed	[r/min]	5000		3000			2500
Inertia moment	[kg·m²x10⁻⁴]	27.96	46.56	27.96	46.56	73.85	106.70
	[gf·cm·s²]	28.53	47.51	28.53	47.51	75.36	108.90
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	32.59	54.33	39.43	59.89	93.27	120.15
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	12.5	17.4	12.5	17.4	25.12	33.8

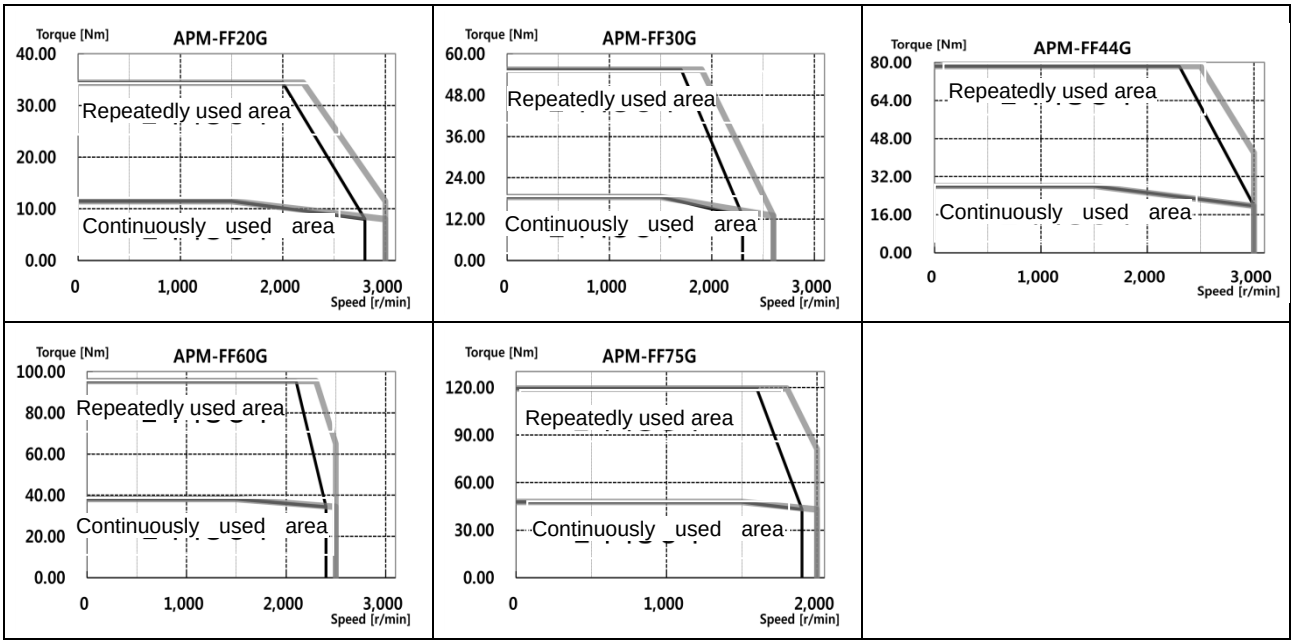
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FF20G	FF30G	FF44G	FF60G	FF75G	-
Applicable Drive (L7SAxxx□)		L7SA020B	L7SA035B	L7SA050B	L7SA075B		
Rated output	[kW]	1.8	2.9	4.4	6.0	7.5	
Rated torque	[N·m]	11.45	18.46	28.00	38.20	47.70	
	[kgf·cm]	116.90	188.30	285.70	389.80	487.20	
Maximum instantaneous torque	[N·m]	34.35	55.38	78.40	95.50	119.30	
	[kgf·cm]	350.60	564.90	799.60	974.90	1,217.30	
Rated current	[A]	12.16	15.98	30.70	35.14	35.26	
Maximum current	[A]	36.48	47.94	85.96	87.85	88.15	
Rated rotation speed	[r/min]	1500					
Maximum rotation speed	[r/min]	3000	2700	3000	2500	2200	
Inertia moment	[kg·m²x10⁻⁴]	27.96	46.56	73.85	106.70	131.30	
	[gf·cm·s²]	28.53	47.51	75.36	108.90	134.00	
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	46.92	73.14	106.15	136.73	173.63	
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	12.5	17.4	25.2	33.8	38.5	

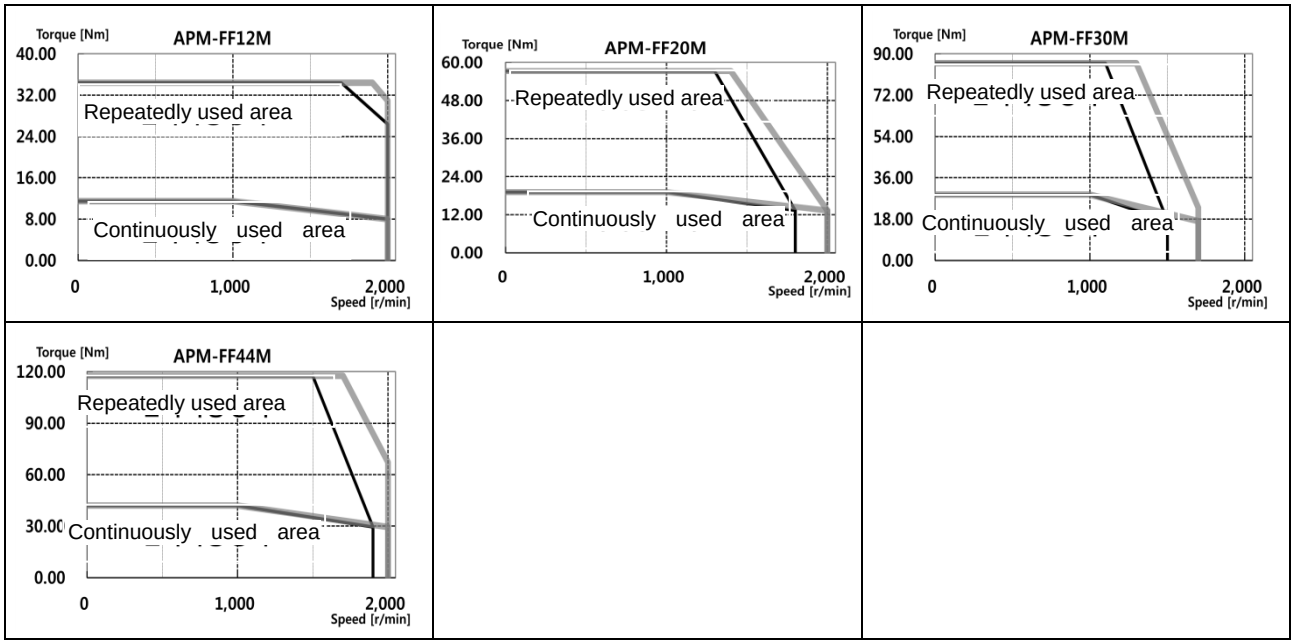
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FF12M	FF20M	FF30M	FF40M	-	-
Applicable Drive (L7SAxxx□)		L7SA020B		L7SA035B	L7SA050B		
Rated output	[kW]	1.2	2.0	3.0	4.4		
Rated torque	[N·m]	11.46	19.09	28.64	42.02		
	[kgf·cm]	116.9	194.8	292.2	428.7		
Maximum instantaneous torque	[N·m]	34.38	57.29	85.94	105.05		
	[kgf·cm]	350.70	584.40	876.60	1,071.52		
Rated current	[A]	11.01	12.96	16.58	30.60		
Maximum current	[A]	33.03	38.88	49.74	85.68		
Rated rotation speed	[r/min]	1000					
Maximum rotation speed	[r/min]	2000		1700	2000		
Inertia moment	[kg·m²x10⁻⁴]	27.96	46.56	73.85	106.7		
	[gf·cm·s²]	28.53	47.51	75.36	108.9		
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	46.94	78.27	111.04	165.38		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	12.5	17.4	25.2	33.8		

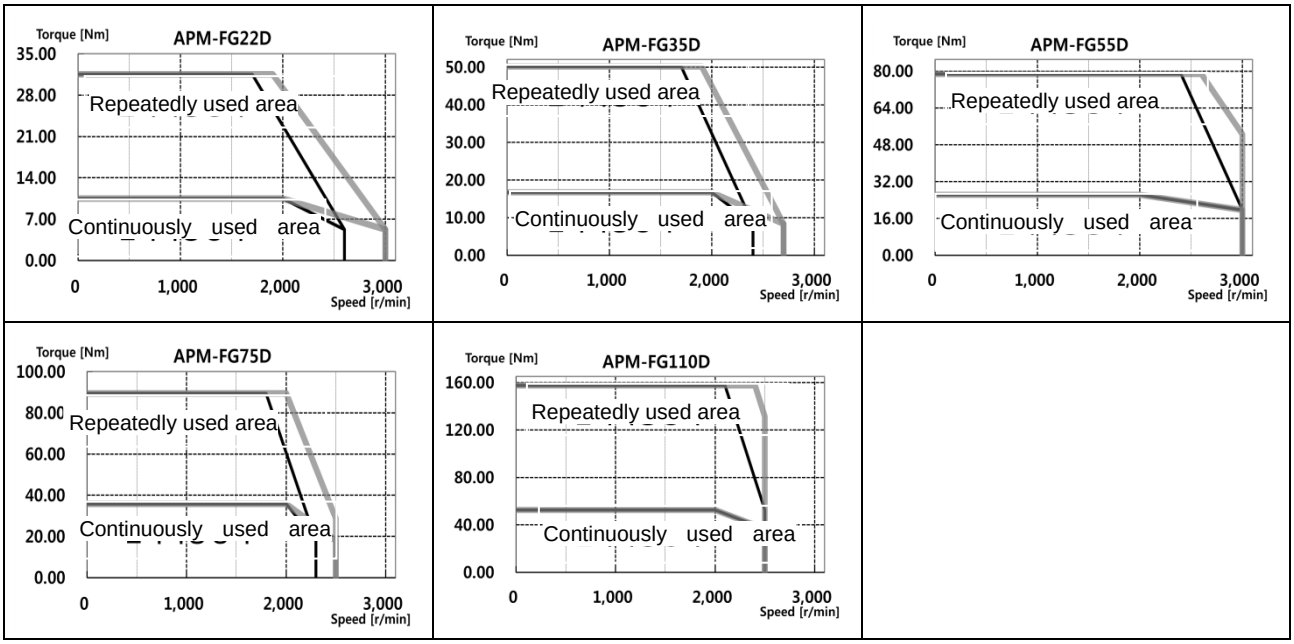
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FG22D	FG35D	FG55D	FG75D	FG110D	-
Applicable Drive (L7SAxxx□)		L7SA020B	L7SA035B	L7SA050B	L7SA750B	L7SA150B	
Rated output	[kW]	2.2	3.5	5.5	7.5	11	
Rated torque	[N·m]	10.50	16.71	26.25	35.81	52.52	
	[kgf·cm]	107.1	170.4	267.8	365.4	525.9	
Maximum instantaneous torque	[N·m]	31.51	50.12	78.76	89.53	157.55	
	[kgf·cm]	321.30	511.30	803.4	913.5	1,607.60	
Rated current	[A]	10.25	14.67	29.74	30.17	51.39	
Maximum current	[A]	30.75	44.01	89.22	75.43	154.17	
Rated rotation speed	[r/min]	2000					
Maximum rotation speed	[r/min]	3000	2700	3000	2500		
Inertia moment	[kg·m²x10⁻⁴]	41.13	71.53	117.72	149.4	291.36	
	[gf·cm·s²]	41.97	72.99	120.12	152.45	297.31	
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	26.78	38.99	58.51	85.83	94.65	
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	15.4	20.2	28.12	33.45	66.2	

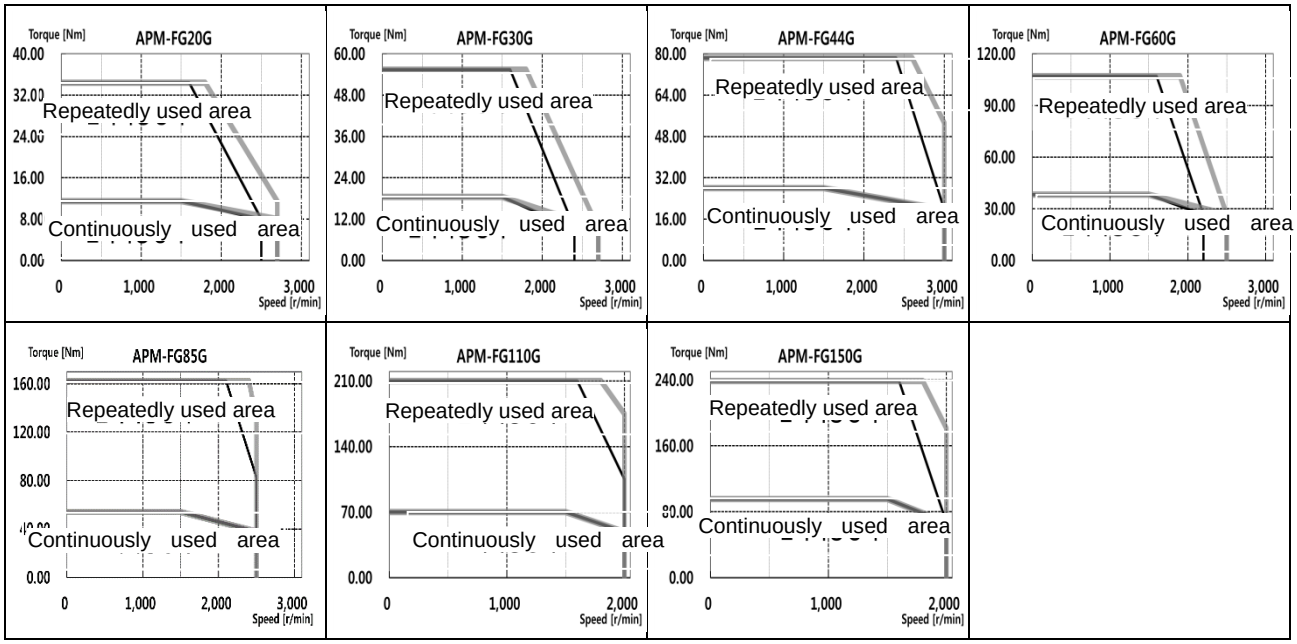
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**



■ [200V]

Servo Motor Type (APM-□□□□□)		FG20G	FG30G	FG44G	FG60G	FG85G	FG110G	FG150G
Applicable Drive (L7SAxxx□)		L7SA020B	L7SA035B	L7SA050B	L7SA075B	L7SA150B		
Rated output	[kW]	1.8	2.9	4.4	6.0	8.5	11	15
Rated torque	[N·m]	11.50	18.50	28.00	38.2	54.11	69.99	95.45
	[kgf·cm]	116.9	188.4	285.8	389.7	552.1	714.2	974
Maximum instantaneous torque	[N·m]	34.40	55.40	78.40	95.50	162.32	209.97	238.63
	[kgf·cm]	350.80	565.10	800.24	974.30	1,656.30	2,142.60	2,435
Rated current	[A]	11.18	16.21	31.72	32.18	52.94	59.3	75.6
Maximum current	[A]	33.54	48.63	88.82	96.54	158.82	177.9	189
Rated rotation speed	[r/min]	1500						
Maximum rotation speed	[r/min]	2700		3000	2500		2000	
Inertia moment	[kg·m²x10⁻⁴]	14.13	71.53	117.72	149.4	291.36	291.36	424.57
	[gf·cm·s²]	41.97	72.99	120.12	152.45	297.31	297.31	416.08
Allowed load inertia		Motor inertia x 5						
Rated power rate	[kW/s]	31.91	47.66	66.64	97.63	100.48	168.27	223.44
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)						
	Option	X						
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)						
	Time rating	Continuous						
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]						
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)						
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.						
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)						
Weight	[kg]	15.4	20.2	28.0	33.45	66.2	66.3	92.2

♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, **■: 3-phase AC230V]**



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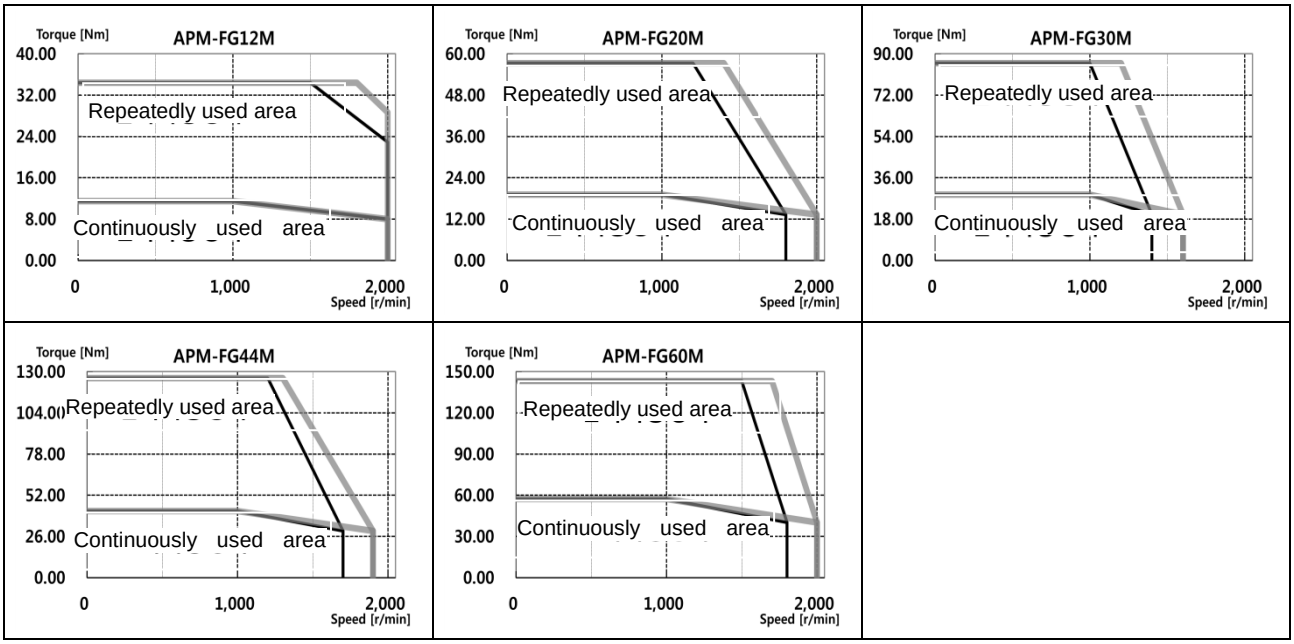
■ [200V]

Servo Motor Type (APM-□□□□□)		FG12M	FG20M	FG30M	FG44M	FG60M	-
Applicable Drive (L7SAxxx□)		L7SA020B		L7SA020B	L7SA020B	L7SA075B	
Rated output	[kW]	1.2	2.0	3.0	4.4	6.0	
Rated torque	[N·m]	11.50	19.10	28.60	42.00	57.29	
	[kgf·cm]	116.9	194.9	292.3	428.7	584.6	
Maximum instantaneous torque	[N·m]	34.40	57.30	85.90	126.00	143.2	
	[kgf·cm]	350.8	584.6	876.9	128.61	1,432.4	
Rated current	[A]	11.28	13.10	15.52	27.26	39.32	
Maximum current	[A]	33.84	39.3	46.56	81.78	98.30	
Rated rotation speed	[r/min]	1000					
Maximum rotation speed	[r/min]	2000		1600	1900	2000	
Inertia moment	[kg·m²x10⁻⁴]	41.13	71.53	117.72	149.40	291.36	
	[gf·cm·s²]	41.97	72.99	120.12	152.45	297.31	
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	31.91	51.00	69.70	118.14	112.65	
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	15.4	20.2	28.0	33.5	66.2	

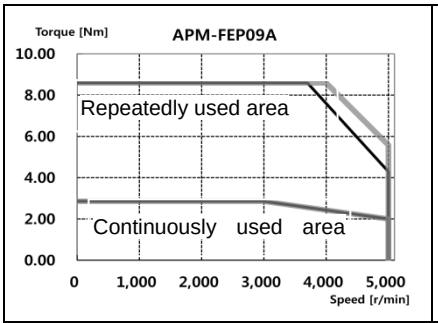
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC200V**, ■: 3-phase AC230V**]**

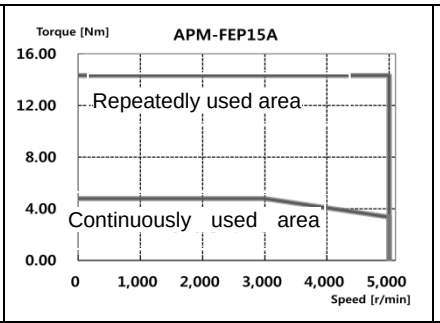


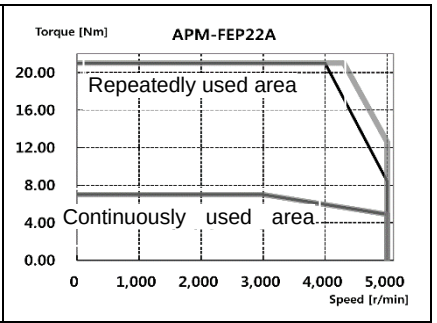
■ [400V]

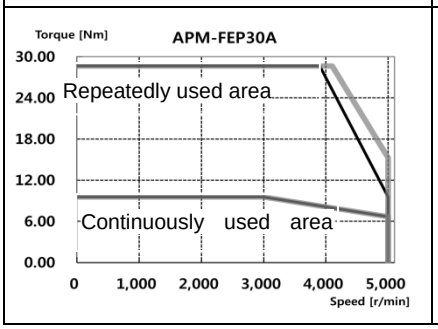
Servo Motor Type (APM-□□□□□□)		FEP09A	FEP15A	FEP22A	FEP30A	-	-
Applicable Drive (L7SBxxxB)		L7SB010B	L7SB020B		L7SB035B		
Rated output	[kW]	0.9	1.5	2.2	3.0		
Rated torque	[N·m]	2.86	4.77	7.00	9.55		
	[kgf·cm]	29.23	48.72	71.46	97.44		
Maximum instantaneous torque	[N·m]	8.59	14.32	21.01	28.65		
	[kgf·cm]	87.7	146.16	214.37	292.33		
Rated current	[A]	3.47	6.68	7.64	9.94		
Maximum current	[A]	10.40	20.03	22.92	29.81		
Rated rotation speed	[r/min]	3000					
Maximum rotation speed	[r/min]	5000					
Inertia moment	[kg·m²x10⁻⁴]	5.659	10.179	14.619	19.040		
	[gf·cm·s²]	5.774	10.387	14.917	19.429		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.50	22.40	33.55	47.89		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.5	7.54	9.68	11.78		

♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, **■: 3-phase AC400V]**





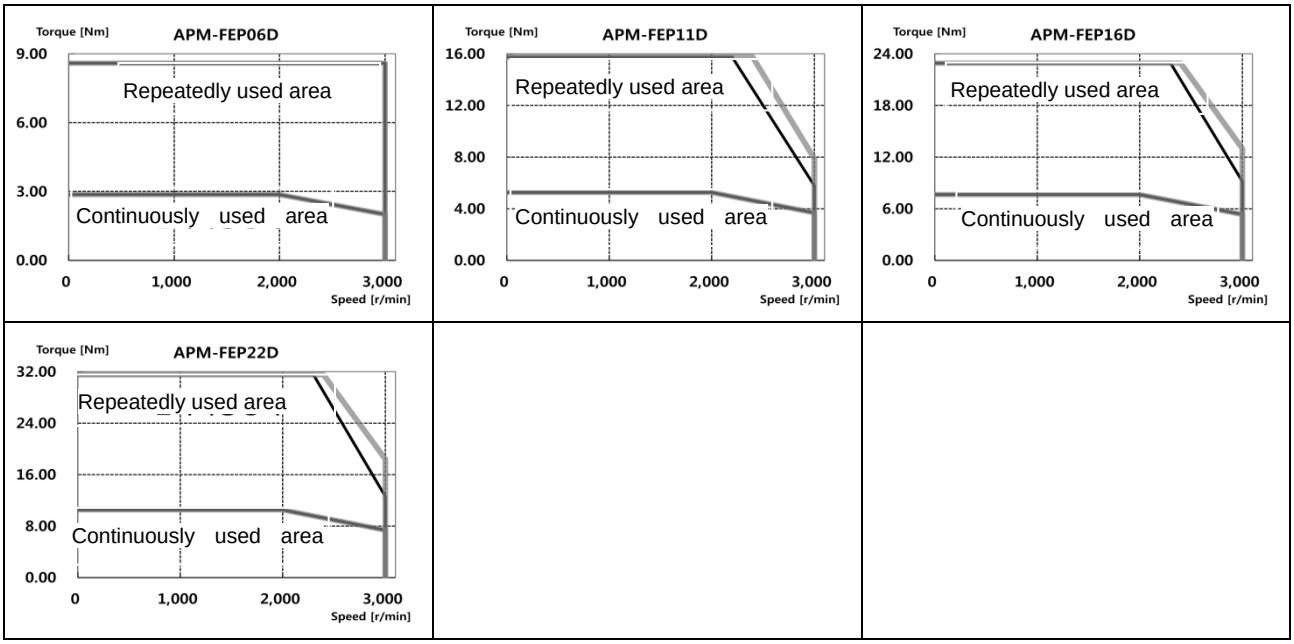




■ [400V]

Servo Motor Type (APM-□□□□□□)		FEP06D	FEP11D	FEP16D	FEP22D	-	-
Applicable Drive (L7SBxxxB)		L7SB010B		L7SB020B			
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 current	[A]	3.28	3.40	4.97	6.80		
Maximum current	[A]	9.83	10.19	14.92	20.04		
Rated rotation speed	[r/min]	2000					
Maximum rotation speed	[r/min]	3000					
Inertia moment	[kg·m²x10⁻⁴]	5.659	10.179	14.619	19.040		
	[gf·cm·s²]	5.774	10.387	14.917	19.429		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.50	27.10	39.92	57.95		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.5	7.54	9.68	11.78		

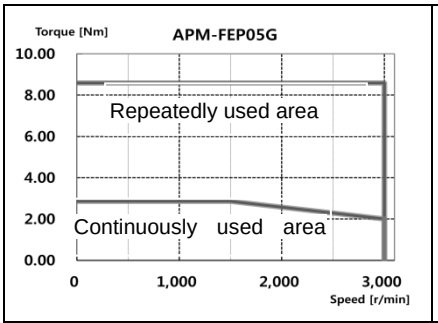
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, ■: 3-phase AC400V**]**

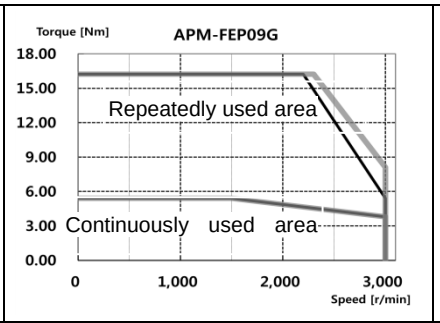


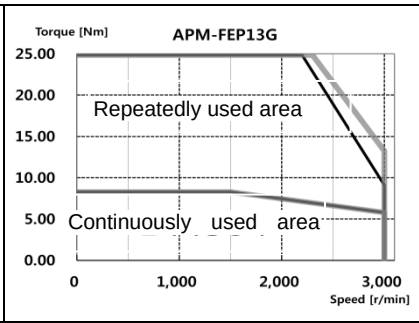
■ [400V]

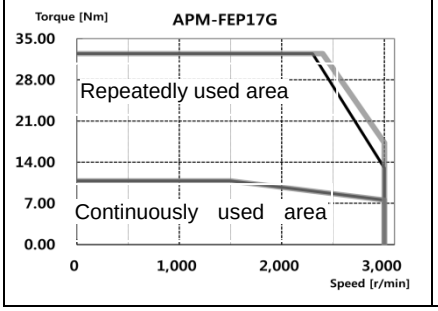
Servo Motor Type (APM-□□□□□□)		FEP05G	FEP09G	FEP13G	FEP17G	-	-
Applicable Drive (L7SBxxxB)		L7SB010B		L7SB020B			
Rated output	[kW]	0.45	0.85	1.3	1.7		
Rated torque	[N·m]	2.86	5.41	8.28	10.82		
	[kgf·cm]	29.23	55.22	84.45	110.43		
Maximum instantaneous torque	[N·m]	8.59	16.23	24.83	32.47		
	[kgf·cm]	87.70	165.65	253.35	331.30		
Rated current	[A]	3.28	3.50	5.39	7.01		
Maximum current	[A]	9.83	10.50	16.16	21.02		
Rated rotation speed	[r/min]	1500					
Maximum rotation speed	[r/min]	3000					
Inertia moment	[kg·m²x10⁻⁴]	5.659	10.179	14.619	19.040		
	[gf·cm·s²]	5.774	10.387	14.917	19.429		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.50	28.77	46.85	61.52		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.5	7.54	9.68	11.78		

♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, **■: 3-phase AC400V]**





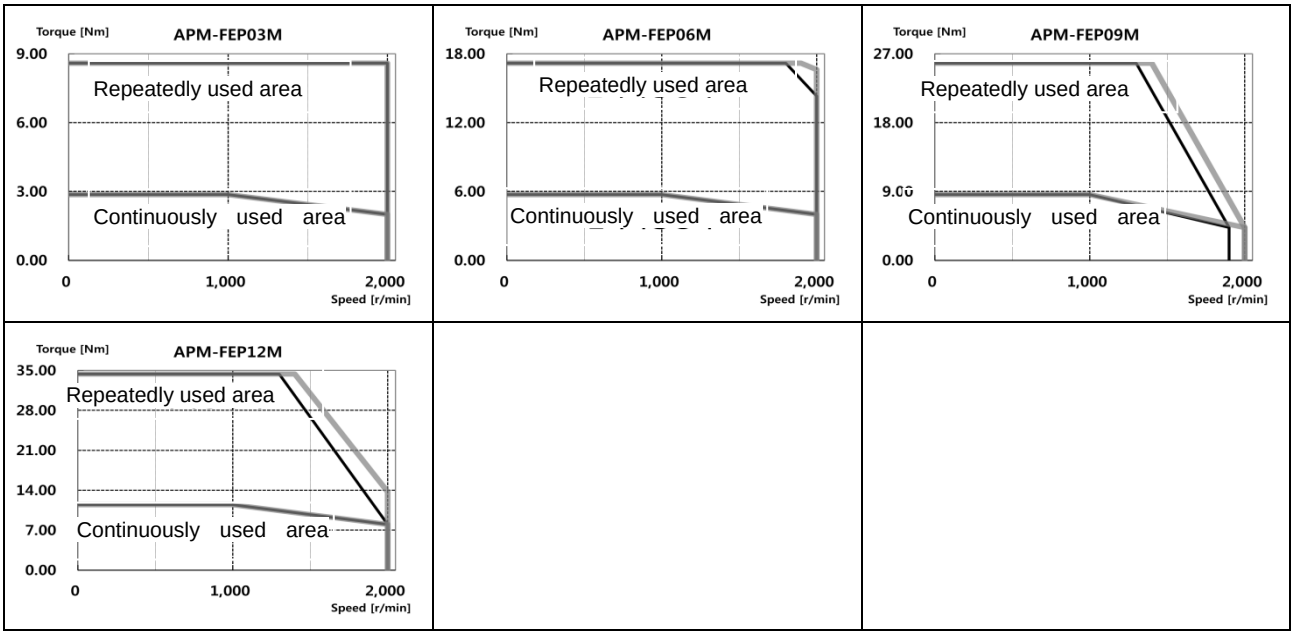




■ [400V]

Servo Motor Type (APM-□□□□□□)		FEP03M	FEP05M	FEP09M	FEP12M	-	-
Applicable Drive (L7SBxxxB)		L7SB010B			L7SB020B		
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 current	[A]	3.28	3.28	3.33	4.87		
Maximum current	[A]	9.83	9.83	9.99	14.60		
Rated rotation speed	[r/min]	1000					
Maximum rotation speed	[r/min]	2000					
Inertia moment	[kg·m²x10⁻⁴]	5.659	10.179	14.619	19.040		
	[gf·cm·s²]	5.774	10.387	14.917	19.429		
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	14.50	32.25	50.53	68.97		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	5.5	7.54	9.68	11.78		

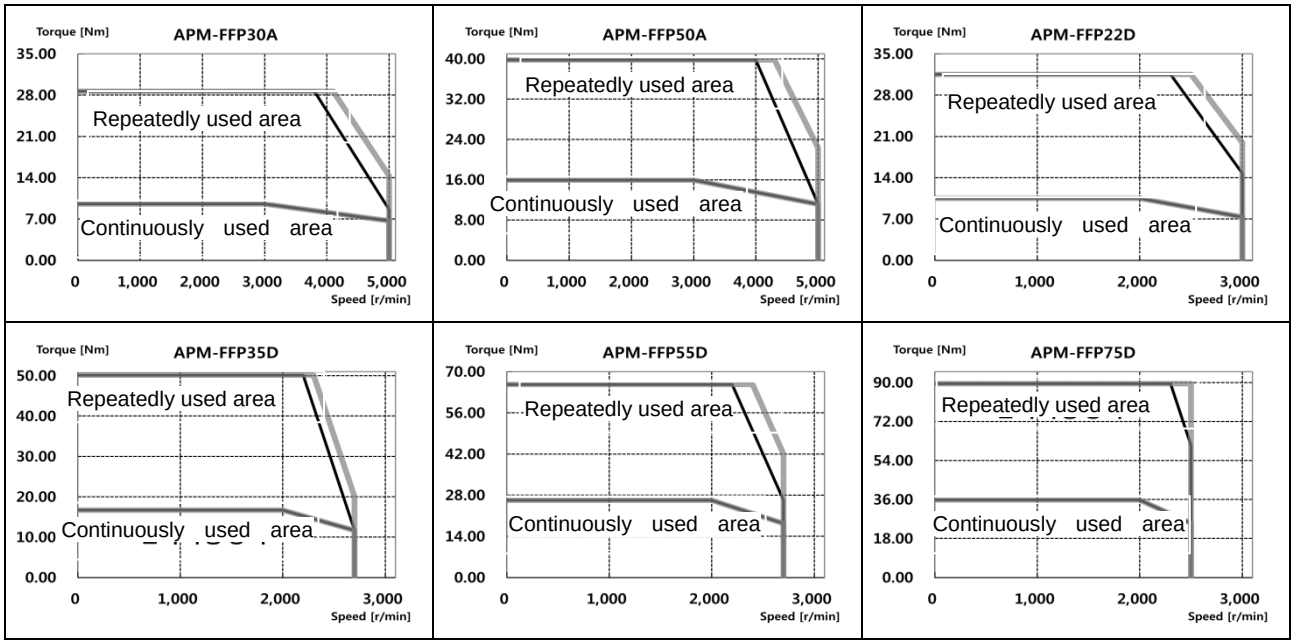
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, ■: 3-phase AC400V**]**



■ [400V]

Servo Motor Type (APM-□□□□□□)		FFP30A	FFP50A	FFP22D	FFP35D	FFP55D	FFP75D
Applicable Drive (L7SBxxxB)		L7SB035B	L7SB075B	L7SB020B	L7SB035B	L7SB050B	L7SB075B
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	669.84	913.52
Rated current	[A]	9.79	16.07	6.93	9.09	14.7	18.97
Maximum current	[A]	29.38	40.18	20.80	27.26	36.75	47.42
Rated rotation speed	[r/min]	3000		2000			
Maximum rotation speed	[r/min]	5000		3000	2800	2700	2500
Inertia moment	[kg·m²x10⁻⁴]	27.960	46.560	27.960	46.560	73.850	106.730
	[gf·cm·s²]	28.531	47.510	28.531	47.510	75.357	108.908
Allowed load inertia		Motor inertia x 10					
Rated power rate	[kW/s]	32.61	54.50	39.46	59.98	93.38	120.15
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	12.4	17.7	12.4	17.7	26.3	35.6

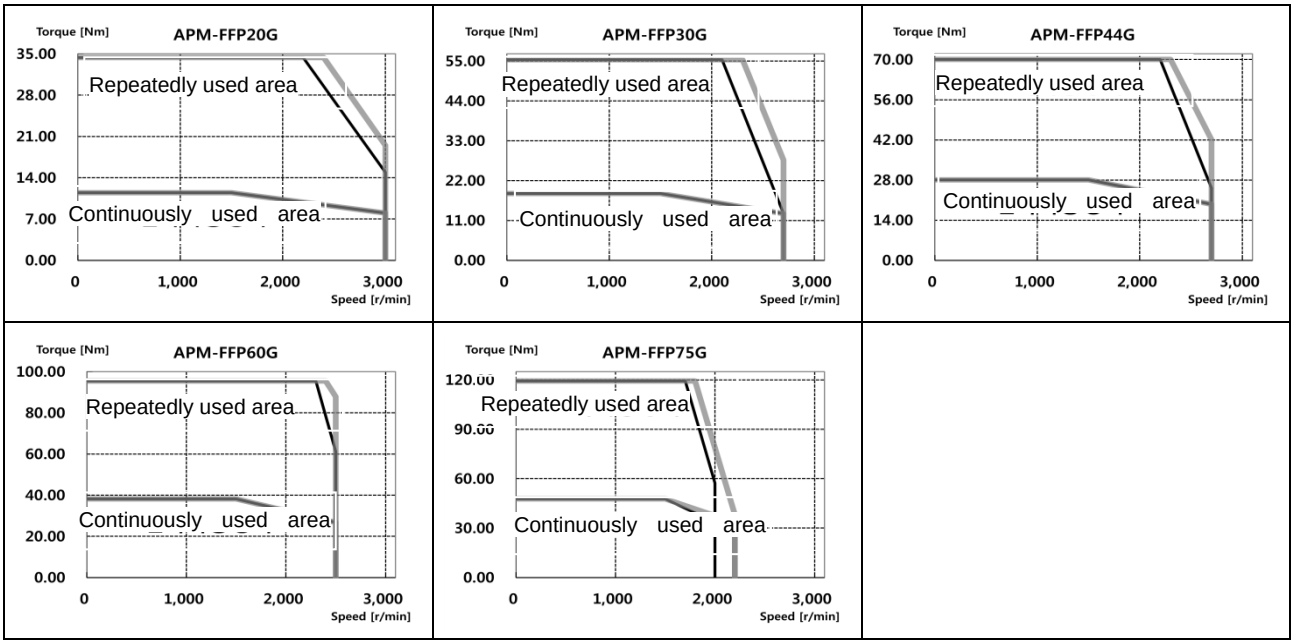
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, **■: 3-phase AC400V]**



■ [400V]

Servo Motor Type (APM-□□□□□□)		FFP20G	FFP30G	FFP44G	FFP60G	FFP75G	-
Applicable Drive (L7SBxxxB)		L7SB020B	L7SB035B	L7SB050B	L7SB075B		
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	70.02	95.49	119.37	
	[kgf·cm]	350.79	565.16	714.48	974.42	1,218.02	
Rated current	[A]	7.56	10.04	15.68	20.23	20.01	
Maximum current	[A]	22.69	30.12	39.20	50.28	50.03	
Rated rotation speed	[r/min]	1500					
Maximum rotation speed	[r/min]	3000	2700		2500	2200	
Inertia moment	[kg·m²x10⁻⁴]	27.960	46.560	73.850	106.730	131.290	
	[gf·cm·s²]	28.531	47.510	85.306	108.908	133.969	
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	46.96	73.21	106.25	136.70	173.64	
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	12.4	17.7	26.3	35.6	39.4	

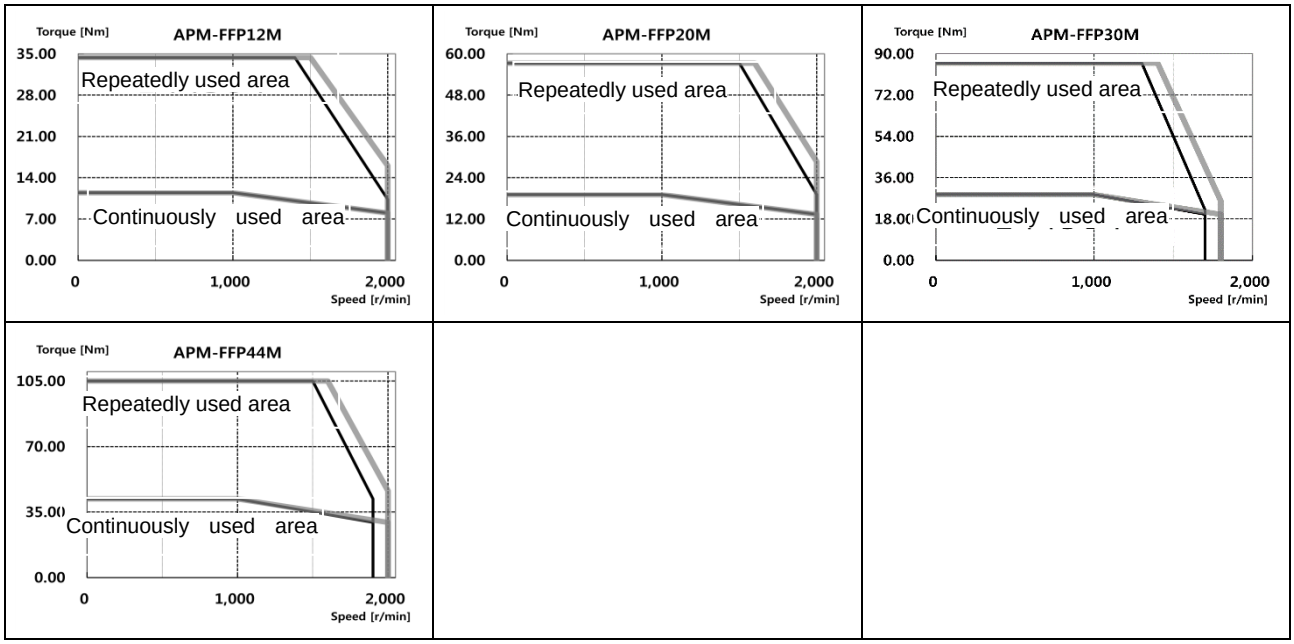
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, ■: 3-phase AC400V**]**



■ [400V]

Servo Motor Type (APM-□□□□□□)		FFP12M	FFP20M	FFP30M	FFP44M	-	-
Applicable Drive (L7SBxxxB)		L7SB020B		L7SB035B	L7SB050B		
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	105.05		
	[kgf·cm]	350.79	584.65	730.81	1,071.85		
Rated current	[A]	4.83	7.94	9.97	16.69		
Maximum current	[A]	14.50	23.83	29.91	41.73		
Rated rotation speed	[r/min]	1000					
Maximum rotation speed	[r/min]	2000		1800	2000		
Inertia moment	[kg·m²x10⁻⁴]	27.960	46.560	73.850	106.730		
	[gf·cm·s²]	28.531	47.510	75.357	108.908		
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	46.96	78.34	111.13	145.48		
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	12.4	17.7	26.3	35.6		

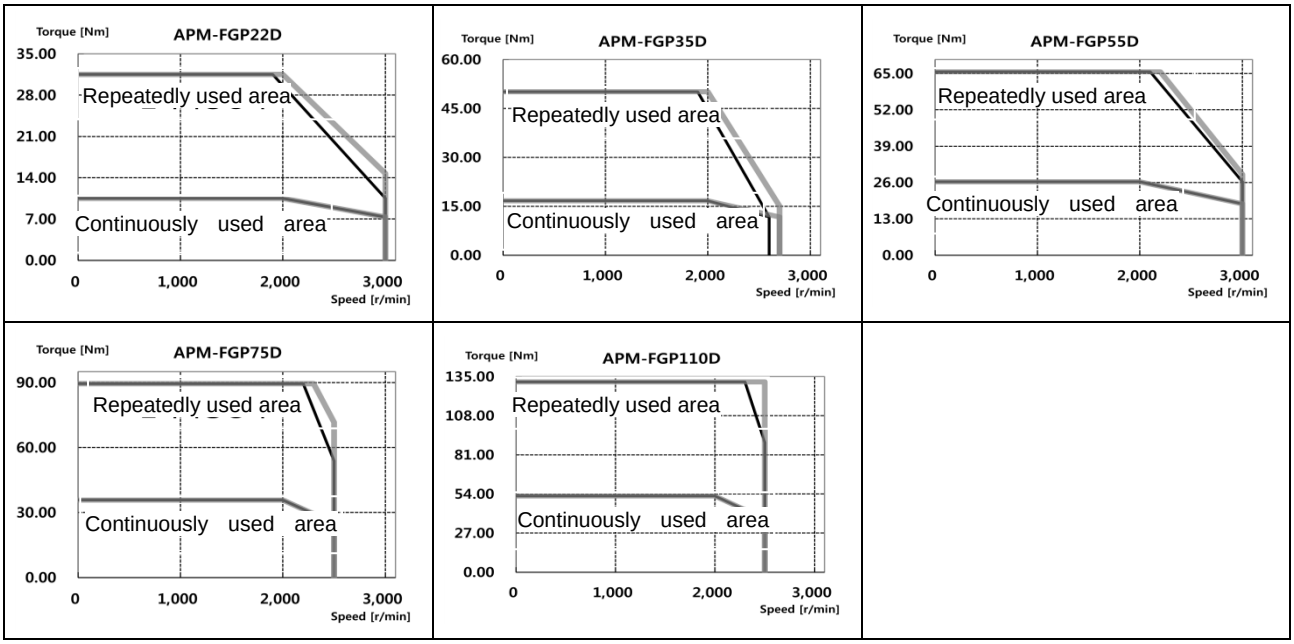
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, **■: 3-phase AC400V]**



■ [400V]

Servo Motor Type (APM-□□□□□□)		FGP22D	FGP35D	FGP55D	FGP75D	FGP110D	-
Applicable Drive (L7SBxxxB)		L7SB020B	L7SB035B	L7SB050B	L7SB075B	L7SB150B	
Rated output	[kW]	2.2	3.5	5.5	7.5	11.0	
Rated torque	[N·m]	10.50	16.71	26.26	35.81	52.52	
	[kgf·cm]	107.19	170.52	267.96	365.41	525.9	
Maximum instantaneous torque	[N·m]	31.51	50.13	65.65	89.52	131.30	
	[kgf·cm]	321.56	511.57	669.84	913.52	1,339.69	
Rated current	[A]	7.12	8.73	16.04	19.10	27.41	
Maximum current	[A]	21.35	26.20	40.10	47.76	68.52	
Rated rotation speed	[r/min]	2000					
Maximum rotation speed	[r/min]	3000	2700	3000	2500		
Inertia moment	[kg·m²x10⁻⁴]	41.130	71.530	117.720	149.400	291.360	
	[gf·cm·s²]	41.969	72.990	120.122	152.449	297.310	
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	26.83	39.04	58.58	85.83	94.68	
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	16.95	21.95	30.8	37.52	66.2	

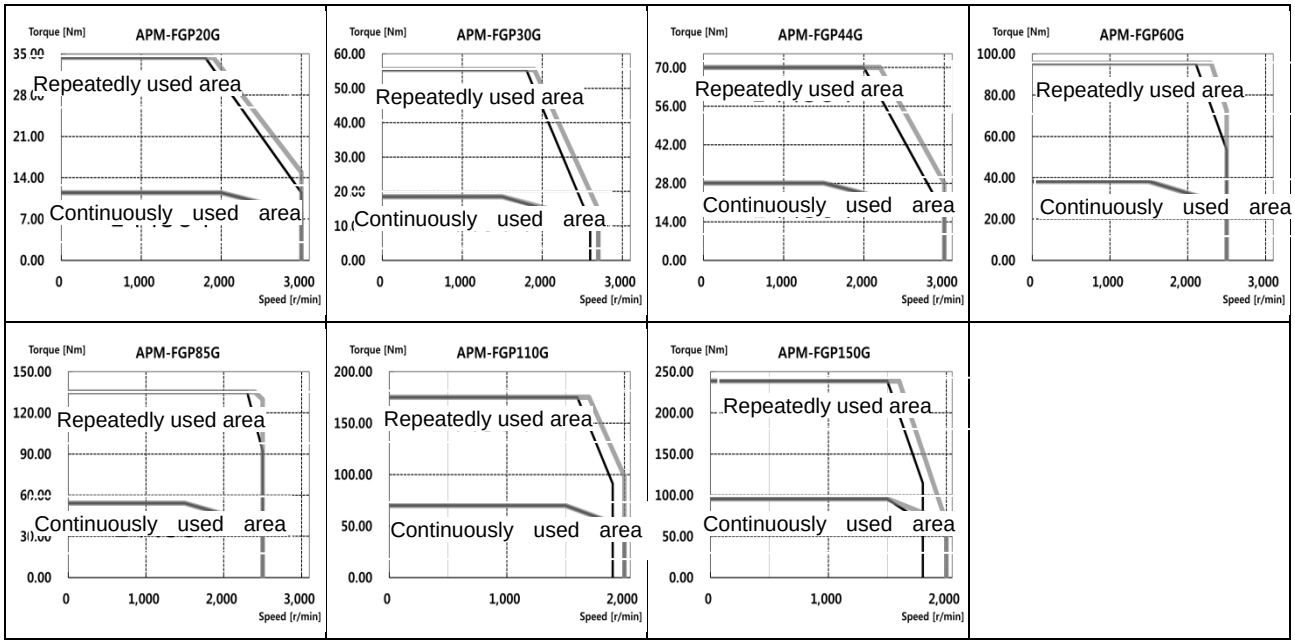
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, ■: 3-phase AC400V**]**



■ [400V]

Servo Motor Type (APM-□□□□□□)		FGP20G	FGP30G	FGP44G	FGP60G	FGP85G	FGP110G	FGP150G
Applicable Drive (L7SBxxxB)		L7SB020B	L7SB035B	L7SB050B	L7SB075B	L7SB150B		
Rated output	[kW]	1.8	2.9	4.4	6.0	8.5	11.0	15.0
Rated torque	[N·m]	11.46	18.46	28.01	38.20	54.11	70.03	95.49
	[kgf·cm]	116.93	188.39	285.83	389.77	552.17	714.57	974.42
Maximum instantaneous torque	[N·m]	34.38	55.39	84.03	95.49	135.28	175.07	238.73
	[kgf·cm]	350.79	565.16	857.49	974.42	1,380.43	1,786.43	2,436.05
Rated current	[A]	7.76	9.65	17.11	20.38	28.24	28.02	35.71
Maximum current	[A]	23.29	28.95	46.19	50.95	70.60	70.05	89.25
Rated rotation speed	[r/min]	1500						
Maximum rotation speed	[r/min]	3000	2700	3000	2500		2000	
Inertia moment	[kg·m²x10⁻⁴]	41.130	71.530	117.720	149.400	291.360	291.360	424.57
	[gf·cm·s²]	41.969	72.990	120.122	152.449	297.310	297.310	416.080
Allowed load inertia		Motor inertia x 5						
Rated power rate	[kW/s]	25.531	42.41	59.25	84.36	100.5	168.3	234.44
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)						
	Option	X						
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)						
	Time rating	Continuous						
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]						
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)						
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.						
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)						
Weight	[kg]	16.95	21.95	30.8	37.52	66.2	66.3	92.2

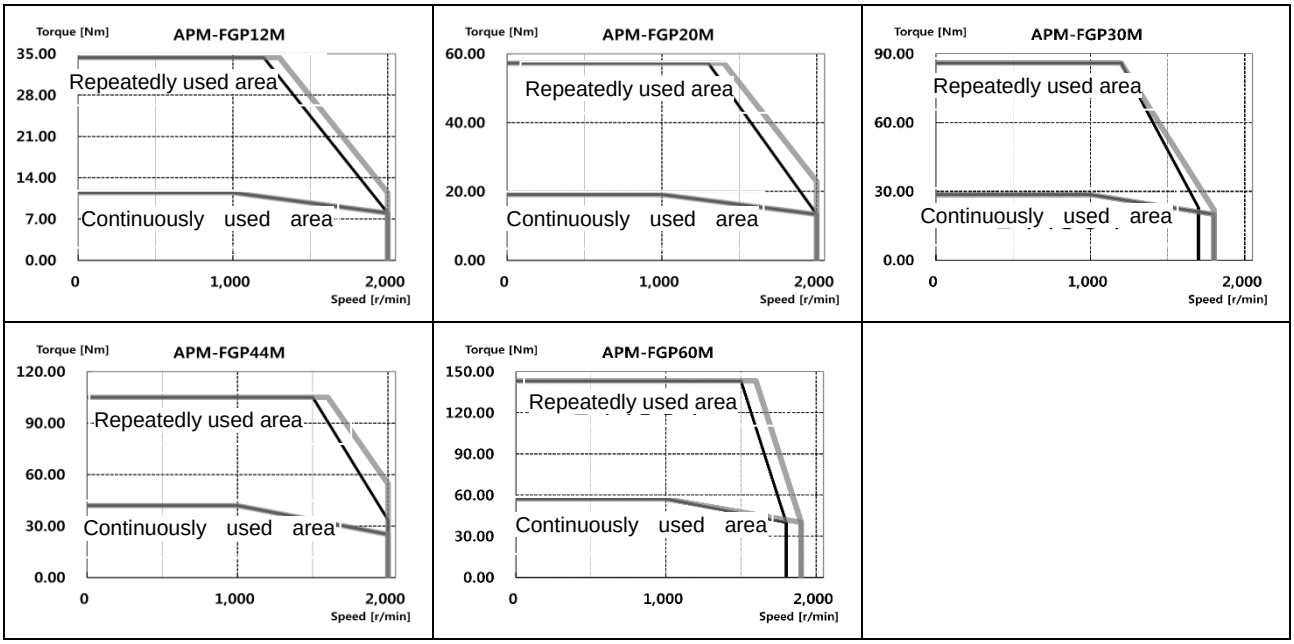
♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, **■: 3-phase AC400V]**



■ [400V]

Servo Motor Type (APM-□□□□□□)		FGP12M	FGP20M	FGP30M	FGP44M	FGP60M	-
Applicable Drive (L7SBxxxB)		L7SB020B		L7SB035B	L7SB050B	L7SB075B	
Rated output	[kW]	1.2	2.0	3.0	4.4	6.0	
Rated torque	[N·m]	11.46	19.10	28.26	42.02	57.30	
	[kgf·cm]	116.93	194.88	292.33	428.74	584.65	
Maximum instantaneous torque	[N·m]	34.38	57.30	85.94	105.05	143.24	
	[kgf·cm]	350.79	584.65	876.98	1071.85	1,461.63	
Rated current	[A]	4.75	7.88	9.97	17.39	20.23	
Maximum current	[A]	14.24	23.64	29.91	43.48	49.69	
Rated rotation speed	[r/min]	1000					
Maximum rotation speed	[r/min]	2000		1800	2000	1800	
Inertia moment	[kg·m²x10⁻⁴]	41.130	71.530	117.720	149.400	291.360	
	[gf·cm·s²]	41.969	72.990	120.122	152.449	297.310	
Allowed load inertia		Motor inertia x 5					
Rated power rate	[kW/s]	31.93	50.99	54.93	118.17	112.64	
Speed and position detector	Standard	Serial Multi-Turn Type(19bit)					
	Option	X					
Specifications and features	Protection method	Fully closed·self-cooling IP55(excluding axis penetration)					
	Time rating	Continuous					
	Ambient temperature	Ambient temperature : 0~40[°C], Storage temperature: -10~60[°C]					
	Ambient humidity	Ambient humidity : 20~80[%]RH, Storage humidity: 90[%]RH or less (no condensation)					
	Atmosphere	No direct sunlight, corrosive gas, or combustible gas.					
	Anti-vibration	Vibration acceleration of 49[m/s2](5G)					
Weight	[kg]	16.95	21.95	30.8	37.52	66.2	

♦ Rotation Speed – Torque Characteristics♦ **[■: 3-phase AC380V**, ■: 3-phase AC400V**]**



■ Electric brake specification

Applicable motor series	FAL	FBL	FCL	FE/FEP	FF/FFP	FG/FGP	FG/FGP110G FG/FGP150G
Usage	For retain	For retain	For retain	For retain	For retain	For retain	For retain
Input voltage[V]	DC 24V	DC 24V	DC 24V	DC 24V	DC 24V	DC 24V	DC 24V
Static friction torque[N•m]	0.32	1.47	3.23	10.4	40	74	120
Capacity[W]	6	6.5	9	19.4	25	32	26
Coil resistance[Ω]	96	89	64	29.6	23	327	22.2
Rated current[A]	0.25	0.27	0.38	0.81	1.04	0.28	1.08
Brake method	Spring brake	Spring brake	Spring brake	Spring brake	Spring brake	Spring brake	Spring brake
Insulation grade	Grade F	Grade F	Grade F	Grade F	Grade F	Grade F	Grade F

Note1) The same specifications apply to all electric brakes installed in our servo motors.

Note2) Electric brakes are designed to maintain a stop. Never use them for absolute braking.

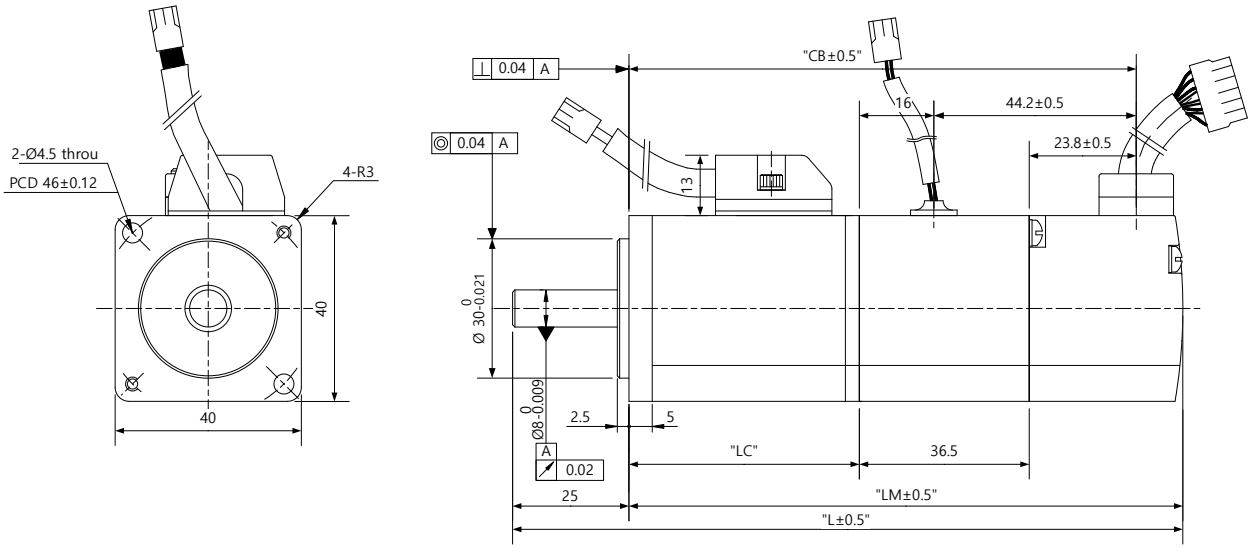
Note3) The characteristics of the electric brakes were measured at 20°C.

Note4) These brake specifications are subject to change. Check the voltage specifications on your specific motor.

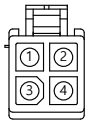
Note5) Brake UL standard of FAL, FBL, FCL, FE, and FEP Series meets Class 2.

2.1.2 Outline drawing

■ SA Series | APM-SAR3A, SAR5A, SA01A, SA015A



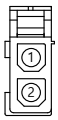
<Power Connector>



Pin No.	Signal name
1	U
2	V
3	W
4	FG

Plug : 172167-1(AMP)

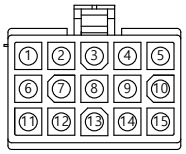
<Brake Connector>



Pin No.	Polarity
1	BK+
2	BK-

Plug : 172165-1(AMP)

<Encoder Connector>



Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
1	A	6	/Z	11	W
2	/A	7	U	12	/W
3	B	8	/U	13	+5V
4	/B	9	V	14	0V
5	Z	10	/V	15	SHIELD

Plug : 172171-1(AMP)

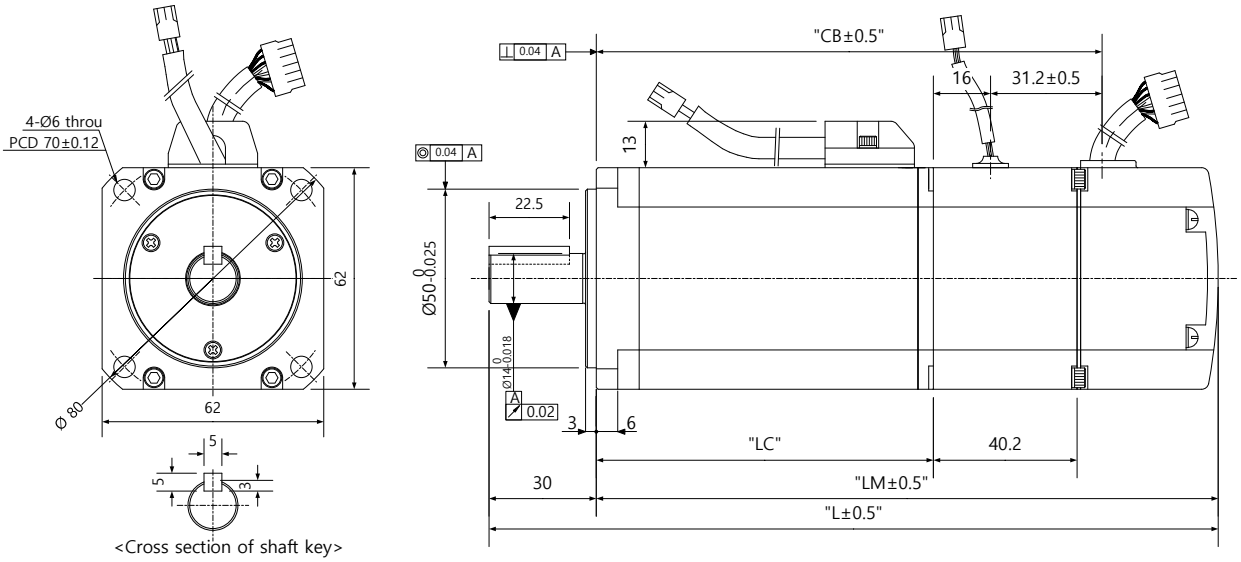
Model	External Dimensions				Weight (kg)
	L	LM	LC	CB	
SAR3A	101.3(137.6)	76.3(112.6)	42.5(42.4)	66.3(102.6)	0.32(0.67)
SAR5A	108.3(144.6)	83.3(119.6)	49.5(49.4)	73.3(109.6)	0.38(0.73)
SA01A	125.3(161.6)	100.3(136.6)	66.5(66.4)	90.3(126.6)	0.5(0.85)
SA015A	145.3	120.3	86.5	110.3	0.7

Note1) The standard shaft end for 40 flange is straight.

Note2) Use DC 24 [V] for brake-opening power.

Note3) The sizes in parentheses apply when attached to brakes.(Except SA015A)

■ SB Series | APM-SB01A, SB02A, SB04A



<Power Connector>

Pin No.	Signal name
1	U
2	V
3	W
4	FG

Plug : 172167-1(AMP)

<Brake Connector>

Pin No.	Polarity
1	BK+
2	BK-

Plug : 172165-1(AMP)

<Encoder Connector>

Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
1	A	6	/Z	11	W
2	/A	7	U	12	/W
3	B	8	/U	13	+5V
4	/B	9	V	14	0V
5	Z	10	/V	15	SHIELD

Plug : 172171-1(AMP)

Model	External Dimensions				Weight (kg)
	L	LM	LC	CB	
SB01A	122(162)	92(132)	52.5(52.3)	59.5(99.5)	0.82(1.4)
SB02A	136(176)	106(146)	66.5(66.3)	73.5(113.5)	1.08(1.66)
SB04A	164(204)	134(174)	94.5(94.3)	101.5(141.5)	1.58(2.16)

Note1) Use DC 24 [V] for brake-opening power.

Note2) The sizes in parentheses apply when attached to brakes.

Note3) Option specification; Serial M-turn Encoder Pin Map

<Serial M-Turn Connector>

Pin No.	Signal name	Pin No.	Signal name
1	MA	6	GND_B
2	/MA	7	+5V
3	SL	8	0V
4	/SL	9	SHIELD
5	VDD_B		

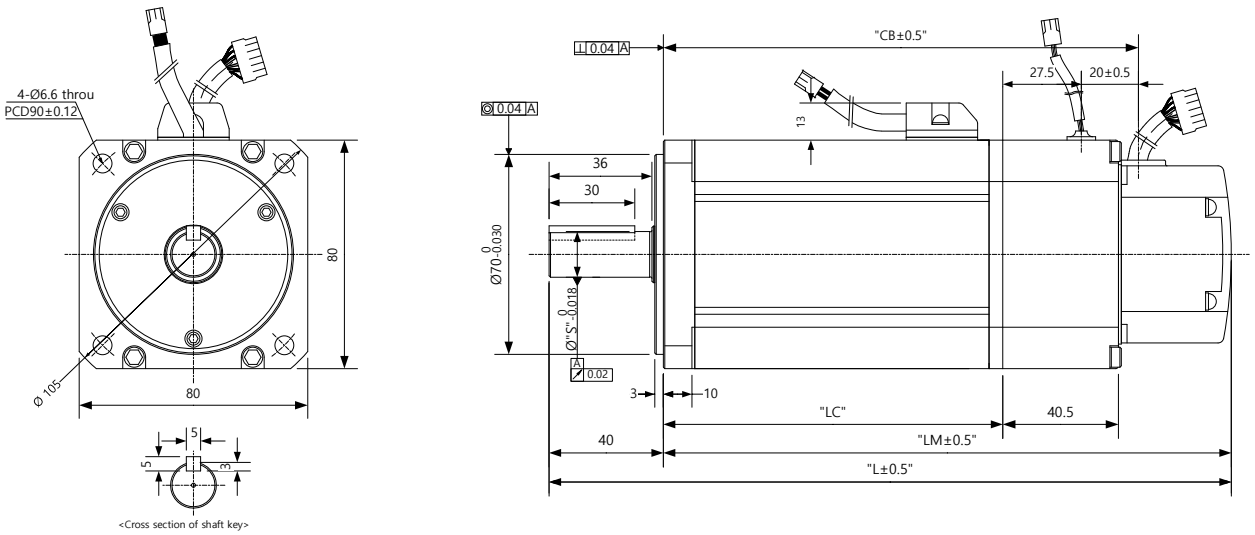
Plug : 172169-1(AMP)

<Serial S-Turn Connector>

Pin No.	Signal name	Pin No.	Signal name
1	MA	6	-
2	/MA	7	+5V
3	SL	8	0V
4	/SL	9	SHIELD
5	-		

Plug : 172169-1(AMP)

■ SC Series | APM-SC04A, SC03D, SC06A, SC05D, SC08A, SC06D, SC10A, SC07D



<Power Connector>

Pin No.	Signal name
1	U
2	V
3	W
4	FG

Plug : 172167-1(AMP)

<Brake Connector>

Pin No.	Polarity
1	BK+
2	BK-

Plug : 172165-1(AMP)

<Encoder Connector>

Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
1	A	6	/Z	11	W
2	/A	7	U	12	/W
3	B	8	/U	13	+5V
4	/B	9	V	14	0V
5	Z	10	/V	15	SHIELD

Plug : 172171-1(AMP)

Model	External Dimensions					Weight (kg)
	L	LM	LC	CB	S	
SC04A,SC03D	158.5(199.8)	118.5(158.8)	79(78.8)	86(126.3)	14	1.88(2.92)
SC06A,SC05D	178.5(218.8)	138.5(178.8)	99(98.8)	106(146.3)	16	2.52(3.56)
SC08A,SC06D	198.5(238.8)	158.5(198.8)	119(118.8)	126(166.3)	16	3.15(4.22)
SC10A,SC07D	218.5(258.8)	178.5(218.8)	139(138.8)	146(186.3)	16	3.80(4.94)

Note1) Use DC 24 [V] for brake-opening power

Note2) The sizes in parentheses apply when attached to brakes

Note3) Option specification; Serial type PinMap

<Serial M-Turn Connector>

Pin No.	Signal name	Pin No.	Signal name
1	MA	6	GND_B
2	/MA	7	+5V
3	SL	8	0V
4	/SL	9	SHIELD
5	VDD_B		

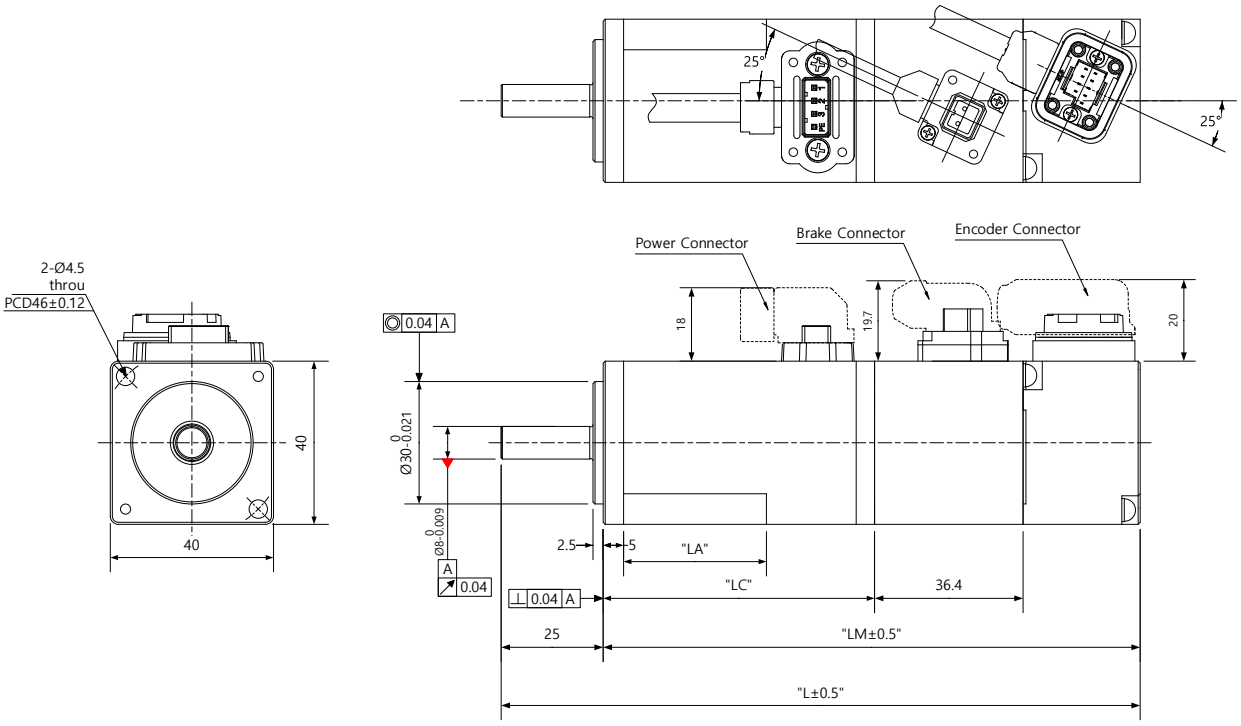
Plug : 172169-1(AMP)

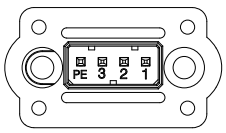
<Serial S-Turn Connector>

Pin No.	Signal name	Pin No.	Signal name
1	MA	6	-
2	/MA	7	+5V
3	SL	8	0V
4	/SL	9	SHIELD
5	-		

Plug : 172169-1(AMP)

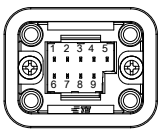
■ FAL Series | APM – FALR5A
APM – FAL01A
APM – FAL015A





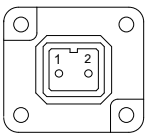
Pin No.	Signal name
1	U
2	V
3	W
PE	FG

<Power Connector Pin array>



Multi Turn (M)			
Pin No.	Signal name	Pin No.	Signal name
1	MA	6	/MA
2	SLO	7	/SLO
3	GND_B	8	VDD_B
4	0V	9	+5V
5	Shield		

<Encoder Connector Pin array>



Pin No.	Signal name
1	BK+
2	BK-

<Brake Connector Pin array>

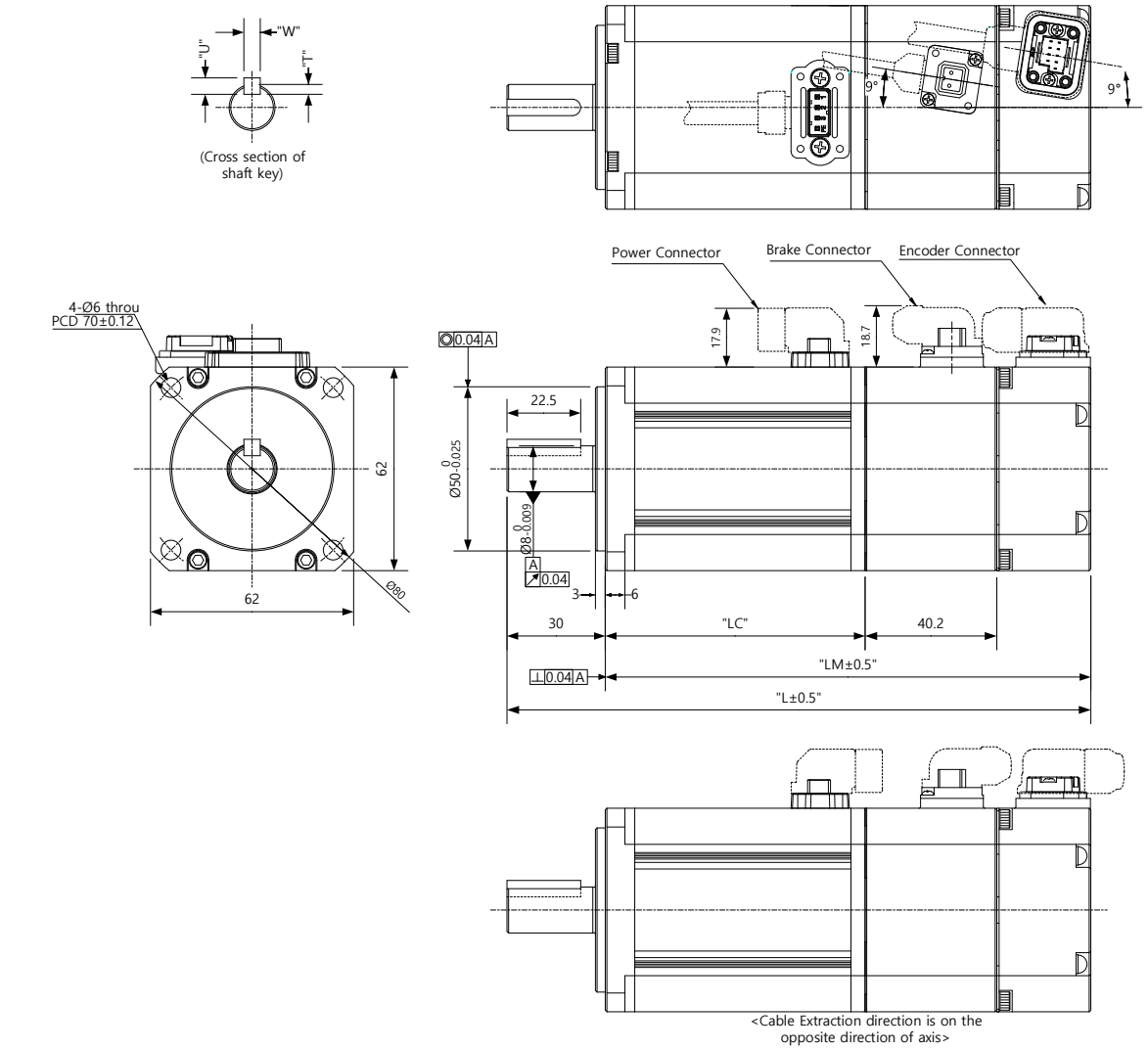
형명	External Dimensions				Weight (kg)
	L	LM	LC	LA	
FALR5A	103.2(139.6)	78.2(114.6)	49.5	23	0.31(0.66)
FAL01A	120.2(156.6)	95.2(131.6)	66.5	35	0.45(0.80)
FAL015A	140.2	115.2	86.5	35	0.61

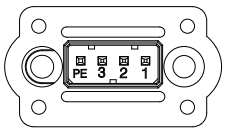
NOTE 1) Use DC power (24V) to operate the brake.

