MITSUBISHI
ELECTRIC

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS
MELSERVO-J4

Conversion Unit for SSCNET of MR-J2S-B Compatible AC Servo

MODEL (Servo Amplifier)

MR-J4-_B_-RJ020

MODEL (Drive Unit)

MR-J4-DU_B_-RJ020

MODEL (Converter Unit)

MR-CR55K_

MODEL (Conversion Unit for SSCNET of MR-J2S-B)

MR-J4-T20

SERVO AMPLIFIER
INSTRUCTION MANUAL

F

● Safety Instructions ●

Please read the instructions carefully before using the equipment.

To use the equipment correctly, do not attempt to install, operate, maintain, or inspect the equipment until you have read through this Instruction Manual, Installation guide, and appended documents carefully. Do not use the equipment until you have a full knowledge of the equipment, safety information and instructions.
In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage.

Note ⚠ that the CAUTION level may lead to a serious consequence according to conditions.
Please follow the instructions of both levels because they are important to personnel safety.
What must not be done and what must be done are indicated by the following diagrammatic symbols.

🛇	Indicates what must not be done. For example, "No Fire" is indicated 🛇 by .
●	Indicates what must be done. For example, ⏚ grounding is indicated by .

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".
After reading this Instruction Manual, keep it accessible to the operator.

1. To prevent electric shock, note the following

⚠ WARNING

●Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

●Ground the servo amplifier and servo motor securely.

●Any person who is involved in wiring and inspection should be fully competent to do the work.

●Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.

●Do not operate switches with wet hands. Otherwise, it may cause an electric shock.

●The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.

●During power-on or operation, do not open the front cover of the servo amplifier. Otherwise, it may cause an electric shock.

●Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.

●Except for wiring and periodic inspection, do not remove the front cover of the servo amplifier even if the power is off. The servo amplifier is charged and you may get an electric shock.

●To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.

●To avoid an electric shock, insulate the connections of the power supply terminals.

2. To prevent fire, note the following

⚠ CAUTION

●Install the servo amplifier, servo motor, and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to smoke or a fire.

●Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier’s power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.

●In order to configure a circuit that shuts down the power supply on the side of the servo amplifier’s power supply, always connect one molded-case circuit breaker or fuse per one servo amplifier between the power supply and the power supply (L1, L2, and L3) of a servo amplifier. If a molded-case circuit breaker or fuse is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.

●When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a regenerative transistor malfunction or the like may overheat the regenerative resistor, causing smoke or a fire.

●Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier, servo motor, and MR-J4-T20.

●Always connect a molded-case circuit breaker to the power supply of the servo amplifier.

3. To prevent injury, note the following

⚠ CAUTION

- ●Only the voltage specified in the Instruction Manual should be applied to each terminal. Otherwise, a burst, damage, etc. may occur.
- ●Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- ●Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- ●The servo amplifier heat sink, regenerative resistor, servo motor, etc. may be hot while power is on and for some time after power-off. Take safety measures, e.g. provide covers, to avoid accidentally touching the parts (cables, etc.) by hand.

4. Additional instructions

The following instructions should also be fully noted. Incorrect handling may cause a malfunction, injury, electric shock, fire etc.

(1) Transportation and installation

⚠ CAUTION

- ●Transport the products correctly according to their mass.
- ●Stacking in excess of the specified number of product packages is not allowed.
- ●Do not hold the front cover when transporting the servo amplifier. Otherwise, it may drop.
- ●Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- ●Do not get on or put heavy load on the equipment.
- ●The equipment must be installed in the specified direction.
- ●Leave specified clearances between the servo amplifier and the cabinet walls or other equipment.
- ●Do not install or operate the servo amplifier and MR-J4-T20 which have been damaged or have any parts missing.
- ●Do not block the intake and exhaust areas of the servo amplifier and MR-J4-T20. Otherwise, it may cause a malfunction.
- ●Do not drop or strike the servo amplifier, servo motor, and MR-J4-T20. Isolate them from all impact loads.
- ●When you keep or use the equipment, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)
	Storage	-20 ˚C to 65 ˚C (non-freezing)
Ambient humidity	Operation	90 %RH or less (non-condensing)
	Storage	
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
Altitude		2000 m or less above sea level (Contact your local sales office for the altitude for options.)
Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)

- ●When the product has been stored for an extended period of time, contact your local sales office.
- ●When handling the servo amplifier and MR-J4-T20, be careful about the edged parts such as corners of them.
- ●The servo amplifier and MR-J4-T20 must be installed in a metal cabinet.

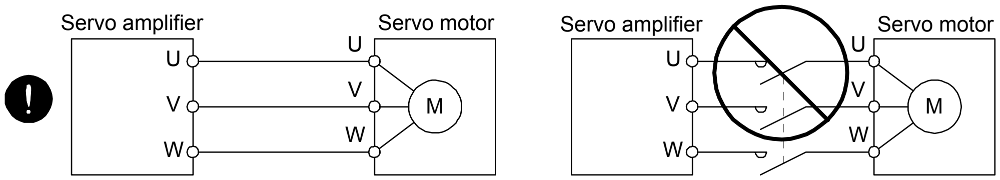
⚠ CAUTION

- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
  Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method).
  Additionally, disinfect and protect wood from insects before packing products.

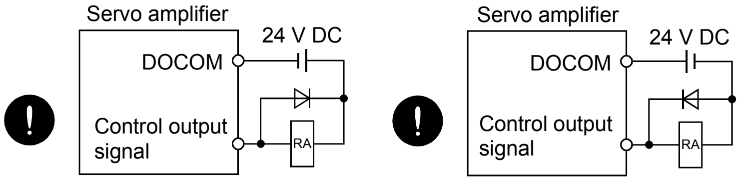
(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
- Do not install a power capacitor, surge killer, or radio noise filter (optional FR-BIF(-H)) on the servo amplifier output side.
- To avoid a malfunction, connect the wires to the correct phase terminals (U, V, and W) of the servo amplifier and servo motor.
- Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



- The connection diagrams in this Instruction Manual are shown for sink interfaces, unless stated otherwise.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For sink output interface

For source output interface

- When the cable is not tightened enough to the terminal block, the cable or terminal block may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.
- Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- Configure a circuit to turn off EM2 or EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.

(3) Test run and adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to operate unexpectedly.
- Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- Do not get close to moving parts during the servo-on status.

(4) Usage

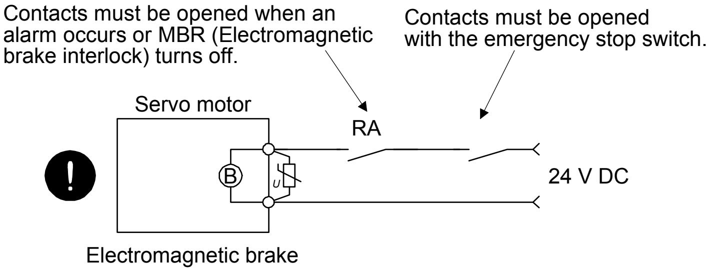
⚠ CAUTION

- When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an external brake to prevent the condition.
- Do not disassemble, repair, or modify the equipment.
- Before resetting an alarm, make sure that the run signal of the servo amplifier is off in order to prevent a sudden restart. Otherwise, it may cause an accident.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break it.
- Use the servo amplifier with the specified servo motor.
- The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- For such reasons as service life and mechanical structure (e.g. where a ball screw and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

⚠ CAUTION

- Ensure safety by confirming the power off, etc. before performing corrective actions. Otherwise, it may cause an accident.
- When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an electromagnetic brake or external brake to prevent the condition.
- Configure an electromagnetic brake circuit so that it is activated also by an external emergency stop switch.



- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- ●Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.
- ●It is recommended that the servo amplifier be replaced every 10 years when it is used in general environment.
- ●When using the servo amplifier that has not been energized for an extended period of time, contact your local sales office.

(7) General instruction

- ●To illustrate details, the equipment in the diagrams of this Instruction Manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this Instruction Manual.

● DISPOSAL OF WASTE ●

Please dispose a servo amplifier, battery (primary battery) and other options according to your local laws and regulations.

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the servo amplifier may malfunction when the EEP-ROM reaches the end of its useful life.

- Write to the EEP-ROM due to parameter setting changes
- Write to the EEP-ROM due to device changes

STO function of the servo amplifier

The STO function cannot be used when the servo amplifier is in the J2S compatibility mode.
To use the STO function, switch the operation mode to J4 mode. Refer to section 13.1 for the mode switching procedure.

Compliance with global standards

Refer to app. 6 and 7 for the compliance with global standard.

«About the manuals»

You must have this Instruction Manual and the following manuals to use this servo. Ensure to prepare them to use the servo safely.
Servo amplifiers and drive units are written as servo amplifiers in this Instruction Manual under certain circumstances, unless otherwise stated.

Relevant manuals

Manual name	Manual No.
MELSERVO Servo Motor Instruction Manual (Vol. 3)	SH(NA)030113
Linear Encoder Instruction Manual (Note 1)	SH(NA)030111
MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting) (Note 2)	SH(NA)030109
Instructions and Cautions for Drive of HC/HA Series Servo Motor with MR-J4-(DU)_B_-RJ020 (Note 3)	SH(NA)030127
Conversion unit for SSCNET of MR-J2S-B MR-J4-T20 Installation Guide (Packed with MR-J4-T20.)	IB(NA)0300204
EMC Installation Guidelines	IB(NA)67310

Note 1. It is necessary for using the fully closed loop system.
2. It is necessary for using a converter unit.
3. It is necessary for using an HC series/HA series servo motor.

«Wiring»

Wires mentioned in this Instruction Manual are selected based on the ambient temperature of 40 °C.

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1. FUNCTIONS AND CONFIGURATION

POINT

- Refer to chapter 14 for the MR-CR55K_ converter unit and MR-J4-DU_B_-RJ020 drive unit.

1.1 Summary

This Instruction Manual explains about the MR-J4-_B_-RJ020 AC servo amplifiers compatible with a conversion unit for SSCNET of MR-J2S-B, and the MR-J4-T20 conversion unit for SSCNET of MR-J2S-B. Always use MR-J4-T20 with MR-J4-_B_-RJ020.
MR-J4-_B_-RJ020 can be connected to SSCNET of MR-J2S-B by being used with MR-J4-T20.
MR-J4-_B_-RJ020 servo amplifiers have "J2S compatibility mode (factory setting)" and "J4 mode" as the operation mode. The "J2S compatibility mode" is the operation mode compatible with the previous functions of the MR-J2S-B series.
This Instruction Manual explains when the "J2S compatibility mode" is used except for in chapter 13.
When using the servo amplifier in "J4 mode", refer to chapter 13.
When you use an MR-J4-_B_-RJ020 servo amplifier, please note the following items.

(1) When an HG series servo motor is used in the J2S compatibility mode, the encoder resolution per servo motor revolution will be 131072 pulses/rev (17 bits), not 4194303 pulses/rev (22 bits)

(2) It may be required to change existing equipment program because the initialization time after power on is different between MR-J2S-_B_ servo amplifier and MR-J4-_B_-RJ020 servo amplifier. Especially when using it in vertical motion applications, please be careful of electromagnetic brake release time. The moving part can fall.

(3) Motor-less operation cannot be used with MR Configurator. To use motor-less operation, set "_ 1 _ _" in [Pr. 24].

(4) When using [Pr. 13 Position loop gain 1] of MR-J4-_B_-RJ020 and MR-J2S-_B_ simultaneously such as in the interpolation mode, check droop pulses for each axis and readjust gains as necessary.

(5) MR-J4-_B_-RJ020 servo amplifier is not compatible with adaptive vibration suppression control.

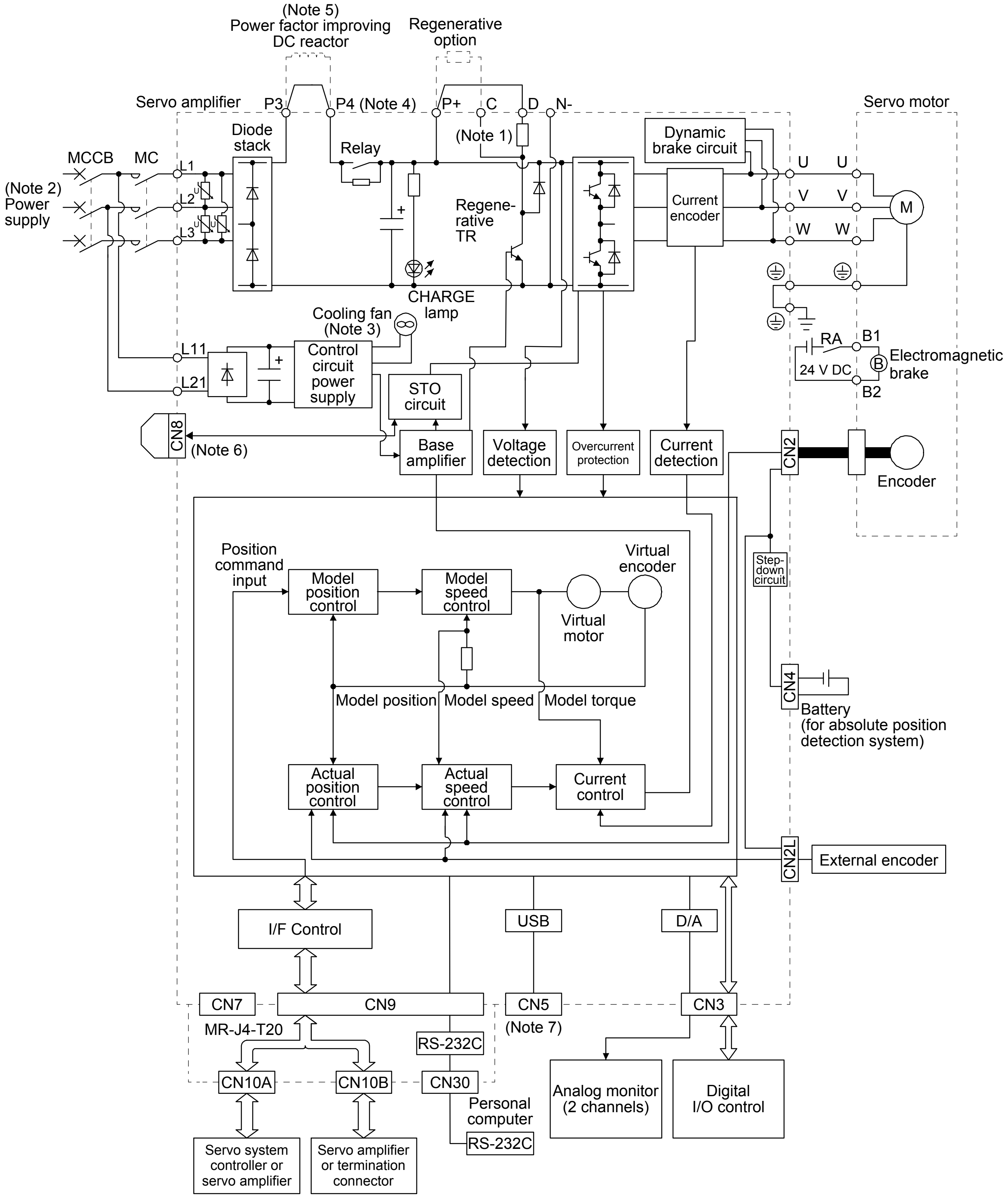
(6) Power is not supplied from the SSCNET cable connection connector to the encoder. When using the MR-J4-_B_-RJ020 servo amplifier in absolute position detection system, always connect a battery to the CN4 connector.

(7) When the servo amplifier is set to the J2S compatibility mode, it supports the fully closed loop system. In the fully closed loop control mode, when an HG series servo motor is used for the load-side encoder, the resolution of the load-side encoder will be 131072 pulses/rev (17 bits), which is the same as that of the servo motor side. Refer to chapter 15 for details.

1.2 Function block diagram

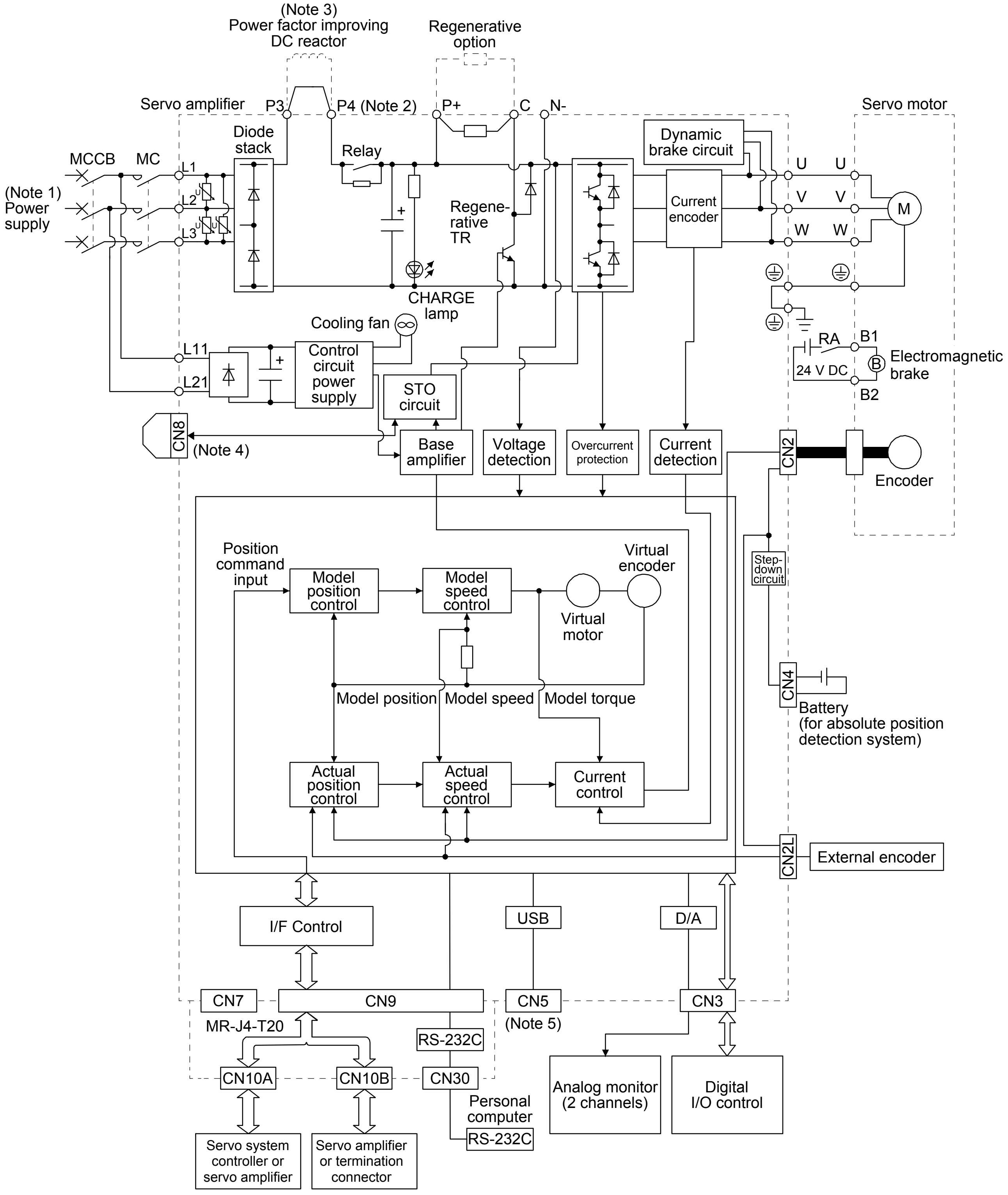
The function block diagram of this servo is shown below.

(1) MR-J4-500B-RJ020 or less/MR-J4-350B4-RJ020 or less



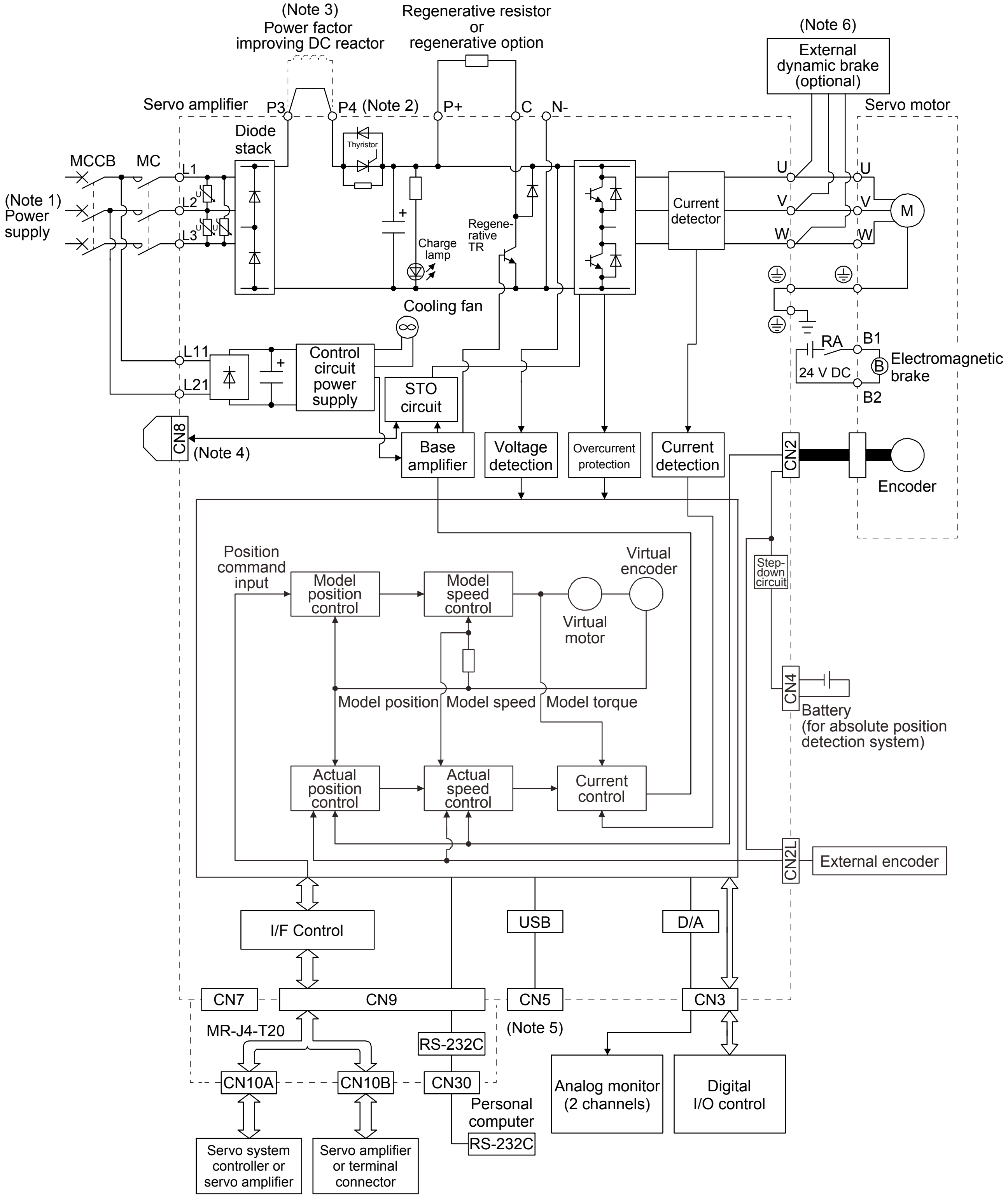
Note
1. The built-in regenerative resistor is not provided for MR-J4-10B-RJ020.
2. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
   For power supply specifications, refer to section 1.3.1.
3. The MR-J4-70B-RJ020 or more, MR-J4-200B4-RJ020 and MR-J4-350B4-RJ020 servo amplifiers have a cooling fan.
4. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
5. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
6. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
7. Used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.

(2) MR-J4-700B-RJ020/MR-J4-500B4-RJ020/MR-J4-700B4-RJ020



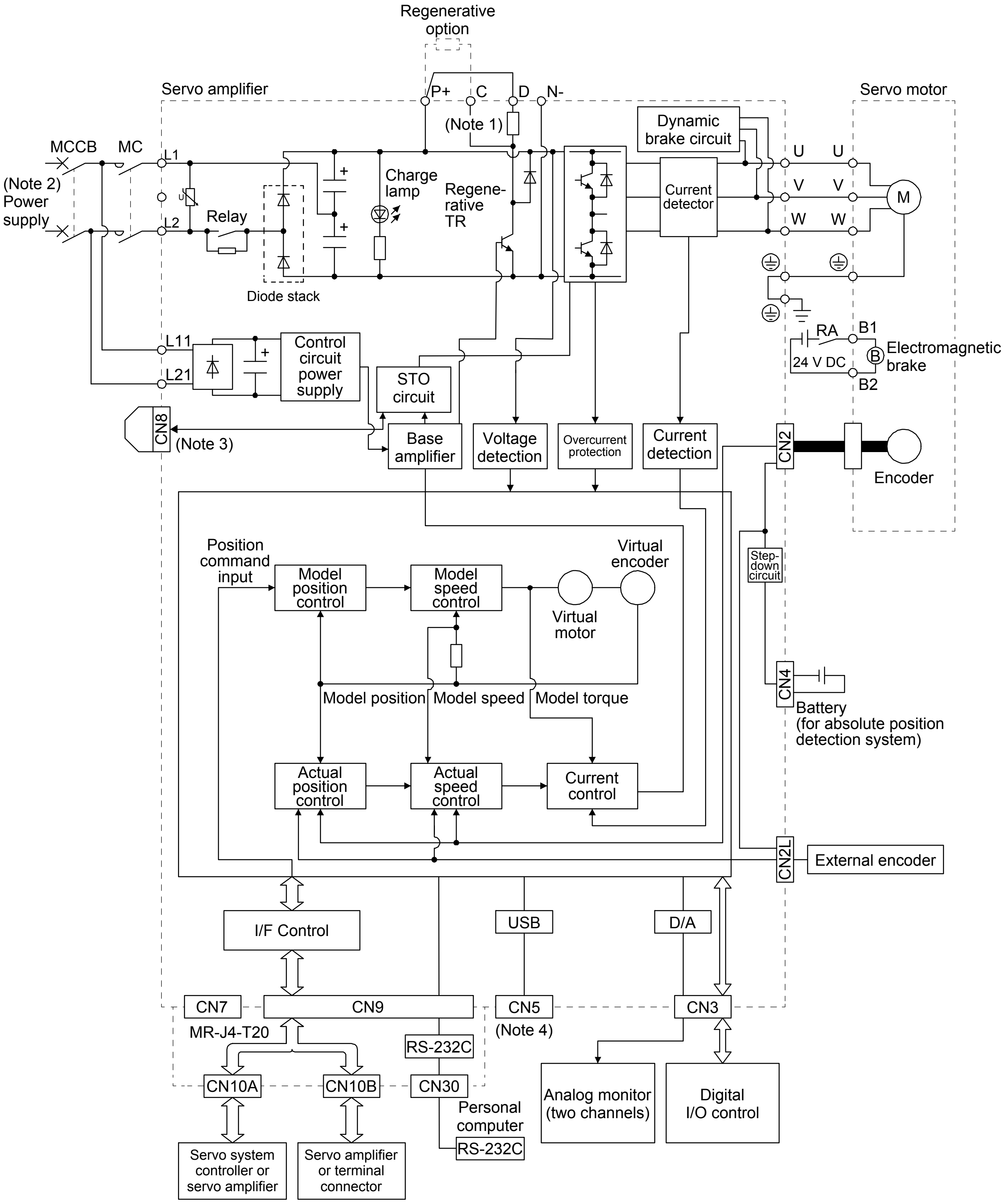
Note 1. For power supply specifications, refer to section 1.3.1.
2. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
3. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
4. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
5. Used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.

(3) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020/
MR-J4-15KB4-RJ020/MR-J4-22KB4-RJ020



Note
1. For power supply specifications, refer to section 1.3.1.
2. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
3. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
4. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
5. This is used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.
6. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 11.7.

(4) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/MR-J4-40B1-RJ020



Note 1. The built-in regenerative resistor is not provided for MR-J4-10B1-RJ020.

2. For power supply specifications, refer to section 1.3.1.

3. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.

4. This is used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.

1.3 Standard specifications

1.3.1 Servo amplifier standard specifications

(1) 200 V class

Model: MR-J4-_-RJ020		10B	20B	40B	60B	70B	100B	200B	350B	500B	700B	11KB	15KB	22KB
Output	Rated voltage	3-phase 170 V AC												
	Rated current [A]	1.1	1.5	2.8	3.2	5.8	6.0	11.0	17.0	28.0	37.0	68.0	87.0	126.0
Main circuit power supply input	Voltage/Frequency	3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz					3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz							
	Rated current (Note 6) [A]	0.9	1.5	2.6	3.2 (Note 3)	3.8	5.0	10.5	16.0	21.7	28.9	46.0	64.0	95.0
	Permissible voltage fluctuation	3-phase or 1-phase 170 V AC to 264 V AC					3-phase 170 V AC to 264 V AC							
	Permissible frequency fluctuation	Within ±5%												
	Power supply capacity [kVA]	Refer to section 10.2.												
	Inrush current [A]	Refer to section 10.5.												
Control circuit power supply input	Voltage/Frequency	1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz												
	Rated current [A]	0.2								0.3				
	Permissible voltage fluctuation	1-phase 170 V AC to 264 V AC												
	Permissible frequency fluctuation	Within ±5%												
	Power consumption [W]	30								45				
	Inrush current [A]	Refer to section 10.5.												
Interface power supply	Voltage	24 V DC ± 10%												
	Current capacity [A]	0.1												
Control method		Sine-wave PWM control, current control method												
Dynamic brake		Built-in										External option (Note 5)		
Fully closed loop control		Compatible (Note 7)												
Load-side encoder interface		Mitsubishi high-speed serial communication/A/B/Z-phase differential input signal (Note 7)												
Communication function	USB	Connection to a personal computer (compatible with an application "MR-J4(W)-B mode selection" (Note 4))												
Encoder output pulses		Compatible (A/B/Z-phase pulse)												
Analog monitor		Two channels												
Protective functions		Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection, magnetic pole detection protection, linear servo control error protection												
Functional safety		Not available												
Compliance to global standards	CE marking	LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061												
	UL standard	UL 508C												
Structure (IP rating)		Natural cooling, open (IP20)				Force cooling, open (IP20)				Force cooling, open (IP20) (Note 2)				
Close mounting (Note 1)		Possible								Impossible				

Model: MR-J4-_-RJ020			10B	20B	40B	60B	70B	100B	200B	350B	500B	700B	11KB	15KB	22KB
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)												
		Storage	-20 ˚C to 65 ˚C (non-freezing)												
	Ambient humidity	Operation	90 %RH or less (non-condensing)												
		Storage													
	Ambience		Indoors (no direct sunlight),free from corrosive gas, flammable gas, oil mist, dust, and dirt												
	Altitude		2000 m or less above sea level (Note 8)												
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)												
Mass [kg]			0.8		1.0		1.4		2.1	2.3	4.0	6.2	13.4		18.2

Note 1. When closely mounting the servo amplifier, operate them at the ambient temperatures of 0 ˚C to 45 ˚C or at 75% or smaller effective load ratio.

2. Except for the terminal block.
3. The rated current is 2.9 A when the servo amplifier is used with a UL or CSA compliant servo motor.
4. The application "MR-J4(W)-B mode selection" is necessary for using MR-J4-_B-RJ020 in the J4 mode.
   It is unnecessary for using MR-J4-_B-RJ020 in the J2S compatibility mode. Use the application "MR-J4(W)-B mode selection" packed with MR Configurator2 of software version 1.17T or later.
5. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 11.7.
6. This value is applicable when a 3-phase power supply is used.
7. Use the servo amplifier or the drive unit with following software version:
   - A4 or later for 7 kW or less
   - A6 or later for 11 kW or more
8. Follow the restrictions in section 2.6 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

(2) 400 V class

Model: MR-J4-_-RJ020			60B4	100B4	200B4	350B4	500B4	700B4	11KB4	15KB4	22KB4
Output	Rated voltage		3-phase 323 V AC								
	Rated current [A]		1.5	2.8	5.4	8.6	14.0	17.0	32.0	41.0	63.0
Main circuit power supply input	Voltage/Frequency		3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz								
	Rated current [A]		1.4	2.5	5.1	7.9	10.8	14.4	23.1	31.8	47.6
	Permissible voltage fluctuation		3-phase 323 V AC to 528 V AC								
	Permissible frequency fluctuation		Within ±5%								
	Power supply capacity [kVA]		Refer to section 10.2.								
	Inrush current [A]		Refer to section 10.5.								
Control circuit power supply input	Voltage/Frequency		1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz								
	Rated current [A]		0.1			0.2					
	Permissible voltage fluctuation		1-phase 323 V AC to 528 V AC								
	Permissible frequency fluctuation		Within ±5%								
	Power consumption [W]		30			45					
	Inrush current [A]		Refer to section 10.5.								
Interface power supply	Voltage		24 V DC ± 10%								
	Current capacity [A]		0.1								
Control method			Sine-wave PWM control, current control method								
Dynamic brake			Built-in						External option (Note 3)		
Fully closed loop control			Compatible (Note 4)								
Load-side encoder interface			Mitsubishi high-speed serial communication/A/B/Z-phase differential input signal (Note 4)								
Communication function	USB		Connection to a personal computer (compatible with an application "MR-J4(W)-B mode selection" (Note 2))								
Encoder output pulses			Compatible (A/B/Z-phase pulse)								
Analog monitor			Two channels								
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection, magnetic pole detection protection, linear servo control error protection								
Functional safety			Not available								
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061								
	UL standard		UL 508C								
Structure (IP rating)			Natural cooling, open (IP20)		Force cooling, open (IP20)		Force cooling, open (IP20) (Note 1)				
Close mounting			Impossible								
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)								
		Storage	-20 ˚C to 65 ˚C (non-freezing)								
	Ambient humidity	Operation	90 %RH or less (non-condensing)								
		Storage									
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt								
	Altitude		2000 m or less above sea level (Note 5)								
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)								
Mass [kg]			1.7		2.1	3.6	4.3	6.5	13.4		18.2

Note
1. Except for the terminal block.
2. The application "MR-J4(W)-B mode selection" is necessary for using MR-J4-_B4-RJ020 in the J4 mode. It is unnecessary for using MR-J4-_B4-RJ020 in the J2S compatibility mode. Use the application "MR-J4(W)-B mode selection" packed with MR Configurator2 of software version 1.17T or later.
3. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.
4. Use the servo amplifier or the drive unit with following software version:
   ・A4 or later for 7 kW or less
   ・A6 or later for 11 kW or more
5. Follow the restrictions in section 2.6 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

(3) 100 V class

Model: MR-J4-_-RJ020			10B1	20B1	40B1
Output	Rated voltage		3-phase 170 V AC		
	Rated current [A]		1.1	1.5	2.8
Main circuit power supply input	Voltage/Frequency		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz		
	Rated current [A]		3.0	5.0	9.0
	Permissible voltage fluctuation		1-phase 85 V AC to 132 V AC		
	Permissible frequency fluctuation		Within ±5%		
	Power supply capacity [kVA]		Refer to section 10.2.		
	Inrush current [A]		Refer to section 10.5.		
Control circuit power supply input	Voltage/Frequency		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz		
	Rated current [A]		0.4		
	Permissible voltage fluctuation		1-phase 85 V AC to 132 V AC		
	Permissible frequency fluctuation		Within ±5%		
	Power consumption [W]		30		
	Inrush current [A]		Refer to section 10.5.		
Interface power supply	Voltage		24 V DC ± 10%		
	Current capacity [A]		0.1		
Control method			Sine-wave PWM control, current control method		
Dynamic brake			Built-in		
Fully closed loop control			Compatible (Note 3)		
Load-side encoder interface			Mitsubishi high-speed serial communication/A/B/Z-phase differential input signal (Note 3)		
Communication function	USB		Connection with the personal computer (compatible with an application software "MR-J4(W)-B mode selection" (Note 2))		
Encoder output pulses			Compatible (A/B/Z-phase pulse)		
Analog monitor			Two channels		
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection		
Functional safety			Not available		
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061		
	UL standard		UL 508C		
Structure (IP rating)			Natural cooling, open (IP20)		
Close mounting (Note 1)			Possible		
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)		
		Storage	-20 ˚C to 65 ˚C (non-freezing)		
	Ambient humidity	Operation	90 %RH or less (non-condensing)		
		Storage			
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt		
	Altitude		2000 m or less above sea level (Note 4)		
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)		
Mass [kg]			0.8		1.0

Note 1. When closely mounting the servo amplifier of 3.5 kW or less, operate them at the ambient temperatures of 0 ˚C to 45 ˚C or at 75% or smaller effective load ratio.

2. The application software "MR-J4(W)-B mode selection" is necessary for using MR-J4-_B1-RJ020 in J4 mode.
It is unnecessary when using MR-J4-_B1-RJ020 in J2S compatibility mode. Use the application "MR-J4(W)-B mode selection" which packed with MR Configurator2 of software version 1.17T or later.

3. The fully closed loop control is available only in J2S compatibility mode. Use a servo amplifier with software version A4 or later.

4. Follow the restrictions in section 2.6 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

1.3.2 Conversion unit for SSCNET of MR-J2S-B

Model			MR-J4-T20
Control circuit power supply	Voltage		5 V DC (supplied from the servo amplifier)
	Rated current [A]		0.1
Network interface			SSCNET interface (CN10A connector/CN10B connector)
Communica-tion function	RS-232C		Connection to a personal computer (MR Configurator (MRZJW3-SETUP161E) (CN30 connector))
Structure			Natural-cooling, open (IP rating: IP00)
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)
		Storage	-20 ˚C to 65 ˚C (non-freezing)
	Ambient humidity	Operation	90 %RH or less (non-condensing)
		Storage	
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
	Altitude		1000 m or less above sea level
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)
Mass [g]			140

1.4 Combinations of servo amplifiers and servo motors

POINT

- ●When an HG series servo motor is used with the MR-J4-_B_-RJ020 servo amplifier, the encoder resolution per servo motor revolution will be 131072 pulses/rev (17 bits), not 4194303 pulses/rev (22 bits).
- ●To operate the HG series servo motor at the maximum torque, set the torque limit value in the servo system controller to 500%. When using the maximum torque in the test operation mode, set [Pr. 10 Forward rotation torque limit value] and [Pr. 11 Reverse rotation torque limit value] to 500%.

(1) 200 V class

Servo amplifier	Servo motor						
	HG-KR	HG-MR	HG-SR	HG-UR	HG-RR	HG-JR	HG-JR (at maximum torque 400%)
MR-J4-10B-RJ020	053 13	053 13					
MR-J4-20B-RJ020	23	23					
MR-J4-40B-RJ020	43	43					
MR-J4-60B-RJ020			51 52			53	
MR-J4-70B-RJ020	73	73		72		73	
MR-J4-100B-RJ020			81 102			103	53
MR-J4-200B-RJ020			121 201 152 202	152	103 153	153 203	73 103
MR-J4-350B-RJ020			301 352	202	203	353	153 203
MR-J4-500B-RJ020			421 502	352 502	353 503	503	353
MR-J4-700B-RJ020			702			601 701M 703	503
MR-J4-11KB-RJ020						801 12K1 11K1M 903	
MR-J4-15KB-RJ020						15K1 15K1M	
MR-J4-22KB-RJ020						20K1 25K1 22K1M	

(2) 400 V class

Servo amplifier	Servo motor		
	HG-SR	HG-JR	HG-JR (at maximum torque 400%)
MR-J4-60B4-RJ020	524	534	
MR-J4-100B4-RJ020	1024	734 1034	534
MR-J4-200B4-RJ020	1524 2024	1534 2034	734 1034
MR-J4-350B4-RJ020	3524	3534	1534 2034
MR-J4-500B4-RJ020	5024	5034	3534
MR-J4-700B4-RJ020	7024	6014 701M4 7034	5034
MR-J4-11KB4-RJ020		8014 12K14 11K1M4 9034	
MR-J4-15KB4-RJ020		15K14 15K1M4	
MR-J4-22KB4-RJ020		20K14 25K14 22K1M4	

(3) 100 V class

Servo amplifier	Servo motor	
	HG-KR	HG-MR
MR-J4-10B1-RJ020	053 13	053 13
MR-J4-20B1-RJ020	23	23
MR-J4-40B1-RJ020	43	43

1.5 Function list

The following table lists the functions of this servo. For details of the functions, refer to each section indicated in the detailed explanation field.

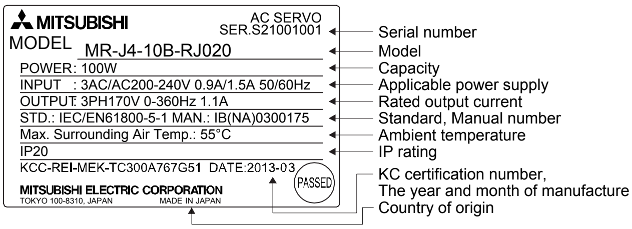
Function	Description	Detailed explanation
Model adaptive control	This realizes a high response and stable control following the ideal model. The two-degrees-of-freedom-model model adaptive control enables you to set a response to the command and response to the disturbance separately.	
Position control mode	This servo is used as a position control servo.	
Speed control mode	This servo is used as a speed control servo.	
Torque control mode	This servo is used as a torque control servo.	
High-resolution encoder	When the servo amplifier is in the J2S compatibility mode, the encoder resolution of the servo amplifier will be 131072 pulses/rev.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
Gain switching function	You can switch gains during rotation and during stop, and can use an input device to switch gains during operation.	Section 7.2
Adaptive vibration suppression control	This is not available with this servo amplifier.	
Machine resonance suppression filter	This is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system.	Section 7.1.1
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 7.1.2
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting an MR Configurator installed personal computer and servo amplifier. MR Configurator is necessary for this function.	
Machine simulation	This is not available with this servo amplifier.	
Gain search function	This is not available with this servo amplifier.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	[Pr. 24]
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 6.2
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used for the 5 kW or more servo amplifier.	Section 11.3
Power regeneration converter	Used when the regenerative option cannot provide enough regenerative power. Can be used for the 5 kW or more servo amplifier.	Section 11.4
Regenerative option	Used when the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capability for the regenerative power generated.	Section 11.2
Torque limit	Servo motor torque can be limited to any value.	[Pr. 10], [Pr. 11]
EM1 (Forced stop) automatic on	This function automatically switches on and disables EM1 (Forced stop) in the servo amplifier.	[Pr. 23]
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for checking output signal wiring, etc.	Section 4.5.1 (1) (d)
Test operation mode	JOG operation, positioning operation, DO forced output, and program operation MR Configurator is necessary for this function.	Section 4.5.1
	Motor-less operation To use motor-less operation, set " _1_ _ " in [Pr. 24].	Section 4.5.2
Analog monitor output	Servo status is outputted in terms of voltage in real time.	[Pr. 22]
MR Configurator	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others. Use MRZJW3-SETUP161E for MR-J4-_B_-RJ020 servo amplifier.	Section 11.7
Linear servo system	This is not available with this servo amplifier.	
Direct drive servo system	This is not available with this servo amplifier.	

Function	Description	Detailed explanation
Fully closed loop system	Fully closed loop system can be configured using the load-side encoder. The fully closed loop system is enabled only in J2S compatibility mode. Use the servo amplifier or the drive unit with following software version: ・A4 or later for 7 kW or less ・A6 or later for 11 kW or more In the fully closed loop system, the following cable can be used for the servo motor encoder: ・Two-wire type for software version A4 or later ・Two-wire and four-wire types for software version A6 or later Check the software version with MR Configurator (MRZJW3-SETUP161E).	Chapter 15
STO function	The STO function cannot be used when the servo amplifier is in J2S compatibility mode.	

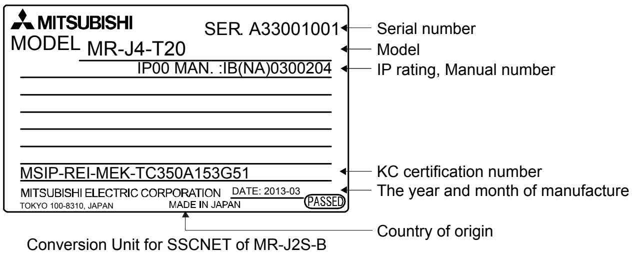
1.6 Model designation

(1) Rating plate

The following shows an example of rating plate for explanation of each item.



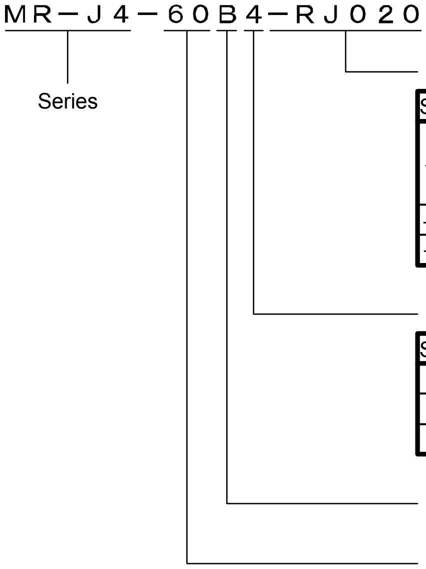
Servo amplifier



Conversion Unit for SSCNET of MR-J2S-B

(2) Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



Special specifications

Symbol	Special specifications
-RJ020	Compatible with the conversion unit for SSCNET of MR-J2S-B Fully closed loop control four-wire type/load-side encoder A/B/Z-phase input compatible (Note 3)
-RU020	MR-J4-_B_-RJ020 without a dynamic brake (Note 1)
-RZ020	MR-J4-_B_-RJ020 without regenerative resistor (Note 2)

Power supply

Symbol	Power supply
None	3-phase or 1-phase 200 V AC to 240 V AC
1	1-phase 100 V AC to 120 V AC
4	3-phase 380 V AC to 480 V AC

SSCNETIII/H interface

Rated output

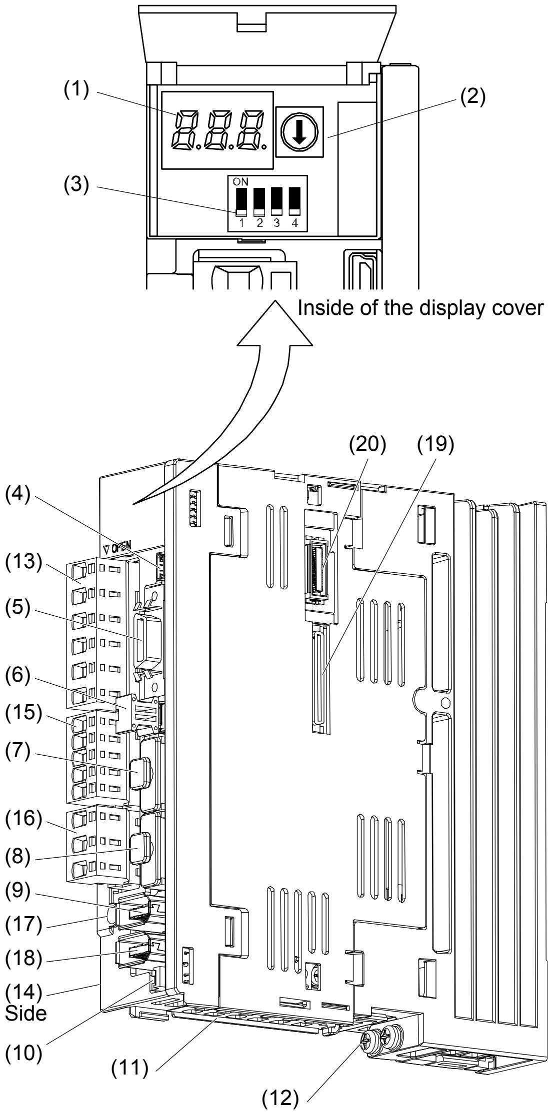
Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
60	0.6
70	0.75
100	1
200	2
350	3.5
500	5
700	7
11K	11
15K	15
22K	22

Note
1. Dynamic brake which is built in 7 kw or smaller servo amplifiers is removed. Refer to app. 10.1 for details.
2. These are servo amplifiers of 11 kW to 22 kW that does not use a regenerative resistor as standard accessory. Refer to app. 10.2 for details.
3. This is available with software version of A4 or later for 7 kW or less, and with A6 or later for 11 kW or more. The following cable can be used for the servo motor encoder:
   - Two-wire type for software version A4 or later
   - Two-wire and four-wire types for software version A6 or later

1.7 Structure

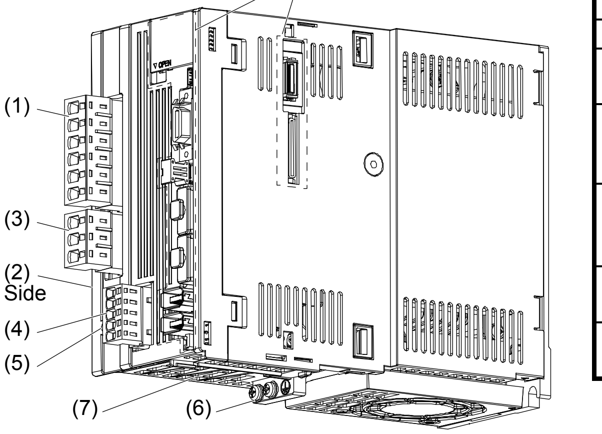
1.7.1 Parts identification

(1) MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less/MR-J4-40B1-RJ020 or less
The diagram shows MR-J4-10B-RJ020.