NOTE 2) The dimension of ( ) is for brake type motor.

NOTE 3) To connect FAL motor, connect power cable first.

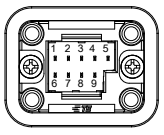
■ FBL Series | APM – FBL01A, FBL02A, FBL04A





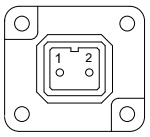
Pin No.	Signal name
1	U
2	V
3	W
PE	FG

<Power Connector pin array>



Multi Turn (M)			
Pin No.	Signal name	Pin No.	Signal name
1	MA	6	/MA
2	SLO	7	/SLO
3	GND_B	8	VDD_B
4	0V	9	+5V
5	Shield		

<Encoder Connector pin array>



Pin No.	Signal name
1	BK+
2	BK-

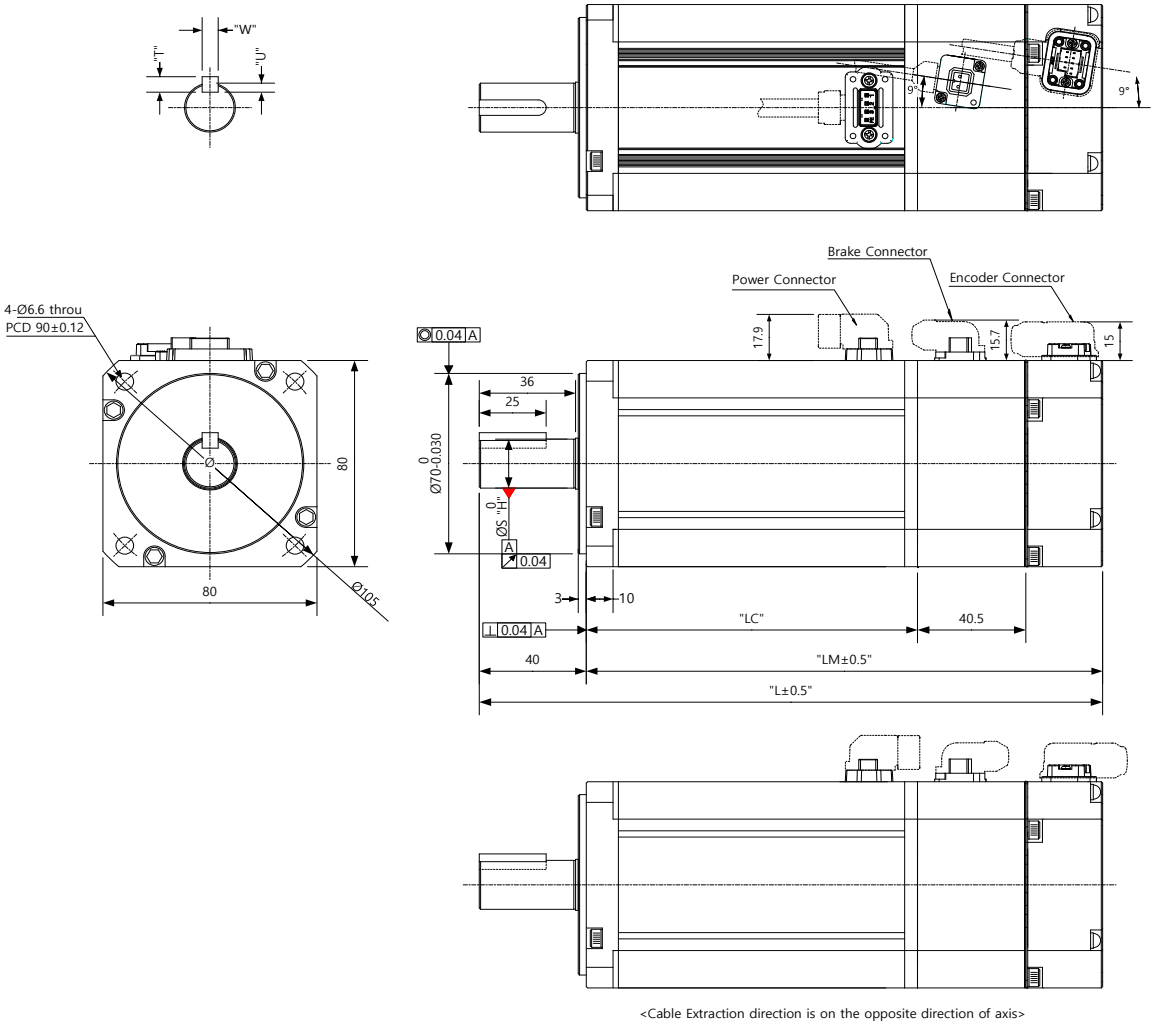
<Brake Connector pin array>

형명	External Dimensions					Key Dimensions			Weight (kg)
	L	LM	LC	S	H	T	W	U	
FBL01A	107.2(147.2)	77.2(117.2)	48.5(48.3)	14	-0.018	5	5	3	0.56(1.3)
FBL02A	118.2(158.2)	88.2(128.2)	59.5(59.3)	14	-0.018	5	5	3	0.74(1.48)
FBL04A	138.2(178.2)	108.2(148.2)	79.5(79.3)	14	-0.018	5	5	3	1.06(1.8)

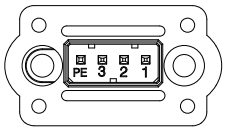
Note 1) Use DC power (24V) to operate the brake.

Note 2) The dimension of ( ) is for brake type motor.

■ FCL Series | APM - FCL04A, FCL03D, FCL06A, FCL05D
APM - FCL08A, FCL06D, FCL10A, FCL07D

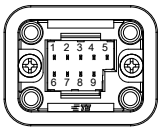


<Cable Extraction direction is on the opposite direction of axis>



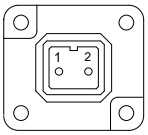
Pin No.	Signal name
1	U
2	V
3	W
PE	FG

<Power Connector pin array>



Multi Turn (M)			
Pin No.	Signal name	Pin No.	Signal name
1	MA	6	/MA
2	SLO	7	/SLO
3	GND_B	8	VDD_B
4	0V	9	+5V
5	Shield		

<Encoder Connector pin array>



Pin No.	Signal name
1	BK+
2	BK-

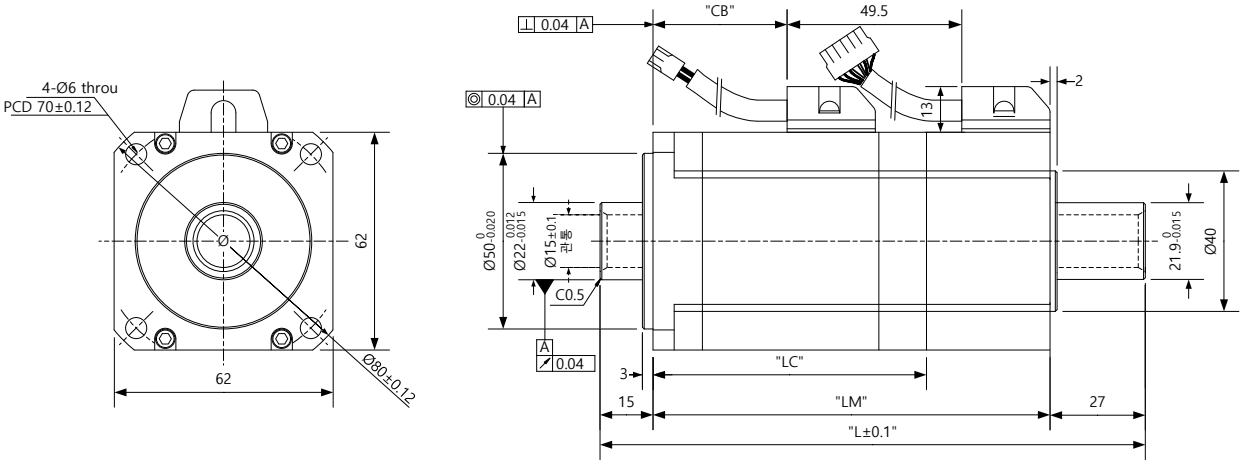
<Brake Connector pin array>

Name	External Dimensions					Key Dimensions			Weight(kg)
	L	LM	LC	S	H	T	W	U	
FCL04A,FCL03D	138.7(179.5)	98.7(139.5)	70(69.8)	14	-0.018	5	5	3	1.52(2.32)/1.26(2.06)
FCL06A,FCL05D	156.7(197.5)	116.7(157.5)	88(87.8)	19	-0.021	6	6	3.5	2.14(2.94)/2.12(2.92)
FCL08A,FCL06D	174.7(215.5)	134.7(175.5)	106(105.8)	19	-0.021	6	6	3.5	2.68(3.48)/2.66(3.46)
FCL10A,FCL07D	192.7(233.5)	152.7(193.5)	124(123.8)	19	-0.021	6	6	3.5	3.30(4.10)/2.78(3.58)

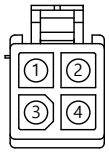
Note 1) Use DC power (24V) to operate the brake.

Note 2) The dimension of ( ) is for brake type motor.

■ HB Series | APM-HB01A (Hollow shaft)
APM-HB02A (Hollow shaft)
APM-HB04A (Hollow shaft)



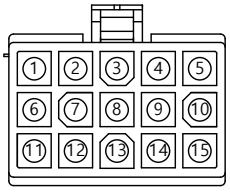
<Power Connector>



Pin No.	Signal name
1	U
2	V
3	W
4	FG

Plug : 172167-1(AMP)

<Encoder Connector>

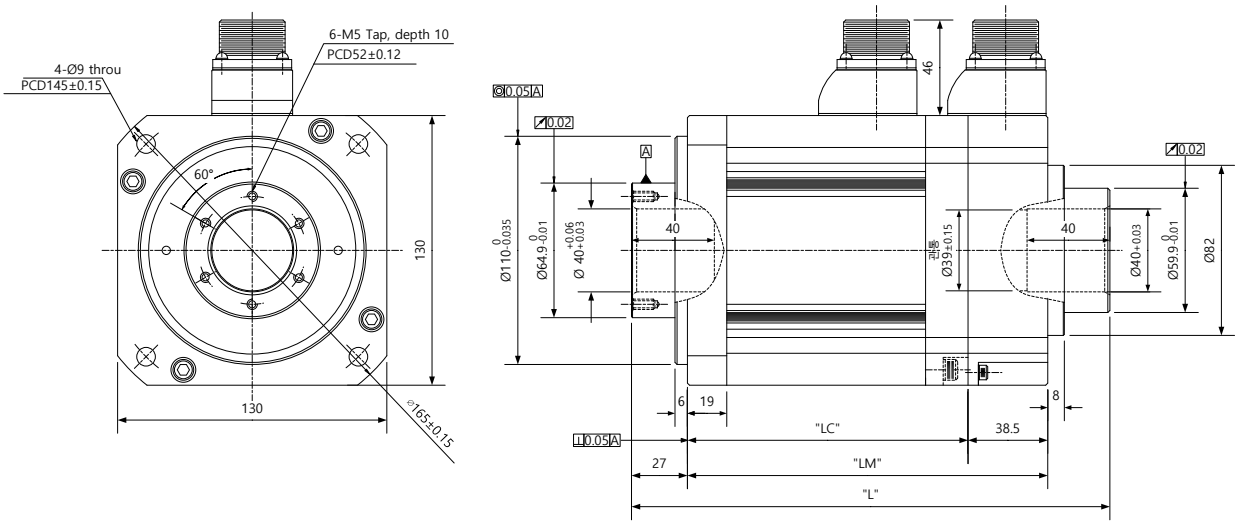


Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
1	A	6	/Z	11	W
2	/A	7	U	12	/W
3	B	8	/U	13	+5V
4	/B	9	V	14	0V
5	Z	10	/V	15	SHIELD

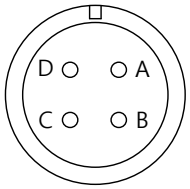
Plug : 172171-1(AMP)

Model	External Dimensions				Hollow Shaft Diameter	Weight (Kg)
	L	LM	LC	CB		
HB01A	140.5	98.5	68.5	24	15	0.89
HB02A	154.5	112.5	82.5	38	15	1.16
HB04A	182.5	140.5	105.5	66	15	1.69

■ HE Series | APM-HE09A(Hollow shaft)
APM-HE15A (Hollow shaft)
APM-HE30A (Hollow shaft)



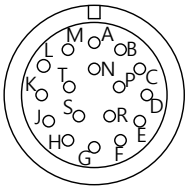
<Power Connector>



Pin No.	Signal name
A	U
B	V
C	W
D	FG

Plug : MS3102A20-4P

<Encoder Connector>

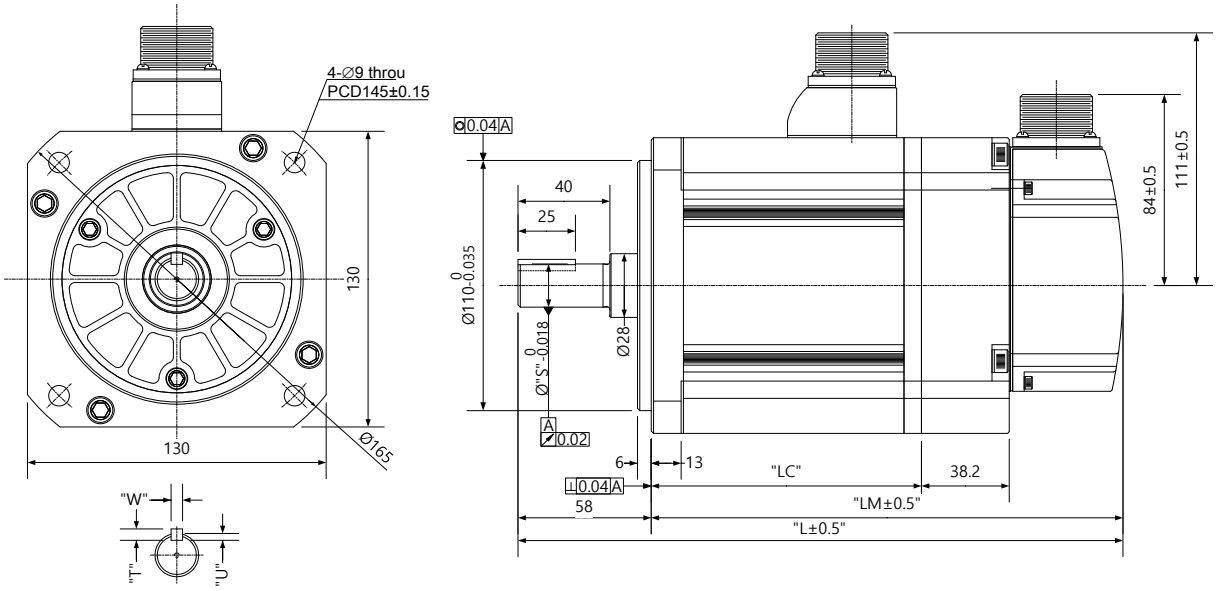


Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	A	F	/Z	P	W
B	/A	K	U	R	/W
C	B	L	/U	H	+5V
D	/B	M	V	G	0V
E	Z	N	/V	J	SHIELD

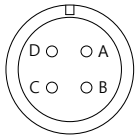
Plug : MS3102A20-15P

Model	External Dimensions			Hollow Shaft Diameter	Weight (Kg)
	L	LM	LC		
HE09A	207	150	111.5	40	5..8
HE15A	231	174	135.5	40	7.4
HE30A	279	222	183.5	40	10.83

■FE(P) Series | APM-FE(P)09A, FE(P)06D, FE(P)05G, FE(P)03M, FE(P)15A, FE(P)11D, FE(P)09G, FE06M APM-FE(P)22A, FE(P)16D, FE(P)13G, FE(P)09M, FE(P)30A, FE(P)22D, FE(P)17G, FE(P)12M



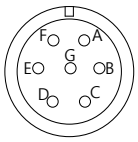
<Power Connector>



Pin No.	Signal name
A	U
B	V
C	W
D	FG

Plug : MS3102A20-4P

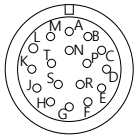
<Brake Type Connector>



Pin No.	Signal name	Pin No.	Signal name
A	U	D	FG
B	V	E	BK+
C	W	F	BK-

Plug : MS3102A20-15P

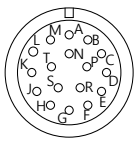
<Serial M-Turn Connector>



Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	MA	F	GND_B	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	V_{DD}_B	N	-	J	SHIELD

Plug : MS3102A20-29P

<Serial S-Turn Connector>



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

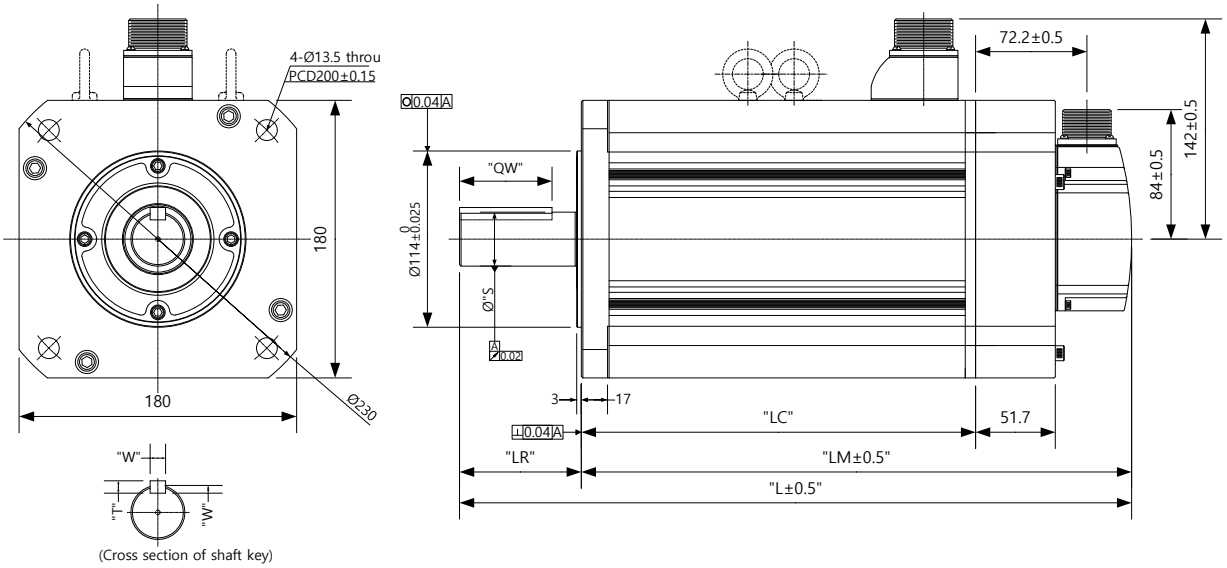
Plug : MS3102A20-29P

Model	External Dimensions				**Key** Dimensions			Weight(kg)
	L	LM	LC	S	T	W	U	
FE(P)09A,FE(P)06D, FE(P)05G,FE(P)03M	197.3(235.3)	139.3(177.3)	89.8(89.6)	19	5	5	3	5.04(6.58)
FE(P)15A,FE(P)11D, FE(P)09G,FE(P)06M	217.3(255.3)	159.3(197.3)	109.8(109.6)	19	5	5	3	6.74(8.28)
FE(P)22A,FE(P)16D, FE(P)13G,FE(P)09M	237.3(275.3)	179.3(217.3)	129.8(129.6)	22	6	6	3.5	8.48(10.02)
FE(P)30A,FE(P)22D, FE(P)17G,FE(P)12M	255.3(293.3)	197.3(235.3)	147.8(147.6)	24	7	8	4	10.05(11.59)

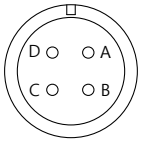
Note1) Use DC power (24V) to operate the brake.

Note2) The sizes in parentheses apply when attached to the brakes.

■ FF(P) Series | APM-FF(P)30A, FF(P)22D, FF(P)20G, FF(P)12M, FF(P)50A, FF(P)35D, FF(P)30G, FF(P)20M, APM-FF(P)55D, FF(P)44G, FF(P)30M, FF(P)75D, FF(P)60G, FF(P)44M, FF(P)75G



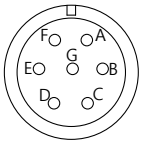
<Power Connector>



Pin No.	Signal name
A	U
B	V
C	W
D	FG

Plug : MS3102A22-22P

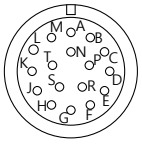
<Brake Type Connector>



Pin No.	Signal name	Pin No.	Signal name
A	U	D	FG
B	V	E	BK+
C	W	F	BK-

Plug : MS3102A24-10P

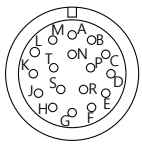
<Serial M-Turn Connector>



Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	MA	F	GND_B	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	V_{DD}_B	N	-	J	SHIELD

Plug : MS3102A20-29P

<Serial S-Turn Connector>



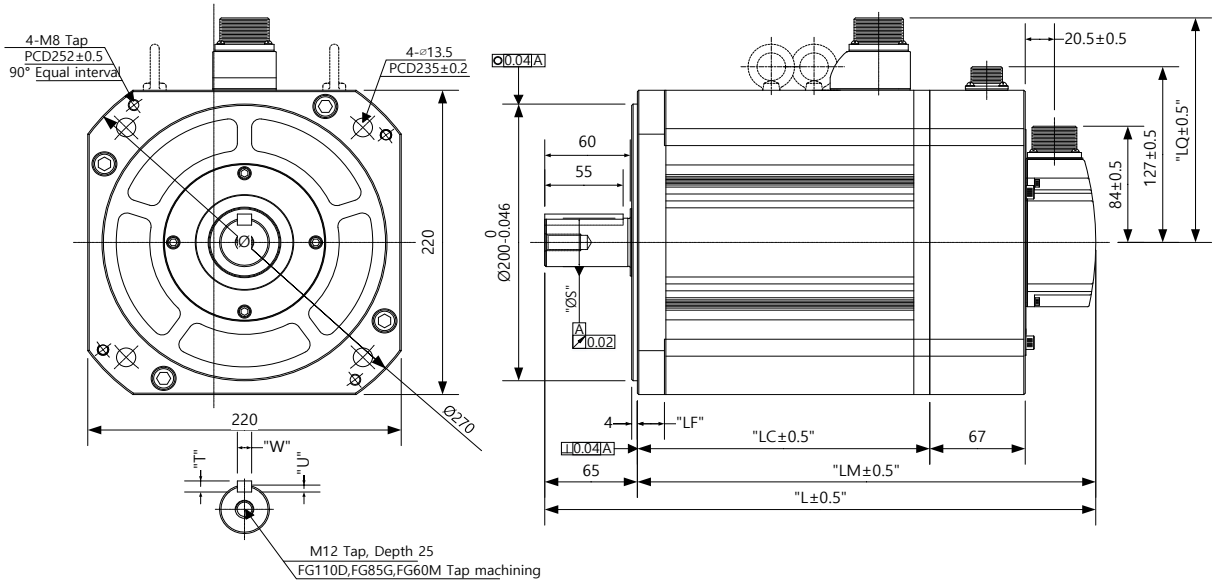
Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	MA	F	-	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	-	N	-	J	SHIELD

Plug : MS3102A20-29P

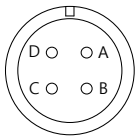
Model	External Dimensions					Key Dimensions				Eye bolts	Weight(kg)
	L	LM	LC	LR	S	QW	T	W	U		
FF(P)30A, FF(P)22D FF(P)20G, FF(P)12M	257.5(308.9)	178.5(229.9)	129(128.7)	79	35 (0~+0.01)	60	8	10	5	X	12.5 (19.7)
FF(P)50A, FF(P)35D FF(P)30G, FF(P)20M	287.5(338.9)	208.5(259.9)	159(158.7)								17.4 (24.6)
FF(P)55D, FF(P)44G FF(P)30M	331.5(382.9)	252.5(303.9)	203(202.7)							O	25.2 (32.4)
FF(P)75D, FF(P)60G, FF(P)44M	384.5(435.9)	305.5(356.9)	256(255.7)		42 (-0.016~0)			12			33.8 (41.0)
FF(P)75G**(주 3)**	439.5	326.5	277	113		96					38.5

Note1) Use DC power (24 V) to operate the brake.
Note2) The sizes in parentheses apply when attached to the brakes.
Note3) For FF75G model, use MS connector 32-17P.

■ FG(P) Series | APM-FG(P)22D, FG(P)20G, FG(P)12M, FG(P)35D, FG(P)30G, FG(P)20M, FG(P)55D, FG(P)44G, APM-FG(P)30M ,FG(P)75D, FG(P)60G, FG(P)44M, FG(P)110D, FG(P)85G, FG(P)60M



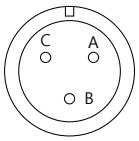
<Power Connector>



Pin No.	Signal name
A	U
B	V
C	W
D	FG

Plug : MS3102A22-22P
(Note 3) Plug : MS3102A32-17P

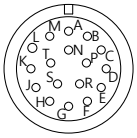
<Brake Connector>



Pin No.	Polarity
A	BK+
B	BK-
C	NC

Plug : MS3102A14-7P

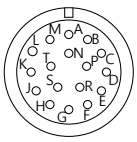
<Serial M-Turn Connector>



Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	MA	F	GND_B	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	VDD_B	N	-	J	SHIELD

Plug : MS3102A20-29P

<Serial S-Turn Connector>



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

Plug : MS3102A20-29P

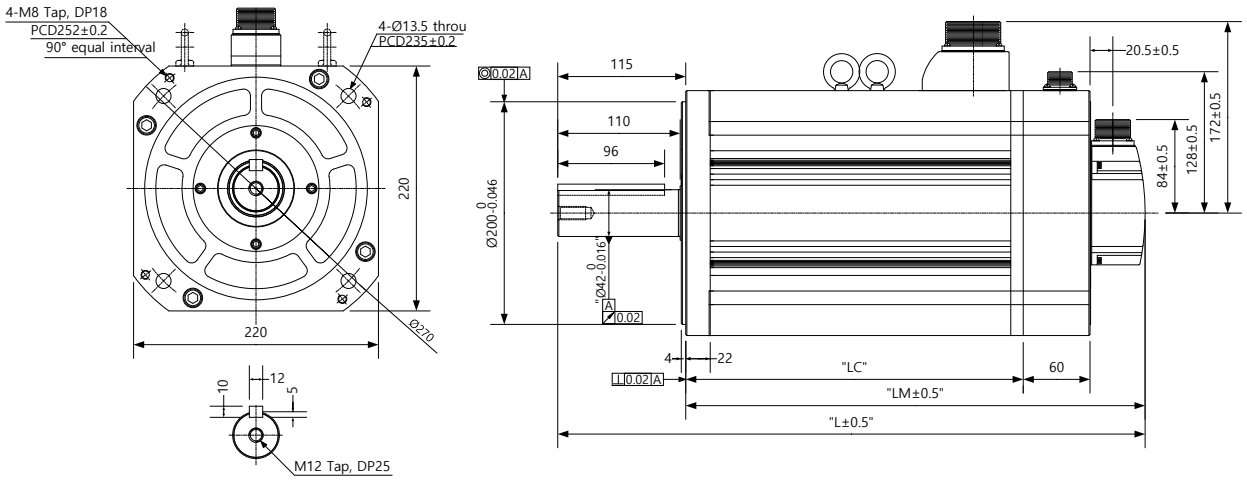
Model	External Dimensions						Key Dimensions			Power Connector	Weight(kg)
	L	LM	LC	LF	LQ	S	T	W	U		
FG(P)22D, FG(P)20G FG(P)12M	229.5 (295.7)	164.5 (230.7)	115 (114.2)	19	162	35 (-0.016~0)	8	10	5	MS3102A 22-22P	15.42 (29.23)
FG(P)35D, FG(P)30G FG(P)20M	250.5 (316.7)	185.5 (251.7)	136 (135.2)								20.22 (34.03)
FG(P)55D, FG(P)44G FG(P)30M	282.5 (348.7)	217.5 (283.7)	168 (167.2)								28.02 (41.83)
FG(P)75D, FG(P)60G FG(P)44M,	304.5 (370.7)	239.5 (305.7)	190 (189.2)			42 (-0.016~0)		12			33.45 (47.26)
FG(P)110D, FG(P)85G FG60M (Note3)	418.5 (484.7)	353.5 (419.7)	304 (303.2)	21	173	45 (-0.016~0)		10	6	MS3102A 32-17P	66.2 (82.6)

Note1) Use DC power (24 V) to operate the brake

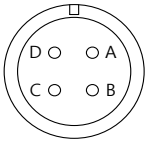
Note2) The sizes in parentheses apply when attached to the brakes.

Note3) Connector specification is MS3102A32-17P

■ FG(P) Series | APM-FG(P)110G



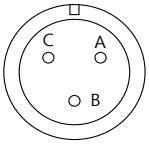
<Power Connector>



Pin No.	Signal name
A	U
B	V
C	W
D	FG

Plug : MS3102A32-17P

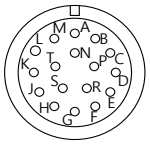
<Brake Connector>



Pin No.	Polarity
A	BK+
B	BK-
C	NC

Plug : MS3102A14-7P

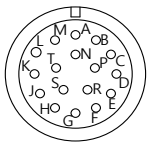
<Serial M-Turn Connector>



Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	MA	F	GND_B	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	V_{DD}_B	N	-	J	SHIELD

Plug : MS3102A20-29P

<Serial S-Turn Connector>



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

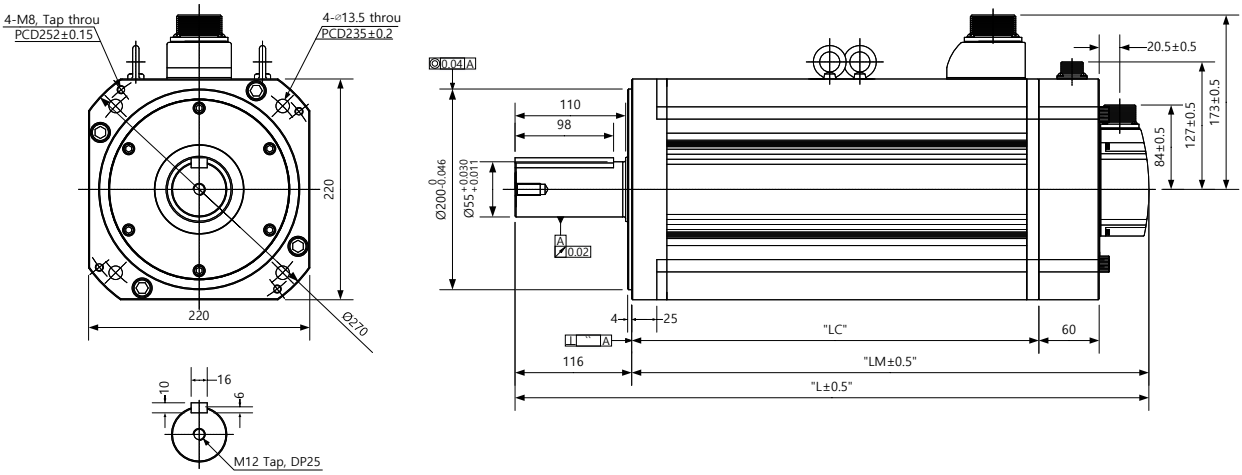
Plug : MS3102A20-29P

Model	External Dimensions			Power Connector	Weight(kg)
	L	LM	LC		
FG(P)110G	468.5(527.7)	353.5(419.7)	304(303.2)	MS3102A 32-17P	66.3(82.7)

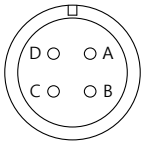
Note1) Use DC power (24 V) to operate the brake

Note2) The sizes in parentheses apply when attached to the brakes.

■ FG(P) Series | APM-FG(P)150G



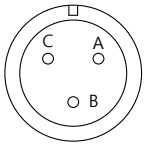
<Power Connector>



Pin No.	Signal name
A	U
B	V
C	W
D	FG

Plug : MS3102A32-17P

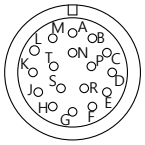
<Brake Connector>



Pin No.	Polarity
A	BK+
B	BK-
C	NC

Plug : MS3102A14-7P

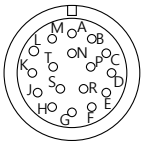
<Serial M-Turn Connector>



Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A	MA	F	GND_B	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	V_{DD}_B	N	-	J	SHIELD

Plug : MS3102A20-29P

<Serial S-Turn Connector>



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

Plug : MS3102A20-29P

Model	External Dimensions			Power Connector	Weight (Kg)
	L	LM	LC		
FG(P)150G	574(630.5)	458(514.5)	408(405)	MS3102A 32-17P	92.2(108.6)

Note1) Use DC power (24 V) to operate the brake.
Note2) The sizes in parentheses apply when attached to the brakes

2.2 Servo Drive

2.2.1 Product Features

[200V product feature]

Item \ Model name			L7SA001□	L7SA002□	L7SA004□	L7SA008□	L7SA010□	L7SA020□	L7SA035□	L7SA050□	L7SA075B	L7SA150B
Input power	Main power		3-phase AC 200~230[V](-15~10[%]), 50~60[Hz]									
	Control power		Single phase AC 200~230[V](-15~10[%]), 50~60[Hz]									
Rated current [A]			1.4	1.7	3.0	5.2	6.75	13.5	16.7	32	39.4	76
Maximum current [A]			4.2	5.1	9.0	15.6	20.25	40.5	50.1	96	98.5	190
Encoder Type			Quad. Type Incremental line drive Serial 18bit(100W(M8)dedicated) / 19bit / 20bit(DD motor dedicated)									
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 order	DC –10[V] ~ +10[V](reverse at - voltage)									
		Acceleration/deceleration time	Linear or S-shaped acceleration/deceleration (0~10,000[ms], 1[ms] unit setting possible)									
		Speed regulation	±0.01% or less (when the load changes between 0 and 100%) ±0.1% or less(temperature of 25℃ (±10))									
	Positioning	Input frequency	1[Mpps], Line drive / 200[kpps], Open collector									
		Input pulse method	Sign + pulse string, CW+CCW, Phase A/B									
		Electronic gear ratio	Digital setting and selection of 4 gear ratios, fine adjustment possible									
	Torque control	Torque command	DC –10[V] ~ 10[V](reverse direction torque at - voltage)									
		Speed limit	DC 0 ~ 10[V], Within ±1[%] of internal speed command									
		Repetition precision	Within ±1%									
Input/output signal	Analog input	Input range	DC -10 ~ 10[V]									
		Resolution	12[bit]*									
	Analog output	Output range	DC -10 ~ 10[V]									
		Resolution	12[bit]*									

Item \ Model name		L7SA001□	L7SA002□	L7SA004□	L7SA008□	L7SA010□	L7SA020□	L7SA035□	L7SA050□	L7SA075B	L7SA150B
Input/output signal	Digital input	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 19 function inputs can be selectively assigned. Possible to set positive/negative logic of selection signal.									
	Digital output	5 channels (allocable), 3 channels (fixed by alarm code) ALARM, READY, ZSPD, BRAKE, INPOS, TLMT, VLMT, INSPD, WARN 9 output can be selectively assigned. Possible to set positive/negative logic of selection signal.									
Communication	RS422	Accessible to PC software and RS422 Server									
	USB	Status monitoring and JOG operation, parameter upload/download available through PC software									
Encoder		Serial BiSS encoder, Quadrature encoder support									
Encoder output type		Arbitrary division output through FPGA (up to 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									
	Display function	Seven segments (5 DIGIT)									
	Self-setting function	loader([SET], [MODE], [UP], [DOWN] keys)									
	Add-on functions	Automatic gain tuning function, Z phase detection, manual JOG operation, Program JOG operation, analog input automatic calibration function									
	Protection functions	Overcurrent, overload, overvoltage, under voltage, main power input error, control power input error, overspeed, motor cable disconnection, overheating error (power module overheating, drive operating temperature error), encoder error, excessive regeneration, sensor error, communication error									
Operating ambient 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.									

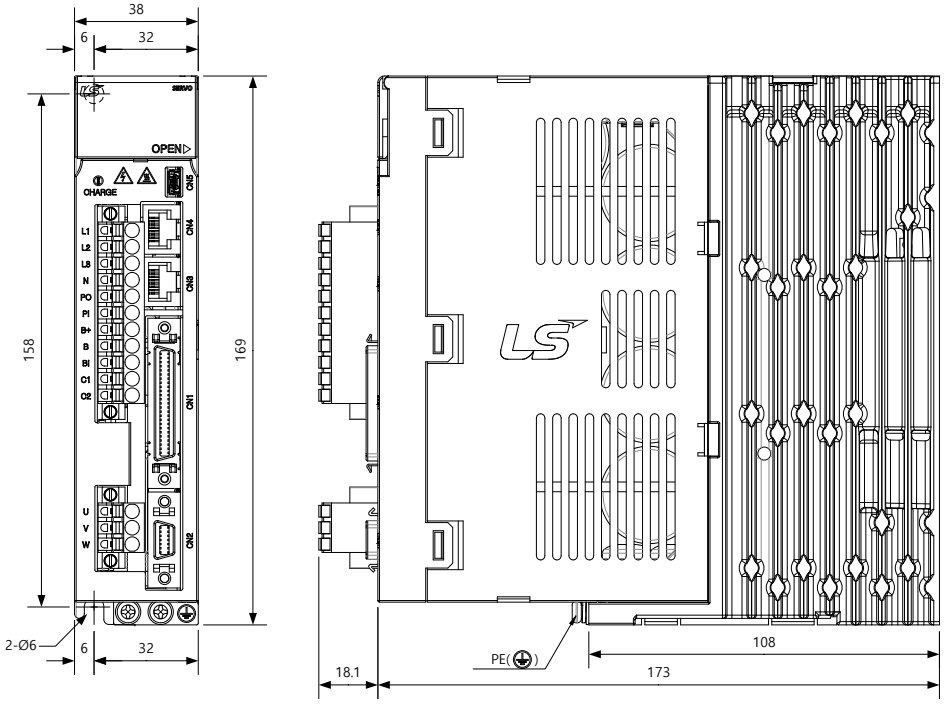
[400V product feature]

Item \ Model name			L7SB010B	L7SB020B	L7SB035B	L7SB050B	L7SB075B	L7SB150B
Input power	Main power		Three-phase AC380 ~ 480[V](-15 ~ 10[%]), 50 ~ 60[Hz]					
	Control power		Single-phase AC380 ~ 480[V](-15 ~ 10[%]), 50 ~ 60[Hz]					
Rated current [A]			3.7	8	10.1	17.5	22.4	39
Maximum current [A]			11.1	24.	30.3	47.25	56	97.5
Encoder Type			Serial: 19bit					
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 order	DC –10[V] ~ +10[V](reverse at - voltage)					
		Acceleration/deceleration time	Linear or S-shaped acceleration/deceleration (0~10,000[ms], 1[ms] unit setting possible)					
		Speed regulation	±0.01% or less (when the load changes between 0 and 100%) ±0.1% or less(temperature of 25℃ (±10))					
	Positioning	Input frequency	1[Mpps], Line drive / 200[kpps], Open collector					
		Input pulse Type	Sign + pulse string, CW+CCW, Phase A/B					
		Electronic gear ratio	Digital setting and selection of 4 gear ratios, fine adjustment possible					
	Torque control	Torque command	DC –10[V] ~ 10[V](reverse direction torque at - voltage)					
		Speed limit	DC 0 ~ 10[V], Within ±1[%] of internal speed command					
		Repetition precision	Within ±1%					
Input/output signal	Analog input	Input range	DC -10 ~ 10[V],					
		Resolution	12[bit]*					
	Analog output	Output range	DC -10 ~ 10[V]					
		Resolution	12[bit]*					

Item \ Model name		L7SB010B	L7SB020B	L7SB035B	L7SB050B	L7SB075B	L7SB150B
Input/output signal	Digital input	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 19 function inputs can be selectively assigned. Possible to set positive/negative logic of selection signal.					
	Digital output	5 channels (allocable), 3 channels (fixed by alarm code) ALARM, READY, ZSPD, BRAKE, INPOS, TLMT, VLMT, INSPD, WARN 9 output can be selectively assigned. Possible to set positive/negative logic of selection signal.					
Communication	RS422	Accessible to PC software and RS422 Server					
	USB	Status monitoring and JOG operation, parameter upload/download available through PC software					
Encoder		Serial BiSS encoder, Quadrature encoder support					
Encoder output type		Arbitrary division output through FPGA (up to 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					
	Display function	Seven segments (5 DIGIT)					
	Self-setting function	Loader ([SET], [MODE], [UP], [DOWN] keys)					
	Add-on functions	Automatic gain tuning function, Z phase detection, manual JOG operation, Program JOG operation, analog input automatic calibration function					
	Protection functions	Overcurrent, overload, overvoltage, under voltage, main power input error, control power input error, overspeed, motor cable disconnection, overheating error (power module overheating, drive operating temperature error), encoder error, excessive regeneration, sensor error, communication error					
Operating ambient 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.					

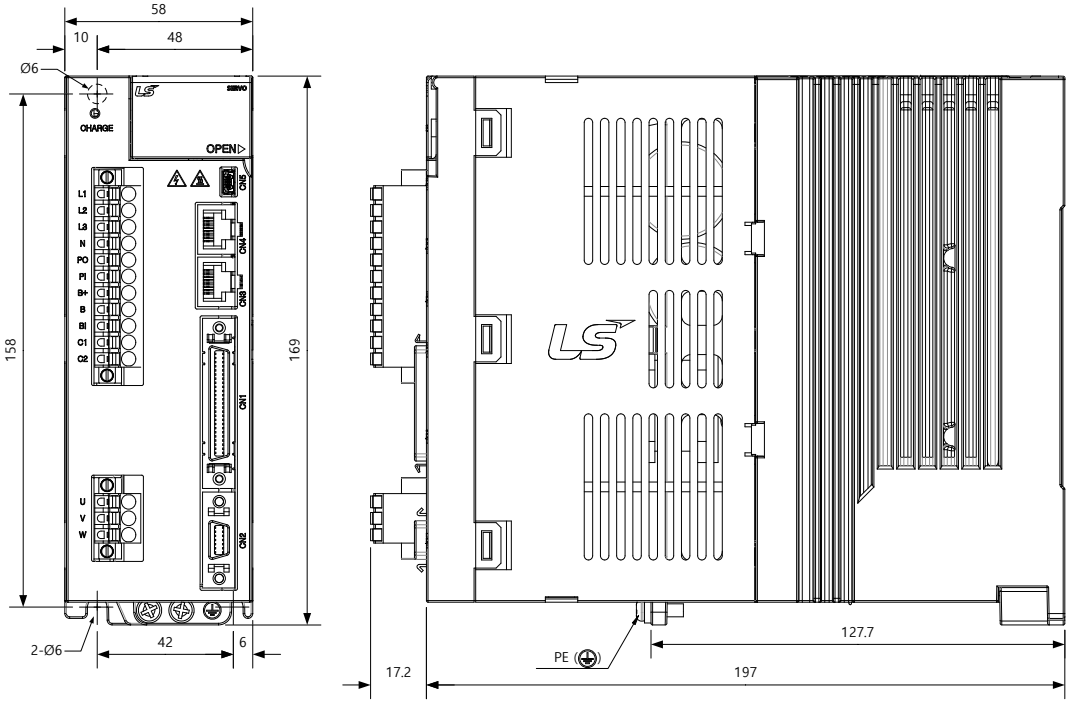
2.2.2 Outline drawing

■ L7SA001□ ~ L7SA004□



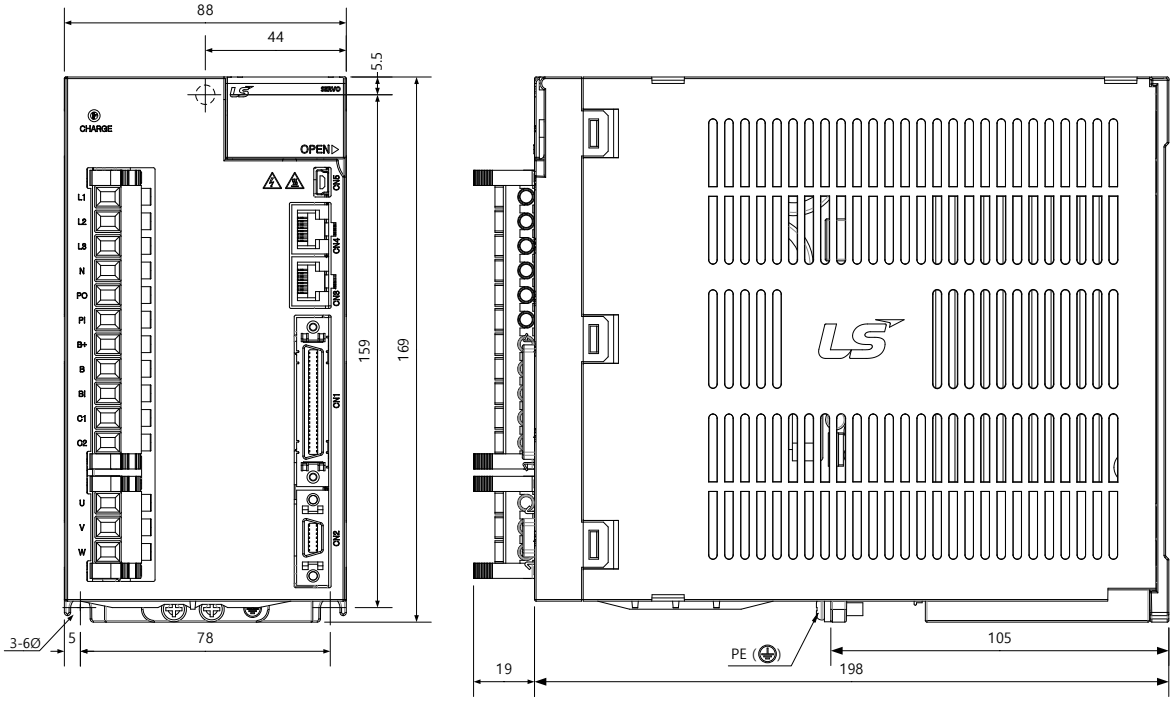
★ Weight: 1.0[kg]

■ L7SA008□ / L7SA010□



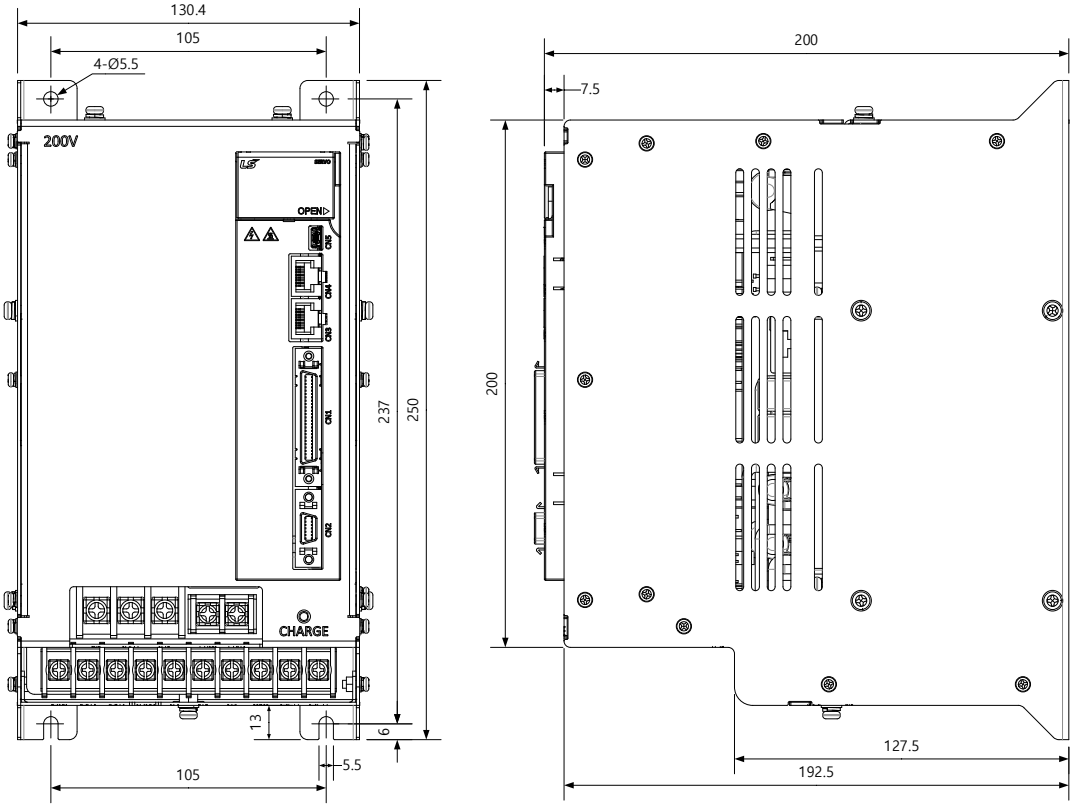
*Weight: 1.5[kg] (including cooling pan)

■ L7SA020□ / L7SA035□



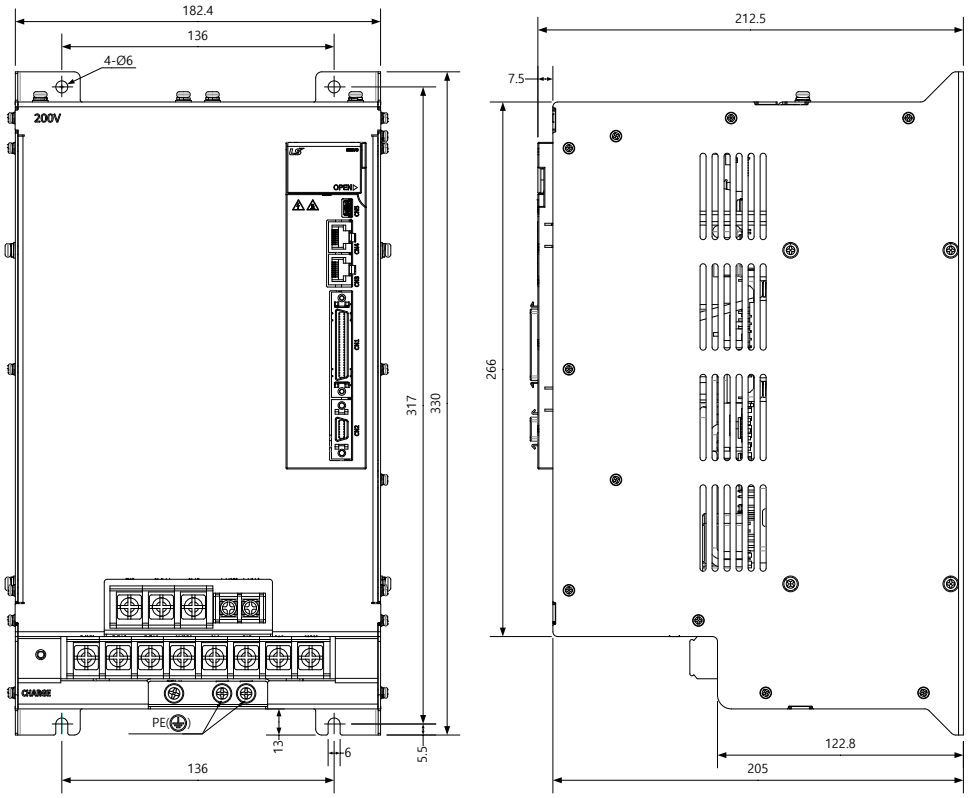
*Weight: 2.5[kg] (including cooling pan)

■ L7SA050□



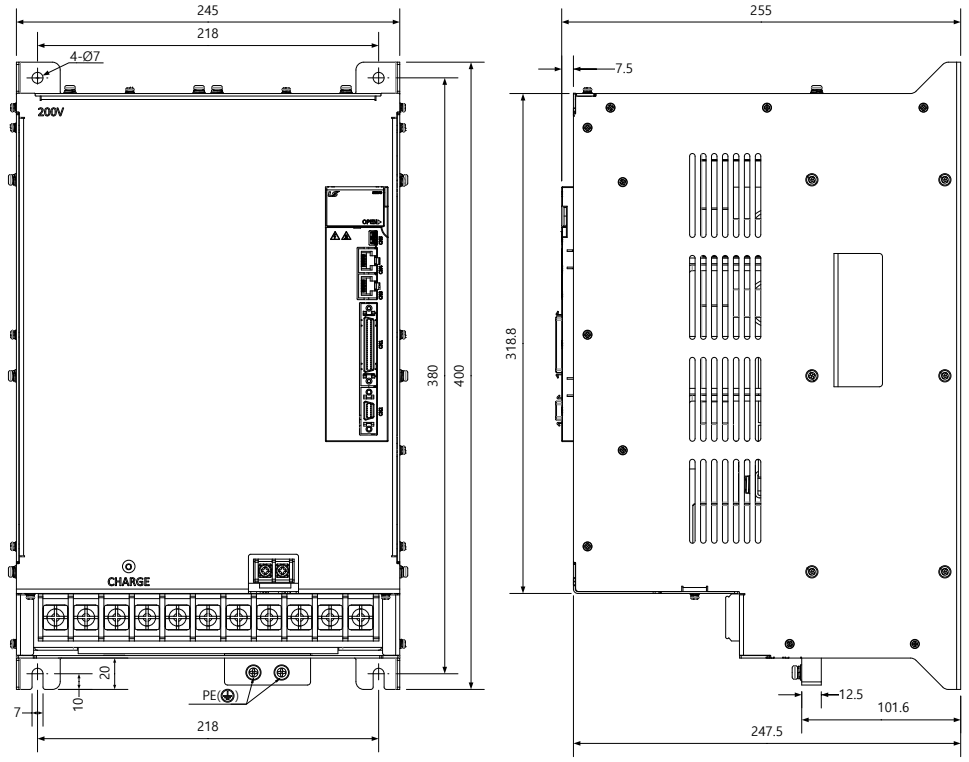
*Weight: 5.5[kg] (including cooling pan)

■ L7SA075B



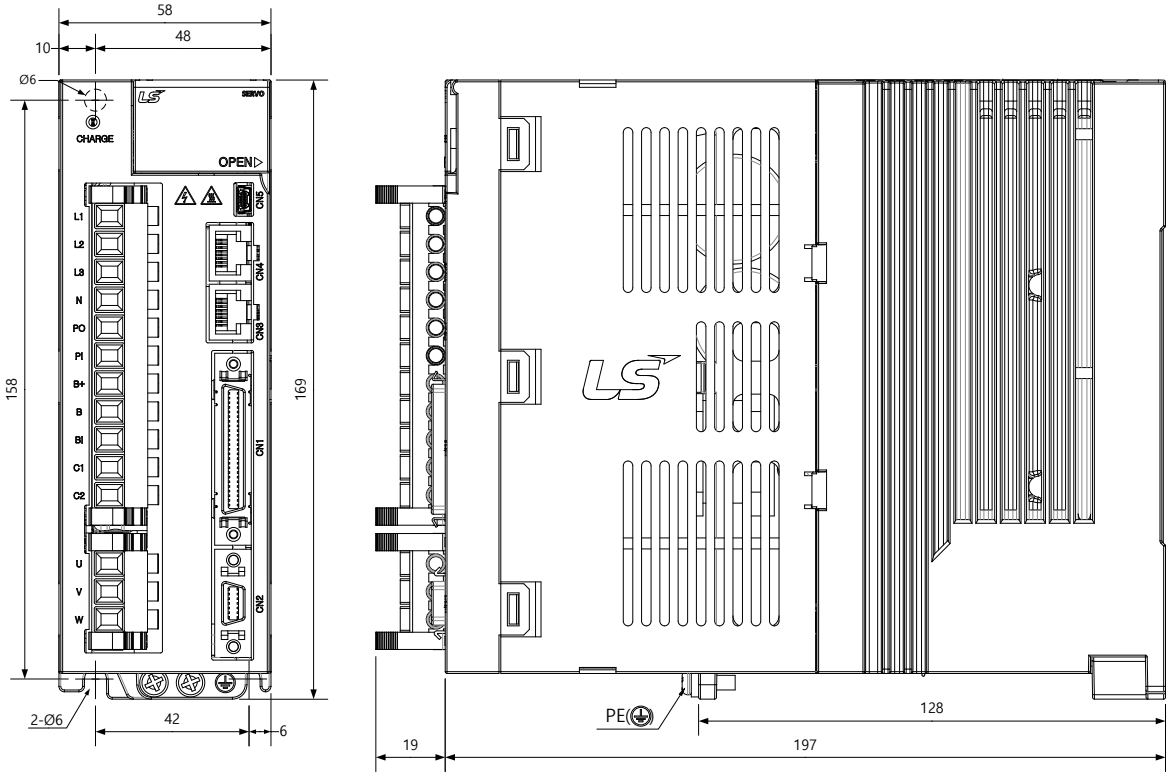
*Weight: 9.7[kg] (including cooling pan)

■ L7SA150B



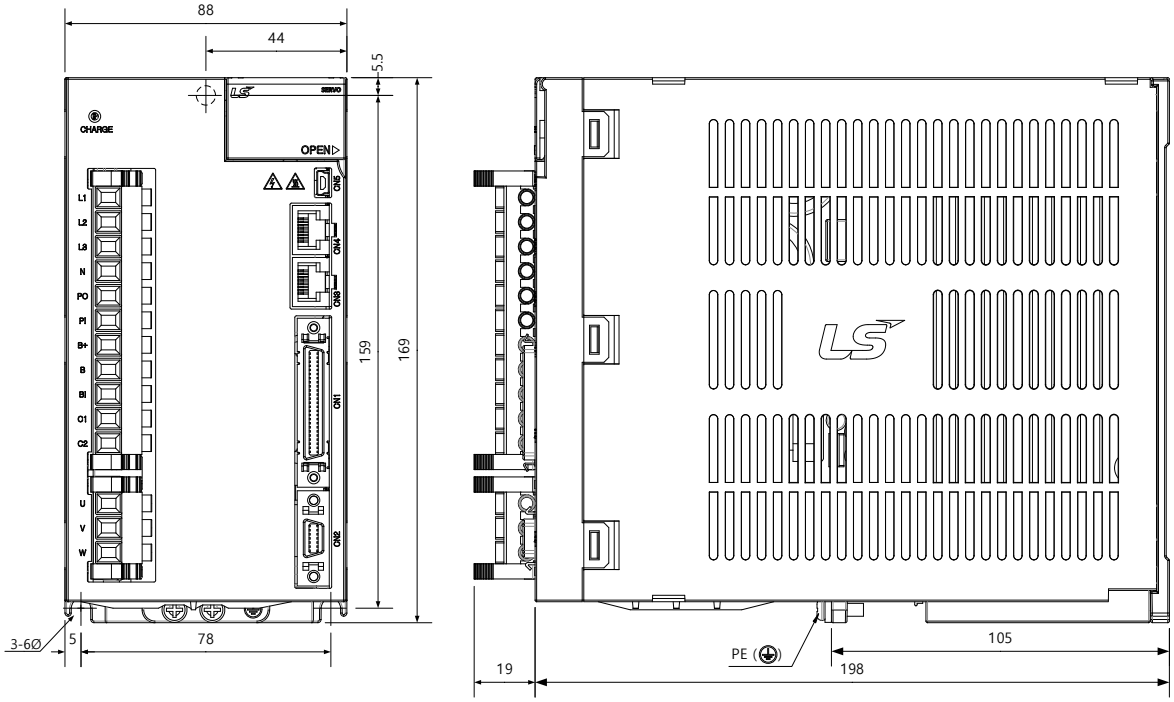
*Weight: 16.2[kg] (including cooling pan)

■ L7SB010B



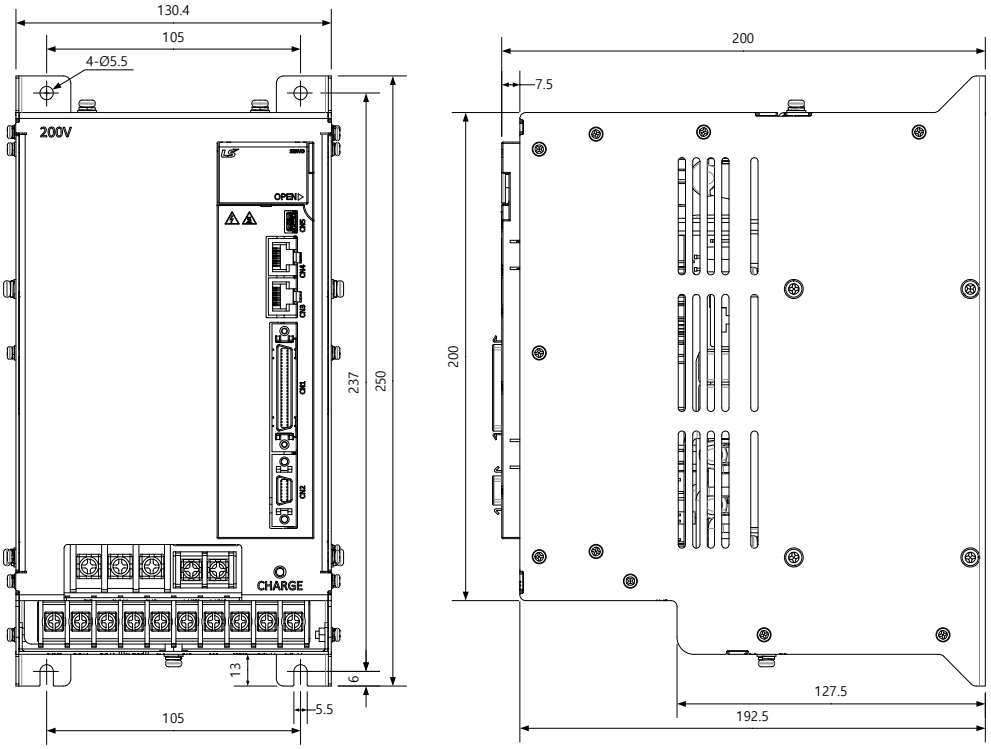
*Weight: 1.5[kg] (including cooling pan)

■ L7SB020B / L7SB035B



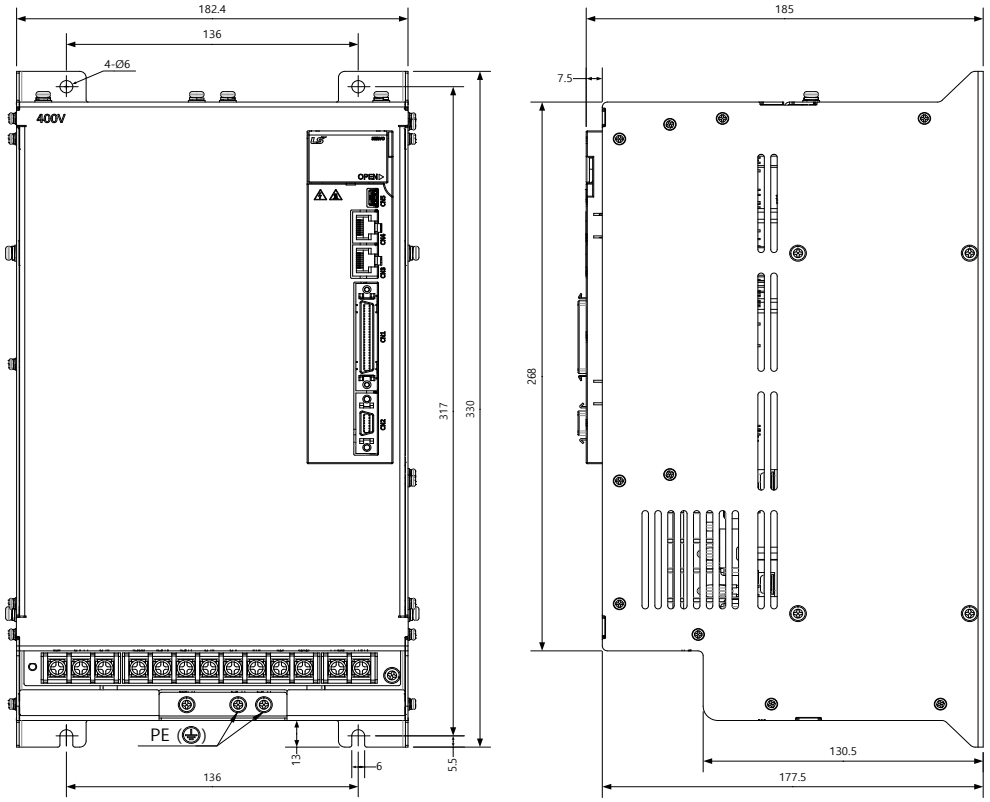
*Weight: 2.5[kg] (including cooling pan)

■ L7SB050B



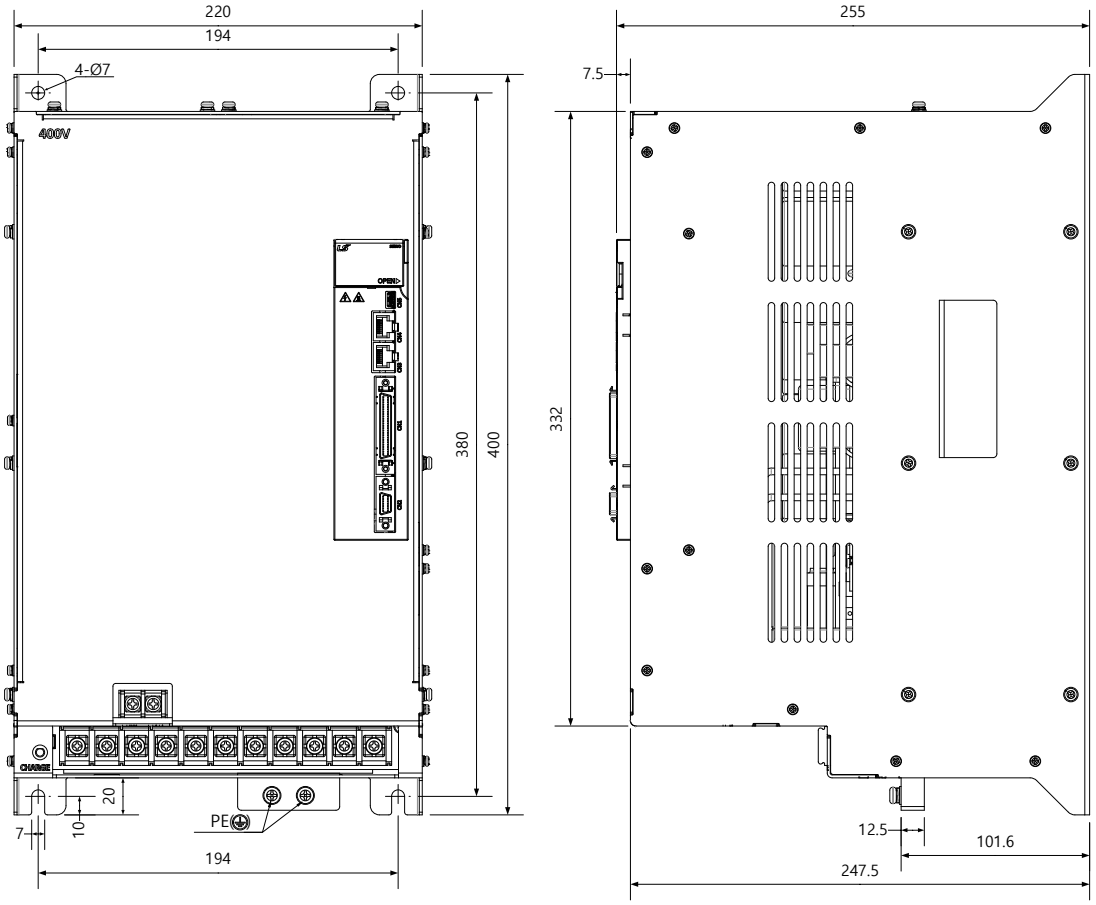
*Weight: 5.5[kg] (including cooling pan)

■ L7SA075B



*Weight: 9.7[kg] (including cooling pan)

■ L7SB150B



*Weight: 16.2[kg] (including cooling pan)

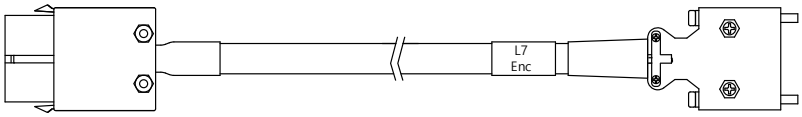
2.3 Options and Peripheral Devices

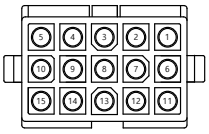
■ Option (Incremental encoder cable)

Classification	For signal	Product name	Small capacity AMP Type INC encoder cable
Product name (*Note 1)	APCS- E□□□AS	Applicable Motors	All model of APM-SA/SB/SC/HB SERIES INC

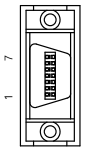
Specification

Motor Side Connector — Dirve Side Connector





Pin No.	Encoder Signal	Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	A	6	/Z	11	W
2	/A	7	U	12	/W
3	B	8	/U	13	+5V
4	/B	9	V	14	0V
5	Z	10	/V	15	SHIELD



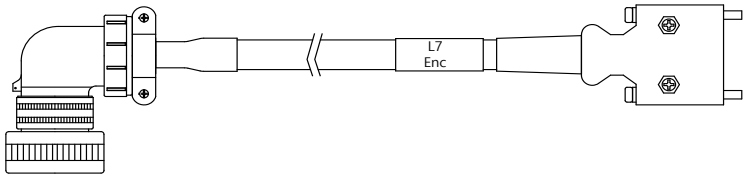
Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	W	8	/Z
2	/W	9	Z
3	V	10	/B
4	/V	11	B
5	U	12	/A
6	/U	13	A
7	0V	14	+5V
Plate		SHIELD	

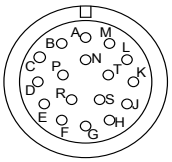
1. Motor connection
a. CAP Spec(15 Position) : 172163-1(TE company)
b. SOCKET spec.:170361-1(AMP company)
2. Drive connection (CN2)
a. CASE Spec. : 10314-52A0-008(3M) or SM-14J(Suntone)
b. Connector Spec. : 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 7Px0.2SQ or 7Px24AWG

Classification	For signal	Product name	Medium-large capacity MS Type INC encoder cable
Product name (*Note 1)	APCS- E□□□BS	Applicable Motors	All model of APM-HE SERIES INC

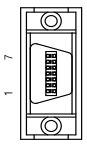
Specification

Motor Side Connector — Dirve Side Connector





Pin No.	Encoder Signal	Pin No.	Encoder Signal	Pin No.	Encoder Signal
A	A	F	/Z	P	W
B	/A	K	U	R	/W
C	B	L	/U	H	+5V
D	/B	M	V	G	0V
E	Z	N	/V	J	SHIELD



Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	W	8	/Z
2	/W	9	Z
3	V	10	/B
4	/V	11	B
5	U	12	/A
6	/U	13	A
7	0V	14	+5V
Plate		SHIELD	

1. Motor connection (MS: Military Standard)
a. PLUG spec.: MS3108B 20-29S
2. Drive connection (CN2)
a. Case spec.: 10314-52A0-008(3M) or SM-14J(Suntone)
b. CONNECTOR spec.: 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 7Px0.2SQ or 7Px24AWG

Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

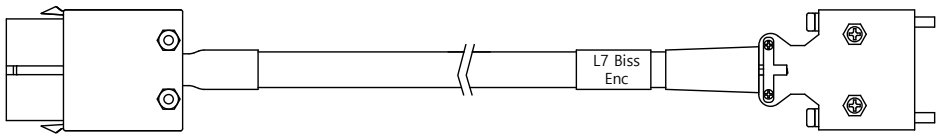
Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20
Regular cable	N03	N05	N10	N20

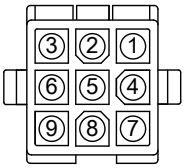
■ Option [serial encoder cable]

Classification	For signal	Product name	Small capacity AMP Type serial encoder cable (single turn)
Product name (*Note 1)	APCS- E□□□CS	Applicable Motors	All model of APM-SB/SC SERIES S-turn

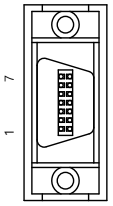
Specification

Motor Side Connector — Dirve Side Connector





Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	MA	6	-
2	/MA	7	+5V
3	SLO	8	0V
4	SLO	9	SHIELD
5	-		



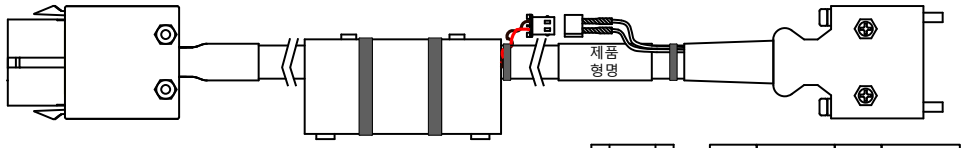
Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	-	8	-
2	-	9	-
3	MA	10	-
4	/MA	11	-
5	SLO	12	-
6	/SLO	13	-
7	0V	14	+5V
Plate		SHIELD	

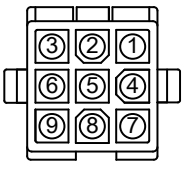
1. Motor connection
a. CAP Spec(9 Position) : 172161-1(AMP company)
b. SOCKET spec.:170361-1(AMP company)
2. Drive connection (CN2)
a. Case spec.: 10314-52A0-008(3M) or SM-14J(Suntone)
b. Connector Spec. : 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 3Px0.2SQ or 3Px24AWG

Classification	For signal	Product name	Small capacity AMP Type serial encoder cable (multi turn)
Product name (*Note 1)	APCS- E□□□CS1	Applicable Motors	All model of APM-SB/SC SERIES M-turn

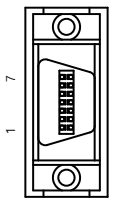
Specification

Motor Side Connector — Dirve Side Connector





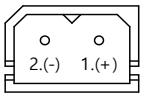
Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	MA	6	GND_B
2	/MA	7	+5V
3	SLO	8	0V
4	SLO	9	SHIELD
5	VDD_B		



Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	-	8	-
2	-	9	-
3	MA	10	-
4	/MA	11	-
5	SLO	12	-
6	/SLO	13	-
7	0V	14	+5V
Plate		SHIELD	

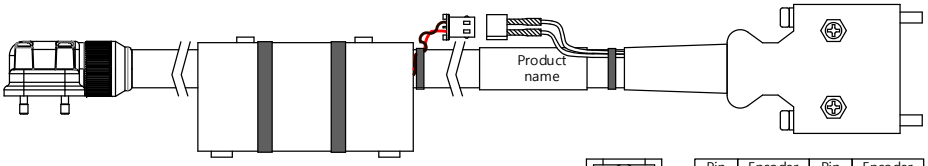
1. Motor connection
a. CAP Spec(9 Position) : 172161-1(TE company)
b. SOCKET spec.: 170361-1 (TE company)
2. Drive connection (CN2)
a. Case spec.: 10314-52A0-008(3M) or SM-14J(Suntone)
b. Connector Spec. : 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 4Px0.2SQ or 4Px24AWG
4. Battery connection
a. CONNECTOR spec.: 5267-02A(Molex)
b. Battery spec.: ER6V(TOSHIBA, AA, 3.6V, 2000mAh)

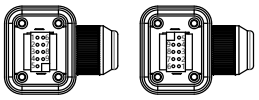
Battery Connector

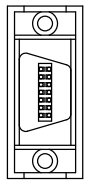


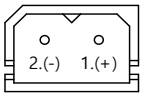
Pin No.	Encoder Signal	Wire collar
1	BATTERY(VDD_B)	Red
2	BATTERY 0V(GND_B)	Black

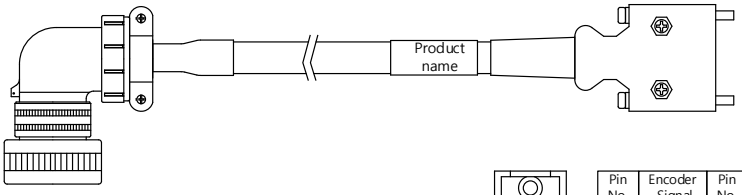
■ Option [serial encoder cable]