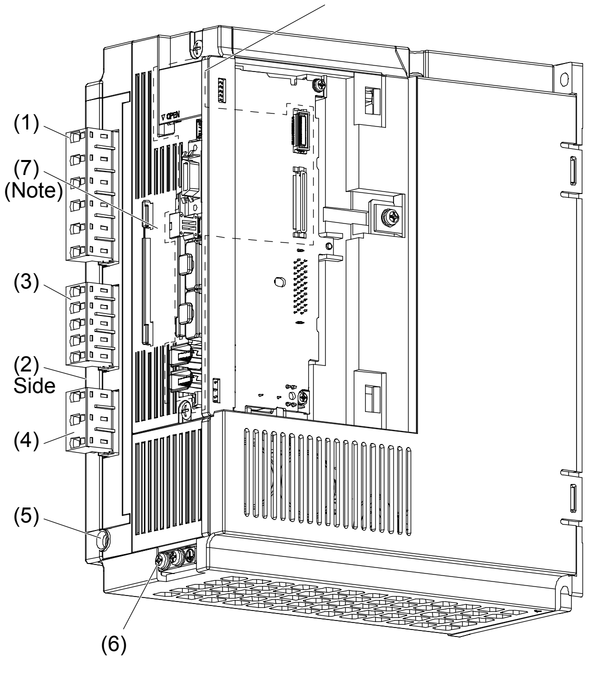
No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, 7-segment LED shows the servo status and the alarm number.	Section 4.3
(2)	Axis selection rotary switch (SW1) Used to set the axis No. of servo amplifier.	
(3)	Control axis setting switch (SW2) Not used in J2S compatibility mode. Turn all switches "OFF (down)".)	
(4)	USB communication connector (CN5) Connect with the personal computer. Used to change the servo amplifier mode.	Section 13.1
(5)	I/O signal connector (CN3) Used to connect digital I/O signals. The pin assignments are different from the MR-J2S series. Wire it correctly in accordance with section 3.4.	Section 3.2 Section 3.4
(6)	STO input signal connector (CN8) Not used in J2S compatibility mode. Always attach the supplied short-circuit connector.	
(7)	SSCNET III cable connector (CN1A) Not used in J2S compatibility mode. Always cap the connector.	
(8)	SSCNET III cable connector (CN1B) Not used in J2S compatibility mode. Always cap the connector.	
(9)	Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
(10)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
(11)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(12)	Protective earth (PE) terminal	Section 3.1 Section 3.3
(13)	Main circuit power connector (CNP1) Connect the input power supply.	
(14)	Rating plate	Section 1.6
(15)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1 Section 3.3
(16)	Servo motor power connector (CNP3) Connect the servo motor.	
(17)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(18)	External encoder connector (CN2L) Used only for the fully closed loop system.	Section 3.4 Chapter 15
(19)	Optional unit connector (CN7) Connector used for connection with the CN70 connector of MR-J4-T20	
(20)	Optional unit connector (CN9) Connector used for connection with the CN90 connector of MR-J4-T20	

(2) MR-J4-350B-RJ020


The broken line area is the same as
MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less.

No.	Name/Application	Detailed explanation
(1)	Main circuit power connector (CNP1) Connect the input power supply.	Section 3.1 Section 3.3
(2)	Rating plate	Section 1.6
(3)	Servo motor power connector (CNP3) Connect the servo motor.	Section 3.1 Section 3.3
(4)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	
(5)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(6)	Protective earth (PE) terminal	Section 3.1 Section 3.3
(7)	Battery holder Install the battery for absolute position data backup.	Section 12.2

(3) MR-J4-350B4-RJ020


The broken line area is the same as
MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less.

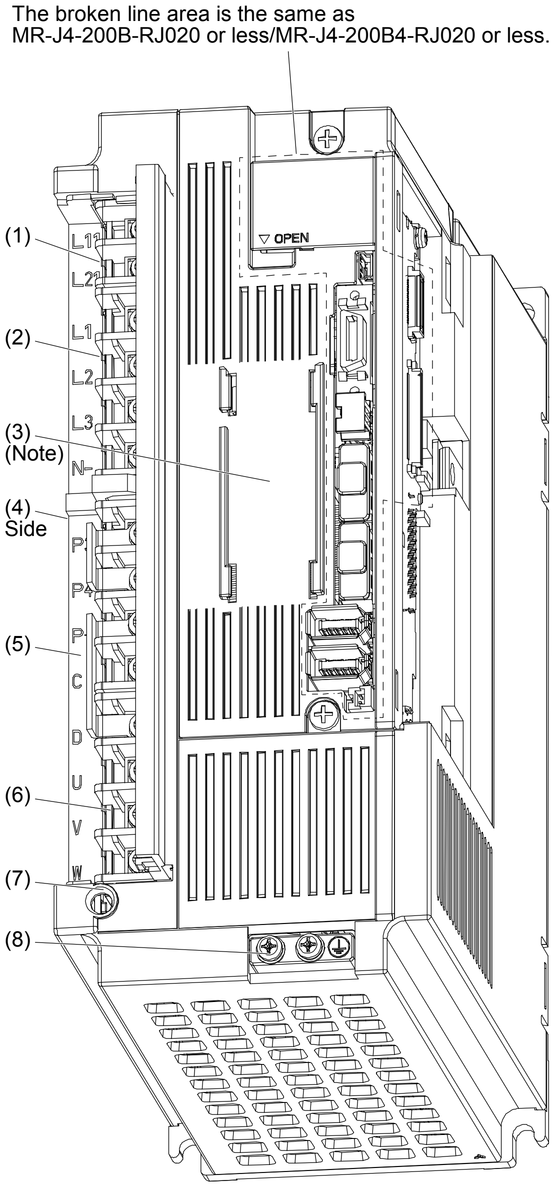
No.	Name/Application	Detailed explanation
(1)	Main circuit power connector (CNP1) Connect the input power supply.	Section 3.1 Section 3.3
(2)	Rating plate	Section 1.6
(3)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1 Section 3.3
(4)	Servo motor power output connector (CNP3) Connect the servo motor.	
(5)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(6)	Protective earth (PE) terminal	Section 3.1 Section 3.3
(7)	Battery holder Install the battery for absolute position data backup.	Section 12.2

Note. Lines for slots around the battery holder are omitted from the illustration.

(4) MR-J4-500B-RJ020

POINT

- The servo amplifier is shown with the front cover open. The front cover cannot be removed.


The broken line area is the same as MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less.

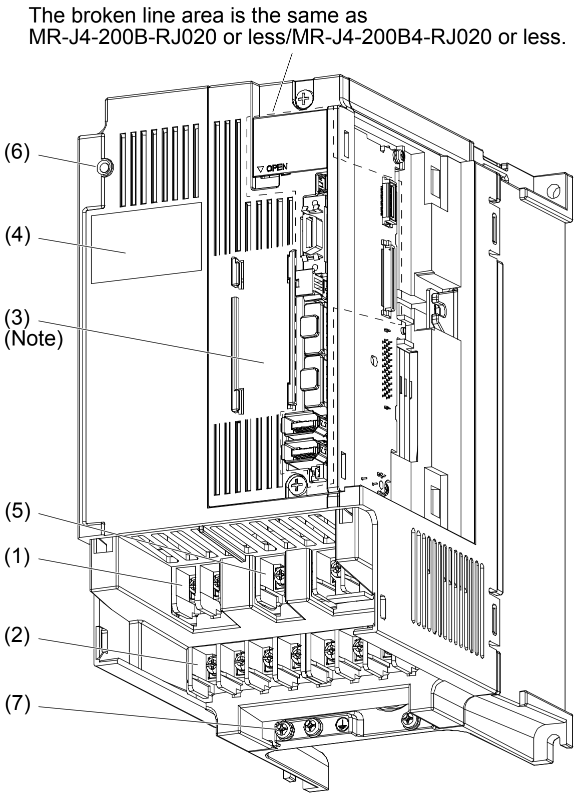
No.	Name/Application	Detailed explanation
(1)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1) Connect the input power supply.	
(3)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(4)	Rating plate	Section 1.6
(5)	Regenerative option/power factor improving reactor terminal block (TE3) Used to connect a regenerative option and a power factor improving DC reactor.	Section 3.1 Section 3.3
(6)	Servo motor power supply terminal block (TE4) Connect the servo motor.	
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(8)	Protective earth (PE) terminal	Section 3.1 Section 3.3

Note. Lines for slots around the battery holder are omitted from the illustration.

(5) MR-J4-500B4-RJ020

POINT

- The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.



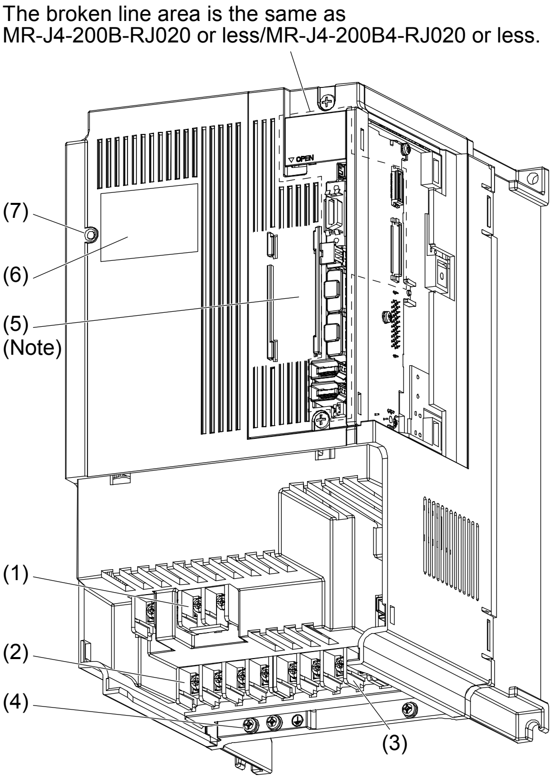
Note. Lines for slots around the battery holder are omitted from the illustration.

No.	Name/Application	Detailed explanation
(1)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option, and servo motor.	
(3)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(4)	Rating plate	Section 1.6
(5)	Regenerative option/power factor improving reactor terminal block (TE3) Used to connect a regenerative option and a power factor improving DC reactor.	Section 3.1 Section 3.3
(6)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(7)	Protective earth (PE) terminal	Section 3.1 Section 3.3

(6) MR-J4-700B-RJ020/MR-J4-700B4-RJ020

POINT

- ●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.



No.	Name/Application	Detailed explanation
(1)	Regenerative option/power factor improving reactor terminal block (TE3) Used to connect a regenerative option and a power factor improving DC reactor.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option, and servo motor.	
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

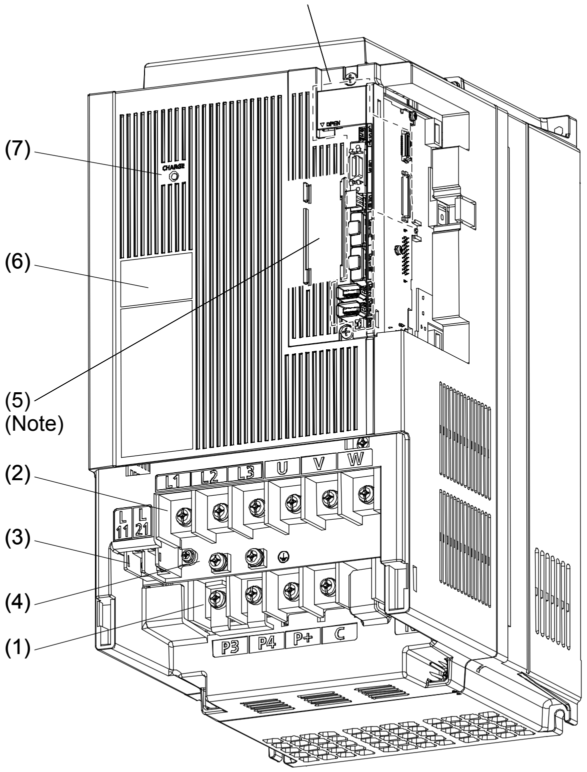
Note. Lines for slots around the battery holder are omitted from the illustration.

(7) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020

POINT

- The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.

The broken line area is the same as MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less.



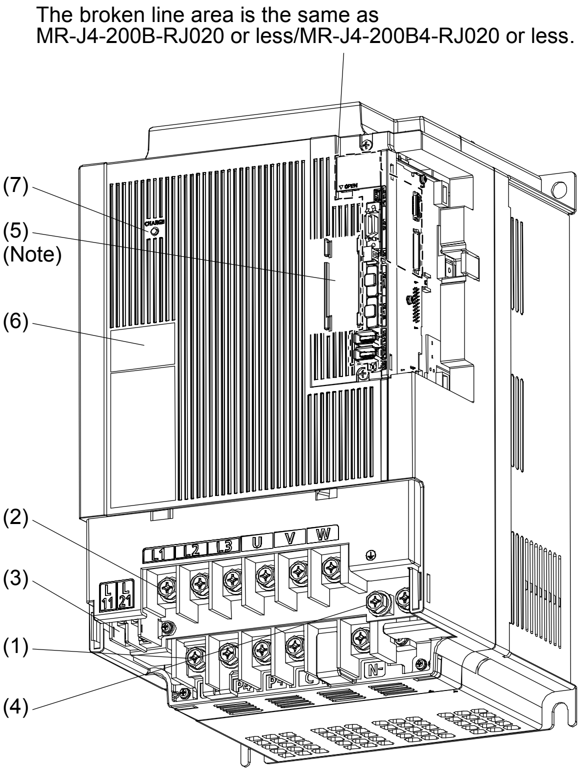
No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

Note. Lines for slots around the battery holder are omitted from the illustration.

(8) MR-J4-22KB-RJ020/MR-J4-22KB4-RJ020

POINT

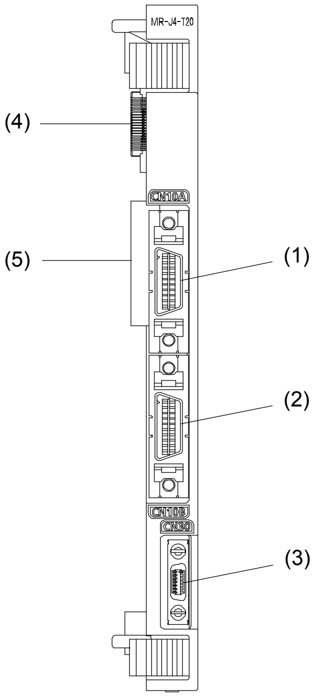
- The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.



No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

Note. Lines for slots around the battery holder are omitted from the illustration.

1.7.2 Parts identification of MR-J4-T20



No.	Name/Application	Detailed explanation
(1)	SSCNET cable connector (CN10A) Used to connect the servo system controller or the previous axis servo amplifier.	Section 3.2 Section 11.1
(2)	SSCNET cable connector (CN10B) Used for connection with the next axis servo amplifier or for connection of the terminal connector (MR-A-TM).	
(3)	RS-232C communication connector (CN30) Connect with the personal computer.	
(4)	Optional unit connector (CN90) Connector used for connection with the CN9 connector of the servo amplifier	
(5)	Optional unit connector (CN70) Connector used for connection with the CN7 connector of the servo amplifier	

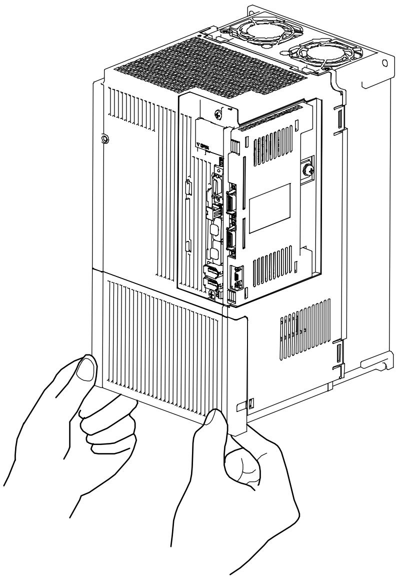
1.7.3 Removal and reinstallation of the front cover

⚠WARNING

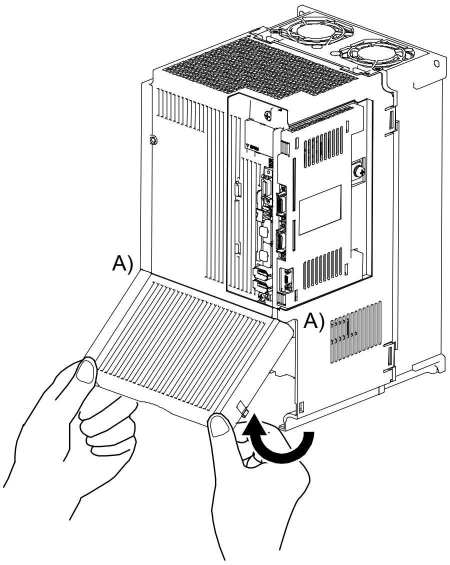
- Before removing or installing the front cover, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

The following shows how to remove and reinstall the front cover of MR-J4-700B-RJ020 to MR-J4-22KB-RJ020 and MR-J4-500B4-RJ020 to MR-J4-22KB4-RJ020.
The diagram shows MR-J4-700B-RJ020.

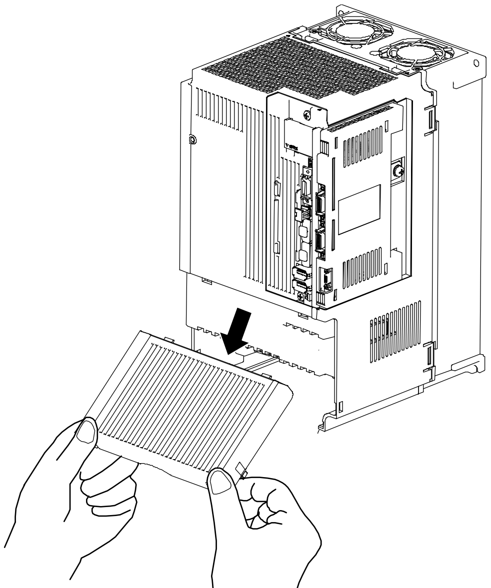
(1) Removal of the front cover



1) Hold the ends of lower side of the front cover with both hands.

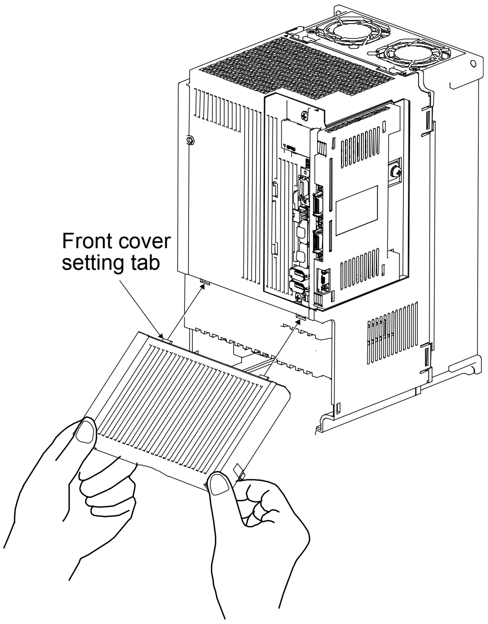


2) Pull up the cover, supporting at point A).

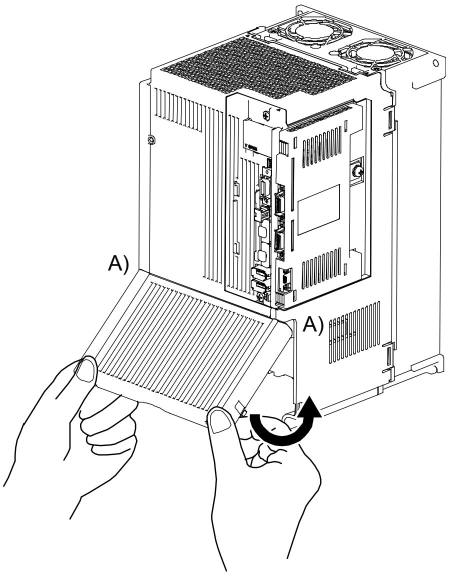


3) Pull out the front cover to remove.

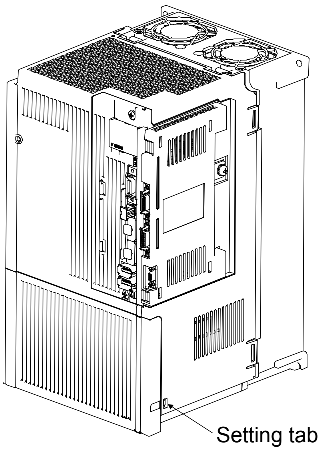
(2) Reinstallation of the front cover



1) Insert the front cover setting tabs into the sockets of servo amplifier (2 places).



2) Push down the cover, supporting at point A).



3) Press the cover against the terminal box until the installing knobs click.

1.8 Installation and removal of MR-J4-T20

⚠WARNING

- ●Before installing or removing MR-J4-T20, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

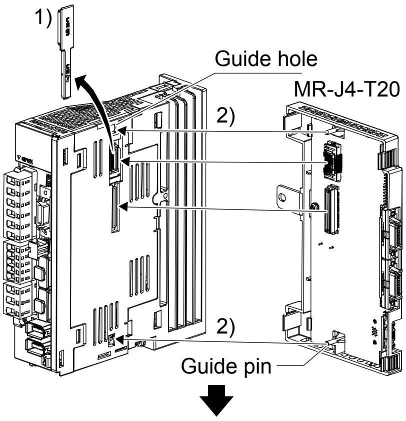
- ●Avoid installing and removing MR-J4-T20 repeatedly. Any contact failure of the connector may be caused.
- ●Avoid unsealing MR-J4-T20 to be free of dust and dirt against the connector except installing. Make sure to use the pre-packing when storing.
- ●Avoid using MR-J4-T20 of which the hook and knobs for fixing are damaged. Any contact failure of the connector may be caused.
- ●When installing and removing MR-J4-T20 to MR-J4-500B-RJ020 to MR-J4-22KB-RJ020 and MR-J4-350B4-RJ020 to MR-J4-22KB4-RJ020 servo amplifiers, avoid dropping out the installing screw inside it. Otherwise, it may cause a malfunction.
- ●When installing MR-J4-T20 to MR-J4-500B-RJ020 to MR-J4-22KB-RJ020 and MR-J4-350B4-RJ020 to MR-J4-22KB4-RJ020 servo amplifiers, avoid damaging the control board by the fixing plate. Otherwise, it may cause a malfunction.
- ●Make sure to tighten MR-J4-T20 with the enclosed installing screws when installing.

POINT

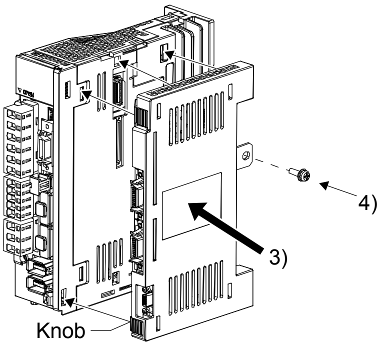
- ●The internal circuits of the servo amplifier and MR-J4-T20 may be damaged by static electricity. Always take the following precautions.
  - ・Ground human body and work bench.
  - ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

(1) For MR-J4-350B-RJ020 or less/MR-J4-200B4-RJ020 or less/MR-J4-40B1-RJ020 or less

(a) Installation of MR-J4-T20

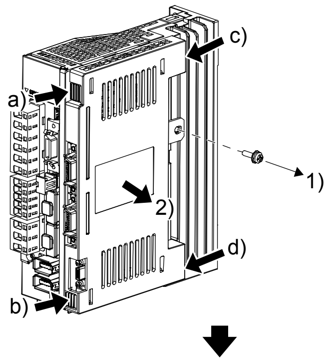


1) Remove the covers of CN7/CN9 connector.
   Make sure to store the removed cover.
2) Find the guide hole on the side of the servo amplifier. To the guide hole, insert the MR-J4-T20's guide pins.

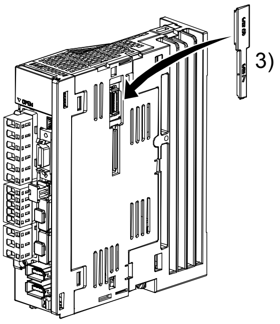


3) Push the four corners of the side of MR-J4-T20 simultaneously to the servo amplifier until the four knobs click so that CN7 and CN9 connectors are connected straight.
4) Tighten the unit with the enclosed installing screw (M4).

(b) Removal of MR-J4-T20



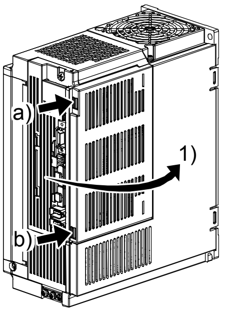
1) Remove the installing screw.
2) Keep pushing the knobs (a), b), c), d)) and pull out MR-J4-T20 to the arrow direction. Avoid pulling out MR-J4-T20 while it is tightened with the installation screw.



3) After removing MR-J4-T20, make sure to cap the CN7/CN9 connector to avoid dust and dirt.

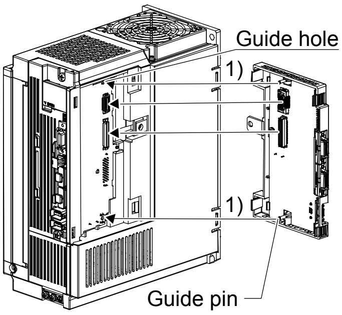
(2) For MR-J4-500B-RJ020 to MR-J4-700B-RJ020 and MR-J4-350B4-RJ020 to MR-J4-700B4-RJ020

(a) Removal of the side cover

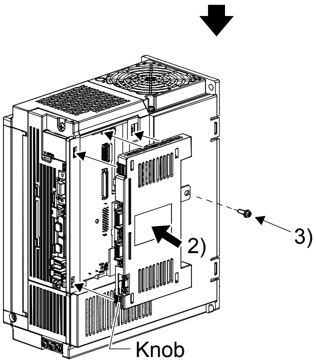


1) Keep pushing the knobs (a) , b)) and pull out the side cover to the arrow direction.

(b) Installation of MR-J4-T20

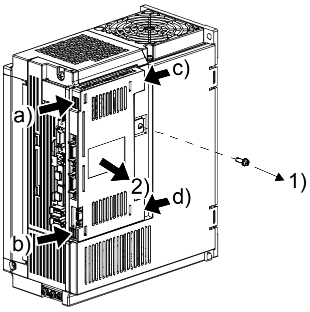


1) Find the guide hole on the side of the servo amplifier. To the guide hole, insert the MR-J4-T20's guide pins.



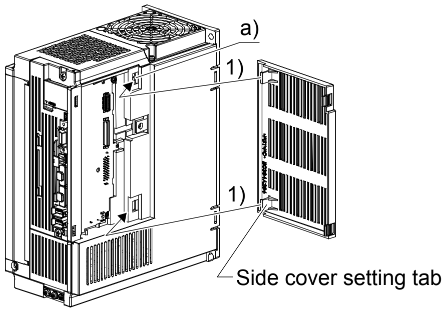
2) Push the four corners of the side of MR-J4-T20 simultaneously to the servo amplifier until the four knobs click so that CN7 and CN9 connectors are connected straight.
3) Tighten the unit with the enclosed installing screw (M4).

(c) Removal of MR-J4-T20

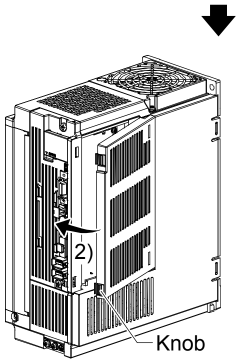


1) Remove the installing screw.
2) Keep pushing the knobs (a), b), c), d)) and pull out MR-J4-T20 to the arrow direction. Avoid pulling out MR-J4-T20 while it is tightened with the installation screw.

(d) Installation of the side cover



1) Insert the side cover setting tabs into the sockets a) of servo amplifier.

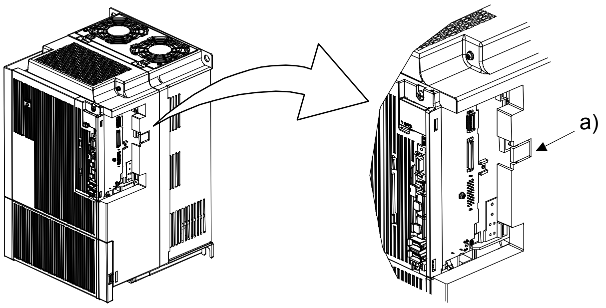


2) Push the side cover at the supporting point a) until the knobs click.

(3) For MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020

⚠CAUTION	●Avoid touching any remained burr after cutting off the part a) of the case. Otherwise, it may cause injury.

The installing screw holes for the MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020 servo amplifiers are covered and not shown at shipping. When installing the unit for the first time, cut off the part a) of the case after removing the side cover.
When cutting off the part a), avoid damaging the case of the servo amplifier. After cutting off it, inside of the servo amplifier has been exposed even though the side cover and the unit are installed. Avoid unwanted parts from entering through the opened area into the servo amplifier.
For installing or removing the unit, refer to (2) in this section. The side cover structure is the same for MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020 and for this unit. Install or remove the side cover with the same way as for the unit.

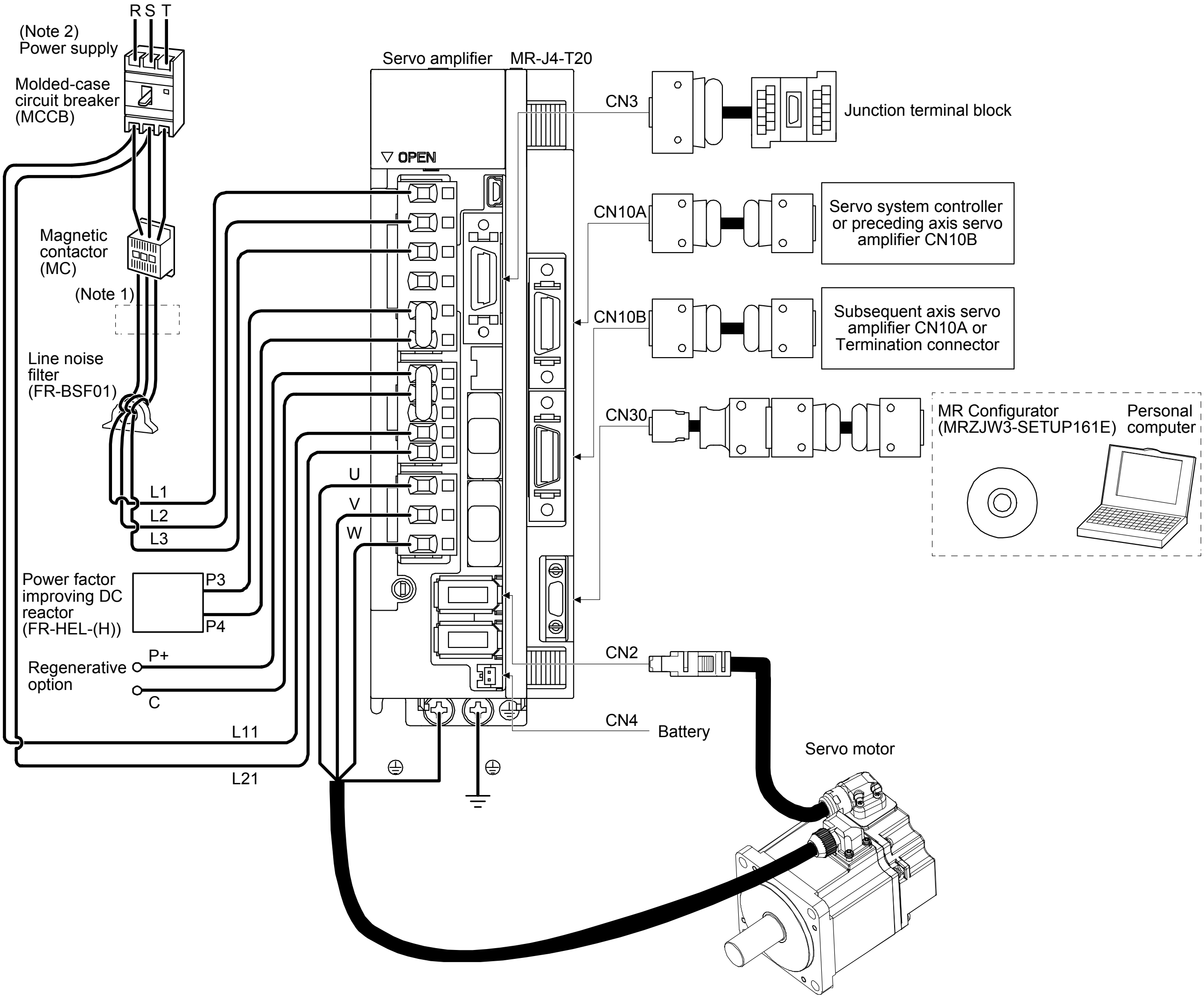


1.9 Configuration including peripheral equipment

CAUTION	●Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT
●Equipment other than the servo amplifier and servo motor are optional or recommended products.

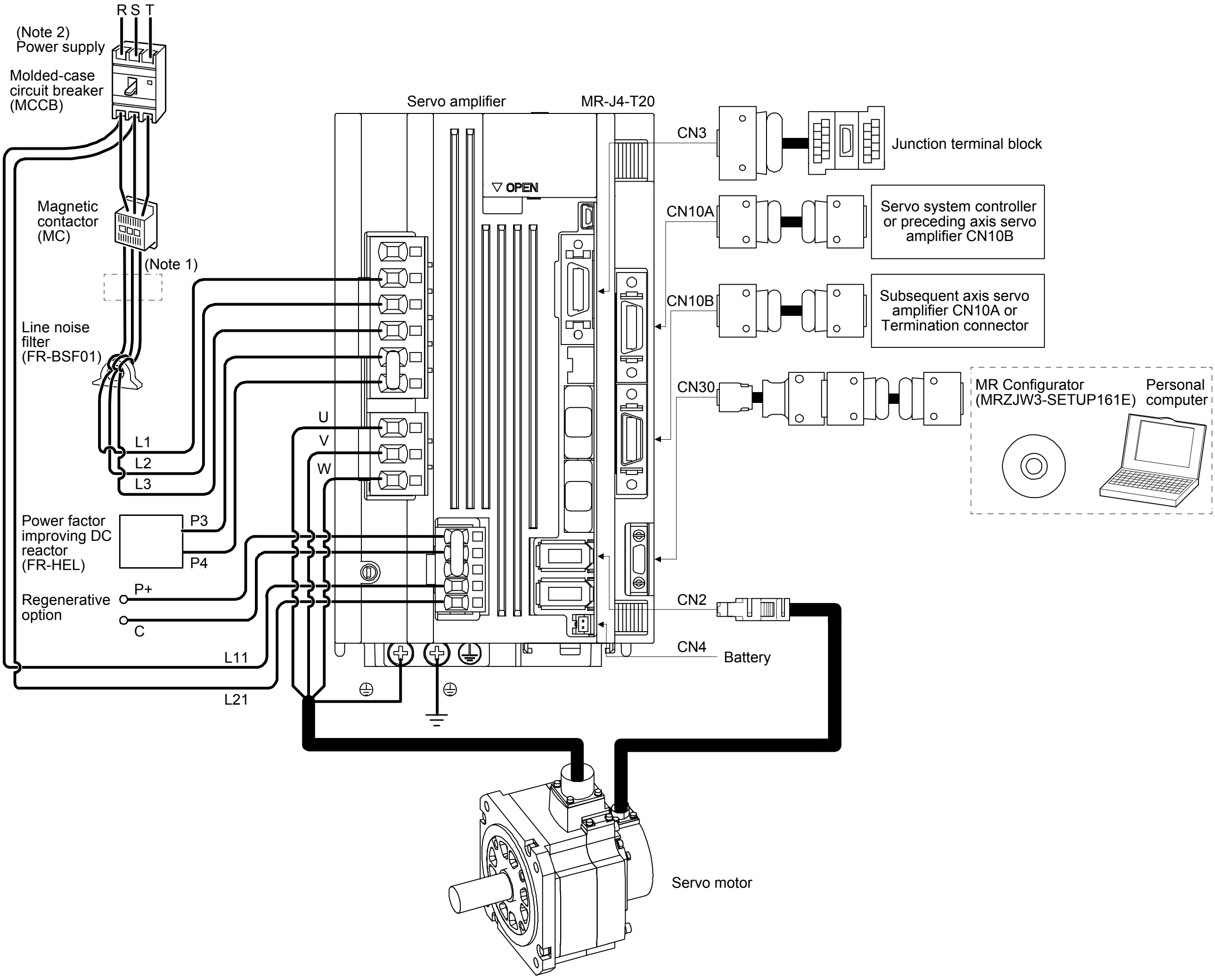
(1) MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less
The diagram shows MR-J4-10B-RJ020.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-J4-70B-RJ020 or less. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. For power supply specifications, refer to section 1.3.1.

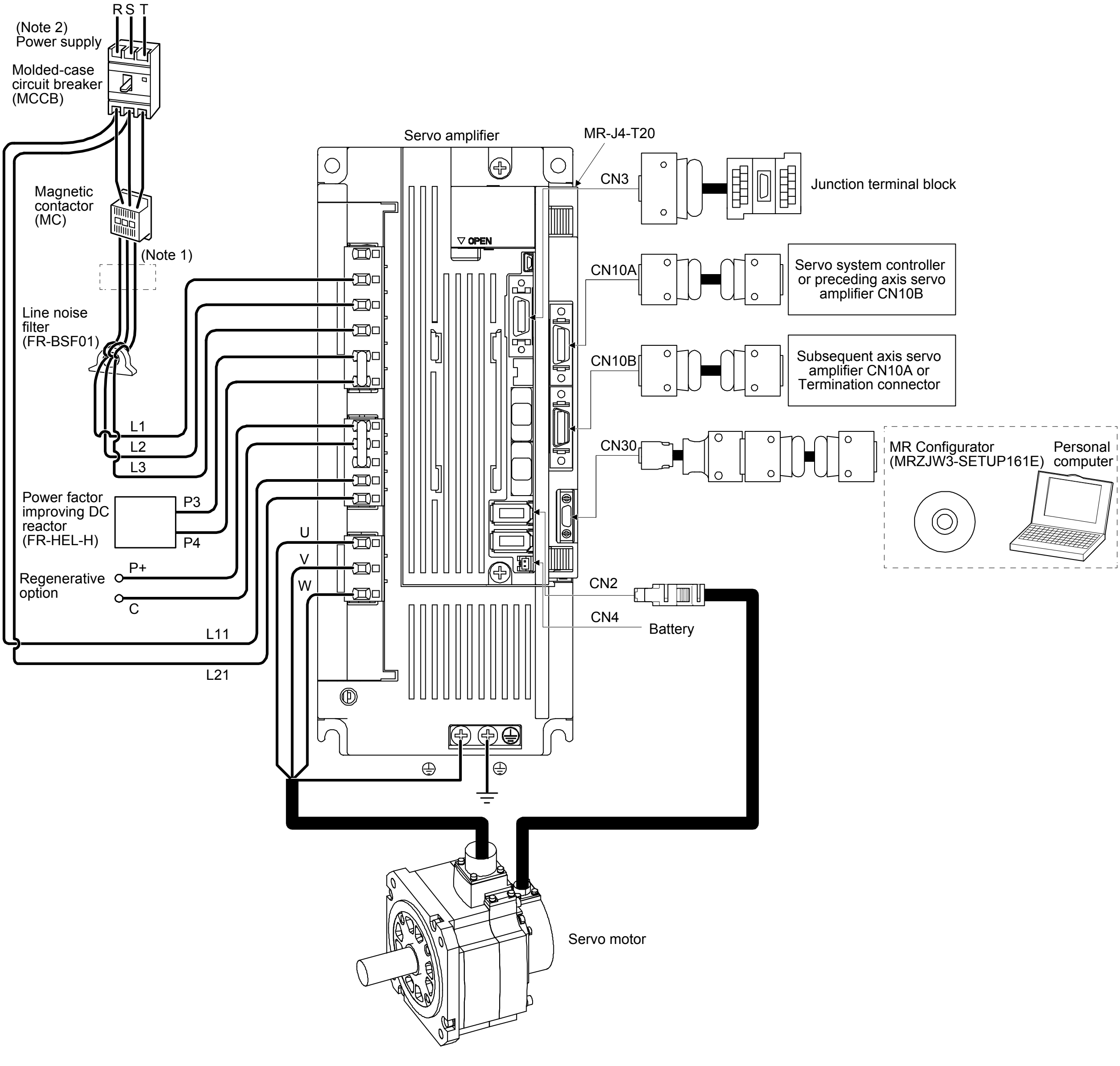
(2) MR-J4-350B-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

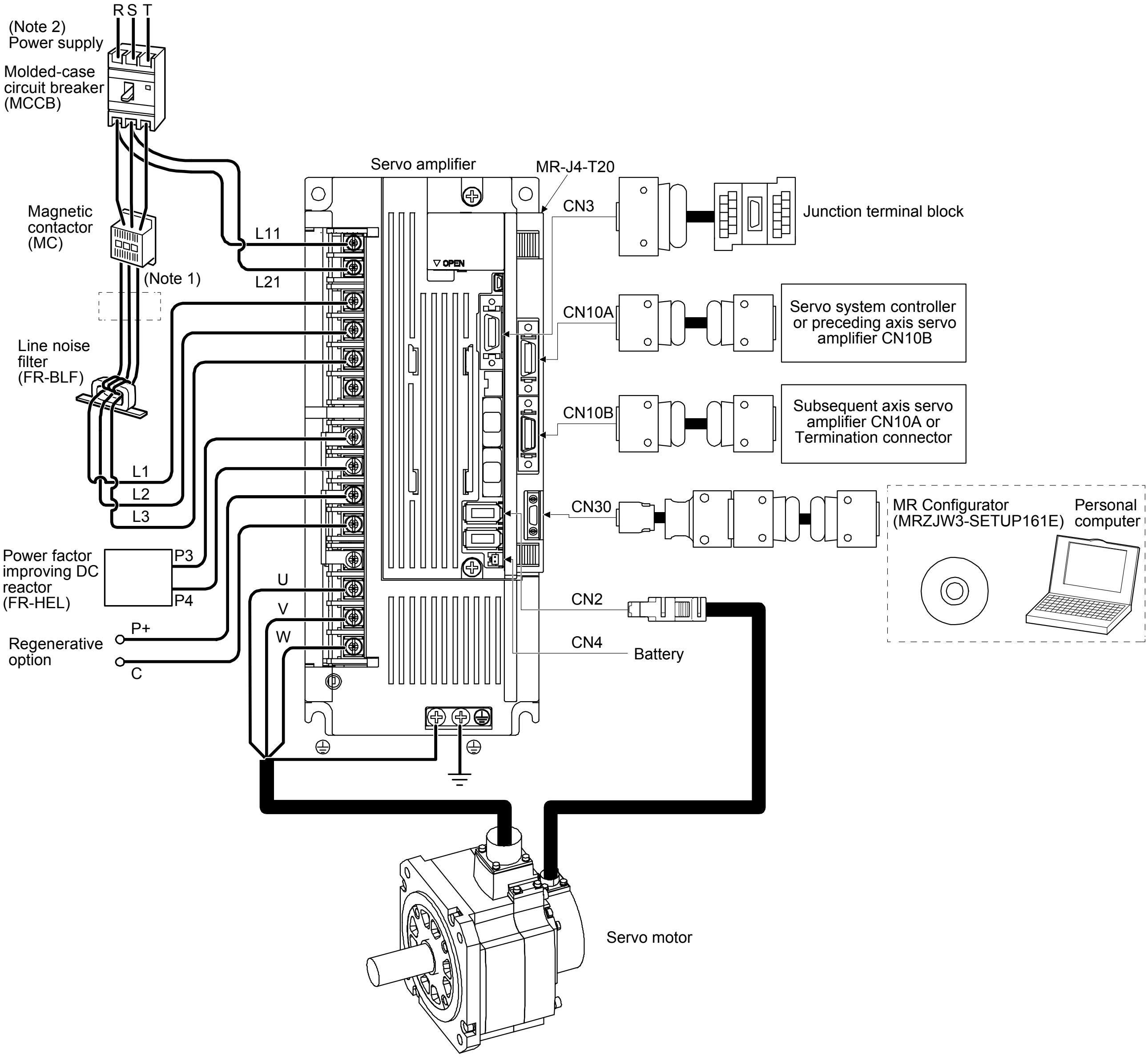
(3) MR-J4-350B4-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

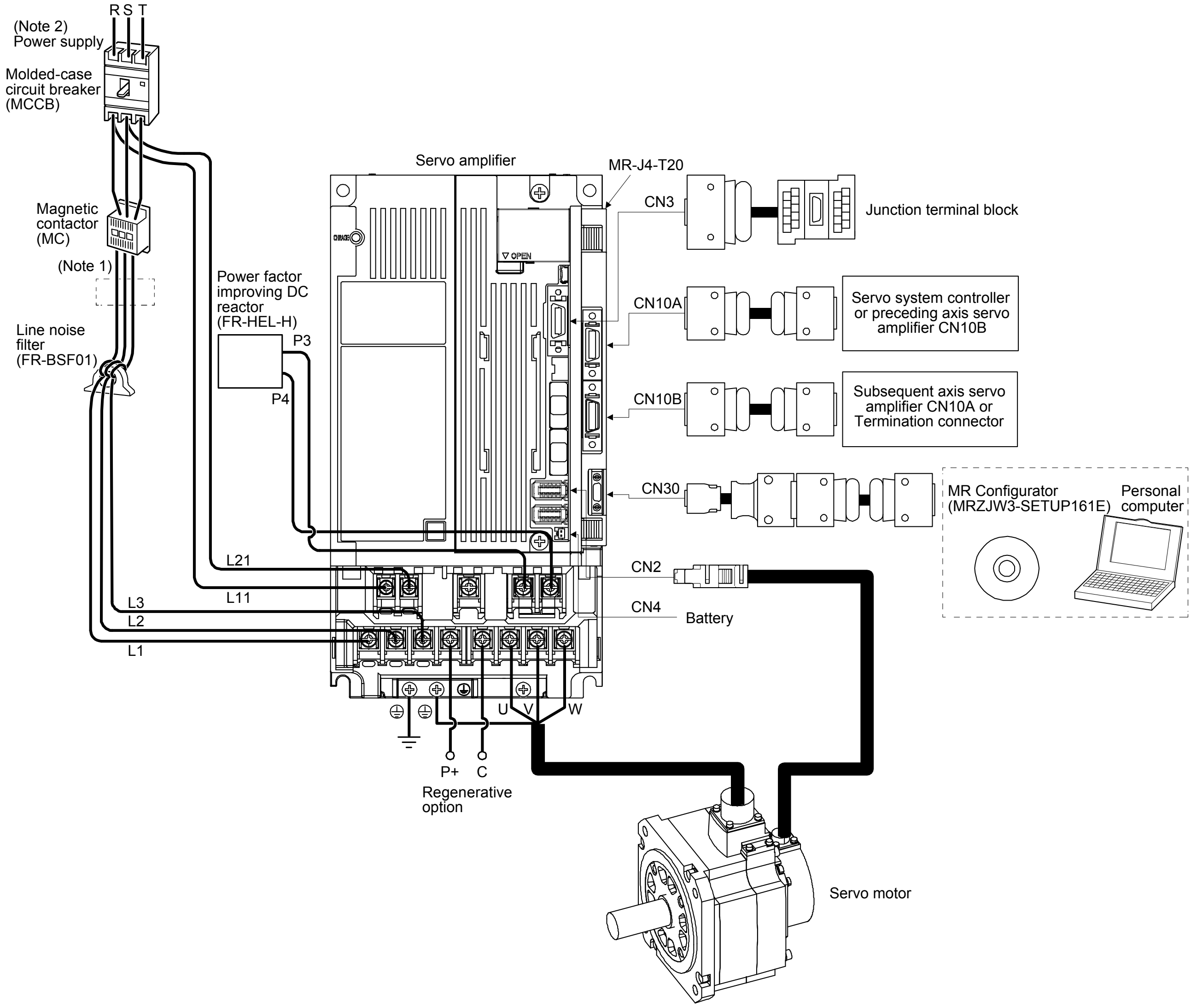
(4) MR-J4-500B-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(5) MR-J4-500B4-RJ020

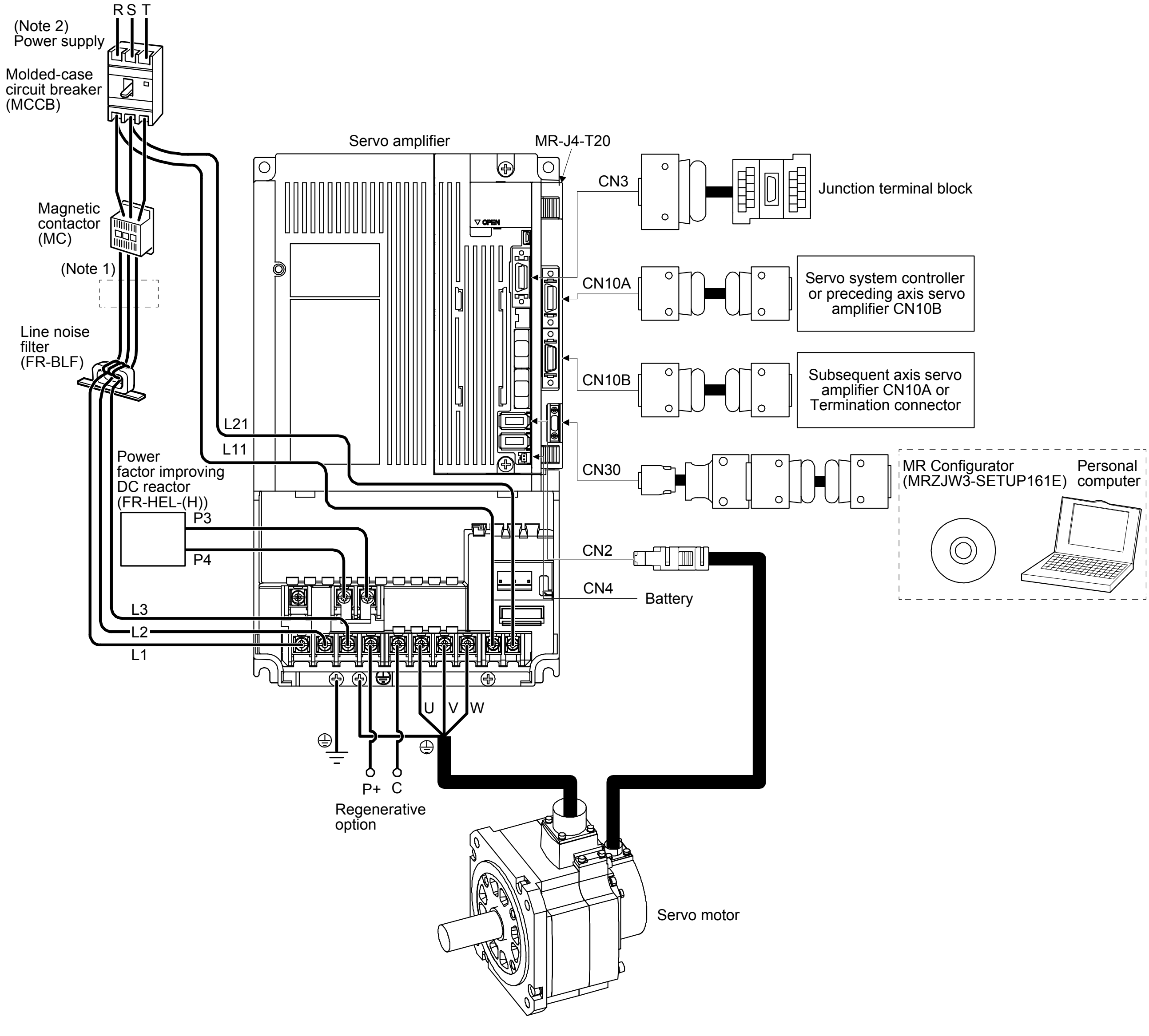


Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(6) MR-J4-700B-RJ020/MR-J4-700B4-RJ020

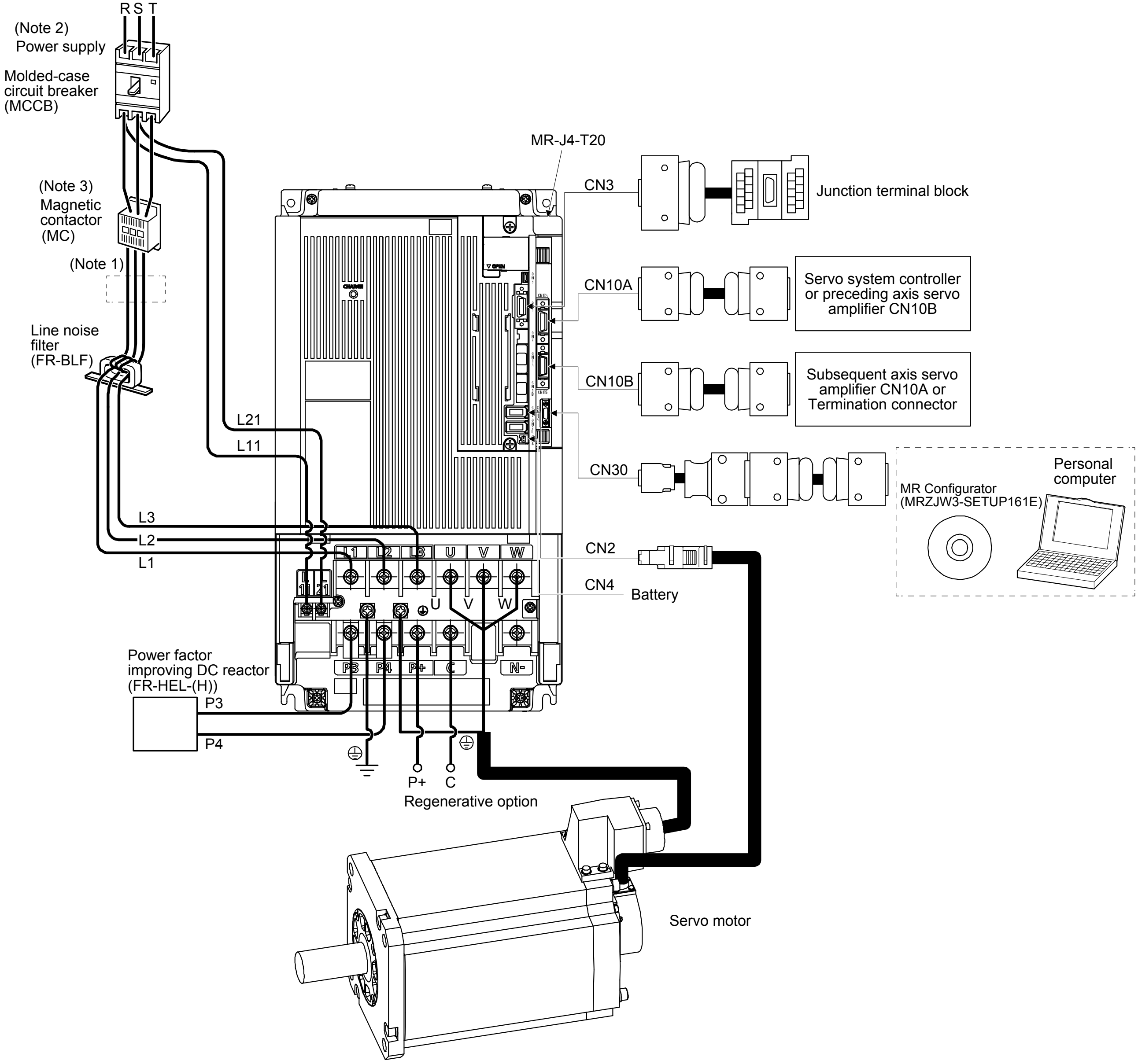
The diagram shows MR-J4-700B-RJ020.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

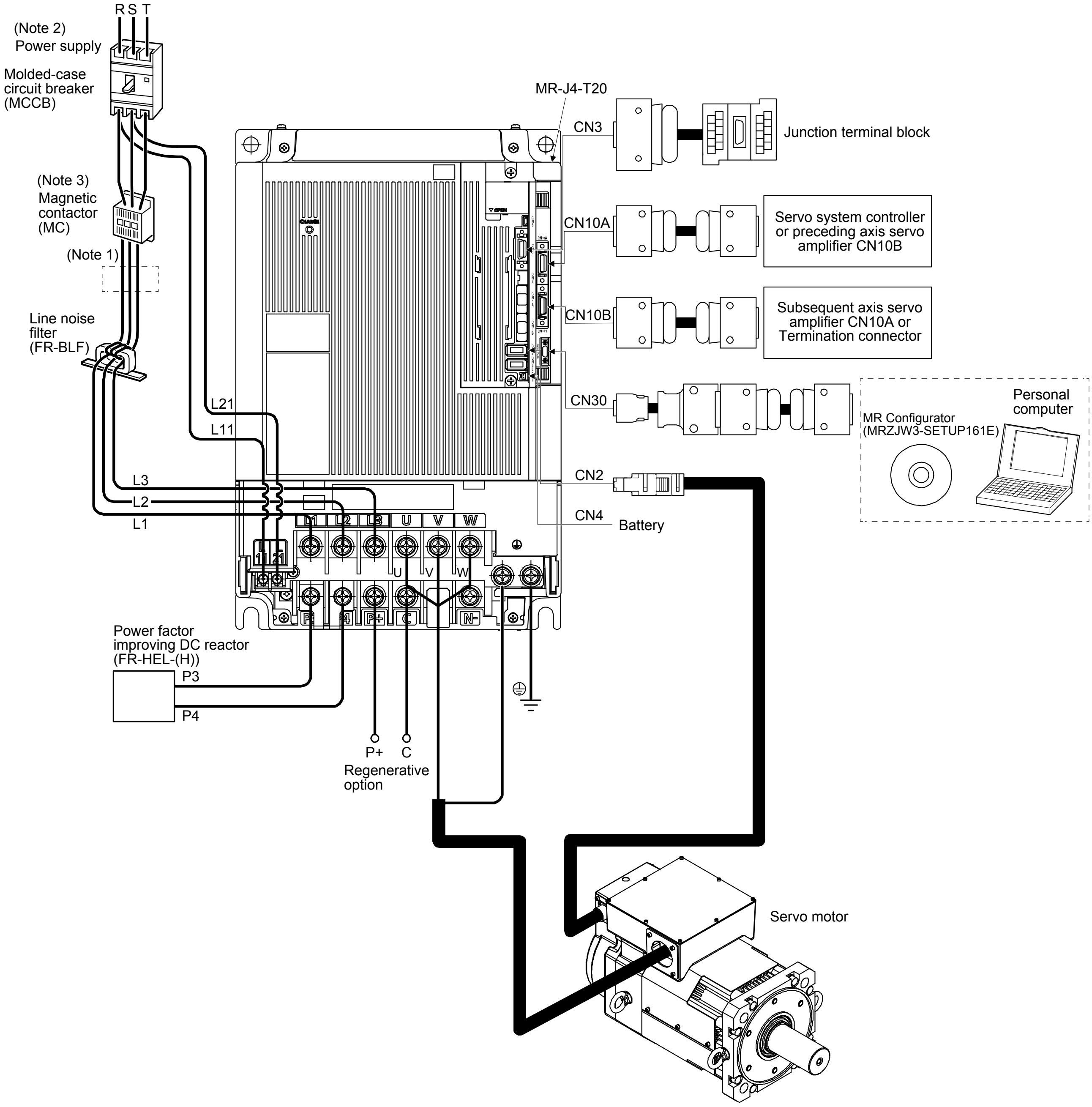
(7) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

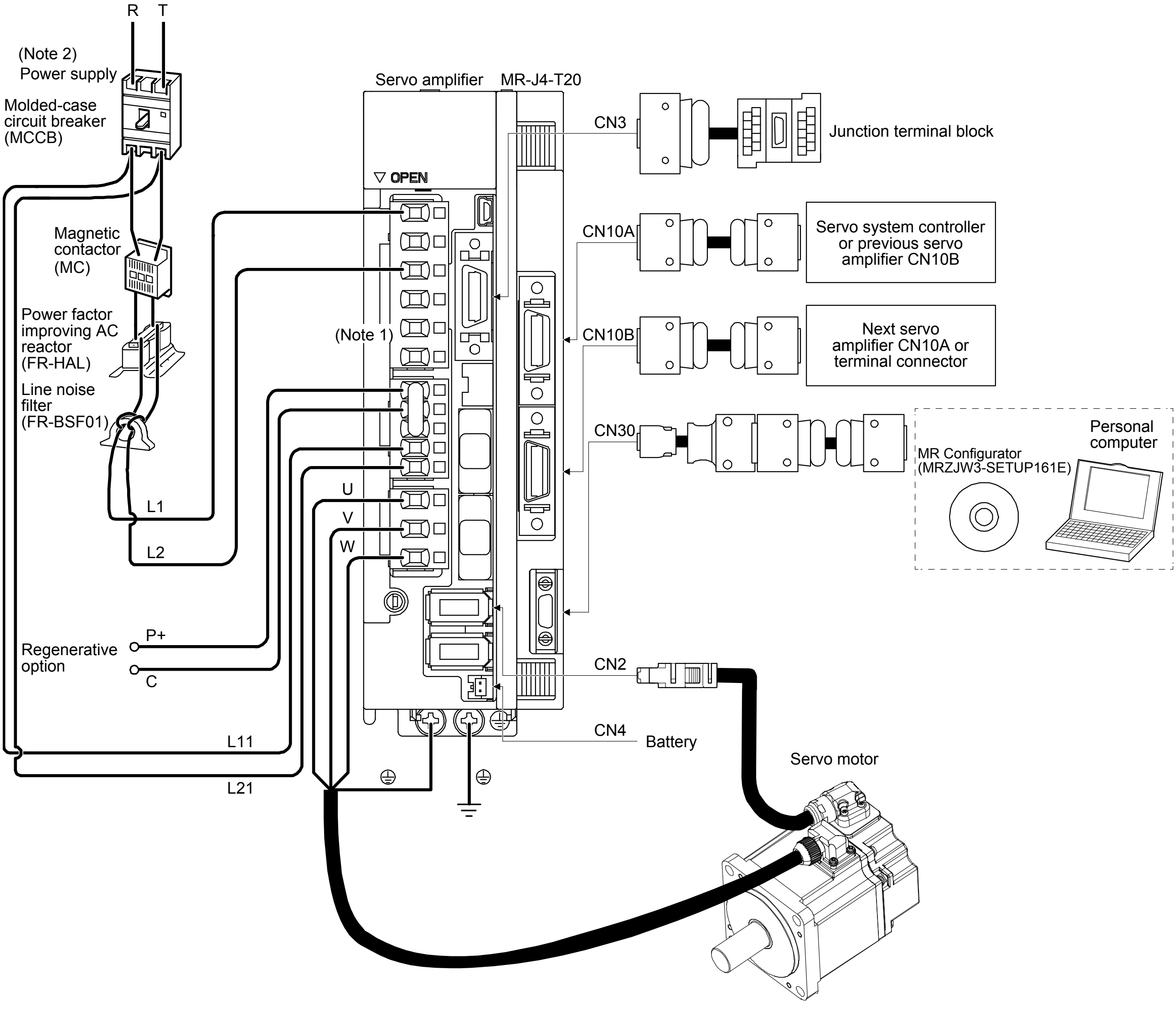
(8) MR-J4-22KB-RJ020/MR-J4-22KB4-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(9) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/MR-J4-40B1-RJ020
The diagram shows MR-J4-10B1-RJ020.



Note 1. The power factor improving DC reactor cannot be used.
2. For power supply specifications, refer to section 1.3.1.

MEMO

2. INSTALLATION

⚠WARNING

- To prevent electric shock, ground each equipment securely.

⚠CAUTION

- Stacking in excess of the specified number of product packages is not allowed.
- Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the equipment. Otherwise, it may cause injury.
- Use the equipment within the specified environment. For the environment, refer to section 1.3.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and MR-J4-T20.
- Do not block the intake and exhaust areas of the servo amplifier and MR-J4-T20. Otherwise, it may cause a malfunction.
- Do not drop or strike the servo amplifier and MR-J4-T20. Isolate them from all impact loads.
- Do not install or operate the servo amplifier and MR-J4-T20 which have been damaged or have any parts missing.
- When the product has been stored for an extended period of time, contact your local sales office.
- When handling the servo amplifier and MR-J4-T20, be careful about the edged parts such as corners of them.
- The servo amplifier and MR-J4-T20 must be installed in a metal cabinet.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
  Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method).
  Additionally, disinfect and protect wood from insects before packing products.

POINT

- When pulling out CNP1, CNP2, and CNP3 connectors of 100 V class and 600 W or less of 200 V class servo amplifiers, pull out CN3 and CN8 connectors beforehand.

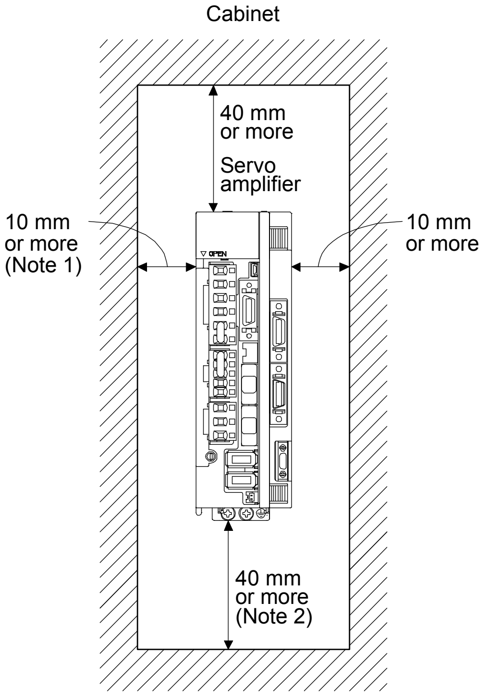
2.1 Installation direction and clearances

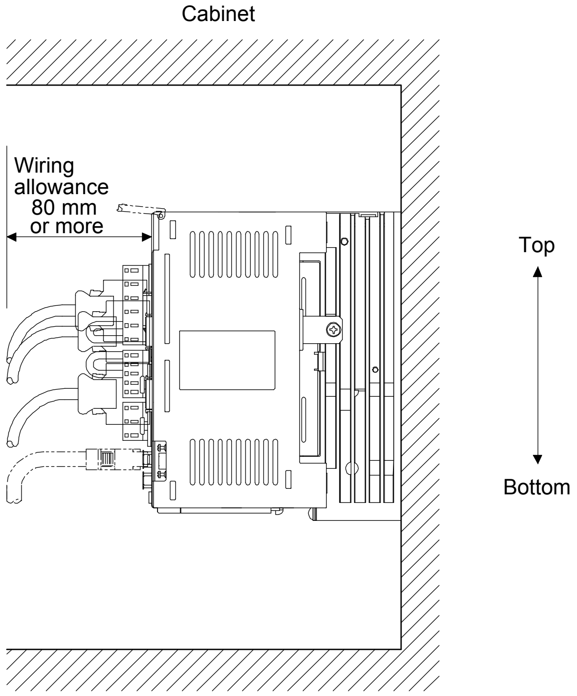
⚠CAUTION

- ●The equipment must be installed in the specified direction. Otherwise, it may cause a malfunction.
- ●Leave specified clearances between the servo amplifier/MR-J4-T20 and the cabinet walls or other equipment. Otherwise, it may cause a malfunction.

(1) Installation clearances of the servo amplifier

(a) Installation of one servo amplifier





Note 1. For the MR-J4-500B-RJ020 servo amplifier, the clearance between the left side and wall will be 25 mm or more.

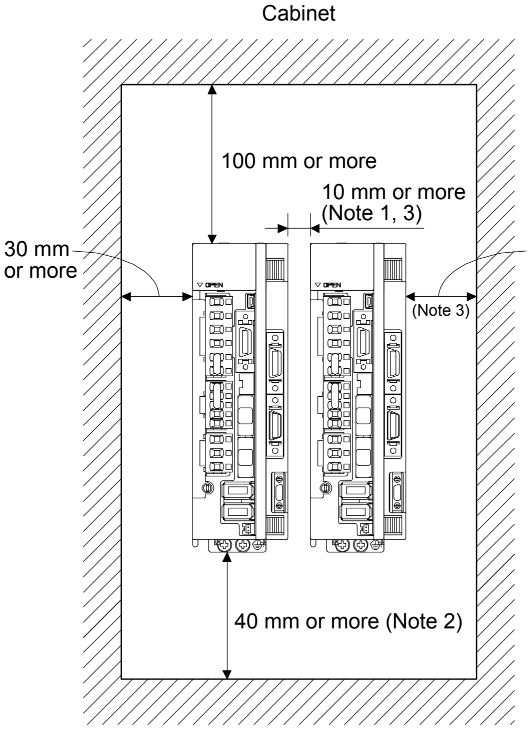
2. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

(b) Installation of two or more servo amplifiers

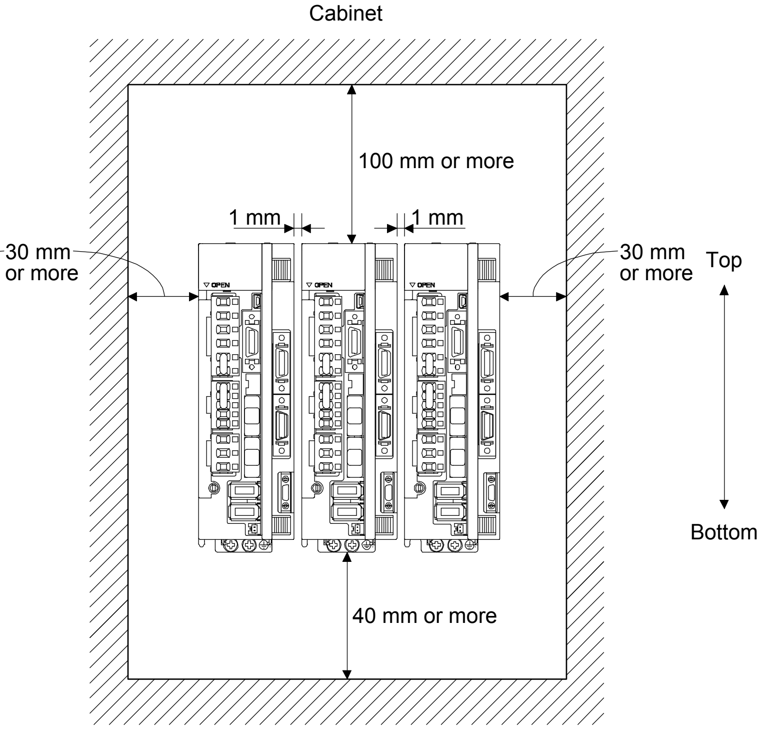
POINT

- ●Close mounting is possible depending on the capacity of the servo amplifier. Refer to section 1.3 for availability of close mounting.
- ●When mounting the servo amplifiers closely, do not install the servo amplifier whose depth is larger than that of the left side servo amplifier since CNP1, CNP2, and CNP3 connectors cannot be disconnected.

Leave a large clearance between the top of the servo amplifier and the cabinet walls, and install a cooling fan to prevent the internal temperature of the cabinet from exceeding the environment. When mounting the servo amplifiers closely, leave a clearance of 1 mm between the adjacent servo amplifiers in consideration of mounting tolerances. In this case, keep the ambient temperature within 0 ˚C to 45 ˚C or use the servo amplifier with 75% or less of the effective load ratio.



Leaving clearance



Mounting closely

Note 1. When you install the MR-J4-500B-RJ020 servo amplifier on the right side, the clearance between the left side and the wall will be 25 mm or more.

2. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

3. A clearance for mounting can be smaller for the following servo amplifiers.

Servo amplifier	Clearance for the right-side servo amplifier [mm] (recommended clearance: 10 mm or more)	Clearance for the right-side cabinet wall [mm] (recommended clearance: 30 mm or more)
MR-J4-10B-RJ020/MR-J4-20B-RJ020 MR-J4-70B-RJ020/MR-J4-100B-RJ020 MR-J4-10B1-RJ020/MR-J4-20B1-RJ020	8	28
MR-J4-200B-RJ020/MR-J4-350B-RJ020 MR-J4-200B4-RJ020	3	23
MR-J4-500B4-RJ020	8	28

(2) Others
When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the servo amplifier is not affected.
Install the servo amplifier on a perpendicular wall in the correct vertical direction.

2.2 Keep out foreign materials

(1) When drilling in the cabinet, prevent drill chips and wire fragments from entering the servo amplifier.

(2) Prevent oil, water, metallic dust, etc. from entering the servo amplifier through openings in the cabinet or a cooling fan installed on the ceiling.

(3) When installing the cabinet in a place where toxic gas, dirt and dust exist, conduct an air purge (force clean air into the cabinet from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the cabinet.

2.3 Encoder cable stress

(1) The way of clamping the cable must be fully examined so that bending stress and cable's own weight stress are not applied to the cable connection.

(2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, and brake) with having some slack from the connector connection part of the servo motor to avoid putting stress on the connector connection part. Use the optional encoder cable within the bending life range. Use the power supply and brake wiring cables within the bending life of the cables.

(3) Avoid any probability that the cable insulator might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.

(4) For installation on a machine where the servo motor moves, the flexing radius should be made as large as possible. Refer to section 10.4 for the bending life.

2.4 Inspection items

⚠WARNING	●Before starting maintenance and/or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier. ●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

⚠CAUTION	●Do not perform insulation resistance test on the servo amplifier. Otherwise, it may cause a malfunction. ●Do not disassemble and/or repair the equipment on customer side.

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

(2) Check the cables and the like for scratches or cracks. Inspect them periodically according to operating conditions especially when the servo motor is movable.

(3) Check that the connector is securely connected to the servo amplifier and MR-J4-T20.

(4) Check that the wires are not coming out from the connector.

(5) Check for dust accumulation on the servo amplifier and MR-J4-T20.

(6) Check for unusual noise generated from the servo amplifier and MR-J4-T20.

(7) Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.

2.5 Parts having service life

Service lives of the following parts are listed below. However, the service life vary depending on operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service life. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on, forced stop by EM1 (Forced stop), and controller forced stop times: 100,000 times Number of on and off for STO: 1,000,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
Absolute position battery	Refer to section 12.2.

(1) Smoothing capacitor

The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in air-conditioned environment (ambient temperature of 40 ˚C or less).

(2) Relays

Contact faults will occur due to contact wear arisen from switching currents. Relays reach the end of their lives when the power has been turned on, forced stop by EM1 (Forced stop) has occurred, and controller forced stop has occurred 100,000 times in total, or when the STO has been turned on and off 1,000,000 times while the servo motor is stopped under servo-off state. However, the lives of relays may depend on the power supply capacity.

(3) Servo amplifier cooling fan

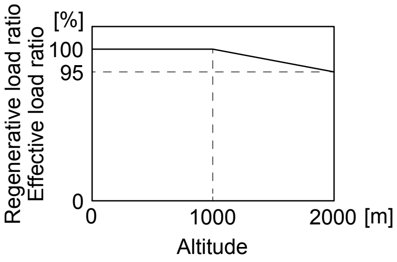
The cooling fan bearings reach the end of their life in 10,000 hours to 30,000 hours. Normally, therefore, the cooling fan must be replaced in a few years of continuous operation as a guideline. It must also be changed if unusual noise or vibration is found during inspection.

The life indicates under the yearly average ambient temperature of 40 ˚C, free from corrosive gas, flammable gas, oil mist, dust and dirt.

2.6 Restrictions when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level

(1) Effective load ratio and regenerative load ratio

Heat dissipation effects decrease in proportion to decreasing air density, and hence use the servo amplifiers with the effective load ratio and the regenerative load ratio within the following range.



When closely mounting the servo amplifiers, operate them at the ambient temperatures of 0 °C to 45 °C or at 75% or smaller effective load ratio. (Refer to section 2.1.)

(2) Input voltage

Generally, withstand voltage decreases as increasing altitude; however, there is no restriction on the withstand voltage. Use in the same manner as in 1000 m or less. (Refer to section 1.3.)

(3) Parts having service life

(a) Smoothing capacitor

The capacitor will reach the end of its life in 10 years of continuous operation in air-conditioned environment (ambient temperature of 30 ˚C or less).

(b) Relays

There is no restriction. Use in the same manner as in 1000 m or less. (Refer to section 2.5.)

(c) Servo amplifier cooling fan

There is no restriction. Use in the same manner as in 1000 m or less. (Refer to section 2.5.)

MEMO

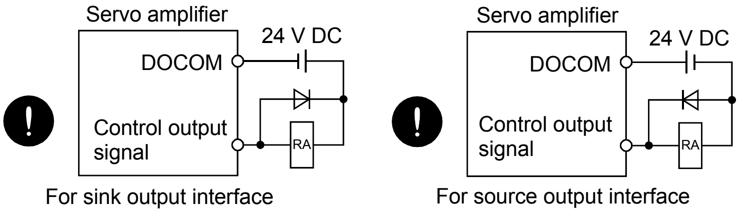
3. SIGNALS AND WIRING

⚠WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- To avoid an electric shock, insulate the connections of the power supply terminals.

⚠CAUTION

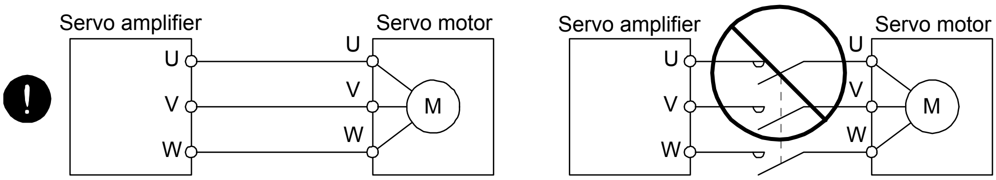
- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



- Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge killer or radio noise filter (optional FR-BIF (-H)) with the power line of the servo motor.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- Do not modify the equipment.
- Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

⚠CAUTION

- Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



3.1 Input power supply circuit

⚠CAUTION

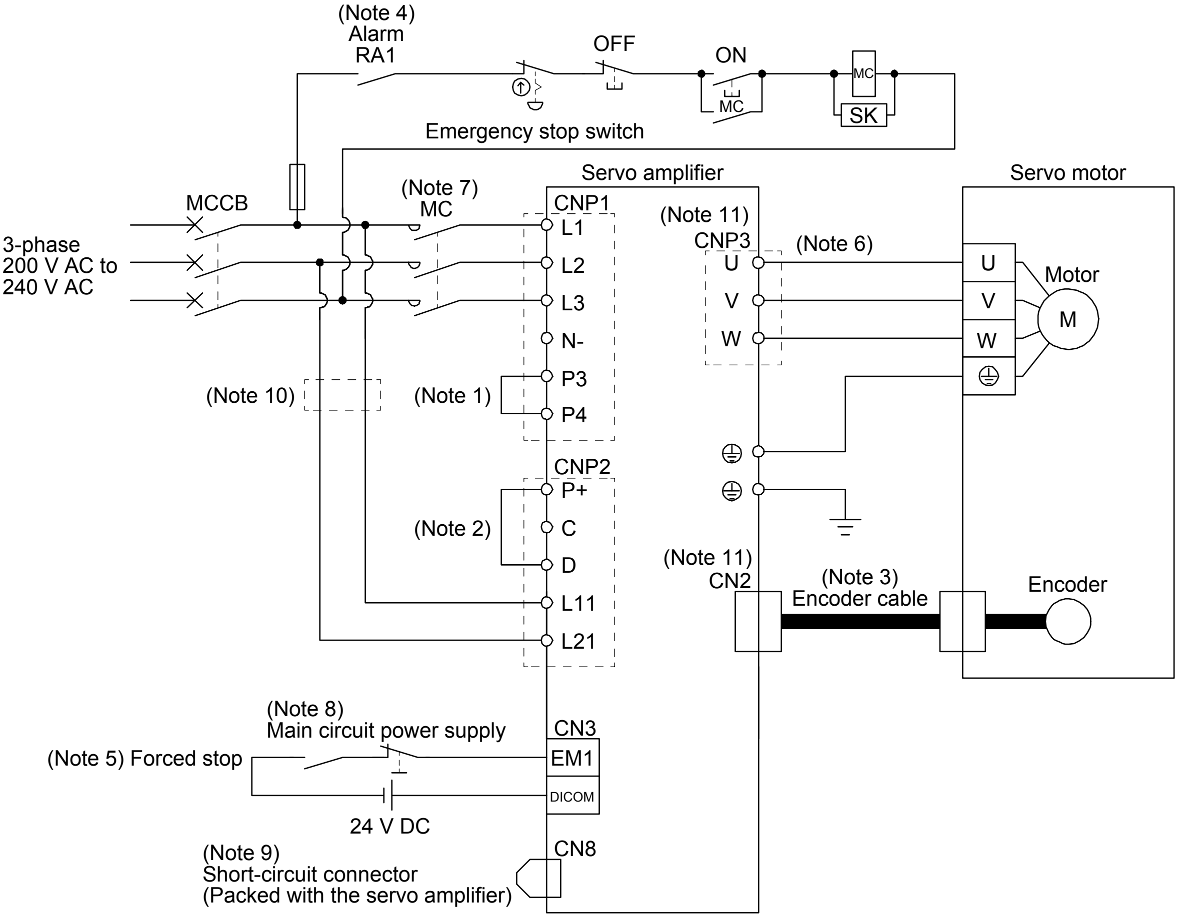
- Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- Switch main circuit power supply off at detection of an alarm on the controller side. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.
- Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit of the specification, the servo amplifier will break down.
- The servo amplifier has a built-in surge absorber (varistor) to reduce exogenous noise and to suppress lightning surge. Exogenous noise or lightning surge deteriorates the varistor characteristics, and the varistor may be damaged. To prevent a fire, use a molded-case circuit breaker or fuse for input power supply.
- Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- The N- terminal is not a neutral point of the power supply. Incorrect wiring will cause a burst, damage, etc.

POINT

- Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-J2S series servo amplifier's. When using MR-J4 as a replacement for MR-J2S, be careful not to connect the power to L2.

Configure the wiring to shut off the main circuit power supply and turn off the servo-on command as soon as an alarm occurs, or the servo forced stop or controller forced stop is enabled. A molded-case circuit breaker (MCCB) must be used with the input cables of the main circuit power supply.

(1) For 3-phase 200 V AC to 240 V AC power supply of MR-J4-10B-RJ020 to MR-J4-350B-RJ020



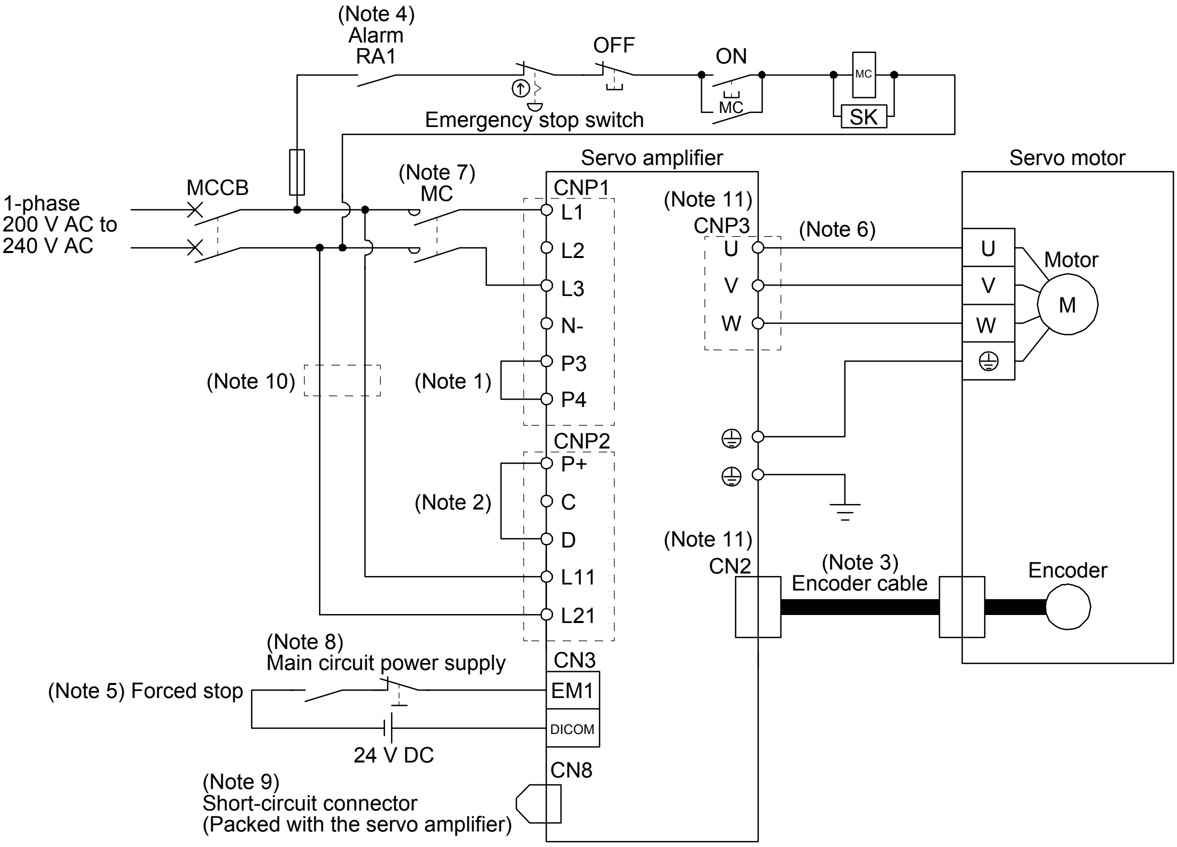
Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

(2) For 1-phase 200 V AC to 240 V AC power supply of MR-J4-10B-RJ020 to MR-J4-70B-RJ020

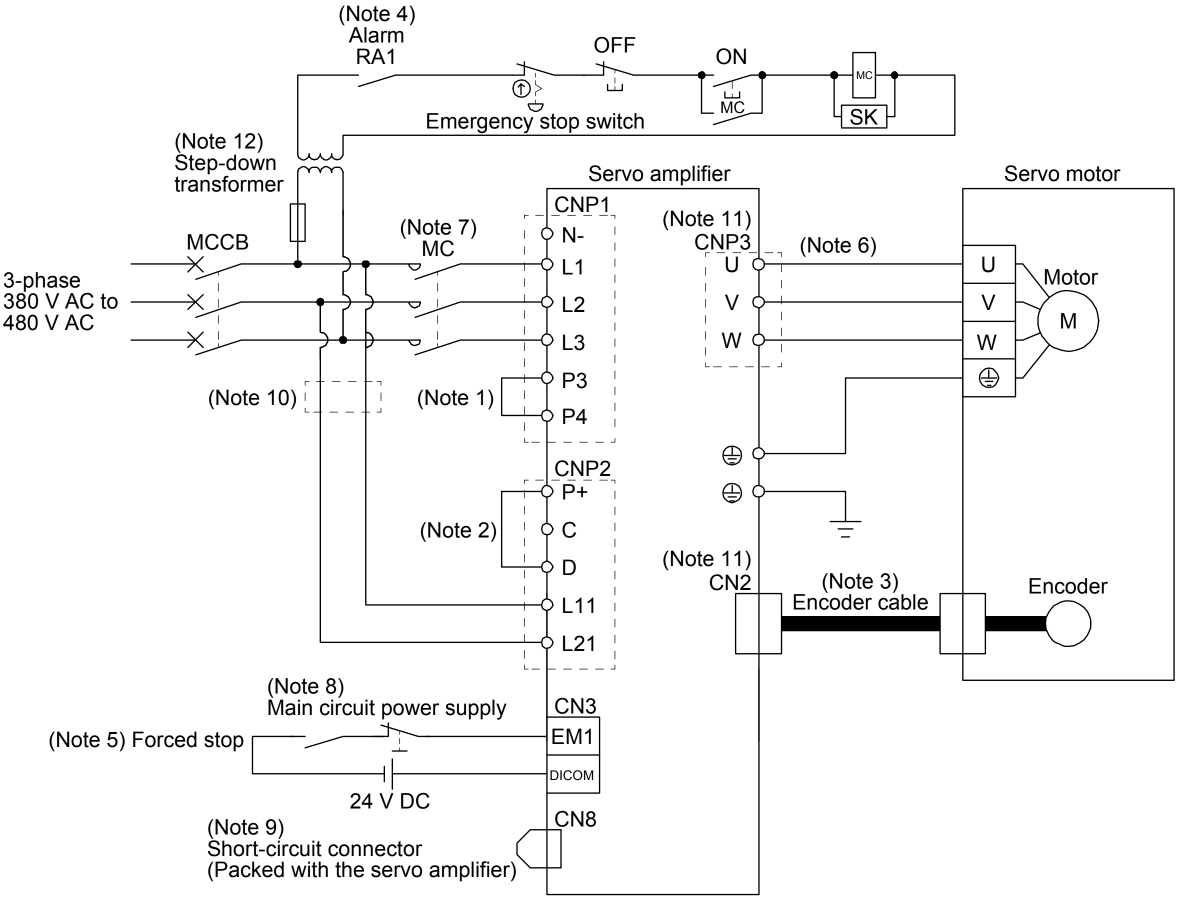
POINT

- ●Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-J2S series servo amplifier's. When using MR-J4 as a replacement for MR-J2S, be careful not to connect the power to L2.



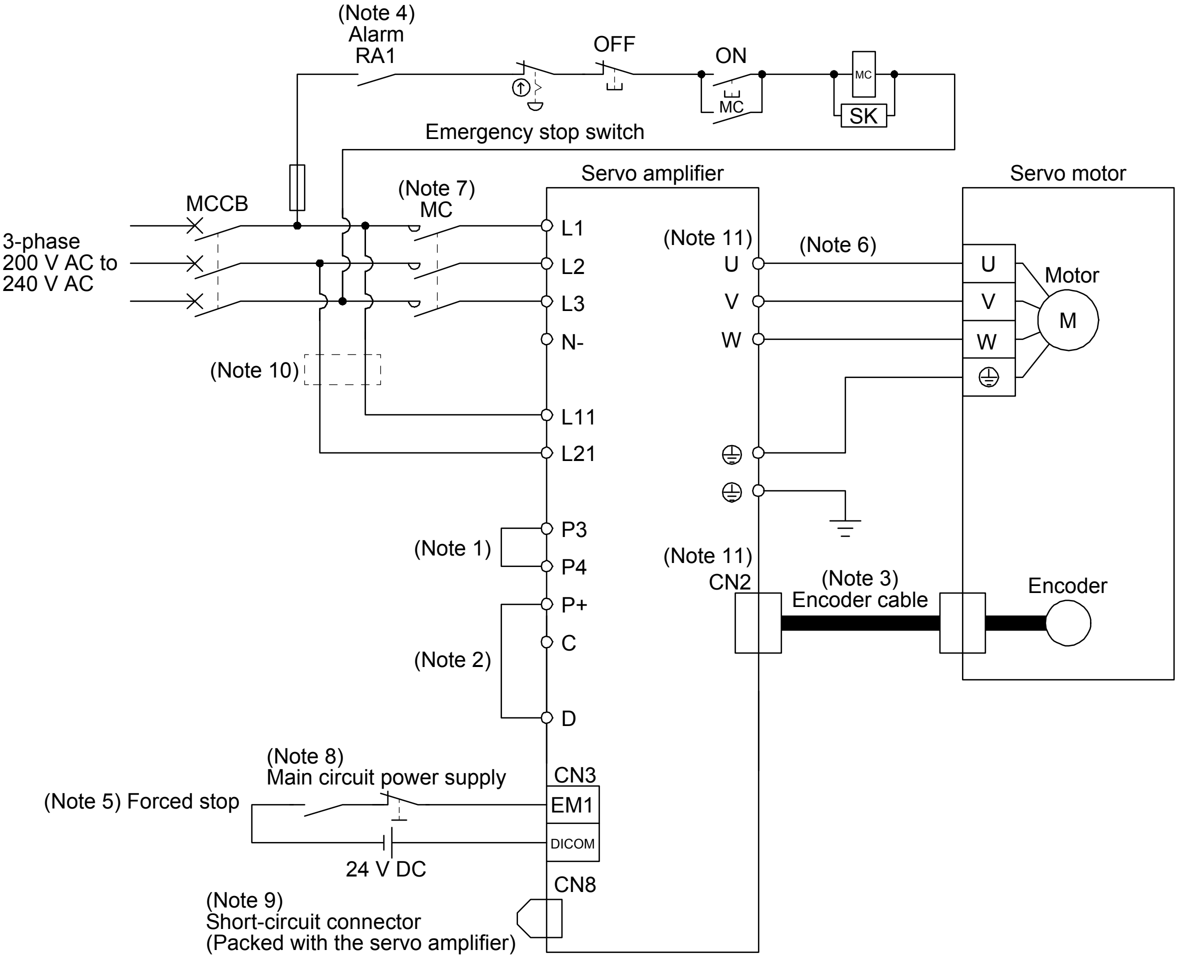
Note
1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

(3) MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020



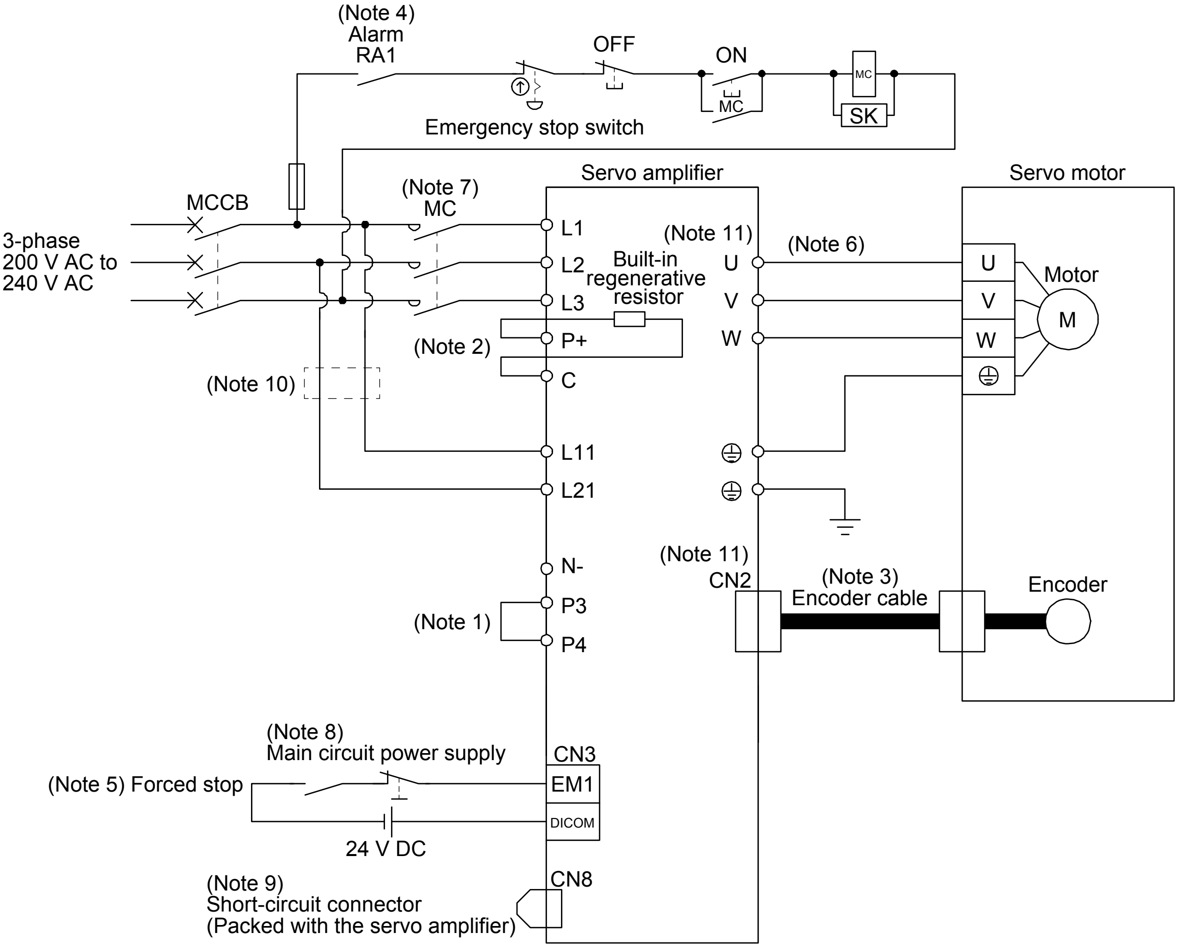
Note
1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. Step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.