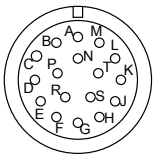
<table>
<tr><td>Classification</td><td>For signal</td><td>Product name</td><td>Small capacity Flat type motor serial encoder cable(multi turn)</td></tr>
<tr><td>Product name (*Note 1)</td><td>APCS- E□□□ES1(Front Direction)/
APCS- E□□□ES1-R(Rear Direction)</td><td>Applicable Motors</td><td>All model of APM-FAL/FBL/FCL SERIES M-turn</td></tr>
<tr><td>Specification</td><td colspan="3">
Motor Side Connector
Dirve Side Connector


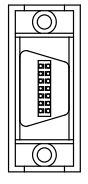


<table>
<tr><th>Pin No.</th><th>Encoder Signal</th><th>Pin No.</th><th>Encoder Signal</th></tr>
<tr><td>1</td><td>MA</td><td>6</td><td>/MA</td></tr>
<tr><td>2</td><td>SLO</td><td>7</td><td>/SLO</td></tr>
<tr><td>3</td><td>-</td><td>8</td><td>-</td></tr>
<tr><td>4</td><td>0V</td><td>9</td><td>+5V</td></tr>
<tr><td>5</td><td>SHIELD</td><td></td><td></td></tr>
</table>


<table>
<tr><th>Pin No.</th><th>Encoder Signal</th><th>Pin No.</th><th>Encoder Signal</th></tr>
<tr><td>1</td><td>-</td><td>8</td><td>-</td></tr>
<tr><td>2</td><td>-</td><td>9</td><td>-</td></tr>
<tr><td>3</td><td>MA</td><td>10</td><td>-</td></tr>
<tr><td>4</td><td>/MA</td><td>11</td><td>-</td></tr>
<tr><td>5</td><td>SLO</td><td>12</td><td>-</td></tr>
<tr><td>6</td><td>/SLO</td><td>13</td><td>-</td></tr>
<tr><td>7</td><td>0V</td><td>14</td><td>+5V</td></tr>
<tr><td colspan="2">Plate</td><td colspan="2">SHIELD</td></tr>
</table>
1. Motor connection
a. CAP Spec(9 Position) : 2201825-1(TE company)
b. SOCKET spec.: 2174065- 4(TE company)
2. Drive connection (CN2)
a. Case spec.: 10314-52A0-008(3M) or SM-14J(Suntone)
b. CONNECTOR spec.: 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 4Px0.2SQ or 4Px24AWG 4. Battery connection
4. Battery connection
a. CONNECTOR spec.: 5267-02A(Molex)
b. Battery spec.: ER6V(TOSHIBA, AA, 3.6V, 2000mAh)
Battery Connector


<table>
<tr><th>Pin No.</th><th>Encoder Signal</th><th>Wire collar</th></tr>
<tr><td>1</td><td>BATTERY(VDD_B)</td><td>Red</td></tr>
<tr><td>2</td><td>BATTERY 0V(GND_B)</td><td>Black</td></tr>
</table>
</td></tr>
<tr><td>Classification</td><td>For signal</td><td>Product name</td><td>Medium-large capacity MS Type serial encoder cable (single turn)</td></tr>
<tr><td>Product name (*Note 1)</td><td>APCS- E□□□DS</td><td>Applicable Motors</td><td>All models of APM-FE(P)/FF(P)/FG(P) SERIES S-turn</td></tr>
<tr><td>Specification</td><td colspan="3">
Motor Side Connector
Dirve Side Connector




<table>
<tr><th>Pin No.</th><th>Encoder Signal</th><th>Pin No.</th><th>Encoder Signal</th><th>Pin No.</th><th>Encoder Signal</th></tr>
<tr><td>A</td><td>MA</td><td>F</td><td>-</td><td>P</td><td>-</td></tr>
<tr><td>B</td><td>/MA</td><td>K</td><td>-</td><td>R</td><td>-</td></tr>
<tr><td>C</td><td>SLO</td><td>L</td><td>-</td><td>H</td><td>+5V</td></tr>
<tr><td>D</td><td>/SLO</td><td>M</td><td>-</td><td>G</td><td>0V</td></tr>
<tr><td>E</td><td>-</td><td>N</td><td>-</td><td>J</td><td>SHIELD</td></tr>
</table>


<table>
<tr><th>Pin No.</th><th>Encoder Signal</th><th>Pin No.</th><th>Encoder Signal</th></tr>
<tr><td>1</td><td>-</td><td>8</td><td>-</td></tr>
<tr><td>2</td><td>-</td><td>9</td><td>-</td></tr>
<tr><td>3</td><td>MA</td><td>10</td><td>-</td></tr>
<tr><td>4</td><td>/MA</td><td>11</td><td>-</td></tr>
<tr><td>5</td><td>SLO</td><td>12</td><td>-</td></tr>
<tr><td>6</td><td>/SLO</td><td>13</td><td>-</td></tr>
<tr><td>7</td><td>0V</td><td>14</td><td>+5V</td></tr>
<tr><td colspan="2">Plate</td><td colspan="2">SHIELD</td></tr>
</table>
1. Motor connection (MS: Military Standard)
a. PLUG spec. : MS3108B 20-29S
2. Drive connection (CN2)
a. Case spec.: 10314-52A0-008(3M) or SM-14J(Suntone)
b. CONNECTOR spec.: 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 3Px0.2SQ or 3Px24AWG
</td></tr>
</table>

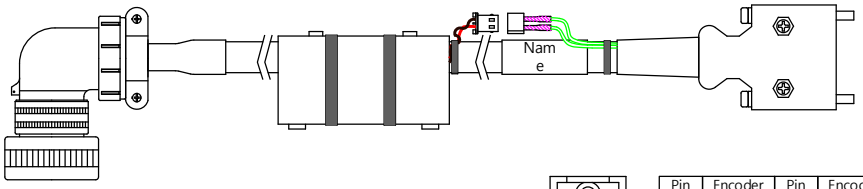
■ Option [serial encoder cable]

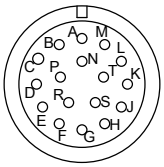
Classification	For signal	Product name	Medium-large capacity MS Type serial encoder cable (multi turn)
Product name (*Note 1)	APCS- E□□□DS	Applicable Motors	All models of APM-FE(P)/FF(P)/FG(P) SERIES M-turn

Specification

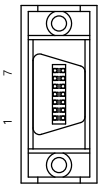
Motor Side Connector

Dirve Side Connector





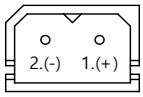
Pin No.	Encoder Signal	Pin No.	Encoder Signal	Pin No.	Encoder Signal
A	MA	F	-	P	-
B	/MA	K	-	R	-
C	SLO	L	-	H	+5V
D	/SLO	M	-	G	0V
E	-	N	-	J	SHIELD



Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	-	8	-
2	-	9	-
3	MA	10	-
4	/MA	11	-
5	SLO	12	-
6	/SLO	13	-
7	0V	14	+5V
Plate		SHIELD	

1. Motor connection (MS: Military Standard)
a. PLUG spec. : MS3108B 20-29S
2. Drive connection (CN2)
a. CASE Spec. : 10314-52A0-008(3M) or SM-14J(Suntone)
b. Connector Spec. : 10114-3000VE(3M) or SM-14J(Suntone)
3. Cable spec.: 4Px0.2SQ or 4Px24AWG
4. Battery connection
a. CONNECTOR spec.: 5267-02A(Molex)
b. Battery spec.: ER6V(TOSHIBA, AA, 3.6V, 2000mAh)

Battery Connector

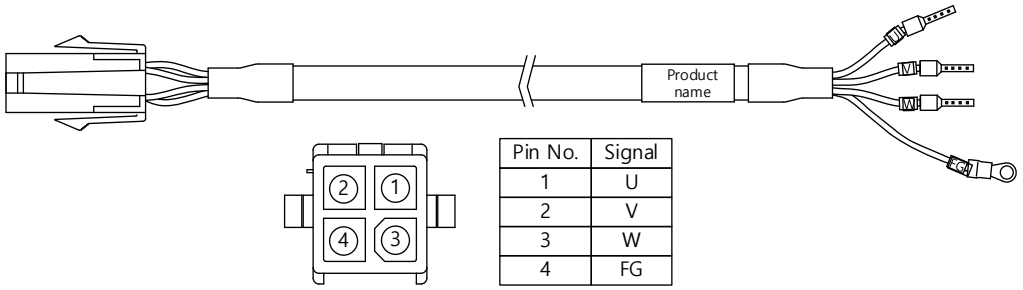
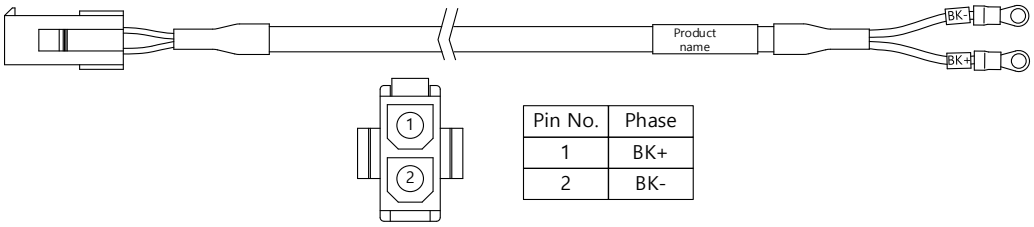


Pin No.	Encoder Signal	Wire collar
1	BATTERY(VDD_B)	Red
2	BATTERY 0V(GND_B)	Black

Note1) 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

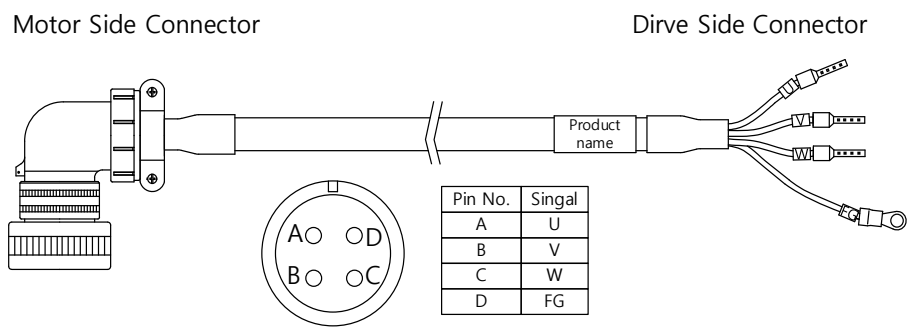
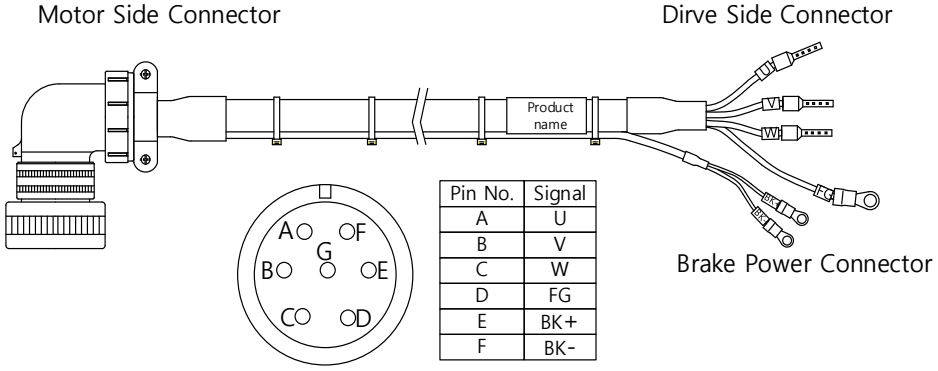
■ [200V] Option (Standard power cable)

Classification	Power	Product name	Small capacity AMP Type power cable
Product name (*Note 1)	APCS- P□□□GS	Applicable Motors	All model of APM-SA/SB/SC/HB SERIES
Specification	Motor Side Connector / Dirve Side Connector  Pin No. / Signal: 1 U, 2 V, 3 W, 4 FG **1. Motor connection** **a. CAP Spec(4 Position) : 172159-1(TE company)** **b. SOCKET spec.: 170362-1 (TE company)** **2. Drive connection(U,V,W,PE)** **a. U,V,W pin spec.: 1512** **B FG pin spec.: 1.5x4 (Ring Terminal)** **3. Cable spec.: 4Cx0.75SQ or 4Cx18AWG**		
Classification	For brake open type	Product name	Small capacity AMP Type brake cable
Product name (*Note 1)	APCS- P□□□KB	Applicable Motors	All model of APM-SA/SB/SC SERIES
Specification	Motor Side Connector / Brake Power Connector  Pin No. / Phase: 1 BK+, 2 BK- **1. Motor connection** **a. CAP Spec(2 Position) : 172157-1(TE company)** **b. SOCKET spec.:170362-1(TE company)** **2. Brake power** **a. Connection terminal spec. : 1.5x3 (Ring Terminal)** **3. Cable Spec. : 2Cx0.75SQ or 2Cx19AWG**		

Note1) 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

■ [200V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(for 130 Flange)
Product name (*Note 1)	APCS- P□□□HS	Applicable Motors	All model of APM-FE/HE SERIES
Specification	 Pin No. / Singal A / U B / V C / W D / FG **1. Motor connection(MS: Military Standard)** **a. PLUG spec.: MS3108B 20-4S** **2. Drive connection(U,V,W,PE)** **a. U,V,W pin spec.: 2512** **b. FG pin spec.: 2.5x4(Ring Terminal)** **3. Cable spec.: 4Cx2.5SQ or 4Cx14AWG**		
Classification	Power and Brake	Product name	Medium capacity MS Type power/brake cable(for 130 Flange)
Product name (*Note 1)	APCS- P□□□NB	Applicable Motors	All model of APM-FE SERIES
Specification	 Pin No. / Signal A / U B / V C / W D / FG E / BK+ F / BK- **1. Motor connection** **a. PLUG spec. : MS3108B 20-15S(MS company)** **2. Drive connection** **a. U, V, W pin spec: 2512** **b. FG pin spec. : 2.5 x 4(Ring Terminal)** **3. Power Cable spec.: 4Cx2.5SQ or 4Cx14AWG** **4. Brake power connection** **a. Connection terminal spec: 1.5 x 3(Ring Terminal)** **5. Brake Cable spec.: 2Cx0.75SQ or 2Cx19AWG**		

Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

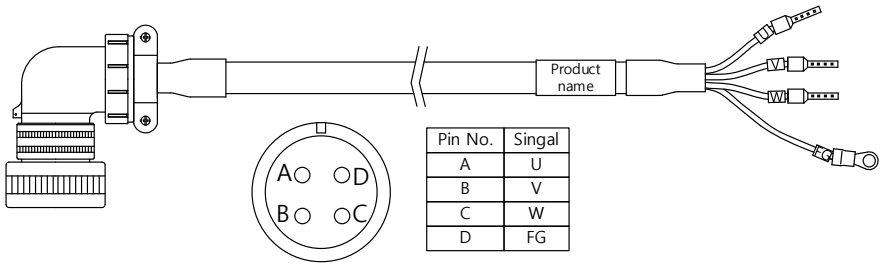
Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20
Regular cable	N03	N05	N10	N20

■ [200V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(180/ 220 Flange)
Product name (*Note 1)	APCS- P□□□IS	Applicable Motors	FF30A, FF22D, FF35D, FF20G, FF30G,FF12M, FF20M, FF30M FG22D, FG35D, FG20G, FG12M, FG20M, FG30M

Specification

Motor Side Connector — Dirve Side Connector



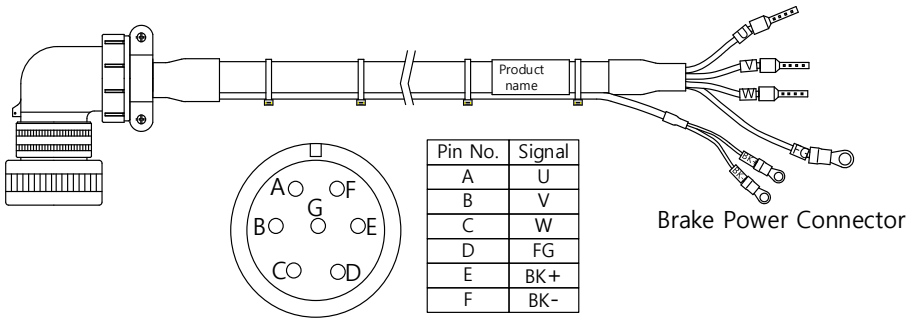
Pin No.	Singal
A	U
B	V
C	W
D	FG

1. Motor connection(MS: Military Standard)
a. PLUG spec. : MS3108B 22-22S
2. Drive connection(U,V,W,PE)
a. U,V,W pin spec.: 2512
b. FG pin spec. : 2.5x4 (Ring Terminal)
3. Cable spec.: 4Cx2.5SQ or 4Cx14AWG

Classification	Power and Brake	Product name	Medium capacity MS Type power/brake cable(for 180 Flange)
Product name (*Note 1)	APCS- P□□□PB	Applicable Motors	FF30A, FF22D, FF35D, FF20G, FF30G, FF12M, FF20M, FF30M

Specification

Motor Side Connector — Dirve Side Connector



Pin No.	Signal
A	U
B	V
C	W
D	FG
E	BK+
F	BK-

1. Motor connection
a. PLUG spec.: MS3108B 24-10S(MS)
2. Drive connection
a. U, V, W pin spec: 2512
b. FG pin spec. : 2.5 x 4(Ring Terminal)
3. Power Cable spec.: 4Cx2.5SQ or 4Cx14AWG
4. Brake power connection
a. Connection terminal spec. : 1.5 x 3(Ring Terminal)
5. Brake Cable spec.: 2Cx0.75SQ or 2Cx19AWG

Note1) 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

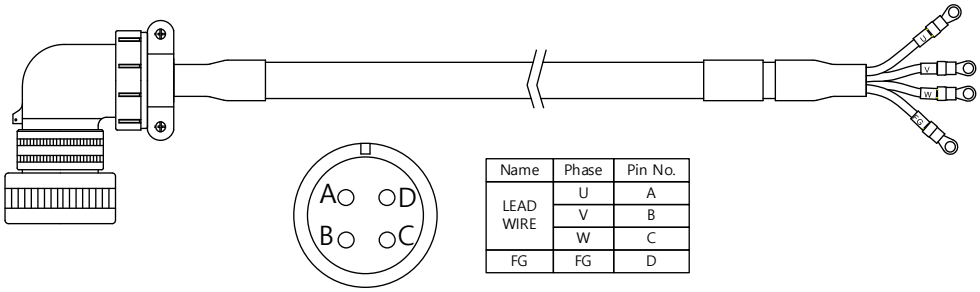
■ [200V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(180/ 220 Flange)
Product name (*Note 1)	APCS- P□□□JS	Applicable Motors	FF50A, FF55D, FF44G, FF44M, FG55D, FG44G, FG44M

Specification

Motor Side Connector

Dirve Side Connector



Name	Phase	Pin No.
LEAD WIRE	U	A
	V	B
	W	C
FG	FG	D

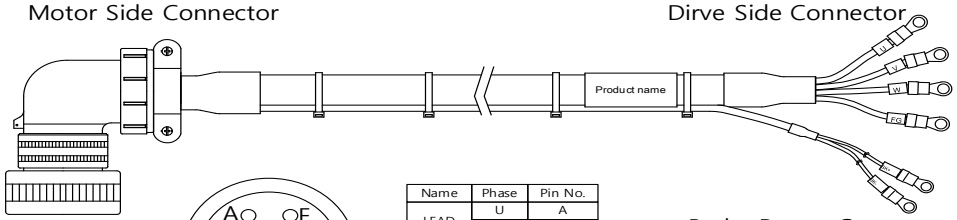
1. Motor connection(MS: Military Standard)
a. PLUG spec. : MS3108B 22-22S
2. Drive connection(U,V,W,PE)
a. U,V,W,FG pin spec.: 6. 0x 5(Ring Terminal)
3. Cable spec.: 4Cx6.0SQ or 4Cx10AWG

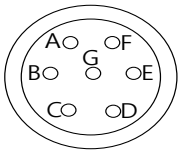
Classification	Power and Brake	Product name	Medium capacity MS Type power/brake cable(for 180 Flange)
Product name (*Note 1)	APCS- P□□□LB	Applicable Motors	FF50A, FF55D, FF44G, FF44M

Specification

Motor Side Connector

Dirve Side Connector





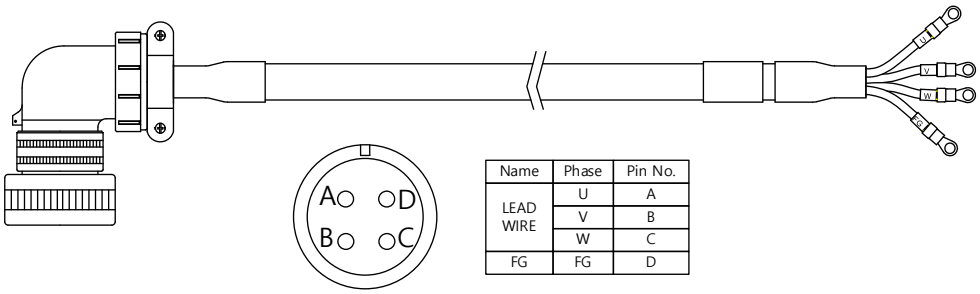
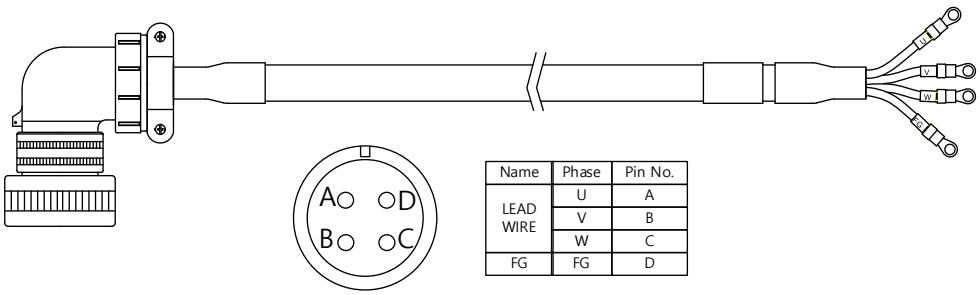
Name	Phase	Pin No.
LEAD WIRE	U	A
	V	B
	W	C
FG	FG	D
FG	+	E
FG	-	F

1. Motor connection(MS: Military Standard)
a. PLUG spec.: MS3108B 24-10S
2. Drive connection(U,V,W,PE)
a. U,V,W,FG pin spec.: 6. 0x 5(Ring Terminal)
3. Power Cable spec.: 4Cx6.0SQ or 4Cx10AWG
4. Brake power connection
a. Connection terminal spec.: 1.5 x 3(Ring Terminal)
5. Brake Cable spec.: 2Cx0.75SQ or 2Cx19AWG

Note1) 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

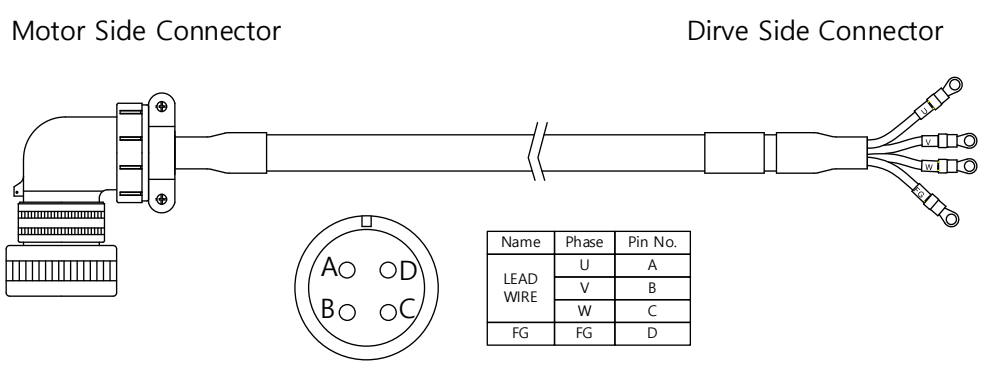
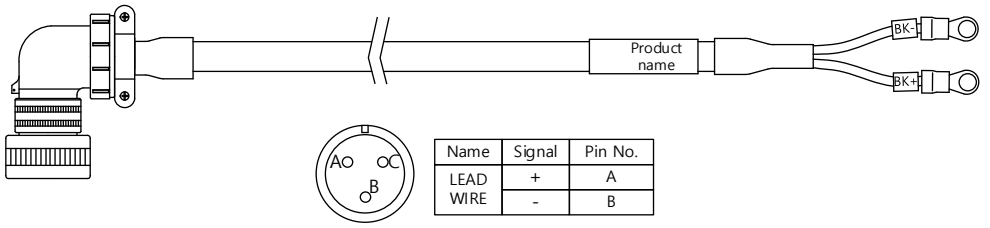
■ [200V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(for 220 Flange)
Product name (*Note 1)	APCS- P□□□MS	Applicable Motors	FG60M, FG75G
Specification	Motor Side Connector / Dirve Side Connector  Name / Phase / Pin No.: LEAD WIRE — U — A; LEAD WIRE — V — B; LEAD WIRE — W — C; FG — FG — D **1. Motor connection(MS: Military Standard)** **a. PLUG spec. : MS3108A 32-17S** **2. Drive connection(U,V,W,PE)** **a. U,V,W,FG pin spec.: 10 x 5(Ring Terminal)** **3. Cable spec.: 4Cx6.0SQ or 4Cx10AWG**		
Classification	Power	Product name	Medium capacity MS Type power cable(for 220 Flange)
Product name (*Note 1)	APCS- P□□□OS	Applicable Motors	FG85G, FG110D, FG110G
Specification	Motor Side Connector / Dirve Side Connector  Name / Phase / Pin No.: LEAD WIRE — U — A; LEAD WIRE — V — B; LEAD WIRE — W — C; FG — FG — D **1. Motor connection(MS: Military Standard)** **a. PLUG spec.: MS3108A 32-17S** **2. Drive connection(U,V,W,PE)** **a. U,V,W,FG pin spec.: 14 x 6(Ring Terminal)** **3. Cable spec.: 4Cx16SQ or 4Cx5AWG**		

Note1) 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

■ [200V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(for 220 Flange)
Product name (*Note 1)	APCS- P□□□VS	Applicable Motors	FG150G
Specification	 Name / Phase / Pin No. LEAD WIRE: U / A; V / B; W / C FG / FG / D **1. Motor connection(MS: Military Standard)** **a. PLUG spec.: MS3108A 32-17S** **2. Drive connection(U,V,W,PE)** **a. U,V,W,FG pin spec.: 14 x 6(Ring Terminal)** **3. Cable spec.: 4Cx25SQ or 4Cx3AWG**		
Classification	Power	Product name	Medium capacity MS Type brake cable(for 220 Flange)
Product name (*Note 1)	APCS- P□□□SB	Applicable Motors	All models of FG Series(Common use of FGP Series)
Specification	 Name / Signal / Pin No. LEAD WIRE: + / A; - / B **1. Motor connection** **a. PLUG spec.: MS3108B 14-7S(MS)** **2. Brake power** **a. Connection terminal spec. : 1.5x3(Ring Terminal)** **3. Cable spec.: 2Cx0.75SQ or 2Cx19AWG**		

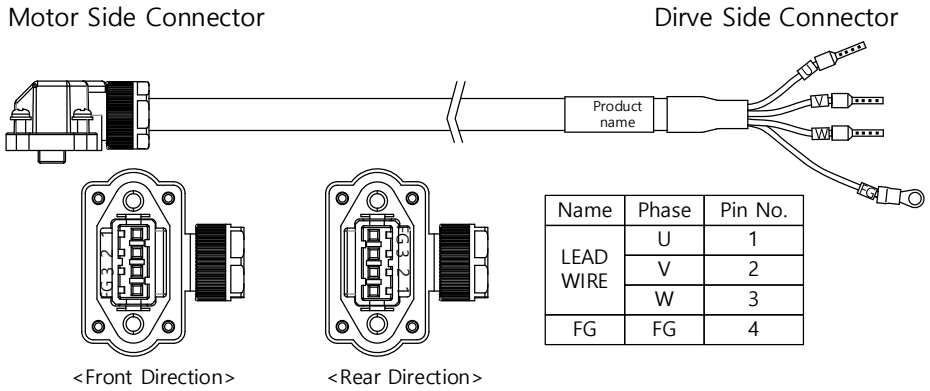
Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

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

■ [200V] Options spec. (small capacity L Series power cable)

Classification	Power	Product name	Small capacity L Series power cable
Product name (*Note 1)	APCS- P□□□LS(Front Direction)/ APCS- P□□□LS-R(Rear Direction)	Applicable Motors	All model of APM- FAL/ FBL/FCL Series

Specification

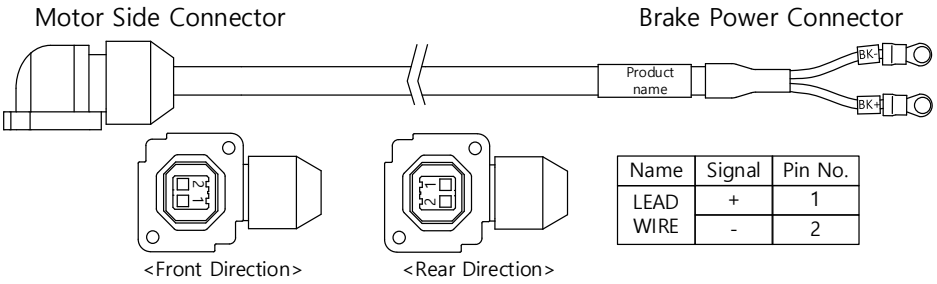


Name	Phase	Pin No.
LEAD WIRE	U	1
	V	2
	W	3
FG	FG	4

1. Motor connection
a. PLUG spec.: SM-JN8FT04 (Suntone)
b. SOCKET spec.: SMS-201 (Suntone)
2. Drive connection(U,V,W,PE)
a. U,V,W pin spec.: 1512
b. FG pin spec.: 1.5x4 (Ring Terminal)
3. Cable spec.: 4Cx0.75SQ or 4Cx18AWG
4. Others: In case of FAL products, it is necessary to install Encoder Cable after installing Power Cable.

Classification	Brake	Product name	Small capacity L Series brake cable
Product name (*Note 1)	APCS- B□□□QS(Front Direction)/ APCS- B□□□QS-R(Rear Direction)	Applicable Motors	All model of APM- FAL/ FBL/FCL Series

Specification



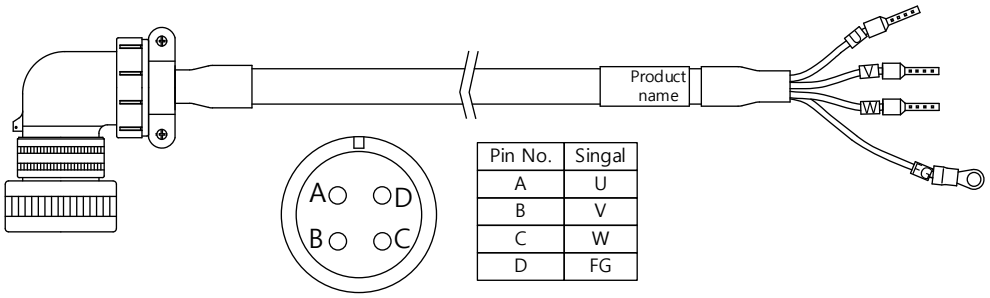
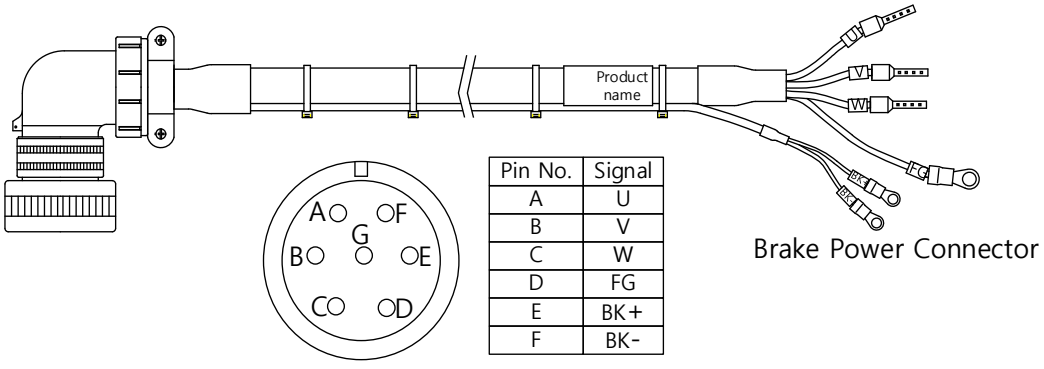
Name	Signal	Pin No.
LEAD WIRE	+	1
	-	2

1. Motor connection
a. PLUG spec.: KN5FT02SJ1(JAE)
b. SOCKET spec.: ST-KN-S-C1B-3500(JAE)
2. Brake power
a. Connection terminal spec. : 1.5x3(Ring Terminal)
3. Cable spec.: 2Cx0.5SQ or 2Cx20AWG

Note1) 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

■ [400V] Option (Standard power cable)

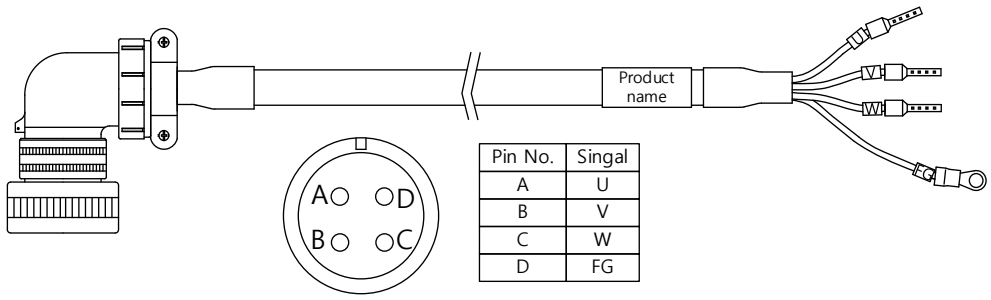
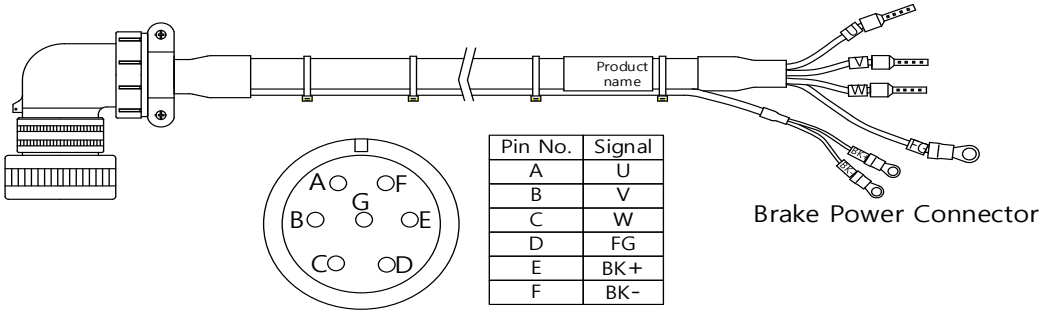
Classification	Power	Product name	Medium capacity MS Type power cable(for 130 Flange)
Product name (*Note 1)	APCF- P□□□HS	Applicable Motors	All model of APM-FEP SERIES
Specification	Motor Side Connector / Dirve Side Connector  Pin No. / Singal: A–U, B–V, C–W, D–FG 1. Motor connection(MS: Military Standard) a. PLUG spec.: MS3108B 20-4S 2. Drive connection(U,V,W,PE) a. U,V,W pin spec.: 1512 b. FG pin spec.: 1.5x4(Ring Terminal) 3. Cable spec.: 4Cx1.5SQ or 4Cx15AWG		
Classification	Power and Brake	Product name	Medium capacity MS Type power/brake cable(for 130 Flange)
Product name (*Note 1)	APCF- P□□□NB	Applicable Motors	All model of APM-FEP SERIES
Specification	Motor Side Connector / Dirve Side Connector  Pin No. / Signal: A–U, B–V, C–W, D–FG, E–BK+, F–BK- 1. Motor connection a. PLUG spec. : MS3108B 20-15S(MS company) 2. Drive connection a. U, V, W pin spec: 1512 b. FG pin spec.: 1.5 x 4(Ring Terminal) 3. Power Cable spec.: 4Cx1.5SQ or 4Cx15AWG 4. Brake power connection a. Connection terminal spec. : 1.5 x 3(Ring Terminal) 5. Brake Cable spec.: 2Cx0.75SQ or 2Cx18AWG		

Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

Note2) 400V products are not provided for general use.

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

■ [400V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(180/ 220 Flange)
Product name (*Note 1)	APCF- P□□□IS	Applicable Motors	FFP30A, FFP22D, FFP35D, FFP20G, FFP30G, FFP12M, FFP20M, FGP22D, FGP35D, FGP20G, FGP30G FGP12M, FGP20M
Specification	Motor Side Connector / Dirve Side Connector  Pin No. / Singal A / U B / V C / W D / FG 1. Motor connection(MS:Military Standard) a. PLUG spec. : MS3108B 22-22S 2. Drive connection(U,V,W,PE) a. U,V,W pin spec.: 2512 b. FG pin spec. : 2.5x4 (Ring Terminal) 3. Cable spec.: 4Cx1.5SQ or 4Cx15AWG		
Classification	Power and Brake	Product name	Medium capacity MS Type power/brake cable(for 180 Flange)
Product name (*Note 1)	APCF- P□□□PB	Applicable Motors	FFP30A, FFP22D, FFP35D, FFP20G, FFP30G, FFP12M, FFP20M
Specification	Motor Side Connector / Dirve Side Connector  Pin No. / Signal A / U B / V C / W D / FG E / BK+ F / BK- 1. Motor connection a. PLUG spec.: MS3108B 24-10S(MS) 2. Drive connection a. U, V, W pin spec: 2512 b. FG pin spec.: 1.5 x 3(Ring Terminal) 3. Power Cable spec.: 4Cx1.5SQ or 4Cx15AWG 4. Brake power connection a. Connection terminal spec. : 1.5 x 3(Ring Terminal) 5. Brake Cable spec.: 2Cx0.75SQ or 2Cx18AWG		

Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

Note2) 400V products are not provided for general use.

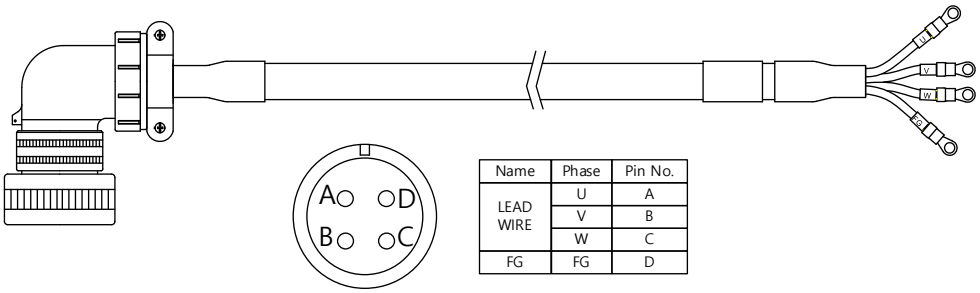
Cable length (m)	3	5	10	20
Robot cable	F03	F05	F10	F20

■ [400V] Option (Standard power cable)

Classification	Power	Product name	Medium capacity MS Type power cable(180/ 220 Flange)
Product name (*Note 1)	APCF- P□□□JS	Applicable Motors	FFP50A, FFP55D, FFP75D, FFP44G, FFP60G, FFP30M, FFP44M, FGP55D, FGP75D, FGP44G, FGP60G, FGP30M, FGP44M

Specification

Motor Side Connector — Dirve Side Connector



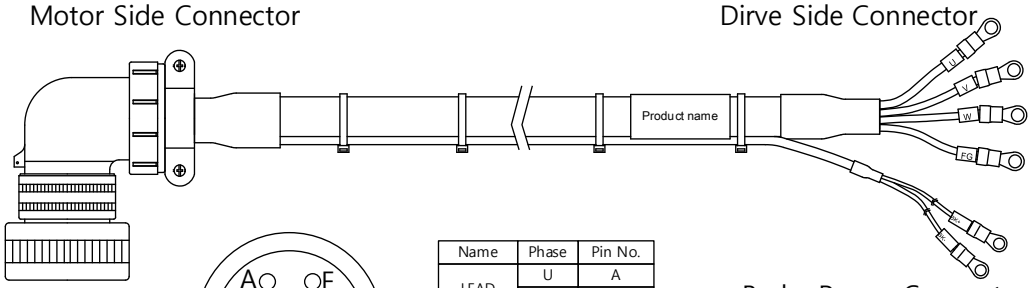
Name	Phase	Pin No.
LEAD WIRE	U	A
	V	B
	W	C
FG	FG	D

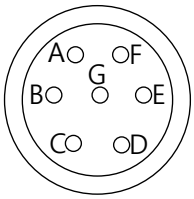
1. Motor connection(MS: Military Standard)
a. PLUG spec.: MS3108B 22-22S
2. Drive connection(U,V,W,PE)
a. U,V,W,FG pin spec.: 4.0x 5(Ring Terminal)
3. Cable spec.: 4Cx4.0SQ or 4Cx11AWG

Classification	Power and Brake	Product name	Medium capacity MS Type power/brake cable(for 180 Flange)
Product name (*Note 1)	APCF- P□□□LB	Applicable Motors	FFP50A, FFP55D, FFP75D, FFP44G, FFP60G, FFP30M, FFP44M

Specification

Motor Side Connector — Dirve Side Connector





Name	Phase	Pin No.
LEAD WIRE	U	A
	V	B
	W	C
FG	FG	D
FG	+	E
FG	-	F

Brake Power Connector

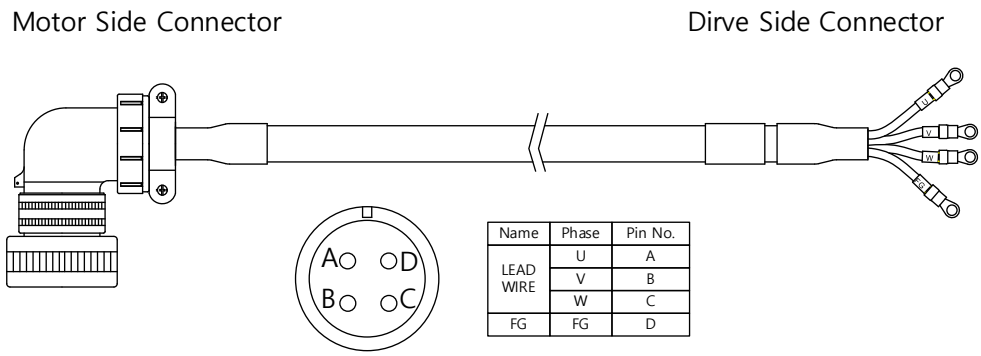
1. Motor connection(MS: Military Standard)
a. PLUG spec. : MS3108B 24-10S
2. Drive connection(U,V,W,PE)
a. U,V,W,FG pin spec.: 4.0x 5(Ring Terminal)
3. Power Cable spec.: 4Cx4.0SQ or 4Cx11AWG
4. Brake power connection
a. Connection terminal spec. : 1.5 x 3(Ring Terminal)
5. Brake Cable spec.: 2Cx0.75SQ or 2Cx18AWG

Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

Note2) 400V products are not provided for general use.

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

■ [400V] Option (Standard power cable)

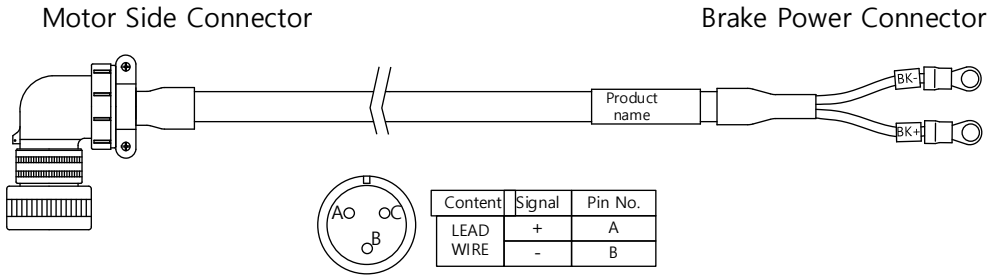
Classification	Power	Product name	Medium capacity MS Type power cable(for 220 Flange)
Product name (*Note 1)	APCF- P□□□MS	Applicable Motors	FFP75G, FGP110D, FGP85G, FGP110G, FGP150G, FGP60M
Specification	 Name / Phase / Pin No. LEAD WIRE: U / A; V / B; W / C FG / FG / D **1. Motor connection(MS: Military Standard)** **a. PLUG spec.: MS3108A 32-17S** **2. Drive connection(U,V,W,PE)** **a. U,V,W,FG pin spec.: 10 x 5(Ring Terminal)** **3. Cable spec.: 4Cx10SQ or 4Cx7AWG**		

Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

Note2) 400V products are not provided for general use.

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

■ [200V/ 400V] Option (Standard power cable)

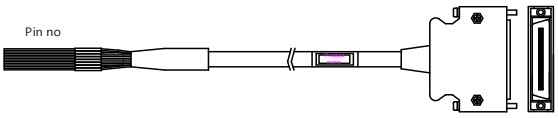
Category	Power	Product Name	Medium capacity MS Type brake cable(for 220 Flange)
Name (Note 1)	APCS- P□□□SB	Applicable Motors	All models of FGP Series(Common use of FG Series)
Spec.			

1. Motor connection
a. PLUG spec. : MS3108B 14-7S(MS company)
2. Brake power
a. Connection terminal spec. : 1.5x3 (Ring Terminal)
3. Cable Spec. : 2Cx0.75SQ or 2Cx19AWG

Note1) 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

■ Options spec. (cable)

<table>
<tr><th>Classification</th><th>Product name</th><th>Product name (Note 1)</th><th>Applicable drive</th><th>Specification</th></tr>
<tr><td>For signal</td><td>CN1 cable</td><td>APC-CN1□□A</td><td>L7 SERIES</td><td>
[Upper level controller] [Drive connector(CN1)]


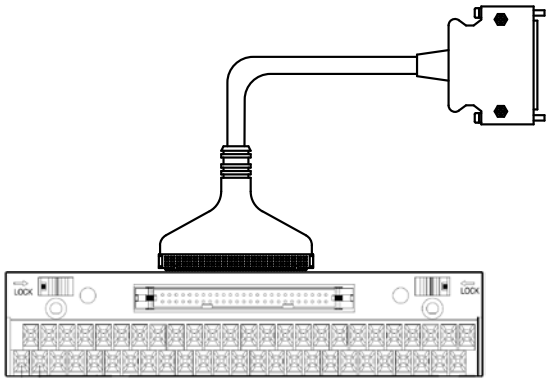
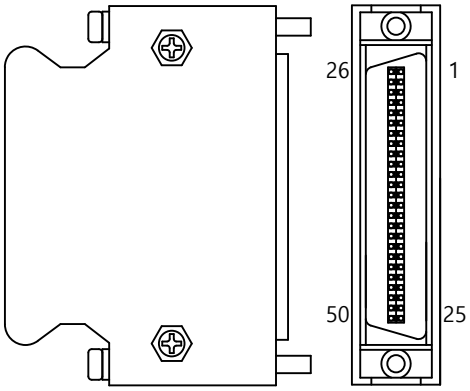
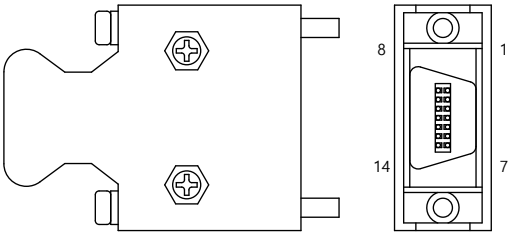
1. Drive connection (CN1)
a. Socket spec.: SM-50J (SUNTONE)
10350-52A0-008(3M)
b. Connector spec.: SM-50J(SUNTONE)
10150-3000VE(3M)
c. CABLE spec. : UL20276(28AWG x 25P)
<table>
<tr><th>CN1</th><th>wire color</th><th>CN1</th><th>wire color</th><th>CN1</th><th>wire color</th><th>CN1</th><th>wire color</th><th>CN1</th><th>wire color</th></tr>
<tr><td>1</td><td>Orange/Black 1</td><td>11</td><td>Orange/Black 2</td><td>21</td><td>Orange/Black 3</td><td>31</td><td>Orange/Black 4</td><td>41</td><td>Orange/Black 5</td></tr>
<tr><td>2</td><td>Orange/Red 1</td><td>12</td><td>Orange/Red 2</td><td>22</td><td>Orange/Red 3</td><td>32</td><td>Orange/Red 4</td><td>42</td><td>Orange/Red 5</td></tr>
<tr><td>3</td><td>Yellow/Black 1</td><td>13</td><td>Yellow/Black 2</td><td>23</td><td>Yellow/Black 3</td><td>33</td><td>Yellow/Black 4</td><td>43</td><td>Yellow/Black 5</td></tr>
<tr><td>4</td><td>Yellow/Red 1</td><td>14</td><td>Yellow/Red 2</td><td>24</td><td>Yellow/Red 3</td><td>34</td><td>Yellow/Red 4</td><td>44</td><td>Yellow/Red 5</td></tr>
<tr><td>5</td><td>White/Black 1</td><td>15</td><td>White/Black 2</td><td>25</td><td>White/Black 3</td><td>35</td><td>White/Black 4</td><td>45</td><td>White/Black 4</td></tr>
<tr><td>6</td><td>White/Red 1</td><td>16</td><td>White/Red 2</td><td>26</td><td>White/Red 3</td><td>36</td><td>White/Red 4</td><td>46</td><td>White/Red 5</td></tr>
<tr><td>7</td><td>Gray/Black 1</td><td>17</td><td>Gray/Black 2</td><td>27</td><td>Gray/Black 3</td><td>37</td><td>Gray/Black 4</td><td>47</td><td>Gray/Black 5</td></tr>
<tr><td>8</td><td>Gray/Red 1</td><td>18</td><td>Gray/Red 2</td><td>28</td><td>Gray/Red 3</td><td>38</td><td>Gray/Red 4</td><td>48</td><td>Gray/Red 5</td></tr>
<tr><td>9</td><td>Pink/Black 1</td><td>19</td><td>Pink/Black 2</td><td>29</td><td>Pink/Black 3</td><td>39</td><td>Pink/Black 4</td><td>49</td><td>Pink/Black 5</td></tr>
<tr><td>10</td><td>Pink/Red 1</td><td>20</td><td>Pink/Red 2</td><td>30</td><td>Pink/Red 3</td><td>40</td><td>Pink/Red 4</td><td>50</td><td>Pink/Red 5</td></tr>
</table>
</td></tr>
<tr><td>For signal</td><td>Communication cable</td><td>APCS-CN5L7U</td><td>L7 SERIES</td><td>
[PC-USB Port] [Servo drive -CN5]

1. PC connection: USB A Plug
a. Drive connection (CN2): Mini USB 5P Plug
b. Electrical requirements: double shielding, twisted pair, EMI filter attached type (reference product: SANWA KU-AMB518)
</td></tr>
</table>

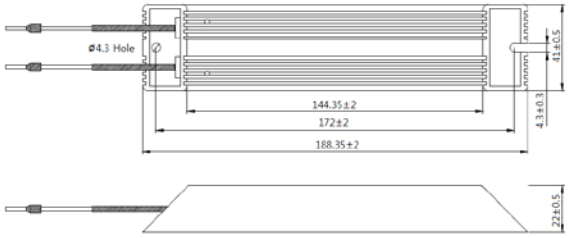
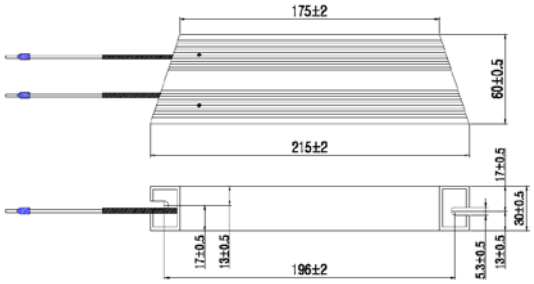
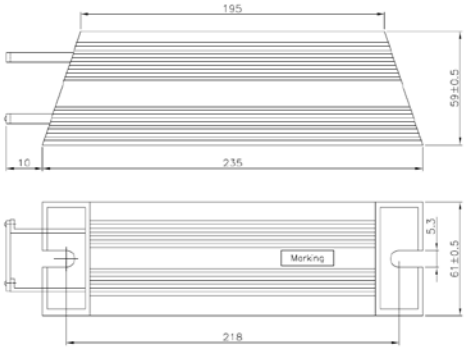
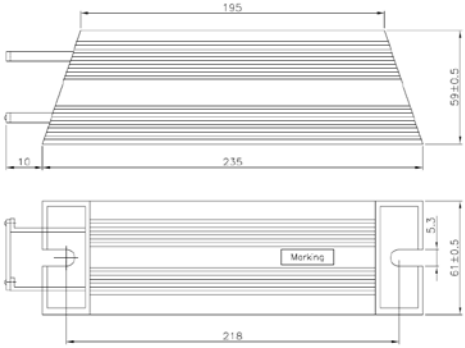
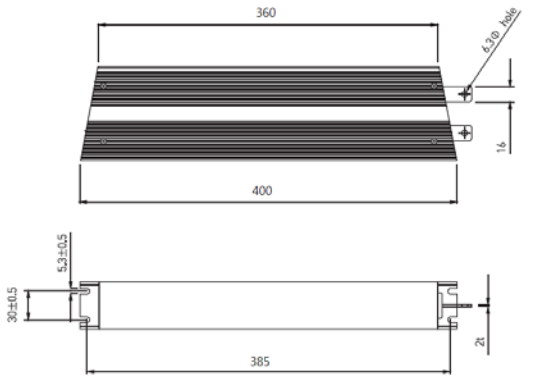
Note1) The □□□in the name indicates the type and length of each cable. Refer to the following table for this information

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

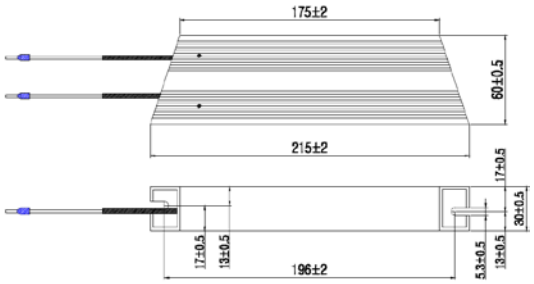
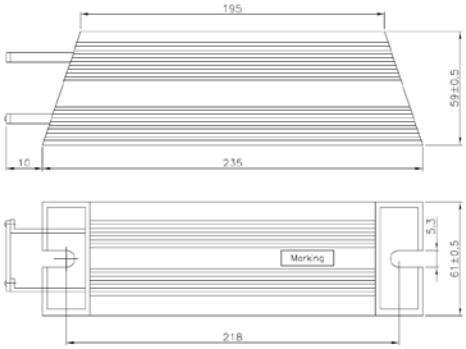
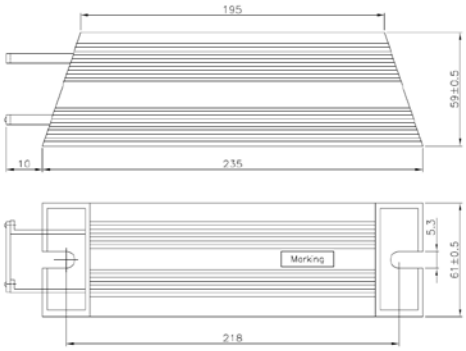
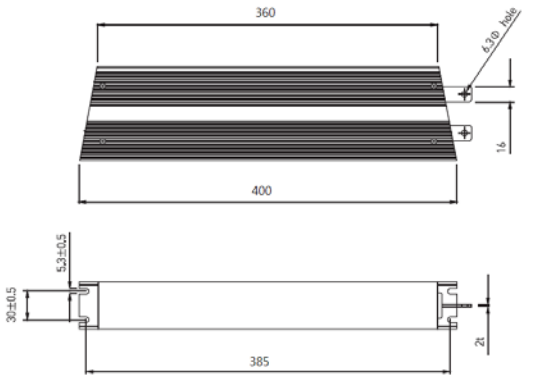
■ **Option spec. (connector)**

Classification	Product name	Model name	Applicable drive	Specification
T/B	CN1 T/B	APC-VSCN1T APC-VPCN1T	L7 SERIES	 **1.** APC-VSCN1T: CN1 T/B extended type of APD-VS **a.** APC-VPCN1T: CN1 T/B extended type of APD-VP **b.** Cable length can be changed **c.** Standard Cable length: 0.5[m]
CN	CN1 Connector	APC-CN1NNA	L7 SERIES	 **a.** CASE spec.: SM-50J(SUNTONE) 10350-52A0-008(3M) **b.** Connector spec.: SM-50J(SUNTONE) 10150-3000VE(3M)
CN	CN2 Connector	APC-CN3NNA	L7 SERIES	 **a.** CASE spec.: SM-14J(SUNTONE) 10314-52A0-008(3M) **b.** Connector spec.: SM-50J(SUNTONE) 10114-3000VE(3M)

■ [200V] Option spec (braking resistor)

Classification	Product Name	Model name	Applicable drive	Specification
Resistor	Brake resistor	APCS-140R50 50 [Ω] (140[W])	L7SA001□ L7SA002□ L7SA004□	
Resistor	Brake resistor	APCS-300R30 30 [Ω] (300[W])	L7SA008□ L7SA010□	
Resistor	Brake resistor	APC-600R30 30 [Ω] (600[W])	L7SA020□ (2P) L7SA035□ (3P)	
Resistor	Brake resistor	APC-600R28 28 [Ω] (600[W])	L7SA050□ (4P) L7SA075B (4P)	
Resistor	Brake resistor	APCS-2000R3R3 3.3 [Ω] (2000[W])	L7SA150B	

■ [400V] Option spec (braking resistor)

Classification	Product Name	Model name	Applicable drive	Specification
Resistor	Brake resistor	APCS-300R82 82 [Ω] (300[W])	L7SB010B	
Resistor	Brake resistor	APC-600R140 140 [Ω] (600[W])	L7SB020B (2P) L7SB035B (2P)	
Resistor	Brake resistor	APC-600R875 25 [Ω] (600[W])	L7SB050B (3P) L7SB075B (3P)	
Resistor	Brake resistor	APCS- 2000R13R4 13.4 [Ω] (2000[W])	L7SB150B	

3. Installation

3.1 Servo Motor

⚠Caution
▪ If the encoder loses multi-turn data, there is a risk of equipment malfunction or accident, so be sure to operate after originating. ▪ When using an absolute value encoder, the multi-turn data of the encoder is lost in the following process. • When replacing motor and encoder cables. • When replacing the battery while the power of the servo is OFF.

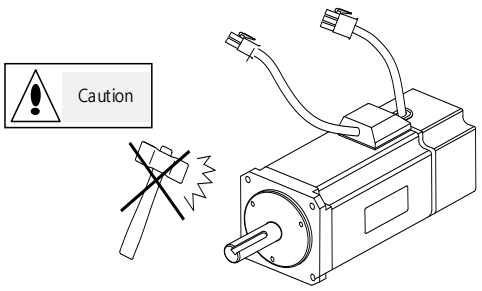
3.1.1 Operating Environment

Item	Environment condition	Remarks
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 49 ㎨ or below on both the X and Y axis.	Excessive vibrations reduce the lifespan of the bearings.

* This device satisfies the electromagnetic wave test standard (EN 60034-1) for industrial use (Class A), so it is intended for use in an industrial environment.

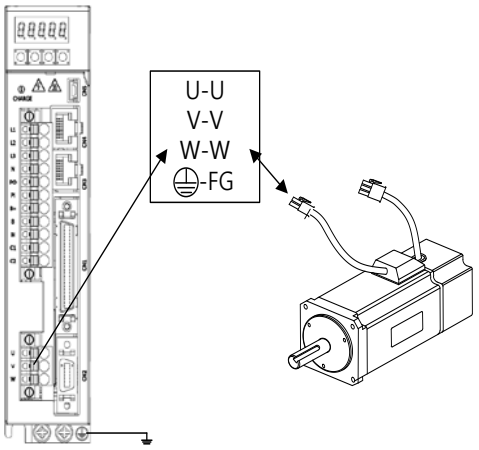
3.1.2 Preventing Impact

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



3.1.3 Motor Connection

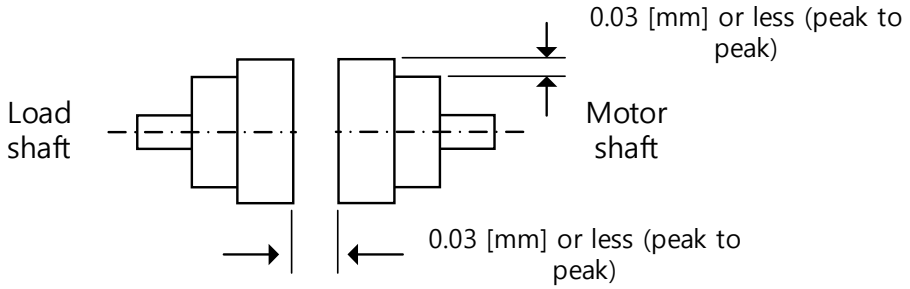
- If the motor is directly connected to commercial power, it may be burned. Be sure to connect with the specified drive before using it.
- Connect the ground terminals of the motor to either of the two ground terminals inside the drive, and attach the remaining terminal to the type-3 ground.



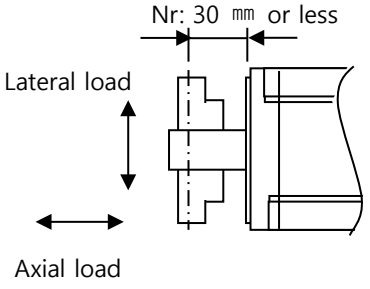
- Connect the U, V, and W terminals of the motor in the same way as the U, V, and W terminals of the drive.
- Ensure that the pins on the motor connector are securely attached.
- In order to protect against moisture or condensation in the motor, make sure that insulation resistor is 10 MΩ (500 V) or higher before installation.

3.1.4 The Load Device Connection

For coupling connections: Install the motor shaft and the load shaft so that they match within the allowable range.

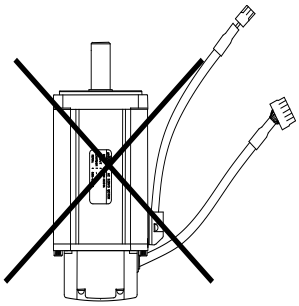


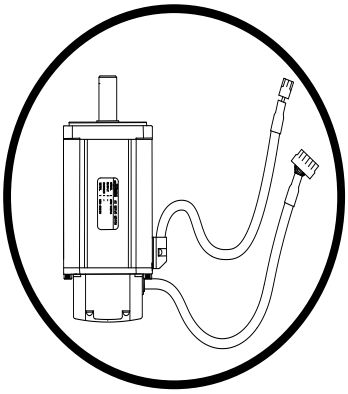
■ For pulley connections:

Flange	Lateral Load		Axial Load		Note
	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	

3.1.5 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. If the motor moves, be sure to use a movable cable and ensure that the cable does not swing.

3.2 Servo Drive

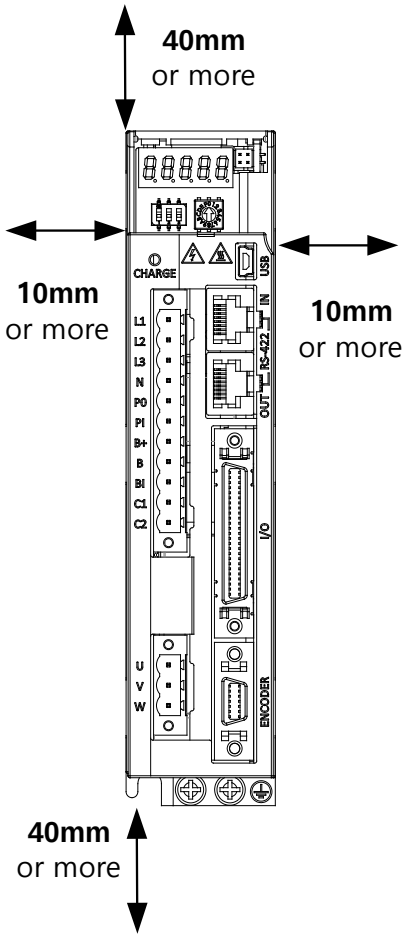
3.2.1 Operating Environment

Item	Environmental conditions	Remarks
Ambient temperature	0~50[℃]	⚠ **Caution** Install a cooling fan on the control panel to maintain an appropriate temperature.
Ambient humidity	90% RH or less	⚠ **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.	

3.2.2 Installation in the Control panel

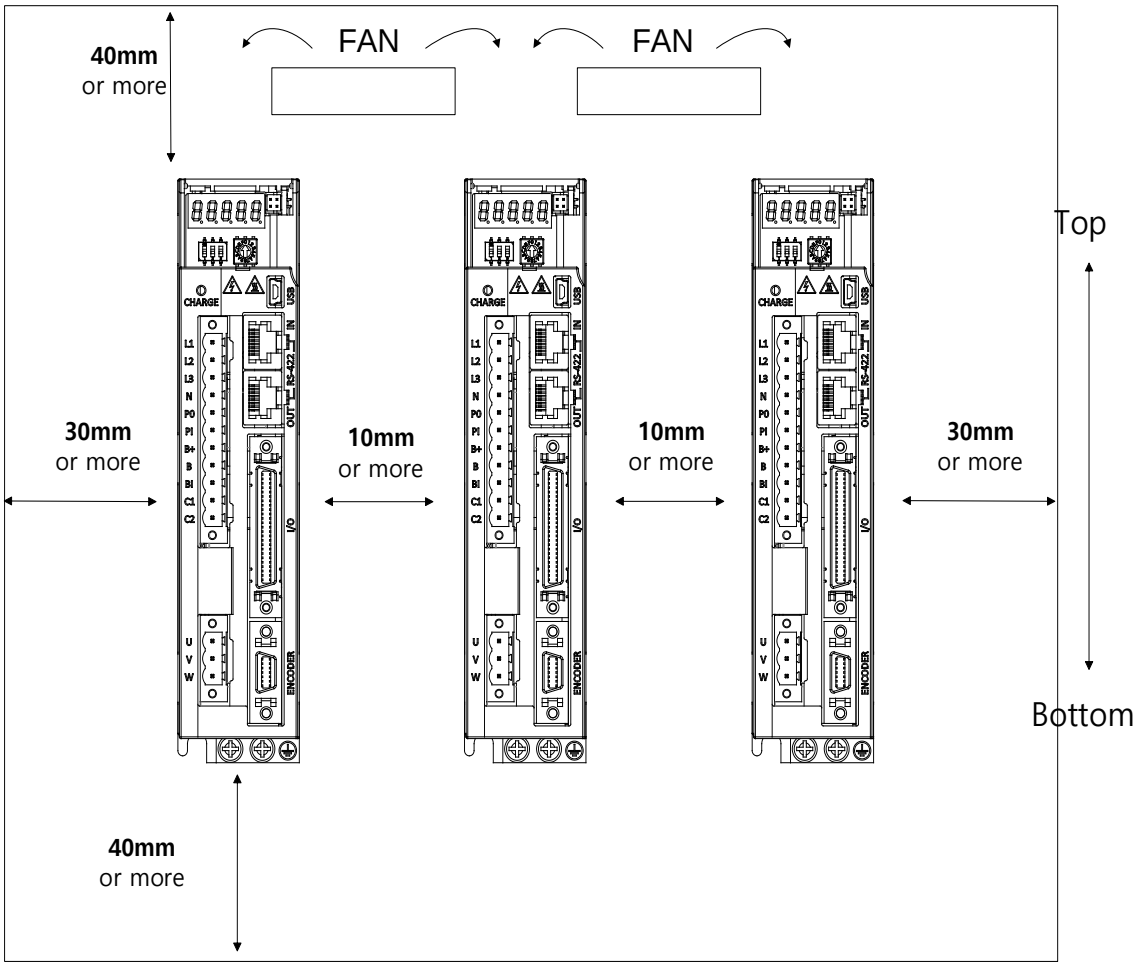
The installation interval in the control panel is as shown in the figure below.

- In case of 1 unit installation



■ In case of installation of 2 or more units

Install a cooling fan on the top of the servo drive to prevent the internal temperature of the control panel from exceeding the environmental conditions of the servo drive. Also, leave enough space while referring to the figure below to allow cooling by heat convection within the fan and control panel.



⚠Caution

- When installing an external regenerative resistor, install it so that it does not affect the drive due to heat.
- When assembling the control panel of the servo drive, make sure to assemble it in close contact with the wall.
- When assembling the control panel, make sure that metal powder generated by drilling, etc. does not enter the drive.
- Take into consideration that oil, water, and other metallic dust do not enter from the control panel gap or ceiling.
- Protect the control panel with an air purge when used in a place with a lot of harmful gas and dust.

3.2.3 Power Supply Wiring

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

> **⚠ Caution**
>
> Over voltages can damage the drive.

- If commercial power is connected to U, V, W terminals of Drive, they may be damaged. Be sure to connect power to L1, L2, L3 terminals.

- Connect short-circuit pins to the B and BI terminals. For external regeneration resistors, remove the short-circuit pins and use standard resistors for the B+ and B terminals.

Type	Resistance value	Standard capacity	* Notes
L7SA 001□	100[Ω]	Built-in 50[W]	⚠ **Caution** For information about resistance during regeneration capacity expansion, refer to Section 2.3, "Options and peripheral device."
L7SA 002□			
L7SA 004□			
L7SA 008□	40[Ω]	Built-in 100[W]	
L7SA 010□			
L7SA 020□	13[Ω]	Built-in 150[W]	
L7SA 035□			
L7SA 050□	6.8[Ω]	Built-in 120[W]	
L7SA 075B	6.8[Ω]	Built-in 240[W]	
L7SA 150B	3.3[Ω]	External 2000[W]	
L7SB 010B	100[Ω]	Built-in 100[W]	
L7SB 020B	40[Ω]	Built-in 150[W]	
L7SB 035B			
L7SB 050B	27[Ω]	Built-in 120[W]	
L7SB 075B	27[Ω]	Built-in 240[W]	
L7SB 150B	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 4 Wiring Method)

- High voltages may remain in the device for sometime even after the main power is disconnected.

-

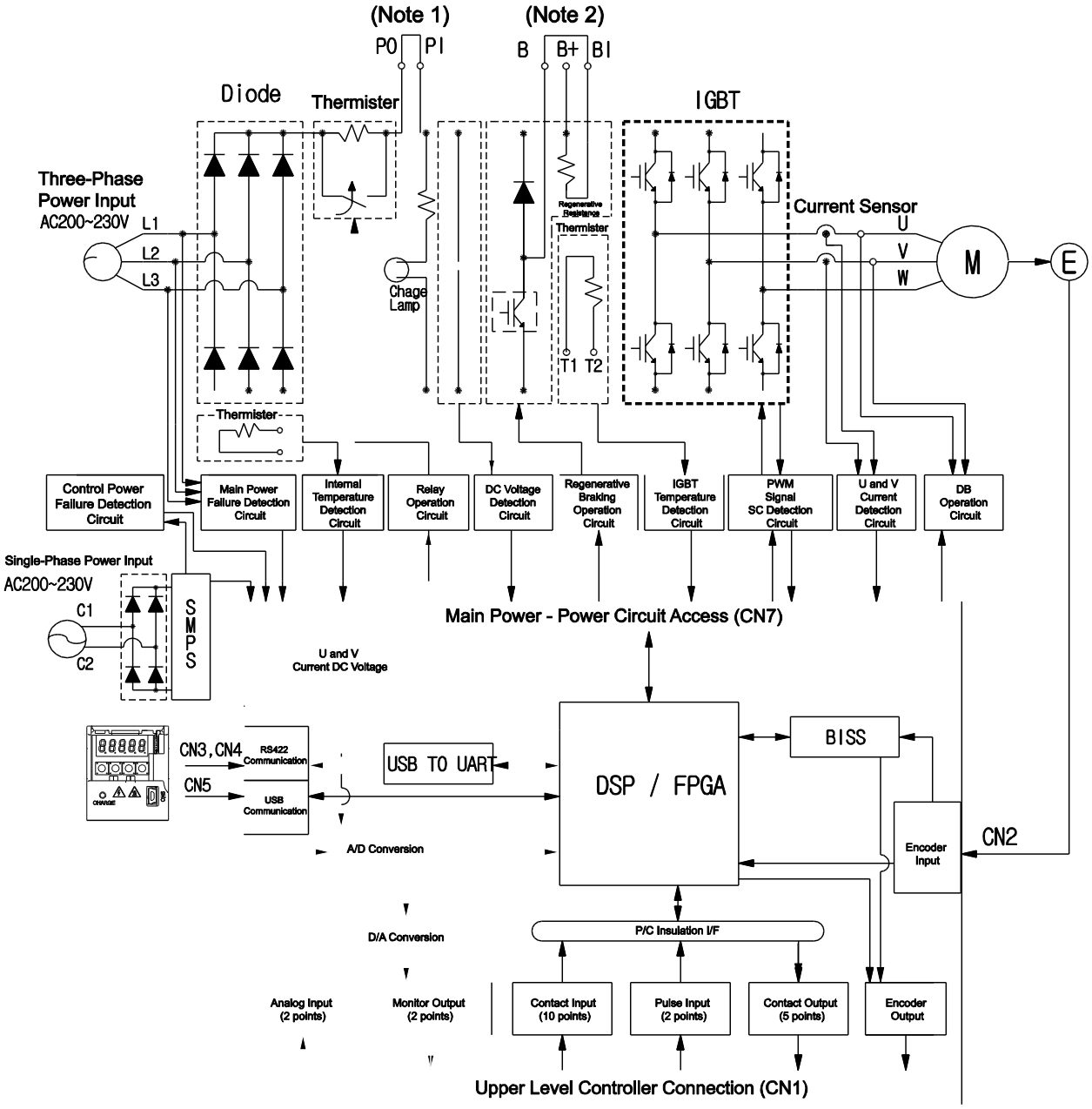
> **⚠ Danger**
>
> After disconnecting the main power, ensure that the charge lamp is off before you start wiring. Failure to do so may result in electric shock.

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

4. Wiring Method

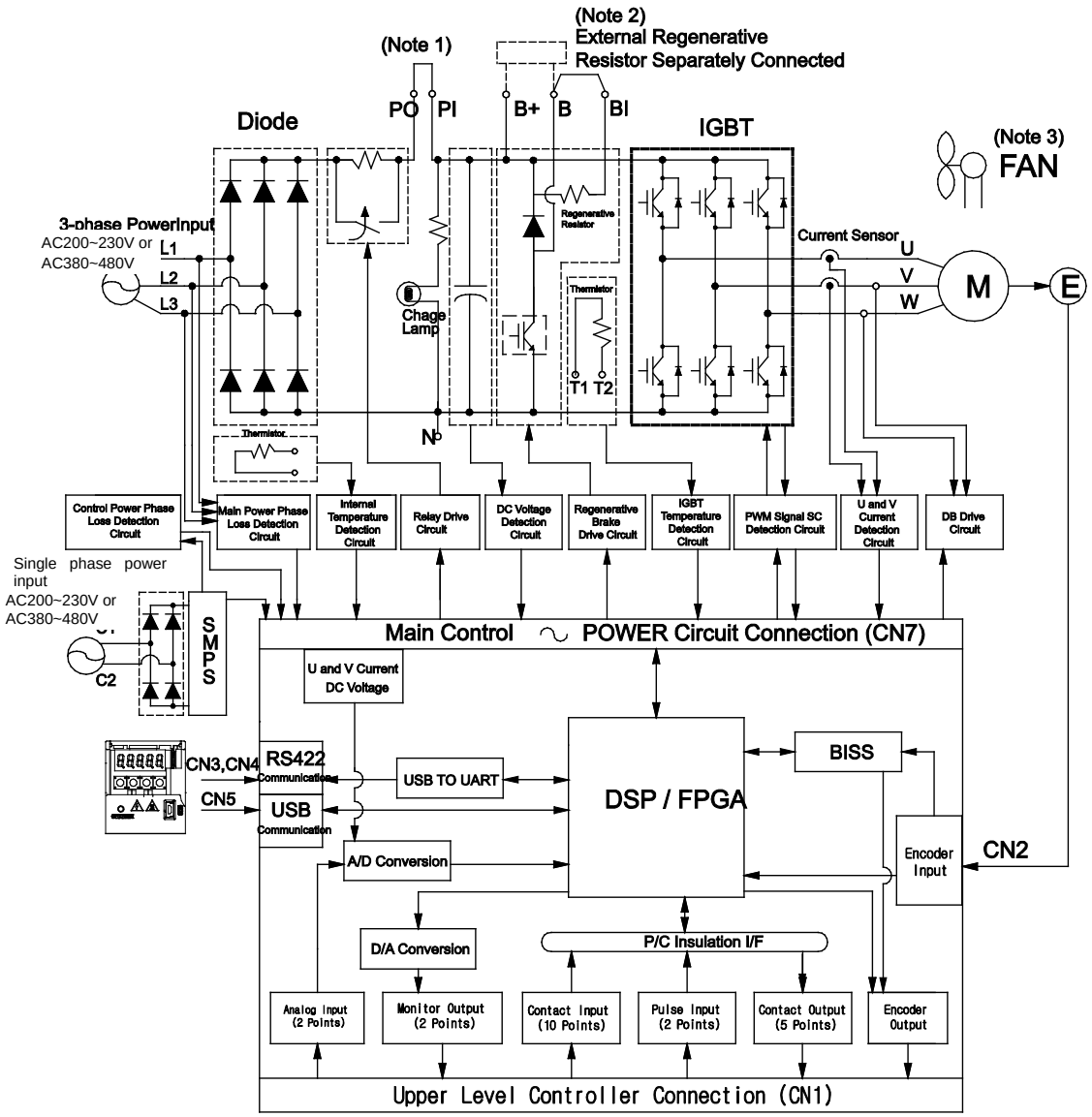
4.1 Internal block diagram

4.1.1 L7 drive block diagram [L7SA001□ ~ L7SA004□]



Note1) If using a DC reactor, connect the PO and PI pins.
Note2) If using an external regeneration resistor, remove the B and BI short-circuit pins and connect the B+ and B pins.
Note3) Wire after checking the input power for each model.
Note4) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.1.2 L7 drive block diagram [L7SA008□ ~ L7SA035□, L7SB010B ~ L7SB035B]



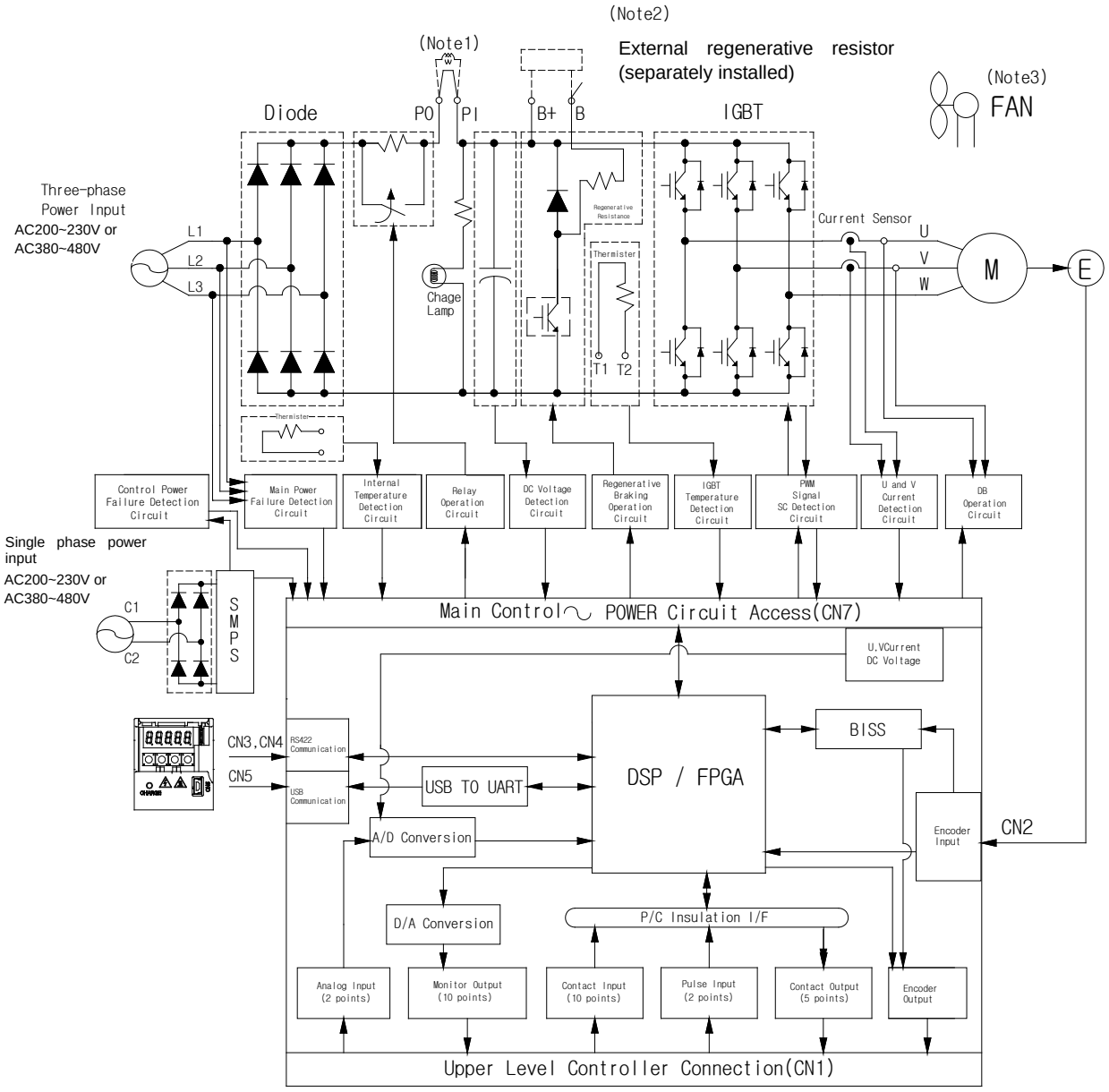
Note1) If using a DC reactor, connect the PO and PI pins.

Note2) If using an external regeneration resistor, remove the B and BI short-circuit pins and connect the B+ and B pins.

Note3) L7SA008□ ~ L7SA035□, L7SB010B ~ L7SB035B models are forcibly cooled by a cooling fan for DC24[V].

Note4) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.1.3 L7 drive block diagram [L7SA050□~L7SA075B, L7SB050B~L7SB075B]



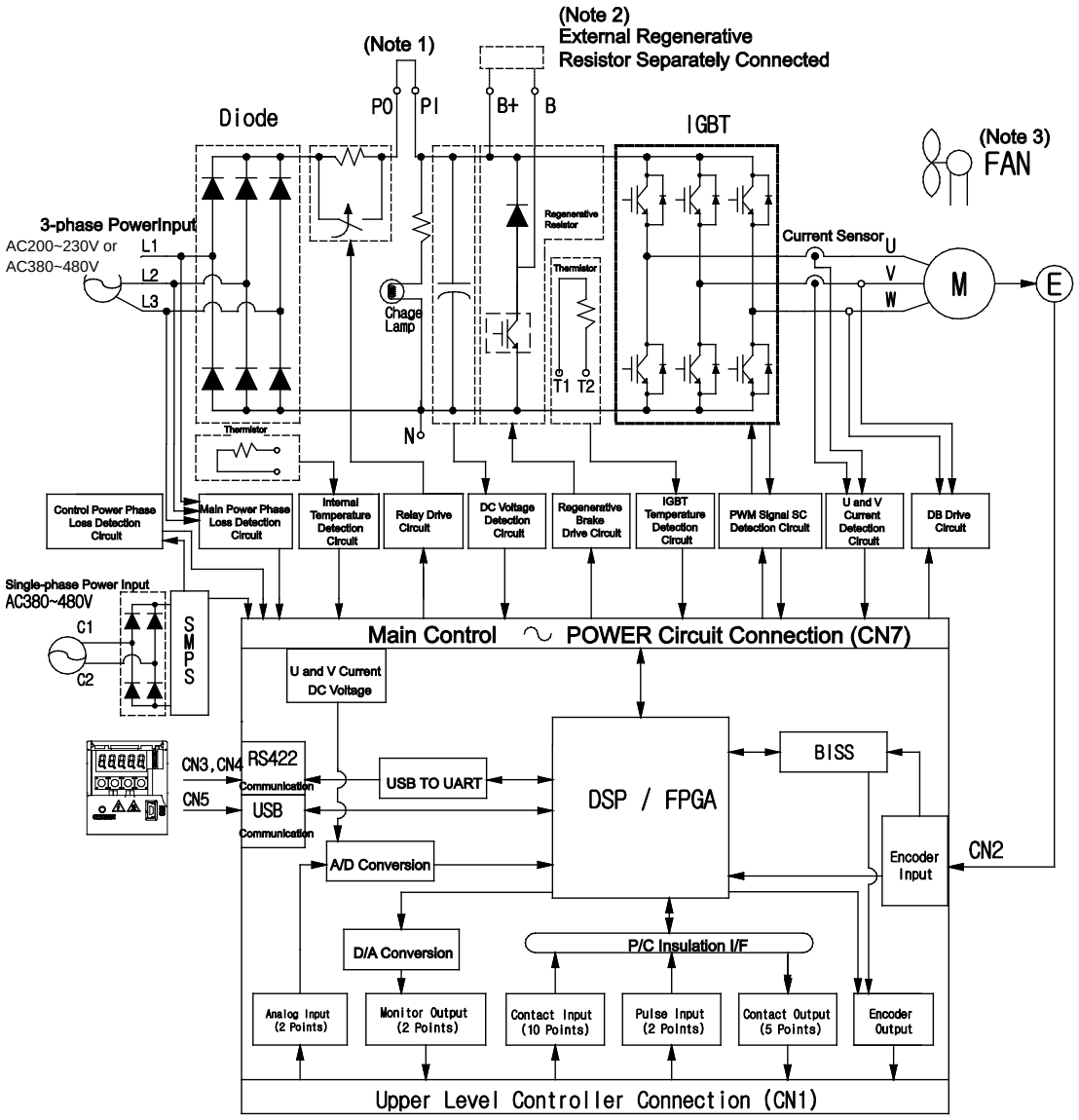
Note1) If using a DC reactor, connect the PO and PI pins.

Note2) When using an external regenerative resistor, connect the external regenerative resistor to the B+ and B terminals after attaching the wiring of the internal regenerative resistor to the internal resistor fixing hole “NC” of the case.

Note3) L7SA050□ ~ L7SA075B□, L7SB050B ~ L7SB075B models are forcibly cooled by a cooling fan for DC24[V].

Note4) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.1.4 L7 drive block diagram [L7SA150B, L7SB150B]



Note1) If using a DC reactor, connect the PO and PI pins.

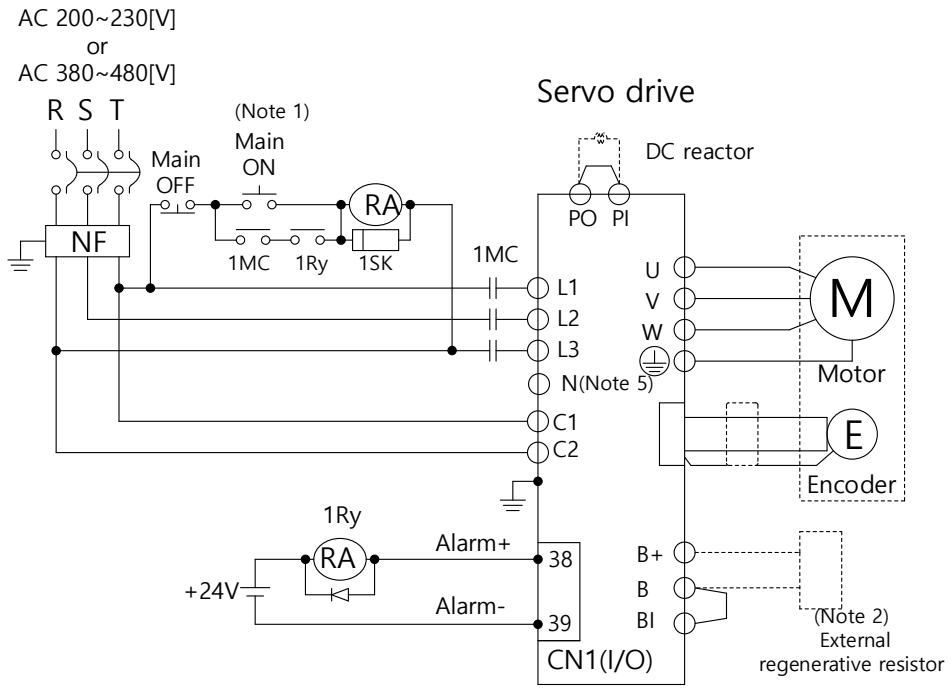
Note2) The built-in regenerative resistor is not available in the L7SA150B model. It is basic to use an external regenerative resistor, and when installing, connect the external regenerative resistor to the B+ and B terminals.

Note3) L7SA150B, L7SB150B model are cooled by a DC 24V cooling fan.

Note4) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.2 Power Supply Wiring

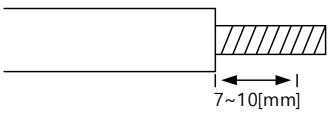
4.2.1 L7 drive block diagram [L7SA001□ ~ L7SA035□, L7SB010B~L7SB035B]



Note1) 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.

Note2) L7SA001□~L7SA004□ (50[W], 100[Ω]), L7SA010□ (100[W], 40[Ω]), L7SA020□~ L7SA035□ (150[W], 13[Ω]), L7SB010B(100[W], 100[Ω]), L7SB020B~ L7SB035B (150[W], 40[Ω]) regenerative resistors are built-in, so please use it by shorting between terminals B and BI. In case of a high regeneration capacity due to frequent acceleration/deceleration, open the shorting pin (B, BI) and connect external resistor to B and BI to use.

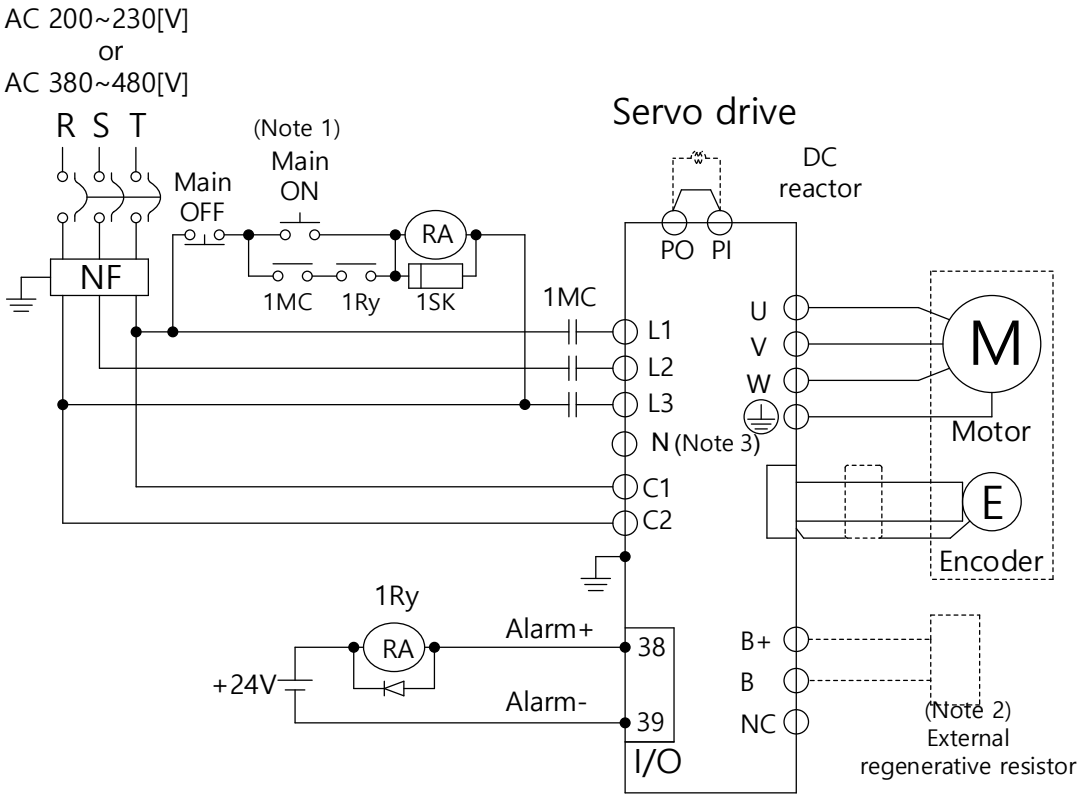
Note3) Remove approximately 7-10[㎜] of the sheathing from the cables for the main circuit power and attach crimp terminals. (Refer to “4.2.4 Power Circuit Electrical Components”).



Note4) To remove the wiring of the main circuit power unit, connect or remove it after pressing the button on the L7SA001□~L7SA010□ drive terminal block. In the case of L7SA020□~L7SA035□, L7SB010B~L7SB035B drives, use a (-) screwdriver to connect or remove them.

Note5) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.2.2 L7 drive block diagram [L7SA050□~L7SA075B, L7SB050B~L7SB075B]

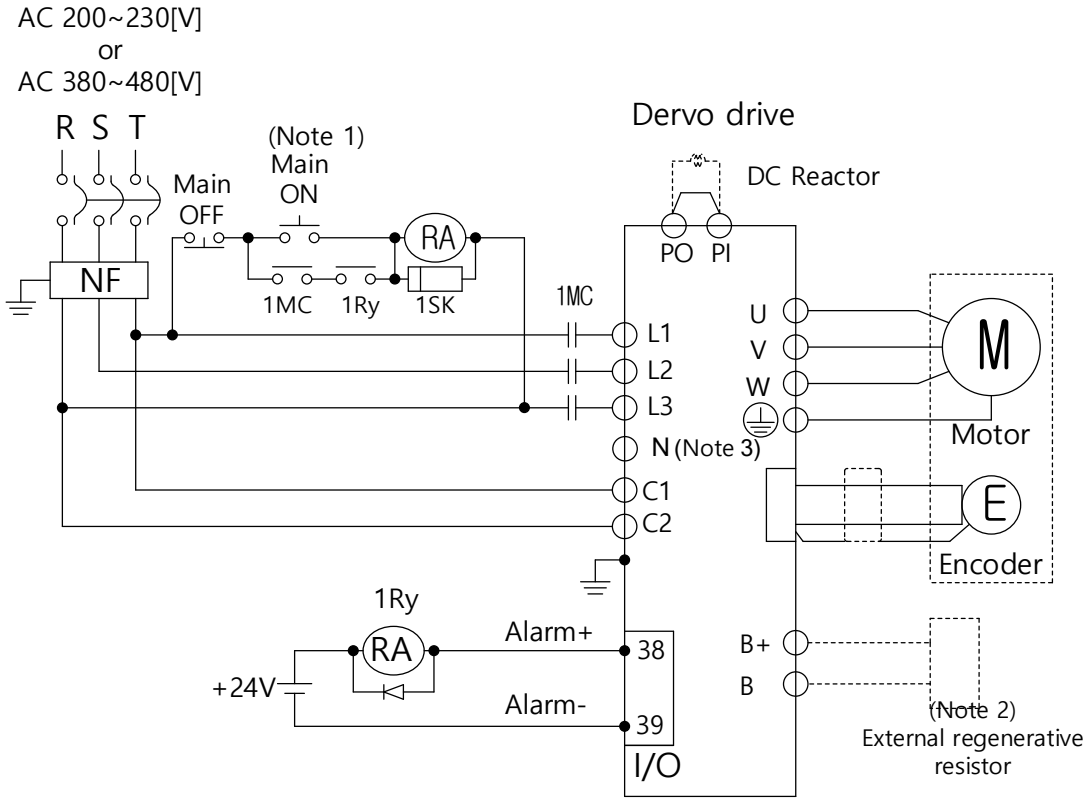


Note1) It takes approximately one to two seconds until alarm signal is output after you turn on the main power. Accordingly, push and hold the main power ON switch for at least two seconds.

Note2) L7SA050□(120[W], 6.8[Ω]), L7SA075B(240[W], 6.8[Ω]), L7SA050B(120[W], 6.8[Ω]), L7SB075B(240[W], 6.8[Ω]]) of the regenerative resistor is built in, so use it after checking the connection status of the internal regenerative resistor to terminals B+ and B. If the regenerative capacity is large due to frequent acceleration/deceleration, connect the wires of the internal regenerative resistor connected to B+ and B to the internal resistor fixing hole “NC” of the case, and then connect the external regenerative resistor to the B and B+ terminals.

Note3) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.2.3 L7 drive block diagram [L7SA150B, L7SB150B]



Note1) 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.

Note2) External regenerative resistors of L7SA150B (2000[W], 3.3[Ω]) and L7SB150B (2000[W], 13.4[Ω]) are basically used, and connect the external regenerative resistor to terminals B+ and B.

Note3) The N terminal is used to connect an external capacitor. If commercial power is connected to the N terminal, the product will be damaged. If you need to connect an external capacitor, be sure to contact the customer service center or dealer.

4.2.4 Power circuit Electrical Components

[200V Electronic component standard]

Name		L7SA001□ L7SA002□	L7SA004□	L7SA008□ L7SA010□	L7SA020□ L7SA035□	L7SA050□	L7SA075B	L7SA150B
MCCB(NFB)		30A Frame 5A (ABE33b/5)	30A Frame 10A (ABE33b/10)	30A Frame 15A (ABE33b/15)	30A Frame 30A (ABE33b/30)	50A Frame 40A (ABE53b/40)	50A Frame 50A (ABE53b/50)	100A Frame 100A (ABS103c/100)
Noise Filter(NF)		TB6-B010LBEI(10A)			TB6-B030NBDC(30A)	TB6-B040As(40A)	TB6-B060LAs(60A)	TB6-B080LAs(80A)
DC reactor		10 [A]		15 [A]	30 [A]	40 [A]	50 [A]	80 [A]
MC		11A / 240V (GM□-9)		18A / 240V (GM□-18)	32A / 240V (GM□-32)	50A / 240V (GM□-50)	50A / 240V (GM□-50)	105A / 240V (GM□-100)
Wire Note) 1	L1,L2,L3 PO,PI,N,B+,B,(BI)U,V,W	AWG16 (1.31 ㎟)		AWG14 (2.08 ㎟)	AWG12 (3.31 ㎟)	AWG10 (5.26 ㎟)	AWG8 (8.36 ㎟)	AWG4 (21.1 ㎟)
	C1, C2	AWG16(1.31 ㎟)						
Crimp terminals Note) 2		UA-F1510 SEOIL		UA-F2010 SEOIL	UA-F4010 SEOIL	GP110028 KET	GP110732 KET	JOPR25-S6W JEONO
Regenerative Resistor (Default)		50[W] 100 Ω		100[W] 40 Ω	150[W] 13 Ω	120[W] 6.8Ω	240[W] 6.8Ω	2000[W] 3.3Ω (*Option)
Connector (L1,L2…U,V,W)		BLF 5.08/03/180F SN BK BX BLF 5.08/11/180F SN BK BX			BLZ7.62HP/03/180LR SN BK BX SO BLZ7.62HP/11/180LR SN BK BX SO			

[400V Electrical Components standard]

Name		L7SB010B	L7SB020B L7SB035B	L7SB050B	L7SB075B	L7SB150B
MCCB (NFB)		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-B040As (40A)	TB6-B060LAs (60A)
DC reactor		10 [A]	20 [A]	30 [A]		50 [A]
MC		9A / 550V (GM□-12)	18A / 550V (GM□-22)	26A / 550V (GM□-40)		38A / 550V (GM□-50)
Wire Note) 1	L1,L2,L3 PO,PI,N, B+,B,(BI) U,V,W	AWG14 (2.08 ㎟)		AWG10 (5.26 ㎟)		AWG8 (8.36 ㎟)
	C1, C2	AWG14 (2.08 ㎟)				
Crimp terminals Note) 2		UA-F1510 SEOIL		GP110028 KET	GP110028 KET	GP110732 KET
Regenerative Resistor (Default)		100[W] 100 Ω	150[W] 40 Ω	120[W] 27 Ω	240[W] 27Ω	2000[W] 13.4Ω (*Option)
Connector (L1,L2…U,V,W)		BLZ7.62HP/03/180LR SN BK BX SO BLZ7.62HP/11/180LR SN BK BX SO				

Note1) When you select a wire, please use 600V, PVC-insulated wire.

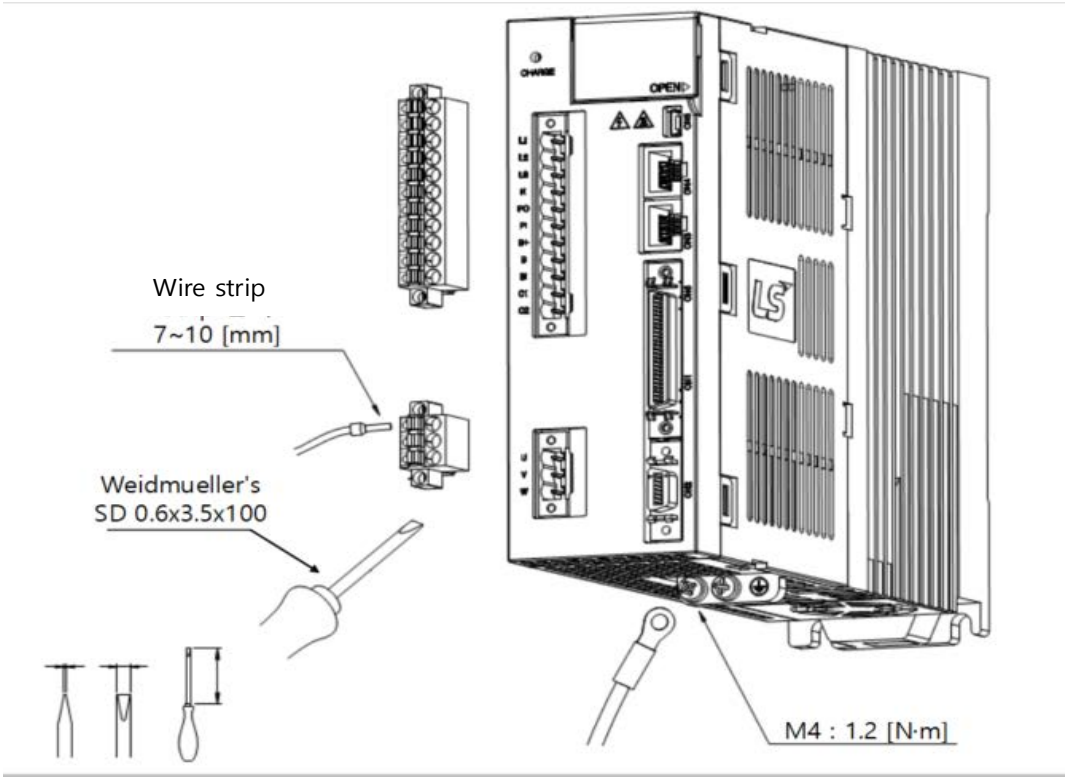
Note2) If the crimp terminal is a SEOIL product, use a 10mm strip & twist of the wire.

To comply with UL (CSA) standards, use UL-certified wire (heat resistant temperature 75℃ or above).

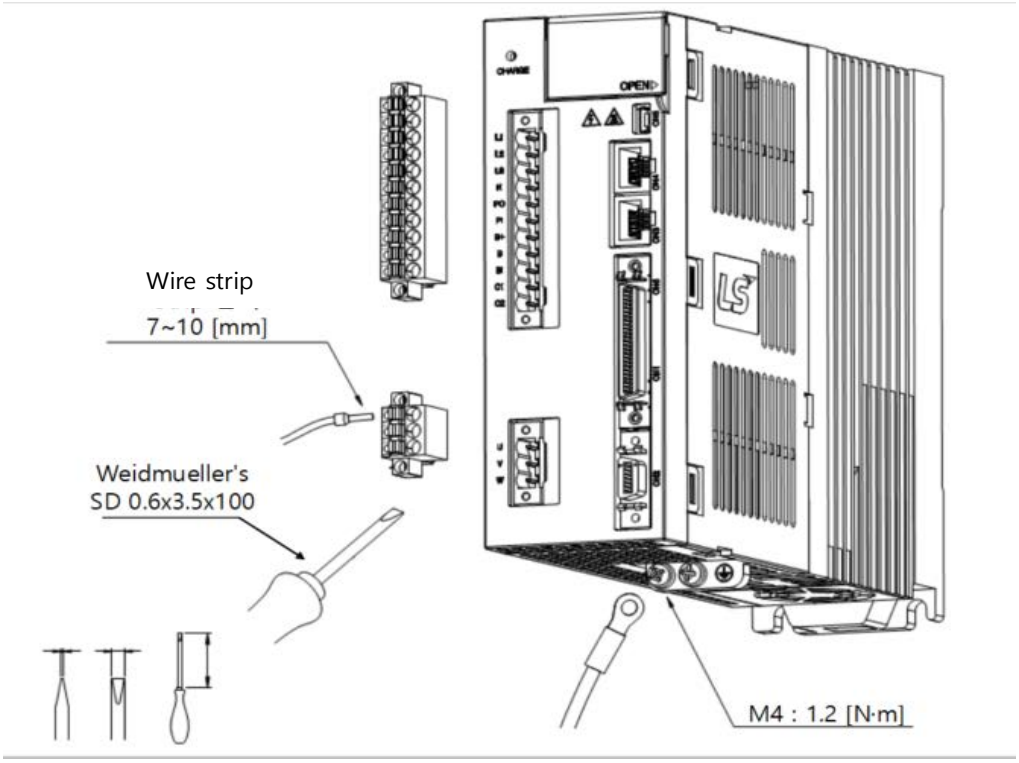
To comply with other standards, use proper wires that meet applicable standards.

For other special specifications, use wires equivalent or superior to those in this section.

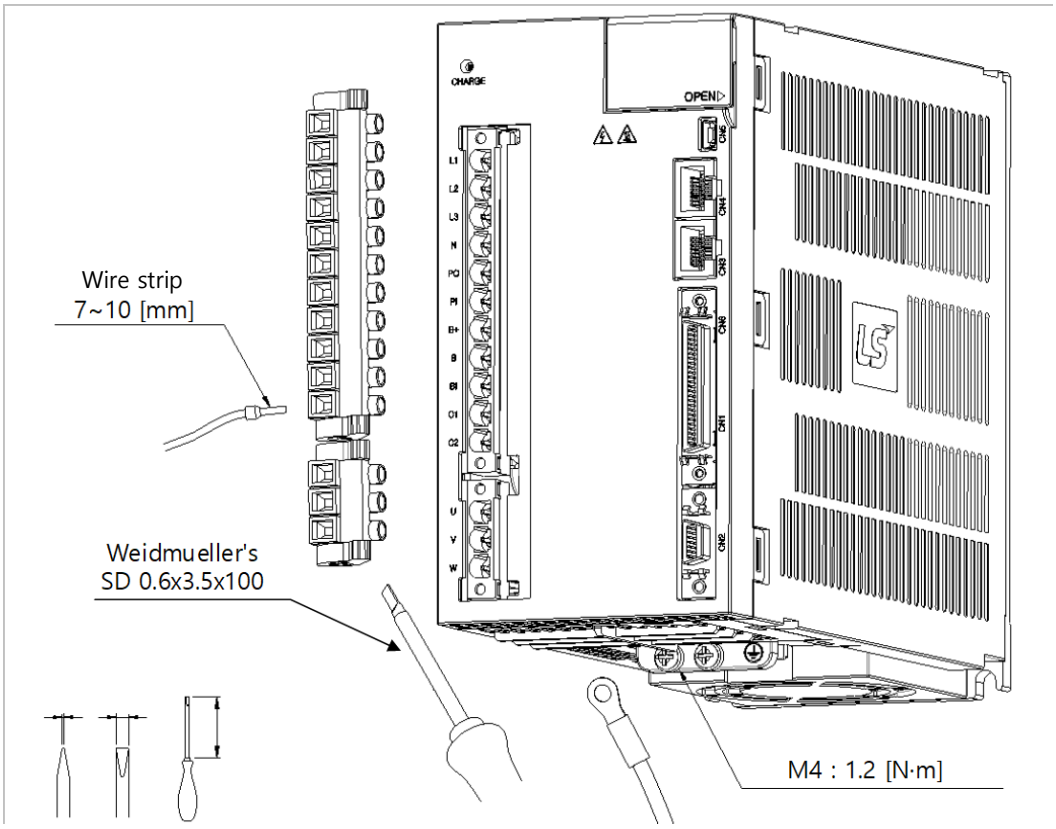
(L7SA004□ or less)



(L7SA008□ ~ L7SA010□)



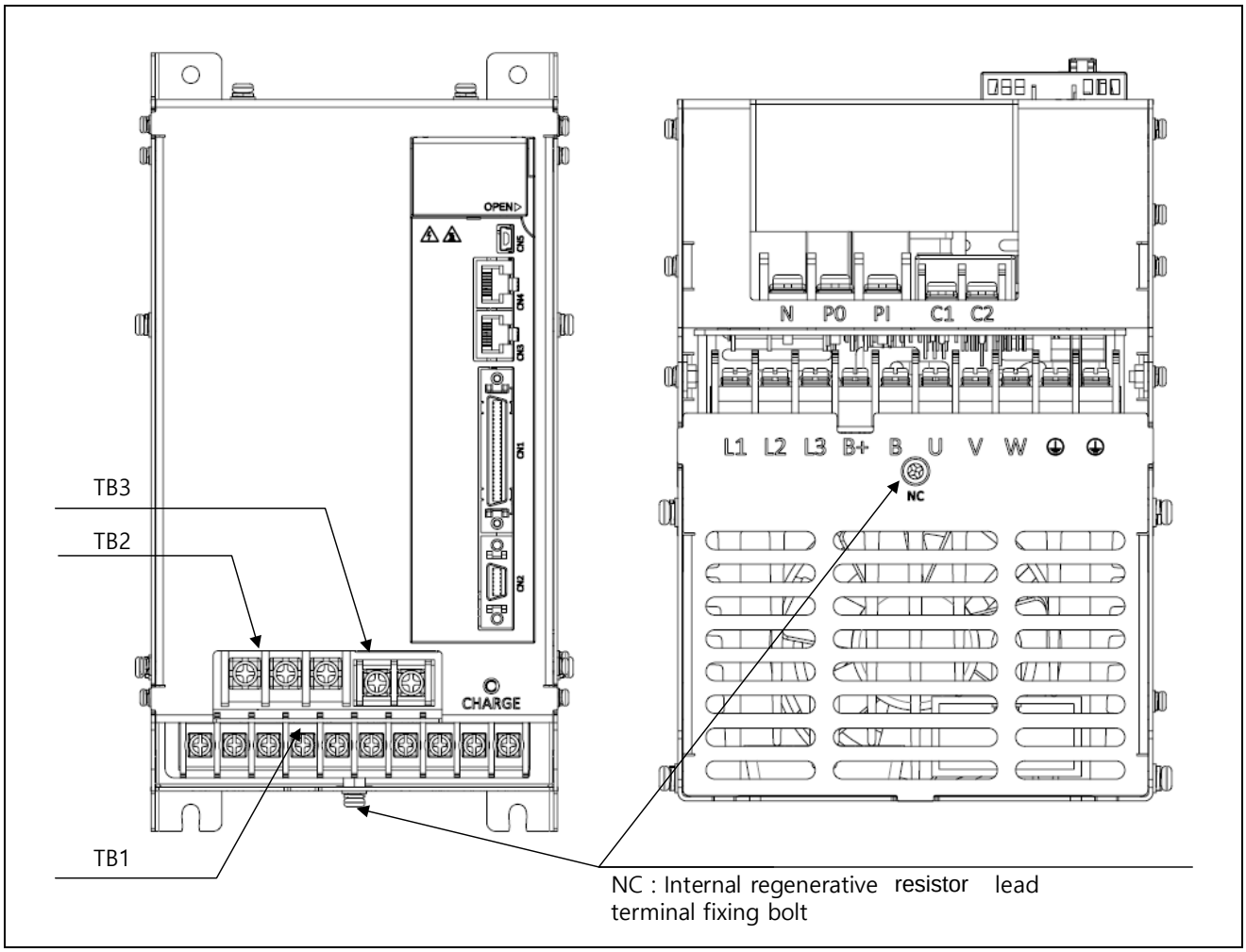
(L7SA020□ ~ L7SA035□)



For information on wiring to BLF 5.08 and BLZ 7.62HP Series connector, refer to the above procedures.

1) Insert electric wire into insert hole with upper locking screw loosened, and use applicable flat head (-) 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 PE 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 PE contact failure and even malfunctioning drive.
6) For the flat head (-) drive, Weidmueller's SD 0.6x3.5x100 product is recommended.

(L7SA050□)



Terminal signal array

TB1

L1	L2	L3	B+	B	U	V	W	⏚	⏚

Terminal screw: M4
Tightening torque: 1.20[N·m]

TB2

N	PO	PI

Terminal screw: M4
Tightening torque: 1.20[N·m]

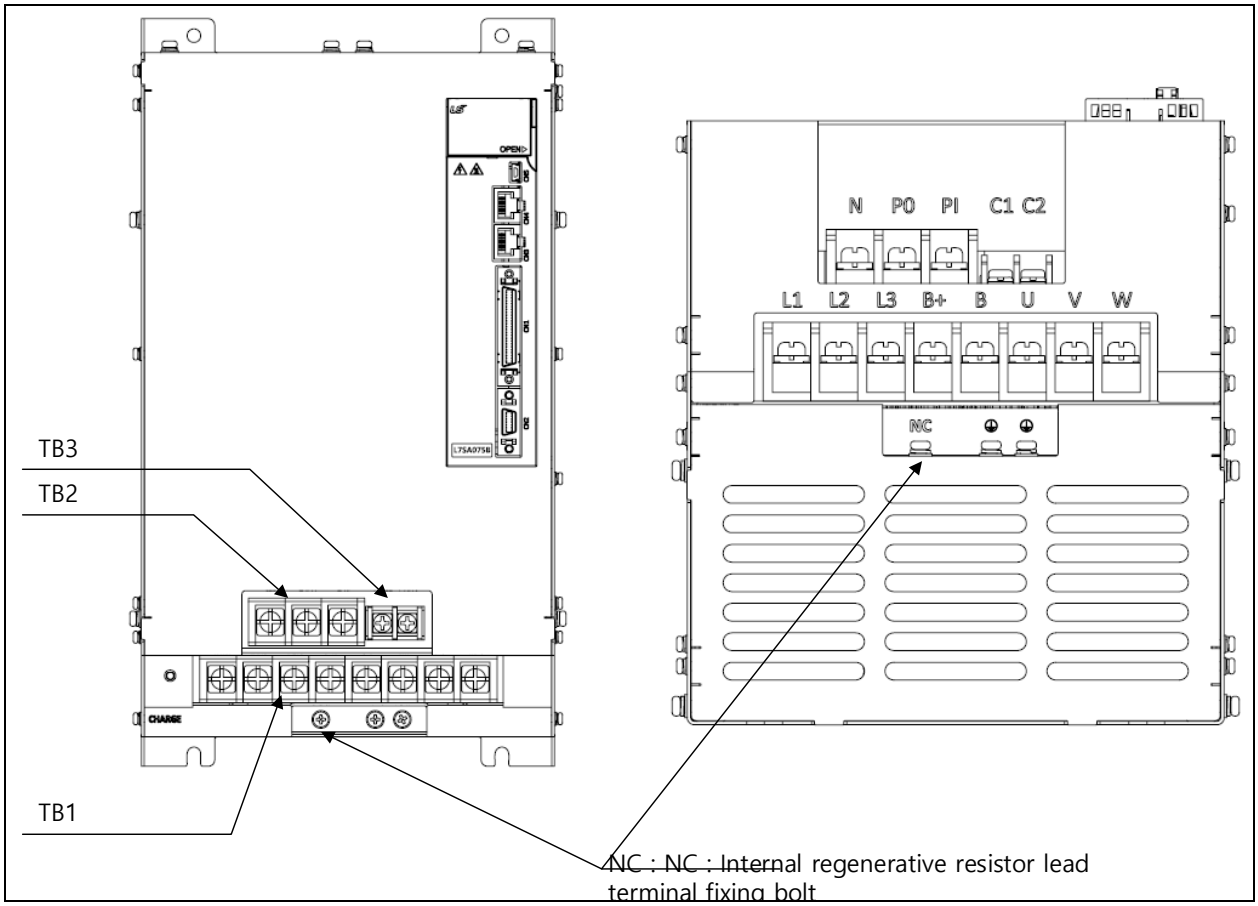
TB3

C1	C2

Terminal screw: M4
Tightening torque: 1.20[N·m]

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

(L7SA075B)



Terminal signal array

TB1

L1	L2	L3	B+	B	U	V	W

Terminal screw: M5
Tightening torque: 2.70[N·m]

TB2

N	PO	PI

Terminal screw: M5
Tightening torque:2.70[N·m]

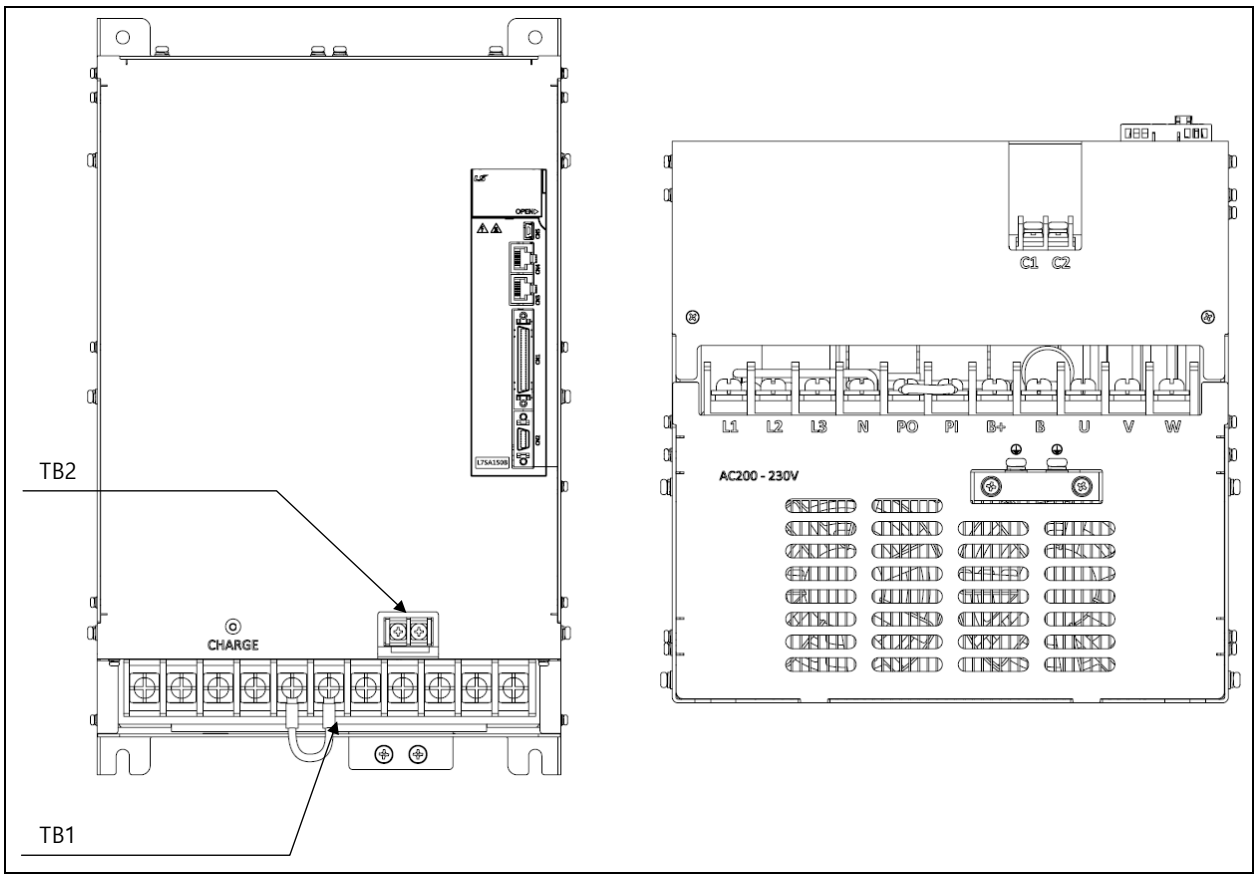
TB3

C1	C2

Terminal screw: M5
Tightening torque: 1.20[N·m]

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

(L7SA150B)



Terminal signal array

TB1

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

TB2

C1	C2

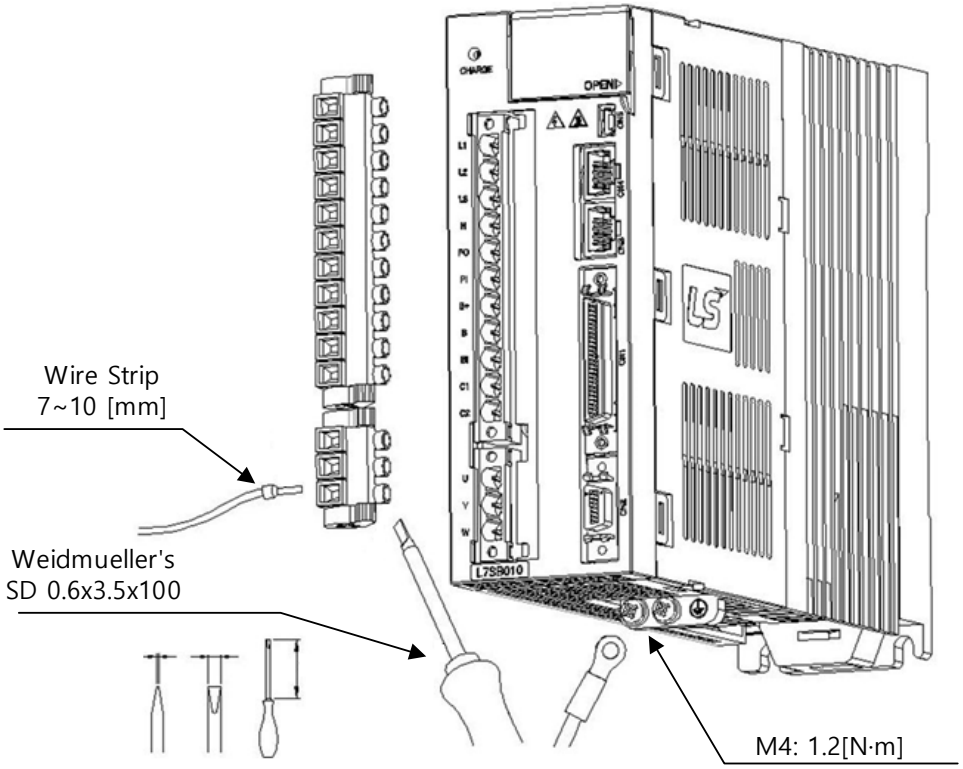
Terminal screw: M6
Tightening torque:
4.70[N·m]

Terminal screw: M4
Tightening torque:
1.20[N·m]

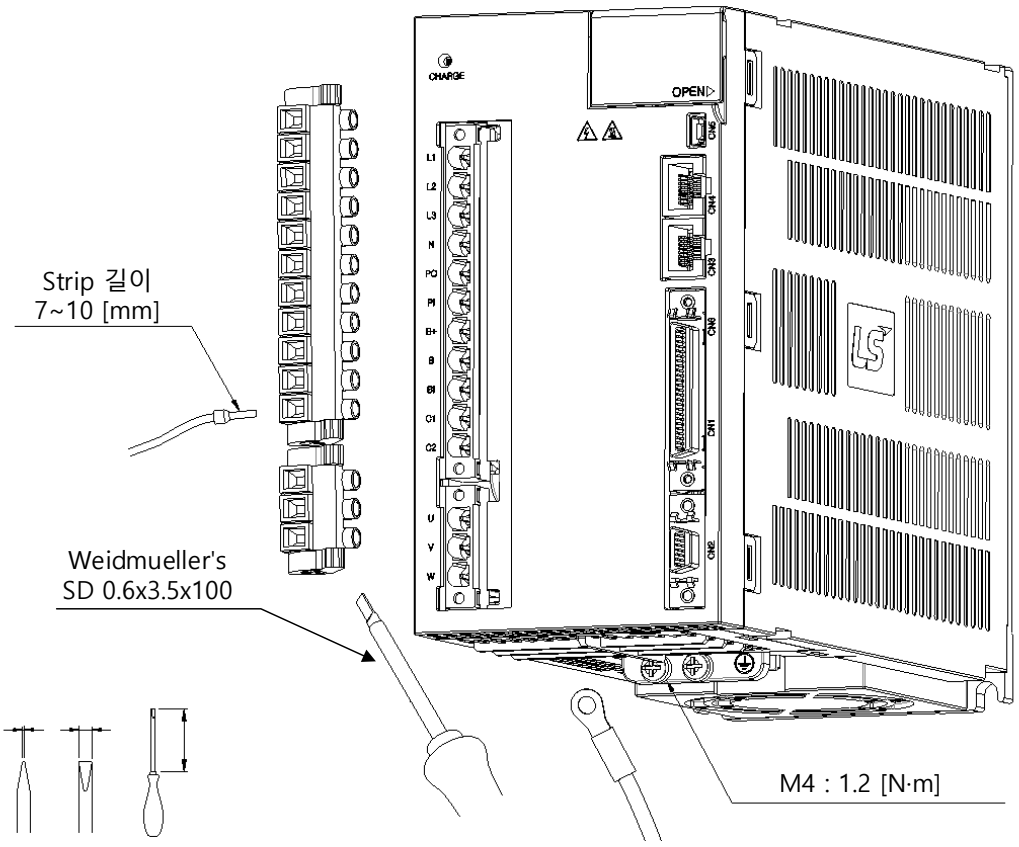
Terminal screw: M5
Tightening torque:
2.70[N·m]

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

(L7SB010B)



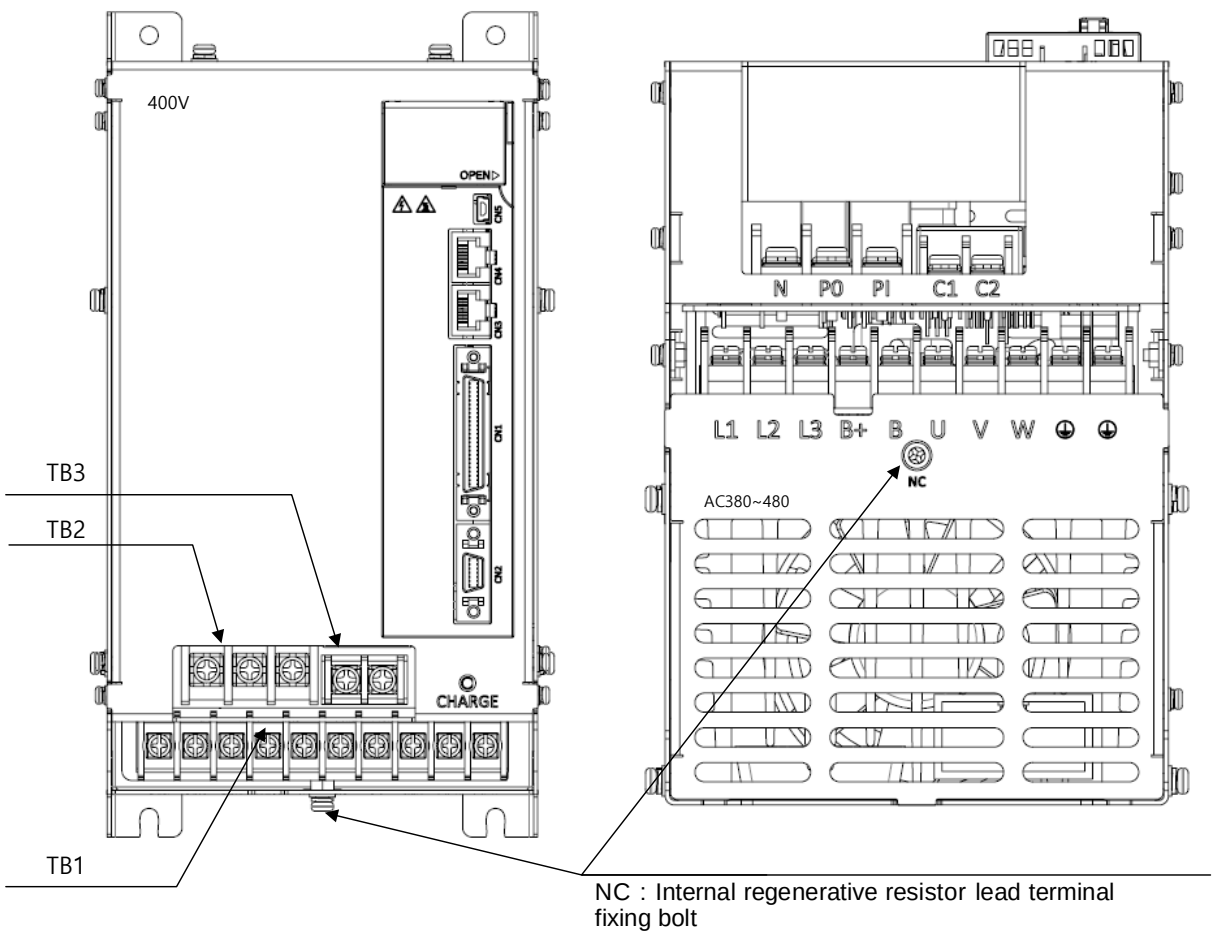
(L7SB020B ~ L7SB035B)



For information on wiring to BLF 5.08 and BLZ 7.62HP Series connector, refer to the above procedures.

1) Insert electric wire into insert hole with upper locking screw loosened, and use applicable flat head (-) 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 PE 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 PE contact failure and even malfunctioning drive.
6) For the flat head (-) drive, Weidmueller's SD 0.6x3.5x100 product is recommended.

(L7SB050B)



Terminal signal array

TB1

L1	L2	L3	B+	B	U	V	W	⏚	⏚

Terminal screw: M4
Tightening torque: 1.20[N·m]

TB2

N	PO	PI

Terminal screw: M4
Tightening torque: 1.20[N·m]

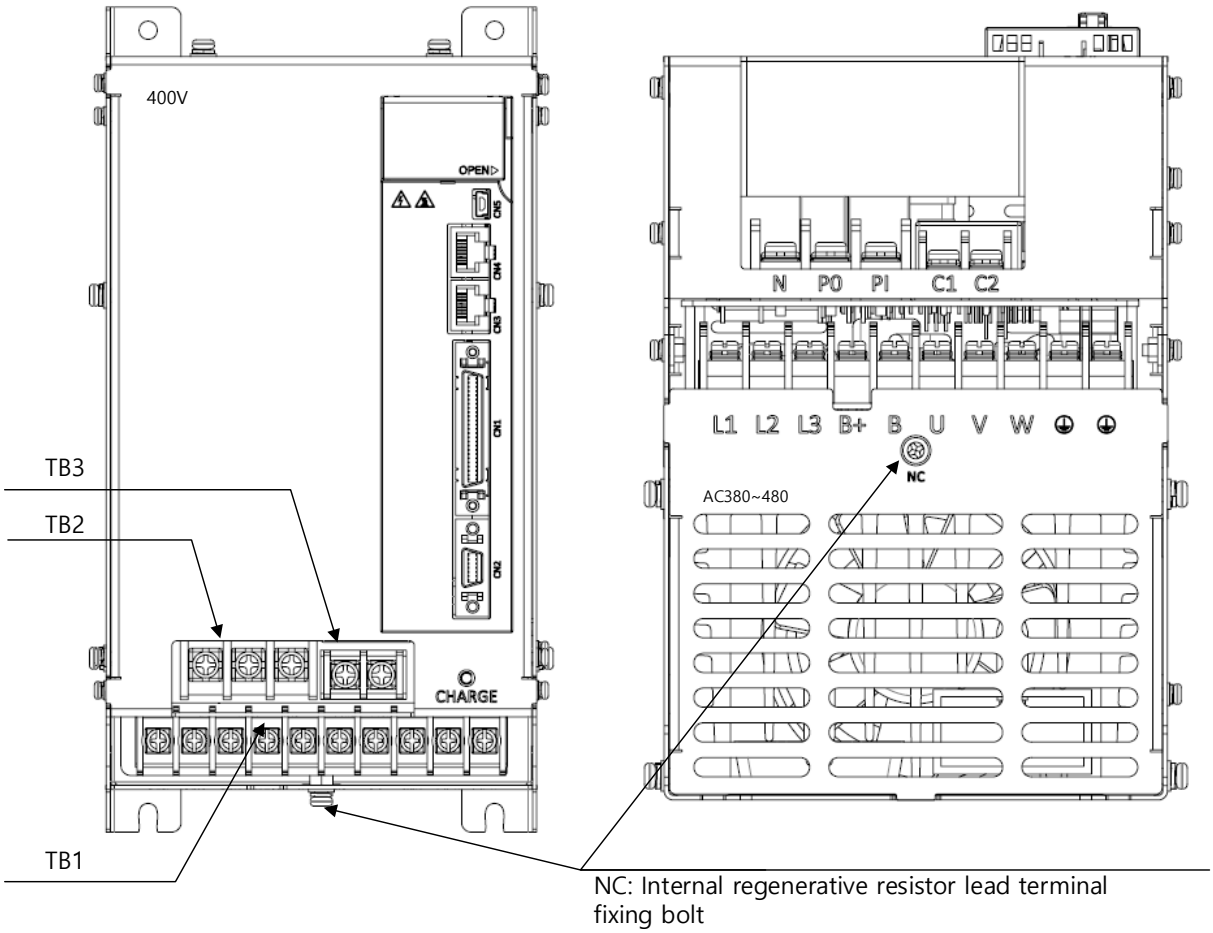
TB3

C1	C2

Terminal screw: M4
Tightening torque: 1.20[N·m]

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

(L7SB075B)



Terminal signal array

TB1

L1	L2	L3	B+	B	U	V	W

Terminal screw: M4
Tightening torque:
1.20[N·m]

TB2

N	PO	PI

Terminal screw: M4
Tightening torque:
1.20[N·m]

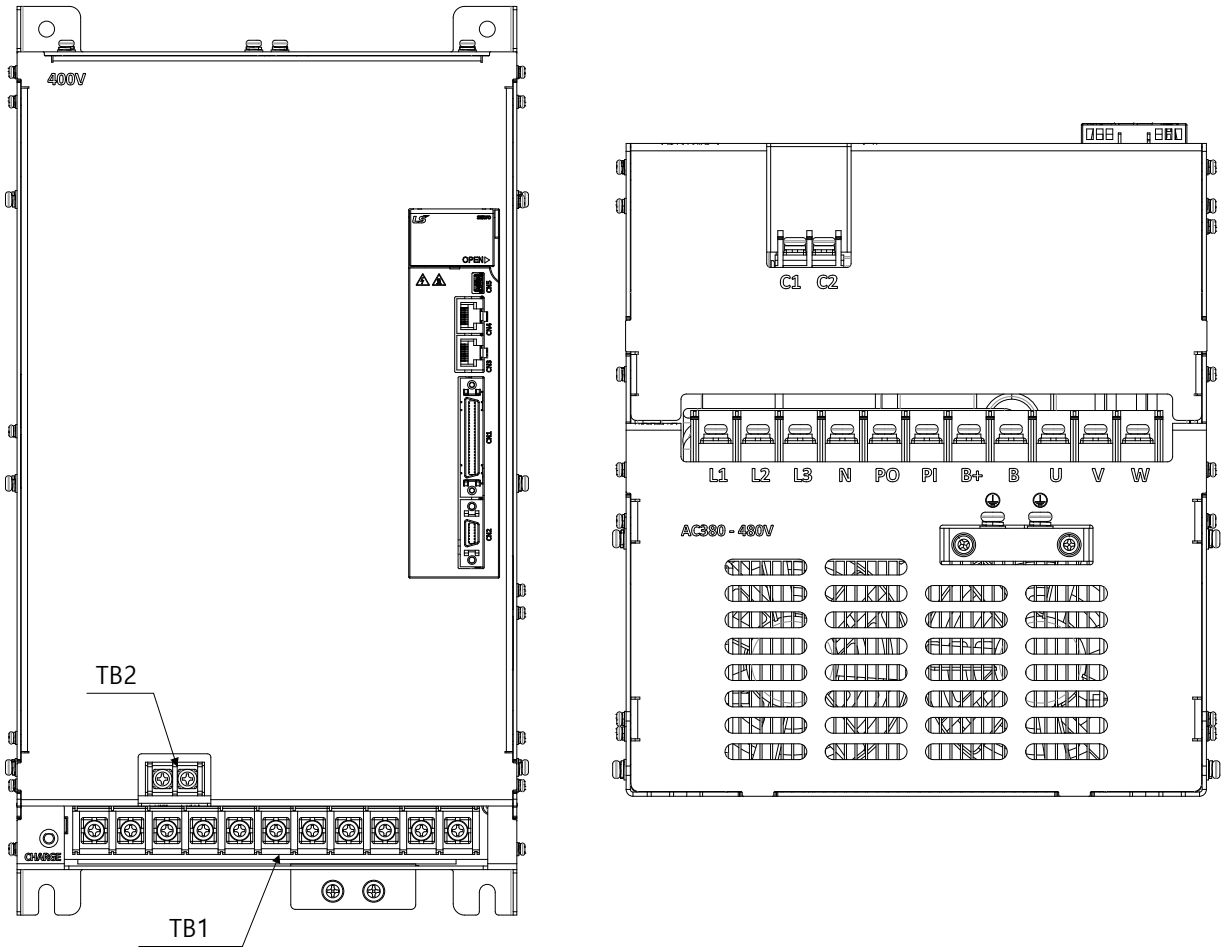
TB3

C1	C2

Terminal screw: M4
Tightening torque:
1.20[N·m]

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

(L7SB150B)



Terminal signal array

TB1

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

Terminal screw: M5
Tightening torque: 2.70[N·m]

TB2

C1	C2

Terminal screw: M4
Tightening torque: 1.20[N·m]

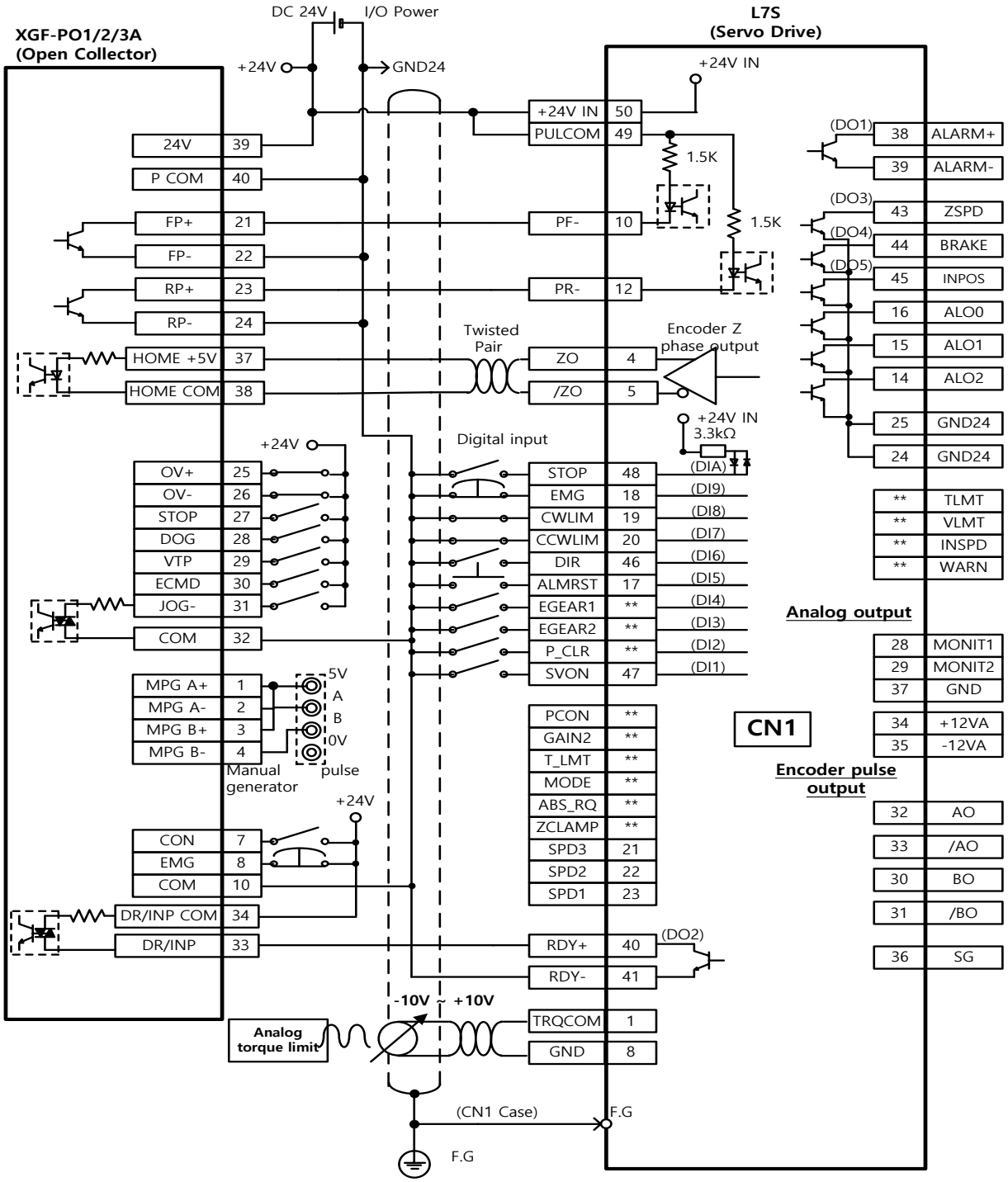
Terminal screw: M5
Tightening torque: 2.70[N·m]

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

4.3 Connection Example with PLC device

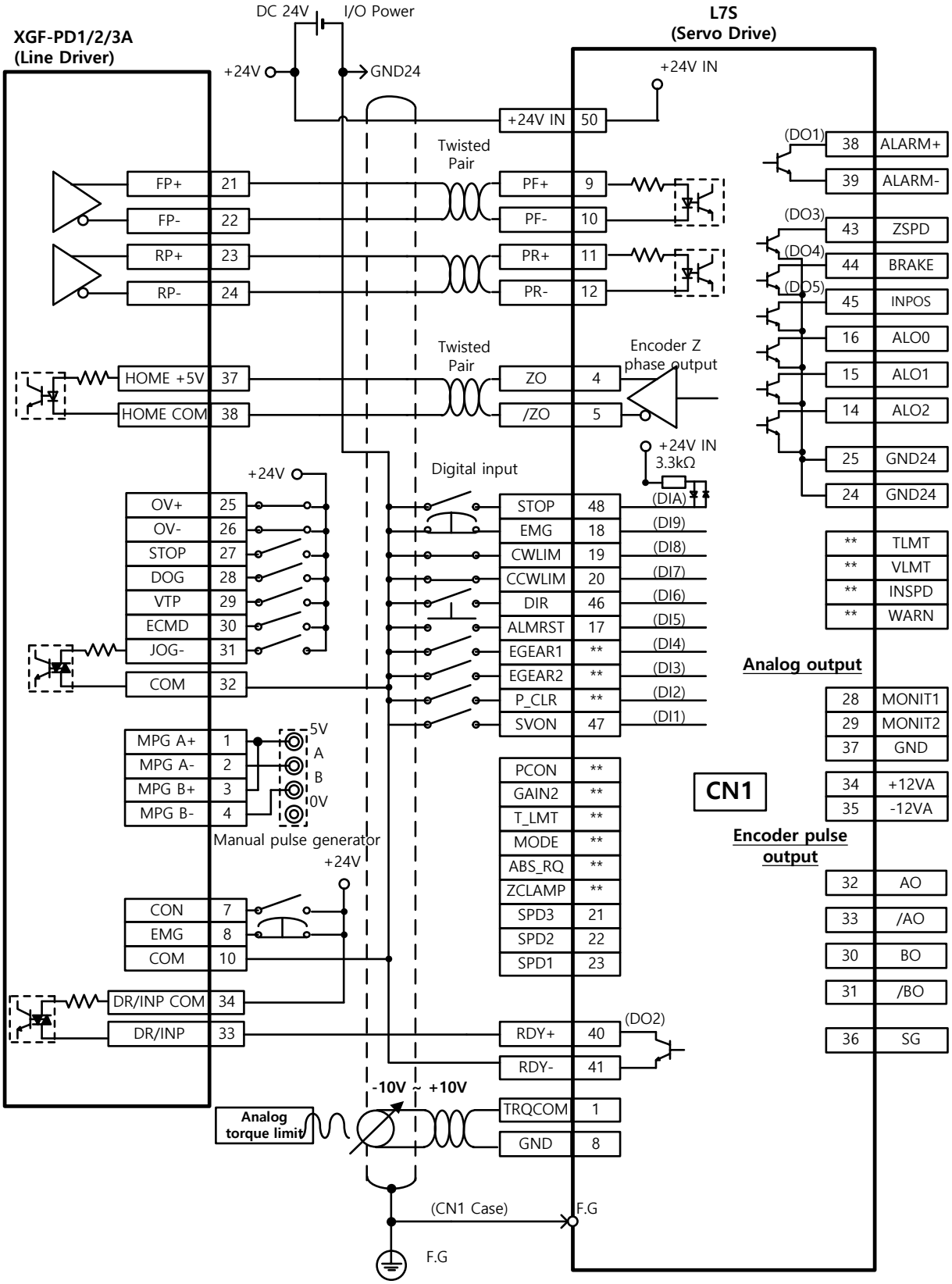
4.3.1 LS ELECTRIC

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



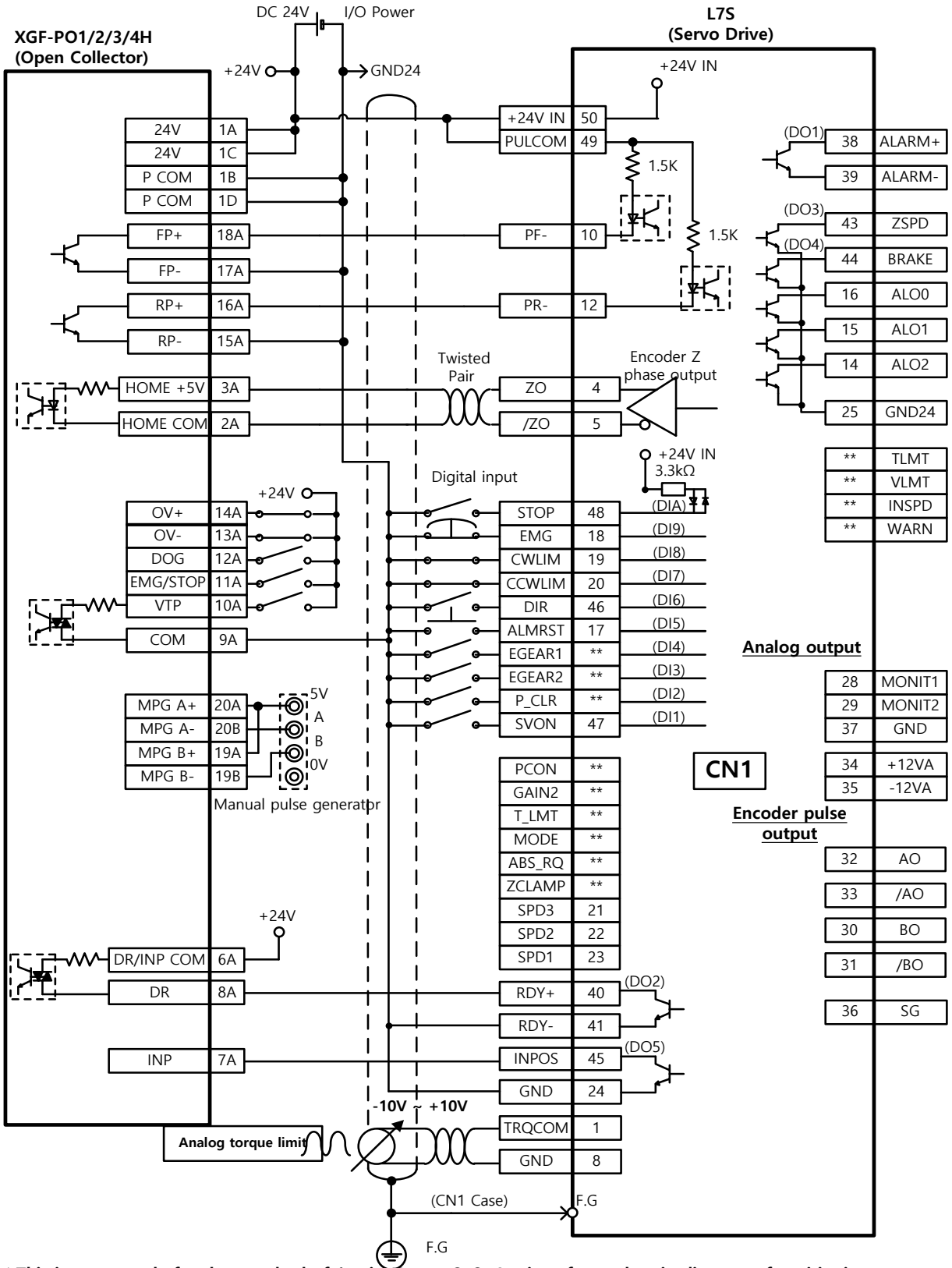
※This is an example for the standard of 1 axis. To use 2, 3 axis, refer to the pin diagram of positioning module.

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



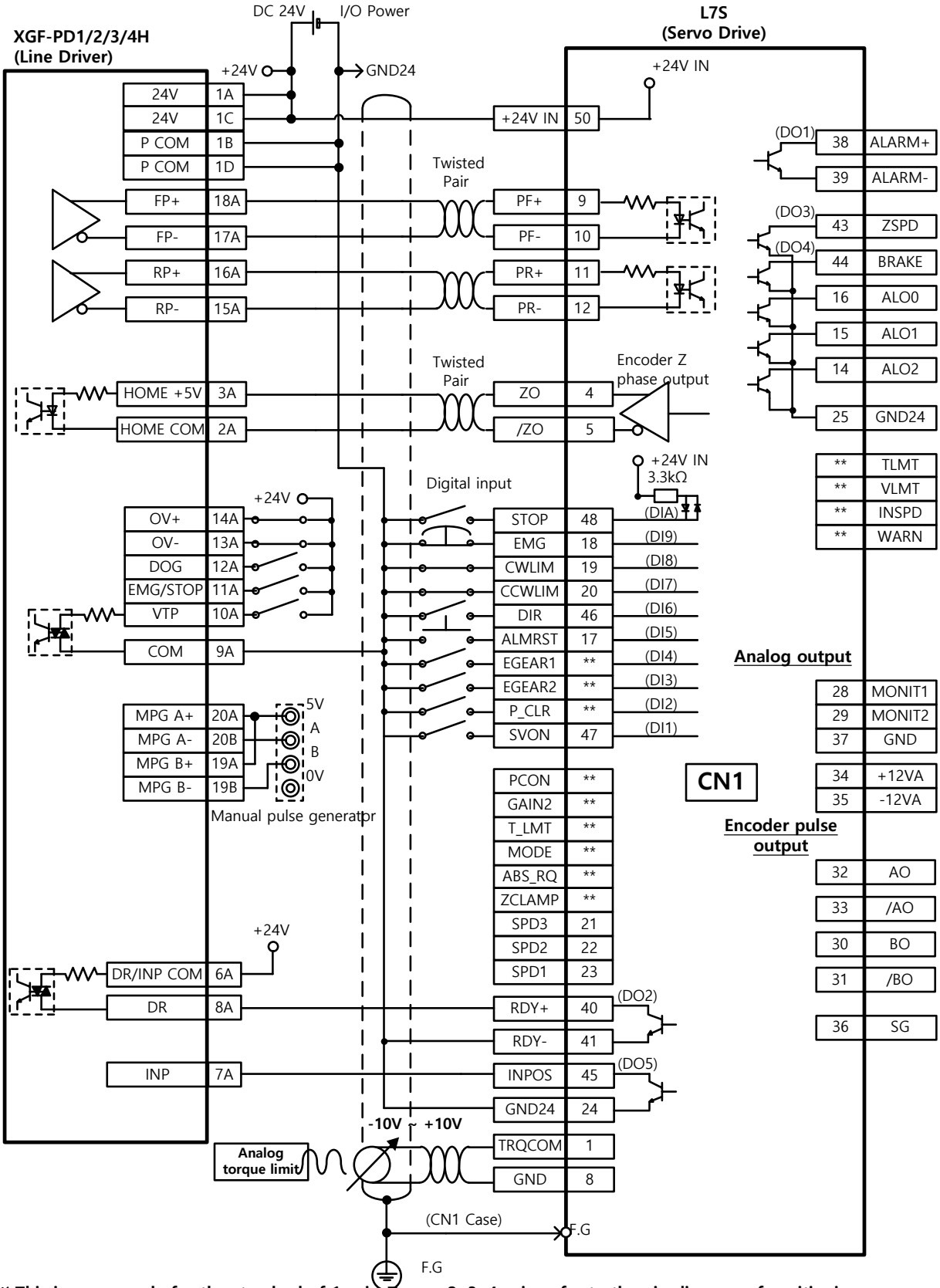
※ This is an example for the standard of 1 axis. To use 2, 3 axis, refer to the pin diagram of positioning module.