(4) MR-J4-500B-RJ020



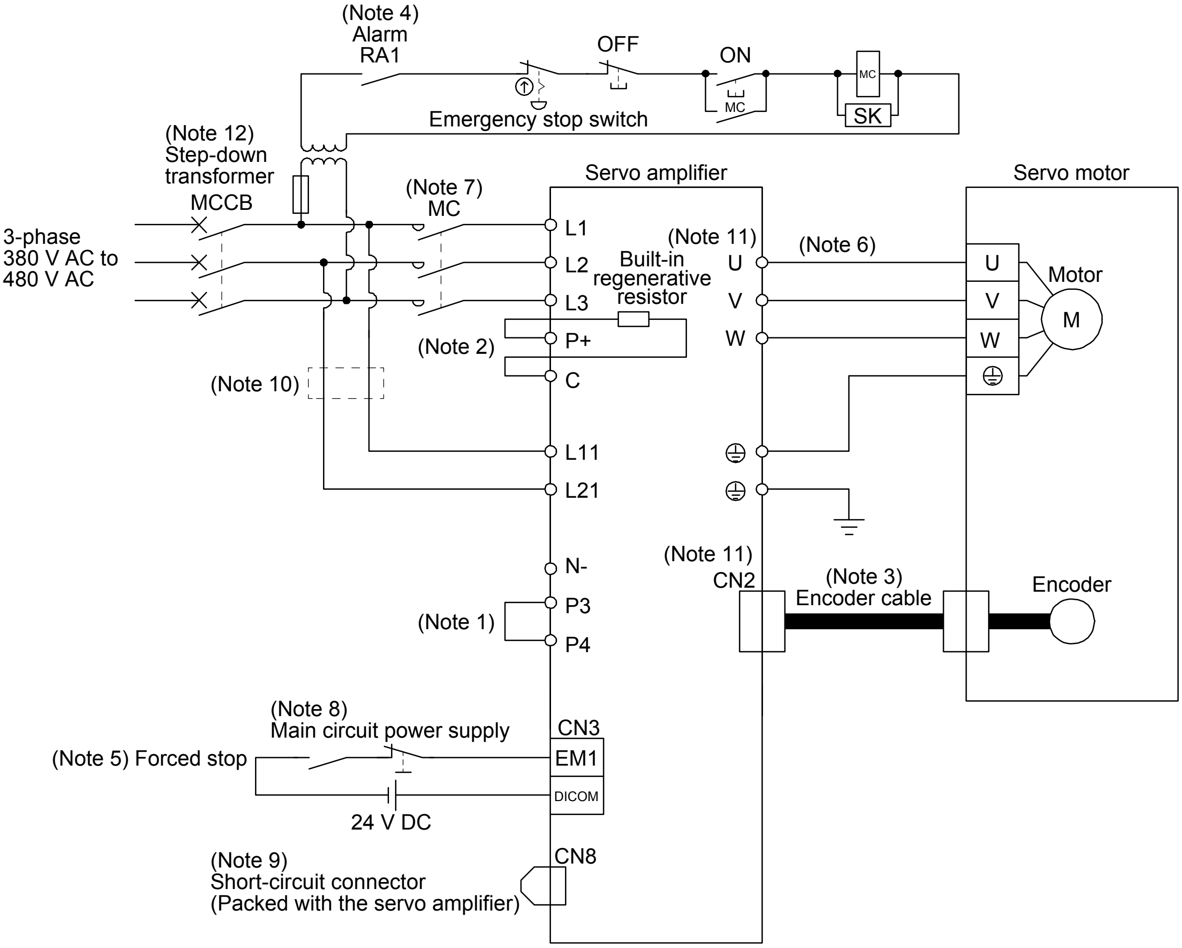
Note
1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

(5) MR-J4-700B-RJ020



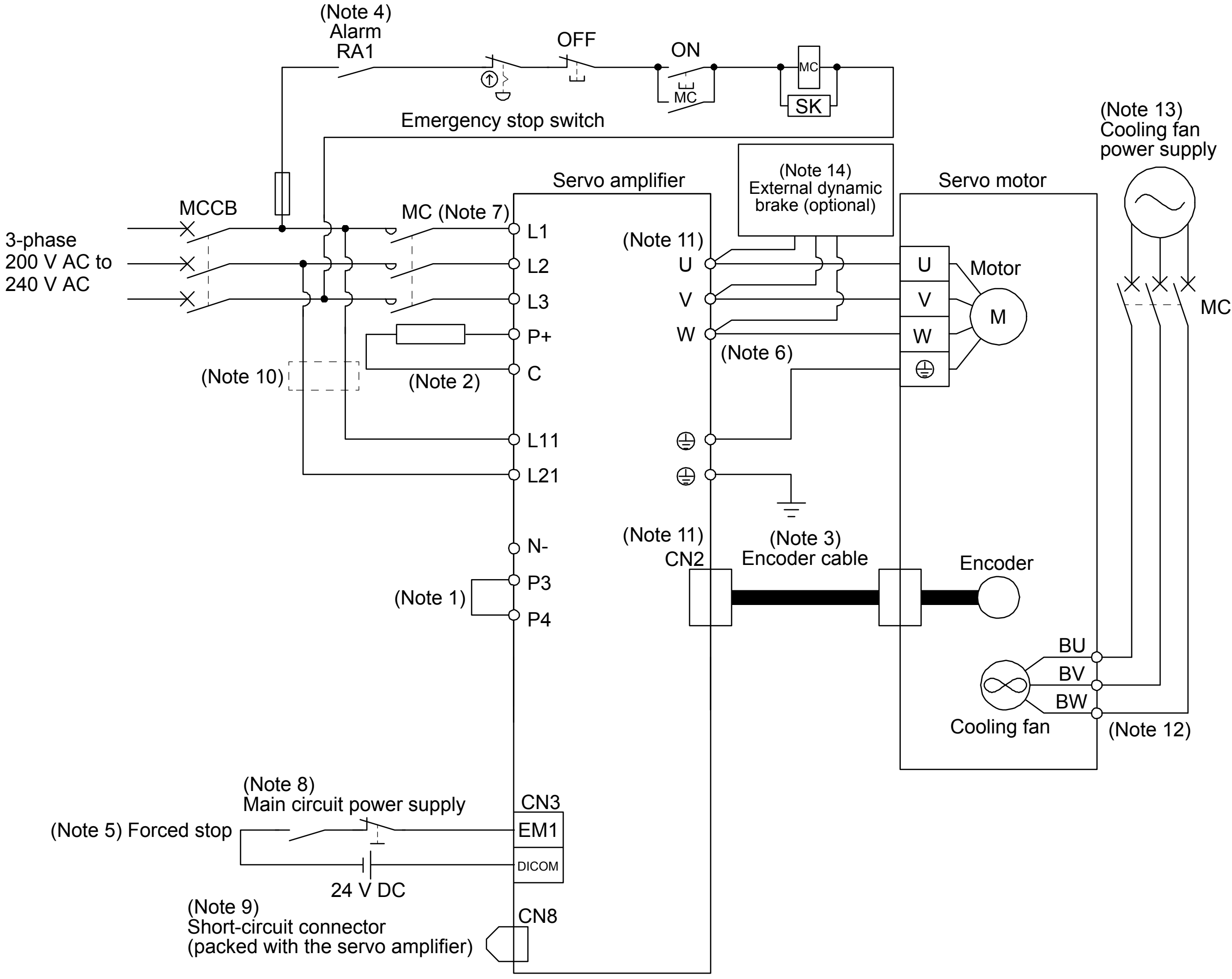
Note
1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

(6) MR-J4-500B4-RJ020/MR-J4-700B4-RJ020



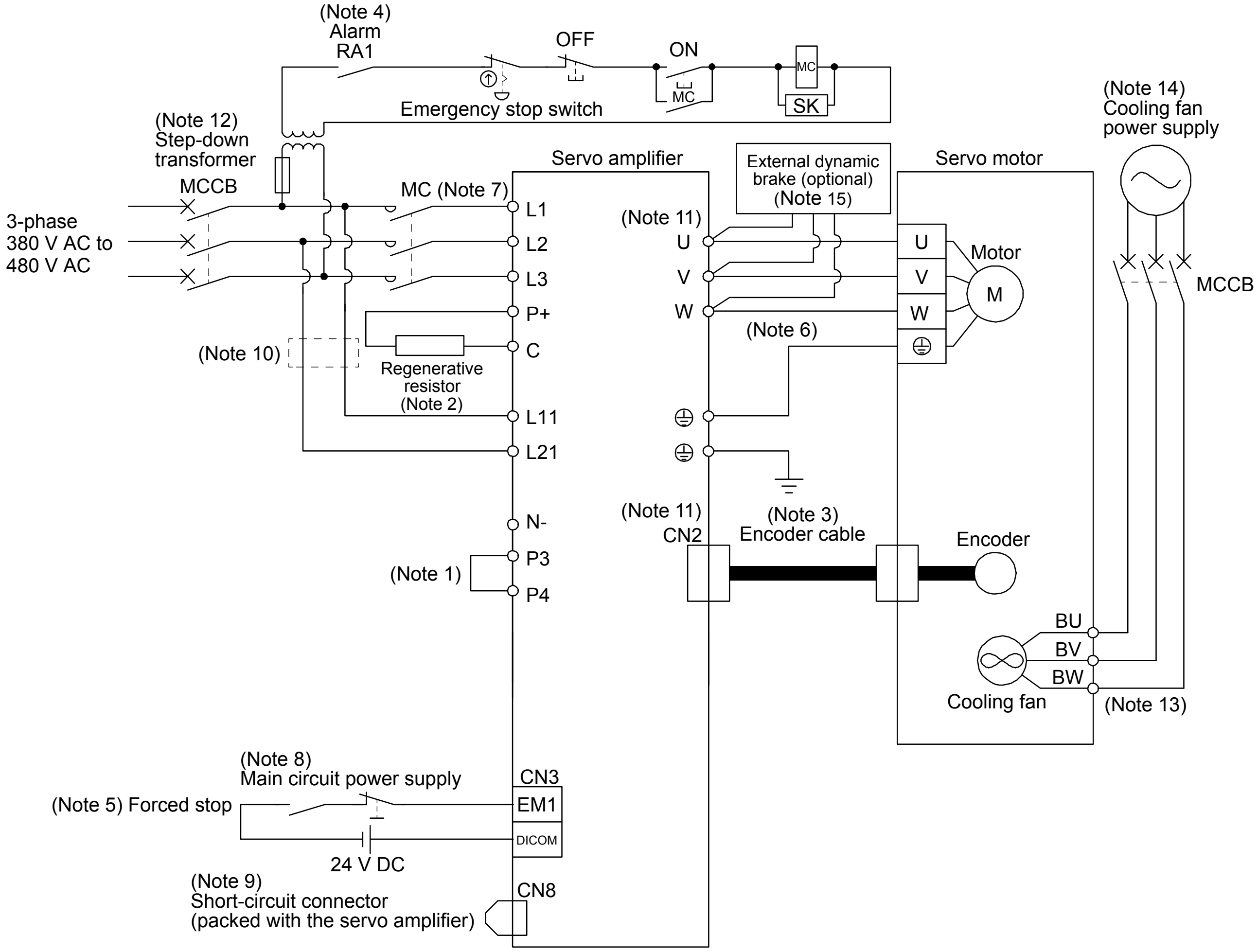
Note
1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. Step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.

(7) MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020



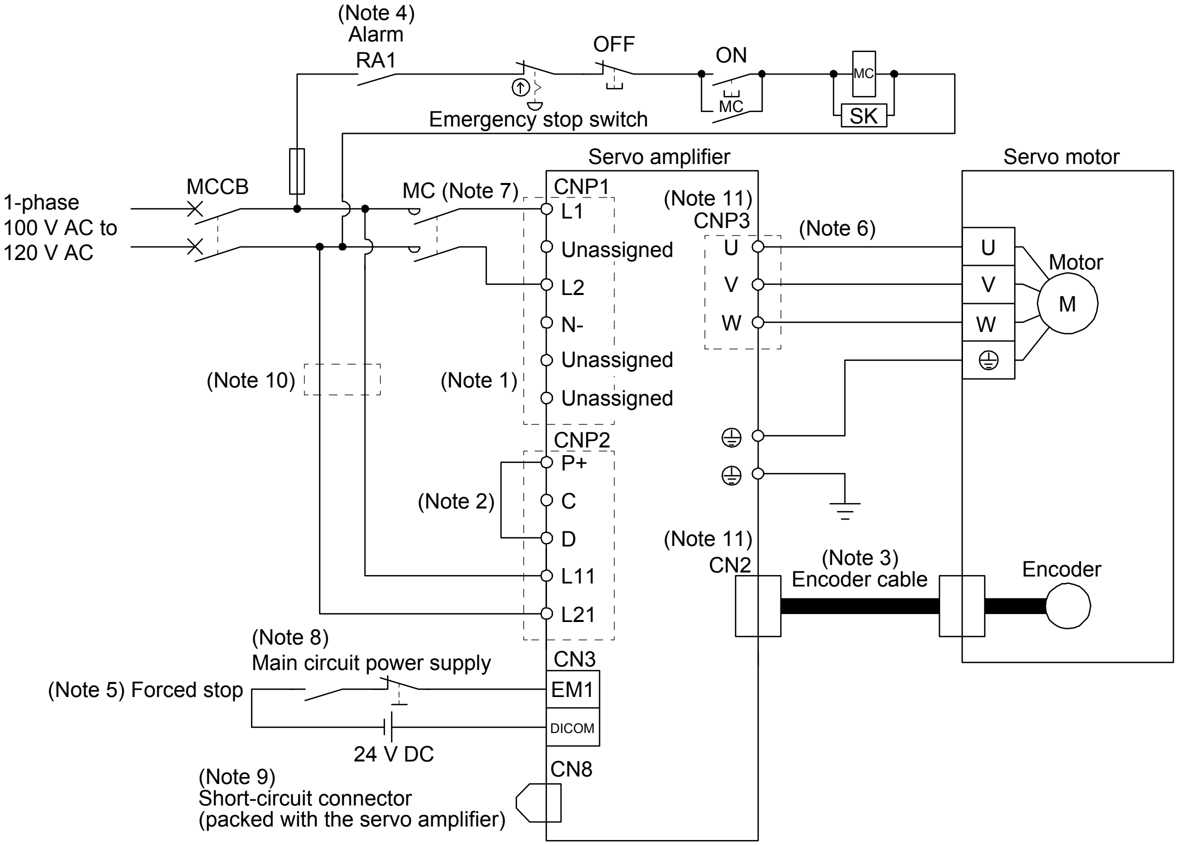
Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. Only HG-JP22K1M servo motor is equipped with a cooling fan.
13. For the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
14. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 11.7.

(8) MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020



Note
1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
2. When using the regenerative resistor, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. A step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.
13. Only HG-JR22K1M4 servo motor has a cooling fan.
14. For the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
15. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 11.7.

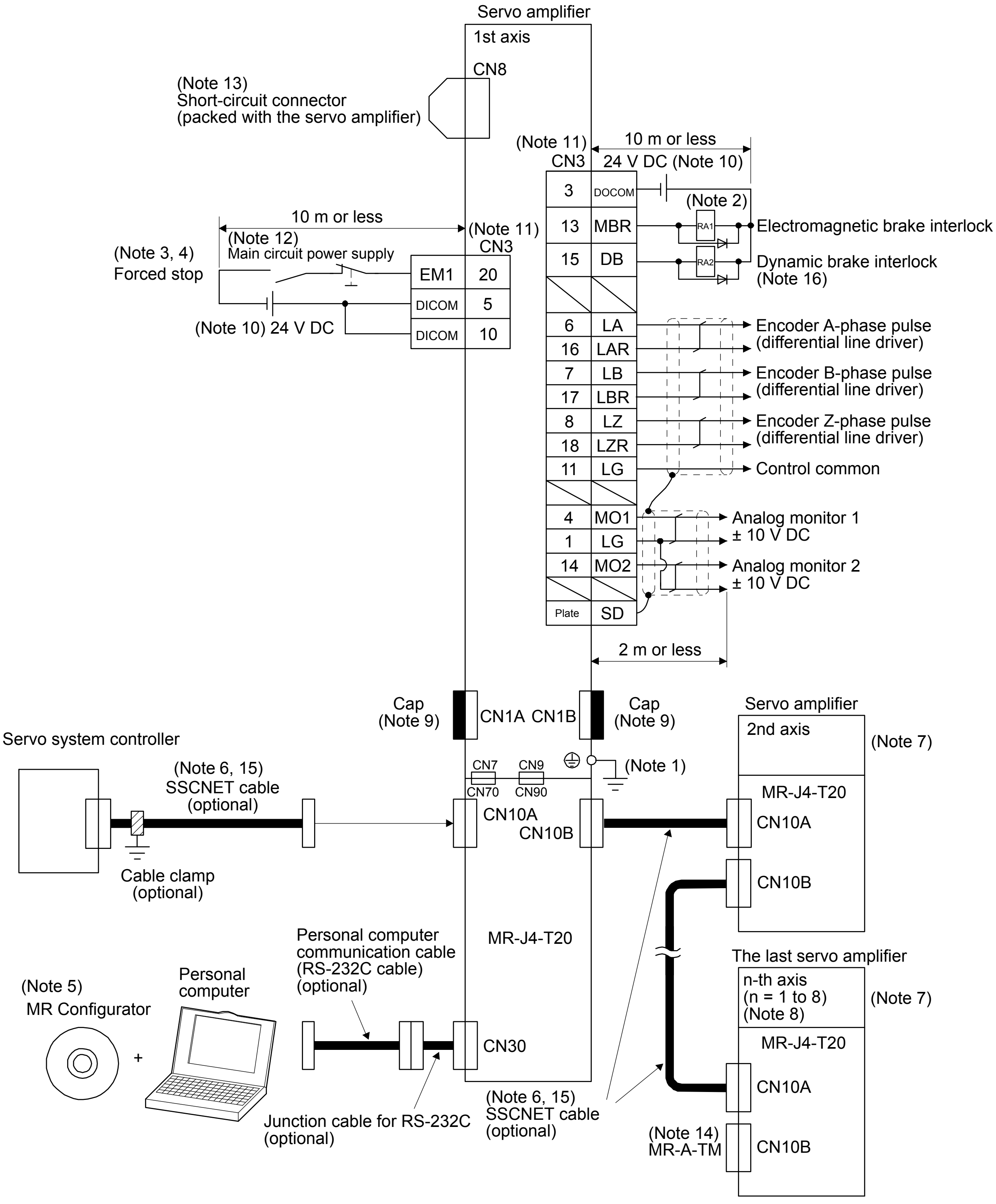
(9) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/MR-J4-40B1-RJ020



Note 1. The power factor improving DC reactor cannot be used.
2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1 and L2, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

3.2 I/O signal connection example

3.2.1 For sink I/O interface



Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.

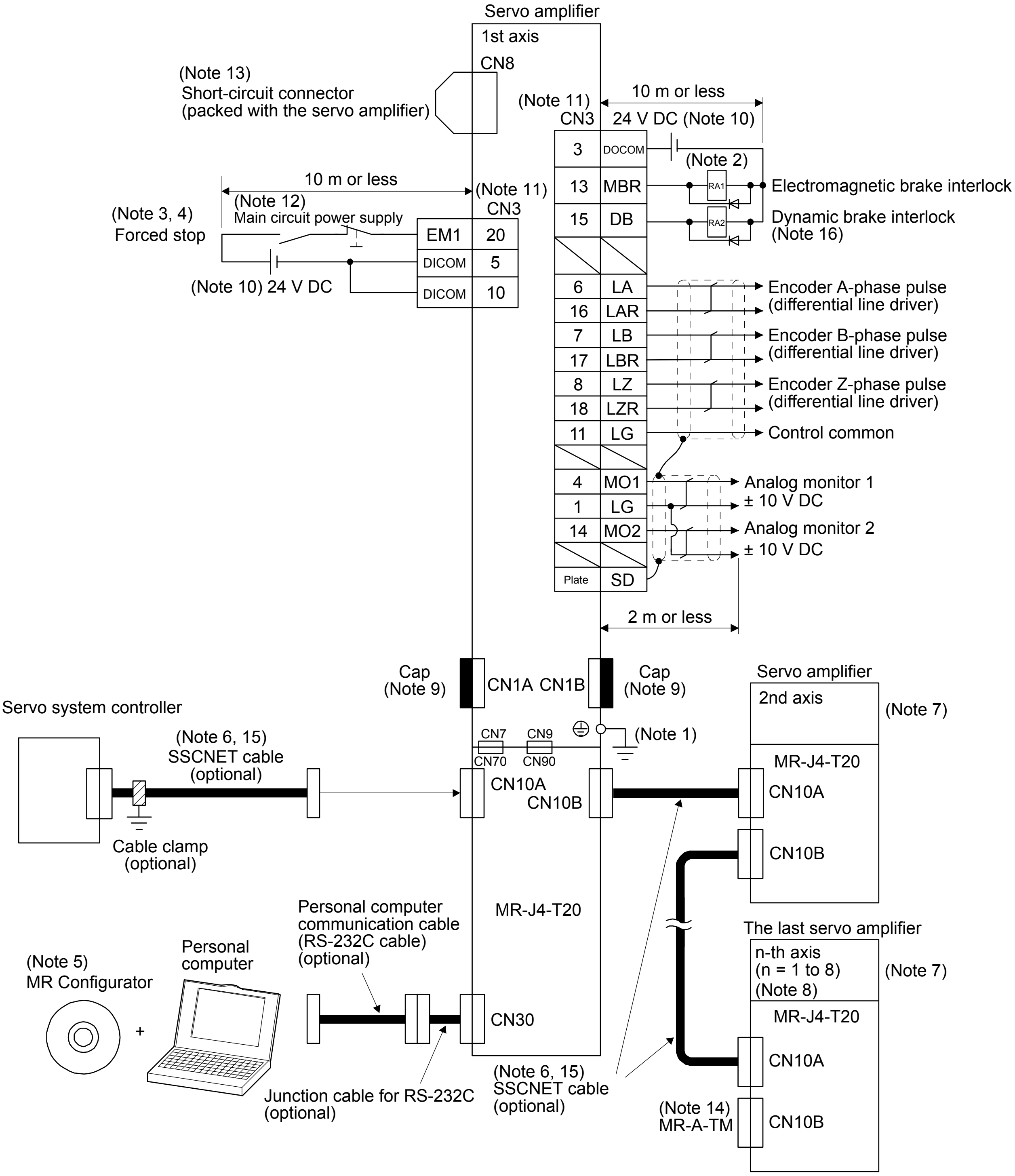
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling EM1 (Forced stop) and other protective circuits.
3. If the controller does not have forced stop function, always install the forced stop switch (normally closed contact).
4. When starting operation, always turn on EM1 (Forced stop). (Normally closed contact)
5. Use MRZJW3-SETUP161E. (Refer to section 11.7.)
6. The SSCNET cables vary depending on servo system controllers connected. Refer to the following table for selecting SSCNET cables. Additionally, use MR-J2HBUS_M for the SSCNET cable to connect previous and next axis servo amplifiers.

Servo system controller		Servo amplifier
		MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5
Positioning module	QD75M	MR-J2HBUS_M
	A1SD75M	MR-J2HBUS_M-A
Motion controller	Q172CPU(N)	Q172J2BCBL_M(-B)
	Q173CPU(N)	Q173J2B_CBL_M
	A171SHCPU(N) A172SHCPU(N) A173UHCPU A273UHCPU	MR-J2HBUS_M-A

7. The wiring after the second servo amplifier is omitted.
8. Up to 8 axes (n = 1 to 8) can be connected.
9. CN1A and CN1B cannot be used in J2S compatibility mode. Be sure to cap the CN1A and CN1B connectors.
10. Supply 24 V DC ± 10% to interfaces from outside. The total current capacity is up to 100 mA. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
11. The pins with the same signal name are connected in the servo amplifier.
12. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
13. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
14. Always attach the terminal connector (MR-A-TM) to CN10B of the last servo amplifier.
15. Connect the SSCNET cable within the overall distance of 30 m. To enhance noise tolerance, it is recommended that the cable clamp and data line filters (3 to 4pcs. connected in series) be attached near the servo system controller-side connector.
16. When using an external dynamic brake with 11 kw or more servo amplifier, set [Pr. 2] to "_ 1 _ _" to enable DB (Dynamic brake interlock).

3.2.2 For source I/O interface

POINT
●For notes, refer to section 3.2.1.



3.3 Explanation of power supply system

3.3.1 Signal explanations

> **POINT**
>
> ●For the layout of connector and terminal block, refer to chapter 9 DIMENSIONS.

<table>
<tr><th>Symbol</th><th>Connection target (application)</th><th>Description</th></tr>
<tr><td>L1/L2/L3</td><td>Main circuit power supply</td><td>Supply the following power to L1, L2, and L3. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
<table>
<tr><th>Servo amplifier / Power</th><th>MR-J4-10B-RJ020 to MR-J4-70B-RJ020</th><th>MR-J4-100B-RJ020 to MR-J4-22KB-RJ020</th></tr>
<tr><td>3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td><td colspan="2">L1/L2/L3</td></tr>
<tr><td>1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td><td>L1/L3</td><td></td></tr>
</table>
<table>
<tr><th>Servo amplifier / Power</th><th>MR-J4-60B4-RJ020 to MR-J4-22KB4-RJ020</th></tr>
<tr><td>3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz</td><td>L1/L2/L3</td></tr>
</table>
<table>
<tr><th>Servo amplifier / Power</th><th>MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020</th></tr>
<tr><td>1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz</td><td>L1/L2</td></tr>
</table>
</td></tr>
<tr><td>P3/P4</td><td>Power factor improving DC reactor</td><td>When not using the power factor improving DC reactor, connect P3 and P4. (factory-wired)
When using the power factor improving DC reactor, disconnect P3 and P4, and connect the power factor improving DC reactor to P3 and P4. Additionally, the power factor improving DC reactor cannot be used for the 100 V class servo amplifiers.
Refer to section 11.11 for details.</td></tr>
<tr><td>P+/C/D</td><td>Regenerative option</td><td>(1) 200 V/100 V class
1) MR-J4-500B-RJ020 or less/MR-J4-40B1-RJ020 or less
When using a servo amplifier built-in regenerative resistor, connect P+ and D. (factory-wired)
When using a regenerative option, disconnect P+ and D, and connect the regenerative option to P+ and C.
2) MR-J4-700B-RJ020 to MR-J4-22KB-RJ020
MR-J4-700B-RJ020 to MR-J4-22KB-RJ020 do not have D.
When using a servo amplifier built-in regenerative resistor, connect P+ and C. (factory-wired)
When using a regenerative option, disconnect wires of P+ and C for the built-in regenerative resistor. And then connect wires of the regenerative option to P+ and C.
(2) 400 V class
1) MR-J4-350B4-RJ020 or less
When using a servo amplifier built-in regenerative resistor, connect P+ and D. (factory-wired)
When using a regenerative option, disconnect P+ and D, and connect the regenerative option to P+ and C.
2) MR-J4-500B4-RJ020 to MR-J4-22KB4-RJ020
MR-J4-500B4-RJ020 to MR-J4-22KB4-RJ020 do not have D.
When using a servo amplifier built-in regenerative resistor, connect P+ and C. (factory-wired)
When using a regenerative option, disconnect wires of P+ and C for the built-in regenerative resistor. And then connect wires of the regenerative option to P+ and C.
Refer to section 11.2 for details.</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Connection target (application)</th><th>Description</th></tr>
<tr><td>L11/L21</td><td>Control circuit power supply</td><td>Supply the following power to L11 and L21.
<table>
<tr><th>Servo amplifier
Power</th><th>MR-J4-10B-RJ020 to MR-J4-22KB-RJ020</th></tr>
<tr><td>1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td><td>L11/L21</td></tr>
</table>
<table>
<tr><th>Servo amplifier
Power</th><th>MR-J4-60B4-RJ020 to MR-J4-22KB4-RJ020</th></tr>
<tr><td>1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz</td><td>L11/L21</td></tr>
</table>
<table>
<tr><th>Servo amplifier
Power</th><th>MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020</th></tr>
<tr><td>1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz</td><td>L11/L21</td></tr>
</table>
</td></tr>
<tr><td>U/V/W</td><td>Servo motor power output</td><td>Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.</td></tr>
<tr><td>N-</td><td>Power regeneration converter
Power regeneration common converter
Brake unit</td><td>This terminal is used for a power regeneration converter, power regeneration common converter and brake unit.
Refer to section 11.3 to 11.5 for details.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Connect it to the grounding terminal of the servo motor and to the protective earth (PE) of the cabinet for grounding.</td></tr>
</table>

3.3.2 Power-on sequence

⚠CAUTION

- The following shows the initialization time (from turning on power until receiving servo-on command) of MR-J2S-_B_ servo amplifier and MR-J4-_B_-RJ020 servo amplifier.
  - MR-J2S-_B_: maximum of 3 s
  - MR-J4-_B_-RJ020: maximum of 4 s

  Therefore, please note the following items when replacing MR-J2S-_B_ servo amplifier with MR-J4-_B_-RJ020 servo amplifier.
  - When a release time of braking for preventing a drop of axis is adjusted with an external timer in a system which a moving part works vertically, the moving part can drop due to longer time until servo-lock. Please readjust the release time of braking or use MBR (Electromagnetic brake interlock).
  - The time from power on until the servo motor begins to work can be longer.

POINT

- The voltage of analog monitor output, output signal, etc. may be unstable at power-on.

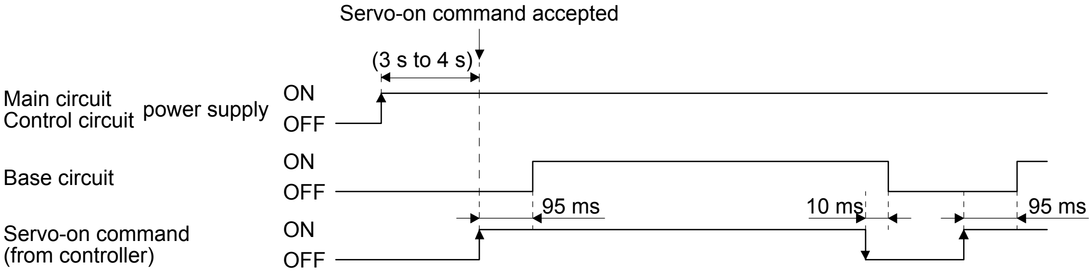
(1) Power-on procedure

1) Always wire the power supply as shown in section 3.1 using the magnetic contactor with the main circuit power supply (L1, L2, and L3). Configure an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Switch on the control circuit power supply (L11 and L21) simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the control circuit power supply is turned on with the main circuit power supply off, and then the servo-on command is transmitted, [AL. E9 Main circuit off warning] will occur. Turning on the main circuit power supply stops the warning and starts the normal operation.

3) The servo amplifier receives the servo-on command within 3 s to 4 s after the main circuit power supply is switched on.
(Refer to (2) of this section.)

(2) Timing chart



3.3.3 Wiring CNP1, CNP2, and CNP3

POINT

- ●For the wire sizes used for wiring, refer to section 11.9.
- ●MR-J4-500B-RJ020 or more/MR-J4-500B4-RJ020 or more do not have these connectors.

Use the servo amplifier power connector for wiring CNP1, CNP2, and CNP3.

(1) Connector

(a) MR-J4-10B-RJ020 to MR-J4-100B-RJ020

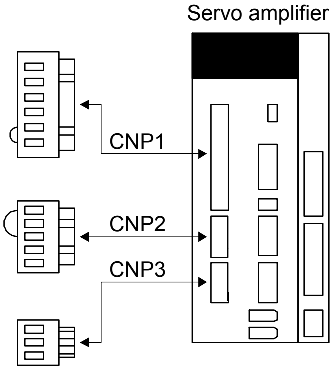


Table 3.1 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufac-turer
		Size	Insulator OD			
CNP1	06JFAT-SAXGDK-H7.5	AWG 18 to 14	3.9 mm or less	9	J-FAT-OT (N) or J-FAT-OT	JST
CNP2	05JFAT-SAXGDK-H5.0					
CNP3	03JFAT-SAXGDK-H7.5					

(b) MR-J4-200B-RJ020/MR-J4-350B-RJ020

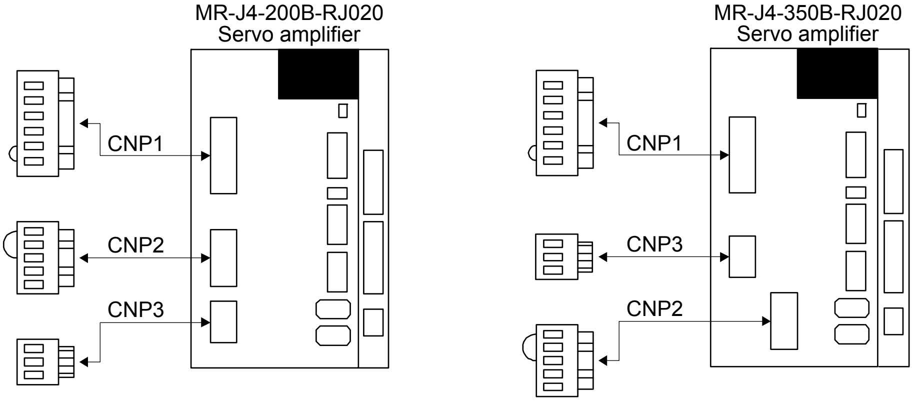


Table 3.2 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufac-turer
		Size	Insulator OD			
CNP1	06JFAT-SAXGFK-XL	AWG 16 to 10	4.7 mm or less	11.5	J-FAT-OT-EXL	JST
CNP3	03JFAT-SAXGFK-XL					
CNP2	05JFAT-SAXGDK-H5.0	AWG 18 to 14	3.9 mm or less	9		

(c) MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020

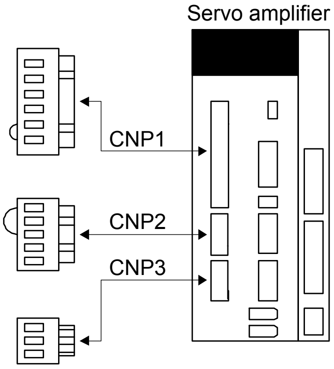


Table 3.3 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufac-turer
		Size	Insulator OD			
CNP1	06JFAT-SAXGDK-HT10.5	AWG 16 to 14	3.9 mm or less	10	J-FAT-OT-XL	JST
CNP2	05JFAT-SAXGDK-HT7.5					
CNP3	03JFAT-SAXGDK-HT10.5					

(d) MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020

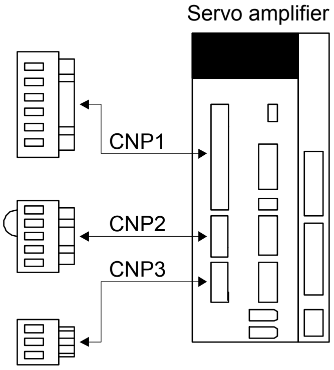


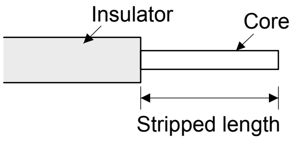
Table 3.4 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufac-turer
		Size	Insulator OD			
CNP1	06JFAT-SAXGDK-H7.5	AWG 18 to 14	3.9 mm or less	9	J-FAT-OT (N) or J-FAT-OT	JST
CNP2	05JFAT-SAXGDK-H5.0					
CNP3	03JFAT-SAXGDK-H7.5					

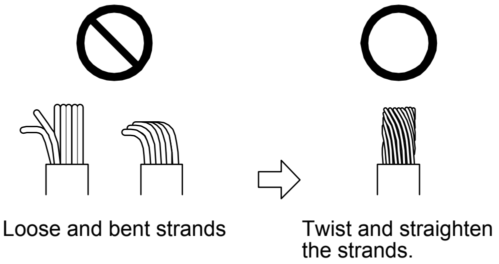
(2) Cable connection procedure

(a) Fabrication on cable insulator

Refer to table 3.1 to 3.4 for stripped length of cable insulator. The appropriate stripped length of cables depends on their type, etc. Set the length considering their status.



Twist strands lightly and straighten them as follows.



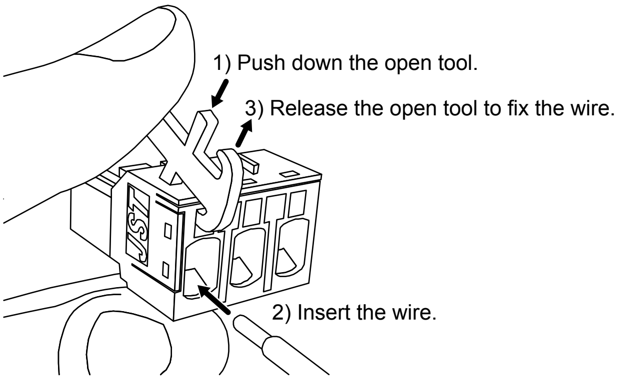
You can also use a ferrule to connect with the connectors. When you use a ferrule, use the following ferrules and crimp terminal.

Servo amplifier	Wire size	Ferrule model (Phoenix Contact)		Crimping tool (Phoenix Contact)
		For one	For two	
MR-J4-10B-RJ020 to MR-J4-100B-RJ020 MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	CRIMPFOX-ZA3
	AWG 14	AI2.5-10BU		
MR-J4-200B-RJ020 to MR-J4-350B-RJ020	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	
	AWG 14	AI2.5-10BU	AI-TWIN2×2.5-10BU	
	AWG 12	AI4-10GY		
MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	
	AWG 14	AI2.5-10BU		

(b) Inserting wire

Insert the open tool as follows and push down it to open the spring. While the open tool is pushed down, insert the stripped wire into the wire insertion hole. Check the insertion depth so that the wire insulator does not get caught by the spring.

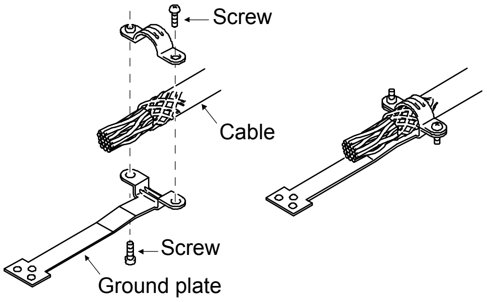
Release the open tool to fix the wire. Pull the wire lightly to confirm that the wire is surely connected. The following shows a connection example of the CNP3 connector for MR-J4-200B-RJ020/MR-J4-350B-RJ020.



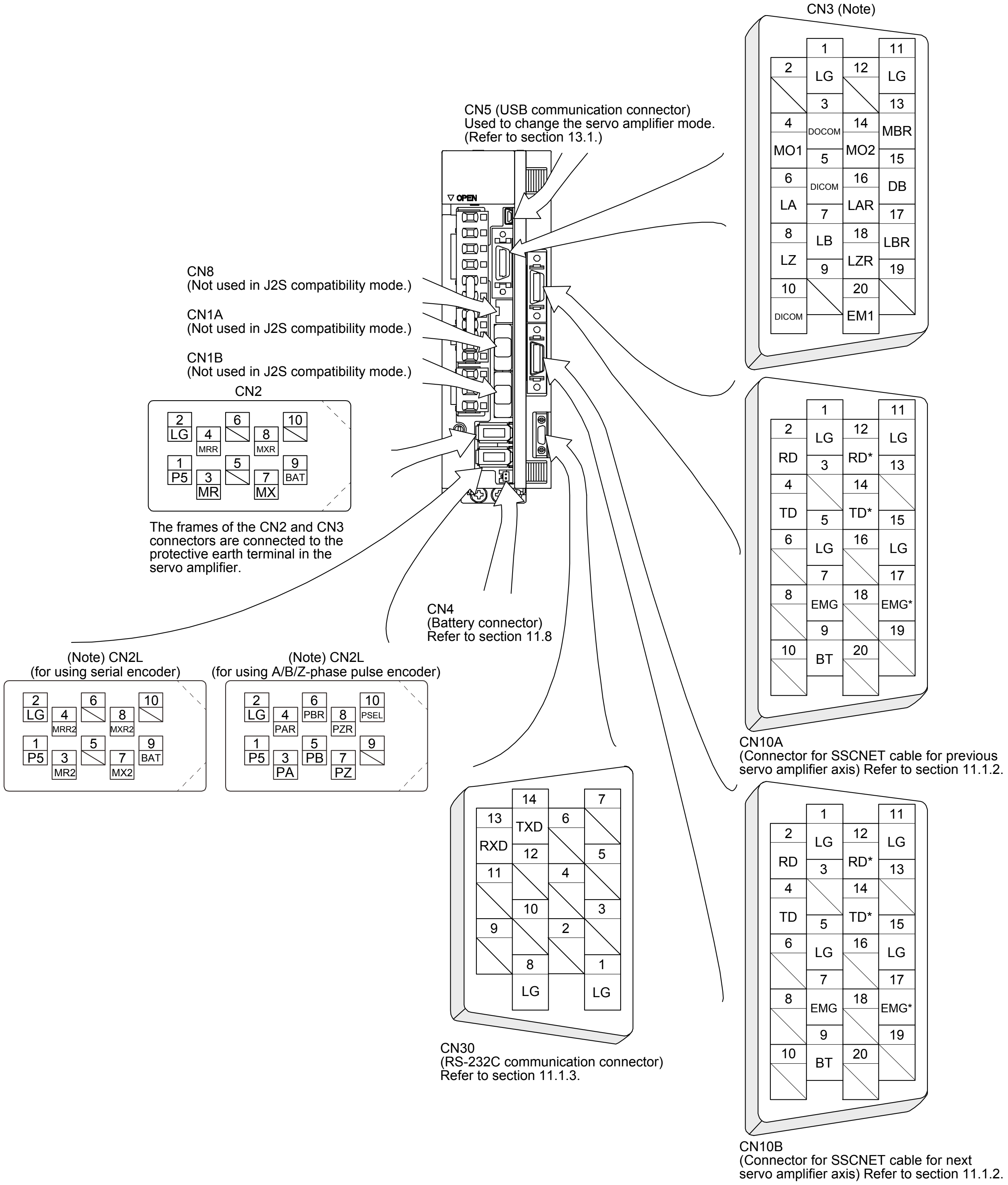
3.4 Connectors and pin assignment

POINT

- The pin assignment of the connectors is as viewed from the cable connector wiring section.
- The CN3 connector pin assignment is different between MR-J4-_B_-RJ020 and MR-J2S-_B_. Wire it correctly in accordance with this section.
- For the CN3 connector, securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.



The servo amplifier front view shown is that of the MR-J4-20B-RJ020 and MR-J4-T20. Refer to chapter 9 DIMENSIONS for the appearances and connector layouts of the other servo amplifiers.


CN3 (Note)

CN5 (USB communication connector)
Used to change the servo amplifier mode.
(Refer to section 13.1.)

CN8
(Not used in J2S compatibility mode.)

CN1A
(Not used in J2S compatibility mode.)

CN1B
(Not used in J2S compatibility mode.)

CN2

The frames of the CN2 and CN3 connectors are connected to the protective earth terminal in the servo amplifier.

CN4
(Battery connector)
Refer to section 11.8

(Note) CN2L
(for using serial encoder)

(Note) CN2L
(for using A/B/Z-phase pulse encoder)

CN10A
(Connector for SSCNET cable for previous servo amplifier axis) Refer to section 11.1.2.

CN30
(RS-232C communication connector)
Refer to section 11.1.3.

CN10B
(Connector for SSCNET cable for next servo amplifier axis) Refer to section 11.1.2.

Note. Used only in the fully closed loop system with the servo amplifier of 7 kW or less. Refer to chapter 15 for details. This CN2L is a connector of 3M. When using any other connector, refer to each servo motor instruction manual.

CN3 connector Pin No.	Symbol		Precautions when replacing MR-J2S-_B_
	MR-J2S-_B_	MR-J4-_B_-RJ020	
2	RXD		This is for manufacturer setting. Leave this open. Connect RXD to the CN30 connector of MR-J4-T20 (13 pins).
3	SG	DOCOM	A 24 V DC external power supply for interface is necessary. Review the wiring.
5	COM	DICOM	
10	VDD	DICOM	
12	TXD		This is for manufacturer setting. Leave this open. Connect TXD to the CN30 connector of MR-J4-T20 (14 pins).

3.5 Signal (device) explanations

For the I/O interfaces (symbols in I/O division column in the table), refer to section 3.7.2.

3.5.1 Input device

Device	Symbol	Connector Pin No.	Function and application	I/O division
Forced stop	EM1	CN3-20	When EM1 is turned off (open between commons), the base circuit shuts off, and the dynamic brake operates to decelerate the servo motor to a stop. The forced stop will be reset when EM1 is turned on (short between commons).	DI-1

3.5.2 Output device

Device	Symbol	Connector Pin No.	Function and application	I/O division
Electromagnetic brake interlock	MBR	CN3-13	When using the device, set operation delay time of the electromagnetic brake in [Pr. 21]. When a servo-off status or alarm occurs, MBR will turn off.	DO-1
Dynamic brake interlock	DB	CN3-15	To use the device, set [Pr. 2] to "_ 1 _ _". DB turns off when the dynamic brake needs to operate. When using the external dynamic brake on the servo amplifier of 11 kW or more, this device is required. (Refer to section 11.17.) For the servo amplifier of 7 kW or less, it is not necessary to use this device.	DO-1

3.5.3 Output signal

Signal name	Symbol	Connector pin No.	Function and application
Encoder A-phase pulse (differential line driver)	LA LAR	CN3-6 CN3-16	These signals output pulses per servo motor revolution set in [Pr. 38] in the differential line driver type. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of π/2. Output pulse specification and dividing ratio setting can be selected with [Pr. 33].
Encoder B-phase pulse (differential line driver)	LB LBR	CN3-7 CN3-17	
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN3-8 CN3-18	The encoder zero-point signal is outputted in the differential line driver type. One pulse is outputted per servo motor revolution. This turns on when the zero-point position is reached. (negative logic) The minimum pulse width is about 400 μs. For home position return using this pulse, set the creep speed to 100 r/min or less.
Analog monitor 1	MO1	CN3-4	This is used to output the data set in [Pr. 22] between MO1 and LG in voltage. Resolution: 10 bits or equivalent
Analog monitor 2	MO2	CN3-14	This signal outputs the data set in [Pr. 22] between MO2 and LG in voltage. Resolution: 10 bits or equivalent

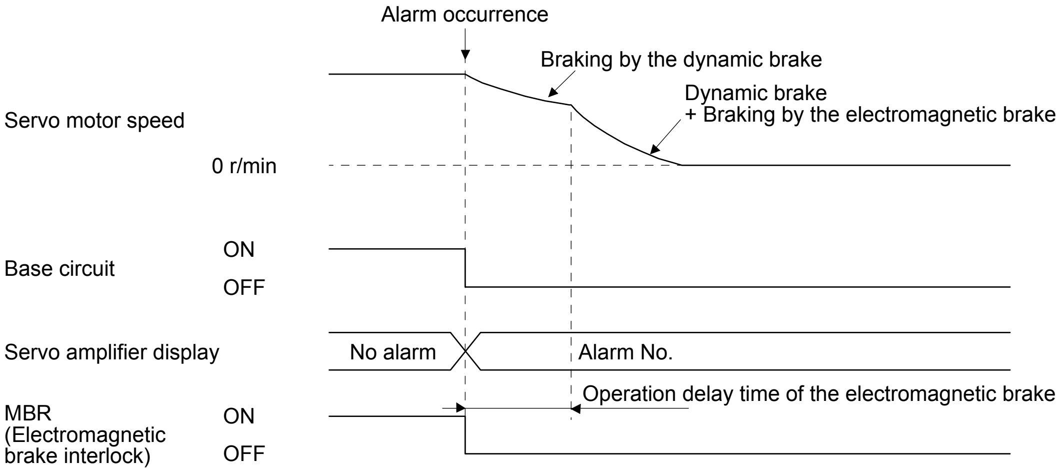
3.5.4 Power supply

Signal name	Symbol	Connector Pin No.	Function and application
Digital I/F power supply input	DICOM	CN3-5 CN3-10	Input 24 V DC (24 V DC ± 10% 100 mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. For sink interface, connect + of 24 V DC external power supply. For source interface, connect - of 24 V DC external power supply.
Digital I/F common	DOCOM	CN3-3	Common terminal of input signal such as EM1 of the servo amplifier. This is separated from LG. For sink interface, connect - of 24 V DC external power supply. For source interface, connect + of 24 V DC external power supply.
Monitor common	LG	CN3-1 CN3-11	Common terminal of MO1 and MO2. Pins are connected internally.
Shield	SD	Plate	Connect the external conductor of the shielded wire.

3.6 Alarm occurrence timing chart

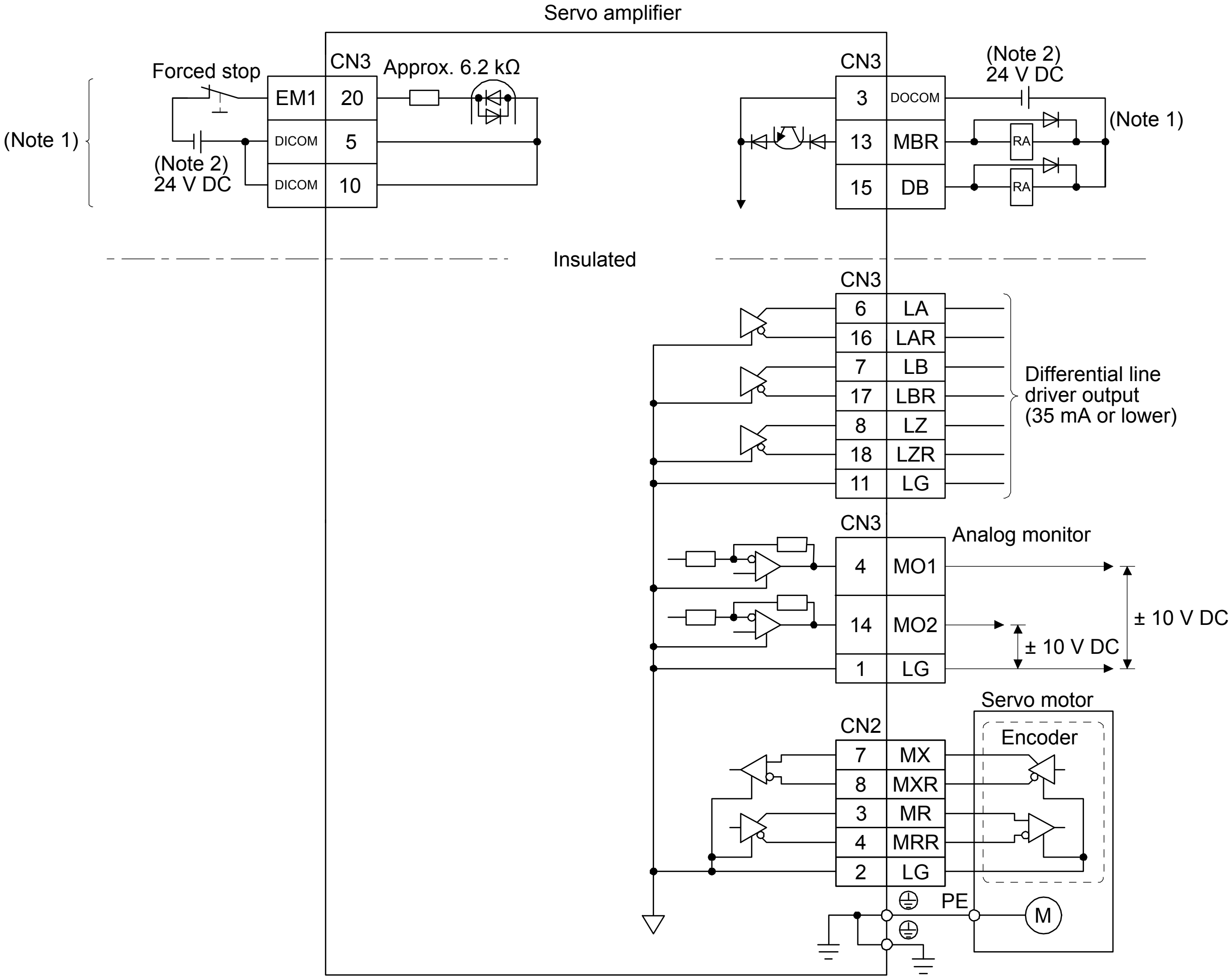
⚠CAUTION
- When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

To deactivate the alarm, cycle the control circuit power or give the error reset or CPU reset command from the servo system controller. However, the alarm cannot be deactivated unless its cause is removed.



3.7 Interfaces

3.7.1 Internal connection diagram



Note 1. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.7.3.

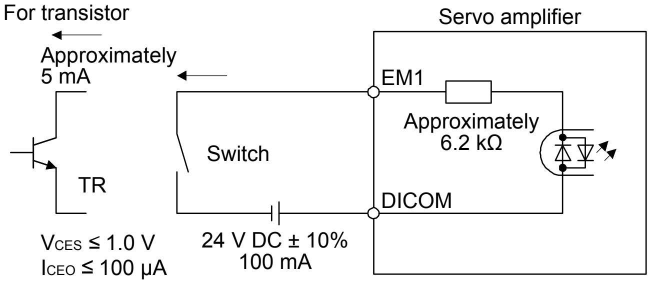
2. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

3.7.2 Detailed explanation of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 3.5. Refer to this section and make connection with the external device.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler cathode side is input terminal. Transmit signals from sink (open-collector) type transistor output, relay switch, etc. The following is a connection diagram for sink input. Refer to section 3.7.3 for source input.



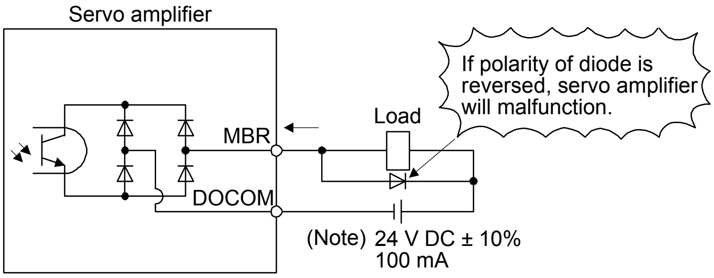
(2) Digital output interface DO-1

This is a circuit in which the collector side of the output transistor is the output terminal. When the output transistor is turned on, the current flows from the collector terminal.

A lamp, relay or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load.

(Rated current: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 2.6 V voltage drop occurs in the servo amplifier.

The following shows a connection diagram for sink output. Refer to section 3.7.3 for source output.