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



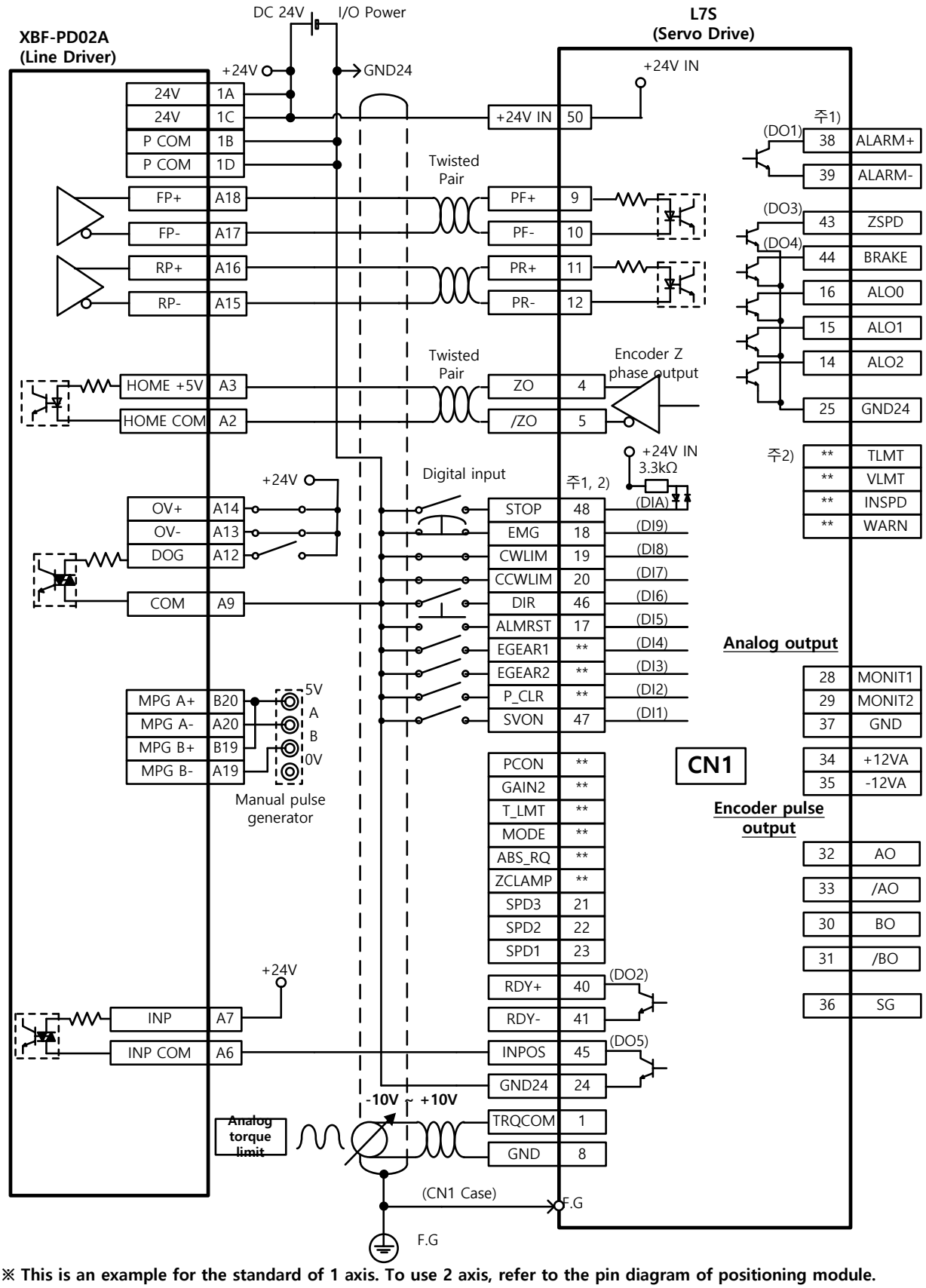
※ This is an example for the standard of 1 axis. To use 2, 3, 4 axis, refer to the pin diagram of positioning module.

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



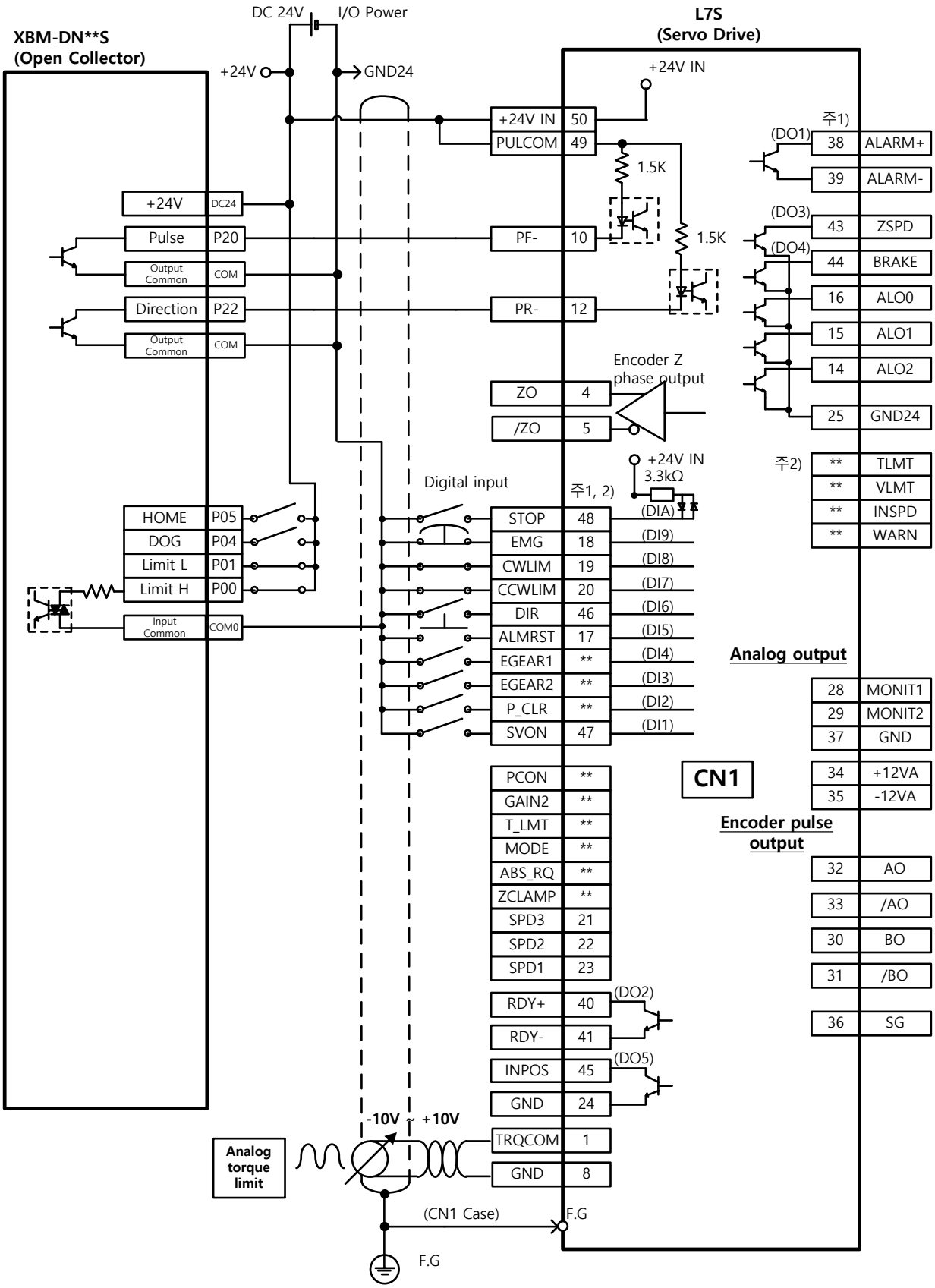
※ This is an example for the standard of 1 axis. To use 2, 3, 4 axis, refer to the pin diagram of positioning module.

5. XBF-PD2A (Line Driver)



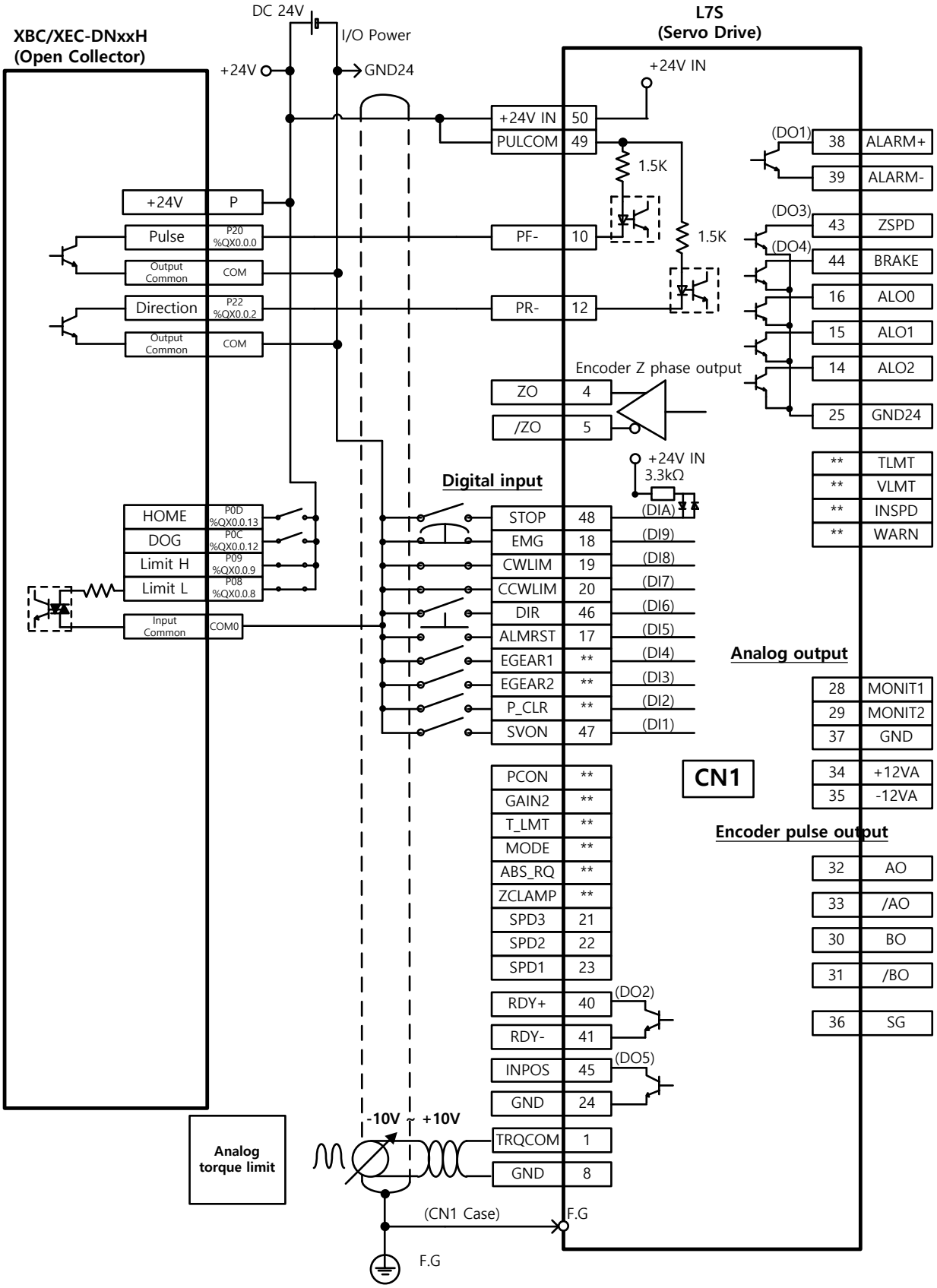
※ This is an example for the standard of 1 axis. To use 2 axis, refer to the pin diagram of positioning module.

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



This is an example for the standard of 1 axis. To use 2 axis, refer to the pin diagram of positioning module.

7. XBC/XEC-DNxxH (Open Collector)



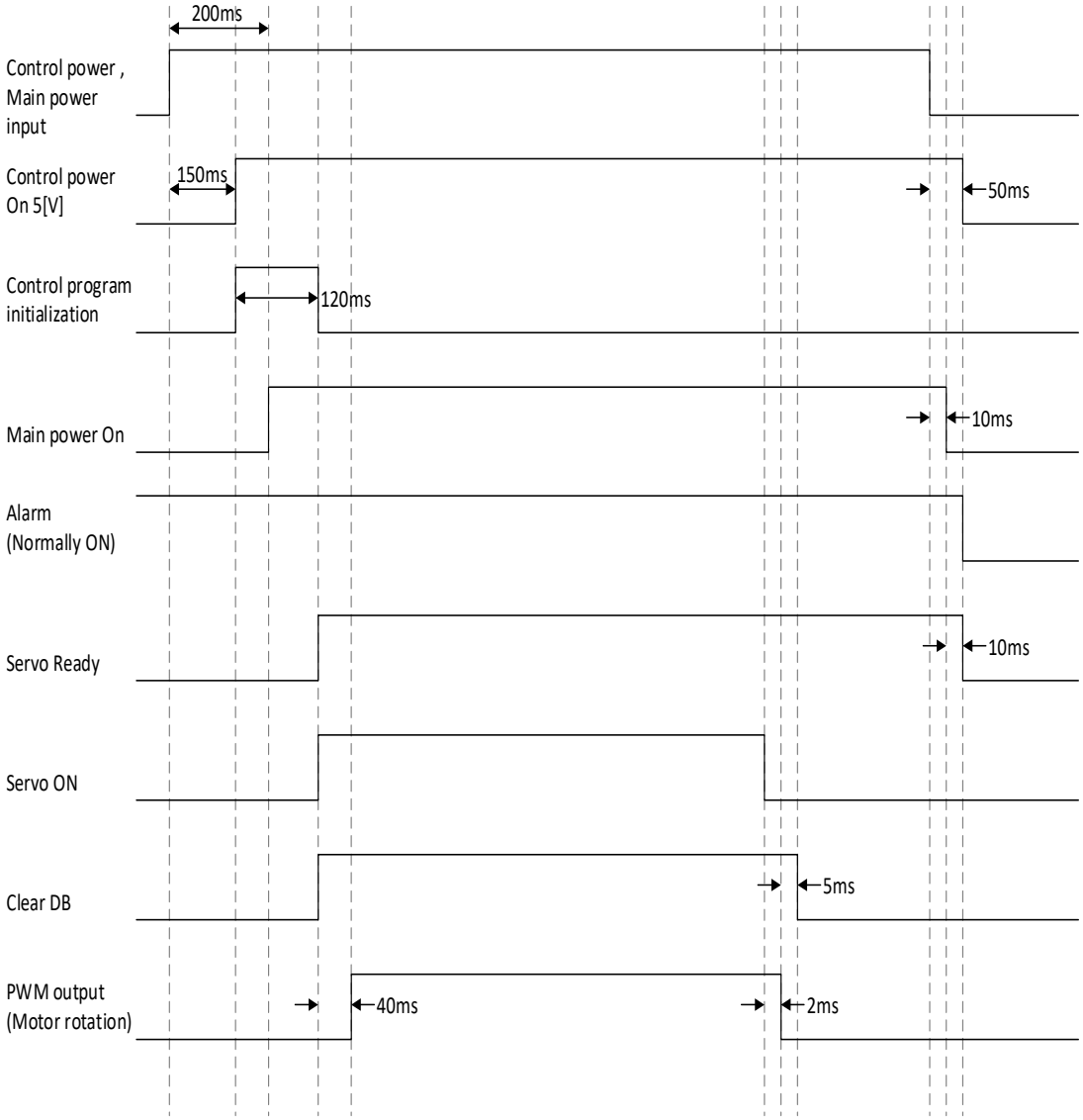
※ This is an example for the standard of 1 axis. To use 2 axis, refer to the pin diagram of positioning module .

4.4 Timing diagram

4.4.1 Timing diagram when power is turned on

In the L7 Series, power is supplied to the control circuit when single-phase power is connected to C1 and C2 terminals, and power is supplied to the main circuit when 3-phase power is connected to L1, L2, and L3.
(Connect after checking drive power)

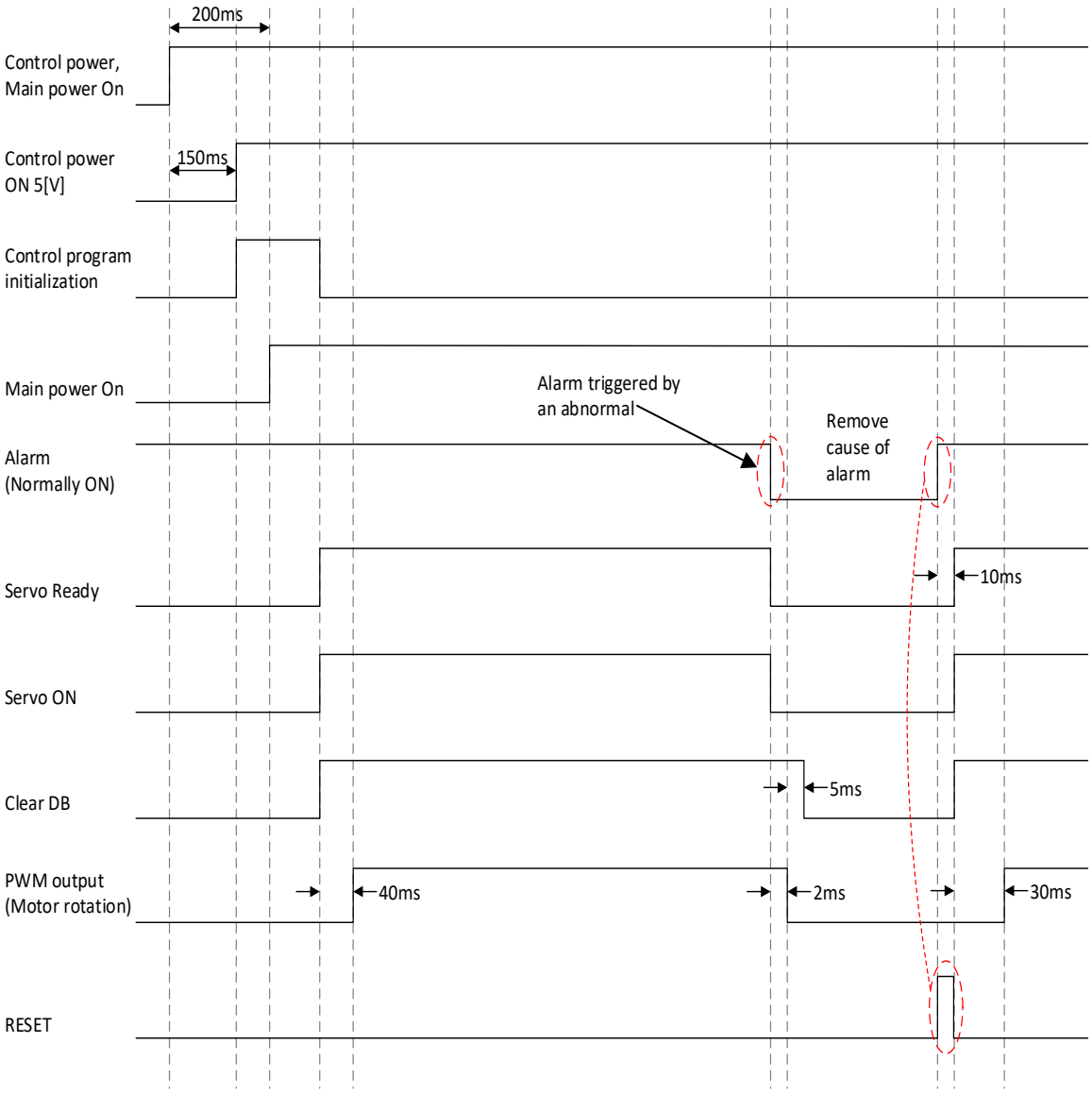
After a maximum of 120 [ms], which is the time required to initialize the inside of the driving device, the servo becomes Ready, and if the servo drive signal is turned ON, it operates after 40 [ms].



4.4.2 Timing chart when an alarm occurs

When an alarm occurs in the servo drive, PWM is blocked and the motor stops.

⚠Caution
▪ Remove the cause of the alarm and reset the alarm after turning off the servo motor drive command (servo ON) signal.

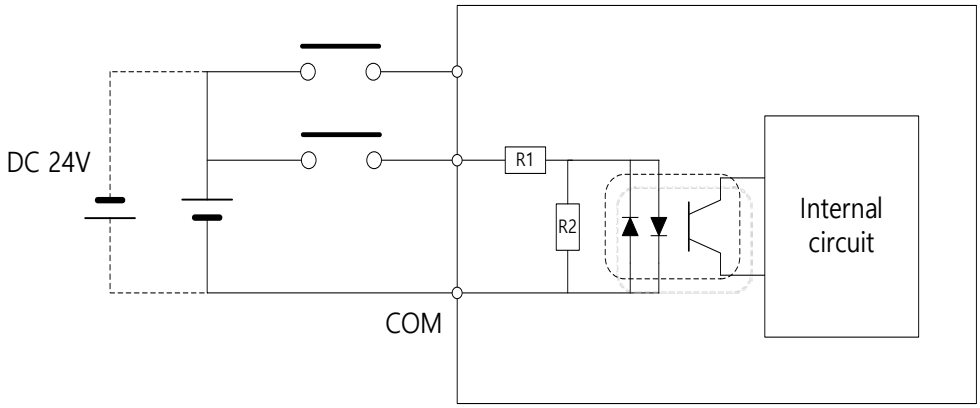


4.5 Control signal wiring

4.5.1 Contact input signal

⚠Caution

2. There are A contact and B contact depending on the characteristics of each signal, and it can be set by [P2-08] and [P2-09].
3. Each contact can be forcibly turned ON/OFF by [Cn-07]. When the power is turned off, each contact is automatically turned off, so special attention is required when using it.
4. It is possible to change the signal definition of each contact by [P2-00], [P2-01], [P2-02], [P2-03], [P2-04].

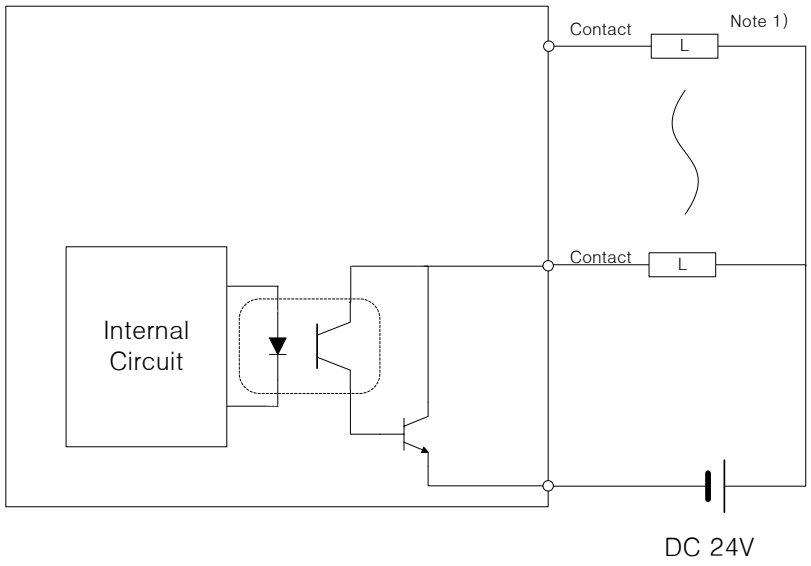


R1: 3.3KΩ, R2 : 680Ω

4.5.2 Contact output signal

⚠Caution

1. There are A contact and B contact for the output contact according to the characteristics of each signal, and it can be set by [P2-10].
2. Each contact can be forcibly turned ON/OFF by [Cn-08]. When the power is turned off, each contact is automatically turned off, and so special attention is required when using it.
3. It is possible to change the signal definition of each contact by [P2-05], [P2-06], [P2-07].
4. Overvoltage or overcurrent may damage may be because it uses an internal transistor switch.
   - Rated voltage and current: DC 24 V ± 10%, 120 mA



Note1) For DO1~ DO4 output signals, the GND24 terminal is separated.

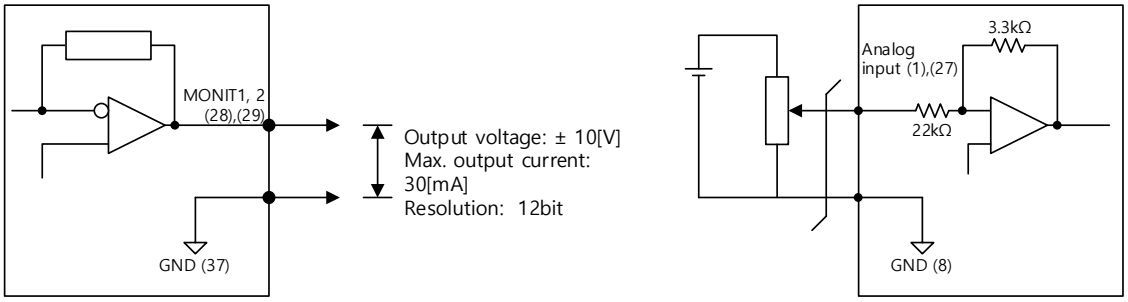
4.5.3 Analog input and output signal

1. Set GND to 0[V] of the control power supply.
2. Use the input signal command voltage within ±10[V] and the input impedance is 22[㏀].
3. Monitor 1 (No. 28), Monitor 2 (No. 29) output signal voltage is ±10 [V].

   Also, refer to the figure below when adjusting the analog input with a variable resistor using the drive-supplied power supply.

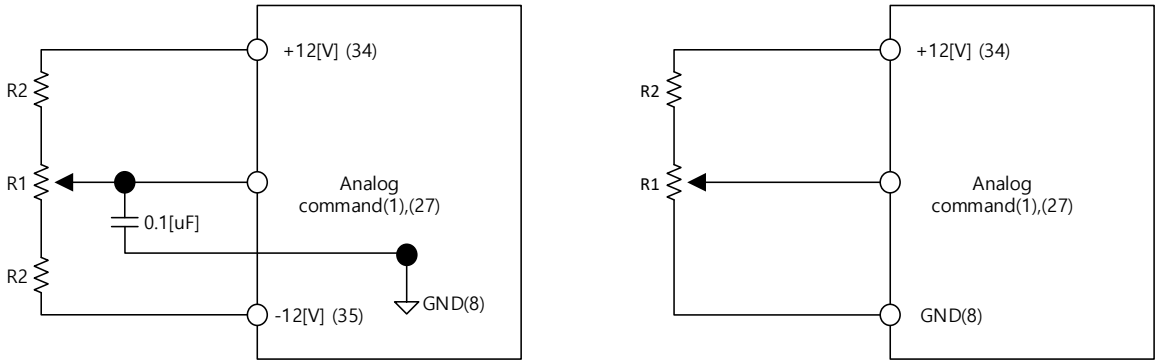
   The maximum output capacity of this power supply is 30 [㎃], so do not exceed the capacity.

<Servo drive>



<Analog output> <Analog input>

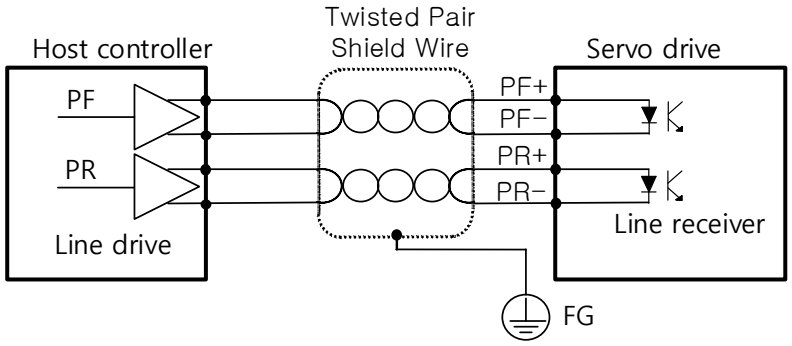
<Analog input example>



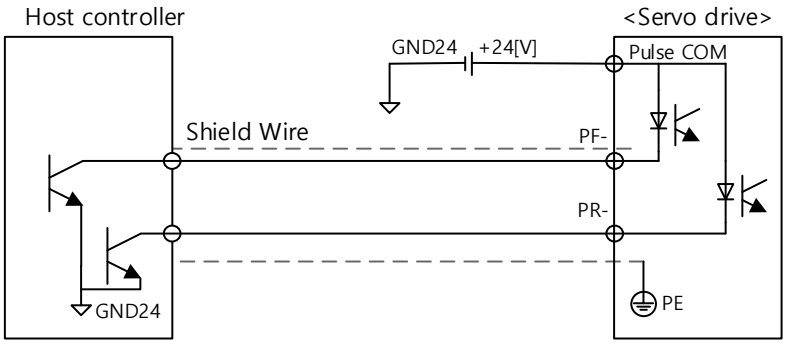
Type	R1	R2
Sel.1	10[kΩ]	660[Ω]
Sel.2	5[kΩ]	330[Ω]
Sel.3	2[kΩ]	132[Ω]

4.5.4 Pulse string input signal

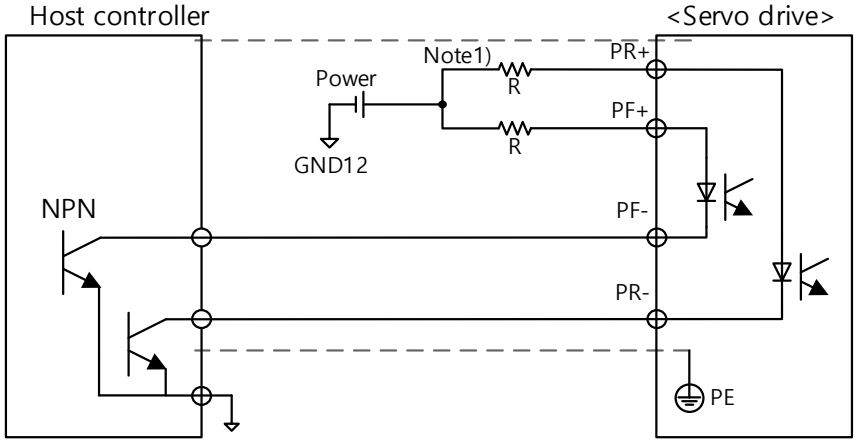
(1) Line drive(5[V]) Pulse input



(2) Open collector (24[V]) Pulse input

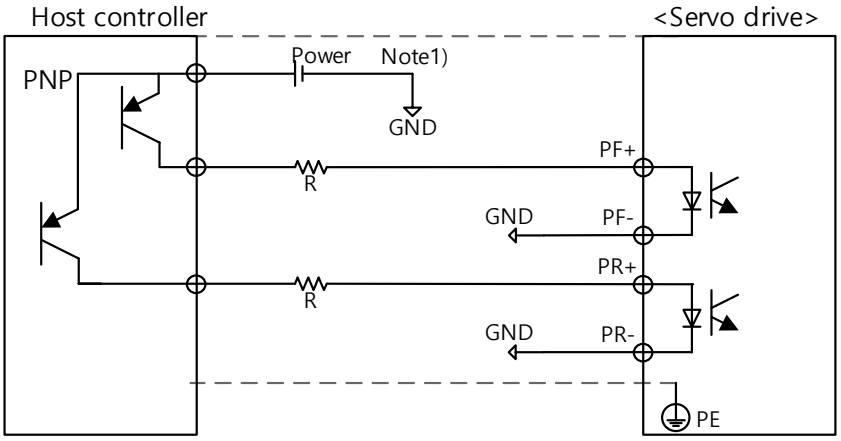


(3) 12[V] or 5[V] NPN open collector pulse command



Note1) When using 5[V] power: R= 100~150[Ω], 1/2[W]
When using 12[V] power: R= 560~680[Ω], 1/2[W]
When using 24[V] power: R= 1.5[kΩ], 1/2[W].

(4) PNP open collector type pulse command

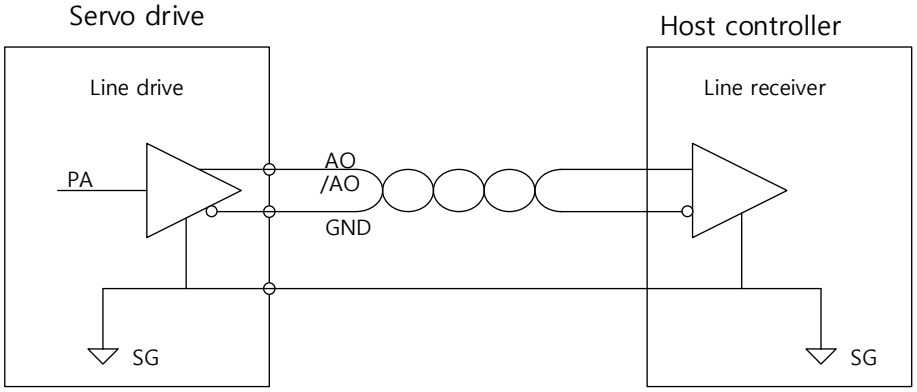


Note1) When using 5[V] power: R= 100~150[Ω], 1/2[W]
When using 12[V] power: R= 560~680[Ω], 1/2[W]
When using 24[V] power: 저항 R= 1.5[kΩ], 1/2[W].

4.5.5 Encoder output signal

Since the encoder signal is output based on GND of the control power supply, connect the GND terminal of the host control device and the GND terminal of CN1.

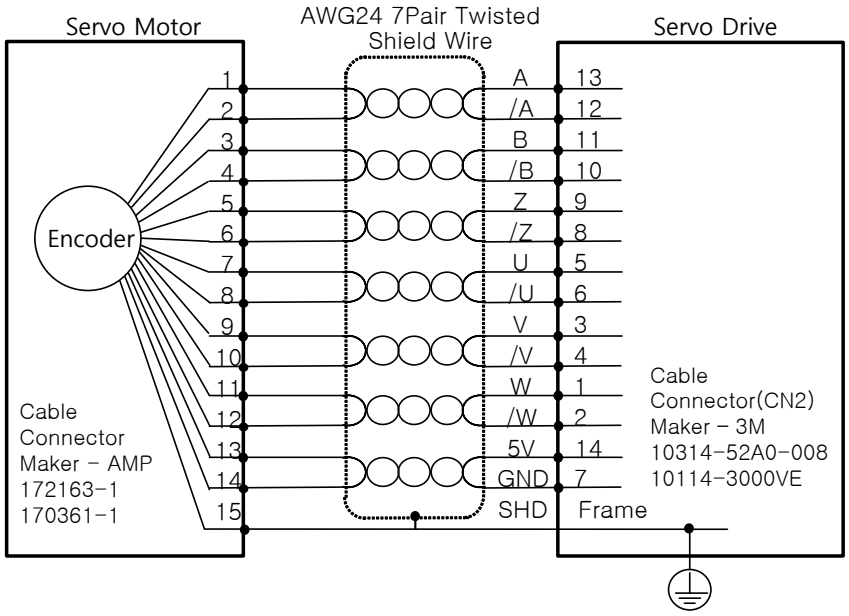
The encoder signal of the servo motor received from CN2 is divided by the division ratio set by [P0-14] and output in the line drive method.



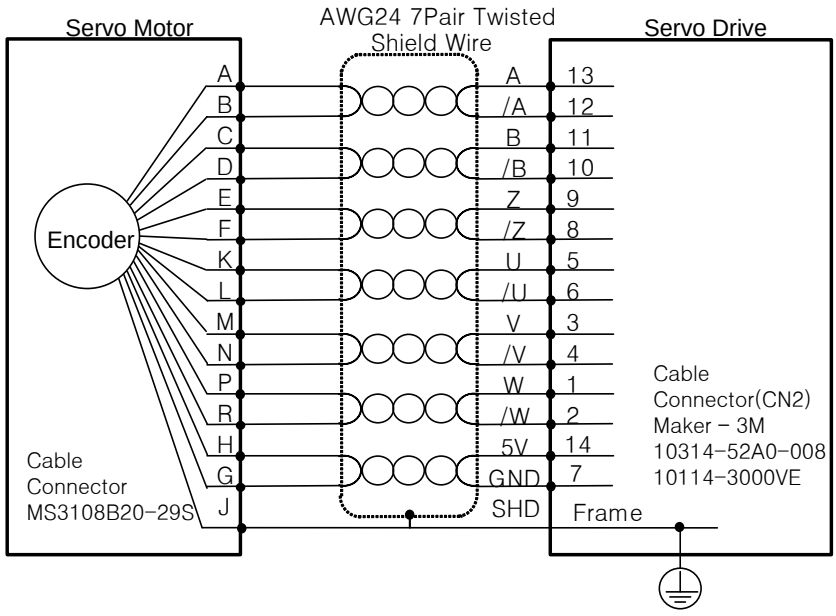
If Bit 3 of 'P0-17 Function Select Bit' is set to '1', open collector A, B, Z phases are output with the existing AL0, AL1, AL2 contact output. (Output current less than 40mA, maximum frequency 100 KHz)

4.6 Quadrature Encoder Signaling unit (CN2) wiring

4.6.1 APCS-E□□□AS cable

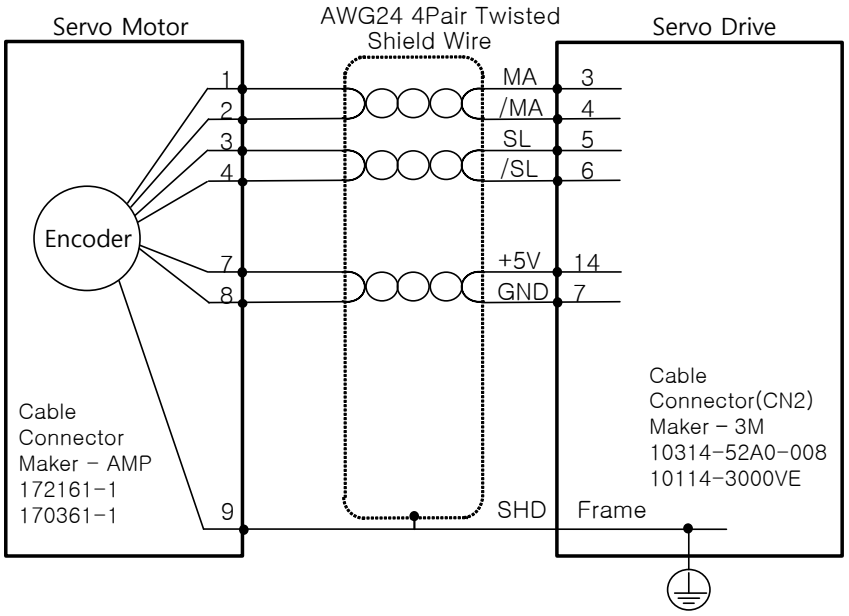


4.6.2 APCS-E□□□BS cable

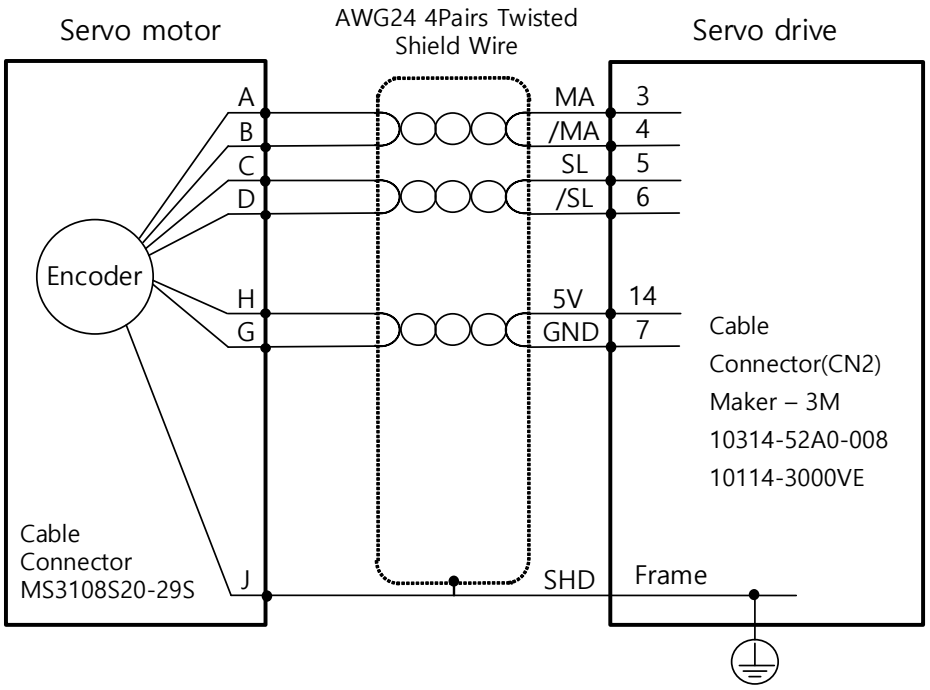


4.7 Serial Encoder Signaling unit (CN2) wiring

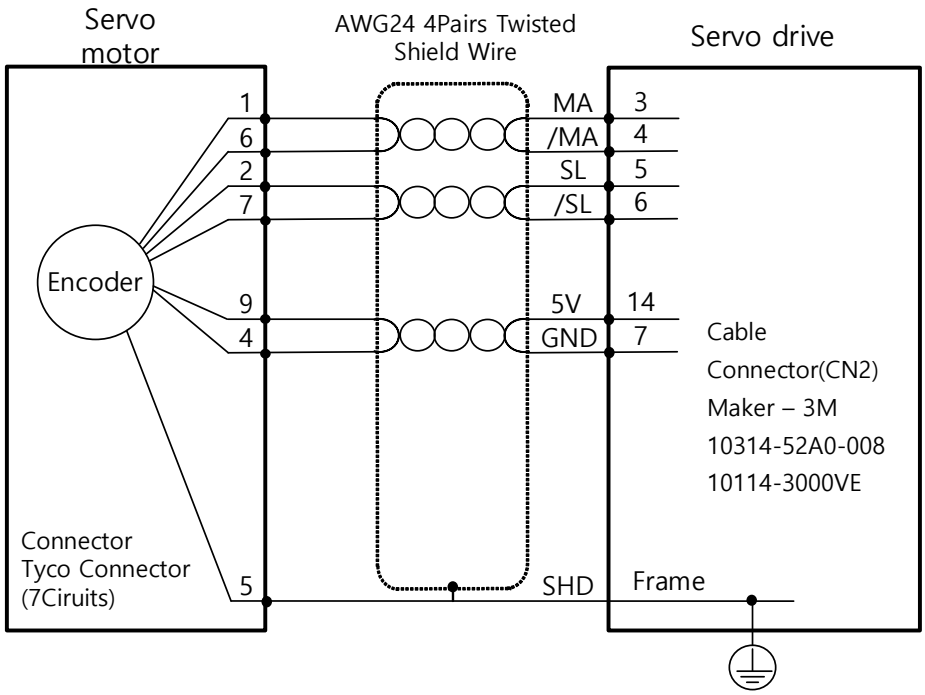
4.7.1 APCS-E□□□CS cable



4.7.2 APCS-E□□□DS cable

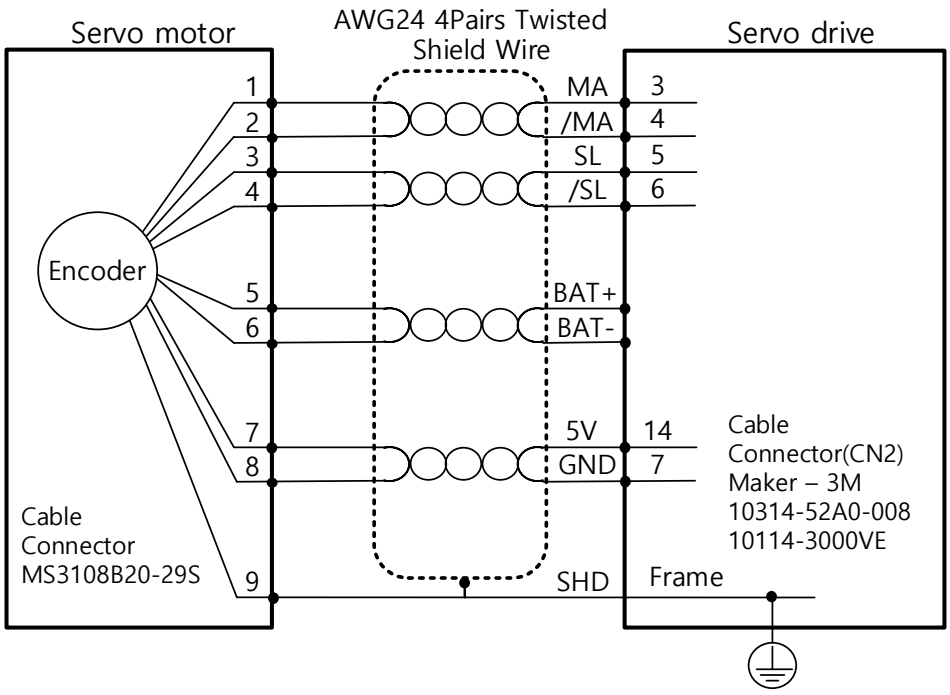


4.7.3 APCS-E□□□ES cable

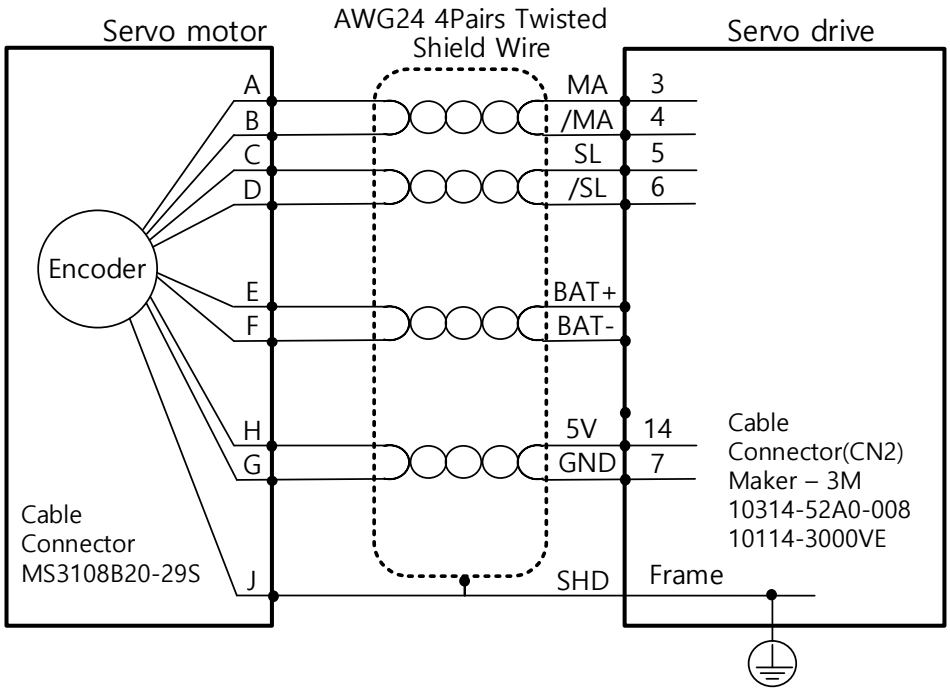


4.8 Multi Encoder Signaling unit (CN2) wiring

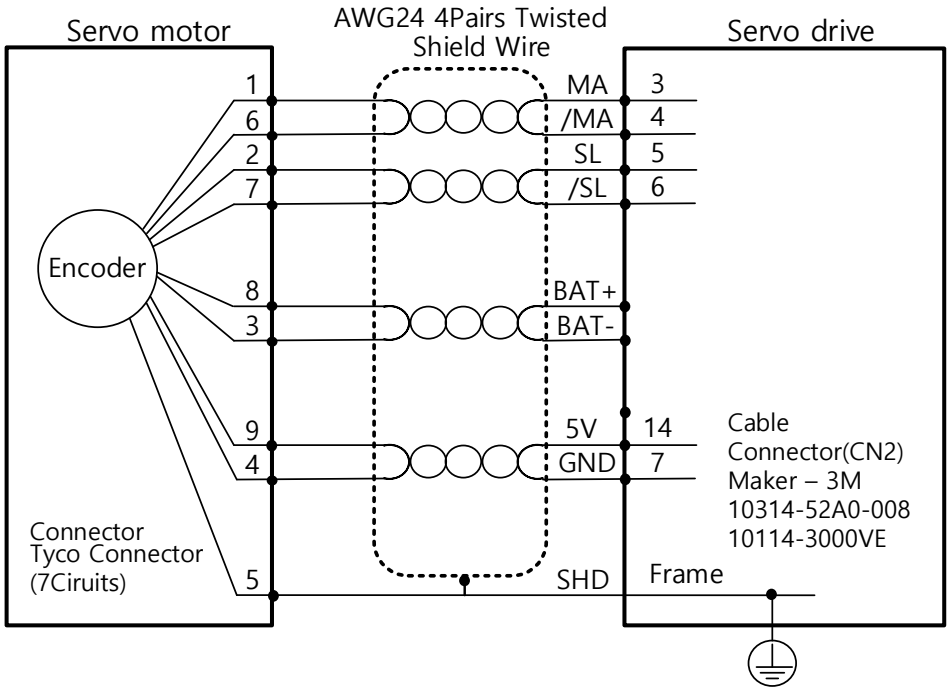
4.8.1 APCS-E□□□CS1 cable



4.8.2 APCS-E□□□DS1 cable



4.8.3 APCS-E□□□ES1 cable



4.9 Absolute encoder data transmission

4.9.1 Absolute encoder data transmission

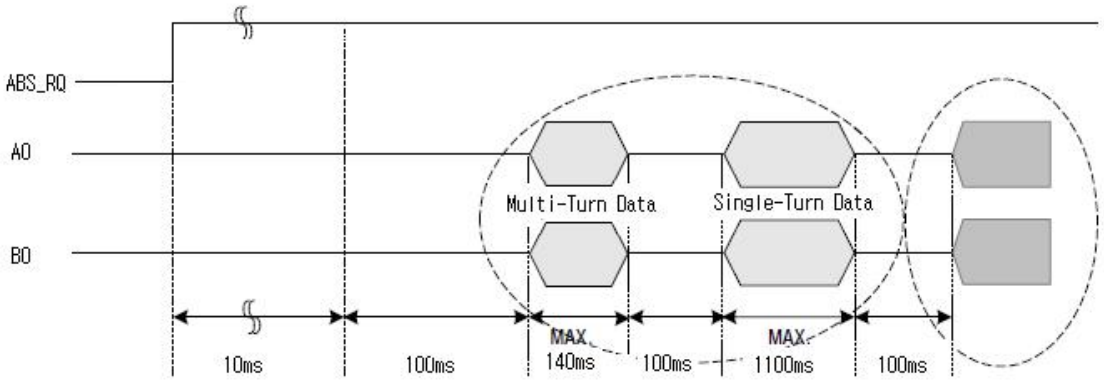
When absolute value data is requested from the absolute encoder, the absolute encoder data is transmitted to the host controller in the form of quadrature pulses through the output of AO and BO, which are encoder output signals.

At this time, the pulse is output at a speed of 500[Kpps].

Among absolute value data, multi-turn data is transmitted first and then single-turn data is transmitted. (However, refer to “5.1.8 External Input Signal and Logic Definition” for allocation of sequence input signal ABS-RQ signal.)

■ Sequence for sending absolute value data

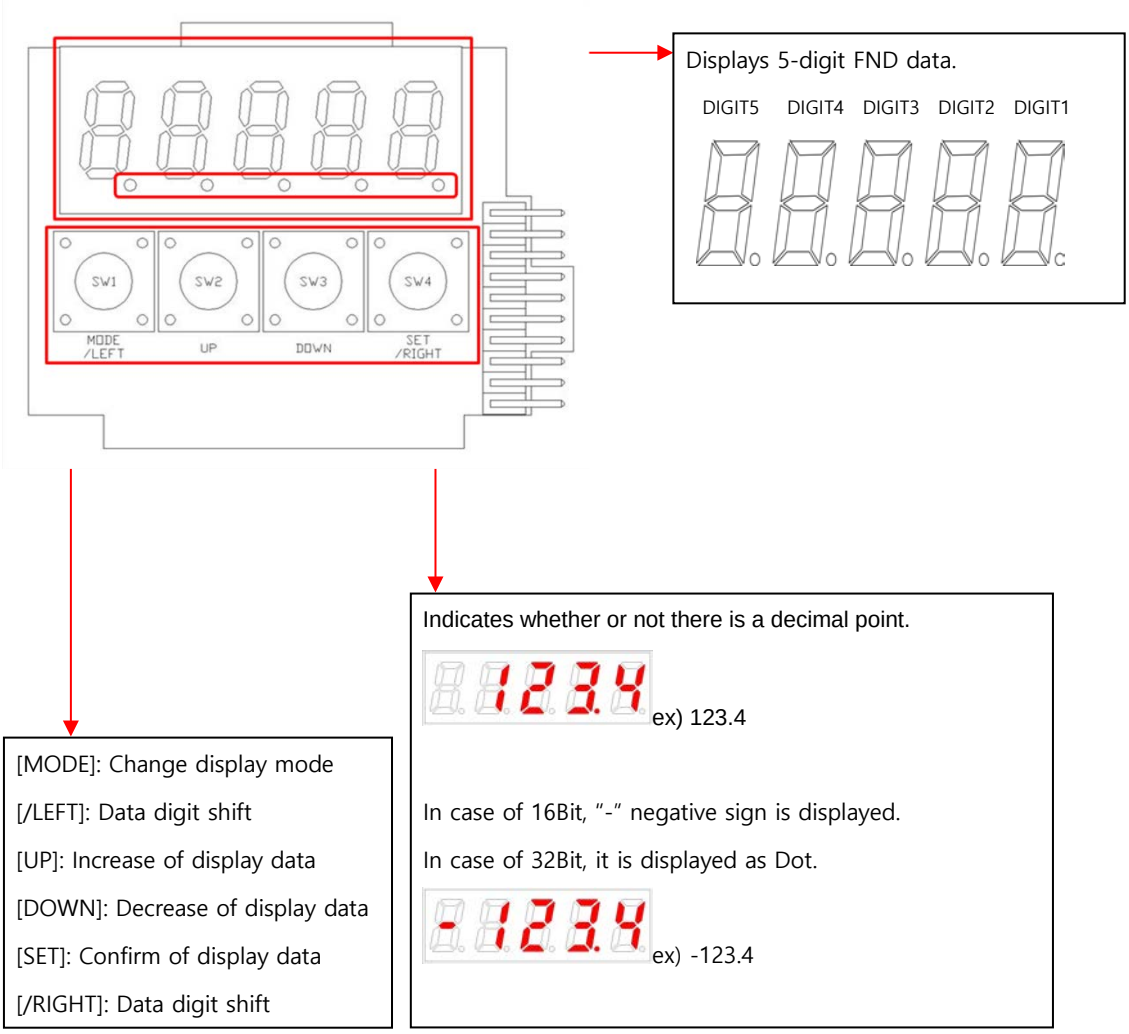
1. The Host controller turns the ABS_RQ signal ON while the servo is OFF.
2. The servo drive checks the ABS_RQ signal for 10 [ms].
3. The servo drive prepares to send multi-turn data for 100[ms].
4. The servo drive transmits multi-turn data for up to 140 [ms] (based on 16-bit multi-turn data).
5. The servo drive prepares to send single-turn data for 100 [ms].
6. The servo drive transmits the data (Single-turn Data) within one rotation with the division ratio applied for up to 1100 [ms] (based on 19-bit Single-turn Data).
7. In the servo drive, the normal encoder output signal operates 100 [ms] after completion of data transmission within one revolution.



5. Parameter Description

5.1 How to operate the loader

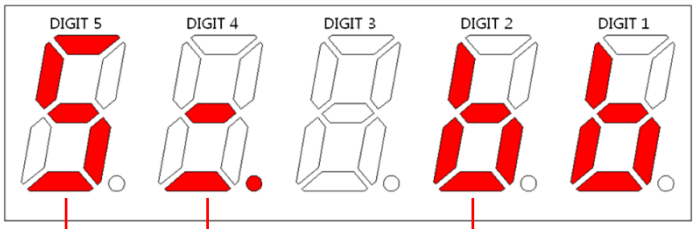
5.1.1 Name of each parts and function



5.1.2 Status summary diaplay

(1) Status summary display in speed mode.

① Servo OFF status example in speed control mode



DIGIT3~1: Display current servo status

- bb - servo OFF status
- run - servo ON status
- Pot - CCW Limit status
- not - CW Limit status

DIGIT4_high: ZSPD

DIGIT4_middle: INSPD or INPOS

DIGIT4_low: Command (speed or torque) status

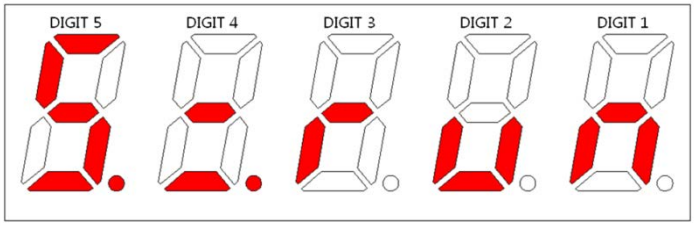
DIGIT4_DOT: READY status

DIGIT5: display of current control mode

- P - position control
- S - speed control
- T - torque control

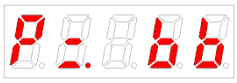
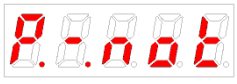
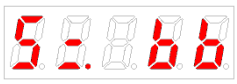
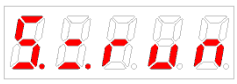
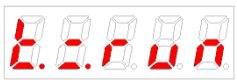
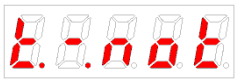
DIGIT5_DOT: Servo On Status

② Servo ON status example in speed control mode

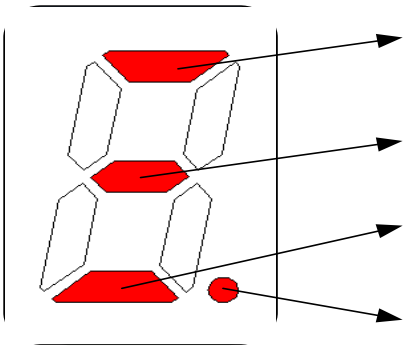


(2) Summary display list of servo operation status

The operation status summary display contents for each servo mode are listed as follows.

Operation status screen	Function	Reference
	Servo OFF status display in position mode	
	Servo ON status display in position mode	
	CCW status display in position mode	
	CW status display in position mode	
	Servo OFF status display in speed mode	
	Servo ON status display in speed mode	
	CCW status display in speed mode	
	CW status display in speed mode	
	Servo OFF status display in torque mode	
	Servo ON status display in torque mode	
	CCW status display in torque mode	
	CW status display in torque mode	

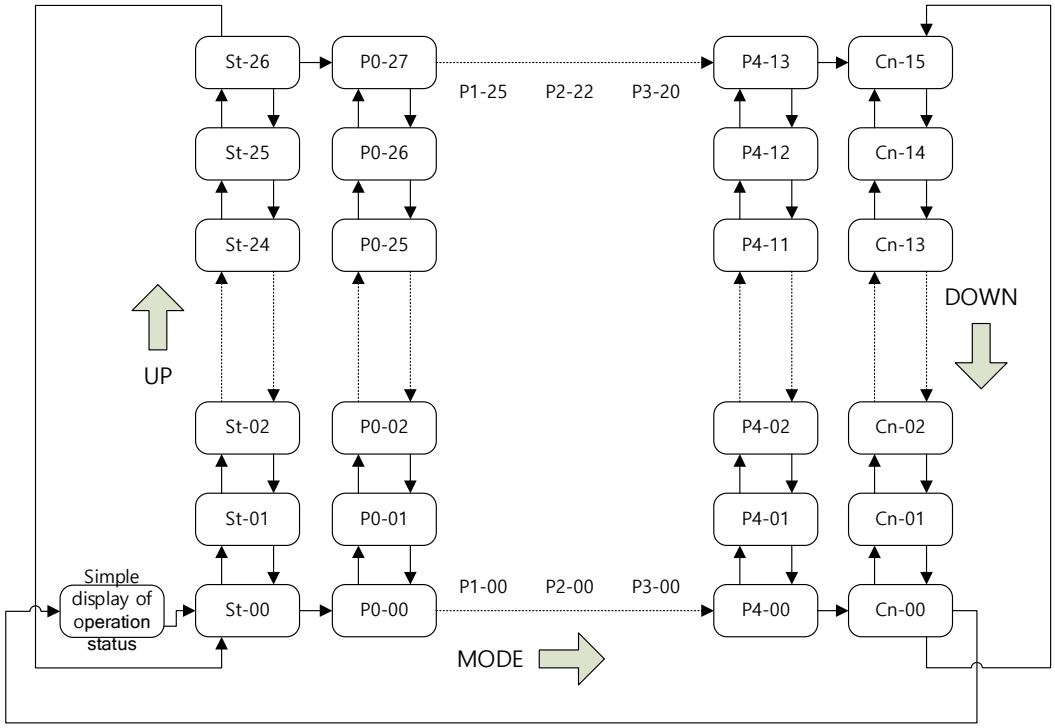
Display the current operation status and servo ready status.



5.1.3 Parameter operation

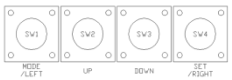
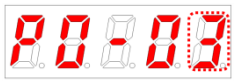
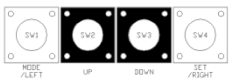
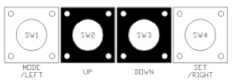
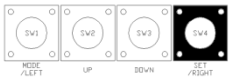
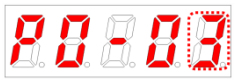
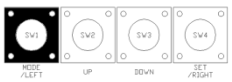
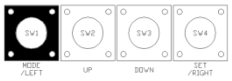
(1) Parameter move

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



- In the state where no alarm occurs at the beginning of startup, the speed operation mode [S= bb], which is a summary display of the operation status, is displayed.
- Parameters that can be edited are from [P0-00] to [Cn-15], and when the [SET] key is pressed while the corresponding parameter number is displayed, the parameter data is displayed and the parameter edit mode is entered.
- In the initial parameter editing state, the rightmost number blinks (0.5 sec ON, 0.5 sec OFF), and this number becomes the editable position.

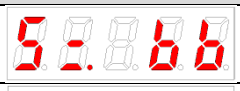
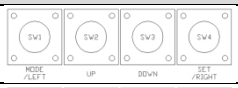
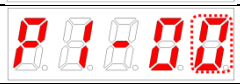
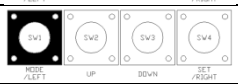
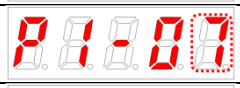
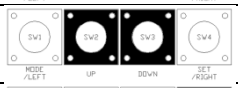
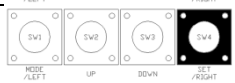
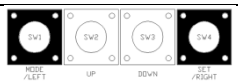
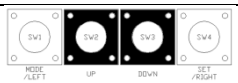
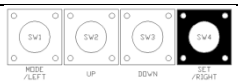
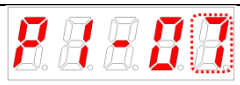
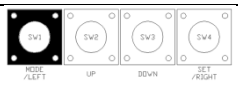
(2) Example of changing speed control mode to position control mode ([P0-03]: 00001 -> 00002)

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied
2			Press the [MODE] key to move to [P0-00].
3			Press the [Up] or [DOWN] key to move to [P0-03].
4			Press the [SET] key to enter the parameter edit window. 00001 is displayed for the corresponding parameter.
5			At the blinking cursor position, press [UP] or [DOWN] key to change to 00002.
6			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 00002 in the parameter.
7			Press and hold the [MODE] key for about 1 second to return to the P0-03 parameter.
8			Press the [MODE] key to change to the position operation [P= bb] status, which is the summary display of the current status.

Note1) “ ▯ “ is a blinking mark.

Note2) In the parameter window, holding down the [UP] / [DOWN] key at the current cursor will continuously increase and decrease the number.

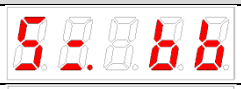
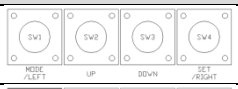
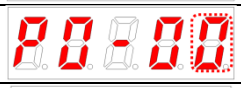
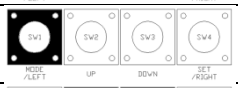
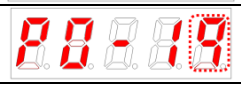
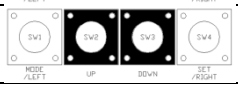
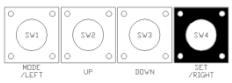
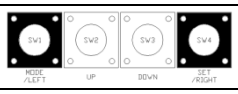
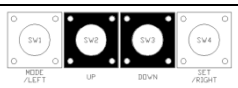
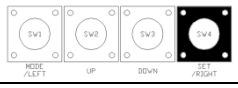
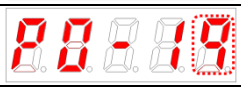
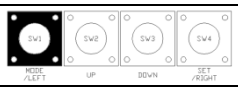
(3) Example of changing speed proportional gain 2 ([P1-07]: 200 [rad/s] -> 500 [rad/s])

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied
2			Press the [MODE] key to move to [P1-00].
3			Press the [Up] or [DOWN] key to and move to [P1-07].
4			Press the [SET] key to enter the parameter edit mode. 00200 is displayed for the corresponding parameter.
5			Press the [/LEFT] or [/RIGHT] key at the blinking cursor position to move to the desired digit DIGIT3.
6			At the blinking DIGIT3 position, press the [UP] or [DOWN] key to change it to 00500.
7			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 00500 in the parameter.
8			Press and hold the [MODE] key for about 1 second to return to the [P1-07 the

Note1) “ ▯ “ is a blinking mark.

Note2) In the parameter window, holding down the [UP] / [DOWN] key at the current cursor will continuously increase and decrease the number.

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

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied
2			Press the [MODE] key to move to [P0-00].
3			Press the [Up] or [DOWN] key to move to [P0-19].
4			Press the [SET] key to enter the parameter edit mode. 00000 is displayed for the corresponding parameter.
5			Press the [/LEFT] or [/RIGHT] key at the blinking cursor position to move to the desired digit DIGIT3.
6			At the blinking DIGIT3 position, press the [UP] or [DOWN] key to change it to -0500.
7			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as -0500 in the parameter.
8			Press and hold the [MODE] key for about 1 second to return to the [P0-19]

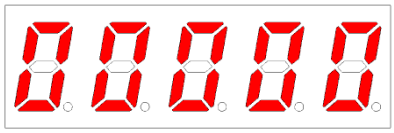
Note1) “ ▯ “ is a blinking mark.

Note2) In the parameter window, holding down the [UP] / [DOWN] key at the current cursor will continuously increase and decrease the number.

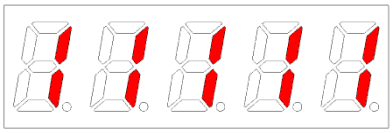
5.1.4 Data display

(1) Binary

① Minimum(0b00000)

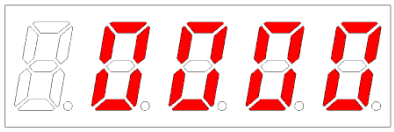


② Maximum(0b11111)

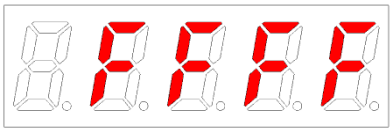


(2) Hex

① Minimum(0x0000)

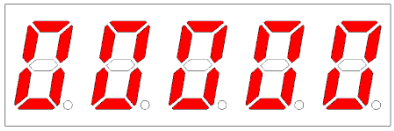


② Maximum(0xFFFF)



(3) 16Bit Unsigned Integer

① ex) 0



② ex) +1234

(4) 16Bit Signed Integer

① ex) -1234

② ex) +5678

① ex) -1234

② ex) +5678

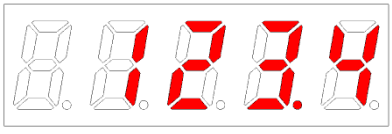
(5) 16Bit decimal point display

① ex) -123.4

② ex) +123.4

① ex) -123.4

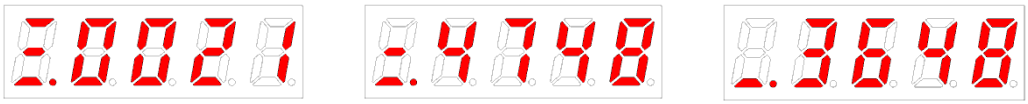
② ex) +123.4



(6) 32Bit Signed Integer data display

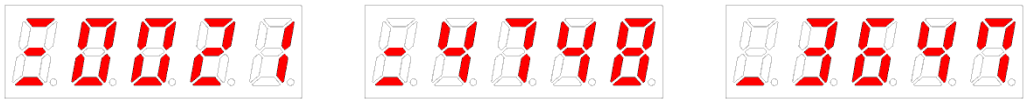
① Minimum(-2147483648)

<Show upper 2 digits> <Show middle 4 digits> <Show lower 4 digits>

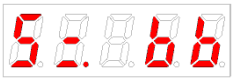
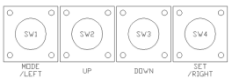
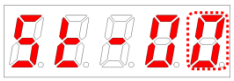
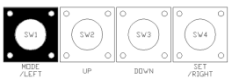
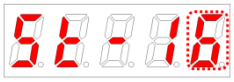
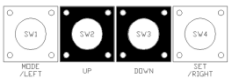
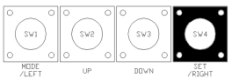
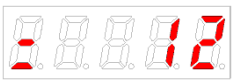
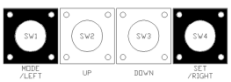
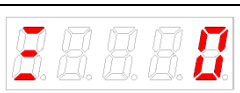
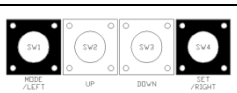
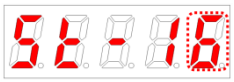
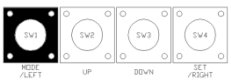


② Maximum(2147483647)

<Show upper 2 digits> <Show middle 4 digits> <Show lower 4 digits>



■ Operation Example) [St-16]: upper=0, middle=0012, lower=2071 are displayed.

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied
2			Press the [MODE] key to move to [St -00].
3			Press the [Up] or [DOWN] key to and move to [St -16].
4			Press the [SET] key to display lower data.
5			Every time [/LEFT] or [/RIGHT] is pressed, lower, middle, and upper data are displayed.
6			Every time [/LEFT] or [/RIGHT] is pressed, lower, middle, and upper data are displayed.
7			Press and hold the [MODE] key for about 1 second to return to the [So-16].

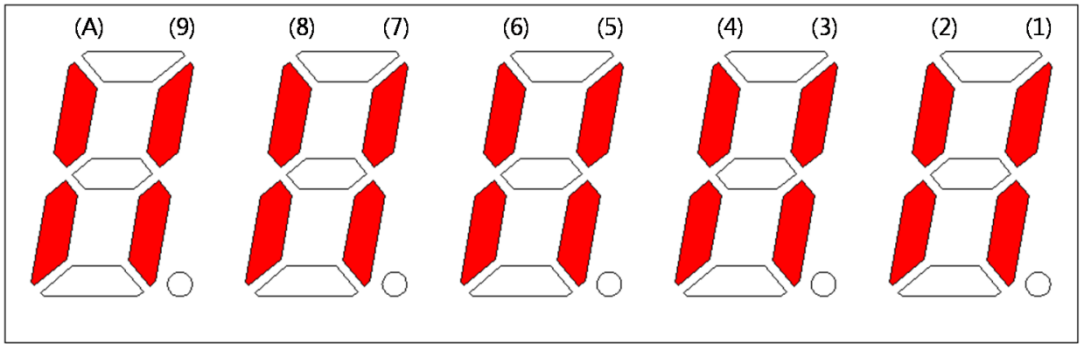
Note1) “ ▯ “ is a blinking mark.

5.1.5 External input signal display [St-14]

Check the ON/OFF status of digital input/output signals connected to the servo drive.

(1) External input signal display

Positioning of the 7-segment LED. The CN1 connector pins correspond as follows.



When the LED at the location corresponding to the pin is turned on, it indicates ON, and when it is turned off, it indicates OFF.

- < Input contacts Display>

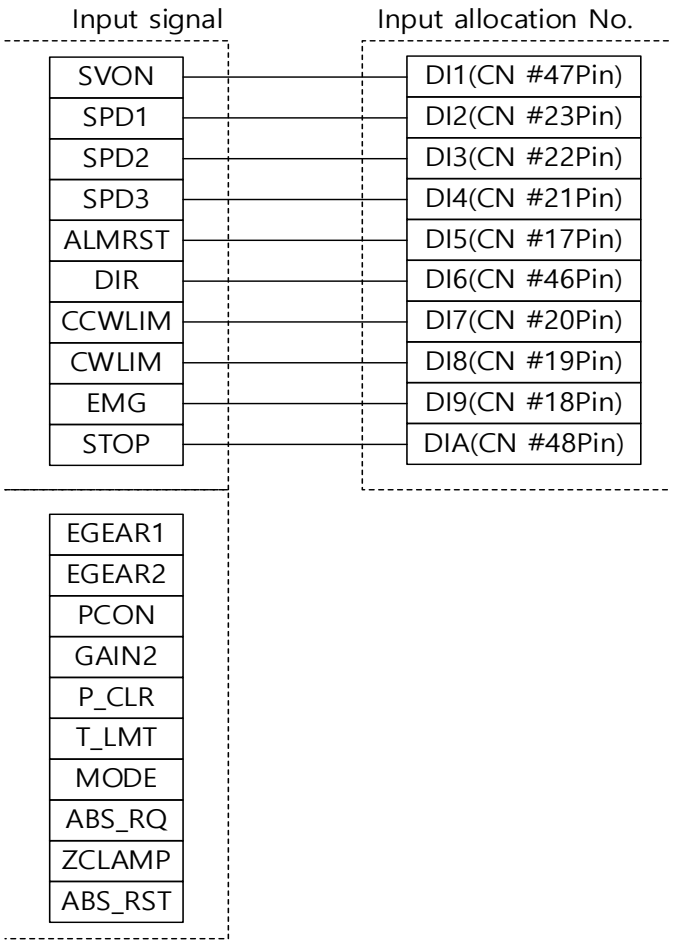
No.	(A)	(9)	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)
Contact point symbol	**DIA**	**DI9**	**DI8**	**DI7**	**DI6**	**DI5**	**DI4**	**DI3**	**DI2**	**DI1**
CN1 Pin No.	48	18	19	20	46	17	21	22	23	47
initial allocation Signal name	STOP	EMG	CWLIM	CCW LIM	DIR	ALM RST	SPD3	SPD2	SPD1	SVON

5.1.6 External input signal and logic definition

The allocation of input signals and how to check the allocation status are shown below.