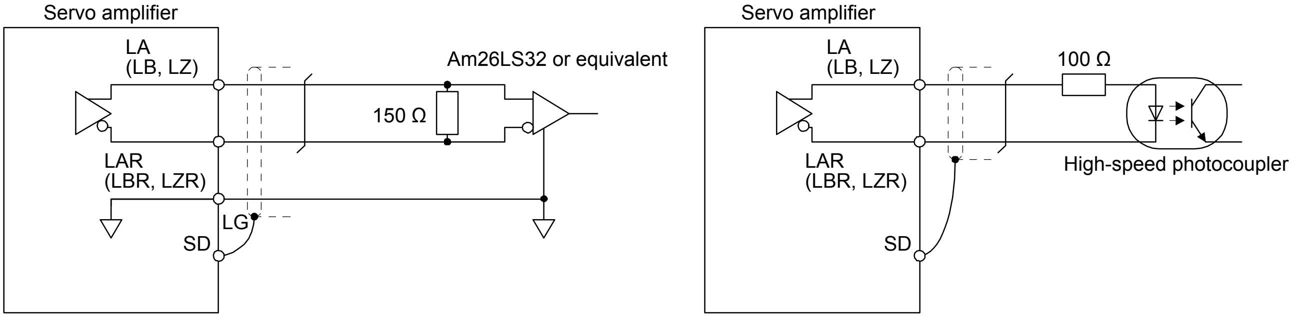


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

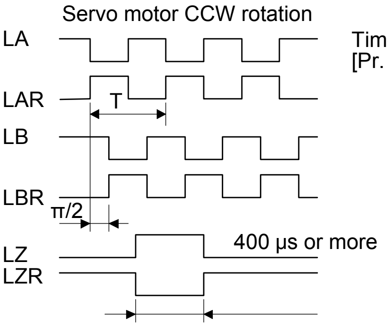
(3) Encoder output pulses DO-2 (differential line driver type)

(a) Interface

Maximum output current: 35 mA

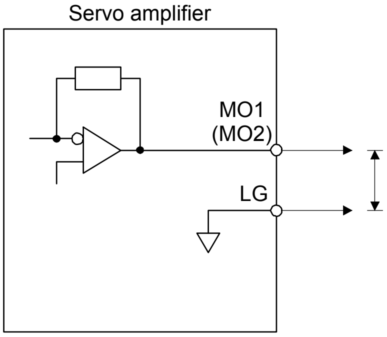


(b) Output pulse



Time cycle (T) is determined by the [Pr. 33] and [Pr. 38] settings.

(4) Analog output



Output voltage: ±10 V (Note)
Maximum output current: 1 mA
Resolution: 10 bits or equivalent

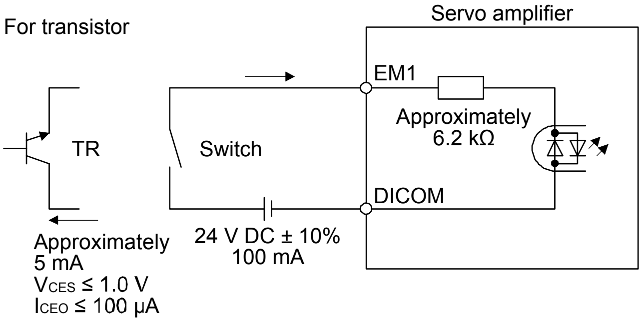
Note. Output voltage range varies depending on the output contents.

3.7.3 Source I/O interfaces

In this servo amplifier, source type I/O interfaces can be used.

(1) Digital input interface DI-1

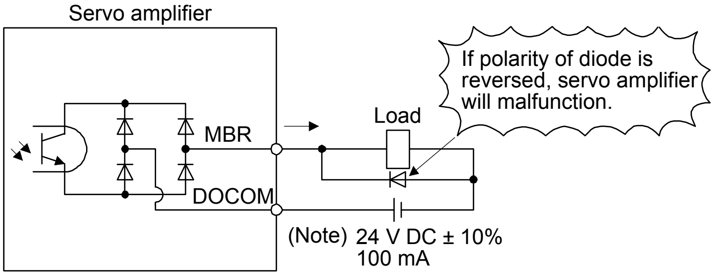
This is an input circuit whose photocoupler anode side is the input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.



(2) Digital output interface DO-1

This is a circuit in which the emitter side of the output transistor is the output terminal. When the output transistor is turned on, the current flows from the output terminal to a load.

A maximum of 2.6 V voltage drop occurs in the servo amplifier.



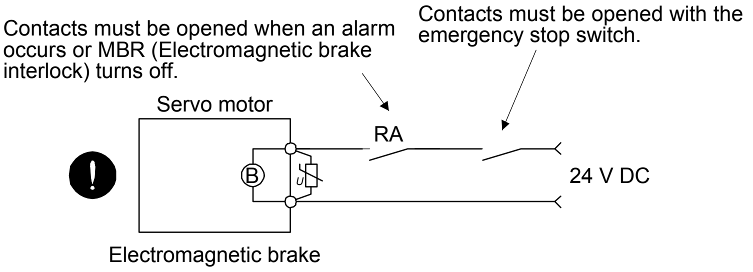
Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

3.8 Servo motor with an electromagnetic brake

3.8.1 Safety precautions

⚠CAUTION

●Configure an electromagnetic brake circuit so that it is activated also by an external emergency stop switch.



●The electromagnetic brake is provided for holding purpose and must not be used for ordinary braking.

●Before operating the servo motor, be sure to confirm that the electromagnetic brake operates properly.

●Do not use the 24 V DC interface power supply for the electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, it may cause a malfunction.

POINT

●Refer to "Servo Motor Instruction Manual (Vol. 3)" for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.

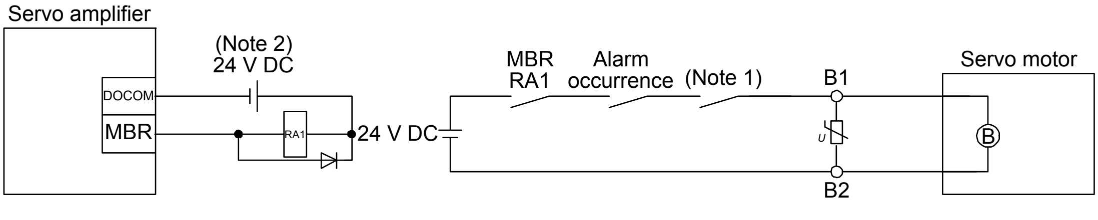
●Refer to "Servo Motor Instruction Manual (Vol. 3)" for the selection of a surge absorber for the electromagnetic brake.

Note the following when the servo motor with an electromagnetic brake is used.

1) The brake will operate when the power (24 V DC) turns off.

2) Turn off the servo-on command after the servo motor stopped.

(1) Connection diagram



Note 1. Create the circuit in order to shut off by interlocking with the emergency stop switch.
2. Do not use the 24 V DC interface power supply for the electromagnetic brake.

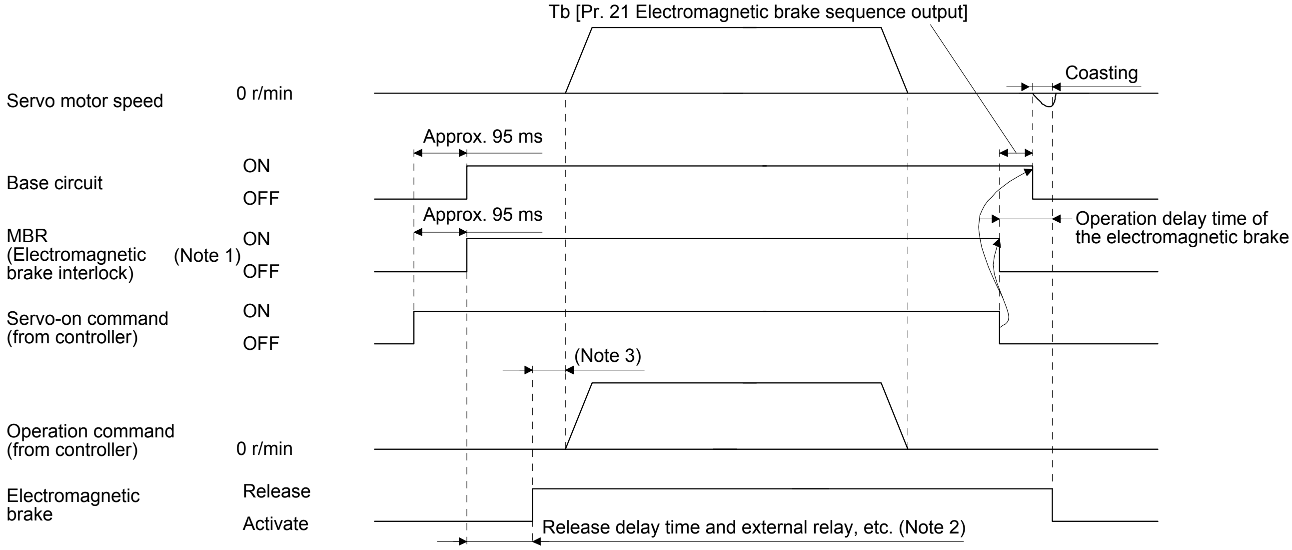
(2) Setting

In [Pr. 21 Electromagnetic brake sequence output], set a delay time (Tb) from MBR (Electromagnetic brake interlock) off to base circuit shut-off at a servo-off as in the timing chart in section 3.8.2.

3.8.2 Timing chart

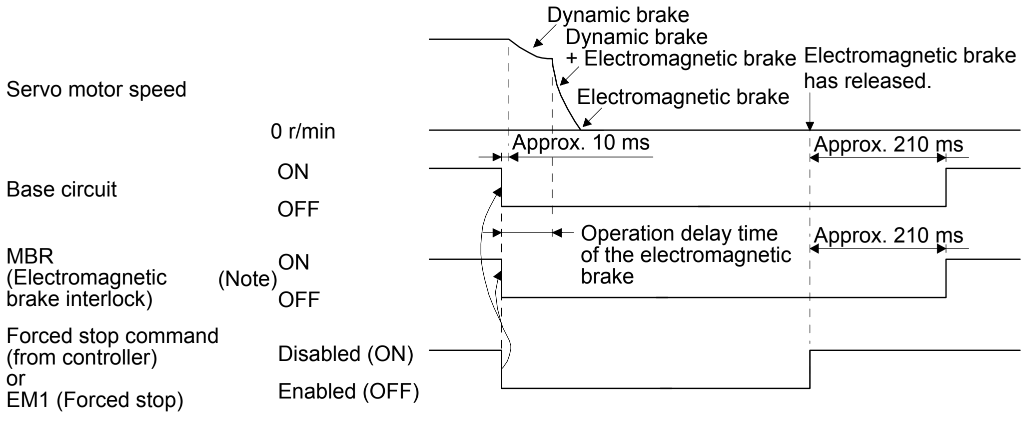
(1) Servo-on command (from controller) on/off

When servo-on command is turned off, the servo lock will be released after Tb [ms], and the servo motor will coast. If the electromagnetic brake is enabled during servo-lock, the brake life may be shorter. Therefore, set Tb about 1.5 times of the minimum delay time where the moving part will not drop down for a vertical axis system, etc.



Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.
2. Electromagnetic brake is released after the release delay time of electromagnetic brake and operation time of external circuit relay, etc. For the release delay time of electromagnetic brake, refer to "Servo Motor Instruction Manual (Vol. 3)".
3. Give the operation command from the controller after the electromagnetic brake is released.

(2) Off/on of the forced stop command (from controller) or EM1 (Forced stop)

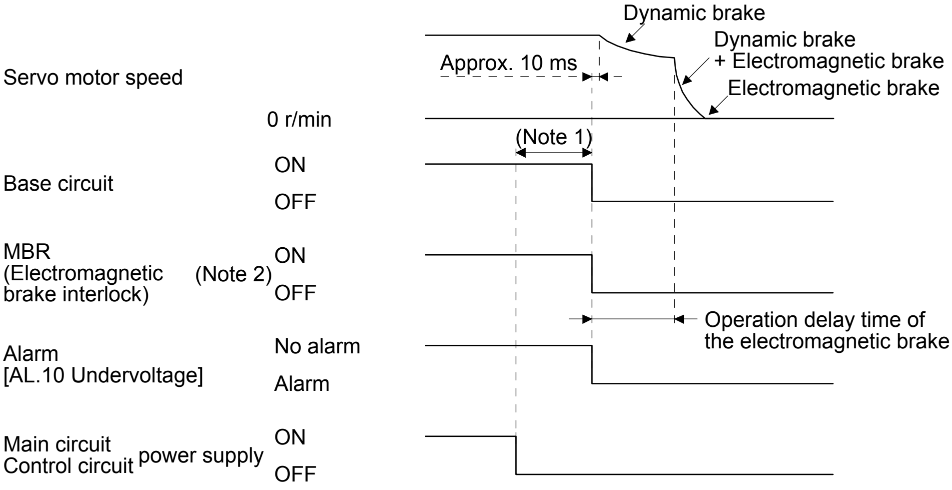


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

(3) Alarm occurrence

The operation status during an alarm is the same as section 3.6.

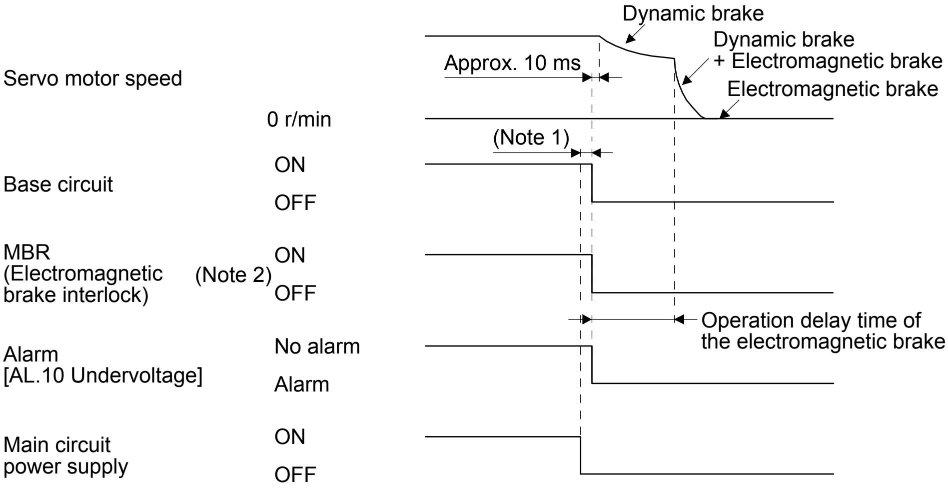
(4) Both main and control circuit power supplies off



Note 1. Variable according to the operation status.

2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

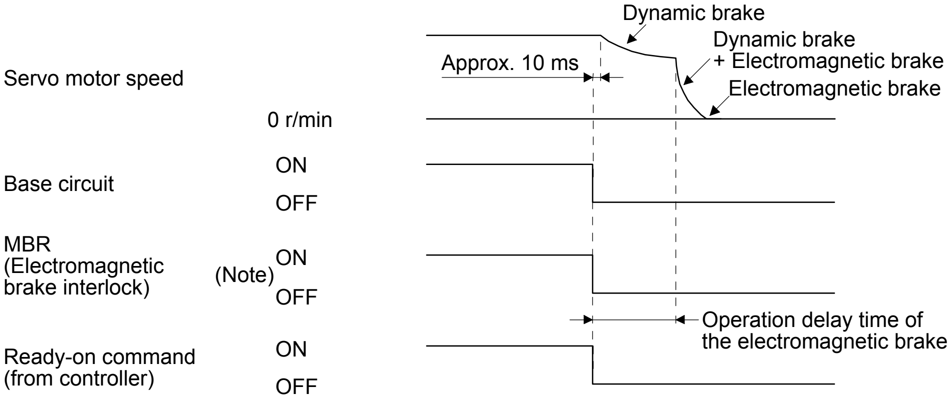
(5) Main circuit power supply off during control circuit power supply on



Note 1. Variable according to the operation status.

2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

(6) Ready-off command from controller

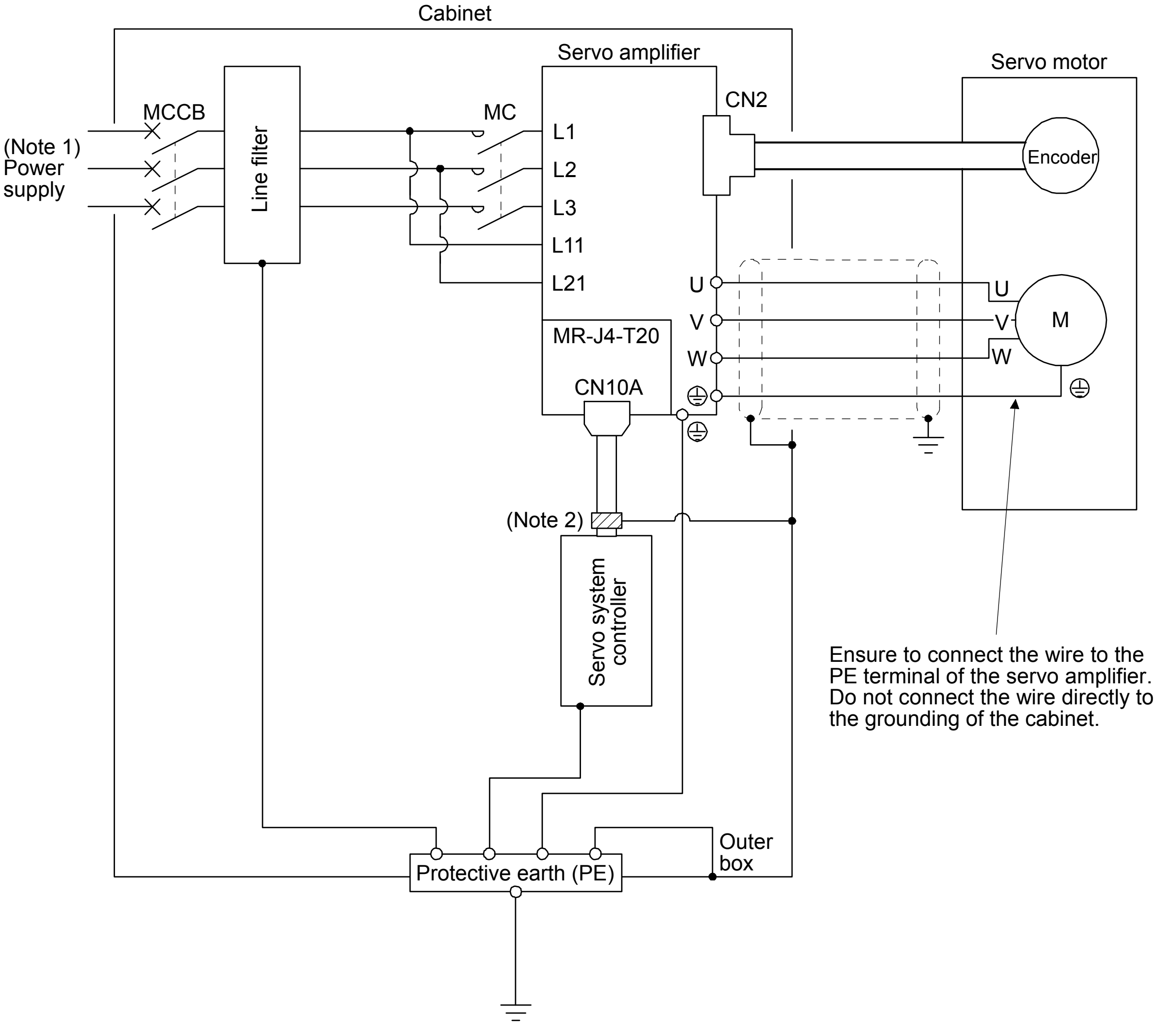


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

3.9 Grounding

⚠WARNING
- ●Ground the servo amplifier and servo motor securely.
- ●To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.

The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to "EMC Installation Guidelines".



Ensure to connect the wire to the PE terminal of the servo amplifier. Do not connect the wire directly to the grounding of the cabinet.

Note 1. For the power supply specifications, refer to section 1.3.
2. To reduce the influence of the external noise, it is recommended to attach a cable clamp fitting to ground the SSCNET cable or connect 3 to 4 data line filters in series near the servo system controller.

4. STARTUP

⚠WARNING

- Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.

⚠CAUTION

- Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly.
- The servo amplifier heat sink, regenerative resistor, servo motor, etc. may be hot while power is on and for some time after power-off. Take safety measures, e.g. provide covers, to avoid accidentally touching the parts (cables, etc.) by hand.
- During operation, never touch the rotor of the servo motor. Otherwise, it may cause injury.

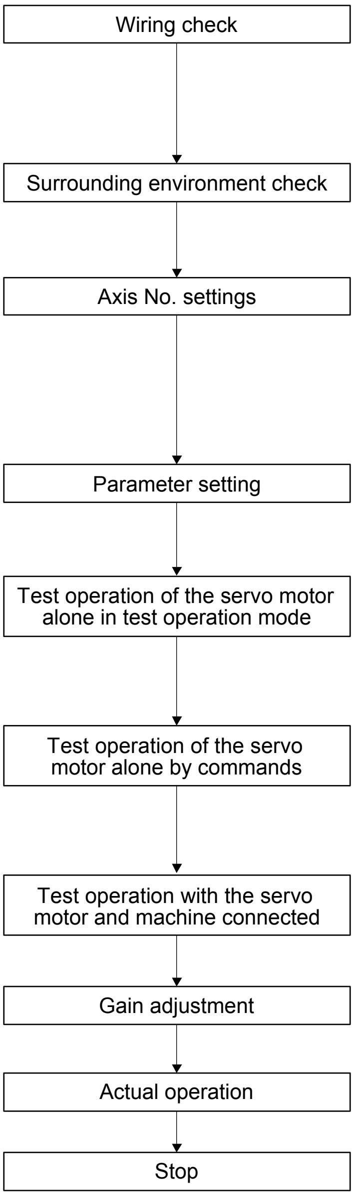
POINT

- Before switching power on, install MR-J4-T20 to the MR-J4-_B_-RJ020 servo amplifier. For the MR-J4-T20 installation procedure, refer to section 1.8.

4.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.

4.1.1 Startup procedure



Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function (section 4.5.1), etc. (Refer to section 4.1.2.)

Check the surrounding environment of the servo amplifier and servo motor. (Refer to section 4.1.3.)

Confirm that the control axis No. set with the axis selection rotary switch (SW1) matches the control axis No. set with the servo system controller. (Refer to section 4.3.1.)

Set the parameters as necessary, such as the used operation mode and regenerative option selection. (Refer to chapter 5.)

For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, check whether the servo motor rotates correctly. (Refer to section 4.5.)

For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, give commands to the servo amplifier and check whether the servo motor rotates correctly.

After connecting the servo motor with the machine, check machine motions with sending operation commands from the servo system controller.

Make gain adjustment to optimize the machine motions. (Refer to chapter 6.)

Stop giving commands and stop operation.

4.1.2 Wiring check

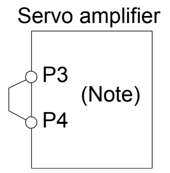
(1) Power supply system wiring

Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

1) The power supplied to the power input terminals (L1, L2, L3, L11, and L21) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.3.)

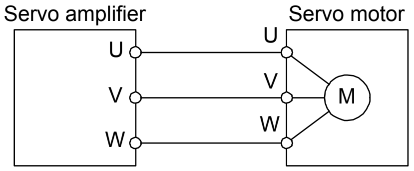
2) When the power factor improving DC reactor is not used, between P3 and P4 should be connected.



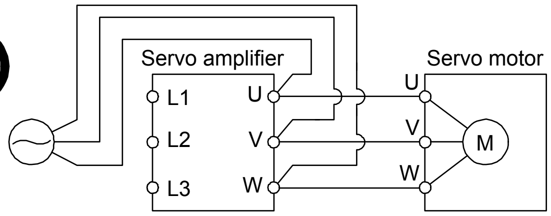
Note. The 100 V class servo amplifiers do not have P3 and P4.

(b) Connection of servo amplifier and servo motor

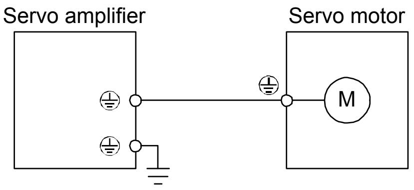
1) The servo amplifier power output (U, V, and W) should match in phase with the servo motor power input terminals (U, V, and W).



2) The power supplied to the servo amplifier should not be connected to the power outputs (U, V, and W). Doing so will fail the servo amplifier and servo motor.



3) The grounding terminal of the servo motor is connected to the PE terminal of the servo amplifier.



4) The CN2 connector of the servo amplifier should be connected to the encoder of the servo motor securely using the encoder cable.

(c) When you use an option and peripheral equipment

1) 200 V class

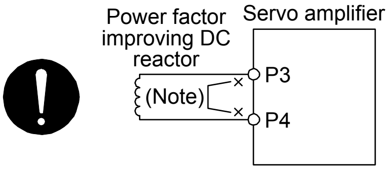
a) When you use a regenerative option for 5 kW or less servo amplifiers
  - The lead wire between P+ terminal and D terminal should not be connected.
  - The regenerative option should be connected to P+ terminal and C terminal.
  - Twisted wires should be used. (Refer to section 11.2.4.)

b) When you use a regenerative option for 7 kW or more servo amplifiers
  - For 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
  - The regenerative option should be connected to P+ terminal and C terminal.
  - Twisted wires should be used. (Refer to section 11.2.4.)

c) When you use a brake unit and power regeneration converter for 5 kW or more servo amplifiers
  - For 5 kW, the lead wire between P+ terminal and D terminal should not be connected.
  - For 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
  - Wires of a brake unit or power regeneration converter should be connected to P+ terminal and N- terminal. (Refer to section 11.3 and 11.4.)
  - Twisted wires should be used when wiring is over 5 m and equal to or less than 10 m using a brake unit. (Refer to section 11.3.)

d) When you use a power regeneration common converter
  - For 5 kW or less, the lead wire between P+ terminal and D terminal should not be connected.
  - For 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
  - The wire of power regeneration common converter should be connected to P4 terminal and N- terminal. (Refer to section 11.5.)

e) The power factor improving DC reactor should be connected between P3 and P4. (Refer to section 11.11.)



Note. Always disconnect between P3 and P4.

2) 400 V class

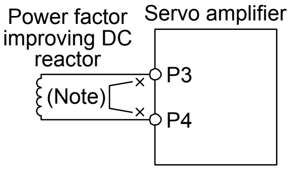
a) When you use a regenerative option for 3.5 kW or less servo amplifiers
  - The lead wire between P+ terminal and D terminal should not be connected.
  - The regenerative option should be connected to P+ terminal and C terminal.
  - Twisted wires should be used. (Refer to section 11.2.4.)

b) When you use a regenerative option for 5 kW or more servo amplifiers
  - For 5 kW and 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should be removed.
  - The regenerative option should be connected to P+ terminal and C terminal.
  - Twisted wires should be used. (Refer to section 11.2.4.)

c) When you use a brake unit and power regeneration converter for 5 kW or more servo amplifiers
  - For 5 kW and 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should be removed.
  - Wires of a brake unit or power regeneration converter should be connected to P+ terminal and N- terminal. (Refer to section 11.3 and 11.4.)
  - Twisted wires should be used when wiring is over 5 m and equal to or less than 10 m using a brake unit. (Refer to section 11.3.)

d) When you use a power regeneration common converter for 11 kW or more servo amplifiers
  - The wire of power regeneration common converter should be connected to P4 terminal and N- terminal. (Refer to section 11.5.)

e) The power factor improving DC reactor should be connected between P3 and P4. (Refer to section 11.11.)



Note. Always disconnect between P3 and P4.

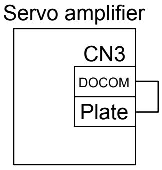
3) 100 V class
  - The lead wire between P+ terminal and D terminal should not be connected.
  - The regenerative option should be connected to P+ terminal and C terminal.
  - Twisted wires should be used. (Refer to section 11.2.4.)

(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN3 connector. You can use the function to check the wiring. In this case, switch on the control circuit power supply only.
Refer to section 3.2 for details of I/O signal connection.

(b) A voltage exceeding 24 V DC is not applied to the pins of the CN3 connector.

(c) Between the plate and DOCOM of the CN3 connector should not be shorted.



4.1.3 Surrounding environment

(1) Cable routing

(a) The wiring cables should not be stressed.

(b) The encoder cable should not be used in excess of its bending life. (Refer to section 10.4.)

(c) The connector of the servo motor should not be stressed.

(2) Environment

Signal cables and power cables are not shorted by wire offcuts, metallic dust or the like.

4.2 Startup

Connect the servo motor with a machine after confirming that the servo motor operates properly alone.

(1) Power on

When the main and control circuit power supplies are turned on, "b1" (for the first axis) appears on the servo amplifier display.

When you use the absolute position detection system, first power-on results in [AL. 25 Absolute position erased] and the servo system cannot be switched on. The alarm can be deactivated by then switching power off once and on again.

Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Parameter setting

POINT

●The following encoder cables are of four-wire type. When using any of these encoder cables, set [Pr. 23] to "_ 1 _ _" to select the four-wire type. Incorrect setting will result in [AL. 16 Encoder error 1].
MR-EKCBL30M-L
MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H
MR-ESCBL30M-L
MR-ESCBL30M-H
MR-ESCBL40M-H
MR-ESCBL50M-H

Set the parameters according to the structure and specifications of the machine. Refer to chapter 5 for details.

After setting the above parameters, turn off the power as necessary. Then switch power on again to enable the parameter values.

(3) Servo-on

Enable the servo-on with the following procedure.

(a) Switch on main circuit power supply and control circuit power supply.

(b) Transmit the servo-on command with the servo system controller.

When the servo-on status is enabled, the servo amplifier is ready to operate and the servo motor is locked.

(4) Home position return

Always perform home position return before starting positioning operation.

(5) Stop

If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop.

Refer to section 3.8 for the servo motor with an electromagnetic brake.

	Operation/command	Stopping condition
Servo system controller	Servo-off command	The base circuit is shut off and the servo motor coasts.
	Ready-off command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
	Forced stop command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop. [AL. E7 Controller forced stop warning] occurs.
Servo amplifier	Alarm occurrence	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
	EM1 (Forced stop) off	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop. [AL. E6 Servo forced stop warning] occurs.

4.3 Switch setting and display of the servo amplifier

Switching to the test operation mode and setting control axis No. are enabled with switches on the servo amplifier.

On the servo amplifier display (three-digit, seven-segment LED), check the status of communication with the servo system controller at power-on, and the axis number, and diagnose a malfunction at occurrence of an alarm.

4.3.1 Switches

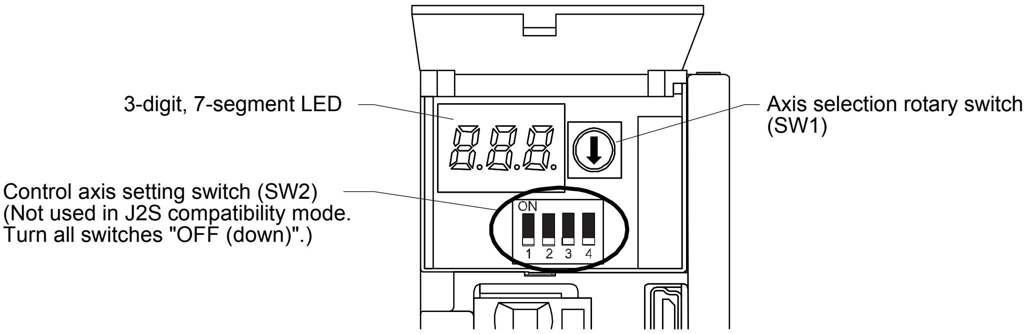
⚠WARNING

- ●When switching the axis selection rotary switch (SW1) and auxiliary axis number setting switch (SW2), use an insulated screw driver. Do not use a metal screw driver. Touching patterns on electronic boards, lead of electronic parts, etc. may cause an electric shock.

POINT

- ●Turning "ON (up)" all the control axis setting switches (SW2) enables an operation mode for manufacturer setting and displays "off". The mode is not available. Set the control axis setting switches (SW2) correctly according to this section.
- ●Cycling the main circuit power supply and control circuit power supply enables the setting of each switch.

The following shows the description of the axis selection rotary switch.

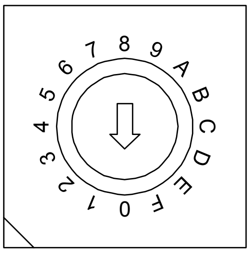


POINT

- The control axis No. set to the axis selection rotary switch (SW1) should be the same as the one set to the servo system controller. The number of the axes you can set depends on the servo system controller.
- For setting the axis selection rotary switch, use a flat-blade screwdriver with the blade edge width of 2.1 mm to 2.3 mm and the blade edge thickness of 0.6 mm to 0.7 mm.

Use the axis selection rotary switch (SW1) to set the control axis number for the servo.
If the same numbers are set to different control axes in a single communication system, the system will not operate properly. The control axes may be set independently of the SSCNET cable connection sequence.
Set the switch to "F" when performing the test operation mode by using MR Configurator.

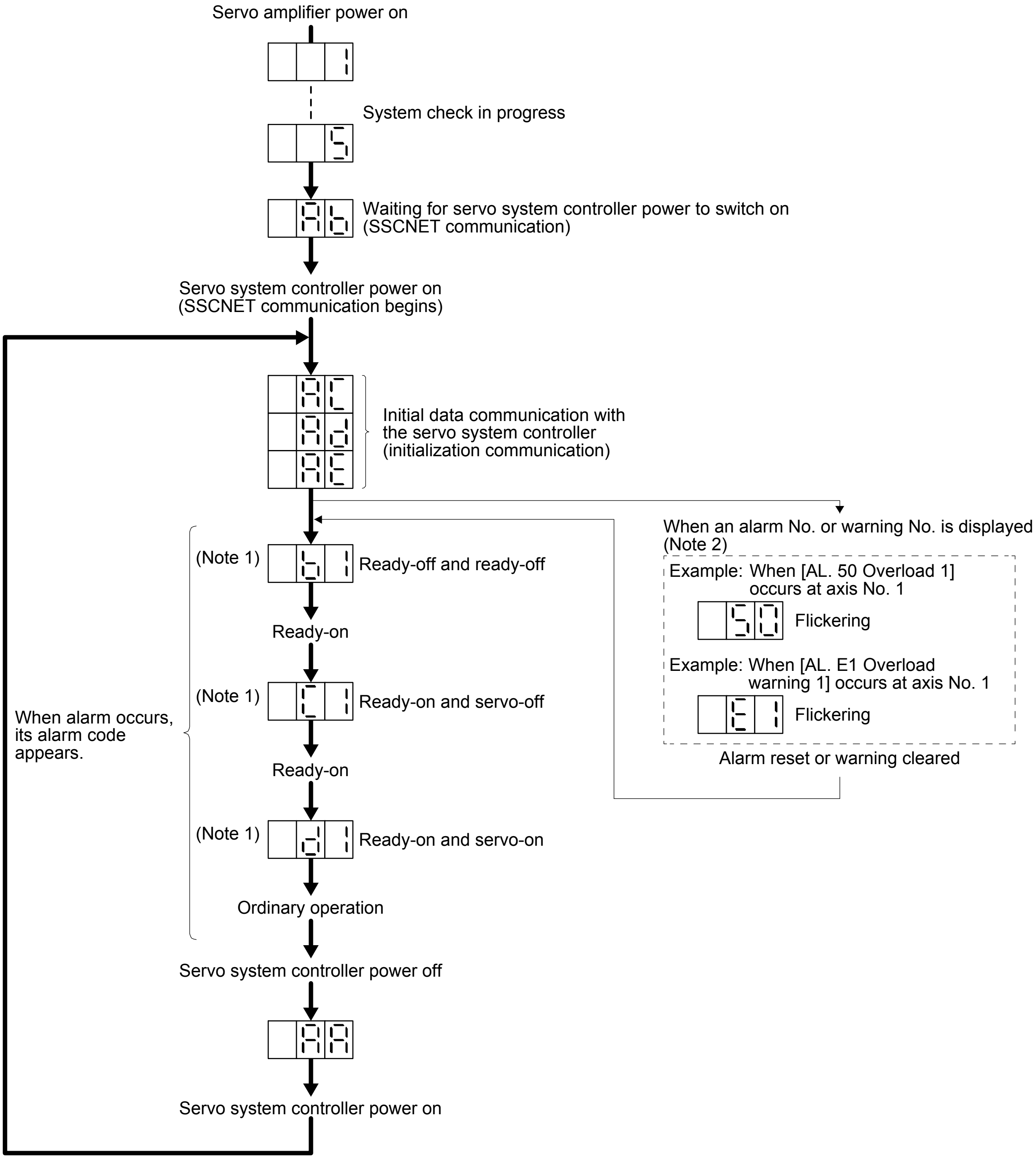
Axis selection rotary switch (SW1)



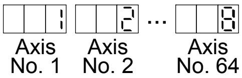
No.	Description
0	Axis No. 1
1	Axis No. 2
2	Axis No. 3
3	Axis No. 4
4	Axis No. 5
5	Axis No. 6
6	Axis No. 7
7	Axis No. 8
8	Not used in J2S compatibility mode.
9	
A	
B	
C	
D	
E	
F	Test operation mode or when a machine analyzer is used (Refer to section 6.1.2)

4.3.2 Status display of an axis

(1) Display sequence



Note 1.



The segment of the last 1 digit shows the axis number.

2. The alarm No. or warning No. is displayed, but the axis No. is not displayed.

(2) Indication list

Display	Status	Description
1 ¦ 5	Initializing	System check in progress
Ab	Initializing	・The servo amplifier power was switched on when the servo system controller power was off. ・The control axis No. set to the axis selection rotary switch (SW1) does not match the one set to the servo system controller. ・A servo amplifier malfunctioned, or communication error occurred with the servo system controller or the previous axis servo amplifier. In this case, the indication changes as follows: "Ab", "AC", "Ad", and "Ab" ・The servo system controller is malfunctioning.
AC	Initializing	Initial setting for communication specifications completed, and then it synchronized with servo system controller.
Ad	Initializing	During initial parameter setting communication with servo system controller
AE	Initializing	During the servo motor/encoder information and telecommunication with servo system controller
AA	Initializing standby	The power supply of servo system controller was turned off while the power supply of servo amplifier is on.
(Note 1) b#	Ready-off	The ready-off command from the servo system controller was received.
(Note 1) d#	Servo-on	The servo-on command from the servo system controller was received.
(Note 1) C#	Servo-off	The servo-off command from the servo system controller was received.
(Note 2) **	Alarm and warning	The alarm No. and the warning No. that occurred are displayed. (Refer to chapter 8.)
888	CPU error	CPU watchdog error has occurred.
b0.	(Note 3) Test operation mode	JOG operation, positioning operation, DO forced output, and program operation
(Note 1) b#. d#. C#.		JOG operation, positioning operation, program operation, output signal (DO) forced output, or motor-less operation was set.

Note 1. # denotes any of numerals 0 to 8 and what it means is listed below.

#	Description
0	Set to the test operation mode.
1 to 8	Axis No.1 to Axis No.8

2. "**" indicates the alarm No. and the warning No.
3. For JOG operation, positioning operation, DO forced output and program operation, MR Configurator is necessary.

4.4 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally.
Refer to section 4.2 for the power on and off methods of the servo amplifier.

POINT

- If necessary, verify controller program by using motor-less operation. Refer to section 4.5.2 for the motor-less operation.

Test operation of the servo motor alone in JOG operation of test operation mode

In this step, confirm that the servo amplifier and servo motor operate normally. With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor rotates correctly. Refer to section 4.5 for the test operation mode.

↓

Test operation of the servo motor alone by commands

In this step, confirm that the servo motor rotates correctly under the commands from the controller.
Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the machine does not operate in the intended direction, check the input signal.

↓

Test operation with the servo motor and machine connected

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the controller.
Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal.
Check any problems with the servo motor speed, load ratio, and other status display items with MR Configurator.
Then, check automatic operation with the program of the controller.

4.5 Test operation mode

⚠CAUTION

- The test operation mode is designed for checking servo operation. It is not for checking machine operation. Do not use this mode with the machine. Always use the servo motor alone.
- If the servo motor operates abnormally, use EM1 (Forced stop) to stop it.

POINT

- The content described in this section indicates that the servo amplifier and a personal computer are directly connected.

By using a personal computer and MR Configurator, you can execute JOG operation, positioning operation, DO forced output program operation without connecting the servo system controller.

4.5.1 Test operation mode in MR Configurator

POINT

- When you set the axis selection rotary switch (SW1) to "F", the SSCNET communication for the servo amplifier and the subsequent servo amplifiers is blocked.

(1) Test operation mode

(a) JOG operation

JOG operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on/off and whether the servo system controller is connected or not.
Exercise control on the JOG operation screen of MR Configurator.

1) Operation pattern

Item	Initial value	Setting range
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 20000

2) Operation method

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Stop	Click the "Stop" button.

(b) Positioning operation

Positioning operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on/off and whether the servo system controller is connected or not.
Exercise control on the positioning operation screen of MR Configurator.

1) Operation pattern

Item	Initial value	Setting range
Travel distance [pulse]	131072	0 to 9999999
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 20000

2) Operation method

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Pause	Click the "Pause" button.

(c) Program operation

Positioning operation can be performed in two or more operation patterns combined, without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on/off and whether the servo system controller is connected or not.

Exercise control on the program operation screen of MR Configurator. For full information, refer to the MR Configurator Installation Guide.

Operation	Screen control
Start	Click the "Start" button.
Stop	Click the "Reset" button.

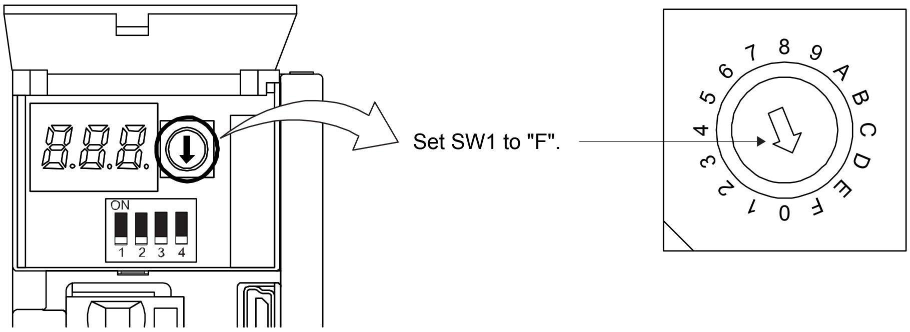
(d) Output signal (DO) forced output

Output signals can be switched on/off forcibly independently of the servo status. This function is used for output signal wiring check, etc. Exercise control on the DO forced output screen of MR Configurator.

(2) Operation procedure

1) Turn off the power.

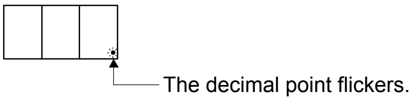
2) Set SW1 to "F".



Setting SW1 to "F" during power-on will not start the test operation mode.

3) Turn on the servo amplifier.

When initialization is completed, the decimal point on the first digit will flicker.



4) Start operation with the personal computer.

4.5.2 Motor-less operation in controller

POINT

- Motor-less operation cannot be used with MR Configurator. To use motor-less operation, set "_ 1 _ _" in [Pr. 24].
- Use motor-less operation which is available by making the servo system controller parameter setting.
- Connect the servo system controller to the servo amplifier before the motor-less operation.

(1) Motor-less operation

Without connecting the servo motor to the servo amplifier, output signals or status displays can be provided in response to the servo system controller commands as if the servo motor is actually running. This operation may be used to check the servo system controller sequence. Use this operation with the forced stop reset. Use this operation with the servo system controller connected to the servo amplifier. To stop the motor-less operation, set the motor-less operation selection to "Disable" in the servo parameter setting of the servo system controller. When the power supply is turned on next time, motor-less operation will be disabled.

(a) Load conditions

Load item	Condition
Load torque	0
Load to motor inertia ratio	Same as the moment of inertia of the servo motor

(b) Alarms

The following alarms and warning do not occur. However, the other alarms and warnings occur as when the servo motor is connected.

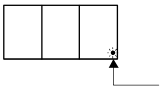
- [AL. 16 Encoder error 1]
- [AL. 20 Encoder error 2]
- [AL. 25 Absolute position erased]
- [AL. 92 Battery cable disconnection warning]
- [AL. 9F Battery warning]

(2) Operation procedure

1) Set the servo amplifier to the servo-off status.

2) Set "_ 1 _ _" in [Pr. 24] and turn off the servo amplifier power.

3) Turn on the servo amplifier.
When initialization is completed, the decimal point on the first digit will flicker.



The decimal point flickers.

4) Start the motor-less operation with the servo system controller.

5. PARAMETERS

⚠CAUTION

- ●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- ●If fixed values are written in the digits of a parameter, do not change these values.
- ●Do not change parameters for manufacturer setting.
- ●Do not set a value other than the described values to each parameter.

POINT

- ●When you connect the amplifier to a servo system controller, servo parameter values of the servo system controller will be written to each parameter.
- ●Setting may not be made to some parameters and their ranges depending on the servo system controller model, servo amplifier software version, and MR Configurator software version. For details, refer to the servo system controller user's manual.
- ●Changing operation mode initializes parameters. When operation mode is changed, make gain adjustment again.

5.1 Parameter list

POINT

- ●The parameter whose symbol is preceded by * is enabled with the following conditions:
  *: After setting the parameter, cycle the power.

5.1.1 Basic setting parameters

No.	Symbol	Name	Initial value	Unit
1	*AMS	Amplifier setting	0000h	
2	*REG	Regenerative resistor	0000h	
3		Automatically set from the servo system controller	0080h	
4			0000h	
5			1	
6	*FBP	Feedback pulse number (Note 2)	0	
7	*POL	Rotation direction selection	0	
8	ATU	Auto tuning	0001h	
9	RSP	Servo response	7 kW or less: 0005h 11 kW or more: 0002h	
10	TLP	Forward rotation torque limit (Note 1)	300	[%]
11	TLN	Reverse rotation torque limit (Note 1)	300	[%]

Note 1. The programming software of motion controller cannot set or change this parameter.
2. The initial value varies in the fully closed loop control mode as follows:

No.	Name	Initial value	
		Standard control mode	Fully closed loop control mode
6	Feedback pulse number	0	7 kW or less: 0 11 kW or more: 255

5.1.2 Adjustment parameters

No.	Symbol	Name	Initial value	Unit
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	7.0	[Multiplier]
13	PG1	Position loop gain 1	7 kW or less: 35 11 kW or more: 19	[rad/s]
14	VG1	Speed loop gain 1	7 kW or less: 177 11 kW or more: 96	[rad/s]
15	PG2	Position loop gain 2	7 kW or less: 35 11 kW or more: 19	[rad/s]
16	VG2	Speed loop gain 2	7 kW or less: 817 11 kW or more: 455	[rad/s]
17	VIC	Speed integral compensation	7 kW or less: 48 11 kW or more: 91	[ms]
18	NCH	Machine resonance suppression filter 1 (notch filter)	0000h	
19	FFC	Feed forward gain	0	[%]
20	INP	In-position range	100	[pulse]
21	MBR	Electromagnetic brake sequence output	0	[ms]
22	MOD	Analog monitor output	0001h	
23	*OP1	Option function 1	0000h	
24	*OP2	Option function 2	0000h	
25	LPF	Low-pass filter	0000h	
26		For manufacturer setting	0	

5.1.3 Extension parameters

No.	Symbol	Name	Initial value	Unit
27	MO1	Analog monitor 1 offset	0	[mV]
28	MO2	Analog monitor 2 offset	0	[mV]
29		For manufacturer setting	0001h	
30	ZSP	Zero speed	50	[r/min]
31	ERZ	Error excessive alarm level	8.0	[0.25 rev]
32	OP5	Option function 5	0000	
33	*OP6	Option function 6	0000	
34	VPI	PI-PID switching position droop	0	[pulse]
35		For manufacturer setting	0	
36	VDC	Speed differential compensation	980	
37		For manufacturer setting	0010h	
38	*ENR	Encoder output pulses	4000	[pulse/rev]
39	DBT	Electronic dynamic brake operating time	0	[ms]
40	*BLK	Parameter writing inhibit (Note)	0000h	

Note. The programming software of motion controller cannot set or change this parameter.

5.1.4 Extension parameters 2

No.	Symbol	Name	Initial value	Unit
41		For manufacturer setting	500	
42			0000h	
43			0111h	
44			20	
45			50	
46			0	
47			0	
48			0	
49	*CDP	Gain switching selection	0000h	
50	CDS	Gain switching condition	10	[kpulse/s]/ [pulse]/ [r/min]
51	CDT	Gain switching time constant	1	[ms]
52	GD2B	Ratio of load inertia to servo motor inertia 2	7.0	[Multiplier]
53	PG2B	Position loop gain 2 change ratio	100	[%]
54	VG2B	Speed loop gain 2 change ratio	100	[%]
55	VICB	Speed integral compensation change ratio	100	[%]
56	*OP8	Option function 8	0000h	
57		For manufacturer setting	0000h	
58	*OPA	Option function A (Note 1)	0000h	
59		For manufacturer setting	0000h	
60	*OPC	Option function C	0000h	
61	NH2	Machine resonance suppression filter 2	0000h	
62	*FCT	Fully closed loop selection (Note 2)	0000h	
63	BC1	Fully closed loop control error detection 1	400	[r/min]
64	BC2	Fully closed loop control error detection 2 (Note 2)	100	[0.1 rev]
65	*FCM	Fully closed loop electronic gear numerator	1	
66	*FCD	Fully closed loop electronic gear denominator	1	
67	DUF	Dual feedback filter (Note 2)	0	[rad/s]
68	FC2	Fully closed loop selection 2 (Note 2)	0	
69		For manufacturer setting	0	
70			0	
71			0	
72			0	
73			0	
74			0	
75			0	

Note 1. Used by servo amplifiers with software version A1 or later.

2. For the fully closed loop control mode, initial values are different as follows.

No.	Name	Initial value	
		Standard control mode	Fully closed loop control mode
62	Fully closed loop selection	0000	1300
64	Fully closed loop control error detection 2	100	10
67	Dual feedback filter	0	10
68	Fully closed loop selection 2	0	0000

5.2 Detailed list of parameters

POINT

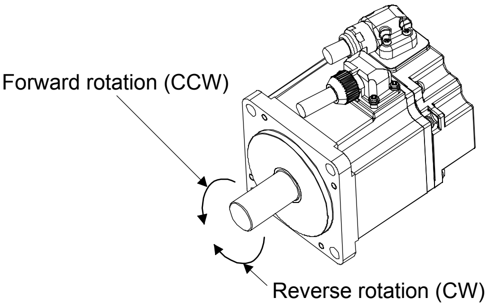
- ●Set a value to each "x" in the "Setting digit" columns.