(1) Assignment of input signal

In the L7 drive, a total of 19 input contact points can be assigned to 10 hardware points. [P2-00], [P2-01], [P2-02], [P2-03], [P2-04] parameters of each input contact function are arranged in the designated DIGIT, and the value of the corresponding DIGIT is changed. Be assigned to the pins of DI1~DIA.
The allocation status of input signals at the time of shipment is shown in the figure below. Duplicate allocation of input signals is possible with N (input signal): 1 (input allocation number).
Ex> When SVON and SPD1 are assigned to DI #01, SVON and SPD1 signals can be used simultaneously when DI #01 signal is input.



⚠Caution
When the input contact function is changed, it is immediately applied to the drive, so care must be taken in operation. Before change, it is recommended to set the 'EEPROM storage not in use' function of [P0-17] parameter DIGIT 5.

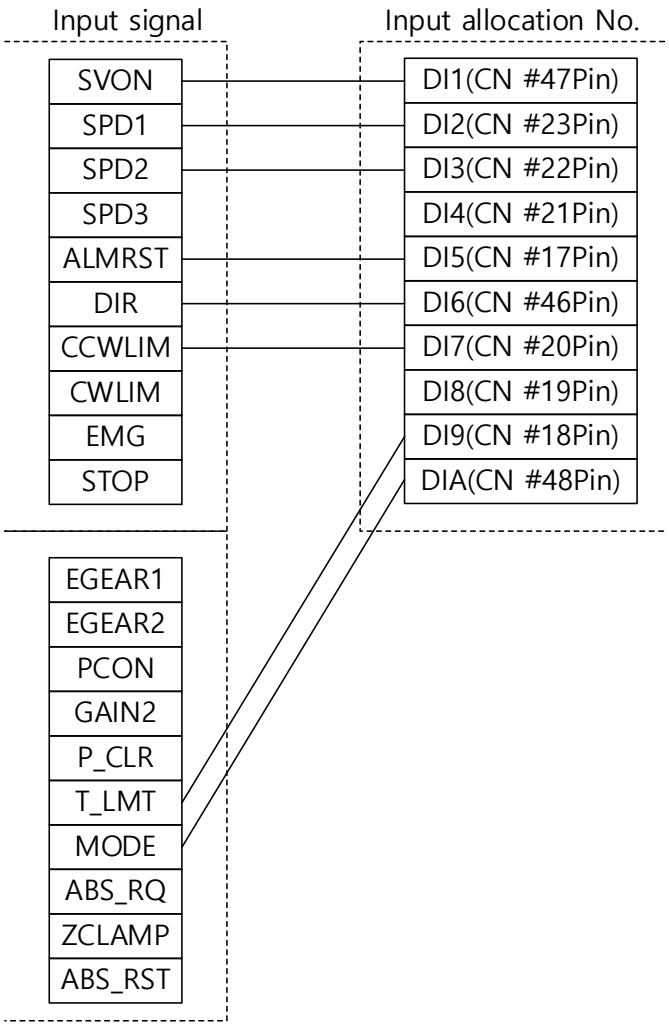
Signal name / Parameter assignment	Input signal	Always assigned	CN1 pin default assignment number										Not allocated	Input Signal Definition	Default setting value
			48	18	19	20	46	17	21	22	23	47			
Servo On[P2-00] DIGIT1 setting	SVON	F	A	9	8	7	6	5	4	3	2	**1**	0	[P2-00]	0x4321
Multi-speed1 [P2-00]. DIGIT2 setting	SPD1	F	A	9	8	7	6	5	4	3	**2**	1	0		
Multi-speed2 [P2-00]. DIGIT3 setting	SPD2	F	A	9	8	7	6	5	4	**3**	2	1	0		
Multi-speed3 [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
Rotation direction selection [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		
Electrical gearing ratio [P2-02]. DIGIT3 setting	EGEAR1	F	A	9	8	7	6	5	4	3	2	1	**0**		
Electrical gearing ratio [P2-02]. DIGIT4 setting	EGEAR2	F	A	9	8	7	6	5	4	3	2	1	**0**		
P control [P2-03]. DIGIT1 setting	PCON	F	A	9	8	7	6	5	4	3	2	1	**0**	[P2-03]	0x0000
Gain2 selection [P2-03]. DIGIT2 setting	GAIN2	F	A	9	8	7	6	5	4	3	2	1	**0**		
Error 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**		
Operation mode switching [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**		
Absolute encoder data reset [P2-04]. DIGIT4 setting	ABS_RST	F	A	9	8	7	6	5	4	3	2	1	**0**		

Note1) In the default setting, “0” does not assign any pins on the CN1 connector.

Note2) In case of ABS_RST signal, the absolute value encoder data is reset only when the signal is kept high for 500 ms.

(2) Example of changing input signal allocation

Input signal definition can be changed in [P2-00], [P2-01], [P2-02], [P2-03], [P2-04].
Input signal logic definition can be changed in [P2-08], [P2-09]
When assigning input signals as follows, set them as shown in the table below.



Signal name / Parameter assignment	Input Signal	Always assigned	CN1 pin default assignment number										Not allocated	Input Signal Definition	Set value after change
			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
Rotation direction selection [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 ratio1 [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 operation [P2-03]. DIGIT1 setting	PCON	F	A	9	8	7	6	5	4	3	2	1	0	[P2-03]	0x9000
Gain 2 selection [P2-03]. DIGIT2 setting	GAIN2	F	A	9	8	7	6	5	4	3	2	1	0		
Error 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		
Operation mode switching [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		
Absolute Encoder Data reset [P2-04]. DIGIT4 setting	ABS_RST	F	A	9	8	7	6	5	4	3	2	1	0		

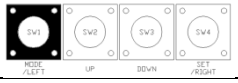
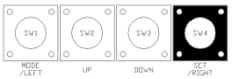
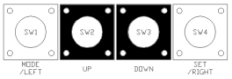
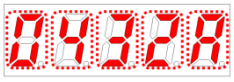
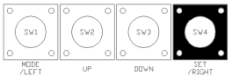
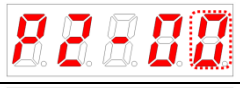
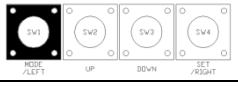
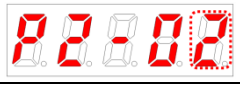
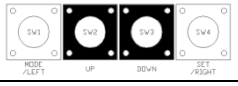
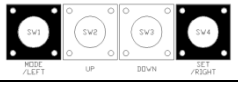
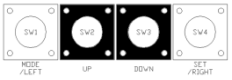
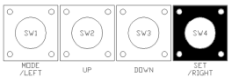
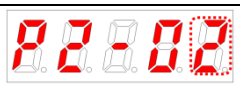
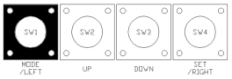
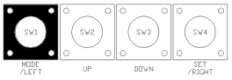
Note1) In the default setting, “0” does not assign any pins on the CN1 connector.

Note2) In case of ABS_RST signal, the absolute value encoder data is reset only when the signal is kept high for 500 ms.

■ Handling example of changing input signal allocation

An example of changing the assignment of input signals is shown below.
The sequence of swapping SVON (CN1-47) and STOP (CN1-48) allocation signals is as follows.

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

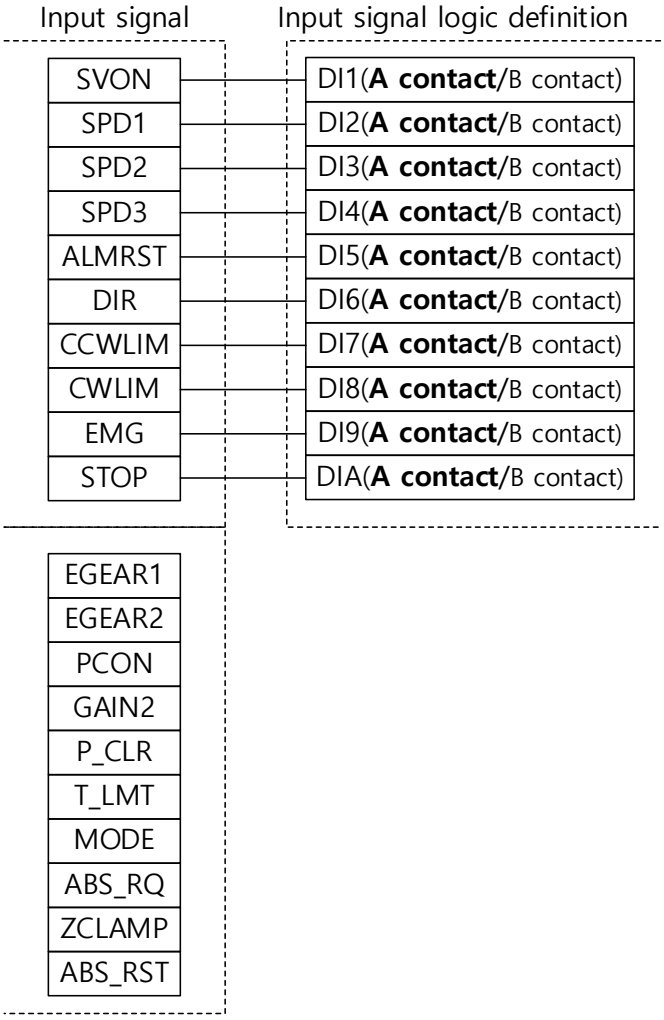
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to move to [P2-00].
2			Press the [SET] key to enter the parameter edit mode. 04321 is displayed for the corresponding parameter.
3			At the blinking cursor position, press [UP] or [DOWN] key to change to 0432A.
4			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 0432A in the parameter.
5			Press and hold the [MODE] key for about 1 second to return to the [P2-00].
6			At the blinking cursor position again, press the [UP] or [DOWN] key to change to P2-02.
7			Press the [SET] key to enter the parameter edit mode. 000A9 are displayed for the corresponding parameter.
8			Press the [/LEFT] or [/RIGHT] key at the blinking cursor position to move to the desired digit DIGIT2.
9			At the blinking cursor position, press [UP] or [DOWN] key to change to 00019.
10			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 00019 in the parameter.
11			Press and hold the [MODE] key for about 1 second to return to the [P2-02].
12	** Unable to modify and reset parameters when servo is ON		
※	If you exit without saving the setting value		Press and hold the [MODE] key for about 1 second to return to parameter.

Note1) “ ▯ “ is a blinking mark

(3) Input signal logic definition

In the L7 drive, the logic of the input signal can be defined through [P2-08] and [P2-09] parameters for 10 hardware contacts from DI1 to DIA.

The logic status of input signals at the time of shipment is shown in the figure below.



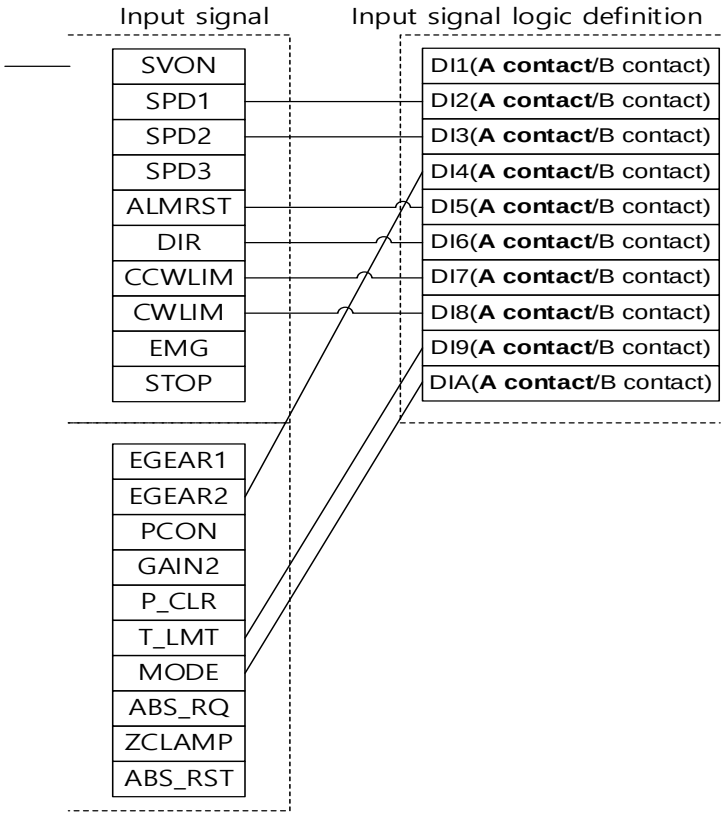
Signal name Parameter assignment	Input signal (initial name)	CN1 pin default assignment number										Contact B	Input signal logic definition	Default setting value
		48	18	19	20	46	17	21	22	23	47			
Servo On [P2-08]. DIGIT1 setting	SVON										1	0	[P2-08]	0x11111
multi-speed 1 [P2-08]. DIGIT2 setting	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		
Rotation direction selection [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		

Note1) In the input signal logic definition, contact A: 1 and contact B: 0.

(4) Example of changing input signal logic definition

Input signal logic definition can be changed in [P2-08], [P2-09]

When assigning input signals as follows, set them as shown in the table below.

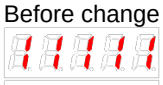
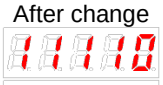
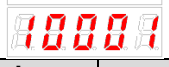


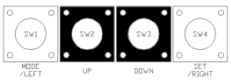
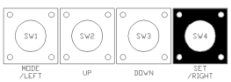
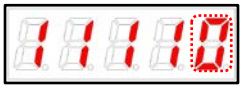
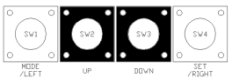
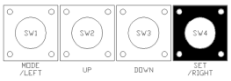
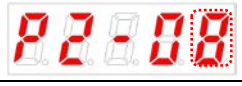
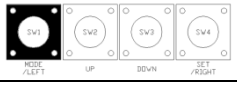
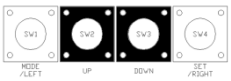
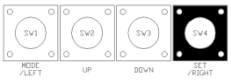
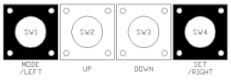
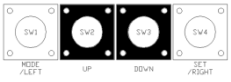
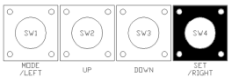
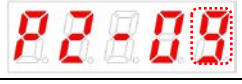
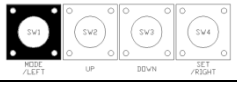
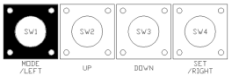
Signal name Parameter assignment	Input Signal	CN1 pin default assignment number										Contact B:	Input signal logic definition	Default setting value
		48	18	19	20	46	17	21	22	23	47			
Servo On [P2-08]. DIGIT 1 setting	SVON										1	0	[P2-08]	0x11111
multi-speed 1 [P2-08]. DIGIT 2 setting	SPD1									1		0		
multi-speed 2 [P2-08]. DIGIT 3 setting	SPD2								1			0		
Electrical gearing ratio 2 [P2-02]. DIGIT4 setting	EGEAR2							1				0		
Alarm reset [P2-08]. DIGIT 5 setting	ALMRST						1					0		
Rotation direction selection [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]. DIGIT3 setting	CWLIM			1								0		
Torque limit [P2-03]. DIGIT4 setting	T_LMT		1									0		
Operation mode switching [P2-04]. DIGIT1 setting	MODE	1										0		

Note1) In the input signal logic definition, contact A: 1 and contact B: 0.

■ Handling example of changing input signal logic definition

An example of changing the logic of input signals is shown below.
The order of changing logic signal contact A of SVON (CN1-47) to contact B and the order of changing logic signal contact B of CCWLIM (CN1-20) to contact A are as follows.

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

Sequence	Loader display after operation	key to use	operation explanation
1			At the blinking cursor position again, press the [UP] or [DOWN] key to move to [P2-08].
2			Press the [SET] key to enter the parameter edit mode. 11111 is displayed for the corresponding parameter.
3			At for the blinking cursor position, press [UP] or [DOWN] key to change to 11110.
4			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 11110 in the parameter.
5			Press and hold the [MODE] key for about 1 second to return to the [P2-08].
6			At the blinking cursor position again, press the [UP] or [DOWN] key to change to P2-09.
7			Press the [SET] key to enter the parameter edit mode. 10001 is displayed for the corresponding parameter.
8			Press the [/LEFT] or [/RIGHT] key at the blinking cursor position to and moving to the desired digit DIGIT2.
9			At the blinking cursor position, press [UP] or [DOWN] key to change to 10011.
10			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 10011 in the parameter.
11			Press and hold the [MODE] key for about 1 second to return to the [P2-09].
12	** Unable to modify and reset parameters when servo is ON		
※	If you exit without saving the setting value		Press and hold the [MODE] key for about 1 second to return to parameter.

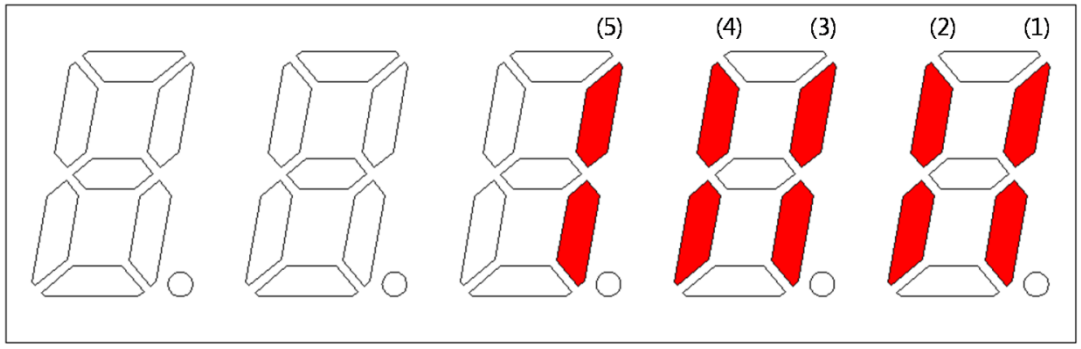
Note1) “ ▯ “ is a blinking mark.

5.1.7 External output signal display [St-15]

You can check the ON/OFF status of digital input/output signals connected to the servo drive.

(1) External output signal display

Positioning of the 7-segment LED. The CN1 connector pins correspond as follows.



When the LED at the location corresponding to the pin is turned on, it indicates ON, and when it is turned off, it indicates OFF.

<Output contact display>

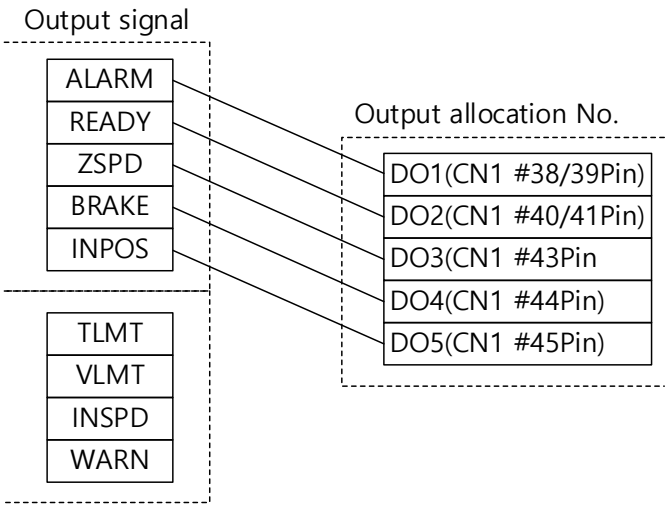
No.	-	-	-	-	-	(5)	(4)	(3)	(2)	(1)
Contact point symbol						**DO5**	**DO4**	**DO3**	**DO2**	**DO1**
CN1 pin number						45	44	43	40/41	38/39
Initial assignment signal name						INPOS	BRAKE	ZSPD	READY	ALARM

5.1.8 External output signal and logic definition

The allocation of output signals and how to check the allocation status are shown below.

(1) Assignment of output signal

- Output signal definition: [P2-05], [P2-06], [P2-07]
- Output signal logic definition: [P2-10]
- The allocation status of output signals at the time of shipment is as follows.

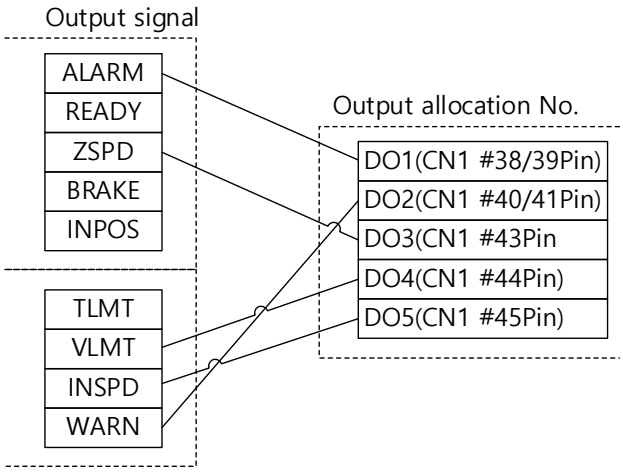


Signal name / Parameter assignment	Output Signal	Always assigned	CN1 pin default assignment number 45	44	43	40/41	38/39	Not assigned	Internal parameter	Default setting value
Alarm [P2-05]. DIGIT1 setting	ALARM	F	5	4	3	2	1	0	[P2-05]	0x4321
Servo Ready [P2-05]. DIGIT2 setting	READY	F	5	4	3	2	1	0		
Zero speed reached completion [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 completion [P2-06]. DIGIT1 setting	INPOS	F	5	4	3	2	1	0	[P2-06]	0x0005
Torque limit reaching [P2-06]. DIGIT2 setting	TLMT	F	5	4	3	2	1	0		
Speed limit reaching [P2-06]. DIGIT3 setting	VLMT	F	5	4	3	2	1	0		
Speed reaching completion [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

Note1) In the default setting, “0” does not assign any pins on the CN1 connector.

(2) Example of changing output signal allocation

- Output signal definition can be changed in [P2-05], [P2-06], [P2-07].
- Output signal logic definition can be changed in [P2-10]
- When assigning output signals as follows, set them as shown in the table below.

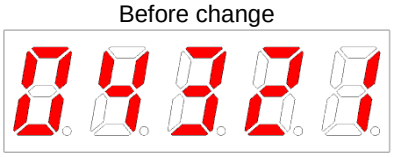
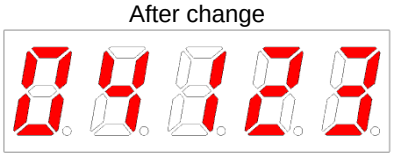


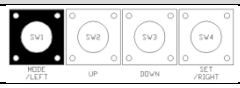
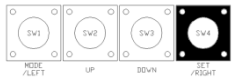
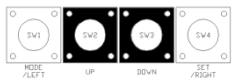
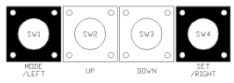
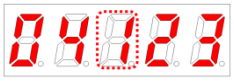
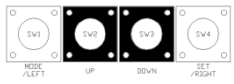
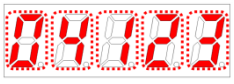
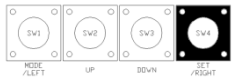
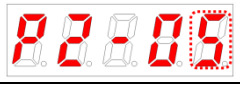
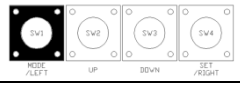
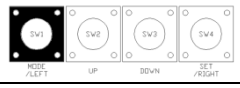
Signal name Parameter assignment	Output signal	Always assigned	CN1 pin default assignment number					Not assigned	Always assigned	After change Setting value
			45	44	43	40 /41	38 /39			
Alarm [P2-05]. DIGIT1 setting	ALARM	F	5	4	3	2	**1**	0	[P2-05]	0x0301
Servo Ready [P2-05]. DIGIT2 setting	READY	F	5	4	3	2	1	**0**		
Zero speed reaching completion [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 reaching completion [P2-06]. DIGIT1 setting	INPOS	F	5	4	3	2	1	**0**	[P2-06]	0x5400
Torque limit reaching [P2-06]. DIGIT2 setting	TLMT	F	5	4	3	2	1	**0**		
Speed limit reaching [P2-06]. DIGIT3 setting	VLMT	F	5	**4**	3	2	1	0		
Speed reaching completion [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

Note1) In the default setting, “0” does not assign any pins on the CN1 connector.

■ Handling example of changing output signal allocation

An example of changing the assignment of output signals is shown below.
The sequence of swapping ALARM (CN1-38/39) and ZSPD (CN1-43) allocation signals is as follows.

[P2-05]: Before change  After change 

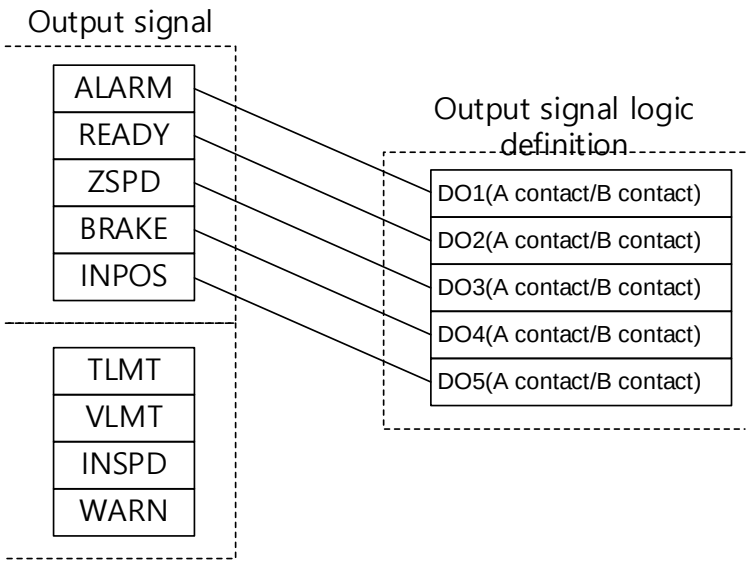
Sequence	Loader window display after operation	key to use	Operation explanation
1			Press the [MODE] key to move to [P2-05].
2			Press the [SET] key to enter the parameter edit mode. 04321 is displayed for the corresponding parameter.
3			At the blinking cursor position, press [UP] or [DOWN] key to change to 04323.
4			Press the [/LEFT] or [/RIGHT] key at the blinking cursor position to move to the desired digit DIGIT3.
5			At the blinking cursor position, press [UP] or [DOWN] key to change to 04123.
6			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 04123 in the parameter.
7			Press and hold the [MODE] key for about 1 second to return to the [P2-05].
8	** Unable to modify and reset parameters when servo is ON		
※	If you exit without saving the setting value		Press and hold the [MODE] key for about 1 second to return to parameter.

Note1) “ ▯ “ is a blinking mark.

An output contact point setting error [AL-72] alarm occurs when overlapping output signals are assigned.

(3) Output signal logic definition

- Output signal logic definition: [P2-10]
- The logic status of output signals at the time of shipment is shown in the figure below.

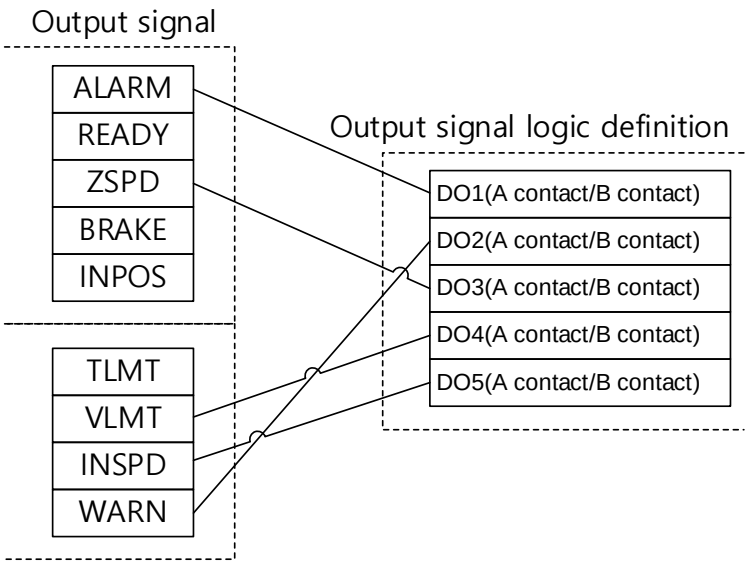


Signal name Parameter assignment	Input Signal	CN1 pin default assignment number					Contact B:	Output signal logic definition	Standard settings
		45	44	43	40 /41	38 /39			
Alarm [P2-10]. DIGIT1 setting	ALARM						0	[P2-10]	0x10110
Servo Ready [P2-10]. DIGIT2 setting	READY				1		0		
Zero speed reached completion [P2-10]. DIGIT3 setting	ZSPD			1			0		
Brake [P2-10]. DIGIT4 setting	BRAKE						0		
Position reaching completion [P2-10]. DIGIT5 setting	INPOS	1					0		

Note1) In the input signal logic definition, contact A: 1 and contact B: 0.

(4) Example of changing output signal logic definition

- Output signal logic definition can be changed in [P2-10]
- When assigning output signals as follows, set them as shown in the table below.



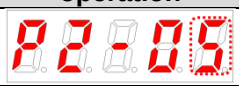
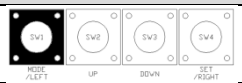
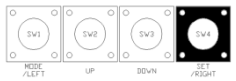
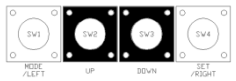
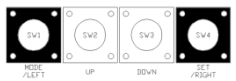
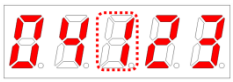
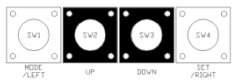
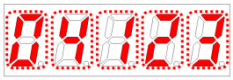
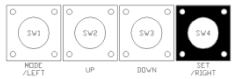
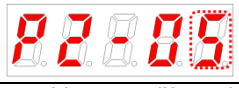
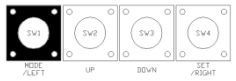
Signal name / Parameter assignment	Input Signal	CN1 pin default assignment number					Contact B	Output signal logic definition	Standard settings
		45	44	43	40/41	38/39			
Alarm [P2-10]. DIGIT1 setting	ALARM						0	[P2-10]	0x11110
Warning [P2-07]. DIGIT1 setting	WARN				1		0		
Zero speed reaching completion [P2-10]. DIGIT3 setting	ZSPD			1			0		
Speed limit reaching [P2-06]. DIGIT3 setting	VLMT		1				0		
Speed reached completion [P2-06]. DIGIT4 setting	INSPD	1					0		

Note1) In the input signal logic definition, contact A: 1 and contact B: 0.

■ Handling example of changing output signal logic definition

An example of changing the assignment of output signals is shown below.
The sequence of swapping ALARM (CN1-38/39) and ZSPD (CN1-43) allocation signals is as follows.

	Before change	After change
[P2-05]:		

Sequence	Loader window display after operation	key to use	Operation explanation
1			Press the [MODE] key to move to [P2-05].
2			Press the [SET] key to enter the parameter edit mode. 04321 is displayed for the corresponding parameter.
3			At the blinking cursor position, press [UP] or [DOWN] key to change to 04323.
4			Press the [/LEFT] or [/RIGHT] key at the blinking cursor position to move to the desired digit DIGIT3.
5			At the blinking cursor position, press [UP] or [DOWN] key to change to 04123.
6			If you press and hold the [SET] key for about 1 second, it blinks twice and is saved as 04123 in the parameter.
7			Press and hold the [MODE] key for about 1 second to return to the [P2-05].
8	** Unable to modify and reset parameters when servo is ON		
※	If you exit without saving the setting value		Press and hold the [MODE] key for about 1 second to return to parameter.

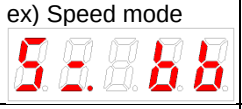
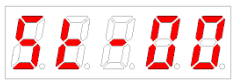
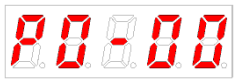
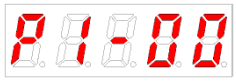
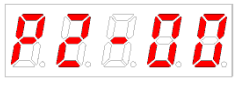
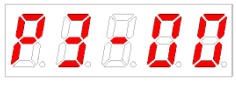
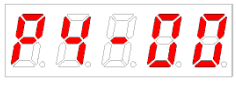
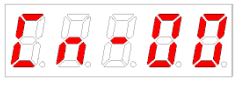
Note1) “ ▯ “ is a blinking mark.

An output contact point setting error [AL-72] alarm occurs when overlapping output signals are assigned.

5.2 Parameter Description

5.2.1 Parameter description

Parameter configuration consists of a total of 8 groups, and the description of each configuration is shown in the table below.

Parameter move	Parameter number	Initial screen	Parameter group name	Description
MODE key	-	ex) Speed mode 	Status Summary Display	Displays a summary of servo status.
	St-00 ~ St-26		Status	Displays servo operation status information.
	P0-00 ~ P0-29		System	Save system configuration information.
	P1-00 ~ P1-27		Control	Save control-related setting parameters.
	P2-00 ~ P2-22		IN / OUT	Saves setting parameters related to analog and digital input/output.
	P3-00 ~ P3-20		Speed Operation	Save the speed operation setting parameters.
	P4-00 ~ P4-14		Position Operation	Save the position pulse operation setting parameters.
	Cn-00 ~ Cn-17		Command	Carries out driving operations.

The meaning of the abbreviation for the application mode in the parameter is as follows.

- P: Used in position control mode
- S: Used in speed control mode
- T: Used in speed control mode

Press the [MODE] key once to move to the next display mode.

5.2.2 Operation status display parameter

For detailed explanation, refer to “5.3 Operation Status Display”.

“**”Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when “*” servo is ON

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
St-00	Current operation status	-	-	Displays the current driving status. DIGIT5 : Operation Mode DIGIT4 : ZSPD, INPOS/INSPD, Command, READY DIGIT3~1 : Run Status (Details: Refer to “5.1.2 Display Status Summary”)	PST
	Operation Status	0	0		
St-01	Current operation speed	[RPM]	0	Displays the current driving speed. (Details: Refer to “5.3.2 Speed Display”)	PST
	Current Speed	-10000	10000		
St-02	Current command speed	[RPM]	0	Displays the current command speed. (Details: Refer to “5.3.2 Speed Display”)	ST
	Command Speed	-10000	10000		
St-03	Tracking position pulse	[pulse]	0	▪ If the minimum or maximum value is exceeded, the display is limited to the minimum or maximum value. ▪ (Details: Refer to “5.3.2 Speed Display”)	P
	Feedback Pulse	-2^30	2^30		
St-04	Position command pulse	[pulse]	0	Displays the accumulated value of position command pulses. ▪ Displays the cumulative value of position command pulses entered after the servo power was turned on. (Details: Refer to 5.3.3 Position Display)	P
	Command Pulse	-2^30	2^30		
St-05	Position pulse remaining amount	[pulse]	0	Displays the remaining position pulses for the servo to drive. ▪ It means the difference between the command pulse and the tracking pulse, and displays the remaining position pulses for the servo to drive. ▪ The remaining position pulse amount displayed when servo is off is ignored when servo is on. (Details: Refer to 5.3.3 Position Display)	P
	Pulse Error	-2^30	2^30		
St-06	Input pulse frequency	[Kpps]	0.0	Displays the input pulse frequency.	P
	Input pulse Frequency	-1000.0	1000.0		
St-07	Current operation torque	[%]	0.0	Displays the current load ratio against the rating. ▪ The load that the servo motor is outputting is displayed as a percentage compared to the rated output.	T
	Current Torque	-300.0	300.0		
St-08	Current command torque	[%]	0.0	Displays the command load ratio against the rating. ▪ The load that the servo motor is outputting is displayed as a percentage compared to the rated output. (Details: Refer to “5.3.4 Display related to torque and load)	T
	Command Torque	-300.0	300.0		

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
St-09	Accumulated overload percentage	[%]	0.0	Displays the current cumulative load factor as a percentage of the maximum cumulative load factor. (Details: Refer to “5.3.4 Display related to torque and load)	PST
	Accumulated Overload	-300.0	300.0		
St-10	Instantaneous maximum load factor	[%]	0.0	Displays the instantaneous maximum load ratio against the rating. ▪ Displays the maximum load from the time the servo power is turned ON and control starts to the present as a percentage compared to the rated output. (Details: Refer to “5.3.4 Display related to torque and load)	PST
	Maximum Load	-300.0	300.0		
St-11	Torque Limit	[%]	-	Displays the torque limit setting value. ▪ Displays the maximum value of the torque that the servo motor can output as a percentage of the rated torque. (T_LMT contact ON: analog torque input, T_LMT contact OFF: [P1-13], [P1-14] setting value)	PST
	Torque Limit	-300.0	300.0		
St-12	DC link voltage	[V]	0.0	Displays the DC Link voltage of the current main power. ▪ The normal DC link voltage of a standard drive using 220[V] power is about 300[V]. ▪ The maximum permissible DC link voltage of a standard drive using 220[V] power is 405[V]. ▪ If the DC link voltage limit is exceeded when there is a lot of regenerative energy or the capacity of the regenerative resistor is small, an overvoltage alarm [AL-41] occurs. ▪ It is suitable when the DC link value is less than 385[V] in the regeneration section. (Details: Refer to “5.3.4 Display related to torque and load)	PST
	DC Link Voltage	0.0	500.0		
St-13	Regenerative overload	[%]	0.0	Displays the regenerative overload rate.	PST
	Regeneration Overload	0.0	20.0		
St-14	Input contacts status	-	-	Displays the input contact status recognized by the servo. (Details: Refer to “5.1.5 External input contact signal display)	PST
	Input Status	-	-		
St-15	Output contact status	-	-	Displays the output contact status output by the servo. (Details: Refer to “5.1.6 External output contact signal display)	PST
	Output Status	-	-		
St-16	Single Turn Data	[pulse]	0	Displays the data (Single-Turn Data) within one rotation of the encoder in units of [Pulse].	PST
	Single-Turn Data	0	2^30		
St-17	Single Turn Data(Degree)	[˚]	0.0	Displays the data (Single-Turn Data) within one rotation of the encoder in units of [degree].	PST
	Single-Turn Data (Degree)	0.0	360.0		
St-18	Multi-Turn Data	[rev]	0	Displays the multi-turn data of the encoder.	PST
	Multi-Turn Data	-32768	32767		

PARAMETER		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
St-19	Internal temperature	[℃]	0	Displays the internal temperature sensor value.	PST
	Room Temperature	-40	200		
St-20	Motor rated speed	[RPM]	0	Displays the rated speed of the currently installed motor.	PST
	Rated RPM	0	10000		
St-21	Motor maximum speed	[RPM]	0	Displays the maximum speed of the currently installed motor.	PST
	Maximum RPM	0	10000		
St-22	Motor rated current	[A]	0.00	Displays the rated current of the currently installed motor.	PST
	Rated Current	0.00	655.35		
St-23	U Phase Current Offset	[mA]	0	Displays U-phase current offset.	PST
	U Phase Current Offset	-200	200		
St-24	V phase Current Offset	[mA]	0	Displays V-phase current offset.	PST
	V Phase Current Offset	-200	200		
St-25	Program version	-	-	Displays the currently installed program version. (Details: Refer to “5.3.7 Version display)	PST
	Software Version	-	-		
St-26	FPGA Version	-	-	Displays the currently installed FPGA version.	PST
	FPGA Version	-	-		
St-27	Analog command torque	%	0	Displays the current analog command torque.	T
	Analog Tq CMD	-300	300		

5.2.3 System setting parameter

For details, refer to “5.4.1 System Parameter Setting”.

“**” Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when servo is ON

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
**P0-00	Motor ID	-	999	▪ Set the ID of the motor directly. ▪ If the motor data could not be read, the initial value is set to 999. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	Motor ID	0	999		
**P0-01	Encoder type	-	0	• 0: Incremental Encoder • 1: Single turn serial encoder • 3: Multi serial encoder (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	Encoder Type	0	5		
**P0-02	Encoder pulse	[ppr]	3000	▪ Serial Type Encoder: Set the number of bits of the encoder. ▪ Incremental Type Encoder: Set the number of pulses of the encoder. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	Enc Resolution	1	30000		
*P0-03	Operation mode selection	-	1	Set the 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 “5.4.1 System Parameter Settings”)	PST
	Operation Mode	0	5		
**P0-04	RS422 communication speed	[bps]	0	Set the communication speed of RS-422 communication. ▪ 0 : 9600[bps] ▪ 1 : 19200[bps] ▪ 2 : 38400[bps] ▪ 3 : 57600[bps] (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	RS422 BaudRate	0	3		
**P0-05	System ID	-	0	Set the drive ID in communication. ▪ When communicating with the servo using USB communication, RS422 communication, or BUS communication, you can use it by assigning an ID to the servo. ▪ It is used to communicate with servos individually by giving each servo its own ID. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	System ID	0	99		
P0-06	Main power input mode	-	0b00000	Set the main power input. DIGIT1-> 0: Single-phase power, 1: 3-phase power input ⚠**Caution**: When using single-phase power, motor output may be lowered. DIGIT2 -> 0: Alarm processing in case of phase loss 1: Warning processing in case of phase loss DIGIT5 -> 0: Analog speed command applied 1: Analog speed command not applied	PST
	Power Fail Mode	0b00000	0b11111		

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
P0-07	RST check hour	[ms]	20	This specifies the checking interval for main power phase loss.	PST
	RST Check Time	0	5000		
P0-08	At start Display parameter	-	0	Set the number of operation status parameters to be displayed at startup. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	Start Up Parameter	0	26		
*P0-09	Regeneration overload derating	[%]	100	This specifies the derating factor which checks for regenerative resistor overloads. If the derating value is set below 100%, an overload alarm occurs quickly.	PST
	Regeneration Derating	1	200		
**P0-10	Regeneration resistor	[Ω]	0	Set the resistance value of the regenerative braking resistor. When set to 0, the resistance value built into the drive is used.	PST
	Regeneration Brake Resistor	0	1000		
**P0-11	Regeneration resistor capacity	[W]	0	Set the capacity of the currently installed regenerative resistor. When set to 0, the resistor value built into the drive is used.	PST
	Regeneration Brake Capacity	0	30000		
*P0-12	Overload detection Basic load rate	[%]	100	Indicates the load rate at which a continuous overload check is initiated. If set below 100, overload check starts early and overload alarm occurs early.	PST
	Overload Check Base	10	100		
P0-13	Continuous overload warning level	[%]	50	Indicates the level at which the continuous overload warning signal is output. A warning signal is output when the set % value compared to the alarm generating load ratio is reached.	PST
	Overload Warning Level	10	100		
*P0-14	Encoder output division	-	12000	Set the division of the encoder output when outputting the encoder signal from the servo to the outside. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	Pulse Out Per, Rotate	-2^21	2^21		
*P0-15	PWM OFF delay time	[ms]	10	Set the delay time until the PWM signal actually turns OFF after servo OFF. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	PWM OFF Delay	0	1000		
*P0-16	DB control mode	-	0x0	Set the DB control mode. ▪ 0: Hold after DB Stop ▪ 1: Release after DB Stop ▪ 2: Release after free run stop ▪ 3: Hold after free run stop (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	DB Control Mode	0x0	0x3		

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
*P0-17	Function setting bit	-	0b00000	Set the function of the drive by DIGIT DIGIT 1 -> Sets the driving direction of the servo. • 0: Forward(CCW), Reverse(CW) • 1: Forward(CW), Reverse(CCW) DIGIT 2 -> Set Servo Lock • 0: Unused • 1: Enable (Torque boost when analog command stop) DIGIT 3 -> Open collector output setting • 0: Unused • 1: Used DIGIT 4 -> Monitor output voltage setting • 0: -10V~+10V • 1: 0~10V DIGIT 5 -> Set EEPROM communication save • 0: Using EEPROM • 1:Unusing EEPROM (Detail: refer to 5.4.1 System Parameter Settings)	PST
	Function Select Bit	0b00000	0b11111		
P0-18	DAC output mode	-	0x3210	Set the output mode of analog output channels 1~2. Set CH0~CH3 from the lowest HEX Code in order ▪ CH0, CH1 output to MONIT1, MONIT2 • 0 : Speed Feedback[RPM] • 1 : Speed Command[RPM] • 2 : Torque Feedback[%] • 3 : Torque Command[%] • 4 : Position Command Frequency[0.1Kpps] • 5 : Following Error[pulse] • 6 : DC Link Voltage[V] • D : Speed command(User)[RPM] • E : Torque command(User)[%] (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	DAC Mode(F)	0x0000	0xFFFF		
P0-19	DAC output offset1 (MONIT1)	[Unit/V]	0	Set the offset of analog output channels 1~2. • Speed: [RPM] • Torque: [%] • Position command frequency: [0.1Kpps] • Position: [pulse] • DC Link: [V] • Offset (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	DAC Offset1(F) (MONIT1)	-1000	1000		
P0-20	DAC output offset 2 (MONIT2)	[Unit/V]	0		
	DAC Offset2(F) (MONIT2)	-1000	1000		
P0-21	Reserved	-	-	-	
P0-22	Reserved	-	-	-	

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
P0-23	DAC output scale1 (MONIT1)	[Unit/V]	500	Set the magnification of analog output channels 1~2. Magnification setting with setting Unit/V ex) Channel 1 scale 100[RPM]: Outputs 100[RPM] as 1[V]. (Details: Refer to “5.4.1 System Parameter Settings”)	PST
	DAC Scale1(F) (MONIT1)	1	10000		
P0-24	DAC output scale 2 (MONIT2)	[Unit/V]	500		
	DAC Scale2(F) (MONIT2)	1	10000		
P0-25	Reserved	-	-		
P0-26	Encoder function setting	-	0	Set the multi-turn encoder function. • 0: Using a multi-turn encoder as a multi-turn method • 1: Using a multi-turn encoder as a single-turn method (Applies from OS Ver 1.29) • 2: Multi-turn encoder is used as a single-turn method, and single-turn data is memorized within 1 revolution when the power is re-applied. (Applies from OS Ver 1.47)	PST
		0	2		
P0-27	Phase U current offset value	[mA]	0	Save phase U current offset value	PST
	U Current Offset	-9999	9999		
P0-28	Phase V current offset	[mA]	0	Save phase V current offset value	PST
	V Current Offset	-9999	9999		
P0-29	Phase W current offset	[mA]	0	Save phase W current offset value	PST
	W Current Offset	-9999	9999		

⚠Caution

- If the motor and encoder cable are replaced while the absolute encoder is in use, or if the battery is replaced with the servo power off, the multi-turn data of the encoder will be lost.
- If the encoder loses multi-turn data, there is a risk of equipment malfunction or accident, so be sure to operate after originating.

5.2.4 Control parameter setting

"**" Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when servo is ON

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
P1-00	Inertia ratio	[%]	100	Set the inertia ratio of the load. ▪ The inertia ratio is based on 100% when the motor is in a no-load state composed of the motor alone, and since the inertia ratio setting for the load is an important control parameter for servo operation characteristics, calculate the load inertia according to the mechanical system and return it from the motor characteristics table. Calculate the rotor inertia as a ratio and set its value. ▪ It is crucial to set the correct inertia ratio for optimal servo operation.	PST
	Inertia Ratio	0	20000		
P1-01	Position proportional gain 1	[Hz]	50	Set the position control proportional gain 1.	P
	Position P Gain1	0	500		
P1-02	Position proportional gain 2	[Hz]	70	Set the position control proportional gain 2.	P
	Position P Gain2	0	500		
P1-03	Position command filter time constant	[ms]	0	Set the filter time constant for the internal position command that reflects the electronic gear ratio.	P
	Pos. Command Filter Time Constant	0	1000		
P1-04	Position feed forward gain	[%]	0	Set the position feed forward feed forward control ratio.	P
	Pos.Feedforward Gain	0	100		
P1-05	Position feed forward Filter time constant	[ms]	0	Set the position feed forward control filter time constant.	P
	Pos.Feedforward Time Constant	0	1000		
P1-06	Speed proportional gain 1	[rad/s]	400	Set the speed control proportional gain 1.	PS
	Speed P Gain1	0	5000		
P1-07	Speed proportional gain 2	[rad/s]	700	Set the speed control proportional gain 2.	PS
	Speed P Gain2	0	5000		
P1-08	Speed integral time constant 1	[ms]	50	Set the speed control integral time constant 1.	PS
	Speed Time Constant 1	1	1000		
P1-09	Speed integral time constant 2	[ms]	15	Set the speed control integral time constant 2.	PS
	Speed Time Constant 2	1	1000		
P1-10	Speed command filter time constant	[ms]	10	Set the time constant of the filter for the speed command value.	PS
	Spd. Command Filter Time Constant	0	1000		
P1-11	Speed feedback filter time constant	0.1[ms]	0.5	Set the time constant of the filter for the speed detection value.	PS
	Spd. Feedback Filter Time Constant	0	100		

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
P1-12	Torque command filter time constant	[ms]	10	Set the time constant of the filter for the torque command value.	PST
	Trq. Command Filter Time Constant	0	1000		
P1-13	Forward rotation torque limit	[%]	300	Set the torque limit value for forward rotation.	PST
	Positive Torque Limit	0	300		
P1-14	Reverse rotation torque limit	[%]	300	Set the torque limit value for reverse rotation.	PST
	Negative Torque Limit	0	300		
P1-15	Switching mode	-	0x00	Set the gain switching mode. [0x0F (DIGIT 1)] ▪ 0: Only the gain 1 is used. ▪ 1: ZSPD auto gain switching In the case of zero speed, switching from gain 1 to gain 2 Switching from gain 2 to gain 1 in the opposite case. ▪ 2: INPOS automatic gain switching Switching from gain 1 to gain 2 in the case of in Position Switching from gain 2 to gain 1 in the opposite case. ▪ 3: Manual gain switching Switching from gain 1 to gain 2 when Gain2 contact point is on. Switching from gain 2 to gain 1 in the opposite case. Set the P,PI control switching mode [0xF0 (DIGIT 2)] ▪ 0: Only PI control ▪ 1: P control when the command torque is higher than the set torque [P1-24] ▪ 2: P control when the command speed is higher than the set speed [P1-25] ▪ 3: P control when the current acceleration is higher than the set acceleration [P1-26] ▪ 4: P control when the current position error is higher than the set position error [P1-27] ▪ P control when PCON contact is ON (take priority over other conditions) (Details: Refer to “5.2.5 Input/Output Parameter Settings”)	PS
	Conversion Mode	0x00	0x43		
P1-16	Gain switching time	[ms]	1	Set the gain switching time during operation. Gain 1->Gain 2, Gain 2->Gain 1 switching is scheduled according to the time setting.	PS
	Gain Conversion Time	1	100		
P1-17	Resonance avoidance operation	-	0	Select whether to operate resonance avoidance operation. 0: Unused, 1: Enable	PST
	Notch Filter Use	0	1		
P1-18	Resonance avoidance frequency	[Hz]	300	Set the resonance avoidance frequency	PST
	Notch Frequency	0	1000		
P1-19	Resonance avoidance range	[Hz]	100	Set the resonance avoidance range	PST
	Notch Bandwidth	0	1000		
P1-20	Automatic gain tuning speed	100 [RPM]	8	Set the operating speed for automatic gain tuning operation.	PST
	Resonance avoidance frequency	[Hz]	300		

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
P1-21	Automatic gain tuning distance	-	3	Set the round-trip operation distance during automatic gain tuning operation.	PST
	Auto Gain Tuning Distance	1	5		
P1-22	Torque control speed limit mode	-	0	Set the speed limit mode for torque control. ▪ 0: Limit [P1-23]. ▪ 1: Motor Maximum Speed ▪ 2: Analog speed command ▪ 3: Limit to the smaller value between the set value of [P1-23] and the analog speed command	T
	Velocity Limit Switch (Torque Control)	0	3		
P1-23	Limit speed	[RPM]	2000	Set the limit speed when speed limit mode [P1-22] is 0 during torque control.	T
	Velocity Limit Value (Torque Control)	0	10000		
P1-24	P control switching torque	%	200	When setting P, PI control conversion mode [P1-15], sets [0x10 (DIGIT 2)] P control conversion torque.	PS
	Torque Switch Value (P Control Conversion)	0	300		
P1-25	P control switching speed	rpm	50	When setting P, PI control conversion mode [P1-15], sets [0x20 (DIGIT 2)] P control conversion speed.	PS
	Speed Switch Value (P Control Conversion)	0	6000		
P1-26	P control switching acceleration	rpm/s	1000	When setting P, PI control conversion mode [P1-15], sets [0x30 (DIGIT 2)] P control switching acceleration.	PS
	Acc. Switch value (P Control Conversion)	0	5000		
P1-27	P control switching position error	pulse	2000	When setting P, PI control conversion mode [P1-15], sets [0x40 (DIGIT 2)] P control switching position error.	PS
	Position Err Switch Value (P Control Conversion)	0	10000		

5.2.5 Input/Output parameters setting

For details, refer to “5.4.3 Analog I/O Parameter Setting” and “5.4.4 I/O Parameter Setting”. “**” Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when servo is ON.

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
**P2-00	Input signal definition 1	-	0x4321	Allocates pins on the CN1 connector for digital input signals. ▪ Initial input signal allocation status • [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(**) • [P2-04]DIGIT4 = ABS_RST(**) ** Unassigned signals. (Details: Refer to “Chapter 5.1.6 External Input Signal and Logic Definition”)	PST
	Input Port Define1	0	0xFFFF		
**P2-01	Input signal definition 2	-	0x8765		
	Input Port Define2	0	0xFFFF		
**P2-02	Input signal definition 3	-	0x00A9		
	Input Port Define3	0	0xFFFF		
**P2-03	Input signal definition 4	-	0x0000		
	Input Port Define4	0	0xFFFF		
**P2-04	Input signal definition 5	-	0x0F00		
	Input Port Define5	0	0xFFFF		
**P2-05	Output signal definition 1	-	0x4321	Allocates pins on the CN1 connector for digital output signals. ▪ Initial output signal allocation status • [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(**) ** Unassigned signals. (Details: Refer to “Chapter 5.1.8 External Output Signal and Logic Definition”) **Occurrence of output contact setting error [AL-72] when redundant assignment**	
	Output Port Define1	0	0xFFFF		
**P2-06	Output signal definition 2	-	0x0005		
	Output Port Define2	0	0xFFFF		
**P2-07	Output signal definition 3	-	0x0000		
	Output Port Define3	0	0xFFFF		

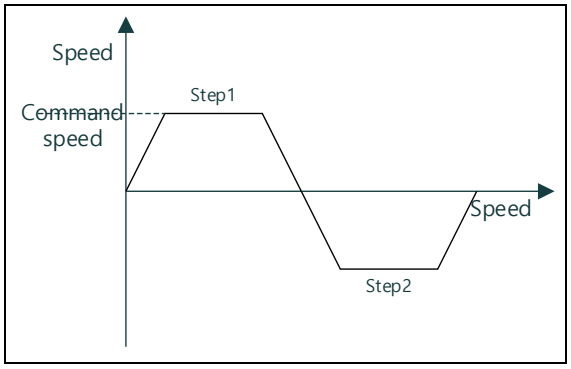
Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
P2-08	Input signal logic definition 1	-	0b11111	Defines logic of CN1 connector for digital input signals. **(0: B contact, 1: A contact)** ▪ Initial input logic definition • [P2-08]DIGIT1 = DI1(CN1 #47) (A contact) • [P2-08]DIGIT2 = DI2(CN1 #23) (A contact) • [P2-08]DIGIT3 = DI3(CN1 #22) (A contact) • [P2-08]DIGIT4 = DI4(CN1 #21) (A contact) • [P2-08]DIGIT5 = DI5(CN1 #17) (A contact) (Details: Refer to "Chapter 5.1.6 External Input Signal and Logic Definition")	PST
	Input Logic Set1	0	0b11111		
P2-09	Input signal logic definition 2	-	0b10001	Defines logic of CN1 connector for digital input signals. **(0: B contact, 1: A contact)** ▪ Initial input logic definition • [P2-09]DIGIT1 = DI6(CN1 #46) (A contact) • [P2-09]DIGIT2 = DI7(CN1 #20) (A contact) • [P2-09]DIGIT3 = DI8(CN1 #19) (A contact) • [P2-09]DIGIT4 = DI9(CN1 #18) (A contact) • [P2-09]DIGIT5 = DIA(CN1 #48) (A contact) (Details: Refer to "Chapter 5.1.6 External Input Signal and Logic Definition")	PST
	Input Logic Set2	0	0b11111		
**P2-10	Output signal logic definition	-	0b10110	Defines logic of CN1 connector for digital output signals. **(0: B contact, 1: A contact)** • [P2-10]DIGIT1 = DO1(CN1 # 38/ 39) (B contact) • [P2-10]DIGIT2 = DO2(CN1 # 40/ 41) (A contact) • [P2-10]DIGIT3 = DO3(CN1 #43) (A contact) • [P2-10]DIGIT4 = DO4(CN1 #44) (B contact) • [P2-10]DIGIT5 = DO5(CN1 #45) (A contact) (Details: Refer to "Chapter 5.1.8 External Output Signal and Logic Definition") (Details: Refer to "5.4.4 Input/Output Parameter Settings")	PST
	Output Logic Set	0	0b11111		
P2-11	Position reaching output range	[pulse]	10	Set the remaining pulse range for outputting position arrival output in position operation mode. (Details: Refer to "5.4.4 I/O Parameter Settings")	P
	In Position Range	1	65535		
P2-12	Zero speed output range	[RPM]	10	Set the range of speed that outputs zero speed output when stopped. (Details: Refer to "5.4.4 I/O Parameter Settings")	PST
	Zero Speed Range	1	500		
P2-13	Speed reaching output range	[RPM]	10	Set the range of speed that outputs command speed reaching. (Details: Refer to "5.4.4 I/O Parameter Settings")	S
	In Speed Range	1	500		
P2-14	Brake output operation speed	[RPM]	100	Set the speed at which the brake output contact is turned ON. (Details: Refer to "5.4.4 I/O Parameter Settings")	PST
	Brake Output Speed	0	6000		
P2-15	Brake output delay time	[ms]	500	Set the delay time until the brake output contact turns ON when the servo is OFF or stopped. (Details: Refer to "5.4.4 I/O Parameter Settings")	PST
	Brake Output Delay Time	0	1000		
P2-16	Position pulse clear mode	-	1	Select the operation type of position pulse clear operation (PCLR) mode. • 0: Operates in Edge Mode • 1: Operate in level mode (torque: maintain) • 2: Operate in level mode (torque: 0) (Details: Refer to "5.4.4 I/O Parameter Settings")	P
	PCLR Mode	0	2		

Parameter		Unit	Initial	Description	Applicable mode
Code	Name	Minimum	Maximum		
*P2-17	Analog Velocity Command Scale	[RPM]	2000	Set the speed command scale when the analog speed command is 10[V]. (Details: Refer to “5.4.3 Analog Inout/Output Parameter Settings”)	S
	Analog Speed Command Scale	1	15000		
P2-18	Analog speed command offset	[mV]	0	Set the offset for the analog speed command. (Details: Refer to “5.4.3 Analog Input/Output Parameter Settings”)	S
	Analog Speed Command Offset	-1000	1000		
P2-19	Zero speed clamp voltage	[mV]	0	Set the voltage range for the clamp operation of the analog zero speed command.	S
	Zero Speed Clamp Voltage	0	1000		
*P2-20	Analog torque Command Scale	[%]	100	Set the torque scale when the analog torque command is 10[V]. (Details: Refer to “5.4.3 Analog Input/Output Parameter Settings”)	T
	Analog Torque Command Scale	1	350		
P2-21	Analog torque command offset	[mV]	0	Set the offset for the analog torque command. (Details: Refer to “5.4.3 Analog Input/Output Parameter Settings”)	T
	Analog Torque Command Offset	-1000	1000		
P2-22	Zero torque clamp voltage	[mV]	0	Set the voltage range for the clamp operation of the analog zero torque command.	T
	Zero Torque Clamp Voltage	0	1000		

5.2.6 Speed operation setting parameters

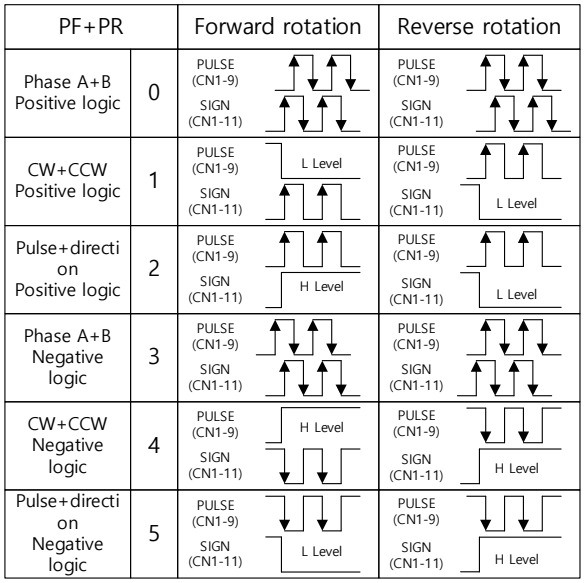
"**" Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when servo is ON

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Initial</th><th rowspan="2">Description</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="14">Set speed command 1~6 according to 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 "5.4.5 Speed Operation Parameter Settings")
[P0-06] Depending on Bit 5 setting, whether to apply analog speed command can be set.(From O/S Ver 1.46)</td></tr>
<tr><td>Speed Command 1</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>Speed Command 2</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>Speed Command 3</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>Speed Command 4</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>Speed Command 5</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>Speed Command 6</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>Speed Command 7</td><td>-6000</td><td>6000</td></tr>
<tr><td rowspan="2">P3-07</td><td>Phase Z detection operation speed setting</td><td>[RPM]</td><td>10</td><td rowspan="2">Set the operation speed during Z-phase detection operation.</td></tr>
<tr><td>Z Search Operation Speed</td><td>1</td><td>300</td></tr>
<tr><td rowspan="2">P3-08</td><td>Speed command accel. time</td><td>[ms]</td><td>0</td><td rowspan="2">Set the acceleration time for speed command.
(Details: Refer to "5.4.5 Speed Operation Parameter Settings")</td></tr>
<tr><td>Speed Command ACC. Time</td><td>0</td><td>10000</td></tr>
<tr><td rowspan="2">P3-09</td><td>Speed command decel. time</td><td>[ms]</td><td>0</td><td rowspan="2">Set the decel. time for speed command.
(Details: Refer to "5.4.5 Speed Operation Parameter Settings")</td></tr>
<tr><td>Speed Command DEC. Time</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">Set S-Curve time for speed command</td></tr>
<tr><td>Speed Command S-Curve Time</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">Set the acceleration/deceleration type of speed command.
(0;Trapezoidal, 1;Sinusoidal)
(Details: Refer to "5.4.5 Speed Operation Parameter Settings")</td></tr>
<tr><td>ACC.DEC. Pattern</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">Set the operation speed for manual JOG operation [Cn-00]</td></tr>
<tr><td>JOG Operation Speed</td><td>-6000</td><td>6000</td></tr>
</table>

Parameter		Unit	Initial	Description
Code	Name	Minimum	Maximum	
P3-13	Program JOG operation speed 1	[RPM]	0	During program JOG operation, sets the operation speed/operation time for [Cn-01] programs 1 to 4 Test operation is repeated from Step 1 to Step 4 Set the operation speed ([P3-13]~[P3-16]) and operation time ([P3-17]~[P3-20]) in each step ex) Step1~Step2 operation 
	Program Jog Speed1	-6000	6000	
P3-14	Program JOG operation speed 2	[RPM]	3000	
	Program Jog Speed2	-6000	6000	
P3-15	Program JOG operation speed 3	[RPM]	0	
	Program Jog Speed3	-6000	6000	
P3-16	Program JOG operation speed 4	[RPM]	-3000	
	Program Jog Speed4	-6000	6000	
P3-17	Program JOG operation time 1	[ms]	500	
	Program Jog Time1	0	65535	
P3-18	Program JOG operation time 2	[ms]	5000	
	Program Jog Time2	0	65535	
P3-19	Program JOG operation time 3	[ms]	500	
	Program Jog Time3	0	65535	
P3-20	Program JOG operation time 4	[ms]	5000	
	Program Jog Time4	0	65535	

5.2.7 Position operation setting parameters

"**" Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when servo is ON

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Initial</th><th rowspan="2">Description</th></tr>
<tr><th>Code</th><th>Name</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td rowspan="2">**P4-00</td><td>Position input pulse logic</td><td>-</td><td>0</td><td rowspan="2">Set the logic of position operation input pulse.
- Position command input pulse type and the rotation direction for each logic are as follows:
 

ex) The relationship between the direction signal and the rotation direction when the position pulse input logic setting is set to 2
-If the direction signal is Low: reverse rotation (CW/clockwise)
- If the direction signal is high: forward rotation (CCW/counterclockwise)
(Details: Refer to "5.4.6 Position Operation Parameter Settings")</td></tr>
<tr><td>Pulse Input Logic</td><td>0</td><td>5</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th>Unit</th><th>Initial</th><th rowspan="2">Description</th></tr>
<tr><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">Set the electronic gear ratio numerator/denominator 1, 2, 3, 4.
<table><tr><th>EGEAR 1</th><th>EGEAR 2</th><th>Electronic gear ratio Numerator/denominator</th><th>Electronic gear ratio</th></tr><tr><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td>Electronic gear ratio numerator 1</td><td rowspan="2">Electrical gearing ratio 1</td></tr><tr><td>Electronic gear ratio denominator 1</td></tr><tr><td rowspan="2">ON</td><td rowspan="2">OFF</td><td>Electronic gear ratio numerator 2</td><td rowspan="2">Electrical gearing ratio 2</td></tr><tr><td>Electronic gear ratio denominator 2</td></tr><tr><td rowspan="2">OFF</td><td rowspan="2">ON</td><td>Electronic gear ratio numerator 3</td><td rowspan="2">Electrical gearing ratio 3</td></tr><tr><td>Electronic gear ratio denominator 3</td></tr><tr><td rowspan="2">ON</td><td rowspan="2">ON</td><td>Electronic gear ratio numerator 4</td><td rowspan="2">Electrical gearing ratio 4</td></tr><tr><td>Electronic gear ratio denominator 4</td></tr></table>▪ The electronic gear ratio sets the relationship between the position command input pulse and the motor encoder pulse as a numerator/denominator, and is set so that no error occurs during position operation.
Caution) If the final value of the gear ratio is set to a decimal point or a large value of 60000 or more, a driving error may occur.(Details: Refer to “5.4.6 Position Operation Parameter Settings”)</td></tr>
<tr><td>Electric Gear Num.1</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>Electric Gear Num.2</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>Electric Gear Num.3</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>Electric Gear Num.4</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>Electric Gear Den.1</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>Electric Gear Den.2</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>Electric Gear Den.3</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>Electric Gear Den.4</td><td>1</td><td>32767</td></tr>
<tr><td rowspan="2">P4-09</td><td>Electronic gear ratio mode setting</td><td>-</td><td>0</td><td rowspan="2">Select the electronic gear ratio setting mode.
▪ 0: Select electronic gear ratio 1~4
▪ 1: Offset [P4-10] (override) to electronic gear ratio numerator 1
(Details: Refer to “5.4.6 Position Operation Parameter Settings”)</td></tr>
<tr><td>Electric Gear Mode</td><td>0</td><td>1</td></tr>
<tr><td rowspan="2">P4-10</td><td>Electronic gear ratio Numerator offset</td><td>-</td><td>0</td><td rowspan="2">Set the offset of electronic gear ratio numerator 1.
When setting the offset, the offset is set to 1 numerator of the electronic gear ratio as set.
▪ EGEAR1 contact point LOW->HIGH: Increase as much as [P4-10] setting value.
▪ EGEAR2 contact point LOW->HIGH: Decrease as much as [P4-10] setting value.
(Details: Refer to “5.4.6 Position Operation Parameter Settings”)</td></tr>
<tr><td>Electric Gear Num.Offset</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">Set the range to trigger the position error alarm.
(Details: Refer to “5.4.4 I/O Parameter Settings”)</td></tr>
<tr><td>Following Error Range</td><td>1</td><td>2^30</td></tr>
<tr><td rowspan="2">P4-12</td><td>Limit contact point function</td><td>-</td><td>0</td><td rowspan="2">Select the position command pulse clear operation type for CWLIM, CCWLIM contact.
▪ 0: When CCWLIM / CWLIM contact is ON, input pulse is ignored
▪ 1: When CCWLIM / CWLIM contact is ON, input pulse is received and stored in the buffer.</td></tr>
<tr><td>Position Limit Function</td><td>0</td><td>1</td></tr>
<tr><td rowspan="2">P4-13</td><td>Backlash compensation</td><td>-</td><td>0</td><td rowspan="2">Set backlash compensation in position operation.
If the position is distorted by mechanically generated backlash in position operation, set the backlash amount by converting it to the number of pulses.
Set in the opposite direction by Backlash.
(Details: Refer to “5.4.6 Position Operation Parameter Settings”)</td></tr>
<tr><td>Backlash Compensation</td><td>0</td><td>10000</td></tr>
<tr><td rowspan="2">**P4-14</td><td>Pulse input filter</td><td>-</td><td>3</td><td rowspan="2">Set the filter frequency band according to the pulse input.
▪ 0: Unused filter 1: 500Khz (Min)
▪ 2: 750Khz 3: 1Mhz(Default) 4: 1.25Mhz
The above frequency band was calculated based on the width of the input pulse due to the characteristics of the digital filter.</td></tr>
<tr><td>Pulse Input Filter</td><td>0</td><td>5</td></tr>
</table>

5.2.8 Operation parameters

"**" Parameters that cannot be modified and power reset when servo is ON, parameters that cannot be modified when servo is ON

Parameter		Unit	Initial	Description
Code	Name	Minimum	Maximum	
Cn-00	Manual JOG operation	-	-	Manual JOG operation is performed by the drive alone. (Refer to Chapter 5 Operation and Operation") ▪ [MODE]: end ▪ [UP]: forward(CCW) ▪ [DOWN]: reverse(CW) ▪ [SET]: servo ON / OFF Related parameters as shown below. ▪ [P3-08]: Speed command accel. time ▪ [P3-09]: Speed command decel. time ▪ [P3-10]: Speed command S-Curve ▪ [P3-11]: Speed operation pattern ▪ [P3-12]: JOG operation speed (Details: Refer to "5.4.5 Speed Operation Parameter Settings") (Details: Refer to "6.2 Handling and Operating")
	Jog	-	-	
Cn-01	Program JOG operation	-	-	It operates continuously according to a pre-determined program. ▪ [SET]: Program JOG RUN or STOP Related parameters as shown below. ▪ [P3-08]: Speed command accel. time ▪ [P3-09]: Speed command decel. time ▪ [P3-10]: Speed command S-Curve ▪ [P3-11]: Speed operation pattern ▪ [P3-13~16]: Program operation speed 1~4 ▪ [P3-17~20]: Program operation time 1~4 It operates regardless of the contact input status of CN1. (Details: Refer to "5.4.5 Speed Operation Parameter Settings") (Details: Refer to "6.2 Handling and Operating")
	ProgramJog	-	-	
Cn-02	Alarm reset	-	-	Reset the generated alarm. (Details: Refer to "6.2 Handling and Operating")
	Alarm Reset	-	-	
Cn-03	Alarm history read	-	-	Check the saved alarm code history. [UP] or [DOWN]: Read alarm code ▪ ex) Last First History [AL-42]: RST_PFAIL occurred • 01: Recent alarm history • 20: Previous 20th alarm history (Details: Refer to "6.2 Handling and Operating")
	Get Alarm History	-	-	
Cn-04	Alarm history Clear	-	-	This function deletes all of the alarm code history stored in the drive. (Details: Refer to "6.2 Handling and Operating")
	Alarm History Clear	-	-	

Parameter		Unit	Initial	Description
Code	Name	Minimum	Maximum	
Cn-05	Automatic gain tuning	-	-	Automatic gain tuning operation is performed Related parameters as shown below. ▪ [P1-22]: Automatic gain tuning speed ▪ [P1-23]: Automatic gain tuning distance (Details: Refer to “6.2 Handling and Operating”)
	Auto Gain Tuning	-	-	
Cn-06	Phase Z detection operation	-	-	Operates Phase Z detection operation. ▪ [SET]: enter mode and servo ON operation status ▪ [UP]: Phase Z forward search ▪ [DOWN]: Phase Z reverse search Related parameters as shown below. ▪ [P3-07]: Phase Z detection operation speed setting[RPM] (Details: Refer to “6.2 Handling and Operating”)
	Z search	-	-	
Cn-07	Forced input contact ON/OFF	-	-	Temporarily forcibly turns ON/OFF the input contact point. ▪ [UP]: (A),(8),(6),(4),(2) forced signal ON/OFF ▪ [Down]: (9),(7),(5),(3),(1) forced signal ON/OFF ▪ [MODE]: digit shift (Details: Refer to “6.2 Handling and Operating”)
	Forced Input Test	-	-	
Cn-08	Forced output contact ON/OFF	-	-	Temporarily forcibly turns ON/OFF the output contact. ▪ [UP]: (4),(2) forced signal ON/OFF ▪ [Down]: (5),(3),(1) forced signal ON/OFF ▪ [MODE]: digit shift (Details: Refer to “6.2 Handling and Operating)
	Forced Output Test	-	-	
Cn-09	Parameter initial	-	-	Initialize parameter data. (Details: Refer to “6.2 Handling and Operating”)
	Parameter Initialization	-	-	
Cn-10	Automatic speed command offset correction	-	-	Offset of analog speed command is automatically corrected. The voltage range that can be set is -1V to 1V. Offset voltages greater than this range are displayed as [oVrnG] and are not compensated for. The corrected offset can be checked in the analog speed command offset [P2-18]. (Details: Refer to “6.2 Handling and Operating”)
	Auto Speed Command Offset Calibration	-	-	
Cn-11	Automatic torque command offset correction	-	-	Offset of analog torque command is automatically corrected. The voltage range that can be set is -1V to 1V. Offset voltages greater than this range are displayed as [oVrnG] and are not compensated for. The corrected offset can be checked in [P2-21] analog torque command offset. (Details: Refer to “6.2 Handling and Operating”)
	Auto Torque Command Offset Calibration	-	-	

Parameter		Unit	Initial	Description
Code	Name	Minimum	Maximum	
Cn-12	Manual speed command offset correction	-	-	Offset of analog speed command is manually corrected. The voltage range that can be set is -1V to 1V. Offset voltages greater than this range are displayed as [oVrnG] and are not compensated for. The corrected offset can be checked in the analog speed command offset [P2-18]. (Details: Refer to “6.2 Handling and Operating”)
	Manual Speed Command Offset Calibration	-	-	
Cn-13	Manual torque command offset correction	-	-	Offset of analog torque command is manually corrected. The voltage range that can be set is +1V to -1V. Offset voltages greater than this range are displayed as [oVrnG] and are not compensated for. The corrected offset can be checked in the analog torque command offset [P2-21]. (Details: Refer to “6.2 Handling and Operating”)
	Manual Torque Command Offset Calibration	-	-	
Cn-14	Absolute encoder reset	-	-	This function resets the absolute encoder. (Details: Refer to “6.2 Handling and Operating”)
	Abs Encoder Reset	-	-	
Cn-15	Instantaneous maximum load rate initialization	-	-	Initialize the instantaneous maximum load factor value to 0. ▪ [UP]: + forward max. load rate display ▪ [DOWN]: - reverse max. load display ▪ [SET]: Max. load initialization (Details: Refer to “6.2 Handling and Operating”)
	Max Load Clear	-	-	
Cn-16	Parameter locking	-	-	Set parameter lock. ▪ [UP]: UnLock ▪ [DOWN]: Lock (Details: Refer to” 6.2 Handling and Operating”)
	Parameter Lock	-	-	
Cn-17	Current offset	-	-	Save the current offset value to P0-27~P0-28 parameters. (Details: Refer to” 6.2 Handling and Operating”)
	Calculate Current Offset	-	-	

5.3 Operation status display

5.3.1 Status display

1. Current operating status [St-00] display current operating status (Refer to “5.1.2 Status summary display”)

5.3.2 Speed display

1. Current operation speed [St-01]
   Display current operation speed in [RPM] unit.
2. Current command speed [St-02]
   Display current command speed in [RPM] unit

5.3.3 Position display

1. Tracking position pulse [St-03]
   As the servo motor rotates after the servo power is turned ON, it displays the cumulative value of position command pulses that have been followed up to now.
2. Position command pulse [St-04]
   Displays the cumulative value of position command pulses entered after the servo power was turned on.
3. Position pulse remaining [St-05]
   - It means the difference between the command pulse and the tracking pulse, and displays the remaining position pulses for the servo to drive.
   - When servo is off, the remaining amount of delayed position pulse is ignored when servo is on.
4. Input pulse frequency [St-06]
   Displays the frequency of the input pulse.

5.3.4 Display related to torque and load

1. Current operation torque [St-07]
   Displays the energy (load) output by the servo motor as a percentage compared to the rated output.
2. Current command torque [St-08]
   The internal torque command calculated from the servo control algorithm is displayed as a percentage of the rated torque.
3. Accumulated overload rates [St –09]
   Displays the current energy (load) to the rated energy (load) of the servo motor as a percentage.
4. Instantaneous maximum load rates [St-10]
   Displays the maximum (peak) load from the time the servo power is turned ON and control starts to the present as a percentage compared to the rated output.
5. Torque limit [St-11]
   Displays the maximum value of the torque that the servo motor can output as a percentage of the rated torque.
6. DC Link voltage [St–12]
   - The normal DC link voltage of a standard drive using 220[V] power is about 300[V].
   - The maximum permissible DC link voltage of a standard drive using 220[V] power is 405[V].
   - If the DC link voltage limit is exceeded when there is a lot of regenerative energy or the capacity of the regenerative resistor is small, an overvoltage alarm [AL-41] occurs.
   - It is suitable when the DC link value is less than 385[V] in the regeneration section.
7. Regeneration overload [St-13]
   Displays the overload rate for the regenerative capacity of the servo drive.

5.3.5 I/O status display

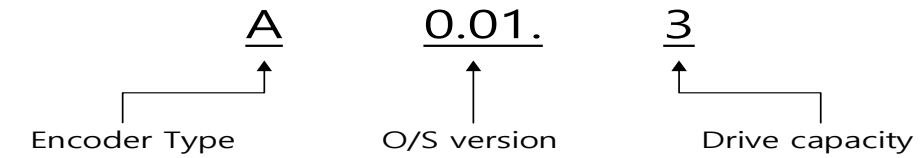
1. CN1 I/O input status[St-14]
   Refer to “5.1.5 External Input Signal Display [St-14]”
2. CN1 I/O Output contacts status[St-15]
   Refer to “5.1.7 External Output Signal Display [St-15]”

5.3.6 Other status and data display

1. Display data (Pulse) within 1 rotation [St-16]
   Displays the data (Single-Turn Data) within one rotation of the encoder in units of [Pulse].
2. Display data (degree) within 1 rotation [St-17]
   Displays the data (Single-Turn Data) within one rotation of the encoder in units of [degree]
3. Multi-rotation data display [St-18]
   Displays the multi-turn data of the encoder.
4. Internal temperate display [St-19]
   The value of the internal temperature sensor of the servo drive is displayed in [℃].
5. Motor rated speed display [St-20]
   Displays the rated speed of the currently installed motor in [RPM] units.
6. Motor maximum speed display [St-21]
   Displays the maximum speed of the currently installed motor n [RPM] units.
7. Motor rated current display [St-22]
   Displays the rated current of the currently installed motor in [A] units.
8. Phase U current offset display [St-23]
   Displays U-phase current offset in [mA] units.
9. Phase V current offset display [St-24]
   Displays Phase V current offset in [mA] units.

5.3.7 Version display.

1. Software version display [St-25]
   Displays the currently installed software version.



Character	Encoder Type
A	Quadrature (Incremental)
B	Serial

No.	Drive capacity
0	Default
1	100 [W]
2	200 [W]
3	400 [W]
4	750 [W]
5	1.0 [kW]
6	2.0 [kW]
7	3.5 [kW]
8	5.0 [kW]
9	7.5 [kW]
A	15 [kW]

5.4 Parameter setting

5.4.1 System parameter setting

1. Motor ID setting [P0-00]
- Please refer to ID: xxx of INPUT on the label attached to the motor.

2. Encoder setting
- Encoder type [P0-01]
- Please refer to the Encoder information on the label attached to the motor and the table below.
- Encoder pulse [P0-02]
- Please refer to the Encoder information on the label attached to the motor and the table below. Please note that the encoder type is different depending on the part APM-SB04A□K1G103 □ in the model name of the motor.

Label attached to the motor	System parameter setting	
APM-SB04A□K1G103	**Encoder Type [P0-01]**	**Enc Resolution [P0-02]**
A~G (Incremental Type)	0	1024~6000p/r
N (Serial Type)	1	19 [bits]
M (Multi turn Type)	3	19 [bits]

Note1) For the serial type, the values of P0-00, P0-01, and P0-02 are set automatically when the motor is connected.
Note2) Incremental type is p/r input, and serial and multi-turn types are bit input.

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

Operation mode	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
When communicating with the servo using RS422 communication or BUS communication, you can use it by giving the servo an ID. In this case, options are required regarding communication.
- Communication speed setting[P0-04]
  Baud Rate, which is the communication speed of RS422, can be selected.
  - 0: 9600[bps]
  - 1: 19200[bps]
  - 2: 38400[bps]
  - 3: 57600[bps]
- System ID[P0-05]
  It is used to communicate with servos individually by giving each servo its own ID.

5. Main power input mode setting [P0-06]
Set the input mode of the main power and the processing method in case of phase loss.
- DIGIT1: set main power input type
  (0: single-phase power input, 1: Three-phase power input)
- DIGIT2: Set error and warning handling 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)
- DIGIT5: Set whether to apply analog input speed in multi-step speed control.
  (0: Analog speed applied, 1: Analog speed not applied)

6. RST check hour setting [P0-07]
Set the check time in case of main power phase loss.

7. Setting Display Parameters at starting [P0-08]
- Set parameters to be initially applied when servo power is turned on.

- The setting value is divided into 0 to 25 from [St-00] to [St-25] and sets the number of the corresponding parameter.

8. Regenerative overload derating factor setting [P0-09]
This specifies the derating factor which checks for regenerative resistor overloads. If the derating value is set below 100%, an overload alarm occurs at a time proportional to the set value.

9. Set regenerative resistor value [P0-10]
Set the resistor value of the regenerative braking resistor. When set to 0, the resistor value built into the drive is used.

10. Regenerative resistor setting
Set the capacity of the currently installed regenerative resistor. When set to 0, the built-in resistor capacity of the drive is used.

11. Overload detection basic load factor setting [P0-12]
Indicates the load rate at which a continuous overload check is initiated. If set below 100, overload check starts early and overload alarm occurs early.

12. Overload warning level setting [P0-13]
Set the level at which the continuous overload warning signal is output. A warning signal is output when the set % value compared to the alarm generating value is reached.

13. Encoder pulse division output (encoder output division [P0-14])
When outputting the encoder signal from the servo to the outside, the output pulse divides and output by the set division value (encoder output division [P0-14]).

- ex) Set the division value (pulse output division [P0-14] = 12000) in the motor with encoder 3,000 [ppr]

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

14. PWM OFF delay time setting [P0-15]
Sets the delay time for actual PWM OFF when the servo OFF command is executed. In other words, when the brake of the motor is driven by the output contact “BRAKE” signal, after the servo is turned off, the “BRAKE” signal is turned off and set delay time, at which actual PWM is turned off to prevent the motor from flowing in the vertical axis during the delay time during which the motor brake is applied. (Setting range: 0~1000[ms], Initialization value 10)

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

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

16. Servo function setting bit [P0-17]
Set the function of the drive by DIGIT

- DIGIT 1 -> sets the driving direction of the servo.
  - 0: CCW (Forward), CW(Reverse)
  - 1: CW (Forward), CCW(Reverse)
- DIGIT 2 -> Sets the servo lock.
  - 0: Unused
  - 1: Used(Torque increase at analog command stop)
- DIGIT 3 -> Open collector output setting
  - 0: Unused
  - 1: Used(AL0, AL1, AL2 output contacts -> Open collector A, B, Z output)

Alarm Code Group		Alarm Code	Name
1	Current	AL-10	IPM Fault
		AL-11	IPM Temperature
		AL-14	Over Current
		AL-15	Current Offset
		AL-16	Over Current
2	Load	AL-21	Continuous Overload
		AL-22	Room Temperature
		AL-23	Regen Overload
3	Encoder/Motor	AL-24	Motor Cable Open
		AL-30	Encoder Comm
		AL-31	Encoder Cable Open
		AL-32	Encoder Data Error
		AL-33	Motor Setting Error
		AL-34	Encoder Z Phase Open
		AL-35	Low Batter Error
4	Voltage	AL-40	Under Voltage
		AL-41	Over Voltage
		AL-42	RST Power Fail
		AL-43	Control Power Fail
5	Control	AL-50	Over Speed Limit
		AL-51	Position Following
		AL-53	Over Pulse CMD
		AL-54	Speed Deviation
6	Communication and parameter	AL-55	Motor Over Run
		AL-63	Parameter Checksum
		AL-74	Parameter Range
7	Standard settings	AL-71	Invalid Factory Setting
		AL-72	GPIO Setting

- DIGIT 4 -> Monitor output voltage setting (Apply to both monitor 1 and 2)
  - 0: -10~+10V
  - 1: 0~+10V
- DIGIT 5 -> Set EEPROM communication save.
- 0: EEPROM used
- 1:EEPROM not used

17. DAC output setting

There are 2 DAC outputs, and the value corresponding to the data is output according to the set condition at a cycle of 200[usec] each.

- DAC output type [P0-18 DIGIT1, DIGIT2]

Form	Data contents	Form	Data contents
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[0.1Kpps]	-	

- DAC output scale [P0-23], [P0-24]
  If the output value is too small or too large, it can be output by properly enlarging or reducing the ratio. Set the magnification [Unit/V] of analog output channels 1~2.
  (Speed [RPM], Torque [%], Position command frequency [0.1Kpps], Position [pulse], DC Link [V])
  ex) Channel 1 scale 100=> Outputs 100[RPM] as 1[V].
- DAC output offset [P0-19], [P0-20]
  Set the offset [Unit/V] of analog output channels 1~2.
  (Speed [RPM], Torque [%], Position command frequency [0.1Kpps], Position [pulse], DC Link [V])

5.4.2 Control parameter setting

The setting sequence of control parameters is as follows.

- Load inertia ratio [P1-00] setting: Refer to “6.2.6 Automatic Gain Tuning [Cn-05]”
- Position proportional gain [P1-01], [P1-02] adjustment
  Increase within the range where the servo motor does not overshoot or oscillate. (Do not use during speed operation or torque operation.)
- Speed proportional gain [P1-06], [P1-07] adjustment:
  Increase within the range where the servo motor does not vibrate.
- Speed integral time constant [P1-08], [P1-09] adjustment:
  Refer to the table below to set according to the setting value of the speed proportional gain.

(1) Inertia ratio setting [P1-00]

Calculate the load inertia according to the mechanical system and set the ratio by calculating the ratio to the rotor inertia in the motor characteristics table.

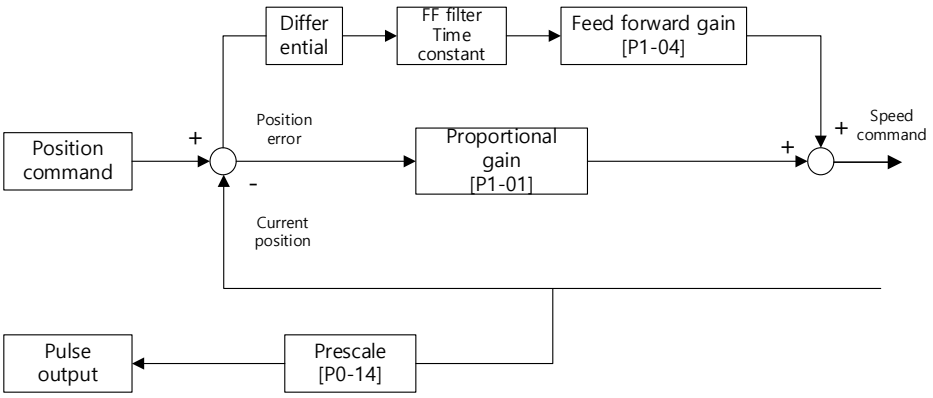
The inertia/load ratio is an important control parameter for the operation of the servo. It is crucial to set the correct inertia ratio for optimal servo operation.

- The table below is the recommended value of appropriate control gain according to the load inertia ratio.

Motor Flange	Inertia ratio		Gain setting 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
	Middle inertia	5 ~ 20	20 ~ 70	200 ~ 500	20 ~ 60
	High inertia	20 ~ 50	10 ~ 40	100 ~ 300	50 ~ 100

* If it is difficult to calculate the inertia ratio, the inertia ratio can be tuned during trial operation.

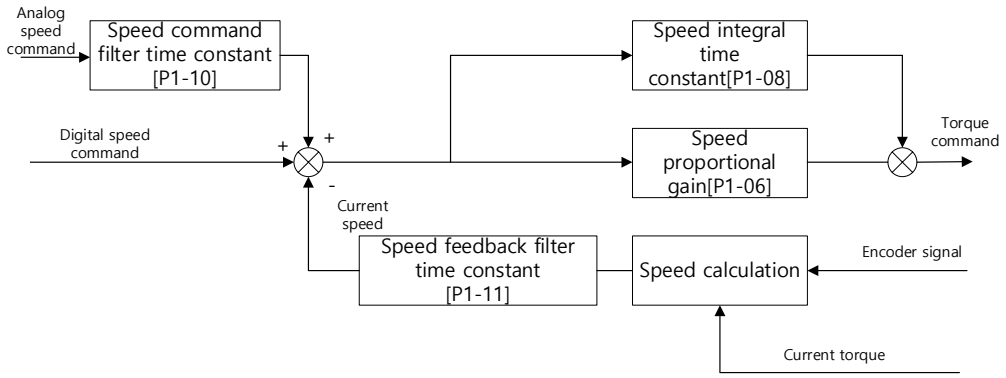
(2) Position control gain



- Position Command: It counts the position command pulse input from the outside and converts it into a position command value, applies the electronic gear ratio, and uses it as an internal position command through [P1-03] position command filter. If the numerator of the electronic gear ratio is large, the external input position command pulse change has a large effect on the internal position command change, so it is necessary to adjust [P1-03] position command filter time constant to alleviate it.
- Current Position: It counts the pulse signal received from the encoder and converts it into the current position value using the electronic gear ratio setting.

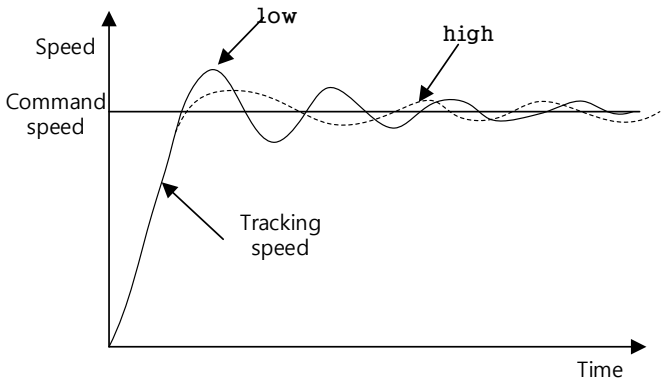
- Position proportional gain [P1-01], [P1-02]: The difference between the position command and the current position is converted into a speed command by multiplying the position proportional gain.
  * Recommended setting = speed proportional gain [P1-06] / 10
- Feed forward gain [P1-04]: It is used to shorten the positioning time by obtaining the gradient as the differential value for the position command and adding the speed command to this gradient. If this value is too large, overshoot may occur in position control or position control may become unstable. Therefore, it is necessary to set it to an appropriate value by gradually increasing it from a small value while watching the trial run.
- Feed forward filter [P1-05]: In the feed forward control filter, control fluctuates when the position command changes too rapidly. In such cases, you can set filter values to eliminate oscillations caused by rapid changes.

(3) Speed control gain

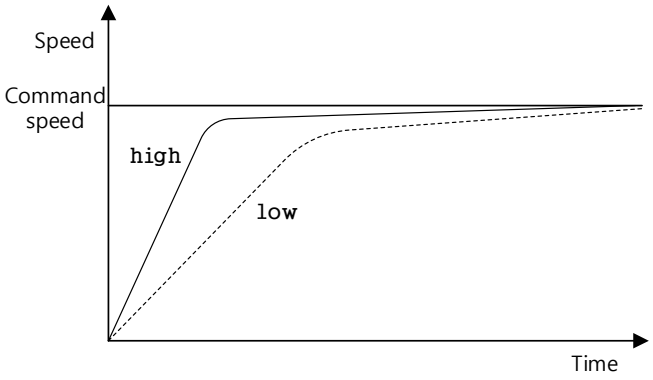


- Speed command: The analog speed signal input from the outside is used as a speed command through the speed command filter [P1-10], or the digital speed command is used in the [RPM] unit set in the internal parameter.
- Current speed: The speed is calculated by counting the encoder signal according to time, and the calculated speed is used as the current speed through a filter. At this time, an algorithm that estimates the speed using the current torque and inertia is used to compensate for the speed calculation error at very low speeds during speed calculation. Therefore, accurate setting of motor constant and inertia ratio has a lot to do with motor speed control stability.
- Speed integral time constant [P1-08]: The integral value for the speed error, which is the difference between the command and the current speed, is obtained, and this value is multiplied by the integral time constant to convert into a torque command.
  If the integral time constant is reduced, the transient response characteristics can be improved to improve the speed followability, but overshoot occurs if it is too small. Also, if it is too large, the transient response characteristics are degraded and it is operated with proportional control characteristics.

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



- Speed proportional gain [P1-06]: The speed error is multiplied by the proportional gain and converted into a torque command.
  If this value is large, the speed response becomes faster and the speed followability increases, but if it is too large, vibration occurs. Also, if this value is small, the speed response becomes slow, and the speed follow-up becomes poor, and the servo loses power.



- Speed feedback filter time constant [P1-11]: If the motor speed fluctuates due to drive system vibration or if vibration occurs due to gain when a load with too much inertia is applied, the vibration can be suppressed by applying a filter to the speed feedback. At this time, if the value is too large, the speed response decreases and the control performance deteriorates.

  Recommended setting = 0~ Speed integral time constant [P1-08]/ 10

(4) Torque command filter time constant setting [P1-12]

The stability of the command signal can be improved by setting a digital filter for the digital analog torque command voltage. At this time, if too large a value is set, the response to the torque command will decrease. Therefore, set it to an appropriate value according to the system

(5) Torque limit setting [P1-13], [P1-14]

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

(6) Gain1<->Gain2 switching mode setting[P1-15] 0x0F (DIGIT 1)

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

- 0: Only the gain 1 is used.
- 1: ZSPD automatic gain switching
  In the case of zero speed, switching from gain 1 to gain 2
  Switching from gain 2 to gain 1 in the opposite case.
- 2: INPOS automatic gain switching
  Switching from gain 1 to gain 2 in the case of in Position
  Switching from gain 2 to gain 1 in the opposite case.
- 3: Manual gain switching
  Switching from gain 1 to gain 2 when gain2 contact point is on.
  Switching from gain 2 to gain 1 in the opposite case.

(7) Gain1<->Gain2 switching time setting[P1-16]

- Set the gain switching time during operation.
- Gain 1->Gain 2, Gain 2->Gain 1 switching is scheduled according to the time setting.

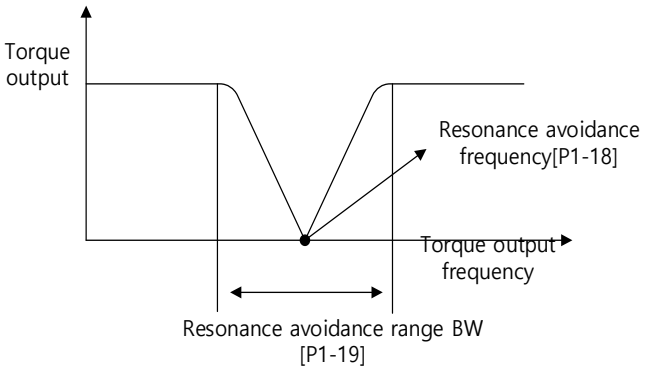
(8) P / PI switching mode setting [P1-15 DIGIT2]

Set the P, PI control switching mode. [0xF0 (DIGIT 2)]

- 0: only PI control
- 1: P control when the command torque is higher than the set torque [P1-24]
- 2: P control when the command speed is higher than the set speed [P1-25]
- 3: P control when the current acceleration is higher than the setting acceleration [P1-26]
- 4: P control when the current position error is higher than the set position error [P1-27]
- P control when PCON contact is ON (take priority over other conditions)

By using these functions, the position operation characteristics can be improved by applying the P control operation stop function after PI control operation.

(9) Resonance avoidance operation setting [P1-17], [P1-18], [P1-19]



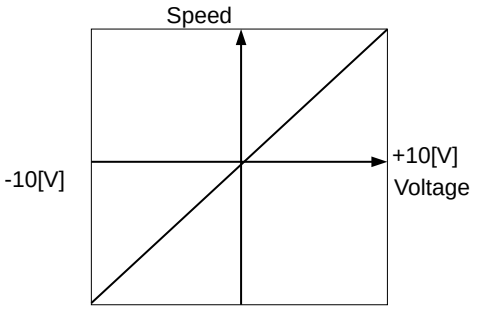
Depending on the system, if vibration due to mechanical resonance occurs at a specific frequency, the vibration due to resonance can be suppressed by suppressing the torque output for this frequency band.

- Resonance avoidance operation [P1-17]
  - 0: Unused
    1: Used

5.4.3 Analog input/output parameter setting

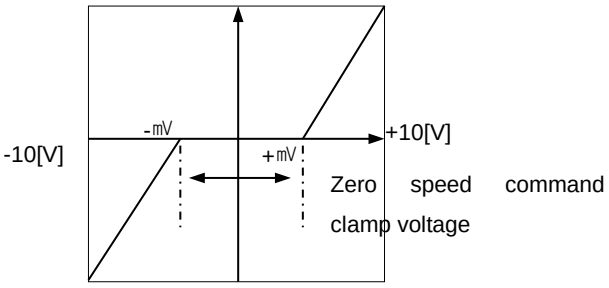
(1) Analog speed scale setting

- Analog speed command scale [P2-17]: Set the analog speed command value at 10 [V] in [RPM] unit. At this time, the maximum setting value is the maximum motor speed.
- Analog speed command offset [P2-18]: There are cases where a certain voltage exists even at 0 speed command on the analog signal connection circuit. At this time, you can compensate by setting the voltage value corresponding to a certain voltage as an offset. The unit is set in [㎷] unit.
- Zero speed command clamp setting



Zero speed command clamp voltage"

[P2-19] = 0

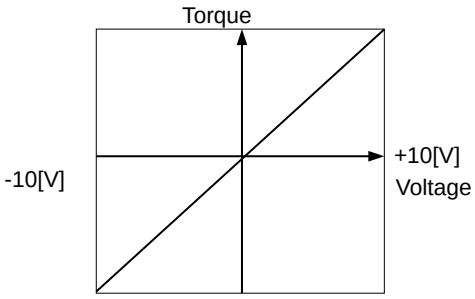


Zero speed command clamp voltage

[P2-19] = Not 0[mV]

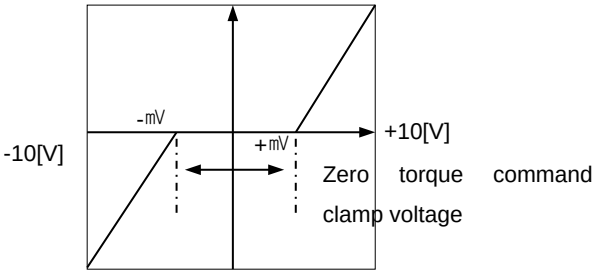
(2) Analog torque scale setting

- Analog torque command scale [P2-20]: set the analog torque command value at 10[V] as a percentage compared to the rated torque. At this time, the setting must be used within the torque limit [P1-13] [P-14] set value of the system parameter setting.
- At this time, the setting must be used within the torque limit [P1-13] [P-14] set value of the system parameter setting. At this time, you can compensate by setting the voltage value corresponding to a certain voltage as an offset. The unit is set in [㎷] unit.
- Zero torque command clamp



Zero torque command clamp voltage

[P2-22] = 0



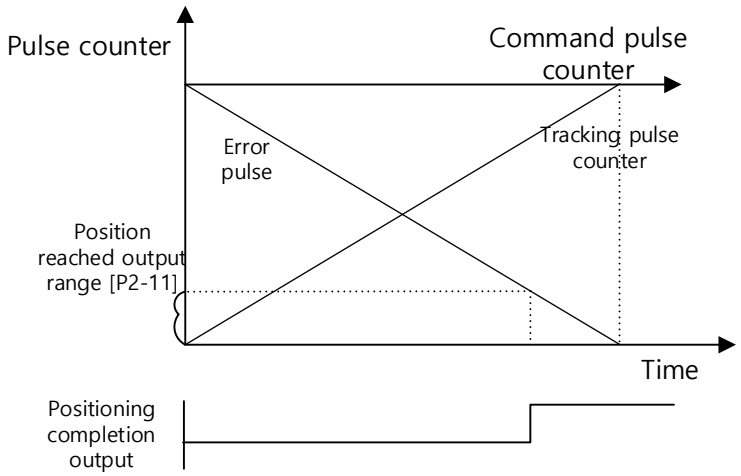
Zero torque command clamp voltage

[P2-22] = Not 0[mV]

5.4.4 I/O parameter setting

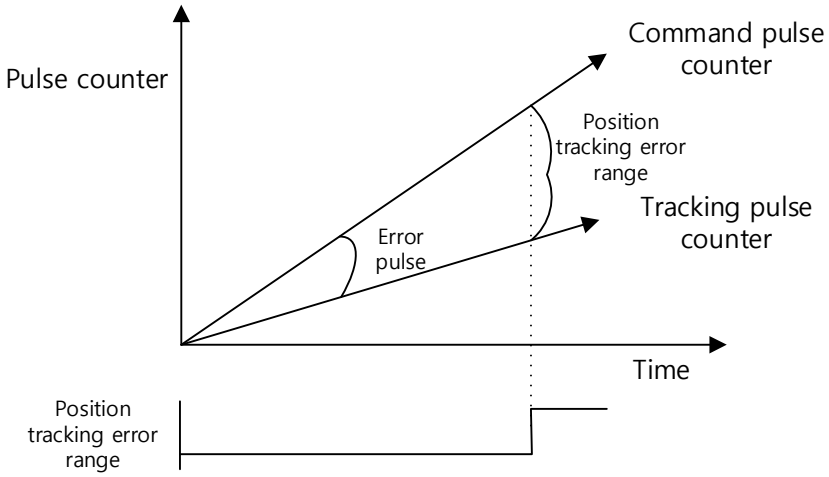
(1) Position operation parameter setting

- Position reach output range [P2-11]: When the error pulse value, which is the difference between the command position pulse and the tracking position pulse, is within the setting range, the positioning completion signal is output.



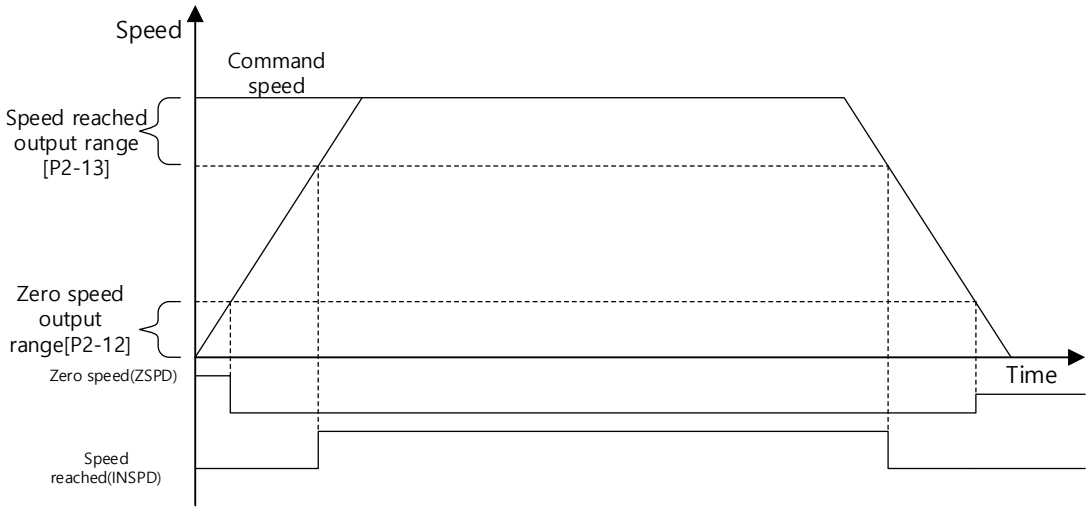
If the setting value is too large, the positioning completion output signal may occur during operation according to the position command pulse, so it must be set to an appropriate value.

- Position operation tracking error range [P4-11]



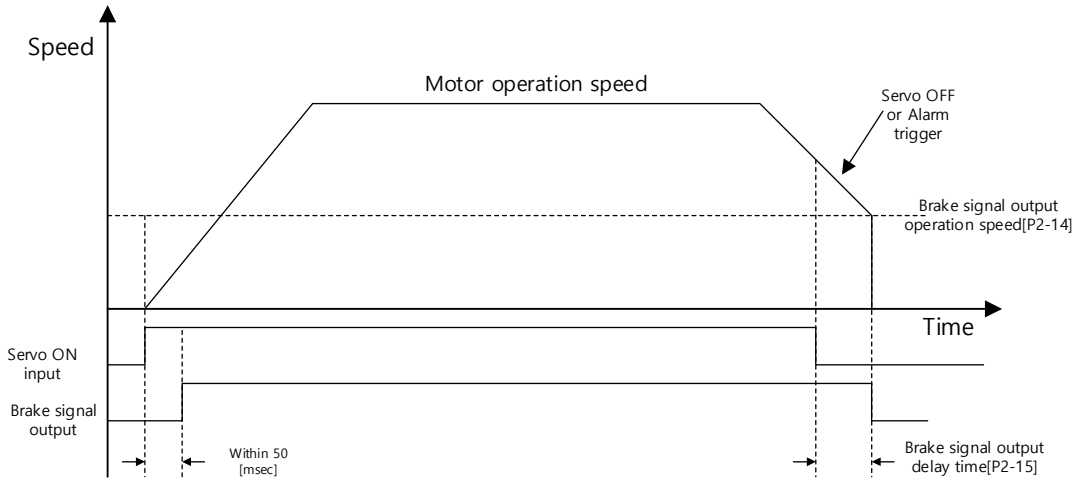
If the error pulse is greater than the set value of the position operation following error range, the position following error alarm [AL-51] occurs.

(2) Speed control parameter setting



- Zero speed output range [P2-12]: When the current speed is below the set speed, the zero speed signal is output.
- Speed reach completion output range [P2-13]: Speed reach completion signal is output.

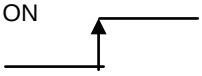
(3) Brake signal output parameter setting



- Brake signal output operation speed [P2-14], brake signal output delay time [P2-15]
  If an alarm occurs while operating the motor with the servo by applying the servo built-in brake to the vertical axis, or if the servo is decelerated by servo OFF, the operation condition among brake signal output operation speed [P2-14] or brake signal output delay time [P2-15]. This function prevents the vertical axis from falling with the motor brake by turning the brake signal “OFF” by the first satisfied signal.

(4) Position pulse clear mode [P2-16]

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

Setting	Operation method
0	Operates only at the edge that converts contact OFF -> ON Does not operate in OFF or ON state 
1	Operates immediately when the contact is on_Level and maintains torque when high is input.
2	Operates immediately when the contact is on_ Level, and maintains torque at 0 when High is input.

(5) Output signal logic definition setting [P2-10]

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

5.4.5 Speed operation parameter setting

(1) Speed command [P3-00]~[P3-06]

You can operate by setting the operation speed in [RPM] units. The operation speed is selected according to the speed command input contact point.

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

[P0-06] Depending on Bit 5 setting, whether to apply analog speed command can be set.

(From O/S Ver 1.47)

0: In case of multi-step speed control, analog speed command is applied

1: In case of multi-step speed control, analog speed command is not applied

(2) Jog 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]: Set the time taken to stop during operation at the rated motor speed in [ms].

(3) S-drive [P3-11]

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

- 0: Trapezoidal -> acceleration/deceleration time[P3-08], [P3-09] setting
- 1: Sinusoidal -> acceleration/deceleration time[P3-08], [P3-09] + S-Curve time[P3-10] setting

(4) Manual JOG operation [Cn-00]

Press the [Right] key to rotate forward at the JOG operation speed [P3-12], and press the [Left] key to rotate backward at the JOG operation speed [P3-12].

(5) Programs JOG operation [Cn-01]

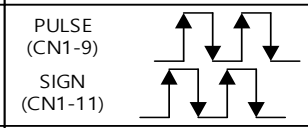
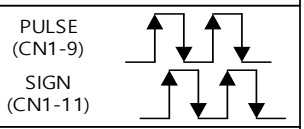
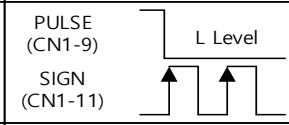
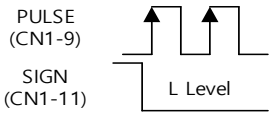
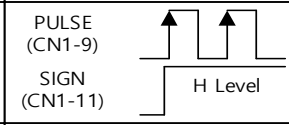
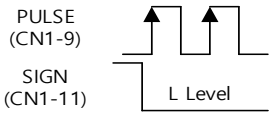
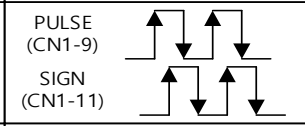
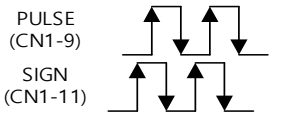
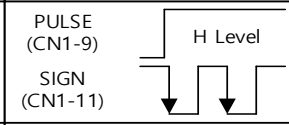
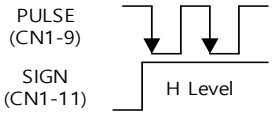
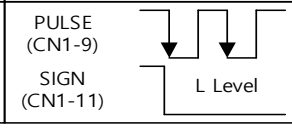
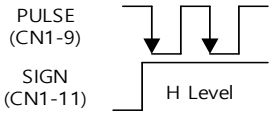
Test operation is repeated from Step 1 to Step 4
Set the operation speed ([P3-13]~[P3-16]) and operation time ([P3-17]~[P3-20]) in each step.

5.4.6 Position operation parameter setting

(1) Input pulse logic [P4-00]

Set the type of position command input pulse and the rotation method for each 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+B Positive logic	0		
CW+CCW Positive logic	1		
Pulse+Direction Positive logic	2		
Phase A+B Negative logic	3		
CW+CCW Negative logic	4		
Pulse+Direction Negative logic	5		

(2) Electrical gearing [P4-01]~ [P4-08]

The electronic gear ratio sets the relationship between the position command input pulse and the motor encoder pulse as a numerator/denominator, and is set so that no error occurs during position operation. The setting method is as follows.

Electrical gear ratio = feed per input pulse × number of pulses per motor rotation / feed per motor rotation

Ex) When the deceleration ratio is 1/2, the ball screw lead is 10 [mm], and the encoder pulse is 3000 pulses in the command unit controlled by 1 [㎛] per pulse.

1. Feed per input pulse = 1×10-3=0.001[㎜]
2. Number of pulses per motor rotation = Encoder pulse number×4=3000×4= 12000
3. Feed per motor rotation = 10×1/ 2=5[㎜]
4. Electrical gear ratio = 12000×0.001/5=12/5

Therefore, the numerator of the electrical gear ratio is “12” and the denominator of the electrical gear ratio is “5”.

Note1) In the case of 3000-pulse encoder, 12000 pulses per revolution are achieved because the servo drive multiplies by 4 in the incremental type encoder signal method.

Note2) At this time, the motor speed ([RPM])

Motor speed = 60 × electrical gear ratio × input pulse frequency / number of pulses per motor rotation

Note3) The error pulse [St-05], which is the difference between the command pulse and the tracking pulse during operation, is as follows.

Error pulse = command pulse frequency × electrical gear ratio × {1-(0.01 × [P1-05])}/[P1-01]

Note4) In the serial type encoder signal method, it is 524288 pulses per rotation without 4 multiplication.

Note5) Caution) Please be aware that driving errors may occur when the value of the final gear ratio (numerator/denominator) exceeds the decimal point or 60000.

(3) Backlash compensation [P4-13]

In position pulse command operation, if the operating distance per revolution changes due to wear of the machine, it can be used by adjusting the amount of change due to wear with offset.

(4) Electrical gear ratio offset adjustment

If the driving distance per rotation changes, the amount of change due to wear can be adjusted with an offset.

- Electrical gear ratio setting mode[P4-09]
  - 0: Use electronic gear ratios 1-4.
  - 1: Electrical gear ratio 1 is used and the value set in the electronic gear ratio numerator is overridden.
- Electronic gear ratio numerator offset setting
  In the example above, if the numerator is “12000” and the denominator is “5000” and the 'EGEAR1' contact is “ON”, [P4-10] setting value increases by 1, and if the 'EGEAR2' contact is “ON”, [P4-10] setting value is reduced by 1 and saved in [P4-10] parameter.

  If the offset set in this way is “2”, the electrical gear ratio is applied from “12000/5000” to “12002/5000” and operates. Also, if the offset is “-2”, the electrical gear ratio is applied from “12000/5000” to 11998/5000 and operates.

5.5 List of alarms and warnings

5.5.1 Summary display list of servo alarm status

When an alarm occurs, the fault signal output contact point (ALARM) is turned off, and the motor is stopped by Dynamic Brake.

Alarm Code	Name	Content	Check Items
	IPM Fault	Over current(H/W)	Check drive output incorrect wiring/encoder incorrect wiring. Check Motor ID/Drive ID/Encoder settings Determine whether there is a conflict or binding in the equipment.
	IPM temperature	IPM overheating	Check drive output incorrect wiring, encoder incorrect wiring. Check Motor ID, Drive ID, Encoder settings. Determine whether there is a conflict or binding in the equipment.
	Over current	Over current(S/W)	Check drive output incorrect wiring, encoder incorrect wiring. Check Motor ID, Drive ID, Encoder settings. Determine whether there is a conflict or binding in the equipment.
	Current Offset	Current offset error	Check if [St-23], [St-24] are more than 10% of the rated current, replace the drive
	Over Current(/CL)	Over current(H/W)	Check drive output incorrect wiring, encoder incorrect wiring. Check Motor ID, Drive ID, Encoder settings. Determine whether there is a conflict or binding in the equipment.
	Continuous overload	Continuous overload	Determine whether there is a conflict or binding in the equipment. Check load status, check brake operation status. Check drive output incorrect wiring, encoder incorrect wiring Check Motor ID, Drive ID, Encoder settings.
	Room Temperature	Drive overheating	Check drive internal temperature [St-19]. Cooling fan installation, load condition inspection
	Regen. Overload	Regenerative overload	Input voltage, regeneration braking resistor and wiring check. Drive replacement
	Motor Cable Open	Motor disconnection	Motor wiring
	Encoder Comm.	Serial encoder communication error	Check for incorrect wiring of the serial encoder cable
	Encoder Cable Open	Encoder cable open	Check whether cable is disconnected.
	Encoder Data Error	Encoder data error	[P0-02] Setting value, check encoder wiring.
	Motor Setting Error	Motor ID setting error	Check [P0-00] setting value.
	Encoder Z PHASE Open	Encoder Z phase disconnection	Check whether cable is disconnected.
	Low Battery Error	Low Battery Error	Back-up battery replacement when using absolute encoder.

Alarm Code	Name	Content	Check Items
			※After replacing the battery, power is re-applied and origin operation is required. (Applies from S/W Ver 1.28)
	Preset Error	Encoder initialization	Back-up battery replacement when using absolute encoder. Lack of voltage and first coupling of encoder. ※ After replacing the battery and alarm reset, power is re-applied and origin operation is required.
	Under Voltage	Low Voltage	Check input voltage, check power wiring.
	Over Voltage	Over voltage	Input voltage, braking resistor damage and wiring. Excessive regenerative operation, check regenerative resistor.
	RST Power Fail	Main power error	Check power supply wiring and power supply.
	Control Power Fail	Control power error	Check power supply wiring and power supply.
	Over Speed Limit	Over speed	Check encoder error, encoder setting value, encoder wiring, gain setting, motor wiring, motor ID, electrical gear ratio, speed command scale
	Position Following	Excessive positional error	Check the position command pulse excessive [P4-11] setting value, wiring and limit contact, gain setting value, encoder setting, and electrical gear ratio setting. Check equipment restraints and load conditions.
	Over Pulse CMD	Pulse command frequency error	Check pulse command frequency from upper controller. Check Command pulse type.
	Speed Deviation	Excessive speed error	Check drive output incorrect wiring, encoder incorrect wiring. Check equipment restraints and load conditions.
	Motor Over Run	Runaway motor	Check drive output incorrect wiring, encoder incorrect wiring. Check equipment restraints and load conditions.
	Parameter Checksum	Parameter error	Check parameter values.
	Parameter Range	Parameter range error	Check parameter values.
	Invalid Factory Setting	Factory setting error	Check parameter values.
	GPIO Setting	Output setting error	Check parameter values.

⚠Caution

- If the motor and encoder cable are replaced while the absolute encoder is in use, or if the battery is replaced with the servo power off, the multi-turn data of the encoder will be lost.
- If the encoder loses multi-turn data, there is a risk of equipment malfunction or accident, so be sure to operate after originating.

5.5.2 Summary display list of servo warning status

If a warning code is displayed in the current operation status [St-00], the servo drive is operating in an abnormal state, so check the parts corresponding to the inspection items.

Warning status (CODE)	Name	Contents and cause	Check Items
	RST_PFAIL	Main power source loss	Main power is not applied when [P0-06] DIGIT2 is set to 1.
	LOW_BATT	Low battery	When applying the absolute value encoder, the output voltage of the encoder backup battery is insufficient.
	OV_TCMD	Excessive torque command	A command exceeding the maximum set torque was input.
	OV_VCMD	Excessive speed command	A command exceeding the maximum set speed was input.
	OV_LOAD	Overload warning	The maximum setting overload [P0-13] setting range has been reached.
	SETUP	Capacity selection	The motor current capacity is greater than the drive current capacity.
	UD_VTG	Low battery warning	When [P0-06] DIGIT2 setting is 1, DC-link voltage is less than 190V.
	EMG	EMG Contact	Check I/O wiring and [P2-09] set value….

Warning codes are displayed in hexadecimal, and when two or more warnings occur simultaneously, the sum of each warning code is displayed. For example, [W-0C] is displayed when [W-04] Excessive torque command and [W-08] Excessive speed command occur simultaneously

When [W-80] occurs, SVON is changed from ON to OFF, and it is automatically released when I/O power is turned on or the contact logic is changed.

6. Handling and Operating

6.1 Checklist before driving

In order to prevent safety accidents and product damage caused by servo motor operation during trial operation, check the following and take measures to ensure that there are no problems.

6.1.1 Check wiring

1. Check if the correct voltage (AC 200 [V]) is applied to the power input terminal.
2. Are the power lines (U, V, W, FG) between the drive and motor properly connected?
3. Is the 24[V] voltage connected to the control signal without any problems?
4. Is the regenerative resistor suitable for the capacity, and is there any problem with the connection?
5. Is the wiring cable severely bent or is there any part where pressure is applied?
6. Are there any problems with grounding and shielding?

6.1.2 Drive signal (CN1) wiring check

Make sure that the wiring and contact status of the driving signal is as follows.

Pin No.	Pin name	Contact status	Pin No.	Pin name	Contact status
18	EMG	ON	19	CWLIM	ON
47	SVON	OFF	20	CCWLIM	ON
48	STOP	OFF	17	ALMRST	OFF

The above state is the factory default state, depending on the input signal allocation ([P2-00], [P2-01], [P2-02], [P2-03], [P2-04]) settings, the assigned function may be different.

6.1.3 Check operating atmosphere

Check that there is no metallic powder or moisture in the wiring area.

6.1.4 Machine status check

1. Are there any abnormalities in the servo motor coupling?
2. Is there any loosening or breakaway of fastening bolts?
3. Are there any obstacles in the driving area of the machine?

6.1.5 System parameter check

1. Is there anything wrong with motor ID setting [P0-00]?
2. Are there any abnormalities in encoder type [P0-01] and encoder pulse [P0-02]?
3. Is the control gain set to an appropriate value?

*Note: Please refer to “Appendix 9.2 Test Procedure”.

6.2 Handling and Operating

6.2.1 Manual JOG operation [Cn-00]

Manual JOG operation is performed by the drive alone.

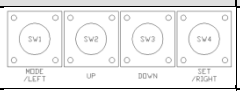
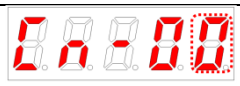
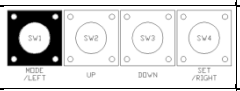
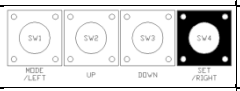
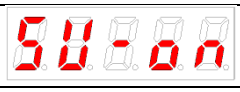
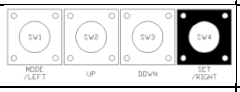
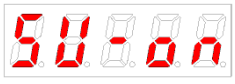
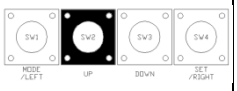
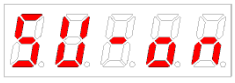
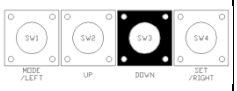
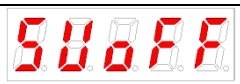
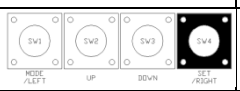
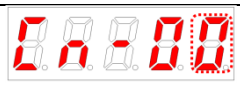
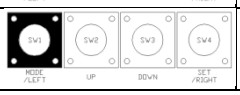
1. [Jog] is displayed when [SET] key is pressed in [Cn-00]
   (However, when EMG, CW/CCW contact is ON in external I/O)
2. When [SET] key is pressed, [SV-on] is displayed and the servo is in ON operation status.
   If an alarm occurs, check the wiring or other sources of alarm, take action, and try again.

   When the loader status is as follows, " " External I/O SVON contact is ON. Please try again after turning the SVON contact OFF.
3. While pressing the [UP] key, the motor rotates forward (CCW) at the JOG operation speed [P3-12].
4. While pressing the [DOWN] key, the motor rotates reverse (CCW) at the JOG operation speed [P3-12].
5. If you press the [SET] key again, manual JOG operation ends and the servo turns OFF.
6. Press and hold the [MODE] key to return to the operation parameter screen [Cn-00].

Related parameter	Speed	Initial
[P3-08]	Speed command accel. time[ms]	0
[P3-09]	Speed command decel. 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

"*"displayed parameters cannot be modified when servo is ON.

[Example of how to operate manual JOG operation]

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied
2			Press the [MODE] key to move to [Cn-00].
3			Press the [SET] key to enter manual JOG operation.
4			Press the [SET] key to turn the servo ON.
5			When the [UP] key is pressed while the servo is ON, it rotates in the forward rotation (CCW) direction. When you release your hand, the motor stops.
6			When the [DOWN] key is pressed while the servo is ON, it rotates in the reverse rotation (CW) direction. When you release your hand, the motor stops.
7			Press the [SET] key to turn the servo ON.
8			Press and hold the [MODE] key for about 1 second to return to [Cn-00].

※" " is a blinking mark.

6.2.2 Programs JOG operation [Cn-01]

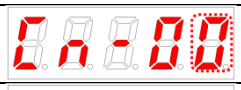
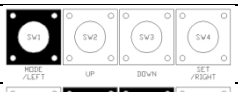
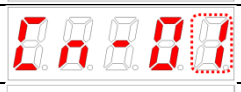
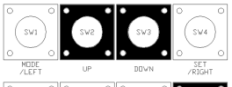
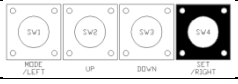
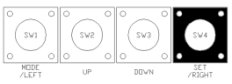
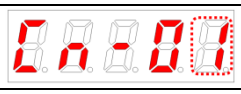
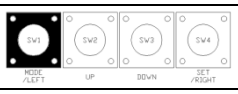
It operates continuously according to a pre-determined program.

1. [P-Jog] is displayed when [SET] key is pressed in [Cn-01] parameter.
2. When [SET] key is pressed, [run] is displayed and after servo ON, program JOG operation is performed.
   (If an alarm occurs at this time, check the wiring of the servo or other sources of alarm, take action, and then try again)
3. If you press the [SET] key again, program JOG operation ends and the servo turns OFF.
4. Press and hold the [MODE] key to return to the operation parameter screen [Cn-00].
5. The operation step is continuously operated by repeating 4 steps from 0 to 3, and the operation speed and time are set in the parameters below.

Related parameter	Speed	Initial
[P3-08]	Speed command accel. time[ms]	100
[P3-09]	Speed command decel. 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 how to operate program JOG operation]

Sequence	Loader display after operation	key to use	operation explanation
1			Displays speed control mode with main power and control power applied.
2			Press the [MODE] key to move to [Cn-00].
3			Press the [Up] or [DOWN] key to move to [Cn-01].
4			Press the [SET] key to enter program JOG operation.
5			Press the [SET] key and the motor runs continuously according to the pre-determined program.
6			If you press the [SET] key once more, the continuous operation by the program ends. It will be marked as [done].
7			Press and hold and moving [MODE] key for about 1 second to return to [Cn-01].

※“ ▯ “ is a blinking mark.

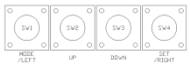
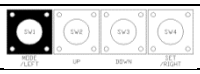
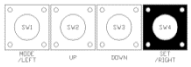
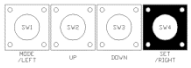
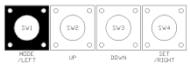
6.2.3 Alarm reset [Cn-02]

Reset the generated alarm.

1. Contact alarm reset: If ALMRST is turned ON during the input contact point, the alarm status is reset and becomes normal.
2. Operation alarm reset: If you press the [SET] key in the alarm reset [Cn-02] parameter among operation parameters, [ALrst] is displayed, and if you press the [SET] key again, the alarm is reset and returns to the normal status.

※ If the alarm continues to persist after the reset operation, check the alarm occurrence condition, remove the cause, and then try again.

[Example of alarm reset operation method]

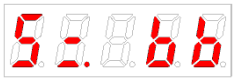
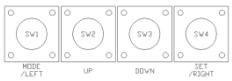
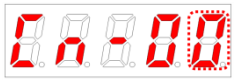
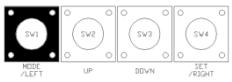
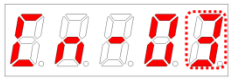
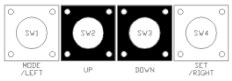
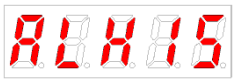
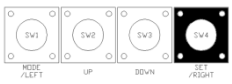
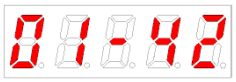
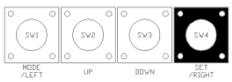
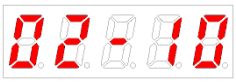
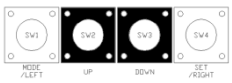
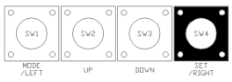
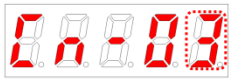
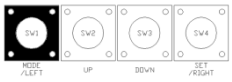
Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied
2			Press the [MODE] key to move to [Cn-00].
3			Press the [Up] or [DOWN] key to move to [Cn-02].
4			Press the [SET] key to enter the alarm reset mode.
5			Press the [SET] key to reset the alarm. It will be marked as [done].
6			Press and hold and moving [MODE] key for about 1 second to return to [Cn-02].

※“ ▯ “ is a blinking mark.

6.2.4 Alarm history read [Cn-03]

Check the saved alarm code history.

[Example of alarm history read operation method]

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied.
2			Press the [MODE] key to move to [Cn-00].
3			Press the [Up] or [DOWN] key to move to [Cn-03].
4			Press [SET] key to enter alarm history reading.
5			Press the [SET] key to display the most recent alarm code. ex) Last first history [AL-42]: main power phase loss 01: Recent alarm history 20: Previous 20th alarm history
6			Press the [UP] or [DOWN] key to read the alarm history. ex) Second recent history [AL-10]: Over current (HW) occurred. 01: Recent alarm history 20: Previous 20th alarm history
7			Pressing [SET] key to end alarm history reading. It will be marked as [done].
8			Press and hold the [MODE] key for about 1 second to return to [Cn-03].

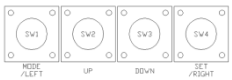
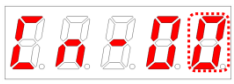
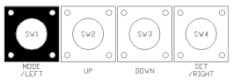
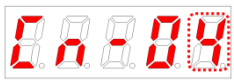
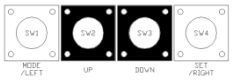
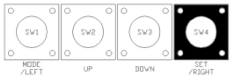
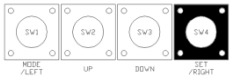
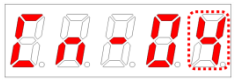
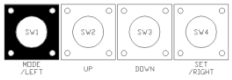
※“ ▯ “ is a blinking mark.

※ In case of OS Ver 1.02 or later, alarm code “AL-43” is not saved.

6.2.5 Alarm history reset [Cn-04]

Delete all the saved alarm code.

[Example of alarm history reset operation method]

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied.
2			Press the [MODE] key to move to [Cn-00].
3			Press the [Up] or [DOWN] key to move to [Cn-04].
4			Pressing [SET] key to enter alarm history reset.
5			Press the [SET] key to deletes alarm history. It will be marked as [done].
6			Press and hold the [MODE] key for about 1 second to return to [Cn-04].

※“ ▯ “ is a blinking mark.

6.2.6 Automatic gain tuning [Cn-05]

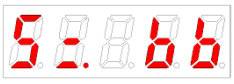
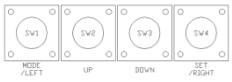
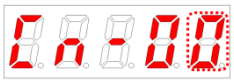
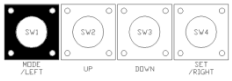
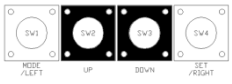
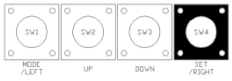
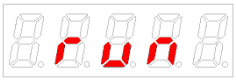
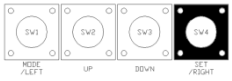
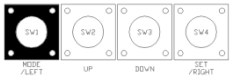
Automatic tuning operation is performed.

1. [Auto] is displayed when [SET] key is pressed in [Cn-05] parameter.
2. When [SET] key is pressed, [run] is displayed and automatic gain tuning starts.

   If an alarm occurs at this time, check the wiring of the servo or other sources of alarm, take action, and then try again.
3. After the gain adjustment is completed, the inertia ratio [%] is displayed, [P1-00]. [P1-06], [P1-08] are automatically changed and saved.

Related parameter	Name	Initial
[P1-20]	Automatic gain tuning speed[100 RPM]	8
[P1-21]	Automatic gain tuning distance	3

[Example of how to operate automatic gain tuning]

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied.
2			Press the [MODE] key to move to [Cn-00].
3			Press the [Up] or [DOWN] key to move to [Cn-05].
4			Pressing [SET] key to enter automatic gain tuning.
5			When the [SET] key is pressed, 3 cycles of forward rotation and reverse rotation are performed.
6		-	When automatic tuning is completed, the tuning result is displayed on the loader. If re-tuning is desired in this state, press the [SET] key.
7			Press and hold the [MODE] key for about 1 second to return to [Cn-05].

※“ ▯ “ is a blinking mark.

6.2.7 Phase Z search operation [Cn-06]

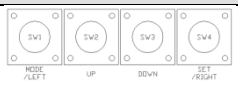
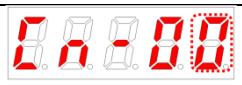
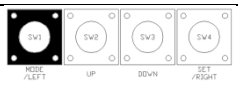
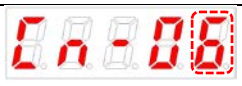
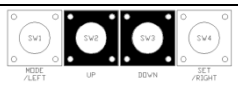
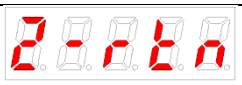
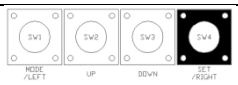
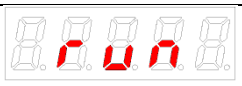
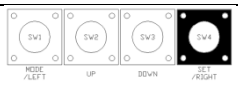
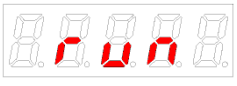
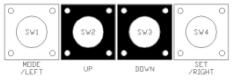
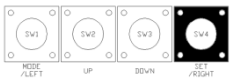
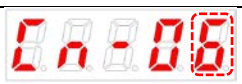
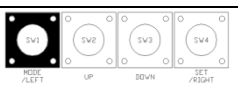
Operates Phase Z search operation.

1. [Z-rtn] is displayed when [SET] key is pressed in [Cn-06].
2. When [SET] key is pressed, [run] is displayed and the servo is in ON status.
3. While pressing the [UP] key, the motor rotates forward until the Z-phase position of the encoder is found.
4. While pressing the [DOWN] key, the motor rotates reverse until the Z-phase position of the encoder is found.
5. When [SET] is pressed, [done] is displayed and Z-phase search operation ends.

※ This function is convenient to use when assembling a machine by finding the position of the Z phase and assembling it based on a certain standard.

Related parameter	Name	Initial
[P3-07]	Phase Z search operation speed setting [RPM]	10

[Example of how to operate Z phase search operation]

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied.
2			Press the [MODE] key to move to [Cn-00].
3			Press the [Up] or [DOWN] key to move to [Cn-06].
4			Press the [SET] key to enter Z phase search operation.
5			Press the [SET] key to turn the servo ON.
6			When the [UP] key is pressed, it rotates in the forward direction (CCW) to find the Z phase. When the [DOWN] key is pressed, it rotates in the reverse direction (CW) to find the Z phase.
7			Press the [SET] key to exit the Z-phase search operation mode. [Done] is displayed as the servo turns off.
8			Press and hold the [MODE] key for about 1 second to return to [Cn-06].

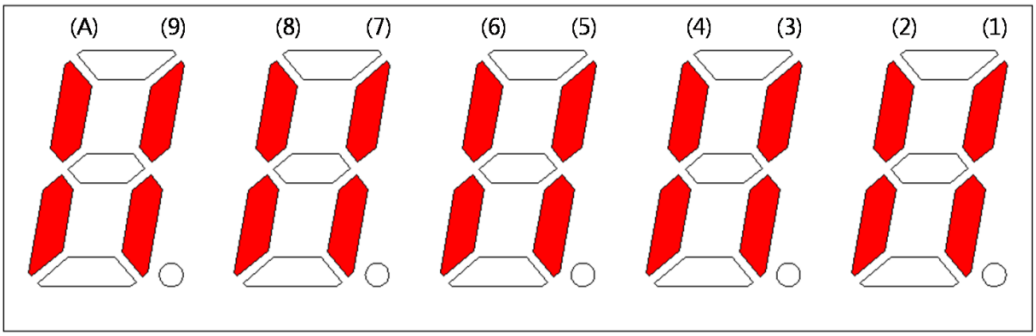
※“ ▯ “ is a blinking mark.

6.2.8 Force input contact ON/OFF [Cn-07]

Forcibly ON/OFF the input contact by the drive alone without the upper controller and I/O jig.

(1) Forced input ON/OFF Setting

Positioning of the 7-segment LED and CN1 contact correspond as follows.



When the LED at the location corresponding each contact is turned on, it indicates ON, and when it is turned off, it indicates OFF.

[Input contacts setting]

No.	(A)	(9)	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)
CN1 pin No.	48	18	19	20	46	17	21	22	23	47
Initial assignment signal name	STOP	EMG	CWLIM	CCWLIM	DIR	ALMRST	SPD3	SPD2	SPD1	SVON

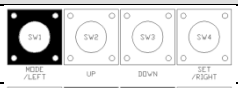
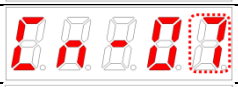
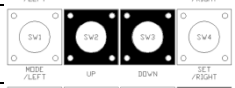
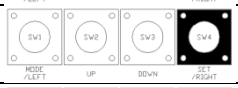
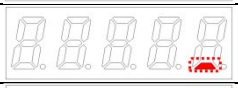
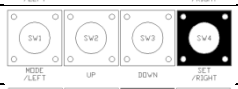
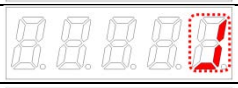
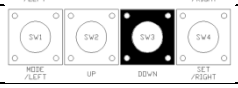
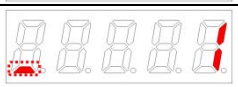
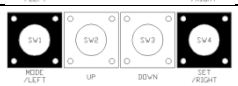
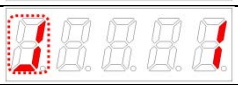
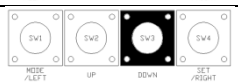
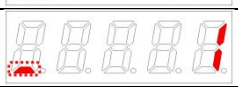
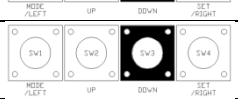
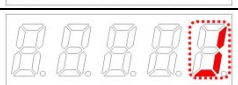
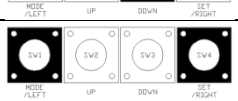
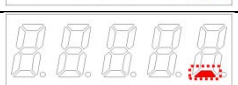
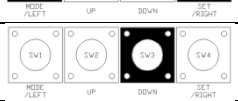
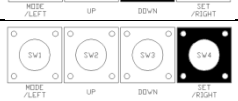
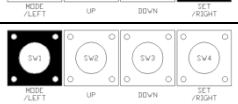
If you press the [UP] key at each digit, (A), (8), (6), (4), (2) signals are forcibly turned ON/OFF.

If you press the [DOWN] key at each digit, (9), (7), (5), (3), (1) signals are forcibly turned ON/OFF. The number of digits is moved with the [MODE] key.

(2) Example of Forced input contact ON/OFF

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

[Example of Forced input contact ON/OFF]

Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to move to [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-07].
3			Press the [SET] key to enter forced input ON/OFF mode.
4			Press the [SET] key to enter forced input bit setting.
5			Press the [DOWN] key to forcibly turn the servo on.
6			Press the [/MODE] key at the blinking cursor position to move to the desired digit DIGIT5.
7			Press the [DOWN] key to forcibly turn EMG on.
8			Press the [DOWN] key to forcibly turn EMG off.
9			Press the [MODE] key at cursor position to move to the desired digit DIGIT1.
10			Press the [DOWN] key to forcibly turn the servo on.
11			Press the [SET] key to end Input ON/OFF mode. It will be marked as [done].
12			Press and hold the [MODE] key for about 1 second to return to [Cn-07].

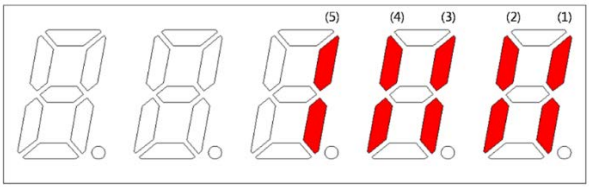
※“ ▯ “ is a blinking mark.

6.2.9 Force input contact ON/OFF [Cn-08]

Forcibly ON/OFF the output by the drive alone without the upper controller and I/O jig.

(1) Forced output ON/OFF setting

Positioning of the 7-segment LED and CN1 contact correspond as follows.



When the LED at the location corresponding each contact is turned on, it indicates ON, and when it is turned off, it indicates OFF.

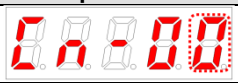
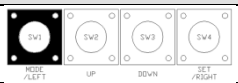
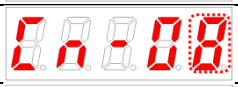
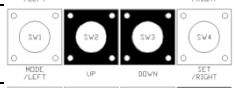
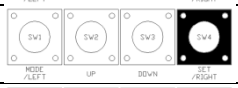
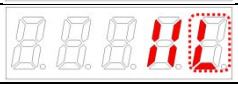
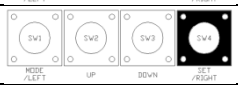
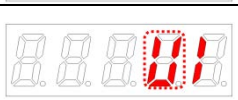
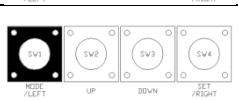
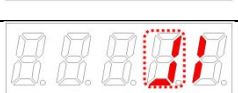
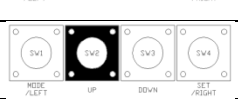
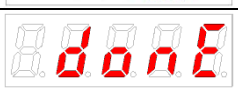
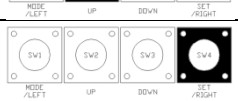
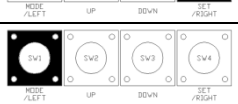
[Output setting]

No.	(5)	(4)	(3)	(2)	(1)
CN1 - pin No.	45	44	43	40/41	38/ 39
Initial assignment signal name	INPOS	BRAKE	ZSPD	READY	ALARM

If you press the [UP] key at each digit, the (4) and (2) signals are forcibly output ON/OFF.
If you press the [DOWN] key at each digit, the (5), (3), and (1) signals are forcibly output ON/OFF.
The number of digits is moved with the [MODE] key.

(2) Example of forced output contact ON/OFF

(BRAKE OFF)
[Example of output contact forced ON/OFF operation method]

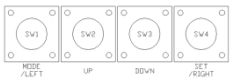
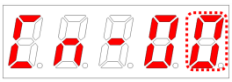
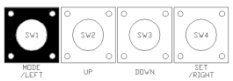
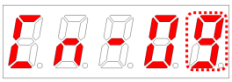
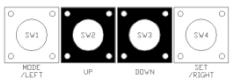
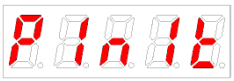
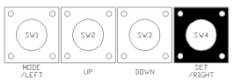
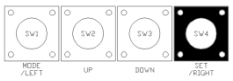
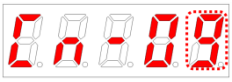
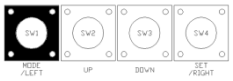
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to move to [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-08].
3			Press the [SET] key to enter forced input ON/OFF setting.
4			Press the [SET] key to enter forced output bit setting.
5			Press the [/MODE] key at the blinking cursor position to move and rotate to the desired digit DIGIT2.
6			Press the [UP] key to turn OFF the BRAKE signal.
7			Press the [SET] key to end Input ON/OFF mode. It will be marked as [done].
8			Press and hold the [MODE] key for about 1 second to return to [Cn-08].

※“ ▯ “ is a blinking mark.

6.2.10 Parameter default [Cn-09]

Initialize parameter data.

[Example of how to operate the parameter default]

Sequence	Loader display after operation	key to use	Operation explanation
1			Displays speed control mode with main power and control power applied.
			Press the [MODE] key to move to [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-09].
3			Press the [SET] key to enter the parameter initialization.
4			Press the [SET] key to initialize data. It will be marked as [done].
5			Press and hold the [MODE] key for about 1 second to return to [Cn-09].

[Parameters not applied when Cn-09 parameter initialization]

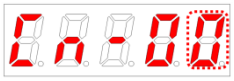
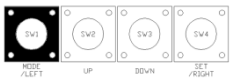
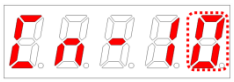
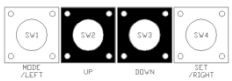
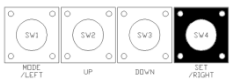
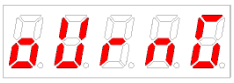
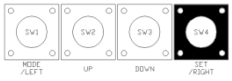
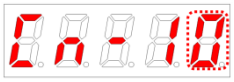
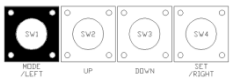
Parameter	Detail parameter
P0-XX	P0-00~P0-02, P0-04, P0-05, P0-10, P0-11, P0-27~P0-29
P1-XX	P1-21, P1-22
P2-XX	P2-00~P2-10, P2-17, P2-18, P2-20, P2-21

※“ ▯ “ is a blinking mark.

6.2.11 Automatic speed command offset compensation [Cn-10]

Offset of analog speed command is automatically corrected.
The adjustable speed command analog voltage range is +1V to -1V. Offset voltages greater than this range are displayed as [oVrnG] over range and are not compensated for.
The corrected offset can be checked in [P2-18] analog speed offset.

[Example of how to operate offset compensation of automatic speed command]

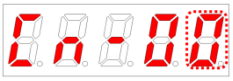
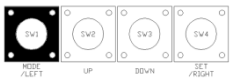
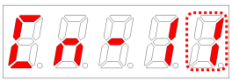
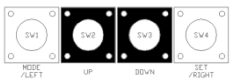
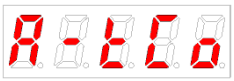
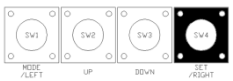
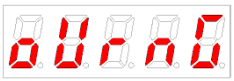
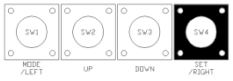
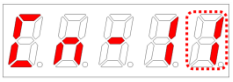
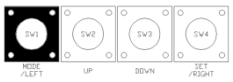
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-10].
3			Press the [SET] key to enter the offset compensation status.
4	or 		Press the [SET] key to perform offset correction. [Done] is displayed. [oVrnG] is displayed if it is out of the allowable range.
5			Press and hold the [MODE] key for about 1 second to return to [Cn-10].

※“ ▯ “ is a blinking mark.

6.2.12 Automatic torque command offset compensation [Cn-11]

Offset of analog torque command is automatically corrected.
The adjustable torque command analog voltage range is +1V to -1V. Offset voltages greater than this range are displayed as over range [oVrnG] and are not compensated.
The corrected offset can be checked in [P2-21] analog torque offset.

[Example of how to operate offset compensation of automatic speed command]

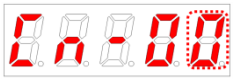
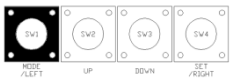
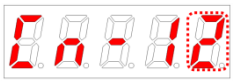
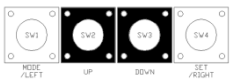
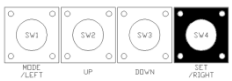
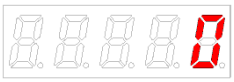
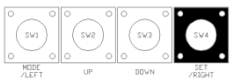
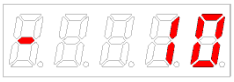
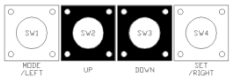
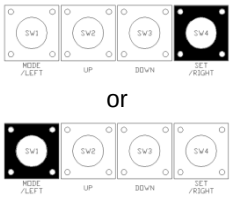
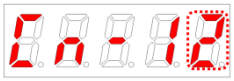
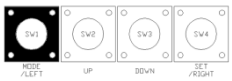
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-11].
3			Press the [SET] key to enter the offset compensation status.
4	 or 		Press the [SET] key to perform offset correction. [Done] is displayed. [oVrnG] is displayed if it is out of the allowable range.
5			Press and hold the [MODE] key for about 1 second to return to [Cn-11].

※“ ▯ “ is a blinking mark.

6.2.13 Manual speed command offset compensation [Cn-12]

Offset of analog speed command is manually corrected.
The adjustable speed command analog voltage range is +1V to -1V. Offset voltages greater than this range are displayed as [oVrnG] over range is called are not compensated.
The corrected offset can be checked in [P2-18] analog speed offset.

[Example of how to operate offset compensation of manual speed command: -10]

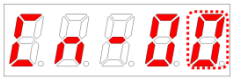
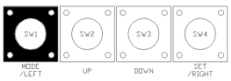
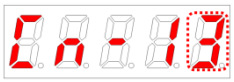
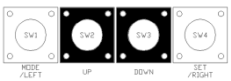
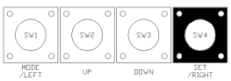
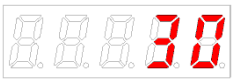
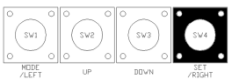
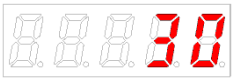
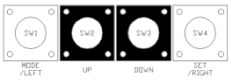
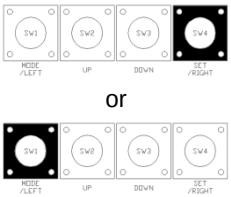
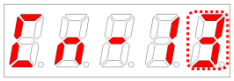
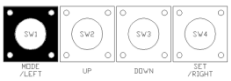
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-12].
3			Press the [SET] key to enter the offset compensation status.
4			Press the [SET] key to enter the offset compensation setting. At this time, the current offset value is displayed.
5			Press the [UP] or [DOWN] key to adjust desired value.
6			Press the [SET] key to save the adjusted offset value. [Done] is displayed. If you press the [MODE] key, it will not be saved.
7			Press and hold the [MODE] key for about 1 second to return to [Cn-12].

※“ ▯ “ is a blinking mark.

6.2.14 How to operate Manual speed command offset compensation [Cn-13]

Offset of analog torque command is manually corrected.
The adjustable torque command analog voltage range is +1V to -1V. Offset voltages greater than this range are displayed as [oVrnG] over range and are not compensated.
The corrected offset can be checked in [P2-21] analog torque command offset.

[Example of how to operate offset compensation of manual speed command]

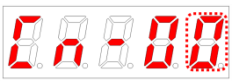
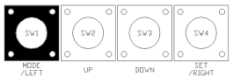
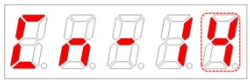
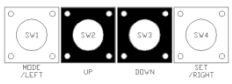
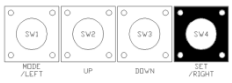
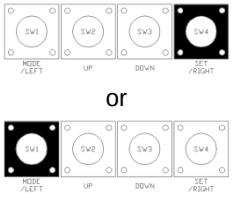
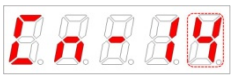
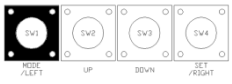
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-13].
3			Press the [SET] key to enter the offset compensation status.
4			Press the [SET] key to enter the offset compensation setting. At this time, the current offset value is displayed.
5			Press the [UP] or [DOWN] key to adjust desired value.
6			Press the [SET] key to save the adjusted offset value. [Done] is displayed. If you press the [MODE] key, it will not be saved.
7			Press and hold the [MODE] key for about 1 second to return to [Cn-13].

※“ ▯ “ is a blinking mark.

6.2.15 Absolute encoder reset [Cn-14]

Initialize encoder multi-turn data to 0.

[Example of how to reset the absolute value encoder]

Sequence	Loader display after operation	key to use	Operation explanation
-1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-14].
3			Press the [SET] key to enter the encoder reset status.
4			If you press the [SET] key, the multi-turn data value of the absolute encoder is initialized. It will be marked as [done]. If you press the [MODE] key, it is not initialized.
7			Press and hold the [MODE] key for about 1 second to return to [Cn-14].

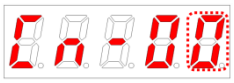
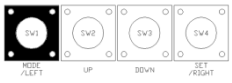
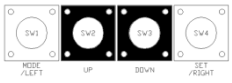
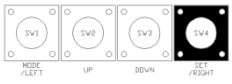
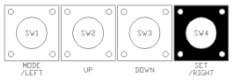
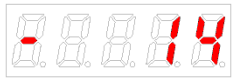
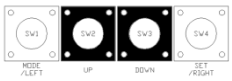
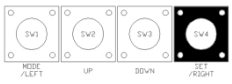
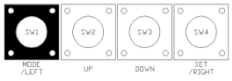
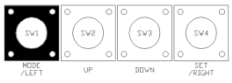
※“ ▯ “ is a blinking mark.

After resetting the absolute encoder value, you can check the initialization value in [st-18].

6.2.16 Instantaneous maximum load rate initialization [Cn-15]

This function initializes the instantaneous maximum load rate to 0.

[Example of how to initialize the instantaneous maximum load ratio]

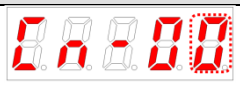
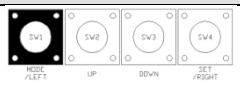
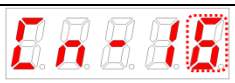
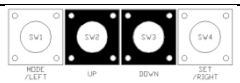
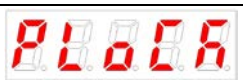
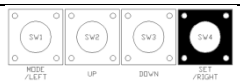
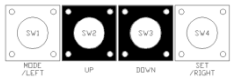
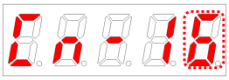
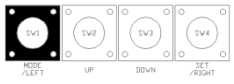
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to move to [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-15].
3			Press the [SET] key to enter the instantaneous maximum load ratio initialization status.
4			Press the [SET] key to display the current maximum load ratio.
5	 or 		If you press the [UP] key, the maximum load ratio in the forward direction is displayed, and if you press the [DOWN] key, the maximum load ratio in the reverse direction is displayed.
6		 or 	When the [SET] key is pressed, the instantaneous maximum load ratio is initialized. It will be marked as [done]. If you press the [MODE] key, it is not initialized.
7			Press and hold the [MODE] key for about 1 second to return to [Cn-15].