5.2.1 Basic setting parameters

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>1</td><td>*AMS</td><td>Amplifier setting
Set this parameter when using the absolute position detection system.
When using this in the fully closed loop system, refer to section 15.4.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Absolute position detection system selection
0: Disabled (used in incremental system)
1: Enabled (used in absolute position detection system)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
2	*REG	Regenerative resistor Select the regenerative option. Incorrect setting may cause the regenerative option to burn. If a selected regenerative option is not for use with the servo amplifier, [AL. 37 Parameter error] occurs.	Refer to Name and function column.	

Setting digit	Explanation	Initial value
_ _ x x	Regenerative option selection 00: Regenerative option is not used. ・For servo amplifier of 100 W, regenerative option is not used. ・For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used. ・Supplied regenerative resistors or regenerative option is used with the servo amplifier of 11 kW to 22 kW. 01: FR-RC/FR-RC-H/FR-CV/FR-CV-H/FR-BU2/FR-BU2-H 05: MR-RB32 08: MR-RB30 09: MR-RB50 (Cooling fan is required.) 0B: MR-RB31 0C: MR-RB51 (Cooling fan is required.) 0E: When the supplied regenerative resistors are cooled by the cooling fan to increase the ability with the servo amplifier of 11 kW to 22 kW. 10: MR-RB032 11: MR-RB12 13: MR-RB5E 14: MR-RB5E (Cooling fan is required.) 17: MR-RB9F 18: MR-RB9F (Cooling fan is required.) 20: MR-RB3N 21: MR-RB5N (Cooling fan is required.) 23: MR-RB5R 24: MR-RB5R (Cooling fan is required.) 25: MR-RB9P 26: MR-RB9P (Cooling fan is required.) 27: MR-RB9T 28: MR-RB9T (Cooling fan is required.) 80: MR-RB3H-4 (Cooling fan is required.) 81: MR-RB5H-4 (Cooling fan is required.) 82: MR-RB3G-4 (Cooling fan is required.) 83: MR-RB5G-4 (Cooling fan is required.) 84: MR-RB34-4 (Cooling fan is required.) 85: MR-RB54-4 (Cooling fan is required.) 86: MR-RB1L-4 87: MR-RB3M-4 (Cooling fan is required.) 90: MR-RB1H-4 9C: MR-RB3U-4 (Cooling fan is required.) 9D: MR-RB5U-4 (Cooling fan is required.)	00h
_ x _ _	External dynamic brake selection 0: Disabled 1: Enabled When using an external dynamic brake with 11 kW or more servo amplifier, select "1".	0h
x _ _ _	For manufacturer setting	0h

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>6</td><td>*FBP</td><td>Feedback pulse number
Set the number of pulses per revolution of the servo motor in the controller side command unit. Information on the servo motor such as the cumulative feedback pulses, current position, droop pulses and within-one-revolution position are derived from the values converted into the number of pulses set here.
If the number of pulses set exceeds the actual servo motor encoder resolution, the servo motor encoder resolution is automatically set.
<table>
<tr><th>Setting value</th><th>Feedback pulse number</th></tr>
<tr><td>0</td><td>16384</td></tr>
<tr><td>1</td><td>8192</td></tr>
<tr><td>6</td><td>32768</td></tr>
<tr><td>7</td><td>131072</td></tr>
<tr><td>255</td><td>Depending on the number of servo motor encoder resolution pulses</td></tr>
</table>
</td><td>0</td><td>Refer to Name and function column.</td></tr>
<tr><td>7</td><td>*POL</td><td>Rotation direction selection
Select the rotation direction of command input pulse.
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>Positioning address increase</th><th>Positioning address decrease</th></tr>
<tr><td>0</td><td>CCW</td><td>CW</td></tr>
<tr><td>1</td><td>CW</td><td>CCW</td></tr>
</table>
The following shows the servo motor rotation directions.


</td><td>0</td><td>0
to
1</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
8	ATU	Auto tuning Select the gain adjustment mode.	Refer to Name and function column.	

Setting digit	Explanation	Initial value
_ _ _ x	Gain adjustment mode selection 0: Interpolation mode 1: Auto tuning mode 1 2: Manual mode 2 3: Auto tuning mode 2 4: Manual mode 1 Refer to table 5.1 for details.	1h
_ _ x _	For manufacturer setting	0h
_ x _ _		0h
x _ _ _		0h

Table 5.1 Gain adjustment mode selection

Setting value	Gain adjustment mode	Automatically adjusted parameter
_ _ _ 0	Interpolation mode	[Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)] [Pr. 15 Position loop gain 2] [Pr. 16 Speed loop gain 2] [Pr. 17 Speed integral compensation]
_ _ _ 1	Auto tuning Mode 1	[Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)] [Pr. 13 Position loop gain 1] [Pr. 14 Speed loop gain 1] [Pr. 15 Position loop gain 2] [Pr. 16 Speed loop gain 2] [Pr. 17 Speed integral compensation]
_ _ _ 2	Manual mode 2	
_ _ _ 3	Auto tuning Mode 2	[Pr. 13 Position loop gain 1] [Pr. 14 Speed loop gain 1] [Pr. 15 Position loop gain 2] [Pr. 16 Speed loop gain 2] [Pr. 17 Speed integral compensation]
_ _ _ 4	Manual mode1	[Pr. 14 Speed loop gain 1] [Pr. 15 Position loop gain 2]

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>9</td><td>RSP</td><td>Servo response
Set the auto tuning response.
If the machine hunts or generates large gear sound, decrease the set value.
To improve performance, e.g. shorten the settling time, increase the set value.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Response level setting
Refer to table 5.2 for settings.</td><td>7 kW or less: 05h
11 kW or more: 02h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table>
Table 5.2 Response level setting
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>1</td><td>Low response</td><td>15</td></tr>
<tr><td>2</td><td></td><td>20</td></tr>
<tr><td>3</td><td></td><td>25</td></tr>
<tr><td>4</td><td></td><td>30</td></tr>
<tr><td>5</td><td></td><td>35</td></tr>
<tr><td>6</td><td></td><td>45</td></tr>
<tr><td>7</td><td>Middle response</td><td>55</td></tr>
<tr><td>8</td><td></td><td>70</td></tr>
<tr><td>9</td><td>Middle response</td><td>85</td></tr>
<tr><td>A</td><td></td><td>105</td></tr>
<tr><td>B</td><td></td><td>130</td></tr>
<tr><td>C</td><td></td><td>160</td></tr>
<tr><td>D</td><td></td><td>200</td></tr>
<tr><td>E</td><td>High response</td><td>240</td></tr>
<tr><td>F</td><td></td><td>300</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>10</td><td>TLP</td><td>Forward rotation torque limit
Set the rated torque = 100%.
The parameter limits the torque in the forward rotation during power running and reverse rotation during regeneration.
In other than the test operation mode by MR Configurator, the torque limit value in the servo system controller is enabled.
To operate HG series servo motor at the maximum torque, set the torque limit value in the servo system controller at 500%. When the maximum torque is used in the test operation mode, set this parameter to 500%.</td><td>300
[%]</td><td>0
to
500</td></tr>
<tr><td>11</td><td>TLN</td><td>Reverse rotation torque limit
Set the rated torque = 100%.
The parameter limits the torque in reverse rotation during power running and forward rotation during regeneration.
In other than the test operation mode by MR Configurator, the torque limit value in the servo system controller is enabled.
To operate HG series servo motor at the maximum torque, set the torque limit value in the servo system controller at 500%. When the maximum torque is used in the test operation mode, set this parameter to 500%.</td><td>300
[%]</td><td>0
to
500</td></tr>
</table>

5.2.2 Adjustment parameters

No.	Symbol	Name and function	Initial value [unit]	Setting range
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio) Set the load moment of inertia to the moment of inertia on servo motor shaft (load inertia ratio). When auto tuning mode 1 or interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 6.1.1.)	7.0 [Multiplier]	0.0 to 300.0
13	PG1	Position loop gain 1 This is used to set the gain of the position loop. Increase the gain to improve track ability in response to the position command. When the auto turning mode 1 or auto turning mode 2 is selected, the result of auto turning is automatically used.	7 kW or less: 35 [rad/s] 11 kW or more: 19 [rad/s]	4 to 2000
14	VG1	Speed loop gain 1 Normally, changing this parameter is not required. Increasing the setting value will also increase the response level but will be liable to generate vibration and noise. When the auto tuning mode 1, auto tuning mode 2, or manual mode 1 is selected, the result of auto tuning is automatically used.	7 kW or less: 177 [rad/s] 11 kW or more: 96 [rad/s]	20 to 8000
15	PG2	Position loop gain 2 This is used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Increasing the setting value will also increase the response level but will be liable to generate vibration and noise. When auto tuning mode 1, auto tuning mode 2, manual mode 1, or interpolation mode is selected, the result of auto tuning is automatically used.	7 kW or less: 35 [rad/s] 11 kW or more: 19 [rad/s]	1 to 1000
16	VG2	Speed loop gain 2 Set this parameter when vibration occurs on machines of low rigidity or large backlash. Increasing the setting value will also increase the response level but will be liable to generate vibration and noise. When the auto tuning mode 1, auto tuning mode 2, or interpolation mode is selected, the result of auto tuning is automatically used.	7 kW or less: 817 [rad/s] 11 kW or more: 455 [rad/s]	20 to 20000
17	VIC	Speed integral compensation Set the time constant of the integral compensation. When the auto tuning mode 1, auto tuning mode 2, or interpolation mode is selected, the result of auto tuning is automatically used.	7 kW or less: 48 [ms] 11 kW or more: 91 [ms]	1 to 1000

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>18</td><td>NCH</td><td>Machine resonance suppression filter 1 (notch filter)
Select the machine resonance suppression filter. (Refer to section 7.1.1.)
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Notch frequency selection
Refer to table 5.3 for settings.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
Table 5.3 Notch frequency selection
<table>
<tr><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th></tr>
<tr><td>00</td><td>Disabled</td><td>10</td><td>281.3</td></tr>
<tr><td>01</td><td>4500</td><td>11</td><td>264.7</td></tr>
<tr><td>02</td><td>2250</td><td>12</td><td>250</td></tr>
<tr><td>03</td><td>1500</td><td>13</td><td>236.8</td></tr>
<tr><td>04</td><td>1125</td><td>14</td><td>225</td></tr>
<tr><td>05</td><td>900</td><td>15</td><td>214.3</td></tr>
<tr><td>06</td><td>750</td><td>16</td><td>204.5</td></tr>
<tr><td>07</td><td>642.9</td><td>17</td><td>195.7</td></tr>
<tr><td>08</td><td>562.5</td><td>18</td><td>187.5</td></tr>
<tr><td>09</td><td>500</td><td>19</td><td>180</td></tr>
<tr><td>0A</td><td>450</td><td>1A</td><td>173.1</td></tr>
<tr><td>0B</td><td>409.1</td><td>1B</td><td>166.7</td></tr>
<tr><td>0C</td><td>375</td><td>1C</td><td>160.1</td></tr>
<tr><td>0D</td><td>346.2</td><td>1D</td><td>155.2</td></tr>
<tr><td>0E</td><td>321.4</td><td>1E</td><td>150</td></tr>
<tr><td>0F</td><td>300</td><td>1F</td><td>145.2</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>19</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain.
When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1 s or more as the acceleration time constant up to the rated speed.</td><td>0
[%]</td><td>0
to
100</td></tr>
<tr><td>20</td><td>INP</td><td>In-position range
Set an in-position range per command pulse.</td><td>100
[pulse]</td><td>0
to
50000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>21</td><td>MBR</td><td>Electromagnetic brake sequence output
Set the delay time from MBR (Electromagnetic brake interlock) off to base circuit shut-off.</td><td>0
[ms]</td><td>0
to
1000</td></tr>
<tr><td>22</td><td>MOD</td><td>Analog monitor output
Select the signals to output to MO1 (Analog monitor 1) and MO2 (Analog monitor 2). Refer to app. 9 (3) for detection point of output selection.
When using this in the fully closed loop system, refer to section 15.4.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Analog monitor 2 output selection
Refer to table 5.4 for settings.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Analog monitor 1 output selection
Refer to table 5.4 for settings.</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
Table 5.4 Analog monitor setting value
<table>
<tr><th>Setting value</th><th>Item</th></tr>
<tr><td>0</td><td>Servo motor speed (±8 V/max. speed)</td></tr>
<tr><td>1</td><td>Torque (±8 V/max. torque) (Note 1)</td></tr>
<tr><td>2</td><td>Servo motor speed (+8 V/max. speed)</td></tr>
<tr><td>3</td><td>Torque (+8 V/max. torque) (Note 1)</td></tr>
<tr><td>4</td><td>Current command (±8 V/max. current command)</td></tr>
<tr><td>5</td><td>Speed command (±8 V/max. speed)</td></tr>
<tr><td>6</td><td>Droop pulses (±10 V/1128 pulses) (Note 2)</td></tr>
<tr><td>7</td><td>Droop pulses (±10 V/2048 pulses) (Note 2)</td></tr>
<tr><td>8</td><td>Droop pulses (±10 V/8192 pulses) (Note 2)</td></tr>
<tr><td>9</td><td>Droop pulses (±10 V/32768 pulses) (Note 2)</td></tr>
<tr><td>A</td><td>Droop pulses (±10 V/131072 pulses) (Note 2)</td></tr>
<tr><td>B</td><td>Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V)</td></tr>
</table>
Note 1. 8 V is outputted at the maximum torque.
2. Encoder pulse unit</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>23</td><td>*OP1</td><td>Option function 1
The servo forced stop function can be disabled.
When using this in the fully closed loop system, refer to section 15.4.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Servo forced stop selection
0: Enabled (EM1 (Forced stop) is used.)
1: Disabled (EM1 (Forced stop) is not used.)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder cable communication method selection
0: Two-wire type
1: Four-wire type
Incorrect setting will result in [AL. 16 Encoder error 1].</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>24</td><td>*OP2</td><td>Option function 2
Select the slight vibration suppression control and motor-less operation.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Slight vibration suppression control selection
0: Disabled
1: Enabled
To enable the slight vibration suppression control, select "Manual mode 2 (_ _ _ 2)" of "Gain adjustment mode selection" in [Pr. 8].</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Motor-less operation selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>25</td><td>LPF</td><td>Low-pass filter
Select the low-pass filter. (Refer to section 7.1.2.)
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Low-pass filter selection
0: Enabled (automatic tuning)
1: Disabled
When enabled, the filter band in the following equation is automatically set.
For 1 kW or less
$\frac{\text{VG2 setting value} \times 10}{2\pi \times (1 + \text{GD2 setting value} \times 0.1)}$ [Hz]
For 2 kW or more
$\frac{\text{VG2 setting value} \times 5}{2\pi \times (1 + \text{GD2 setting value} \times 0.1)}$ [Hz]</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting
(This servo amplifier is not compatible with adaptive vibration suppression control.)</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

5.2.3 Extension parameters

No.	Symbol	Name and function	Initial value [Unit]	Setting range
27	MO1	Analog monitor 1 offset Set the offset voltage of MO1 (Analog monitor 1).	0 [mV]	-999 to 999
28	MO2	Analog monitor 2 offset Set the offset voltage of MO2 (Analog monitor 2).	0 [mV]	-999 to 999
30	ZSP	Zero speed Set the output range of zero speed command sent to the controller.	50 [r/min]	0 to 10000
31	ERZ	Error excessive alarm level Set the range for [AL. 52 Error excessive] to occur.	8.0 [0.25 rev]	0.1 to 100.0

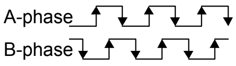
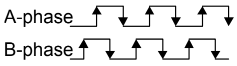
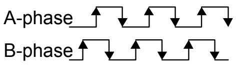
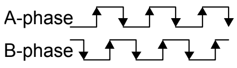
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>32</td><td>*OP5</td><td>Option function 5
Select the PI-PID switching control.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>PI-PID switching control selection
0: Continuous PI control enabled
1: Droop-based switching is valid in the position control mode. (Refer to [Pr. 34].)
2: Continuous PID control enabled
If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the PC (Proportion control) upon positioning completion will suppress the unnecessary torque generated to compensate for a position shift.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>33</td><td>*OP6</td><td>Option function 6
Set the serial communication baud rate selection, serial communication response delay time, and encoder output pulse setting selection.
When using this in the fully closed loop system, refer to section 15.4.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Serial communication baud rate selection
0: 9600 [bps]
1: 19200 [bps]
2: 38400 [bps]
3: 57600 [bps]</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Serial communication response delay time
0: Disabled
1: Enabled (responding after 800 μs or more delay time)</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder output pulse setting selection (Refer to [Pr. 38].)
0: Output pulse specification
1: Division ratio setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>34</td><td>VPI</td><td>PI-PID switching position droop
Set the position droop value (the number of pulses) at which PI control is switched over to PID control.
Setting "0 0 0 1" in [Pr. 32] enables this parameter.</td><td>0 or less
[pulse]</td><td>0
to
50000</td></tr>
<tr><td>36</td><td>VDC</td><td>Speed differential compensation
This is used to set the differential compensation.</td><td>980</td><td>0
to
1000</td></tr>
</table>

No.	Symbol	Name and function	Initial value [Unit]	Setting range
38	*ENR	Encoder output pulses Set the encoder pulses (A-phase and B-phase) output by the servo amplifier. Set the four-fold value of the A-phase and B-phase pulses. When using this in the fully closed loop system, refer to section 15.4. You can use [Pr. 33] to choose the output pulse setting or output dividing ratio setting. The number of A-phase and B-phase pulses actually output is one fourth of the preset number of pulses. The maximum output frequency is 1.3 Mpulses/s (after multiplication by four). Use this parameter within this range. 1. For output pulse designation Set "_ 0 _ _ (initial value)" in [Pr. 33]. Set the number of pulses per servo motor revolution. Output pulse = Setting value [pulse/rev] For instance, when "5600" is set, the actual A/B-phase output pulses are as indicated below. A-phase and B-phase output pulses = 5600/4 = 1400 [pulse] 2. For output dividing ratio setting Set "_ 1 _ _" in [Pr. 33]. The number of pulses per servo motor revolution is divided by the set value. Output pulse = Encoder resolution per servo motor revolution/Setting value [pulse/rev] For instance, when "8" is set, the actual A/B-phase output pulses are as indicated below. A-phase and B-phase pulses = 131072/8 x 1/4 = 4069 [pulse]	4000 [pulse/rev]	0 to 65535
39	DBT	Electronic dynamic brake operating time Set an operating time for the electronic dynamic brake. However, when "0" is set, the operating time is 2000 ms.	0 [ms]	0 to 10000
40	*BLK	Parameter writing inhibit Select a reference range and writing range of the parameter. Refer to table 5.5 for settings.	0000h	Refer to Name and function column.

Table 5.5 [Pr. 40] setting value and reading/writing range

Pr. 40	Setting operation	Operation from controller	Operation from MR Configurator
0000h (initial value)	Reading	[Pr. 1] to [Pr. 75]	[Pr. 1] to [Pr. 11], [Pr. 40]
	Writing		
000Ah	Reading		[Pr. 40]
	Writing		
000Ch	Reading		[Pr. 1] to [Pr. 40]
	Writing		[Pr. 1] to [Pr. 11], [Pr. 40]
000Eh	Reading		[Pr. 1] to [Pr. 40]
	Writing		
000Fh	Reading		[Pr. 1] to [Pr. 75]
	Writing		
100Eh	Reading		[Pr. 1] to [Pr. 40]
	Writing		[Pr. 40]

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>49</td><td>*CDP</td><td>Gain switching selection
Select the gain switching condition. (Refer to section 7.2.)
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Gain switching selection
The gain is changed depending on the setting value of [Pr. 52] to [Pr. 55] with the following conditions.
0: Disabled
1: Control command from controller
2: Command frequency is the [Pr. 50] setting value or more.
3: Droop pulses is the [Pr. 50] setting value or more.
4: Servo motor speed is the [Pr. 50] setting value or more.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>50</td><td>CDS</td><td>Gain switching condition
Set the value of gain switching (command frequency, droop pulses, or servo motor speed) selected in [Pr. 49].
The set value unit differs depending on the switching condition item. (Refer to section 7.2.)</td><td>10
[kpulse/s]
/[pulse]
/[r/min]</td><td>0
to
9999</td></tr>
<tr><td>51</td><td>CDT</td><td>Gain switching time constant
Set the time constant at which the gains will change in response to the conditions set in [Pr. 49] and [Pr. 50]. (Refer to section 7.2.)</td><td>1
[ms]</td><td>0
to
100</td></tr>
<tr><td>52</td><td>GD2B</td><td>Ratio of load inertia to servo motor inertia 2
Set the load to motor inertia ratio when gain switching is enabled.</td><td>7.0
[Multiplier]</td><td>0.0
to
300.0</td></tr>
<tr><td>53</td><td>PG2B</td><td>Position loop gain 2 change ratio
Set the change ratio against position loop gain 2 when gain switching is enabled. Enabled when the auto tuning is disabled.</td><td>100
[%]</td><td>10
to
200</td></tr>
<tr><td>54</td><td>VG2B</td><td>Speed loop gain 2 change ratio
Set the change ratio against speed loop gain 2 when gain switching is enabled. Enabled when the auto tuning is disabled.</td><td>100
[%]</td><td>10
to
200</td></tr>
<tr><td>55</td><td>VICB</td><td>Speed integral compensation change ratio
Set the change ratio against speed integral compensation when gain switching is enabled. Enabled when the auto tuning is disabled.</td><td>100
[%]</td><td>50
to
1000</td></tr>
<tr><td>56</td><td>*OP8</td><td>Option function 8
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Electronic dynamic brake selection
0: Automatic (enabled only for specified servo motors)
2: Disabled
Refer to the following table for the specified servo motors.
<table>
<tr><th>Series</th><th>Servo motor</th></tr>
<tr><td>HG-KR</td><td>HG-KR053/HG-KR13/HG-KR23/HG-KR43</td></tr>
<tr><td>HG-MR</td><td>HG-MR053/HG-MR13/HG-MR23/HG-MR43</td></tr>
<tr><td>HG-SR</td><td>HG-SR51/HG-SR52</td></tr>
</table>
</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>58</td><td>*OPA</td><td>Option function A
This is used to select enabled or disabled for the thermistor of the servo motor.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Servo motor thermistor enabled/disabled selection
0: Enabled
1: Disabled
For servo motors without thermistor, the setting will be disabled.
This parameter is used by servo amplifier with software version A1 or later.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>60</td><td>*OPC</td><td>Option function C
Select the encoder output pulse setting.
When using this in the fully closed loop system, refer to section 15.4.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder output pulse phase selection
0: Increasing A-phase 90° in CCW
1: Increasing A-phase 90° in CW
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>CCW</th><th>CW</th></tr>
<tr><td>0</td><td> </td><td> </td></tr>
<tr><td>1</td><td> </td><td> </td></tr>
</table>
</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>61</td><td>NH2</td><td>Machine resonance suppression filter 2
Select the machine resonance suppression filter 2. (Refer to section 7.1.1.)
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Notch frequency selection
Refer to table 5.6 for settings.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
Table 5.6 Notch frequency selection
<table>
<tr><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th></tr>
<tr><td>00</td><td>Disabled</td><td>10</td><td>281.3</td></tr>
<tr><td>01</td><td>4500</td><td>11</td><td>264.7</td></tr>
<tr><td>02</td><td>2250</td><td>12</td><td>250</td></tr>
<tr><td>03</td><td>1500</td><td>13</td><td>236.8</td></tr>
<tr><td>04</td><td>1125</td><td>14</td><td>225</td></tr>
<tr><td>05</td><td>900</td><td>15</td><td>214.3</td></tr>
<tr><td>06</td><td>750</td><td>16</td><td>204.5</td></tr>
<tr><td>07</td><td>642.9</td><td>17</td><td>195.7</td></tr>
<tr><td>08</td><td>562.5</td><td>18</td><td>187.5</td></tr>
<tr><td>09</td><td>500</td><td>19</td><td>180</td></tr>
<tr><td>0A</td><td>450</td><td>1A</td><td>173.1</td></tr>
<tr><td>0B</td><td>409.1</td><td>1B</td><td>166.7</td></tr>
<tr><td>0C</td><td>375</td><td>1C</td><td>160.1</td></tr>
<tr><td>0D</td><td>346.2</td><td>1D</td><td>155.2</td></tr>
<tr><td>0E</td><td>321.4</td><td>1E</td><td>150</td></tr>
<tr><td>0F</td><td>300</td><td>1F</td><td>145.2</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>62</td><td>*FCT</td><td colspan="3">Fully closed loop selection
This parameter is only for the fully closed loop system. Refer to section 15.4.</td></tr>
<tr><td>63</td><td>BC1</td><td colspan="3">Fully closed loop control error detection 1
This parameter is only for the fully closed loop system. Refer to section 15.4.</td></tr>
<tr><td>64</td><td>BC2</td><td colspan="3">Fully closed loop control error detection 2
This parameter is only for the fully closed loop system. Refer to section 15.4.</td></tr>
<tr><td>65</td><td>*FCM</td><td colspan="3">Fully closed loop electronic gear numerator
This parameter is only for the fully closed loop system. Refer to section 15.4.</td></tr>
<tr><td>66</td><td>*FCD</td><td colspan="3">Fully closed loop electronic gear denominator
This parameter is only for the fully closed loop system. Refer to section 15.4.</td></tr>
</table>

MEMO

6. NORMAL GAIN ADJUSTMENT

POINT

- In the torque control mode, you do not need to make gain adjustment.
- Before making gain adjustment, check that your machine is not being operated at maximum torque of the servo motor. If operated over maximum torque, the machine may vibrate and may operate unexpectedly. Make gain adjustment with a safety margin considering characteristic differences of each machine. It is recommended that generated torque during operation is under 90% of the maximum torque of the servo motor.
- When using [Pr. 13 Position loop gain 1] of MR-J4-_B_-RJ020 and MR-J2S-_B_ simultaneously such as in the interpolation mode, check droop pulses for each axis and readjust gains.

6.1 Different adjustment methods

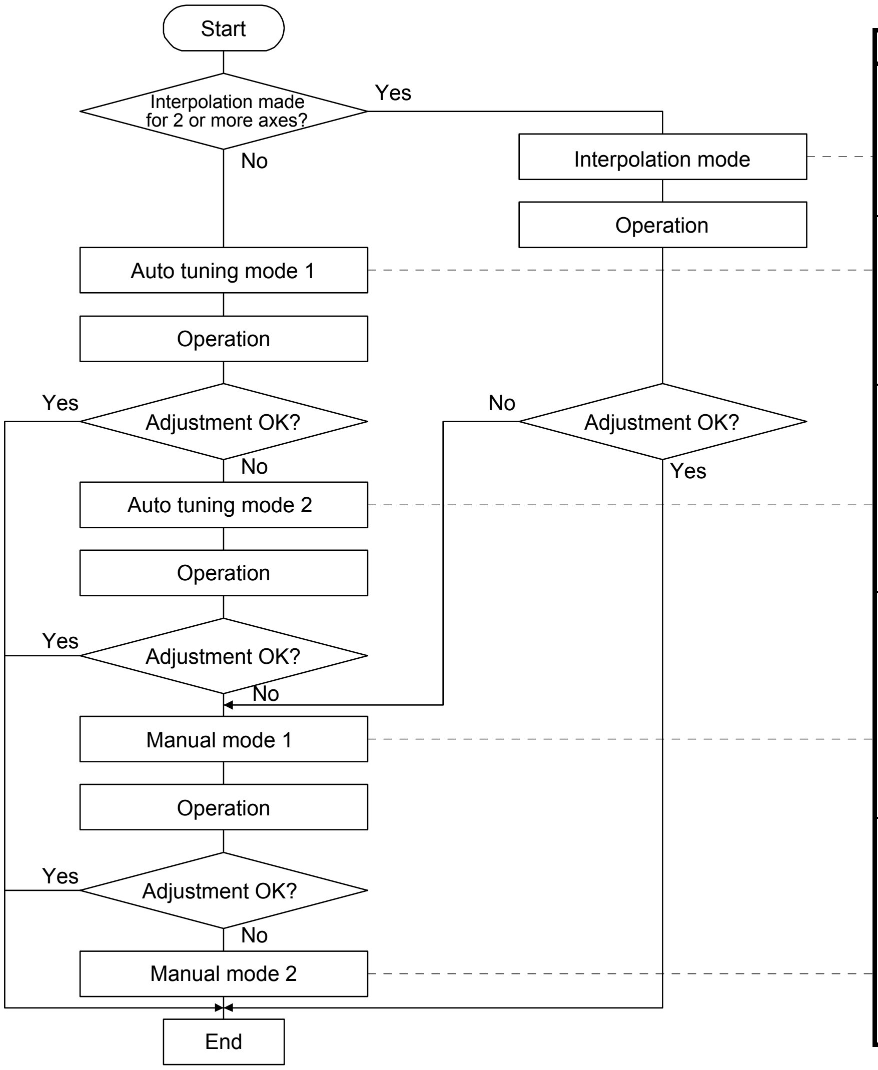
6.1.1 Adjustment on a single servo amplifier

The following shows the gain adjustment modes that can be set on a single servo amplifier. For gain adjustment, first execute "Auto tuning mode 1". If you are not satisfied with the result of the adjustment, execute "Auto tuning mode 2", "Manual mode 1" and "Manual mode 2" in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	[Pr. 8] setting	Estimation of load to motor inertia ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	_ _ _ 1	Always estimated	GD2 ([Pr. 12]) PG1 ([Pr. 13]) VG1 ([Pr. 14]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])	RSP ([Pr. 9])
Auto tuning mode 2	_ _ _ 3	Fixed to [Pr. 12] value	PG1 ([Pr. 13]) VG1 ([Pr. 14]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])	GD2 ([Pr. 12]) RSP ([Pr. 9])
Manual mode 1	_ _ _ 4		VG1 ([Pr. 14]) PG2 ([Pr. 15])	GD2 ([Pr. 12]) PG1 ([Pr. 13]) VG2 ([Pr. 16]) VIC ([Pr. 17])
Manual mode 2	_ _ _ 2			GD2 ([Pr. 12]) PG1 ([Pr. 13]) VG1 ([Pr. 14]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])
Interpolation mode	_ _ _ 0	Always estimated	GD2 ([Pr. 12]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])	PG1 ([Pr. 13]) VG1 ([Pr. 14])

(2) Adjustment sequence and mode usage



Usage
Used when you want to match PG1 (position gain) between 2 or more axes. Normally not used for other purposes.
Allows adjustment by merely changing the response level setting. First, use this mode to make adjustment.
Used when the condition of "Auto tuning mode 1" is not satisfied or the load to motor inertia ratio could not be estimated properly.
This mode permits adjustment easily with three gains if you were not satisfied with auto tuning results.
You can adjust all gains manually when you want to do fast settling or the like.

6.1.2 Adjustment using MR Configurator

POINT

- When using the machine analyzer, set the axis No. of servo amplifier to "F". (Refer to section 4.3.1.)

This section explains the functions and adjustment using the servo amplifier with MR Configurator.

Function	Description	Adjustment
Machine analyzer	With the machine and servo motor coupled, the characteristic of the mechanical system can be measured by giving a random vibration command from a personal computer to the servo and measuring the machine response.	· You can grasp the machine resonance frequency and determine the notch frequency of the machine resonance suppression filter. · You can automatically set the optimum gains in response to the machine characteristic. This simple adjustment is suitable for a machine which has large machine resonance and does not require much settling time.

6.2 Auto tuning

6.2.1 Auto tuning mode

The servo amplifier has a real-time auto tuning function which estimates the machine characteristic (load to motor inertia ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the servo amplifier.

(1) Auto tuning mode 1

The servo amplifier is factory-set to "Auto tuning mode 1".

In this mode, the load to motor inertia ratio of a machine is always estimated to set the optimum gains automatically.

The following parameters are automatically adjusted in "Auto tuning mode 1".

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
13	PG1	Position loop gain 1
14	VG1	Speed loop gain 1
15	PG2	Position loop gain 2
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

POINT

- "Auto tuning mode 1" may not be performed properly if all of the following conditions are not satisfied.
  - The acceleration/deceleration time constant to reach 2000 r/min is 5 s or less.
  - Speed is 150 r/min or higher.
  - The load to motor inertia ratio is 100 times or less.
  - The acceleration/deceleration torque is 10% or more of the rated torque.
- Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use "Auto tuning mode 2", "Manual mode 1" or "Manual mode 2" to make gain adjustment.

(2) Auto tuning mode 2

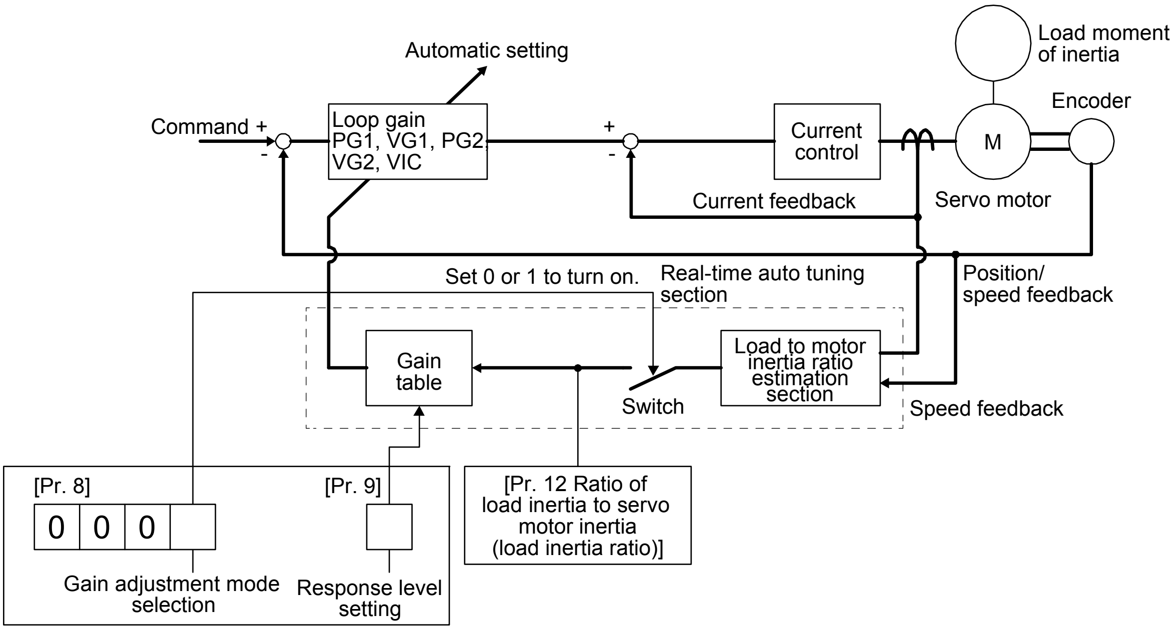
Use "Auto tuning mode 2" when proper gain adjustment cannot be made by "Auto tuning mode 1". Since the load to motor inertia ratio is not estimated in this mode, set the value of a correct load to motor inertia ratio in [Pr. 12].

The following parameters are automatically adjusted in "Auto tuning mode 2".

Parameter	Symbol	Name
13	PG1	Position loop gain 1
14	VG1	Speed loop gain 1
15	PG2	Position loop gain 2
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

6.2.2 Auto tuning mode basis

The block diagram of real-time auto tuning is shown below.



When a servo motor is accelerated/decelerated, the load to motor inertia ratio estimation section always estimates the load to motor inertia ratio from the current and speed of the servo motor. The results of estimation are written to [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio). These results can be confirmed on the status display screen of the MR Configurator.

If you have already known the value of the load to motor inertia ratio or failed to estimate, set "Gain adjustment mode selection" to "Auto tuning mode 2 (_ _ _ 3)" in [Pr. 8] to stop the estimation (turning off the switch in the above diagram), and set the load to motor inertia ratio ([Pr. 12]) manually.

From the preset load to motor inertia ratio ([Pr. 12]) value and response ([Pr. 9]), the optimum loop gains are automatically set on the basis of the internal gain table.

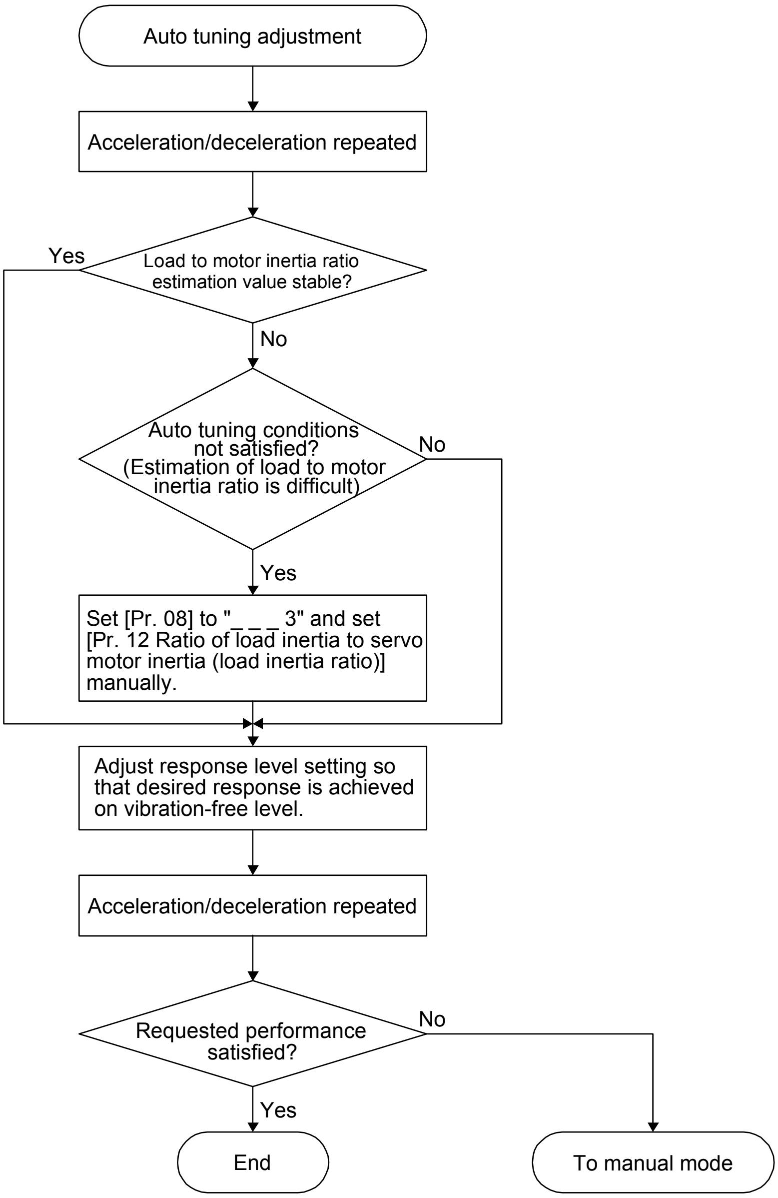
The auto tuning results are saved in the motion controller about every 10 s since power-on. At power-on, auto tuning is performed with the value of each loop gain saved in the motion controller being used as an initial value.

POINT

- If sudden disturbance torque is imposed during operation, the load to motor inertia ratio may be misestimated temporarily. In such a case, set "Gain adjustment mode selection" to "Auto tuning mode 2 (_ _ _ 3)" in [Pr. 8] and then set the correct load to motor inertia ratio in [Pr. 12].
- When any of "Auto tuning mode 1", "Auto tuning mode 2" or "Manual mode 1" settings is changed to the manual mode setting, the current loop gains and load to motor inertia ratio estimation value are saved in the EEP-ROM.

6.2.3 Adjustment procedure by auto tuning

Since auto tuning is enabled before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



6.2.4 Response level setting in auto tuning mode

Set the response of the whole servo system by [Pr. 9]. As the response level setting is increased, the track ability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained within the vibration-free range.
If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100 Hz, [Pr. 18 Machine resonance suppression filter 1 (notch filter)] may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. For changing the setting value of the machine resonance suppression filter, refer to 7.1.1.

[Pr. 9]

Setting value	Machine characteristic	
	Response	Guideline for machine resonance frequency [Hz]
1	Low response	15
2	↑	20
3		25
4		30
5		35
6		45
7		55
8	Middle response	70
9		85
A		105
B		130
C		160
D		200
E	↓	240
F	High response	300

6.3 Manual mode 1 (simple manual adjustment)

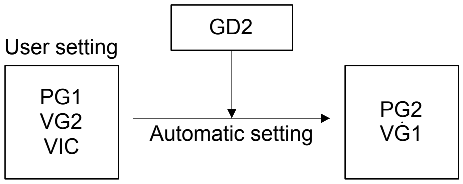
If you are not satisfied with the adjustment of auto tuning, you can make manual adjustment with all gains.

POINT

- If the machine resonance occurs, you can suppress the machine resonance with [Pr. 18 Machine resonance suppression filter 1 (notch filter)]. (Refer to section 7.1.1.)

6.3.1 Manual mode 1 basis

In this mode, setting of three gains of PG1 (position loop gain 1), VG2 (speed loop gain 2) and VIC (speed integral compensation) automatically sets the other gains to the optimum values according to these gains.



Therefore, you can adjust the model adaptive control system in the same image as the general PI control systems (position gain, speed gain and speed integral time constant). Here, the position corresponds to PG1, speed gain to VG2 and speed integral compensation time constant to VIC. When you adjust the gain with this mode, set [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)] properly.

6.3.2 Adjustment by manual mode 1

(1) For speed control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode 2 ([Pr. 8]: _ _ _ 2).	
3	Set an estimated value in [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)].	
4	Increase the [Pr. 16 Speed loop gain 2] within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
5	Decrease the [Pr. 17 Speed integral compensation] within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
6	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the machine resonance suppression filter and then executing steps 4 and 5.	Suppression of machine resonance Refer to section 7.1.1.
7	While checking the motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. 16 Speed loop gain 2]

This parameter determines the response level of the speed control loop. Increasing the setting increases the response level, but the mechanical system is liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency [Hz]} = \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$

2) [Pr. 17 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting [ms]} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain 2/(1 + Load to motor inertia ratio)}}$$

(2) For position control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
13	PG1	Position loop gain 1
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode 2 ([Pr. 8]: _ _ _ 2).	
3	Set an estimated value in [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)].	
4	Set a slightly smaller value in [Pr. 13 Position loop gain 1].	
5	Increase the [Pr. 16 Speed loop gain 2] within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the [Pr. 17 Speed integral compensation] within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the [Pr. 13 Position loop gain 1], and return slightly if vibration takes place.	Increase the position loop gain.
8	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the machine resonance suppression filter and then executing steps 5 to 7.	Suppression of machine resonance Refer to section 7.1.1.
9	While checking the settling characteristic and motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. 16 Speed loop gain 2]

This parameter determines the response level of the speed control loop. Increasing the setting increases the response level, but the mechanical system is liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency [Hz]} = \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$

2) [Pr. 17 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting [ms]} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain 2/(1 + Load to motor inertia ratio)}}$$

3) [Pr. 13 Position loop gain 1]

This parameter determines the response level to a disturbance to the position control loop. Increasing the position loop gain 1 increases the response level to a disturbance, but the mechanical system is liable to vibrate.

$$\text{Position loop gain 1 guideline} \leq \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$
$$\times \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio})} \left(\frac{1}{3} \text{ to } \frac{1}{5}\right)$$

6.4 Interpolation mode

The interpolation mode is used to match the position loop gains of the axes when performing the interpolation operation of servo motors of two or more axes for an X-Y table or the like. In this mode, manually set the position loop gain 1 and speed loop gain 1 that determine command track ability. Other parameters for gain adjustment are set automatically.

(1) Parameter

(a) Automatically adjusted parameter

The following parameters are automatically adjusted by auto tuning.

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
15	PG2	Position loop gain 2
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

(b) Manually adjusted parameter

The following parameters are adjustable manually.

Parameter	Symbol	Name
13	PG1	Position loop gain 1
14	VG1	Speed loop gain 1

(2) Interpolation mode adjustment procedure

Step	Operation	Description
1	Set the auto tuning mode 1 ([Pr. 8: _ _ _ 1]) and machine resonance frequency of response level to 15 Hz ([Pr. 9: _ _ _ 1]).	Select the auto tuning mode 1.
2	During operation, increase the response level setting value in [Pr. 9], and return the setting if vibration occurs.	Adjustment in the auto tuning mode 1
3	Check the values of [Pr. 13 Position loop gain 1] and [Pr. 14 Speed loop gain 1].	Check the upper setting limits.
4	Set to the interpolation mode ([Pr. 8: _ _ _ 0]).	Select the interpolation mode.
5	Set the position loop gain 1 of all the axes to be interpolated to the same value. At that time, adjust to the setting value of the axis, which has the smallest position loop gain 1.	Set the position loop gain 1.
6	Considering the speed loop gain 1 value you checked in step 3 as an upper limit guideline, set not less than three times the position loop gain 1 setting value while checking the servo motor movement.	Set the speed loop gain 1.
7	While checking the interpolation characteristic and the motor status, fine-adjust the gains and response level setting.	Fine adjustment

(3) Parameter adjustment

(a) [Pr. 13 Position loop gain 1]

This parameter determines the response level of the position control loop. Increasing the position loop gain 1 improves track ability to a position command, but a too high value will make overshoot liable to occur at settling. The droop pulse value is determined by the following expression.

$$\text{Number of droop pulses [pulse]} = \frac{\dfrac{\text{Speed [r/min]}}{60} \times 131072 \text{ [pulse]}}{\text{Position loop gain 1 setting}}$$

(b) [Pr. 14 Speed loop gain 1]

Set the response of the model speed loop. Set the values by referring to the following expression.

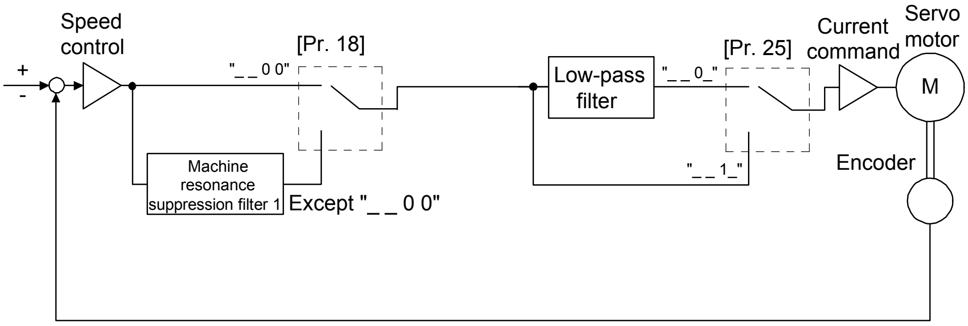
Speed loop gain 1 setting value ≥ Position loop gain 1 setting value × 3

7. SPECIAL ADJUSTMENT FUNCTIONS

POINT

- ●The functions given in this chapter need not be used normally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 6.
- ●MR-J4-_B_-RJ020 servo amplifier is not compatible with the adaptive vibration suppression control.

7.1 Filter setting



7.1.1 Machine resonance suppression filter

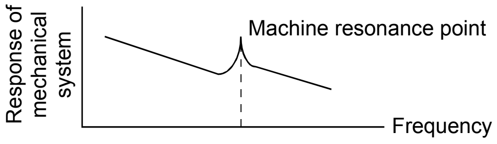
POINT

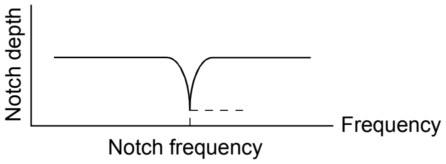
- ●The machine resonance suppression filter is a delay factor for the servo system. Therefore, vibration may increase if you set an incorrect resonance frequency or set notch depth too deep or too wide.
- ●If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum notch frequency is set at the point where vibration is minimal.
- ●A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
- ●The machine characteristic can be grasped beforehand by the machine analyzer on MR Configurator. This allows the required notch frequency and notch characteristics to be determined.

If a mechanical system has a natural resonance point, increasing the servo system response level may cause the mechanical system to produce resonance (vibration or unusual noise) at that resonance frequency. Using the machine resonance suppression filter can suppress the resonance of the mechanical system.

(1) Function

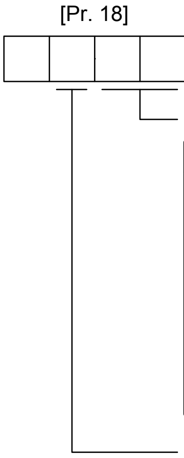
The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency) and gain decreasing depth.





(2) Parameter

Set the notch frequency and notch depth of [Pr. 18 Machine resonance suppression filter 1 (notch filter)].



Notch frequency selection

Setting value	Frequency	Setting value	Frequency	Setting value	Frequency	Setting value	Frequency
00	Disabled	08	562.5	10	281.3	18	187.5
01	4500	09	500	11	264.7	19	180
02	2250	0A	450	12	250	1A	173.1
03	1500	0B	409.1	13	236.8	1B	166.7
04	1125	0C	375	14	225	1C	160.1
05	900	0D	346.2	15	214.3	1D	155.2
06	750	0E	321.4	16	204.5	1E	150
07	642.9	0F	300	17	195.7	1F	145.2

Notch depth selection

Setting value	Depth (Gain)
0	Deep (-40 dB)
1	↑ (-14 dB)
2	↓ (-8 dB)
3	Shallow (-4 dB)

7.1.2 Low-pass filter

POINT

- In a mechanical system with extremely high rigidity where resonance is difficult to occur, setting the low-pass filter to "Disabled" may increase the servo system response to shorten the settling time.

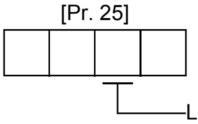
(1) Function

When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is enabled for a torque command as the initial value. The filter frequency of the low-pass filter is automatically adjusted to the value in the following equation.

$$\text{Filter frequency (Hz)} = \frac{\text{Speed loop gain 2 setting value} \times 10}{2\pi \times (1 + \text{Load to motor inertia ratio setting value})}$$

(2) Parameter

Set "Low-pass filter selection" in [Pr. 25].



Low-pass filter selection
0: Enabled (automatic adjustment)
1: Disabled

7.2 Gain switching function

You can switch gains with the function. You can switch gains during rotation and during stop, and can use a control command from a controller to switch gains during operation.

7.2.1 Applications

The following shows when you use the function.