※“ ▯ “ is a blinking mark.

6.2.17 Parameter locking [Cn-16]

Set parameter lock.

[Example of how to operate the parameter lock setting]

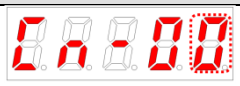
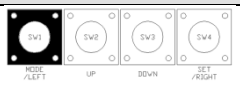
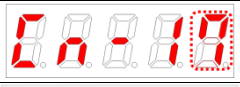
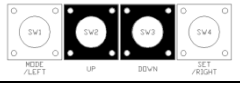
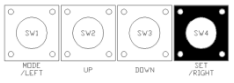
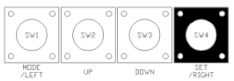
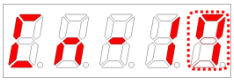
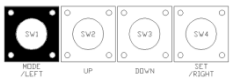
Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-16].
3			Press the [SET] key to enter the parameter lock status.
4	 or 		Press the [UP] key to release the parameter lock. Press the [DOWN] key to set the parameter lock.
5			Press and hold the [MODE] key for about 1 second to return to [Cn-16].

※“ ▯ “ is a blinking mark.

6.2.18 Current offset [Cn-17]

Save the current offset value to [P0-28] ~ [P0-29] parameters.

[Example of how to operate current offset]

Sequence	Loader display after operation	key to use	Operation explanation
1			Press the [MODE] key to display [Cn-00].
2			Press the [Up] or [DOWN] key to move to [Cn-17].
3			Press the [SET] key to enter current offset setting status.
6			When the [SET] key is pressed, the U-phase current offset is saved in [P0-27], and the V-phase current offset is saved in [P0-28].
7			Press and hold the [MODE] key for about 1 second to return to [Cn-17].

※“ ▯ “ is a blinking mark.

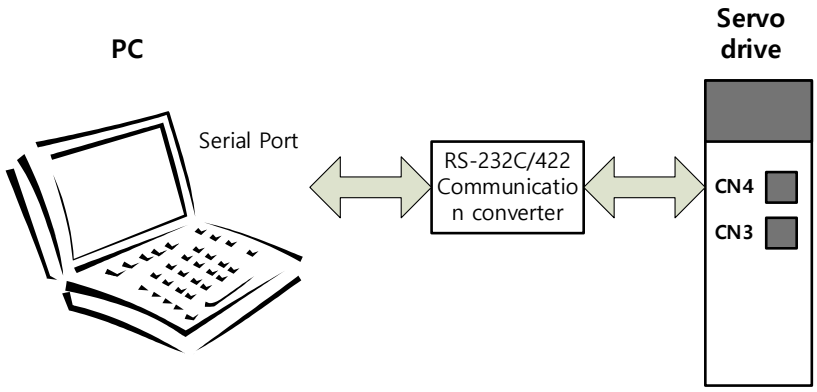
7. Communication protocol

7.1 Overview and Communication spec.

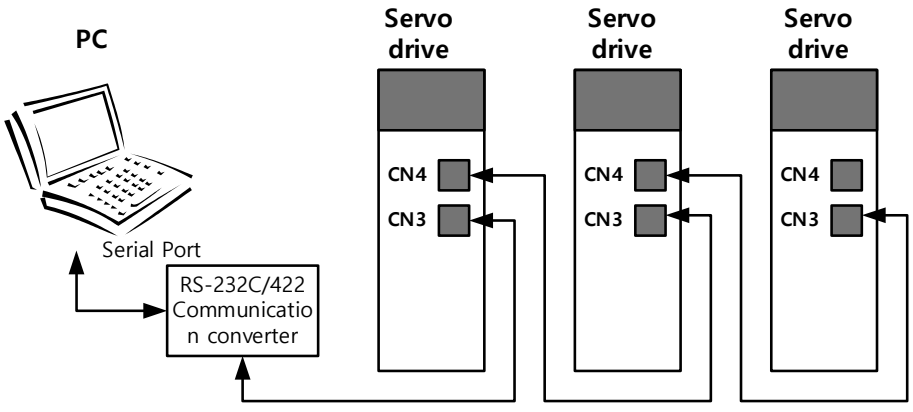
7.1.1 Overview

The L7 servo drive can use functions such as trial run, gain tuning, parameter change, and indexer operation of the drive by connecting it to a host controller such as a handy loader, HMI, PC, or PC through RS-422 serial communication.
In addition by connecting several L7 servo drives in a multi-drop method, up to 32 axes can be operated and operated through communication.

(1) Serial communication connection using RS422



(2) Multi-Drop connection using RS422 (up to 32 units)



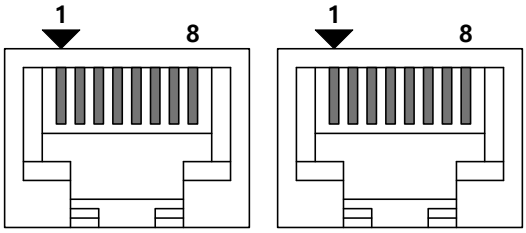
Note1) When using the host controller as a PC, a RS232/ RS485 communication converter must be used. Servo drive CN3 and CN4 connector pins are internally connected 1:1, designed for convenient multi-drop wiring.

7.1.2 Communication specification and cable connection diagram

(1) Communication spec.

Item		Specification
Communication standard		ANSI/TIA/EIA-422 standard
Communication protocol		MODBUS-RTU
Data Type	Data bit	8bit
	Stop bit	1bit
	Parity	None
Synchronization type		Asynchronous type
Transmission speed		9600 /19200/38400/57600 [bps] [P0-04] selectable
Transmission distance		Up to 200[m]
Current consumption		100[㎃] or less

(2) Connector pin for CN3, CN4.



CN 3 **CN 4**

Pin No.	Pin function
1	Do not use
2	OS*Note 1)
3	RXD+
4	TXD-
5	TXD+
6	RXD-
7	Do not use
8	GND

Note1) When connecting to Multi connection, connect the #2 pin of the last drive to the #6 pin (RXD-) to process the terminating resistor (120Ω: applied inside the drive).

Note2) Connect TXD+ and TXD-, RXD+ and RXD- as a twisted pair.

Note3) TXD and RXD in the table above are defined based on the servo drive side.

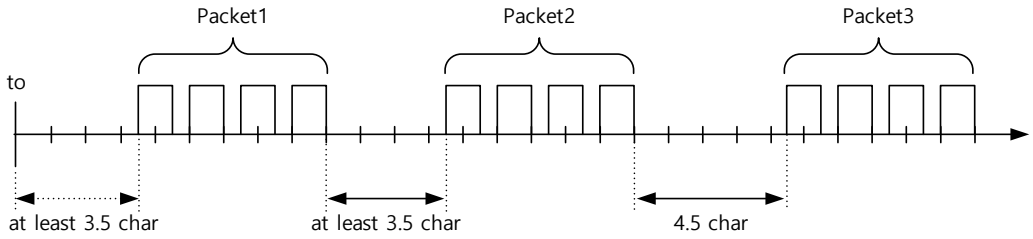
7.2 Communication protocol basic structure

In principle, communication of L7 servo drive complies with MODBUS-RTU protocol. For matters not mentioned in this manual, refer to the relevant standards below. (Relevant standards: Modbus Application Protocol Specification 1.1b, 2006.12.28)

In addition the concepts of sending/ receiving in this manual are defined based on the host.

7.2.1 Sending and receiving packet structure

The maximum transmit/receive packet length of MODBUS-RTU protocol is 256 bytes. Therefore, be careful not to exceed the total length of TX/RX packets over 256Byte. MODBUS-RTU communication mode requires a space of at least 3.5 char between the start and end as shown in the figure below to distinguish packets.



(1) Sending packet structure

Category	Additional Address	Function Code	Data			Error Check	
Byte	**0**	**1**	**2**	**.**	**.**	**n-1**	**n**
Content	Node ID	Function	Data	.	.	CRC(MSB)	CRC(LSB)

(2) Receiving packet structure

[Normal response.]

Category	Additional Address	Function Code	Data			Error Check	
Byte	**0**	**1**	**2**	**.**	**.**	**n-1**	**n**
Content	Node ID	Function	Data	.	.	CRC(MSB)	CRC(LSB)

[Abnormal response]

Category	Additional Address	Function Code	Data	Error Check	
Byte	**0**	**1**	**2**	**3**	**4**
Content	Node ID	Function+0x80	Exception code	CRC(MSB)	CRC(LSB)

(3) Protocol Packet Code Description

- **Node ID**
  Indicates the station number of the servo drive to be transmitted.
  Station number of servo drive is set in [P0-05].
- **Function Code**
  The function codes of the Modbus-RTU standard supported by the L7 servo drive are as follows.

Category	Command code	Description	Usage	
			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**
  [Send]: In the case of the Read Register command, the Modbus address, number of registers, and number of bytes are designated, and in the case of the Write Register command, the Modbus address, the number of bytes, and the value to be set are designated.

  [Receive]: In case of Read Register command, normal response is received with Node ID and Function Code as the same value as when transmitted, and data is received according to the order of registers sent when transmitted.
  In the case of the Write Single Register command, the same data as when sending is received. In the case of Write Multi Register, the start address of the register to write data and the number of registers are received with the Write Multi Register command.
  In the case of an error response, it consists of Node ID, Error Code, and Exception Code, and the packet structure of an error response is the same regardless of the function code.

(4) CRC

Enter the 16-bit CRC Checksum value. It is divided into MSB/LSB and transmitted by 1Byte each.

(5) Exception Code

Exception codes for abnormal responses of all function codes supported by the L7 servo drive are unified as follows.

Exception Code	Description
0x01	Function code not supported
0x02	Wrong register address
0x03	Node-ID mismatch or CRC Check Error
0x04	Command processing failed
0x05	Waiting(data ready status)
0x06	Parameter lock status

7.2.2 Protocol Command Code

(1) Read Single Register (0x03)

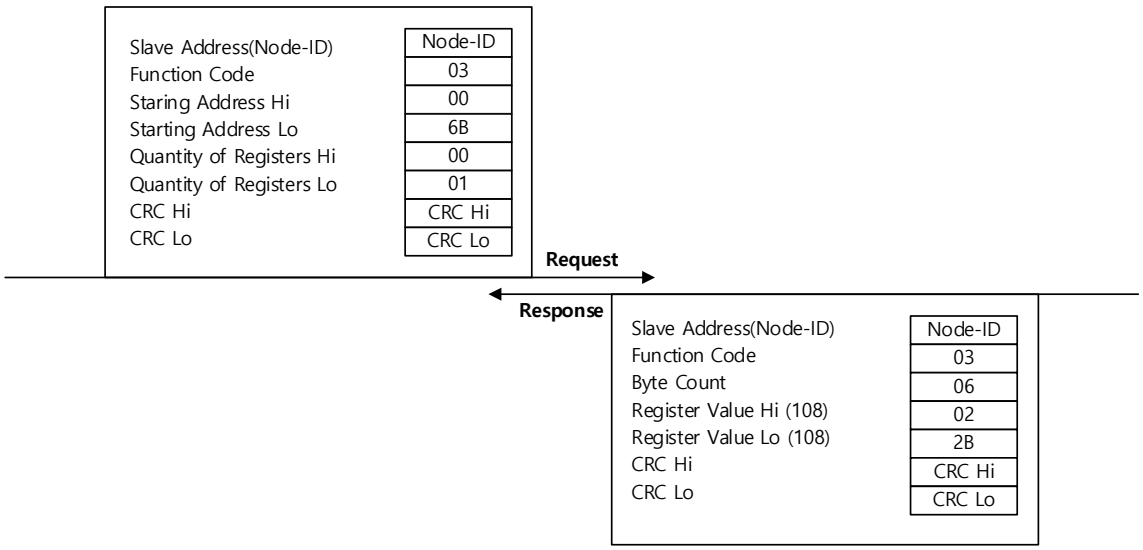
Read single register values (16bit data).

Sending Packet		
Byte	**Content**	**Value**
0	Node ID	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	Node ID	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	Node ID	0x00
1	Error Code	0x03 + 0x80
2	Exception Code	0x01 ~ 0x04
3	CRC Hi	
4	CRC Lo	

Example)



(2) Read Multi Register (0x03)

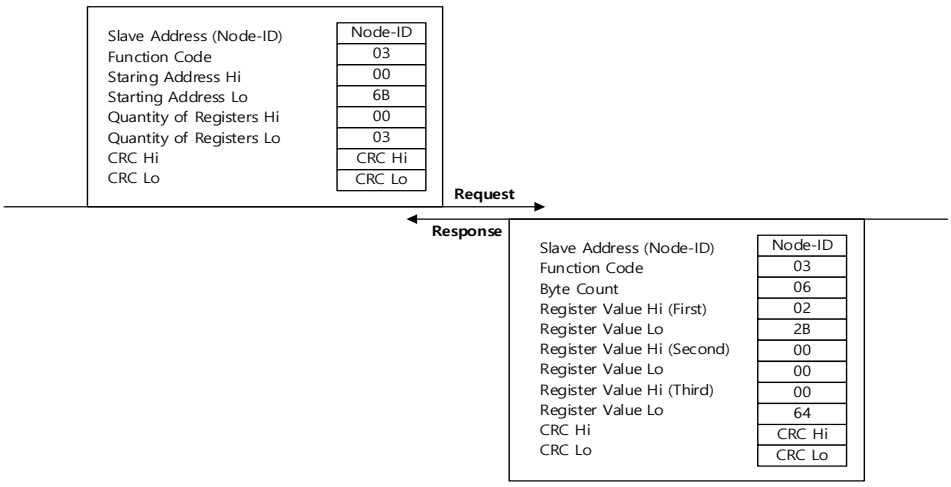
Read a value to a contiguous register block (16-bit data unit).

Sending Packet		
Byte	**Content**	**Value**
0	Node ID	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	Node ID	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	Node ID	0x00
1	Error Code	0x03 + 0x80
2	Exception Code	0x01 ~ 0x04
3	CRC Hi	
4	CRC Lo	

Example)



(3) Write Single Register (0x06)

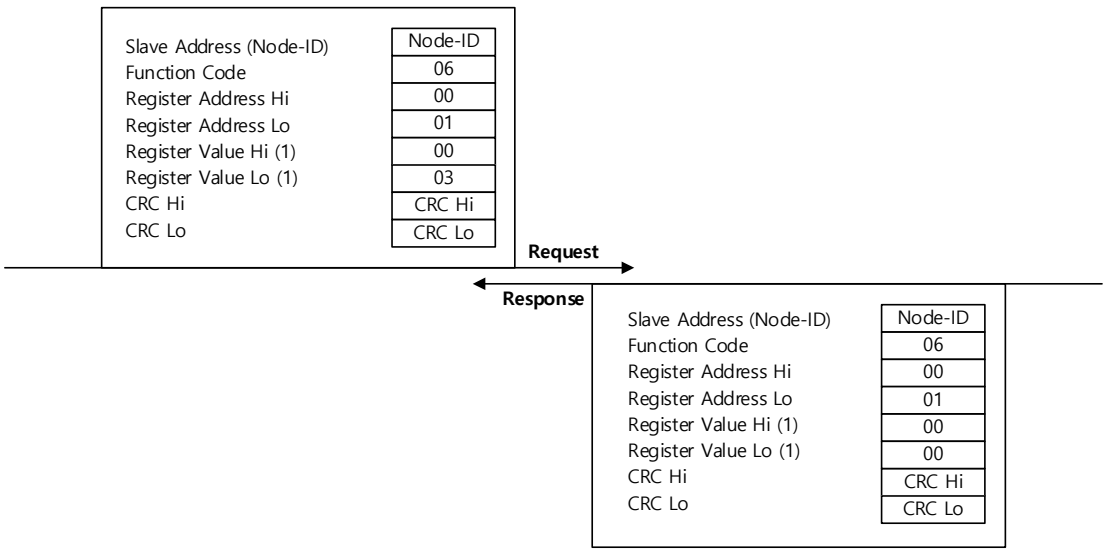
Writes a value to a single register (16bit data).

Sending Packet		
Byte	**Content**	**Value**
0	Node ID	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	Node ID	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	Node ID	0x00
1	Error Code	0x06 + 0x80
2	Exception Code	0x01 ~ 0x06
3	CRC Hi	
4	CRC Lo	

Example)



(4) Write Multi Register (0x10)

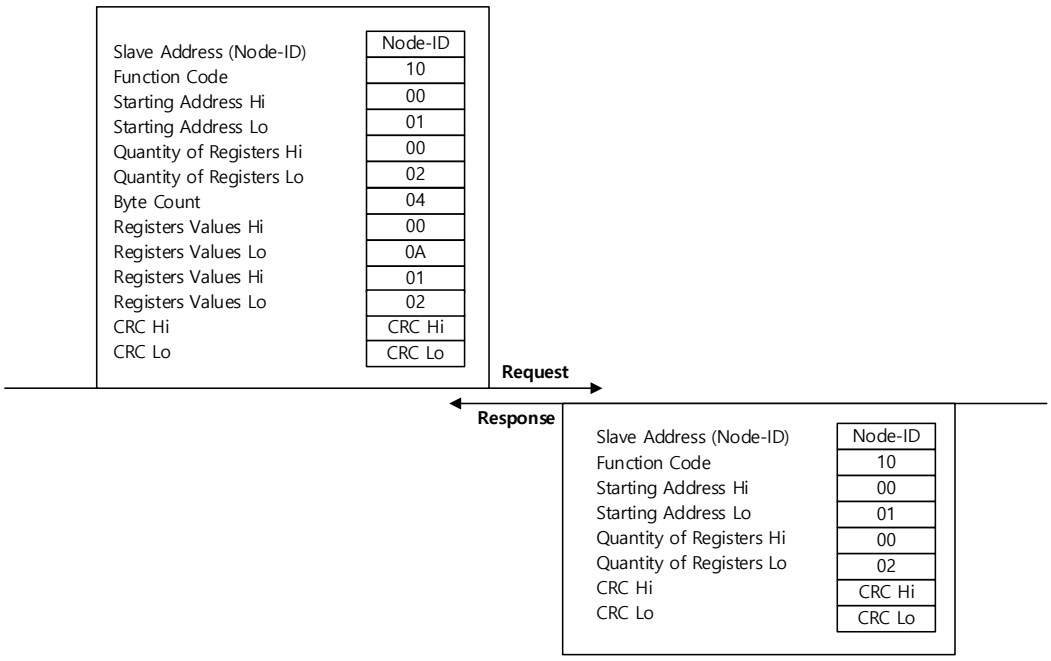
Writes a value to a contiguous register block (16-bit data unit).

Sending Packet		
Byte	**Content**	**Value**
0	Node ID	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	Node ID	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	Node ID	0x00
1	Error Code	0x10 + 0x80
2	Exception Code	0x01 ~ 0x04
3	CRC Hi	
4	CRC Lo	

Example)



(5) Read Each Block Register (0x6A)

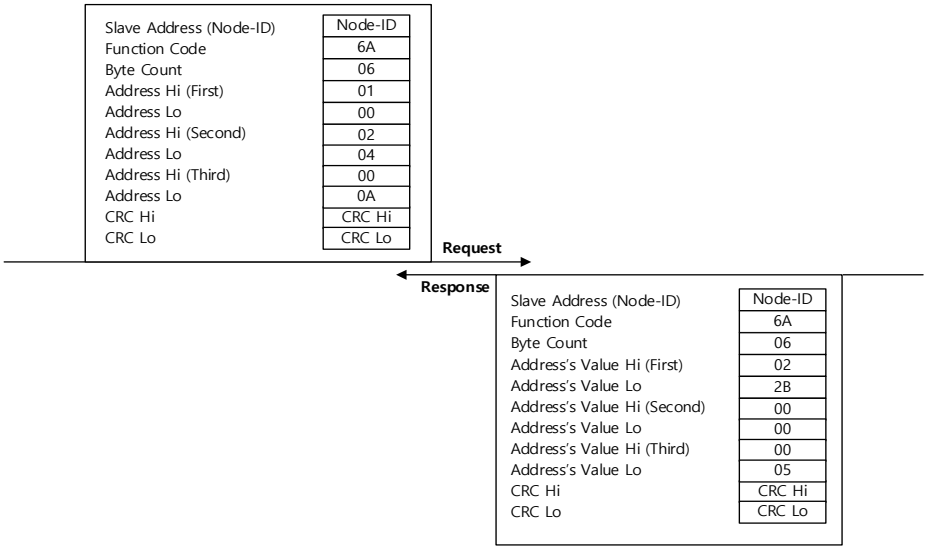
Reads the value of a non-contiguous register block (16-bit data unit).

Sending Packet		
Byte	**Content**	**Value**
0	Node ID	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	Node ID	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	Node ID	0x00
1	Error Code	0x6A + 0x80
2	Exception Code	0x01 ~ 0x04
3	CRC Hi	
4	CRC Lo	

Example)



7.3 L7 Servo Drive Communication Address Table

7.3.1 Operation status parameter communication address table

Communication address	Parameter name	Parameter number	Data type
(Decimal)	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 : InSpeed BIT7 : InPosition BIT8 : Power Ready BIT9 : Analog Command Active BIT10 ~ BIT13 : Control Mode (1 : Trq, 2 : Spd, 3 : 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	Position pulse remaining - L	St – 05	INT32
16	Position pulse remaining - 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 percentage	St – 09	INT16
28	Instantaneous maximum load rate	St – 10	INT16
30	Torque limit values	St – 11	INT16
32	DC link voltage	St – 12	UINT16
34	Regenerative overload	St – 13	UINT16
36	Input contact status	St – 14	UINT16
38	Output contact status	St – 15	UINT16

Communication address	Parameter name	Parameter number	Data type
(Decimal)	Operation status display parameter		
40	Single Turn Data - L	St – 16	INT32
42	Single Turn Data - H		
44	Single Turn Data (Degree)	St – 17	UINT16
46	Multi Turn Data - L	St - 18	INT32
48	Multi Turn Data - H		
50	Servo drive internal temperature	St - 19	INT16
52	Motor rated speed	St - 20	UINT16
54	Motor maximum speed	St - 21	UINT16
56	Motor rated current	St - 22	UINT16
58	U-Phase current offset	St - 23	INT16
60	V-phase 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: 2kW, 7:3.5kW, 8: 5kW, 9: 7.5kW, A: 15kW) BIT5 ~ BIT14: version number BIT15: encoder type (0: Quadrature, 1: Serial)
64	FPGA Version	St - 26	UINT16
66	Analog torque command values	St - 27	INT16
68	Reserved		

7.3.2 System parameter communication address table

Modbus communication address for system parameter group [P0-xx] is as follows.

Communication address (Decimal)	Parameter name	Parameter number	Data type
	System parameter		
70	Motor ID	P0 – 00	UINT16
72	Encoder Type	P0 – 01	UINT16
74	Encoder pulse	P0 – 02	UINT16
76	Operation mode selection	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 check hour	P0 – 07	UINT16
86	Display parameters at starting	P0 – 08	UINT16
88	Regeneration overload derating	P0 – 09	UINT16
90	Regeneration resistor	P0 – 10	UINT16
92	Regeneration resistor capacity	P0 – 11	UINT16
94	Overload detection basic load rate	P0 – 12	UINT16
96	Continuous overload warning level	P0 – 13	UINT16
98	Encoder output division - L	P0 – 14	INT32
100	Encoder output division - 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	
116	Reserved	P0 – 22	
118	DAC output Scale 1	P0 – 23	UINT16
120	DAC output Scale 2	P0 – 24	UINT16
122	Reserved	P0 – 25	
124	Encoder function setting	P0 – 26	
126	U Phase Current Offset	P0 – 27	INT16
128	V Phase Current Offset	P0 – 28	INT16
130	W Phase Current Offset	P0 – 29	INT16
132	Reserved		
134	Reserved		
136	Reserved		
138	Reserved		

7.3.3 Control parameter communication address table

Modbus communication address for control parameter group [P0-xx] is as follows.

Communication address (Decimal)	Parameter name	Parameter number	Data type
	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 feed forward gain	P1 – 04	UINT16
150	Position feed forward 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 torque limit	P1 – 13	UINT16
168	Reverse 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	Automatic gain tuning speed	P1 – 20	UINT16
182	Automatic gain tuning distance	P1 – 21	UINT16
184	Torque control speed limit mode	P1 – 22	UINT16
186	Limit speed	P1 – 23	UINT16
188	P control switching torque	P1 – 24	UINT16
190	P control switching speed	P1 – 25	UINT16
192	P control switching acceleration	P1 – 26	UINT16
194	P control switching position control	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		

7.3.4 I/O parameter communication address table

Modbus communication address for IN/OUT (of Digital group [P0-xx] is as follows.

Communication address (Decimal)	Parameter name	Parameter number	Data type
	I/O Parameters		
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	Position reaching output range	P2 – 11	UINT16
244	Zero speed output range	P2 – 12	UINT16
246	Speed reaching output range	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		

7.3.5 Speed operation parameter communication address table

Modbus communication address for speed operation parameter group [P3-xx] is as follows.

Communication address	Parameter name	Parameter number	Data type
(Decimal)	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-phase detection operation speed setting	P3 - 07	UINT16
296	Speed command accel. time	P3 - 08	UINT16
298	Speed command decel. 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		

7.3.6 Position operation parameter communication address table

Modbus communication address for position operation parameter group [P4-xx] is as follows.

Communication address (Decimal)	Parameter name	Parameter number	Data type
	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 - H3		
336	Electronic gear ratio numerator 2 - L	P4 - 02	INT32
338	Electronic gear ratio numerator 2 - H		
340	Electronic gear ratio numerator 3 - L	P4 - 03	INT32
342	Electronic gear ratio numerator 3 - H		
344	Electronic gear ratio numerator 4 - L	P4 - 04	INT32
346	Electronic gear ratio numerator 4 - H		
348	Electronic gear ratio denominator 1	P4 - 05	UINT16
350	Electronic gear ratio denominator 2	P4 - 06	UINT16
352	Electronic gear ratio denominator 3	P4 – 07	UINT16
354	Electronic gear ratio denominator 4	P4 - 08	UINT16
356	Electronic gear ratio mode setting	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 point function	P4 – 12	UINT16
366	Backlash compensation	P4 - 13	UINT16
368	Pulse input filter	P4 – 14	UINT16

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 Caution

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 electro-dynamometer 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 gage.

8.1.2 What to Inspect

Wait at least 10 minutes after turning off the power before beginning the inspection because the condenser can hold enough voltage to cause an electrical accident.

(1) Inspecting the Servo Motor

⚠Caution
1. Wait at least 10 minutes after turning off the power before beginning the inspection because the condenser can hold enough voltage to cause an electrical accident. 2. When using an absolute value encoder, the multi-turn data of the encoder will be lost when the motor and encoder cable are replaced. After checking, proceed with origin operation.

Check Items	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 resistor. 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 it from the machine 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.

Note1) 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

Check Items	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	Clean it with air pressure or cloth.
Check for loose screws	At least once a year	Check if terminal block or connector tightening screws, etc. are not loose.	Please tighten it well.
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. Smoothing condensers: 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
Aluminium electrolytic condensers on PCB	5 years	Replace with new boards (determined after inspection)
Cooling fans	4-5 years	Replace
Motor bearings	-	Determine after inspection
Motor oil seal	5,000 hours	Replace

8.2 Diagnosing and Troubleshooting Abnormalities

If an error occurs during operation, AL-□□is displayed on the loader. In this case, take appropriate measures according to the following tips. 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	CCWLIM, CWLIM input is OFF	Refer to “1.2 System configuration”	Turn on the P-OT and N-OT inputs.
	The parameters are set incorrectly	Check parameters such as motor, encoder, and encoder type control mode.	Parameter resetting (Refer to “Chapter 5 Parameter Description”)
	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.
	External wiring is incorrect, disconnection of the cable	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 less	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 (Inertia, gain, and time constants).	Check the parameters.	Refer to “Chapter 5 Parameter Description”.

8.2.2 Servo Drive

When an alarm occurs, the fault signal output contact point (ALARM) is turned off, and the motor is stopped by Dynamic Brake.

Alarm Code	Name	Content	Check Items
	IPM fault	Over current(H/W)	Check drive output incorrect wiring/encoder incorrect wiring Check Motor ID/Drive ID/Encoder settings Determine whether there is a conflict or binding in the equipment.
	IPM temperature	IPM overheating	Check drive output incorrect wiring, encoder incorrect wiring Check Motor ID, Drive ID, Encoder settings Determine whether there is a conflict or binding in the equipment.
	Over current	Over current(S/W)	Check drive output incorrect wiring, encoder incorrect wiring Check Motor ID, Drive ID, Encoder settings Determine whether there is a conflict or binding in the equipment.
	Current Offset	Current offset error	Check if [St-23], [St-24] are more than 10% of the rated current, replace the drive
	Over Current(/CL)	Over current(H/W)	Check drive output incorrect wiring, encoder incorrect wiring Check Motor ID, Drive ID, Encoder settings Determine whether there is a conflict or binding in the equipment.
	Continuous overload	Continuous overload	Determine whether there is a conflict or binding in the equipment. Load condition inspection, Brake operation status check Check drive output incorrect wiring, encoder incorrect wiring Check Motor ID, Drive ID, Encoder settings
	Room Temperature	Drive overheating	Check drive internal temperature [St-19] Cooling fan installation, load condition inspection
	Regen. Overload	Regenerative overload	Input voltage, regeneration braking resistor and wiring check Drive replacement
	Motor Cable Open	Motor disconnection	Motor wiring
	Encoder Comm.	Serial encoder communication error	Check for incorrect wiring of the serial encoder cable
	Encoder Cable Open	Encoder cable open	Check whether cable is disconnected.
	Encoder Data Error	Encoder data error	[P0-02] Setting value, check encoder wiring
	Motor Setting Error	Motor ID setting error	Check [P0-00] setting value
	Encoder Z PHASE Open	Encoder Z phase disconnection	Check whether cable is disconnected.
	Low Battery Error	Low Battery Error	Back-up battery low voltage when using absolute encoder Battery Replacement ※After replacing the battery, power is re-applied and origin operation is required. (Applies from S/W Ver 1.28)
	Preset Error	Encoder initialization	Back-up battery replacement when using absolute encoder Lack of voltage and first coupling of encoder. ※ After replacing the battery and alarm reset, power is re-applied and origin operation is required.

Alarm Code	Name	Content	Check Items
AL-40	Under Voltage	Low Voltage	Check input voltage, check power wiring
AL-41	Over Voltage	Over voltage	Input voltage, braking resistor damage and wiring. Excessive regenerative operation, check regenerative resistor
AL-42	RS-T Power Fail	Main power error	Check power supply wiring and power supply
AL-43	Control Power Fail	Control power error	Check power supply wiring and power supply
AL-50	Over Speed Limit	Over speed	Check encoder error, encoder setting value, encoder wiring, gain setting, motor wiring, motor ID, electrical gear ratio, speed command scale
AL-51	Position Following	Excessive positional error	Check the position command pulse excessive [P4-11] setting value, wiring and limit contact, gain setting value, encoder setting, and electrical gear ratio setting. Check equipment restraints and load conditions.
AL-53	Over Pulse CMD	Pulse command frequency error	Check pulse command frequency from upper controller Check Command pulse type
AL-54	Speed Deviation	Excessive speed error	Check drive output miswiring, encoder miswiring Check equipment restraint and load status
AL-55	Motor Over Run	Runaway motor	Check drive output miswiring, encoder miswiring Check equipment restraint and load status
AL-63	Parameter Checksum	Parameter error	Check parameter values
AL-64	Parameter Range	Parameter range error	Check parameter values
AL-71	Invalid Factory Setting	Factory setting error	Check parameter values
AL-72	GPIO Setting	Output setting error	Check parameter values

If a warning code is displayed in the current operation status [St-00], the servo drive is operating in an abnormal state, so check the parts corresponding to the inspection items.

⚠Caution

- If the motor and encoder cable are replaced while the absolute encoder is in use, or if the battery is replaced with the servo power off, the multi-turn data of the encoder will be lost.
- If the encoder loses multi-turn data, there is a risk of equipment malfunction or accident, so be sure to operate after originating.

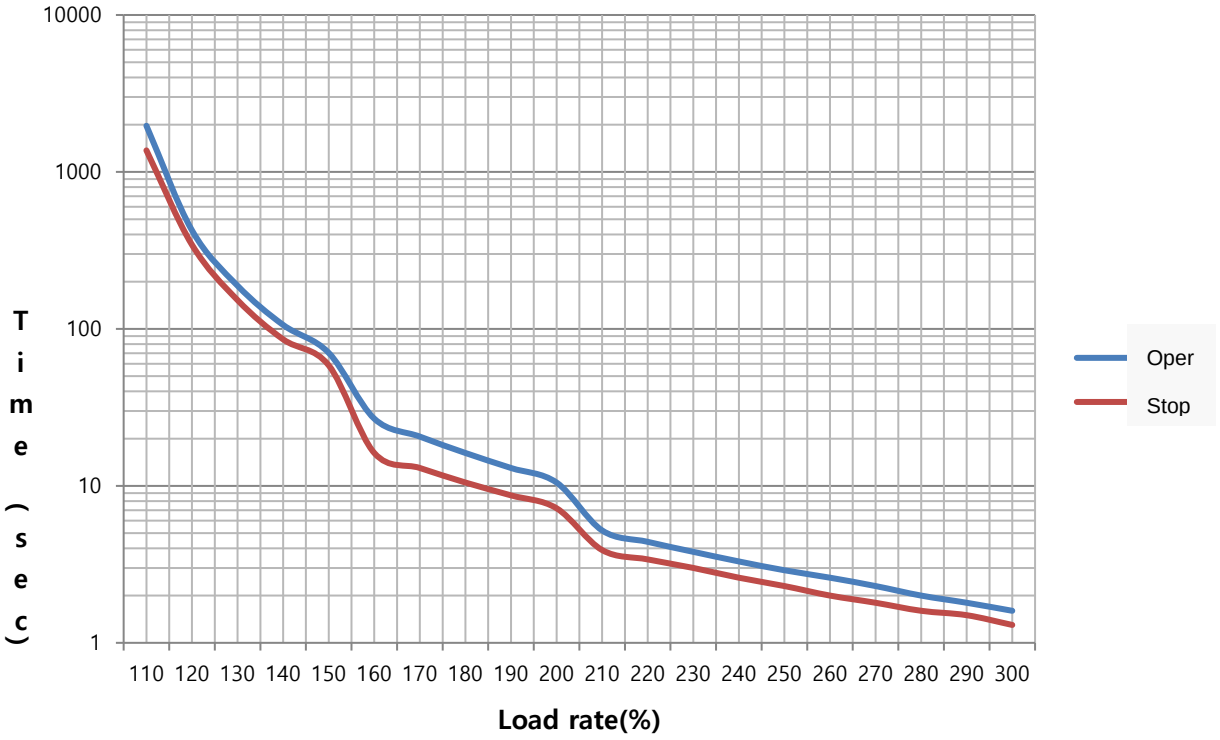
Warning status	Name	Contents and cause	Check Items
	RST_PFAIL	Main power source loss	Main power is not applied when [P0-06] DIGIT2 is set to 1.
	LOW_BATT	Low battery	When applying the absolute value encoder, the output voltage of the encoder backup battery is insufficient.
	OV_TCMD	Excessive torque command	A command exceeding the maximum set torque was input.
	OV_VCMD	Excessive speed command	A command exceeding the maximum set speed was input.
	OV_LOAD	Overload warning	The maximum setting overload [P0-13] setting range has been reached.
	SETUP	Capacity selection	The motor current capacity is greater than the drive current capacity.
	UD_VTG	Low battery warning	When [P0-06]DIGIT2 setting is 1, DC-link voltage is less than 190V
	EMG	EMG Contact	Check I/O wiring and [P2-09] set value

Warning codes are displayed in hexadecimal, and when two or more warnings occur simultaneously, the sum of each warning code is displayed. For example, [W-0C] is displayed when [W-04] Excessive torque command and [W-08] Excessive speed command occur simultaneously

When [W-80] occurs, SVON is changed from ON to OFF, and it is automatically released when I/O power is turned on or the contact logic is changed.

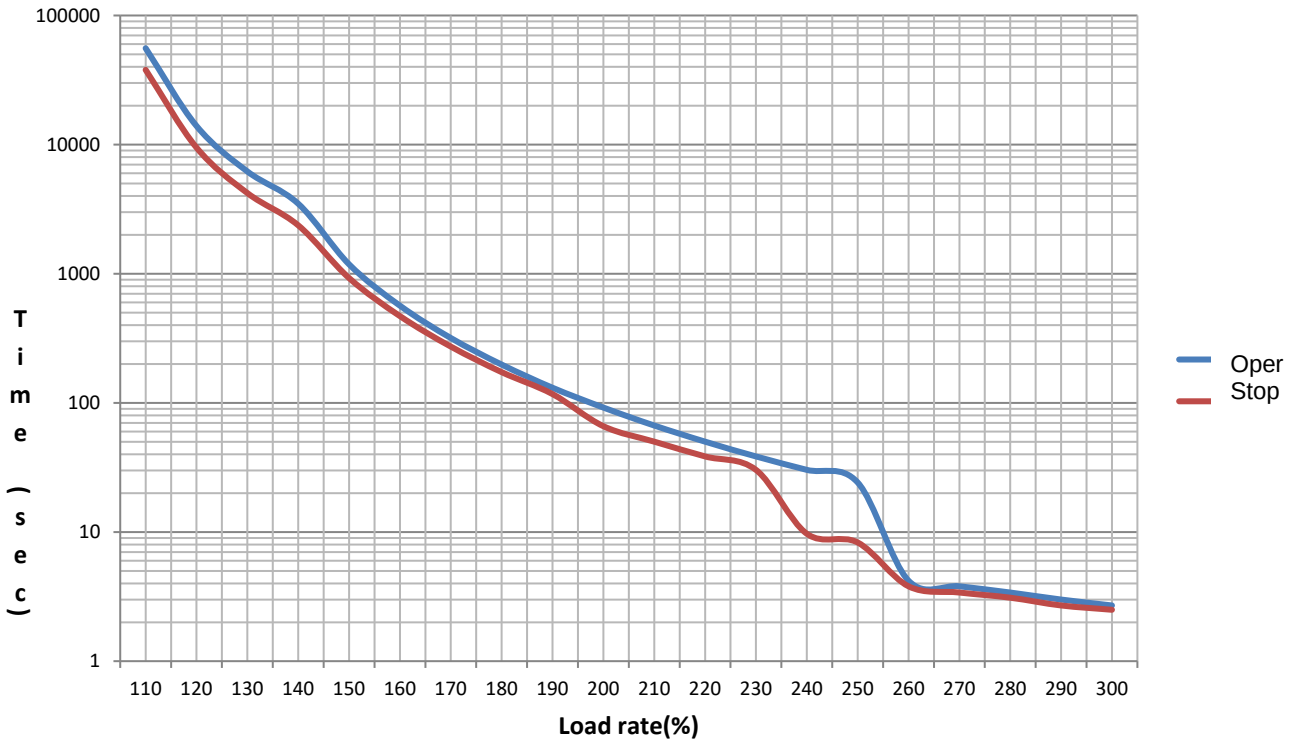
■ Overload Operating Characteristic Curve (When applying 100W or less SA Type motor)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	1969.0	1372.0	210	5.2	3.9
120	424.0	343.2	220	4.4	3.4
130	188.4	152.5	230	3.8	3.0
140	106.0	85.8	240	3.3	2.6
150	70.4	58.6	250	2.9	2.3
160	26.8	16.2	260	2.6	2.0
170	20.6	13.0	270	2.3	1.8
180	16.2	10.5	280	2.0	1.6
190	13.0	8.7	290	1.8	1.5
200	10.5	7.2	300	1.6	1.3



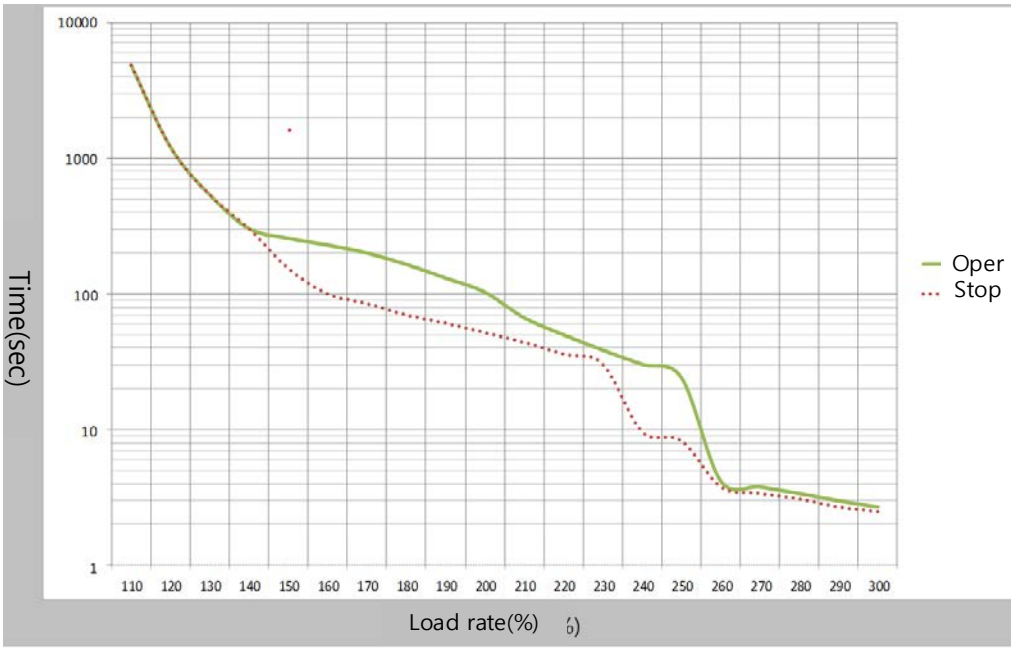
■ Overload Operating Characteristic Curve (L7SA001□, L7SA002□, L7SA004□)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	–	–
110	55776.0	37935.0	210	66.8	50.1
120	13944.0	9483.0	220	50.1	38.5
130	6197.0	4215.0	230	38.5	30.3
140	3486.0	2371.0	240	30.3	9.7
150	1183.0	926.0	250	24.2	8.3
160	566.0	470.0	260	4.2	3.8
170	318.0	273.0	270	3.8	3.4
180	198.0	173.0	280	3.4	3.1
190	131.0	117.0	290	3.0	2.7
200	92.0	66.0	300	2.7	2.5



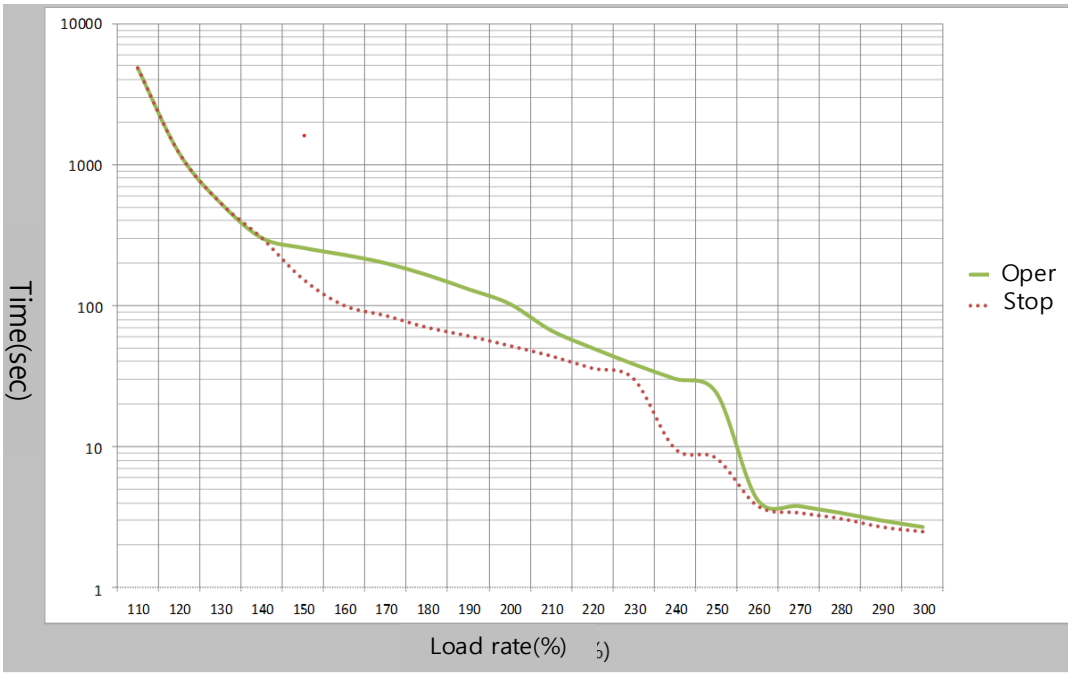
■ Overload Operating Characteristic Curve (L7SA008□, L7SA010□)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	105800	37937.7	210	119	50.1
120	26450	9483.9	220	89.2	38.5
130	11755	4215.1	230	49.3	30.3
140	6612.5	2371	240	38.8	9.7
150	2244	926	250	31.0	8.3
160	1073.6	470	260	7	3.8
170	603.2	273	270	6.4	3.4
180	413.6	173	280	5.7	3.1
190	273.6	117	290	5.0	2.7
200	201.0	66	300	4.6	2.5



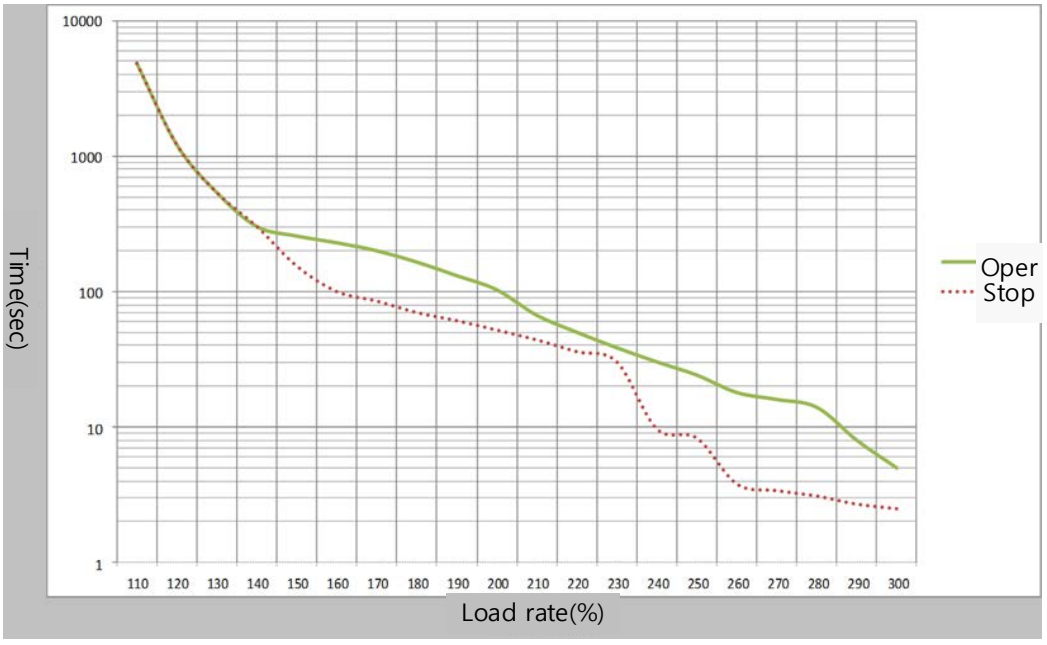
■ Overload Operating Characteristic Curve (L7SA020□, L7SA035□)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	4832	4832	210	66.8	44
120	1208	1208	220	50.1	36
130	536	536	230	38.5	30.3
140	302	302	240	30.3	9.7
150	257	154	250	24.2	8.3
160	229	100	260	4.2	3.8
170	200	85	270	3.8	3.4
180	165	70	280	3.4	3.1
190	131	61	290	3.0	2.7
200	103	52	300	2.7	2.5



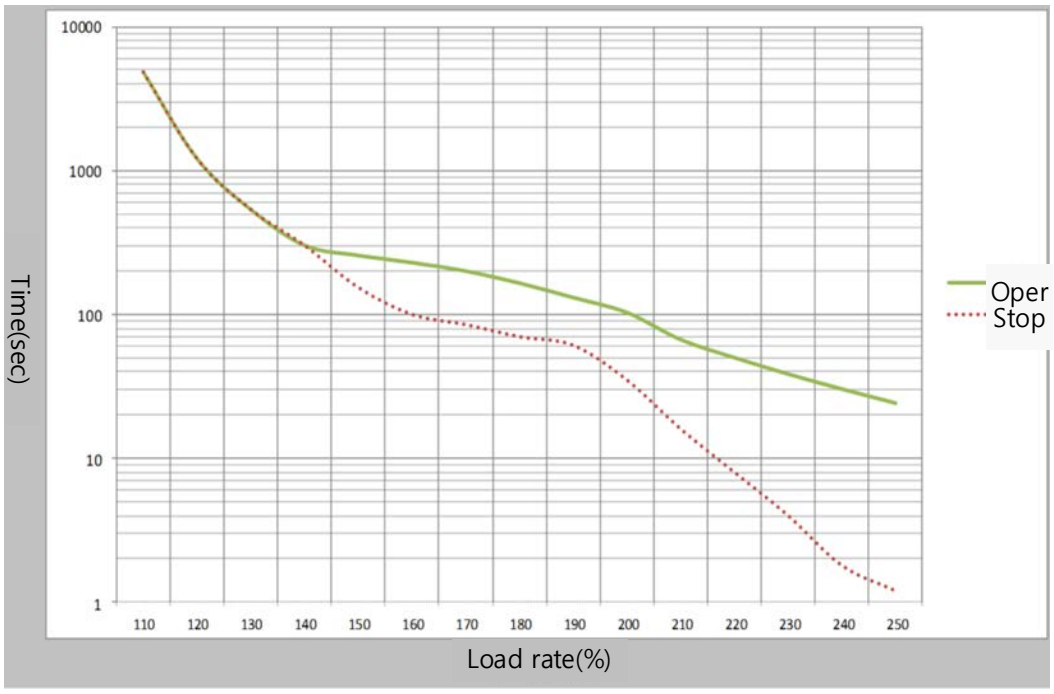
■ Overload Operating Characteristic Curve (L7SA050□)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	4832	4832	210	66.8	44
120	1208	1208	220	50.1	36
130	536.9	536.9	230	38.5	30.3
140	302	302	240	30.3	9.7
150	257	154	250	24.2	8.3
160	229	100	260	18	3.8
170	200	85	270	16	3.4
180	165	70	284	14	3.1
190	131	61	290	8	2.7
200	103	52	300	5	2.5



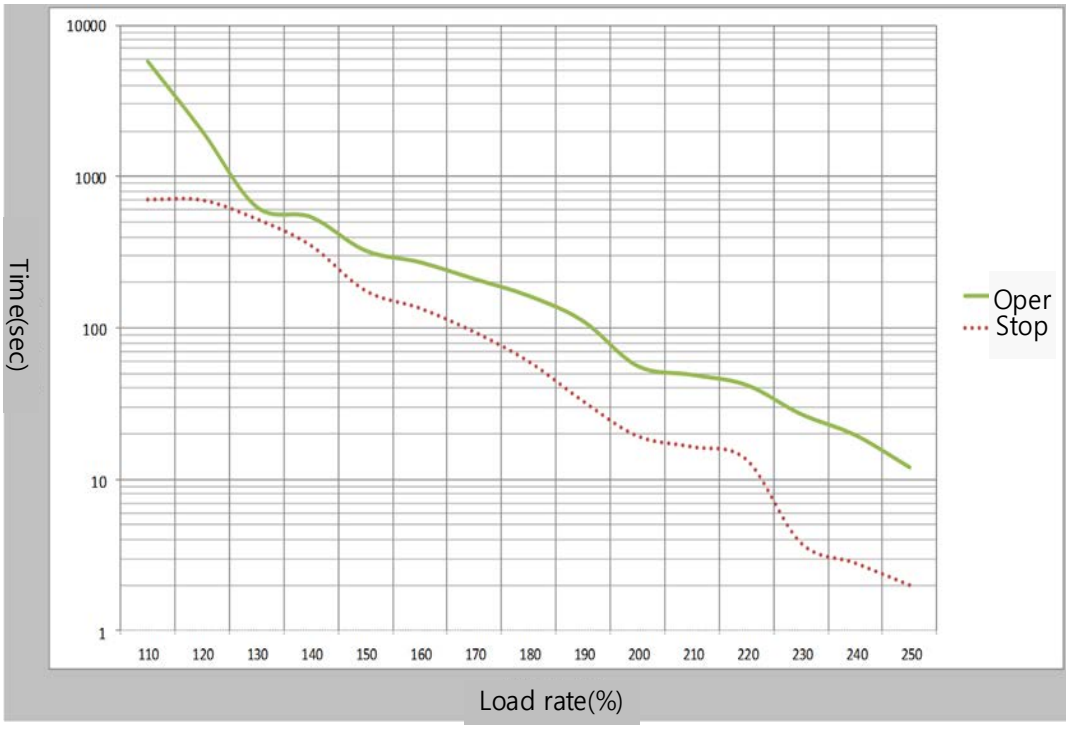
■ Overload Operating Characteristic Curve (L7SA075B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	4832	4832	210	66.8	16
120	1208	1208	220	50.1	8
130	536	536	230	38.4	4
140	302	302	240	30.3	1.8
150	257	154	250	24.2	1.2
160	229	100			
170	200	85			
180	165	70			
190	131	61			
200	103	52			



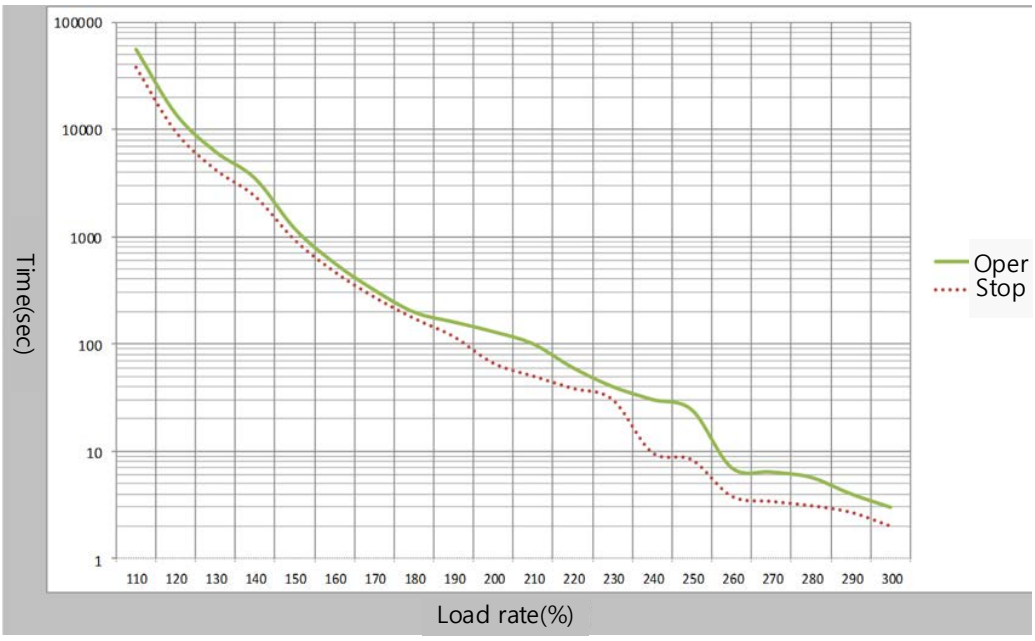
■ Overload Operating Characteristic Curve (L7SA150B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	5760	704	210	49	16.4
120	1998	698.4	220	42	13.5
130	630	524.2	230	27	3.8
140	540	350.1	240	19.6	2.8
150	324	176	250	12	2
160	271.8	135			
170	210.6	94			
180	162.9	60			
190	111	32.8			
200	56	19.3			



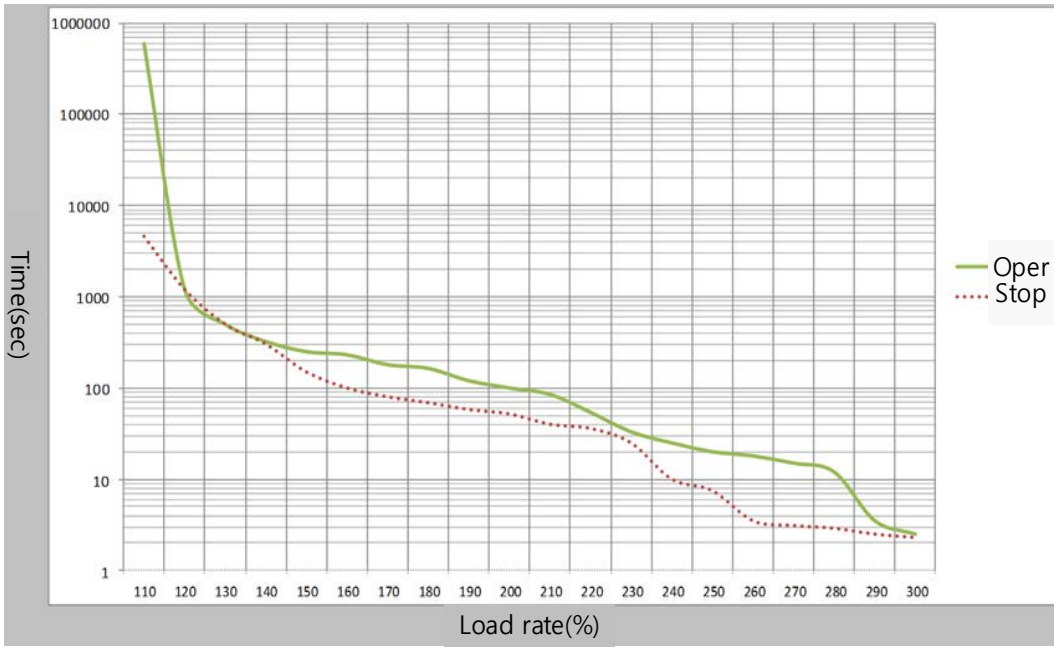
■ Overload Operating Characteristic Curve (L7SB010B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	55776.0	37937.7	210	100.0	50.1
120	13944.0	9483.9	220	60.0	38.5
130	6197.3	4215.1	230	40.0	30.3
140	3486.0	2371.0	240	30.3	9.7
150	1183.0	926.0	250	24.2	8.3
160	566.0	470.0	260	7.0	3.8
170	318.0	273.0	270	6.4	3.4
180	198.0	173.0	284	5.7	3.1
190	160.0	117.0	290	4.0	2.7
200	130.0	66.0	300	3.0	2.0



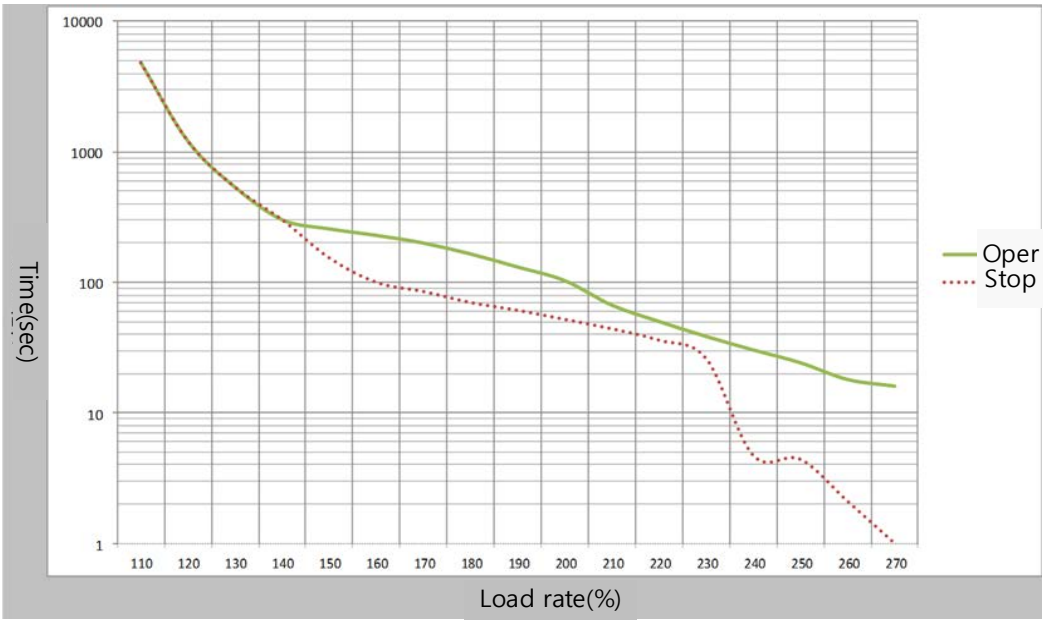
■ Overload Operating Characteristic Curve (L7SB020B, L7SB035B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	593961	4600.0	210	85.0	44
120	1208.0	1208.0	220	54.0	36.0
130	500.0	500.0	230	33.0	25.0
140	323.0	303.0	240	25.0	10.0
150	250.0	150.0	250	20.0	7.5
160	231.0	100.0	260	18.0	3.5
170	180.0	80.0	270	15.0	3.1
180	164.0	69.0	284	12.0	2.9
190	120.0	58.0	290	3.5	2.5
200	100.0	52.0	300	2.5	2.3



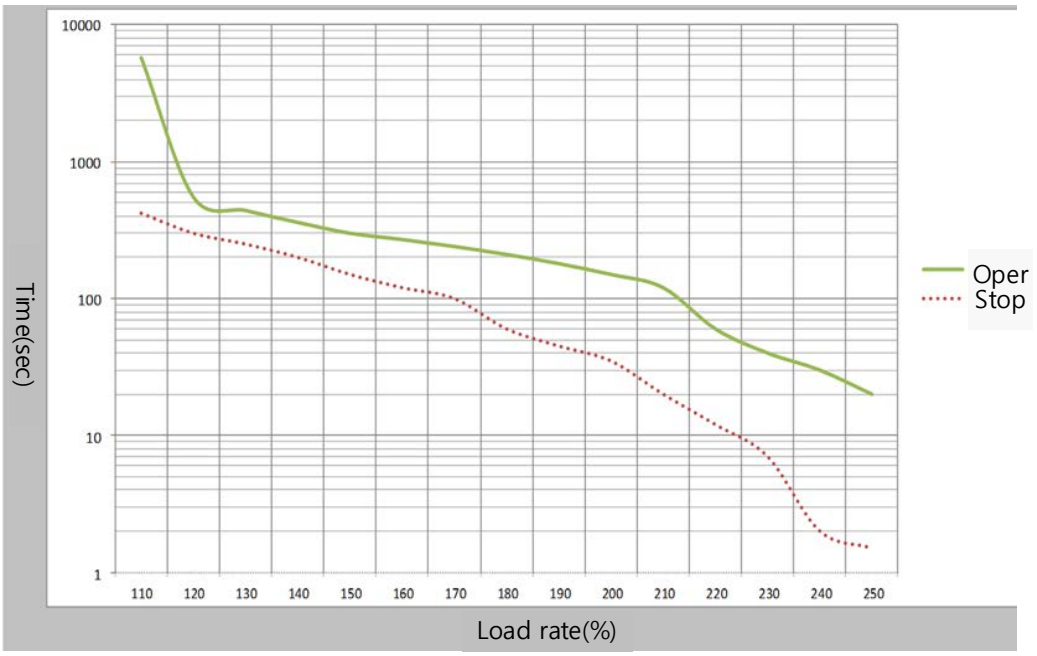
■ Overload Operating Characteristic Curve (L7SB050B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	4832.0	4832.0	210	66.8	44.0
120	1208.0	1208.0	220	50.1	36.0
130	536.0	500.0	230	38.5	26.0
140	302.0	536.8	240	30.3	4.7
150	257.0	154.0	250	24.2	4.4
160	229.0	100.0	260	18.0	2.1
170	200.0	85.0	270	16.0	1.0
180	165.0	70.0			
190	131.0	61.0			
200	103.0	52.0			



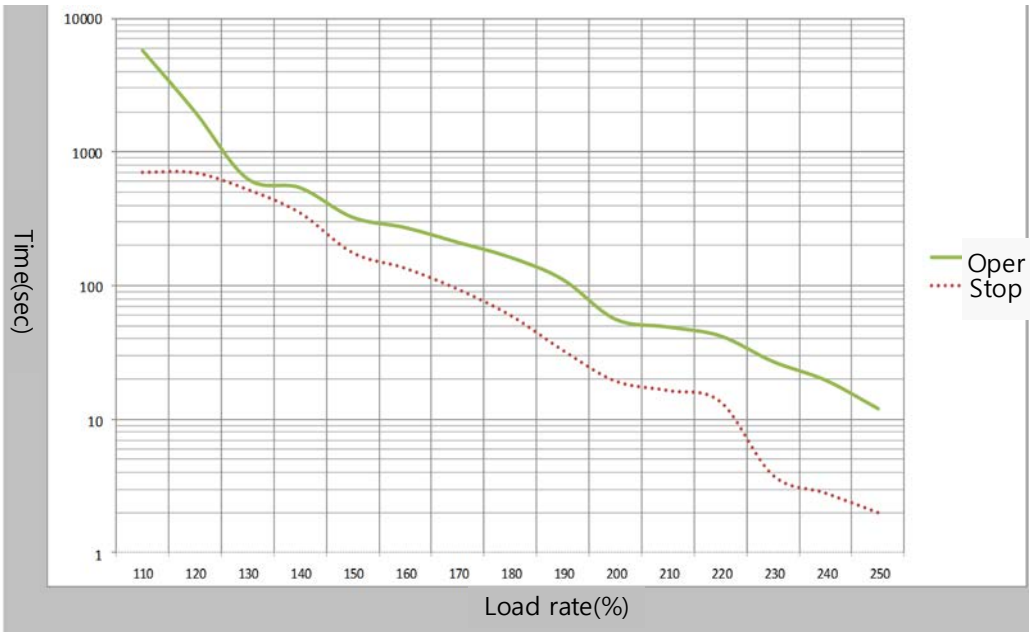
■ Overload Operating Characteristic Curve (L7SB075B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	5760	420	210	120	20
120	550	300	220	60	12
130	440	250	230	40	7
140	360	200	240	30	2
150	300	150	250	20	1.5
160	270	120			
170	240	100			
180	210	60			
190	180	45			
200	150	35			



■ Overload Operating Characteristic Curve (L7SB150B)

Load rate (%)	AL-21 occurred time (sec)		Load rate (%)	AL-21 occurred time (sec)	
	Rotation	Stop		Rotation	Stop
Less than equal to 100	Infinite	Infinite	-	-	-
110	5760	704	210	49	16.4
120	1998	698.4	220	42	13.5
130	630	524.2	230	27	3.8
140	540	350.1	240	19.6	2.8
150	324	176	250	12	2
160	271.8	135			
170	210.6	94			
180	162.9	60			
190	111	32.8			
200	56	19.3			



9. Appendix

9.1 Motor type and ID

[200V]

Model name	ID	Watt	Note
SAR3A	1	30	
SAR5A	2	50	
SA01A	3	100	
***SA015A**	**6**	**150**	**Mass production after August 2018**
SB01A	11	100	
SB02A	12	200	
SB04A	13	400	
HB02A	15	200	Hollow Shaft
HB04A	16	400	Hollow Shaft
SC04A	21	400	
SC06A	22	600	
SC08A	23	800	
SC10A	24	1000	
SC03D	25	300	
SC05D	26	450	
SC06D	27	550	
SC07D	28	650	
HE09A	77	900	Hollow Shaft
HE15A	78	1500	Hollow Shaft

Model name	ID	Watt	Note
DB03D	601	63	
DB06D	602	126	
DB09D	603	188	
DC06D	611	126	
DC12D	612	251	
DC18D	613	377	
DD12D	621	251	
DD22D	622	461	
DD34D	623	712	
DE40D	632	838	
DE60D	633	1257	
DFA1G	641	1728	
DFA6G	642	2513	

*** SA015A: For models produced before August 2018, use ID 5.**

Model name	ID	Watt	Note
FALR5A	702	50	
FAL01A	703	100	
***FAL015A**	**706**	**150**	**Mass production after September 2018**
FBL01A	714	100	
FBL02A	715	200	
FBL04A	716	400	
FCL04A	729	400	
FCL06A	730	600	
FCL08A	731	750	
FCL10A	732	1000	
FCL03D	733	300	
FCL05D	734	450	
FCL06D	735	550	
FCL07D	736	650	
FE09A	761	900	
FE15A	762	1500	
FE22A	763	2200	
FE30A	764	3000	
FE06D	765	600	
FE11D	766	1100	
FE16D	767	1600	
FE22D	768	2200	
FE03M	769	300	
FE06M	770	600	
FE09M	771	900	
FE12M	772	1200	
FE05G	773	450	
FE09G	774	850	
FE13G	775	1300	
FE17G	776	1700	

Model name	ID	Watt	Note
FF30A	781	3000	
FF50A	782	5000	
FF22D	785	2200	
FF35D	786	3500	
FF55D	787	5500	
FF75D	788	7500	
FF12M	789	1200	
FF20M	790	2000	
FF30M	791	3000	
FF44M	792	4000	
FF20G	793	1800	
FF30G	794	2900	
FF44G	795	4400	
FF60G	796	6000	
FF75G	804	7500	
FG22D	811	2200	
FG35D	812	3500	
FG55D	813	5500	
FG75D	814	7500	
FG12M	821	1200	
FG20M	822	2000	
FG30M	823	3000	
FG44M	824	4400	
FG60M	825	6000	
FG20G	831	1800	
FG30G	832	2900	
FG44G	833	4400	
FG60G	834	6000	
FG85G	835	8500	
FG110G	836	11000	
FG150G	837	15000	

*** FAL015A: For models produced before August 2018, use ID 704.**

[400V]

Model name	ID	Watt	Note
FEP09A	261	900	
FEP15A	262	1500	
FEP22A	263	2200	
***FEP22A**	**277**	**2200**	**Mass production after August 2018**
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	**298**	**3000**	**Mass production after August 2018**
FFP44M	292	4400	
FFP20G	29	1800	
FFP30G	294	2900	

Model name	ID	Watt	Note
FFP44G	295	4400	
FFP60G	296	6000	
FFP75G	297	7500	
FGP22D	311	2200	
FGP35D	312	3500	
FGP55D	313	5500	
FGP75D	314	7500	
FGP110D	315	11000	
FGP12M	321	1200	
FGP30M	322	2000	
FGP30M	**338**	**3000**	**Mass production after August 2018**
FGP44M	324	4400	
FGP60M	325	6000	
***FGP60M**	**326**	**6000**	**Mass production after August 2018**
FGP20G	331	1800	
FGP30G	332	2900	
FGP44G	333	4400	
FGP60G	334	6000	
FGP85G	335	8500	
FGP110G	336	11000	
FGP150G	337	15000	
SCP04A	421	400	
SCP06A	422	600	
SCP08A	423	800	
SCP10A	424	1000	

*** FEP22A: For models produced before August 2018, use ID 263.**
*** FFP30M: For models produced before August 2018, use ID 291.**
*** FEP22A: For models produced before August 2018, use ID 323.**
*** FGP60M: For models produced before August 2018, use ID 325.**

9.2 Test Procedure

Thank you very much for purchasing our product. Perform a test run in the order given below.

⚠Caution
In order to avoid unexpected accidents, after attaching the servo motor to the equipment and completing the manual JOG operation test and the first trial run in a no-load state (only the motor without coupling or belt connection), connect the load and do the final trial run.

1. Product check: Check the name tag to verify that the product matches the model you ordered. (Refer to "Chapter 1.1.")

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

2. Power connection: Wire single-phase AC 220 [V] or 380 [V] to control power input C1 and C2, and three-phase AC 220 [V] or 380 [V] to main power input L1, L2, and L3. (Refer to "Chapter 4.2.")

- The product runs even if you input single-phase AC 220 [V] or 380 [V] as the main power. However, such wiring reduces torque and the lifespan of the product. Be sure to input three-phase AC 220 [V] or 380 [V].

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

- Be sure to use robotic 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 220 [V] or 380 [V] 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 9.")
(※ 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 "5.1 How to operate the loader."

6. Motor encoder type setting: Set encoder type in the [P0-01], refer to “5.4.1 System Parameter Setting

7. Main power supply: Supply three-phase AC 220 [V] or 380 [V] 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 is displayed, it indicates that there is 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 " "5.5 List of alarm and warnings."

8. 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.
- 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 "5.5 List of alarm and warnings."

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
- 5: Positon/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 setting parameter: [P3-00]~[P3-20]
b. Input/output setting parameter: [P2-00]~[P2-22]
c. Control setting parameter: [P1-00]~[P1-28]
(Refer to “5.2.4 Control setting parameter”)

11. Perform position operation with the upper level controller by adjusting the following parameter data.
d. Position operation setting parameter: [P4-00]~[P4-14]
e. Input/output parameter setting parameter: [P2-00]~[P2-22]
f. Control parameter setting parameter: [P1-00]~[P1-28]
(Refer to “5.2.4 Control setting parameter”)

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

Revision history

No.	Issue year month	Change contents	Version number	Notes
1	2018.05. 04	new release	1.0	
2	2018.08	Add brand integration and function statements	1.1	
3	2020.07. 24	Mark modified according to company name change	1.2	
4	2020.10. 26	Insert N-stage related precautions	1.3	
5	2021.11. 15	Refer to 7.3.1 St-00 Bit10~Bit13 description error revision 5.2.2 ~ 5.2.8 Detailed description reference path error correction	1.4	
6	2023.09. 30	Addition of installation details in the control panel (panel), addition of cautionary text regarding loss of multi-turn data Integrate L7S_200V and L7S_400V manual	1.5	

Product warranty

This product is made through strict quality control and inspection process by our technical staff.

The product warranty period for this product is normally 12 months from the installation date, and 18 months from the manufacturing date if the installation date is not written. However, it may change according to the terms of the contract. The product described in this user's manual may be discontinued or modified without notice. Be sure to check when you purchase this product.

Free service information

If a drive malfunctions within the product warranty period under normal use, contact our dealer or designated service center. We will repair it free of charge.

Paid service information

Paid service information

- **When a failure occurs due to the consumer's intention or negligence**
- **When a failure occurs due to an abnormality in the power supply or a defect in the connected device**
- **When a breakdown occurs due to a natural disaster (fire, flood, gas damage, earthquake, etc.)**
- **When the product is modified or repaired at a place other than our dealer or service center**
- **When our nameplate is not attached**
- **When the free warranty period has expired**

※ After installing the servo, please fill out this quality assurance form and send it to our quality assurance department (service manager).

Environmental Policy

LS ELECTRIC Co., Ltd supports and observes the environmental policy as below.

Environmental Management

LS ELECTRIC considers the environmental preservation as the preferential management subject and every staff of LS ELECTRIC use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS ELECTRIC' Product is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product, as they are reusable.

Product warranty

Product name	Servo Drive		**Installation date**	
Model name	***L7S Series***		**Warranty**	
Customer	**Name**			
	Address			
	Phone			
Distributor	**Name**			
	Address			
	Phone			

This product is made through strict quality control and inspection process by our technical staff.

The product warranty period is normally 12 months from the installation date, and 18 months from the manufacturing date if the installation date is not written. However, it may change according to the terms of the contract.

Free service information
If a drive malfunctions within the product warranty period under normal use, contact our dealer or designated service center. We will repair it free of charge.

Paid service information
Paid service information ▪ **When a failure occurs due to the consumer's intention or negligence** ▪ **When a failure occurs due to an abnormality in the power supply or a defect in the connected device** ▪ **When a breakdown occurs due to a natural disaster (fire, flood, gas damage, earthquake, etc.)** ▪ **When the product is modified or repaired at a place other than our dealer or service center** ▪ **When our nameplate is not attached** ▪ **When the free warranty period has expired** **※ After installing the servo, please fill out this quality assurance form and send it to our quality assurance department (service manager).**

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

■ **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
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- **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

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2023.10