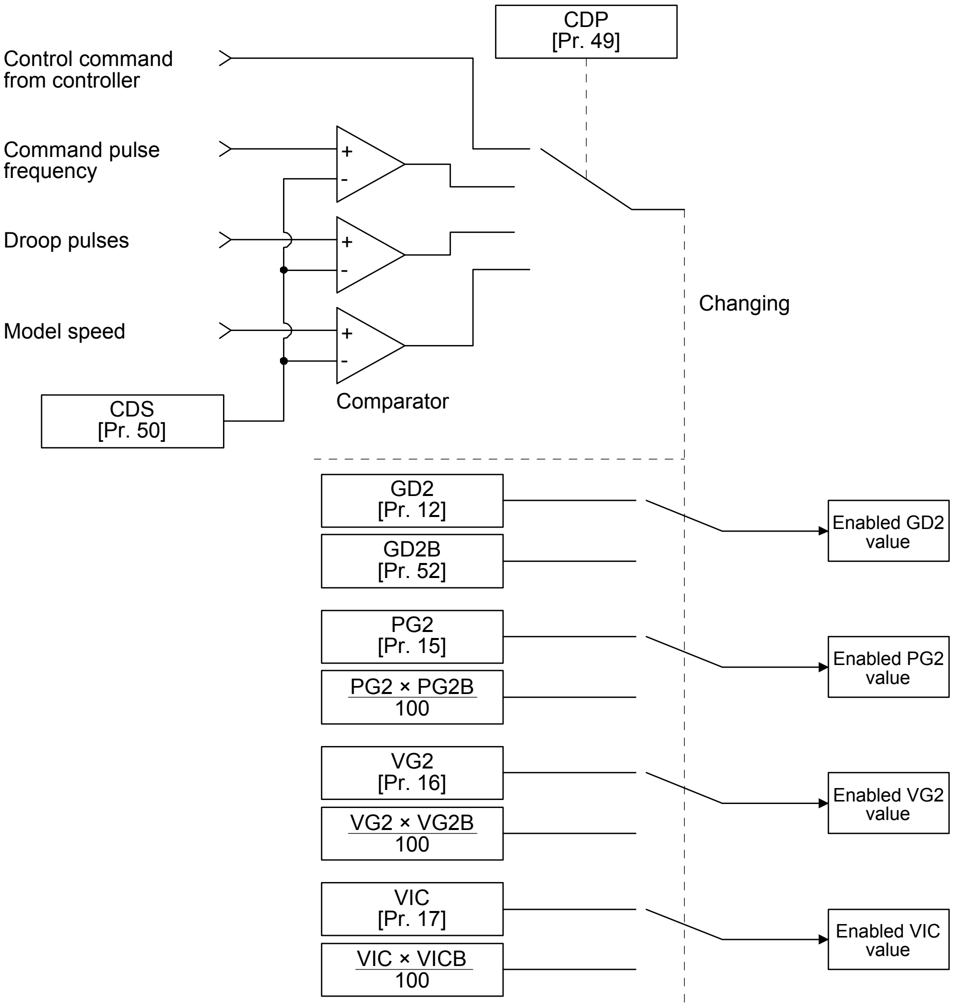
(1) You want to increase the gains during servo-lock but decrease the gains to reduce noise during rotation.

(2) You want to increase the gains during settling to shorten the stop settling time.

(3) You want to change the gains using a control command from a controller to ensure stability of the servo system since the load to motor inertia ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

7.2.2 Function block diagram

The control gains and load to motor inertia ratio settings are changed according to the conditions selected by [Pr. 49 Gain switching function] and [Pr. 50 Gain switching condition].



7.2.3 Parameter

When using the gain switching function, always select "Manual mode 2 (_ _ _ 2)" of "Gain adjustment mode selection" in [Pr. 8 Auto tuning]. The gain switching function cannot be used in the auto tuning mode.

Parameter	Symbol	Name	Unit	Description
13	PG1	Position loop gain 1	[rad/s]	Position and speed gains of a model used to set the response level to a command. Always enabled.
14	VG1	Speed loop gain 1	[rad/s]	Control parameters before changing
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	[Multiplier]	
15	PG2	Position loop gain 2	[rad/s]	
16	VG2	Speed loop gain 2	[rad/s]	
17	VIC	Speed integral compensation	[ms]	
52	GD2B	Ratio of load inertia to servo motor inertia 2	[Multiplier]	Set the ratio of load inertia to servo motor inertia after switching.
53	PG2B	Position loop gain 2 change ratio	[%]	Set the ratio (%) of the position loop gain 2 after switching against the position loop gain 2.
54	VG2B	Speed loop gain 2 change ratio	[%]	Set the ratio (%) of the speed loop gain 2 after switching against the speed loop gain 2.
55	VICB	Speed integral compensation change ratio	[%]	Set the ratio (%) of the speed integral compensation time constant after switching against the speed integral compensation.
49	CDP	Gain switching selection		Select the changing condition.
50	CDS	Gain switching condition	[kpulse/s]/[pulse]/[r/min]	Set the changing condition values.
51	CDT	Gain switching time constant	[ms]	Set the filter time constant for a gain change at changing.

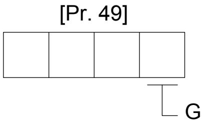
(1) [Pr. 12] to [Pr. 17]
These parameters are the same as in ordinary manual adjustment. Gain switching allows the values of load to motor inertia ratio, position loop gain 2, model loop gain, speed loop gain 2, and speed integral compensation to be changed.

(2) [Pr. 52 Ratio of load inertia to servo motor inertia 2]
Set the ratio of load inertia to servo motor inertia after switching. If the load to motor inertia ratio does not change, set it to the same value as [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)].

(3) [Pr. 53 Position loop gain 2 change ratio]/[Pr.54 Speed loop gain 2 change ratio]/[Pr. 55 Speed integral compensation change ratio]
Set the values of the position loop gain 2, speed loop gain 2 and speed integral compensation after gain switching in the ratio ([%)]. When the setting is 100%, the gain does not change.
For example, if position loop gain 2 = 100, speed loop gain 2 = 2000, speed integral compensation = 20, and position loop gain 2 change ratio = 180%, speed loop gain 2 change ratio = 150%, and speed integral compensation change ratio = 80%, the values after switching are as follows.
Position loop gain 2
= Position loop gain 2 × Position loop gain 2 change ratio/100 = 180 [rad/s]
Speed loop gain 2
= Position loop gain 2 × Position loop gain 2 change ratio/100 = 3000 [rad/s]
Speed integral compensation = Speed integral compensation × Speed integral compensation change ratio/100 = 16 [ms]

(4) [Pr. 49 Gain switching selection]

Set the gain switching condition. Select the switching condition in the first digit.



Gain switching selection
The gain is changed depending on the setting value of [Pr. 52] to [Pr. 55] with the following conditions.
0: Disabled
1: Control command from controller
2: Command frequency is the [Pr. 50] setting value or more.
3: Droop pulse is the [Pr. 50] setting value or more.
4: Servo motor speed is the [Pr. 50] setting value or more.

(5) [Pr. 50 Gain switching condition]

Set a level to switch gain with [Pr. 50] when "Command frequency", "Droop pulses", or "Servo motor speed" is selected with the gain switching selection in [Pr. 49 Gain switching selection].

The setting unit is as follows.

Gain switching condition	Unit
Command frequency	[kpulse/s]
Droop pulses	[pulse]
Servo motor speed	[r/min]

(6) [Pr. 51 Gain switching time constant]

You can set the primary delay filter to each gain at gain switching. This parameter is used to suppress shock given to the machine if the gain difference is large at gain switching, for example.

7.2.4 Gain switching procedure

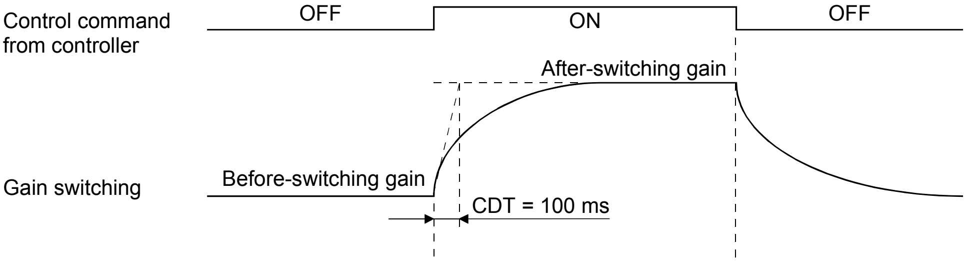
This operation will be described by way of setting examples.

(1) When you choose switching by control command from the controller

(a) Setting

Parameter No.	Symbol	Name	Setting value	Unit
13	PG1	Position loop gain 1	100	[rad/s]
14	VG1	Speed loop gain 1	1000	[rad/s]
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	40	Multiplier
15	PG2	Position loop gain 2	120	[rad/s]
16	VG2	Speed loop gain 2	3000	[rad/s]
17	VIC	Speed integral compensation	20	[ms]
52	GD2B	Ratio of load inertia to servo motor inertia 2	100	Multiplier
53	PG2B	Position loop gain 2 change ratio	70	[%]
54	VG2B	Speed loop gain 2 change ratio	133	[%]
55	VICB	Speed integral compensation change ratio	250	[%]
49	CDP	Gain switching selection	0001 Control command from controller	
51	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart



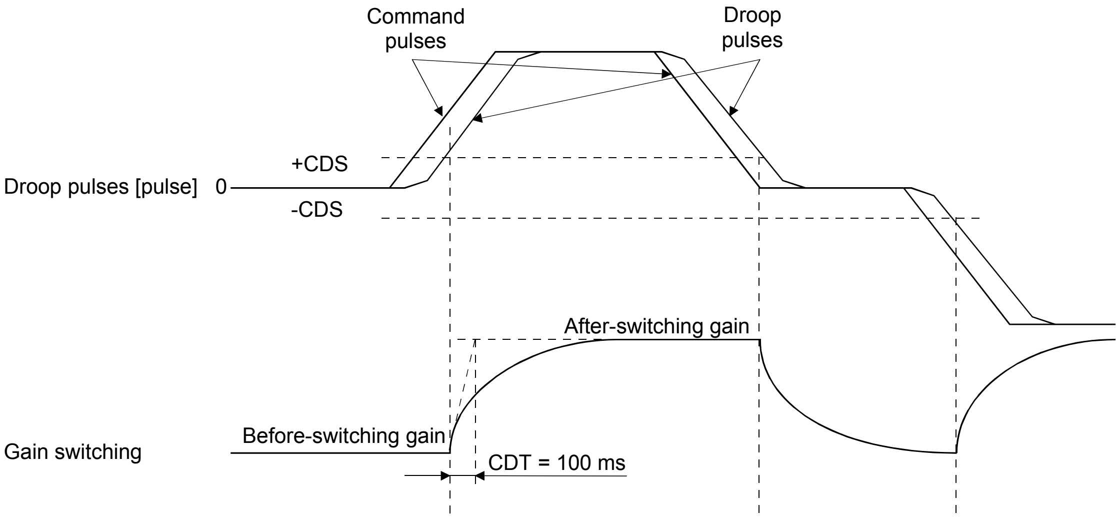
Position loop gain 1			100		
Speed loop gain 1			1000		
Ratio of load inertia to servo motor inertia	4.0	→	10.0	→	4.0
Position loop gain 2	120	→	84	→	120
Speed loop gain 2	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20

(2) When you choose switching by droop pulses

(a) Setting

Parameter No.	Symbol	Name	Setting value	Unit
13	PG1	Position loop gain 1	100	[rad/s]
14	VG1	Speed loop gain 1	1000	[rad/s]
12	GD2	Ratio of load inertia to servo motor inertia	40	Multiplier
15	PG2	Position loop gain 2	120	[rad/s]
16	VG2	Speed loop gain 2	3000	[rad/s]
17	VIC	Speed integral compensation	20	[ms]
52	GD2B	Ratio of load inertia to servo motor inertia 2	100	Multiplier
53	PG2B	Position loop gain 2 change ratio	70	[%]
54	VG2B	Speed loop gain 2 change ratio	133	[%]
55	VICB	Speed integral compensation change ratio	250	[%]
49	CDP	Gain switching selection	0003 (switching by droop pulses)	
50	CDS	Gain switching condition	50	[pulse]
51	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart



Position loop gain 1	100						
Speed loop gain 1	1000						
Ratio of load inertia to servo motor inertia	4.0	→	10.0	→	4.0	→	10.0
Position loop gain 2	120	→	84	→	120	→	84
Speed loop gain 2	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

8. TROUBLESHOOTING

8.1 Alarm and warning list

When an error occurs during operation, the corresponding alarm and warning are displayed. When an alarm or warning is displayed, refer to section 8.2 or 8.3 to remove the failure.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column in the following table.

	No.	Name	Stop method (Note 6)	Alarm reset		
				Power off to on	Error reset	CPU reset
Alarm	10	Undervoltage	EDB	○	○	○
	12. _ (Note 5)	Memory error 1	DB	○		
	13	Clock error	DB	○		
	15	Memory error 2	DB	○		
	16	Encoder error 1	DB	○		
	17	Board error	DB	○		
	19. _	Memory error 3	DB	○		
	1A	Motor combination error	DB	○		
	1B	Converter unit error	DB	○		
	20	Encoder error 2	EDB	○		
	24	Main circuit error	DB	○	○	○
	25	Absolute position erased	DB	○ (Note 2)		
	28	Fully closed loop encoder error 2	EDB	○		
	2A	Fully closed loop encoder error 1	EDB	○		
	30	Regenerative error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	31	Overspeed	EDB	○	○	○
	32	Overcurrent	DB	○	○ (Note 4)	○ (Note 4)
	33	Overvoltage	EDB	○	○	○
	34	CRC error	EDB	○	○	○
	35	Command frequency error	EDB	○	○	○
	36	Transfer error	EDB	○	○	○
	37	Parameter error	DB	○		○ (Note 4)
	3E. 2	Mode selection error	DB	○		○ (Note 3)
	42	Fully closed loop control error detection	EDB	○		
	45	Main circuit device overheat	EDB	○ (Note 1)	○ (Note 1, 4)	○ (Note 1, 4)
	46	Servo motor overheat	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	50	Overload 1	EDB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	51	Overload 2	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	52	Error excessive	EDB	○	○	○
	70	Fully closed loop encoder communication error 1	DB	○		
	71	Fully closed loop encoder communication error 2	EDB	○		
	8E	Serial communication error	EDB	○	○	○
	888	Watchdog	DB	○		
Warnings	92	Battery cable disconnection warning		Warnings are automatically canceled after the cause of occurrence is removed.		
	96	Home position setting warning				
	9F	Battery warning				
	E0	Excessive regeneration warning				
	E1	Overload warning				
	E3	Absolute position counter warning				
	E4	Parameter warning				
	E6	Servo forced stop warning	EDB (Note 7)			
	E7	Controller forced stop warning	EDB			
	E9	Main circuit off warning	DB			
	EE	SSCNET error warning				

Note
1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.
2. For confirming the connection to the servo system controller, the alarm may not be reset unless turning the power on twice or more times.
3. When the mode is correctly set, it will be reset.
4. The alarm factor may not be removed depending on the cause of occurrence.
5. Digits after the decimal point may not be displayed.
6. The following shows two stop methods of DB and EDB.
   DB: Stop with dynamic brake
   EDB: Stop with electronic dynamic brake (enabled only with the specified servo motors)
   Refer to the following table for the specified servo motors. The stop method for other than the specified servo motors will be DB.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52

7. When STO1 or STO2 is turned off (when the short-circuit connector is disconnected), the stop method will be DB.

8.2 Remedies for alarms

⚠CAUTION

- ●When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation. Otherwise, it may cause injury.
- ●If [AL. 25 Absolute position erased] occurs, always make home position setting again. Otherwise, it may cause an unexpected operation.
- ●As soon as an alarm occurs, set the servo amplifier to the servo-off status and interrupt the main circuit power.

POINT

- ●When any of the following alarms has occurred, do not deactivate the alarm to restart. Doing so will cause a malfunction of the servo amplifier and servo motor. Remove its cause and allow about 30 minutes for cooling before resuming the operation. To protect the main circuit elements, any of these alarms cannot be deactivated from the servo system controller until the specified time elapses after its occurrence. Judging the load changing condition until the alarm occurs, the servo amplifier calculates this specified time automatically.
  - ・[AL. 30 Regenerative error] ・[AL. 50 Overload 1]
  - ・[AL. 51 Overload 2]
- ●To deactivate the alarm, cycle the power, command the error reset, or CPU reset from the servo system controller. Refer to section 8.1.
- ●[AL. 37 Parameter error] is not recorded in the alarm history.

When an alarm occurs, the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No.

Remove the cause of the alarm in accordance with this section. Use MR Configurator to refer to the cause of alarm occurrence. However, it is not applicable for [AL. 12. _], [AL. 19. _], [AL. 3E.2] and [AL. 888].

Display	Name	Description	Cause	Action
10	Undervoltage	The power supply voltage dropped. 200 V class: 160 V AC or less 400 V class: 280 V AC or less 100 V class: 80 V AC or less	1. Power supply voltage is low.	Review the power.
			2. There was an instantaneous control circuit power failure of 60 ms or more.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. For servo amplifier, the bus voltage dropped to the following value or less. 200 V class: 200 V DC 400 V class: 380 V DC 100 V class: 158 V DC	
			5. For drive unit, the bus voltage of the converter unit dropped to the following value or less. 200 V class: 200 V DC 400 V class: 380 V DC	
			6. For drive unit, the magnetic contactor connector of the converter unit is disconnected.	Connect it correctly.
			7. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 10] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
12. _	Memory error 1	RAM memory error	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 12] or [AL. 13] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
13	Clock error	Printed board error		
		A clock error transmitted from the controller	2. The controller is malfunctioning. Check method Check if the alarm occurs when you connect the amplifier to the controller.	Replace the controller.
		Next servo amplifier axis error	3. The servo amplifier of the next axis is malfunctioning.	Replace the servo amplifier of the next axis.
		Software process incomplete within the specified time	4. The parameter setting is incorrect.	Set it correctly.
			5. A synchronous signal error transmitted from the controller occurred. Check method Replace the controller, and then check the repeatability.	Replace the controller.

Display	Name	Description	Cause	Action
15	Memory error 2	EEP-ROM error	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 15] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
			2. The number of write times exceeded 100,000.	
			3. The EEP-ROM is malfunctioning during normal operation. Check method Check if the error occurs when you change parameters during normal operation.	
			4. A write error occurred while tuning results was processed. Check method Check if the alarm occurs after an hour from power on.	
			5. The system parameter error occurred. Check method Check if an alarm occurs when you initialize the parameters with the built-in application software "MR-J4(W)-B mode selection" of MR Configurator2.	
16	Encoder error 1	An error occurred in the communication between the encoder and servo amplifier.	1. The Encoder connector (CN2) is disconnected.	Connect it correctly.
			2. The encoder is malfunctioning.	Replace the servo motor.
			3. There is a loose connection of the encoder cable. (It is disconnected or shorted.)	Repair or replace the encoder cable.
			4. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			5. The voltage of the control circuit power supply has been unstable.	Review the power and related parts.
		Incompatible encoder	6. A servo motor, which is not compatible with the servo amplifier, was connected.	Replace it with the servo motor which is compatible with the servo amplifier.

Display	Name	Description	Cause	Action
17	Board error	A part such as CPU is malfunctioning.	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 17] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
		The output terminals (U, V, W) of the servo amplifier and the input terminals (U, V, W) of the servo motor are not connected.	2. The wiring of U, V, W is disconnected or not connected.	Connect the output terminals (U, V, W) of the servo amplifier and the input terminals (U, V, W) of the servo motor correctly.
		Servo amplifier recognition signal error	3. The servo amplifier recognition signal was not read properly. Check method Check if [AL. 17] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
		Inrush current suppression circuit error	4. The inrush current suppressor circuit is malfunctioning.	Replace the servo amplifier.
		Mode selection error	5. There is a mismatch between the operation mode setting and actual operation mode.	Initialize it with the built-in application software "MR-J4(W)-B mode selection" of MR Configurator2.
		MR-J4-T20 error	6. MR-J4-T20 came off.	Check the connection of MR-J4-T20.
19. _	Memory error 3	ROM memory error	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 19] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
1A	Servo motor combination error	The combination of servo amplifier and servo motor is incorrect.	1. The servo amplifier and the servo motor was connected incorrectly.	Use them in the correct combination.
		Encoder error	2. The encoder is malfunctioning.	Replace the servo motor.
1B	Converter alarm	An alarm occurred in the converter unit during the servo-on status.	1. An alarm occurred in the converter unit during the servo-on status.	Check the alarm of the converter unit, and take the action following the remedies for alarms of the converter unit. (Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)".)
			2. The protection coordination cable is not correctly connected.	Connect it correctly.
20	Encoder error 2	An error occurred in the communication between the encoder and servo amplifier.	1. The Encoder connector (CN2) is disconnected.	Connect it correctly.
			2. The encoder is malfunctioning.	Replace the servo motor.
			3. The encoder cable is malfunctioning. (It is disconnected or shorted.)	Repair or replace the cable.
			4. The servo amplifier is malfunctioning.	Replace the servo amplifier.
		The function detects an acceleration error in the encoder.	5. An excessive acceleration occurred due to oscillation, etc.	1. Decrease the speed control gain 2. 2. Decrease the auto tuning response level.

Display	Name	Description	Cause	Action
24	Main circuit error	Ground fault occurred at the servo motor power output (U, V, and W) of the servo amplifier.	1. The power wire is contacting with the servo motor power output (U, V, and W) of the servo amplifier.	Correct the wiring.
			2. The insulator of servo motor power wire deteriorated, resulting in ground fault.	Replace the cable.
			3. The main circuit of servo amplifier failed. Check method Check if [AL. 24] occurs if power is switched on after disconnection of U, V, and W.	Replace the servo amplifier.
25	Absolute position erased	Power was switched on for the first time in the absolute position detection system.	1. Power was switched on for the first time in the absolute position detection system.	Check that the battery is mounted correctly, and make home position return.
		The absolute position data is faulty.	2. When an MR-BAT6V1SET battery was used, CN4 of the servo amplifier was disconnected during control circuit power supply off.	Check that the battery is mounted correctly, and make home position return.
			3. When an MR-BAT6V1BJ battery for junction battery cable was used, both CN4 of the servo amplifier and MR-BAT6V1BJ battery for junction battery cable were disconnected from the MR-BT6VCBL03M junction battery cable.	
			4. When an MR-BAT6V1SET battery was used, the power was turned off with the battery disconnected from CN4.	
			5. When an MR-BAT6V1BJ battery for junction battery cable was used, the power was turned off with the battery disconnected from CN4 and MR-BT6VCBL03M junction battery cable.	
			6. The encoder cable was disconnected with the MR-BAT6V1BJ battery disconnected from MR-BT6VCBL03M junction battery cable.	Check that the MR-BAT6V1BJ battery is connected to CN4 and MR-BT6VCBL03M junction battery cable, and execute a home position return.
			7. The MR-BT6VCBL03M junction battery cable is not connected to the encoder cable.	Connect the MR-BT6VCBL03M junction battery cable to the encoder cable.
			8. The battery voltage is low. The battery is consumed.	Replace the battery.
			9. The voltage has dropped greatly in the encoder cable wired to the battery.	Use a recommended wire.
			10. A battery cable is malfunctioning.	Replace the battery cable.
			11. There is a loose connection of the encoder cable on the servo motor side.	Repair or replace the encoder cable.
		Encoder error	12. An encoder is malfunctioning.	Replace the servo motor.
		Servo amplifier error	13. The servo amplifier is malfunctioning.	Replace the servo amplifier.
28	Fully closed loop encoder error 2	Working environment of linear encoder is not normal.	1. The temperature of linear encoder is high. (Linear encoder manufactured by Mitutoyo)	Check the temperature of linear encoder and contact the linear encoder manufacturer.
			2. The signal level of the linear encoder has dropped.	Check the installation condition of the linear encoder.

Display	Name	Description	Cause	Action
2A	Fully closed loop encoder error 1	An error occurred in the load-side encoder (linear encoder/encoder with A/B/Z-phase pulse specifications)	1. The installation positions of the linear encoder and detection head are not correct.	Adjust the positions of the linear encoder and detection head.
			2. The speed of linear encoder has exceeded the range of specifications.	Use it within the range of specifications.
			3. A load-side encoder is malfunctioning.	Contact the linear encoder manufacturer.
			4. An alarm of the linear encoder occurred.	Check the detailed information indicated in section 15.6 and contact the linear encoder manufacturer.
			5. Noise entered.	Take the noise reduction measures. Contact the linear encoder manufacturer.
30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	There is a mismatch between the built-in regenerative resistor (regenerative option) and [Pr. 2] setting.	Set it correctly.
			2. The built-in regenerative resistor or regenerative option is not connected.	Connect it correctly.
			3. Very frequent operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. Check method Check the regenerative load ratio using MR Configurator.	1. Reduce the frequency of positioning. 2. Replace the regenerative option for the one with larger capacity. 3. Reduce the load.
			4. The power supply voltage is too high. 200 V class: 264 V AC or more 400 V class: 523 V AC or more 100 V class: 132 V AC or more	Review the power.
			5. The built-in regenerative resistor or regenerative option is malfunctioning.	Replace the servo amplifier or regenerative option.
		Regenerative transistor failure	6. The regenerative transistor is malfunctioning. Check method 1. Check if the regenerative option is overheating. 2. Check if the alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Replace the servo amplifier.
31	Overspeed	The servo motor seed has exceeded the permissible instantaneous speed.	1. The short acceleration/deceleration time constant increased the overshoot.	Increase the acceleration/deceleration time constant.
			2. The servo system is unstable, causing an overshoot.	1. Reset the servo gain to a proper value. 2. If the servo gain cannot be set to a proper value. 1) Reduce the load to motor inertia ratio. 2) Review the acceleration/deceleration time constant.
			3. The encoder is malfunctioning.	Replace the servo motor.
			4. The command from the controller is excessive.	Check the operation pattern.

Display	Name	Description	Cause	Action
32	Overcurrent	A current higher than the permissible current was applied to the servo amplifier.	1. Short occurred in the servo amplifier output phases U, V and W.	Correct the wiring.
			2. A transistor in the servo amplifier is malfunctioning. Check method Check if [AL. 32] occurs if power is switched on after disconnection of U, V, and W.	Replace the servo amplifier.
			3. Ground fault occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			4. The servo motor is malfunctioning.	Replace the servo motor.
			5. The dynamic brake is malfunctioning. Check method Check if this occurs when you turn on the servo-on command.	Replace the servo amplifier.
			6. External noises caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
			7. The servo gain is high.	Reduce the speed loop gain.
33	Overvoltage	The value of the bus voltage exceeded the prescribed value. 200 V class: 400 V DC 400 V class: 800 V DC 100 V class: 400 V DC	1. A regenerative option is not used.	Use a regenerative option.
			2. Though the regenerative option is used, the [Pr. 2] setting is "0 0 _ _ (the regenerative option is not used.)".	Set it correctly.
			3. The lead wire of built-in regenerative resistor or regenerative option is broken or disconnected.	1. Replace the lead wire. 2. Connect it correctly.
			4. The regenerative transistor is malfunctioning.	Replace the servo amplifier.
			5. Wire breakage of the built-in regenerative resistor or regenerative option	When using a built-in regenerative resistor, replace the servo amplifier. When using a regenerative option, replace the regenerative option.
			6. The capacity of built-in regenerative resistor or regenerative option is insufficient.	Add another regenerative option or increase the capacity.
			7. The power supply voltage is high.	Review the power.
			8. Ground fault occurred in servo amplifier output phases (U, V and W).	Correct the wiring.
			9. The jumper across BUE-SD of the FR-BU2 brake unit is removed.	Fit the jumper across BUE-SD.
			10. The impedance at main circuit power supply cable (L1, L2, and L3) is high, and the leak current from servo motor power wire (U, V, and W) is large.	Use a regenerative option. (A regenerative resistor not incorporated)
34	CRC error	Communication error with the SSCNET cable	1. The SSCNET cable was disconnected.	Connect it correctly.
			2. The SSCNET cable is malfunctioning.	Replace the cable.
			3. Noises entered into the SSCNET cable.	Take noise suppression measures.
			4. The terminal connector was disconnected.	Mount the termination connector.
			5. The same No. exists in the servo amplifier side axis setting.	Set it correctly.

Display	Name	Description	Cause	Action
35	Command frequency error	The input pulse frequency of command pulse is too high.	1. A command given was greater than the maximum speed of the servo motor.	Check the operation program.
			2. Noises entered into the SSCNET cable.	Take noise suppression measures.
			3. The servo system controller is malfunctioning.	Replace the servo system controller.
36	Transfer error	SSCNET cable or printed board malfunction	1. The SSCNET cable was disconnected.	Connect the SSCNET cable connector.
			2. The SSCNET cable is malfunctioning.	Replace the cable.
			3. The printed board is malfunctioning.	Replace the servo amplifier.
			4. The terminal connector was disconnected.	Mount the termination connector.
37	Parameter error	The parameter setting is incorrect.	1. The parameter setting has changed due to a servo amplifier malfunction.	Replace the servo amplifier.
			2. A parameter was set out of setting range.	Correct the parameter value to within the setting range.
			3. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, etc.	Replace the servo amplifier.
			4. A parameter setting contradicts another.	Correct the setting value.
3E.2	Mode selection error	There is a mismatch between the operation mode setting and actual operation mode.	The power supply was turned on with MR-J4-T20 disconnected.	1. Connect MR-J4-T20 and restart the servo amplifier. 2. Select J2S compatibility mode with the built-in application software "MR-J4(W)-B mode selection" of MR Configurator2.
42	Fully closed loop control error detection	The fully closed loop control error detection function operates. 1) The deviation between the feedback speed of load-side encoder and that of motor-side encoder exceeds the [Pr. 63] setting value. 2) The deviation between the feedback position of load-side encoder and that of motor-side encoder exceeds the [Pr. 64] setting value converted into the motor shaft.	1. A load-side encoder is malfunctioning.	Replace the load-side encoder.
			2. The polarity of the load-side encoder is set reversely.	Check the installation direction of the load-side encoder. Review the [Pr. 62] setting.
			3. The electronic gear setting of the load-side encoder is incorrect.	Review the [Pr. 65] and [Pr. 66] settings. Check the installation condition of the load-side encoder.
			4. The setting of the load-side encoder resolution is incorrect.	Review the setting of the load-side encoder resolution.
45	Main circuit device overheat	The main circuit was overheated.	1. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			2. The ambient temperature is over 55 ˚C.	Lower the ambient temperature.
			3. Turning on and off were repeated under the overload status.	Review the operation pattern.
			4. The cooling fan of the servo amplifier stopped.	1. Replace the servo amplifier or cooling fan. 2. Lower the ambient temperature.
			5. The cooling fan speed is lower than the prescribed value.	Replace the servo amplifier.

Display	Name	Description	Cause	Action
46	Servo motor overheat	A servo motor temperature rise actuated the thermal sensor.	1. The ambient temperature of servo motor is over 40 ˚C.	Review the environment so that the ambient temperature is 0 ˚C to 40 ˚C.
			2. The servo motor is overloaded.	1. Reduce the load. 2. Check the operation pattern. 3. Switch to a larger capacity servo motor.
			3. The thermal sensor in the encoder is malfunctioning.	Replace the servo motor.
		Thermistor wire connection malfunction	4. A thermistor wire is not connected.	Connect the thermistor wire.
			5. The encoder cable MR-ENECBL_M-H for HF-JP series servo motors is used for the HG-JR22K1M/HG-JR22K1M4 servo motor.	Replace the encoder cable with MR-ENECBL_M-HMTH.
			6. The thermistor wire was disconnected.	Repair the lead wire.
		Thermal error due to overload	7. The servo amplifier was used in excess of its continuous output current.	1. Reduce the load. 2. Check the operation pattern. 3. Switch to a larger capacity servo motor.
50	Overload 1	The load exceeded the overload protection characteristic of servo amplifier.	1. The servo amplifier is used in excess of its continuous output current.	1. Reduce the load. 2. Check the operation pattern. 3. Switch to a larger capacity servo motor.
			2. The servo system is unstable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change the auto tuning response setting. 3. Set the auto tuning to off and manually adjust the gain.
			3. A moving part collided against the machine.	1. Check the operation pattern. 2. Install limit switches.
			4. The servo motor is connected incorrectly. The output terminals (U, V, W) of the servo amplifier do not match the input terminals (U, V, W) of the servo motor.	Connect it correctly.
			5. The power cable was disconnected.	Repair the power cable.
			6. The electromagnetic brake is operating. Check method Check if the electromagnetic brake does not work during operation.	Review the wiring.
			7. After the overload alarm occurrence, the operation was resumed without cooling. Check method Wait for 30 minutes or more after an alarm occurs and check if the alarm is canceled.	Leave a sufficient time and reset the alarm.
			8. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			9. The encoder is malfunctioning. Check method When the servo motor shaft is rotated with the servo-off, check if the cumulative feedback pulses do not vary in proportion to the rotation angle of the shaft but the indication skips or returns midway.	Replace the servo motor.

Display	Name	Description	Cause	Action
51	Overload 2	The maximum output current flowed continuously for several seconds due to a machine collision or the like.	1. A moving part collided against the machine.	1. Check the operation pattern. 2. Install limit switches.
			2. The servo motor is connected incorrectly. The output terminals (U, V, W) of the servo amplifier do not match the input terminals (U, V, W) of the servo motor.	Connect it correctly.
			3. The power cable was disconnected.	Repair the power cable.
			4. The connection of the encoder cable is incorrect.	Connect it correctly.
			5. The servo system is unstable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change the auto tuning response setting. 3. Set the auto tuning to off and manually adjust the gain.
			6. The torque is saturated.	Check the operation pattern.
			7. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			8. The encoder is malfunctioning. Check method When the servo motor shaft is rotated with the servo-off, check if the cumulative feedback pulses do not vary in proportion to the rotation angle of the shaft but the indication skips or returns midway.	Replace the servo motor.
52	Error excessive	The deviation between the model position and the actual servo motor position exceeds the [Pr. 31] setting value (initial value: 2 revolutions).	1. The acceleration/deceleration time constant is too short.	Increase the acceleration/deceleration time constant.
			2. The torque limit value is small.	Increase the torque limit value.
			3. The motor cannot be started due to torque shortage caused by a power supply voltage drop.	1. Check the power supply capacity. 2. Switch to a larger capacity servo motor.
			4. The [Pr. 13 Position loop gain 1] value is small.	Increase the setting value and adjust to ensure proper movement.
			5. The servo motor shaft was rotated by external force.	1. When the torque is limited, increase the limit value. 2. Reduce the load. 3. Switch to a larger capacity servo motor.
			6. A moving part collided against the machine.	1. Check the operation pattern. 2. Install limit switches.
			7. The encoder is malfunctioning.	Replace the servo motor.
			8. The connection of the servo motor is incorrect. The output terminals (U, V, W) of the servo amplifier do not match the input terminals (U, V, W) of the servo motor.	Connect it correctly.
			9. The power cable was disconnected.	Repair the power cable.
			10. The connection of the encoder cable is incorrect.	Connect it correctly.

Display	Name	Description	Cause	Action
70	Fully closed loop encoder communication error 1	An error occurred in the communication between the load-side encoder and servo amplifier.	1. CN2L connector is disconnected.	Connect it correctly.
			2. A load-side encoder cable is malfunctioning.	Replace or repair the cable.
71	Fully closed loop encoder communication error 2	An error occurred in the communication between the load-side encoder and servo amplifier.	1. A load-side encoder cable is malfunctioning.	Replace or repair the cable.
			2. Wiring mistake of load-side encoder cable (Each A/B/Z-phase signal and the power wire are not all wired.)	Review the wiring.
8E	Serial communication error	A serial communication error occurred between the servo amplifier and communication device (e.g. personal computer).	1. A communication cable is malfunctioning. (It is disconnected or shorted.)	Repair or replace the cable.
			2. Communication device (e.g. personal computer) is malfunctioning.	Replace the communication device (e.g. personal computer).
			3. The transmitted character was out of specifications.	Correct the transmission command.
			4. The communication protocol is incorrect.	Modify the transmission data according to the communication protocol.
			5. The transmitted command was out of specifications.	Correct the transmission command.
			6. The transmitted data number was out of specifications.	Correct the transmission command.
			7. The servo amplifier is malfunctioning.	Replace the servo amplifier.
888	Watchdog	A part such as CPU is malfunctioning.	A part in the servo amplifier is malfunctioning. Check method Check if [AL. 888] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.

8.3 Remedies for warnings

⚠CAUTION

- If [AL. E3 Absolute position counter warning] occurs, always make home position setting again. Otherwise, it may cause an unexpected operation.

POINT

- When any of the following alarms has occurred, do not cycle the power of the servo amplifier repeatedly to restart. Doing so will cause a malfunction of the servo amplifier and servo motor. If the power of the servo amplifier is switched off/on during the alarms, allow more than 30 minutes for cooling before resuming operation.
  - [AL. E0 Excessive regenerative warning]
  - [AL. E1 Overload warning]
- The warnings are not recorded in the alarm history.

If [AL. E6], [AL. E7], [AL. E9] or [AL. EE] occurs, the amplifier will be in the servo-off status. If any other warning occurs, the operation can be continued but an alarm may take place or proper operation may not be performed.

Remove the cause of warning according to this section. Use MR Configurator to refer to the cause of warning occurrence.

Display	Name	Description	Cause	Action
92	Battery cable disconnection warning	Battery voltage for absolute position detection system decreased.	1. When an MR-BAT6V1SET battery was used, the battery was disconnected from CN4.	Connect it correctly.
			2. When an MR-BAT6V1BJ battery for junction battery cable was used, the battery was not connected to both CN4 and MR-BT6VCBL03M junction battery cable.	
			3. A battery cable was disconnected.	Replace or repair the cable.
			4. Battery voltage supplied from the servo amplifier to the encoder fell to less than about 3.1 V. (Detected with the encoder)	Replace the battery.
			5. An encoder cable was disconnected.	Replace or repair the cable.
96	Home position setting warning	Home position setting could not be made properly.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence.
			2. Home position return was performed while commanding an operation.	Reduce the creep speed.
			3. The creep speed is high.	
9F	Battery warning	Battery voltage for absolute position detection system decreased.	1. The battery is not connected to CN4.	Connect it correctly.
			2. Battery voltage fell to less than 4.9 V. (Detected with the servo amplifier)	Replace the battery.

Display	Name	Description	Cause	Action
E0	Excessive regeneration warning	There is a possibility that the regenerative power may exceed the permissible regenerative power of built-in regenerative resistor or regenerative option.	The regenerative power increased to 85% or more of the permissible regenerative power of built-in regenerative resistor or regenerative option. Check method Check the regenerative load ratio using MR Configurator.	1. Reduce the frequency of positioning. 2. Replace the regenerative option for the one with larger capacity. 3. Reduce the load.
		A warning occurred in the converter unit during the servo-on status.		Check the warning of the converter unit, and take the action following the remedies for warnings of the converter unit. (Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)".)
E1	Overload warning	[AL.50 Overload 1] or [AL.51 Overload 2] may occur.	1. The load increased to 85% or more of the alarm level of [AL.50 Overload alarm 1] or [AL.51 Overload alarm 2]. Check method Check it with the check method for [AL. 50] or [AL. 51].	Refer to [AL. 50] or [AL. 51].
		The servo motor overheat alarm may occur.	2. The load of the motor thermal value increased to 85% or more of the servo motor overheat alarm level. Check method Check it with the check method for [AL. 46].	Refer to [AL. 46].
			3. Ambient temperature of servo motor is over 40 ˚C.	Review environment so that ambient temperature is 0 ˚C to 40 ˚C.
			4. Servo motor is overloaded.	1. Reduce the load. 2. Check operation pattern. 3. Switch to a larger capacity servo motor.
			5. The servo motor thermistor is malfunctioning.	Replace the servo motor.
		The main circuit device overheat alarm may occur.	6. The temperature in the servo amplifier is high. Check method Check it with the check method for [AL. 45].	Refer to [AL. 45].
		Operations over rated output were repeated while the servo motor shaft was not rotated.	7. The load is too large or the capacity is not enough.	1. Reduce the load. 2. Replace the servo amplifier/servo motor with the one of larger capacity.
		The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	8. The status, in which the output wattage (speed × torque) of the servo motor exceeded 150% of the rated output.	1. Reduce the servo motor speed. 2. Reduce the load.
E3	Absolute position counter warning	Absolute position encoder pulses are faulty.	1. The travel distance from the home position exceeded 32768 rotation in the absolute position system.	1. Review the operation range. 2. Execute the home position return again.
			2. Noises entered into the encoder.	Take noise suppression measures.
			3. The encoder is malfunctioning.	Replace the servo motor.
E4	Parameter warning	Parameter outside setting range	A parameter was set to out of range with the servo system controller.	Set it within the range.
E6	Servo forced stop warning	EM1 is off.	1. The forced stop was enabled. (EM1 was turned off.)	Ensure safety and deactivate the forced stop.
		STO1 is off.	2. The short-circuit connector of CN8 is disconnected.	Attach the short-circuit connector came with a servo amplifier.
		STO2 is off.	3. The short-circuit connector of CN8 is disconnected.	Attach the short-circuit connector came with a servo amplifier.

Display	Name	Description	Cause	Action
E7	Controller forced stop warning		The forced stop signal was entered into the servo system controller.	Ensure safety and deactivate forced stop.
E9	Main circuit off warning	The servo-on command was inputted with main circuit power supply off.	1. The main circuit power supply is off.	Turn on the main circuit power.
			2. For servo amplifier, the bus voltage is lower than the prescribed value. 200 V class: 215 V DC 400 V class: 430 V DC 100 V class: 215 V DC	Review the wiring. Check the power supply capacity.
			3. For drive unit, the bus voltage of the converter unit is lower than the prescribed value. 200 V class: 215 V DC 400 V class: 430 V DC	
			4. The setting value of [Pr. PA02 Magnetic contactor drive output selection] of the converter unit contradicts the wiring constitution.	Review the [Pr. PA02] setting.
		Bus voltage dropped during low speed operation.	5. The bus voltage dropped during the servo motor driving under 50 r/min.	Review the power supply capacity. Increase the acceleration time constant.
		The forced stop of the converter unit is enabled during the servo-on command.	6. The forced stop of the converter unit is enabled.	Deactivate the forced stop of the converter unit.
			7. The protection coordination cable is not correctly connected.	Connect it correctly.
EE	SSCNET error warning	The connected servo system controller is not compatible with the SSCNET.		

8.4 Troubleshooting at power on

When the servo system does not boot and system error occurs at power on of the servo system controller, improper boot of the servo amplifier might be the cause. Check the display of the servo amplifier, and take actions according to this section.

Display	Description	Cause	Checkpoint	Action
AA	Communication with the servo system controller has disconnected.	The power of the servo system controller was turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.
		A SSCNET cable was disconnected.	"AA" is displayed in the corresponding axis and following axes.	Replace the SSCNET cable of the corresponding axis.
			Check if the connectors (CN10A, CN10B) are unplugged.	Connect it correctly.
		The terminal connector is disconnected.	Check that the terminal connector (MR-A-TM) is connected with the terminal axis servo amplifier connector (CN10B).	Mount it correctly.
		The power of the servo amplifier was turned off.	"AA" is displayed in the corresponding axis and following axes.	Check the power of the servo amplifier.
				Replace the servo amplifier of the corresponding axis.
Ab	Initialization communication with the servo system controller has not completed.	The setting of the axis No. is incorrect.	Check that the other servo amplifier is not assigned to the same axis No.	Set it correctly.
		Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Set it correctly.
		A SSCNET cable was disconnected.	"Ab" is displayed in the corresponding axis and following axes.	Replace the SSCNET cable of the corresponding axis.
			Check for incorrect connection of the SSCNET cable to CN3.	Connect it correctly.
			Check if the connectors (CN10A, CN10B) are unplugged.	Connect it correctly.
		The terminal connector is disconnected.	Check that the terminal connector (MR-A-TM) is connected with the terminal axis servo amplifier connector (CN10B).	Mount it correctly.
		The power of the servo amplifier was turned off.	"Ab" is displayed in an axis and the following axes.	Check the power of the servo amplifier.
		The servo amplifier is malfunctioning.	"Ab" is displayed in an axis and the following axes.	Replace the servo amplifier of the corresponding axis.
b##. (Note)	The system has been in the test operation mode.	Test operation mode has been enabled.	The axis selection rotary switch (SW1) is set to "F".	Set the axis selection rotary switch (SW1) correctly.
off	The operation mode for manufacturer setting is set.	The operation mode for manufacturer setting is enabled.	Check if the control axis setting switches (SW2-1 to SW2-4) are on.	Turn off all the control axis setting switches (SW2).

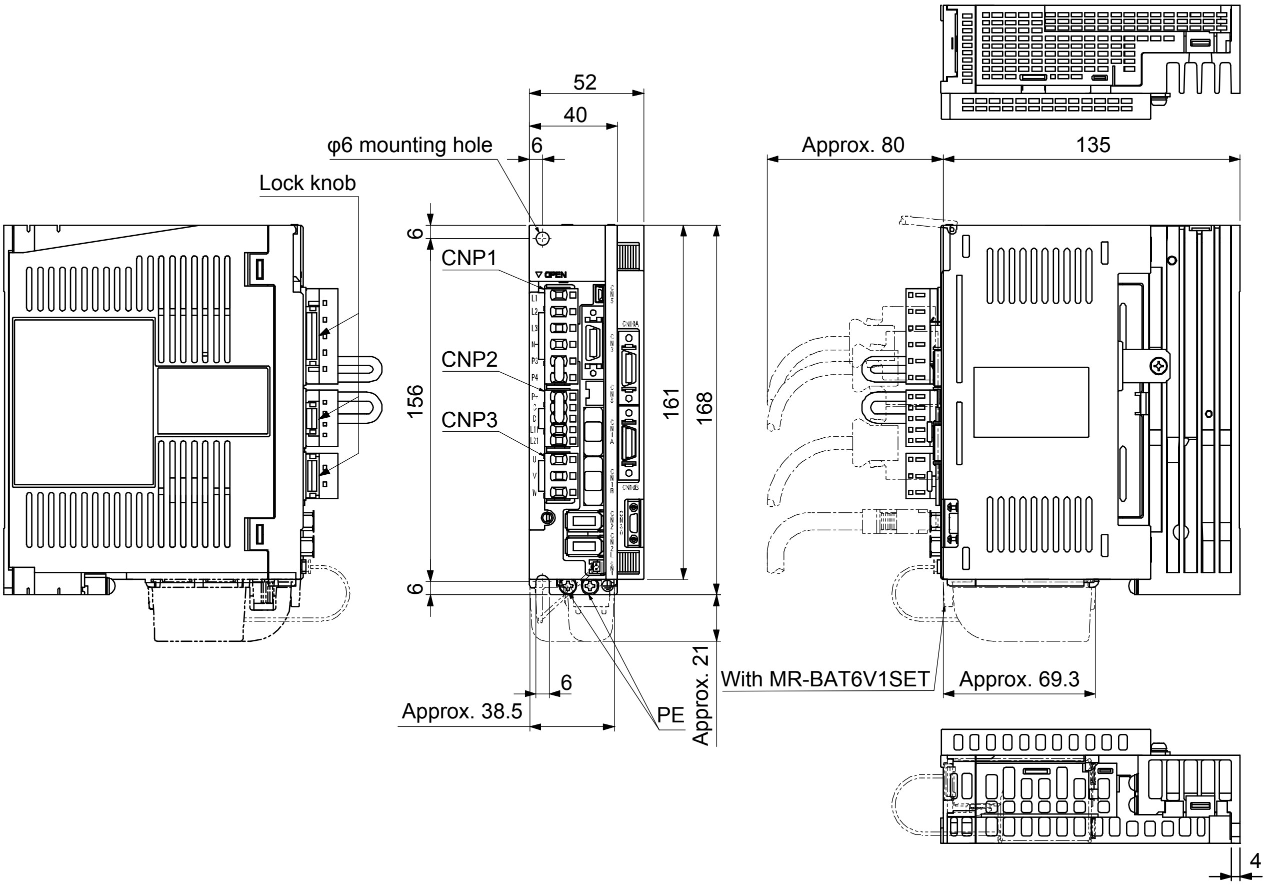
Note. ## indicates an axis No.

9. DIMENSIONS

9.1 Servo amplifier

(1) MR-J4-10B-RJ020/MR-J4-20B-RJ020

[Unit: mm]



Mass: 0.8 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Terminal

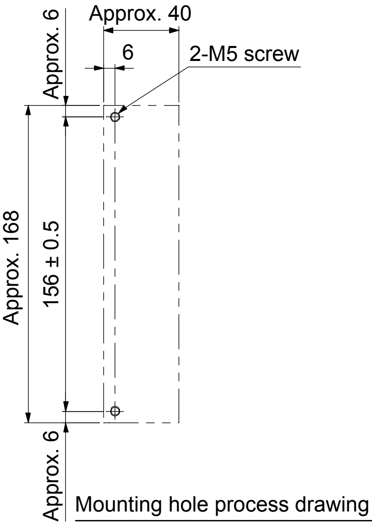
CNP1
L1
L2
L3
N-
P3
P4

CNP2
P+
C
D
L11
L21

CNP3
U
V
W

PE
⏚ ⏚

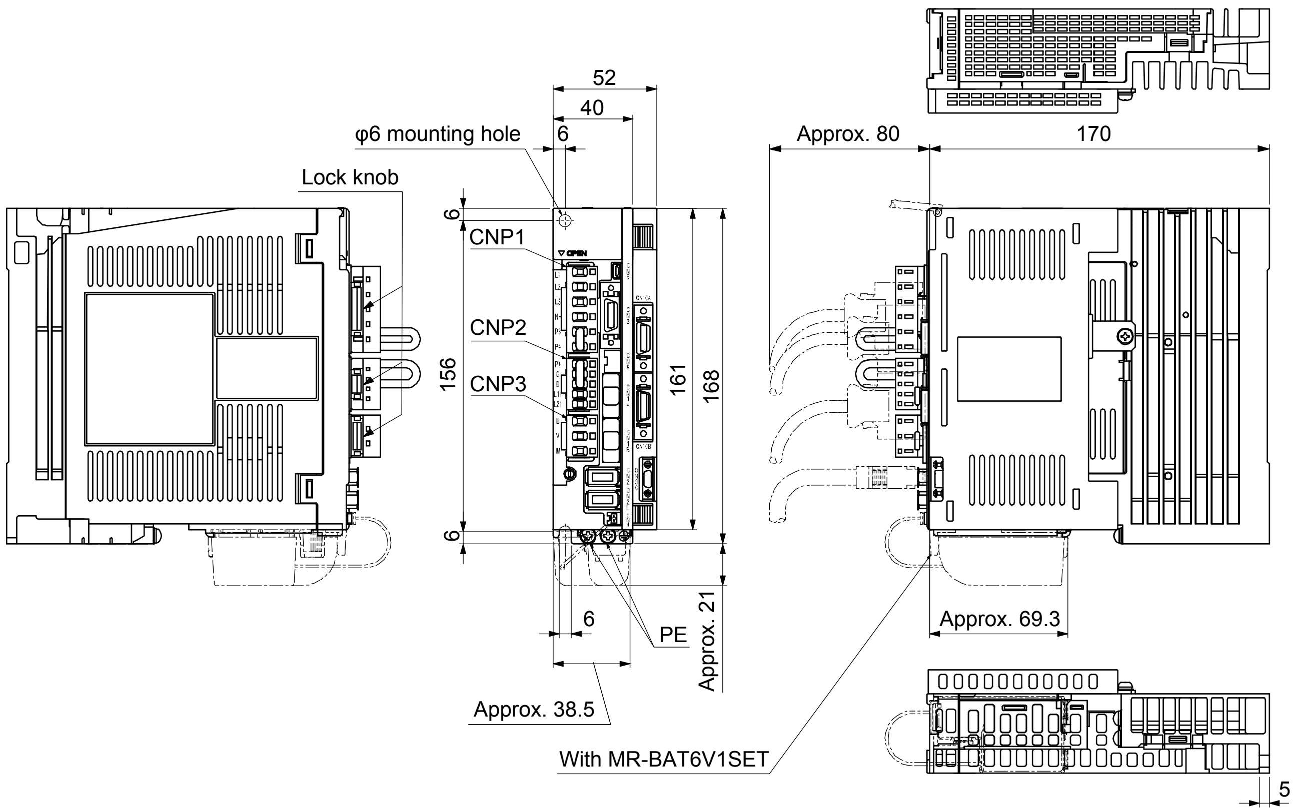
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(2) MR-J4-40B-RJ020/MR-J4-60B-RJ020

[Unit: mm]



Mass: 1.0 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Terminal

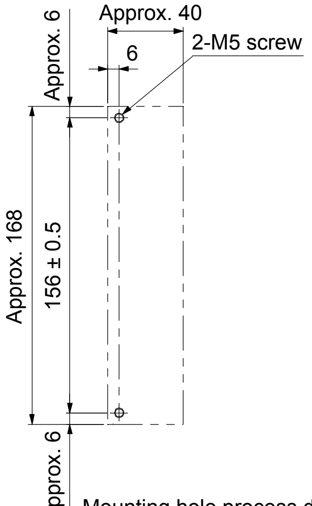
CNP1
- L1
- L2
- L3
- N-
- P3
- P4

CNP2
- P+
- C
- D
- L11
- L21

CNP3
- U
- V
- W

PE
⏚ ⏚

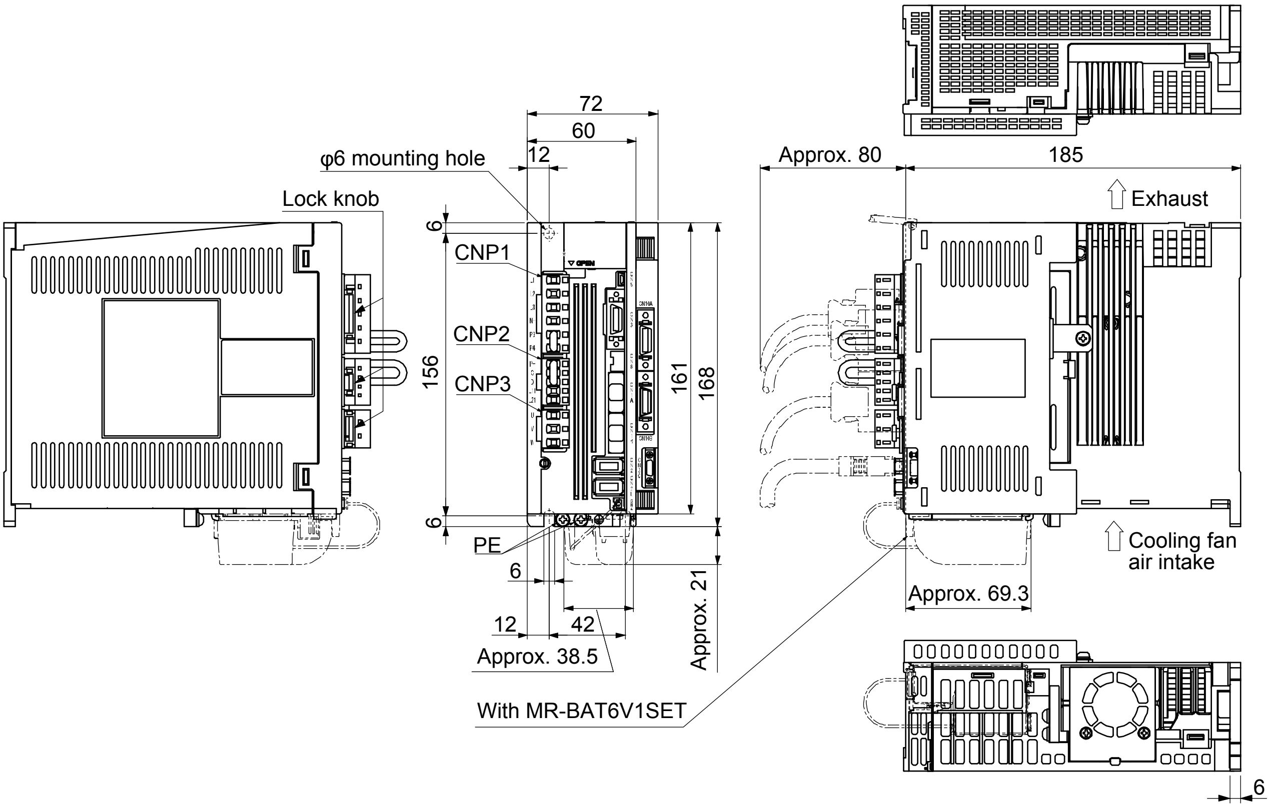
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(3) MR-J4-70B-RJ020/MR-J4-100B-RJ020

[Unit: mm]

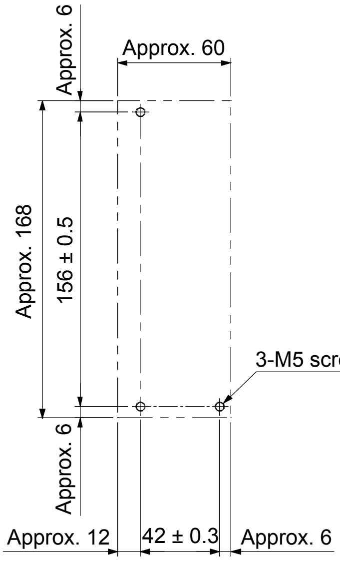


Mass: 1.4 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Terminal

CNP1
L1
L2
L3
N-
P3
P4
CNP2
P+
C
D
L11
L21
CNP3
U
V
W
PE
⏚ ⏚

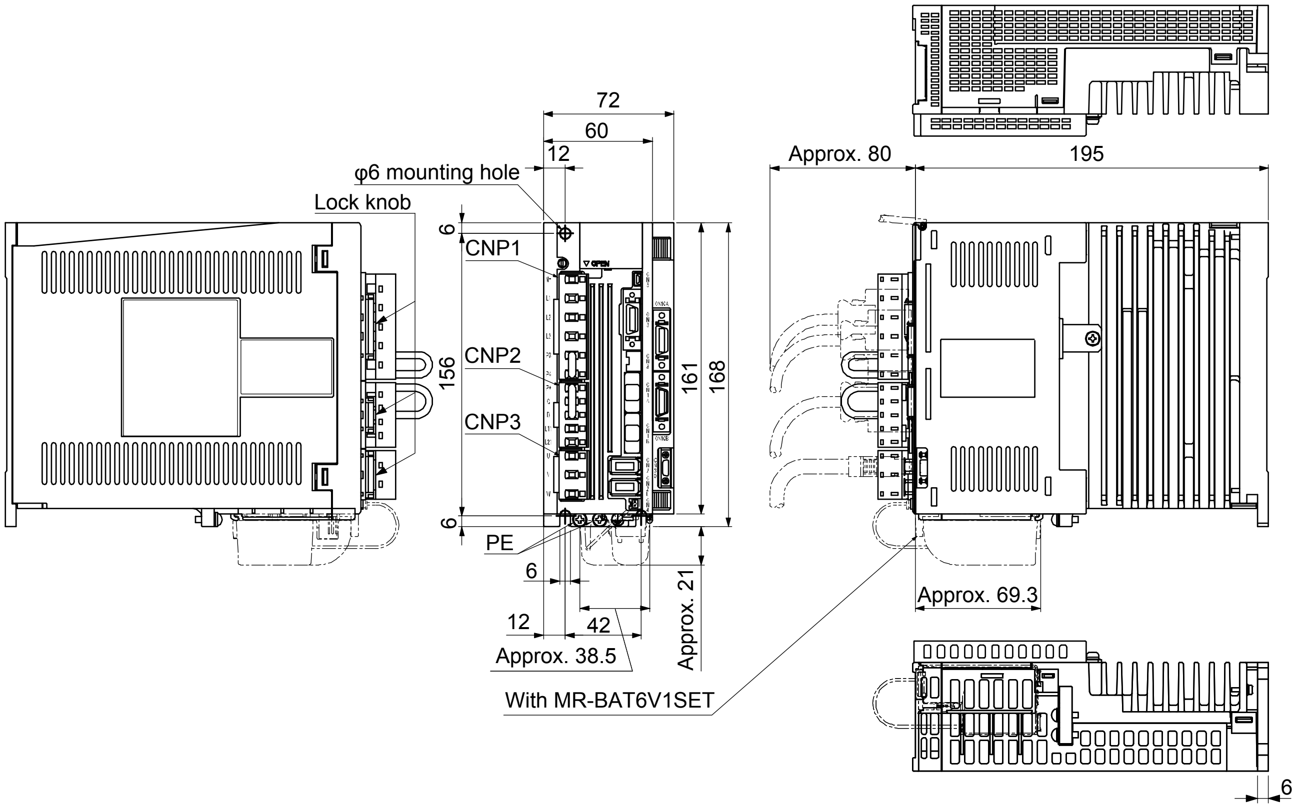
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(4) MR-J4-60B4-RJ020/MR-J4-100B4-RJ020

[Unit: mm]

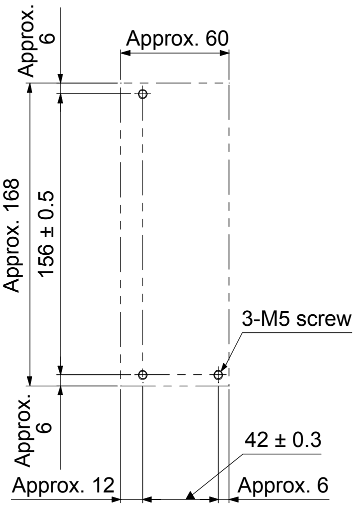


Mass: 1.7 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Terminal

CNP1
N-
L1
L2
L3
P3
P4
CNP2
P+
C
D
L11
L21
CNP3
U
V
W
PE
⏚ ⏚

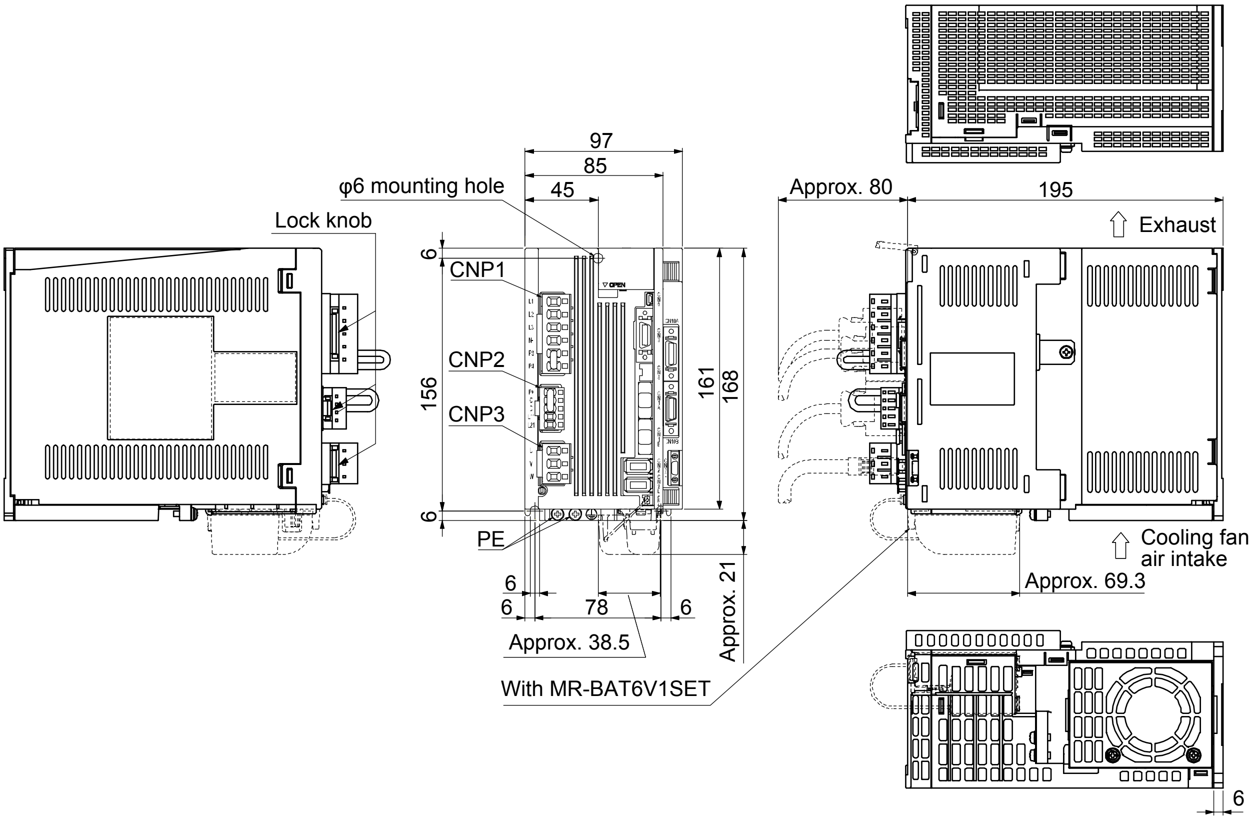
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(5) MR-J4-200B-RJ020

[Unit: mm]

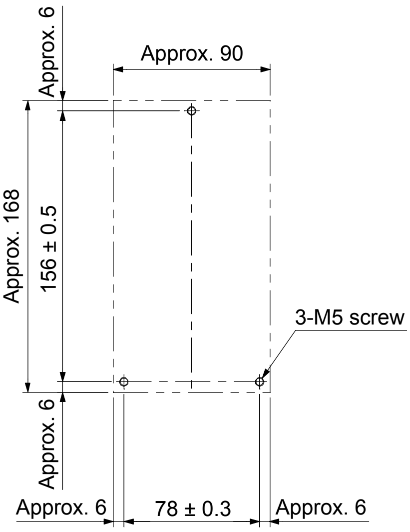


Mass: 2.1 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Terminal

CNP1
L1
L2
L3
N-
P3
P4
CNP2
P+
C
D
L11
L21
CNP3
U
V
W
PE
⏚ ⏚

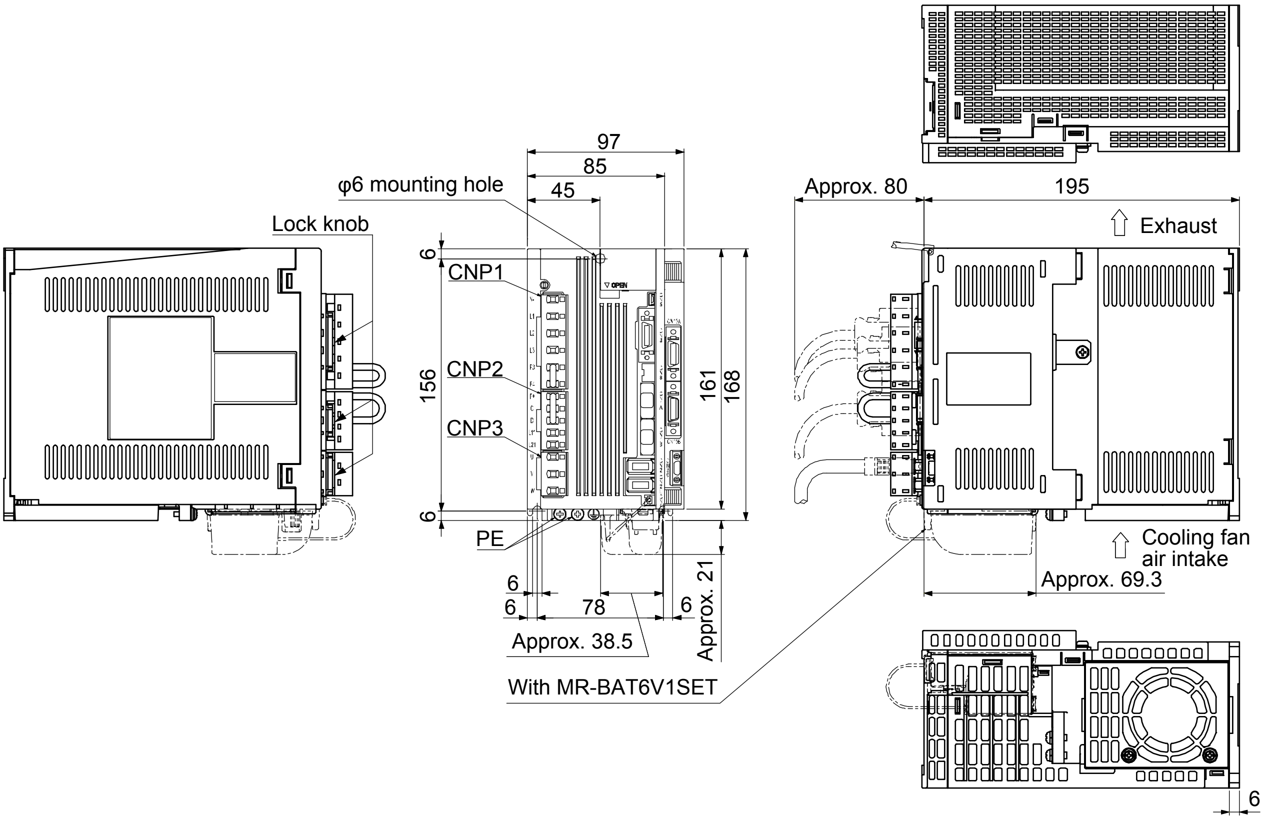
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(6) MR-J4-200B4-RJ020

[Unit: mm]



Mass: 2.1 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Terminal

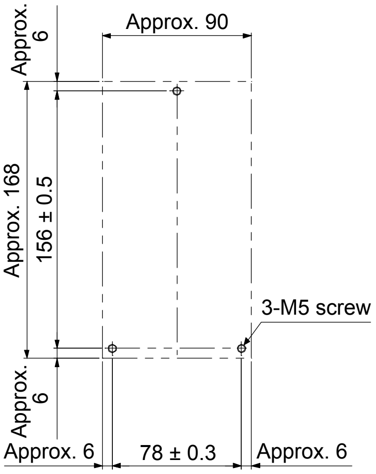
CNP1
- N-
- L1
- L2
- L3
- P3
- P4

CNP2
- P+
- C
- D
- L11
- L21

CNP3
- U
- V
- W

PE
⏚ ⏚

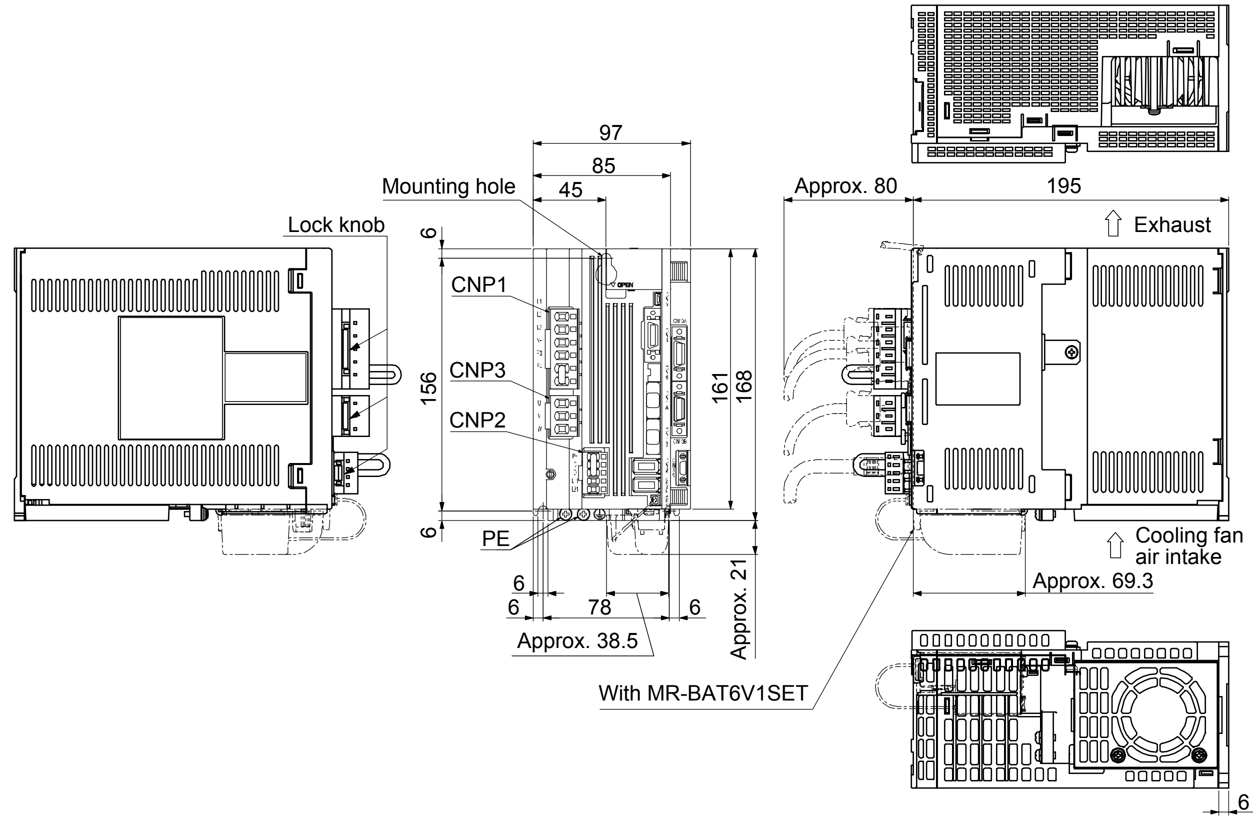
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(7) MR-J4-350B-RJ020

[Unit: mm]



Mass: 2.3 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

Terminal

CNP1
- L1
- L2
- L3
- N-
- P3
- P4

CNP2
- P+
- C
- D
- L11
- L21

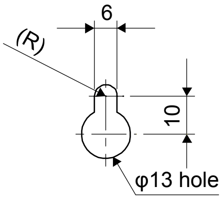
CNP3
- U
- V
- W

PE

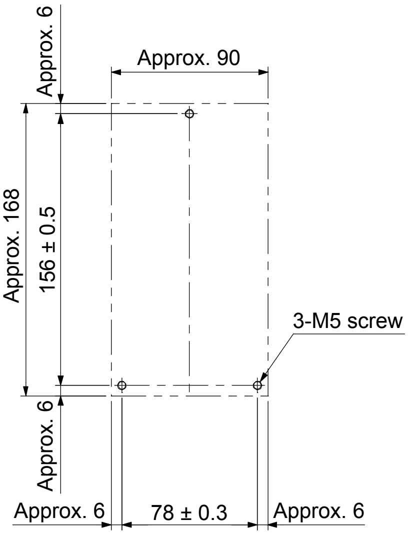
⏚ ⏚

Screw size: M4

Tightening torque: 1.2 [N•m]



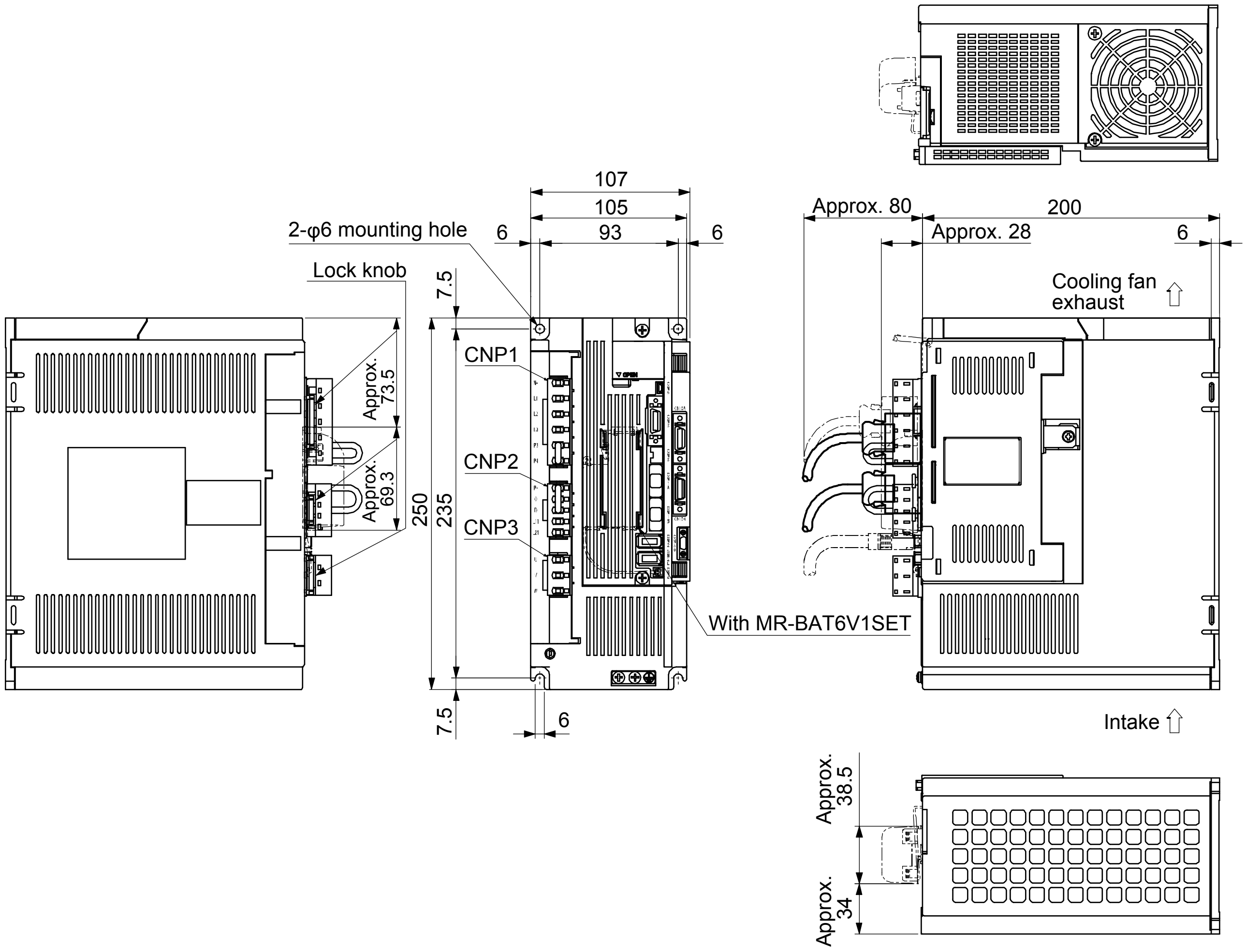
Mounting hole dimensions



Mounting hole process drawing

(8) MR-J4-350B4-RJ020

[Unit: mm]



Mass: 3.6 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

Terminal

CNP1

N-
L1
L2
L3
P3
P4

CNP2

P+
C
D
L11
L21

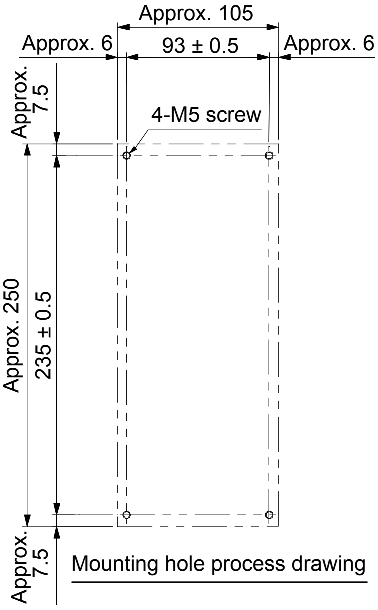
CNP3

U
V
W

PE

⏚ ⏚

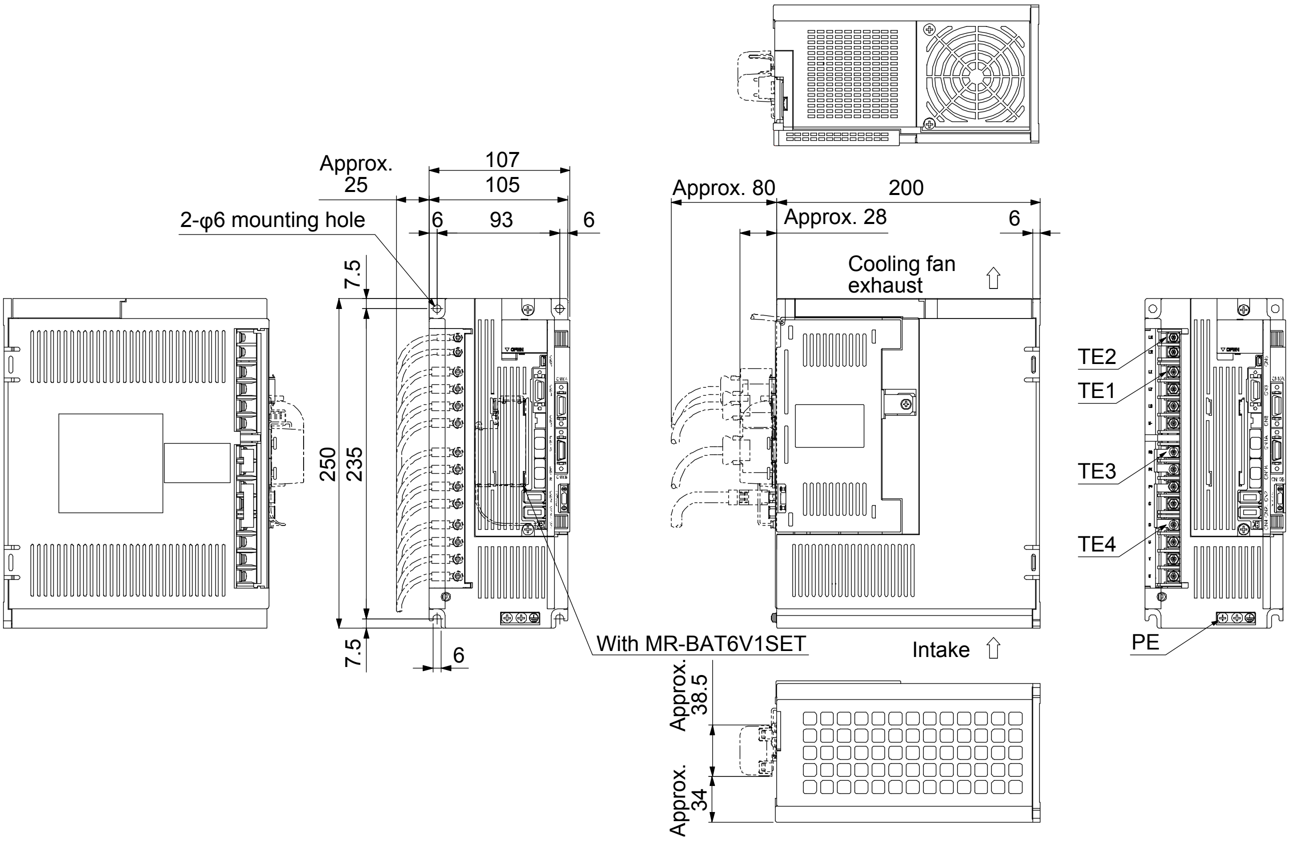
Screw size: M4
Tightening torque: 1.2 [N•m]



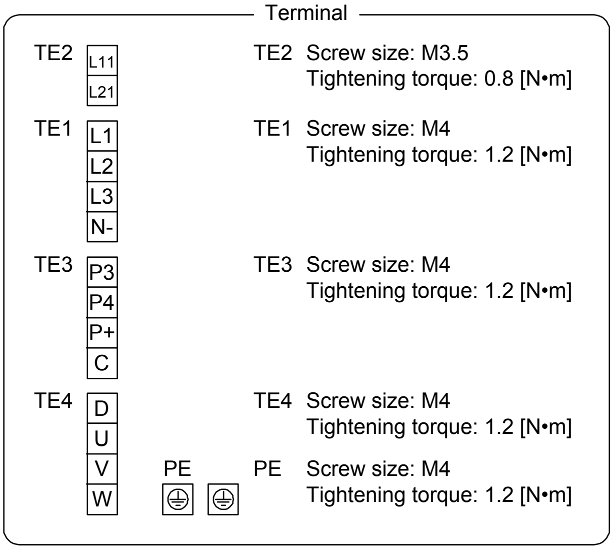
Mounting hole process drawing

(9) MR-J4-500B-RJ020

[Unit: mm]



Mass: 4.0 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



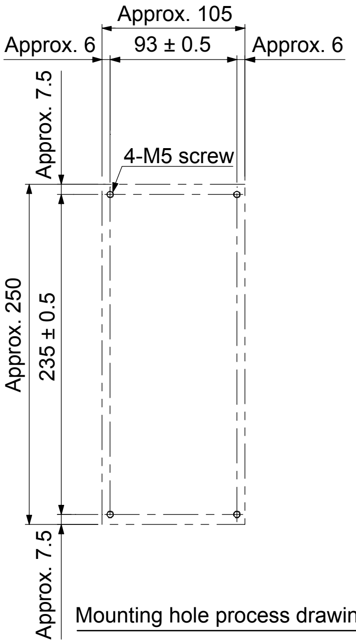
TE2 Screw size: M3.5
Tightening torque: 0.8 [N•m]

TE1 Screw size: M4
Tightening torque: 1.2 [N•m]

TE3 Screw size: M4
Tightening torque: 1.2 [N•m]

TE4 Screw size: M4
Tightening torque: 1.2 [N•m]

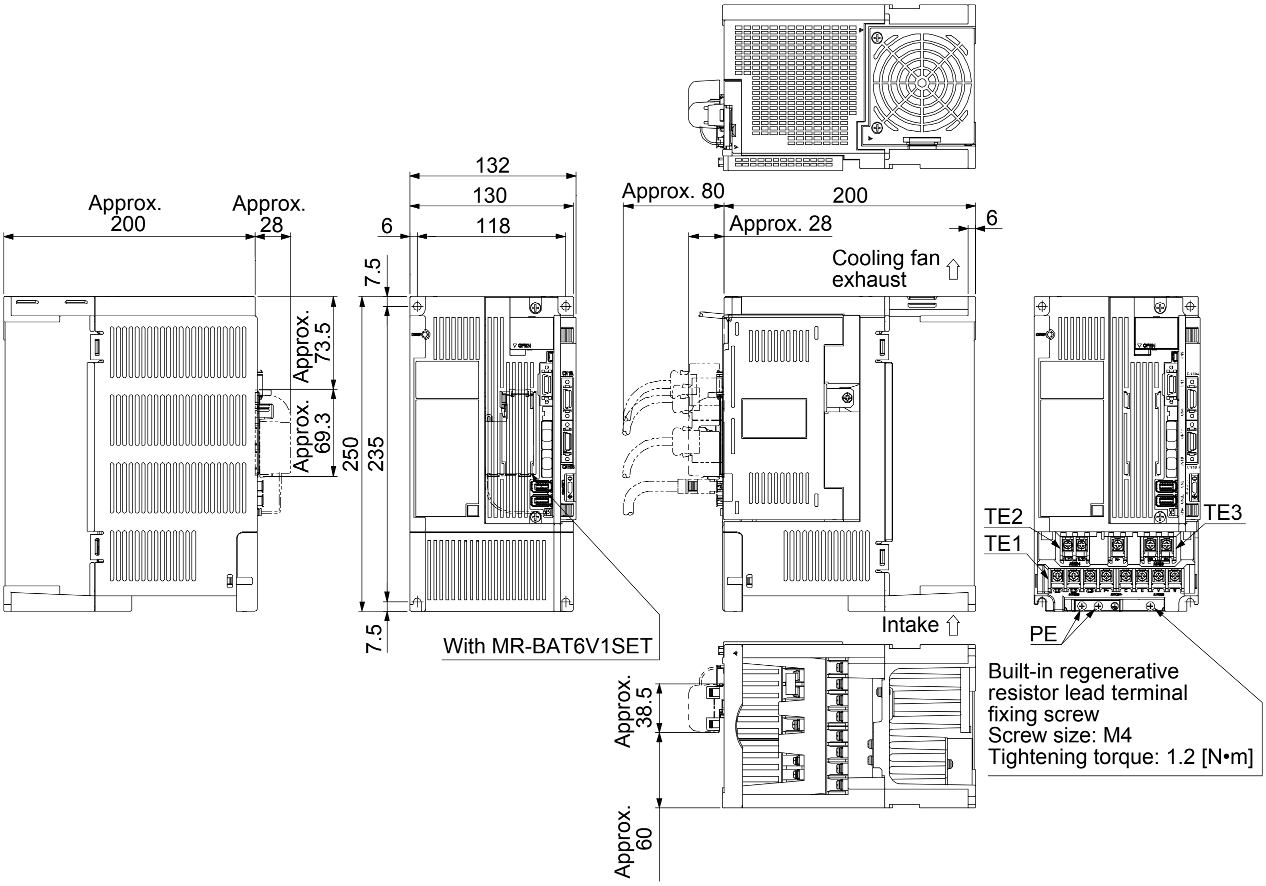
PE Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(10) MR-J4-500B4-RJ020

[Unit: mm]



Terminal

TE2 L11 L21 TE3 N- P3 P4

TE1 L1 L2 L3 P+ C U V W

PE ⏚ ⏚

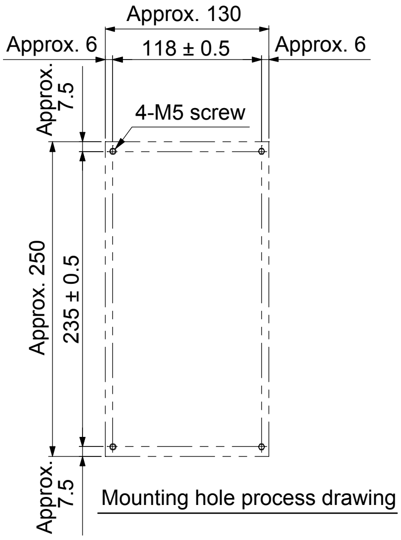
TE2 Terminal screw: M3.5
Tightening torque: 0.8 [N•m]

TE3 Terminal screw: M4
Tightening torque: 1.2 [N•m]

TE1 Terminal screw: M4
Tightening torque: 1.2 [N•m]

PE Screw size: M4
Tightening torque: 1.2 [N•m]

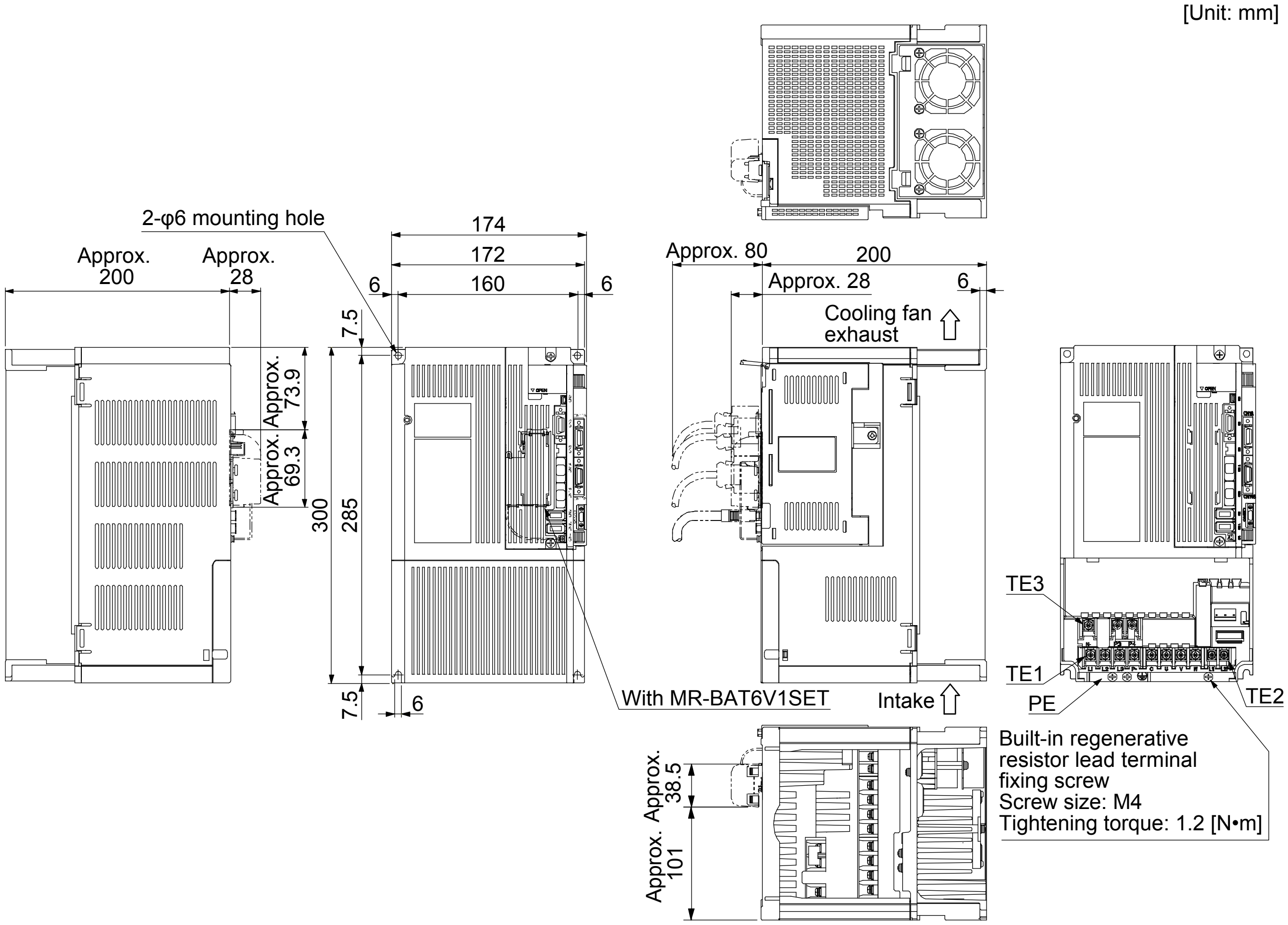
Mass: 4.3 [kg] (servo amplifier only)
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(11) MR-J4-700B-RJ020/MR-J4-700B4-RJ020

[Unit: mm]



Built-in regenerative resistor lead terminal fixing screw
Screw size: M4
Tightening torque: 1.2 [N•m]

Servo amplifier	Mass [kg] (servo amplifier only)
MR-J4-700B-RJ020	6.2
MR-J4-700B4-RJ020	6.5

Terminal

TE3 N- P3 P4

TE1 L1 L2 L3 P+ C U V W TE2 L11 L21

PE ⏚ ⏚

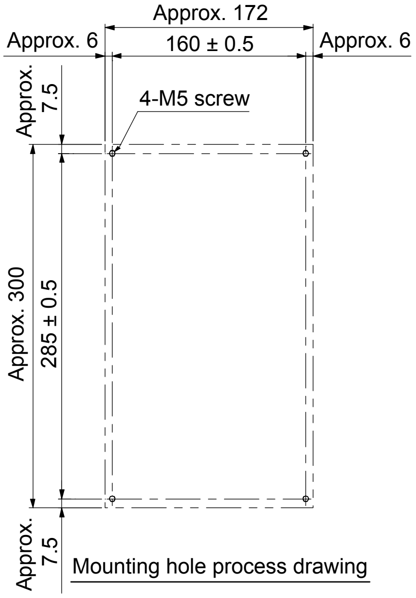
TE3 Screw size: M4
Tightening torque: 1.2 [N•m]

TE1 Screw size: M4
Tightening torque: 1.2 [N•m]

TE2 Screw size: M3.5
Tightening torque: 0.8 [N•m]

PE Screw size: M4
Tightening torque: 1.2 [N•m]

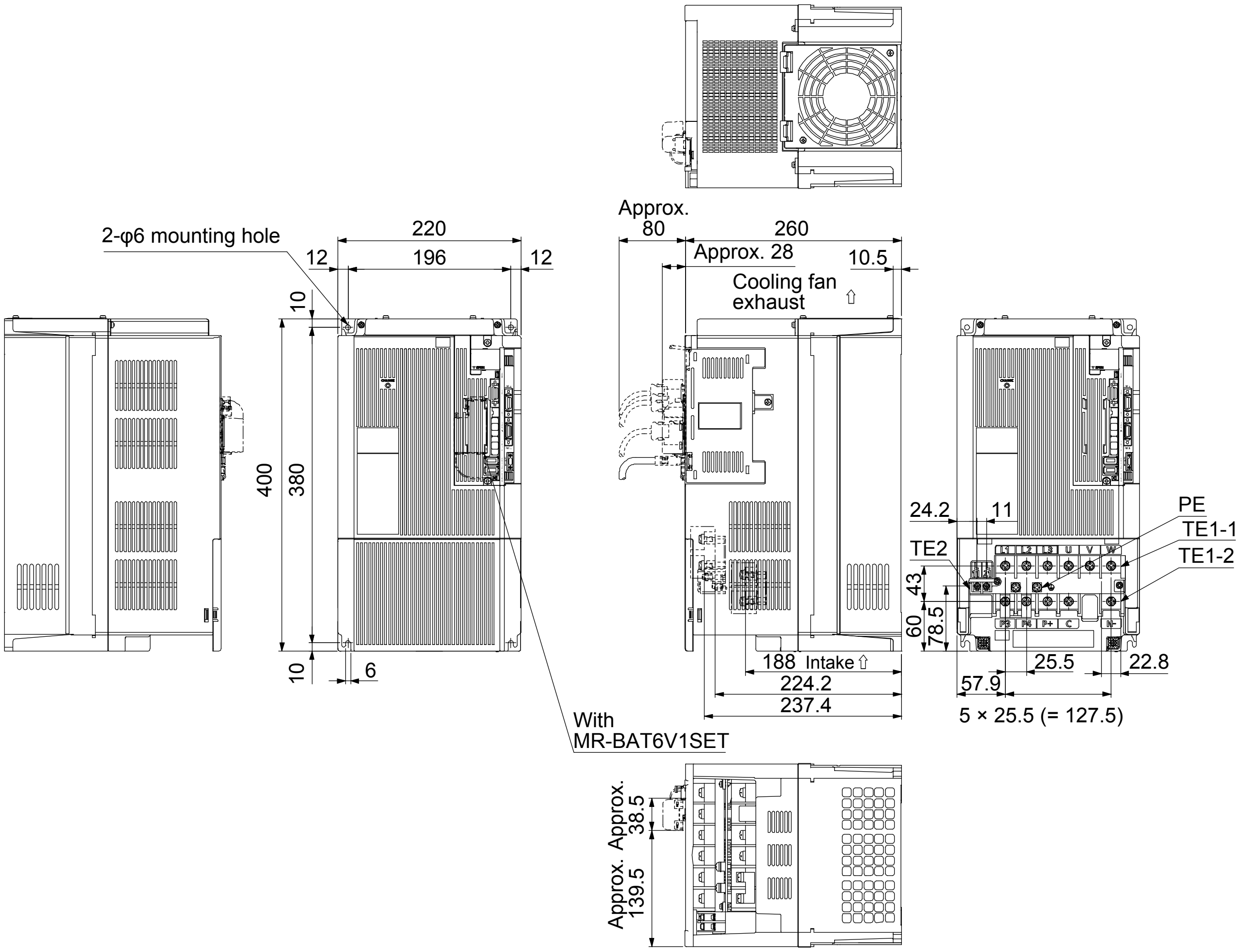
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(12) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020

[Unit: mm]



Mass: 13.4 [kg]

Terminal

TE1-1 | L1 | L2 | L3 | U | V | W |

TE1-2 | P3 | P4 | P+ | C | ╲ | N- |

TE2 | L11 | L21 |

PE ⏚ ⏚

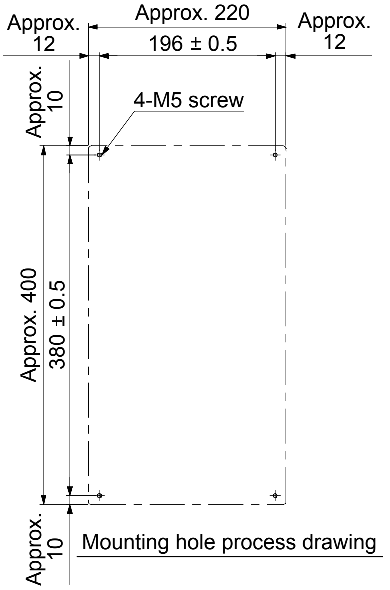
TE1-1 Screw size: M6
Tightening torque: 3.0 [N•m]

TE1-2 Screw size: M6
Tightening torque: 3.0 [N•m]

TE2 Screw size: M4
Tightening torque: 1.2 [N•m]

PE Screw size: M6
Tightening torque: 3.0 [N•m]

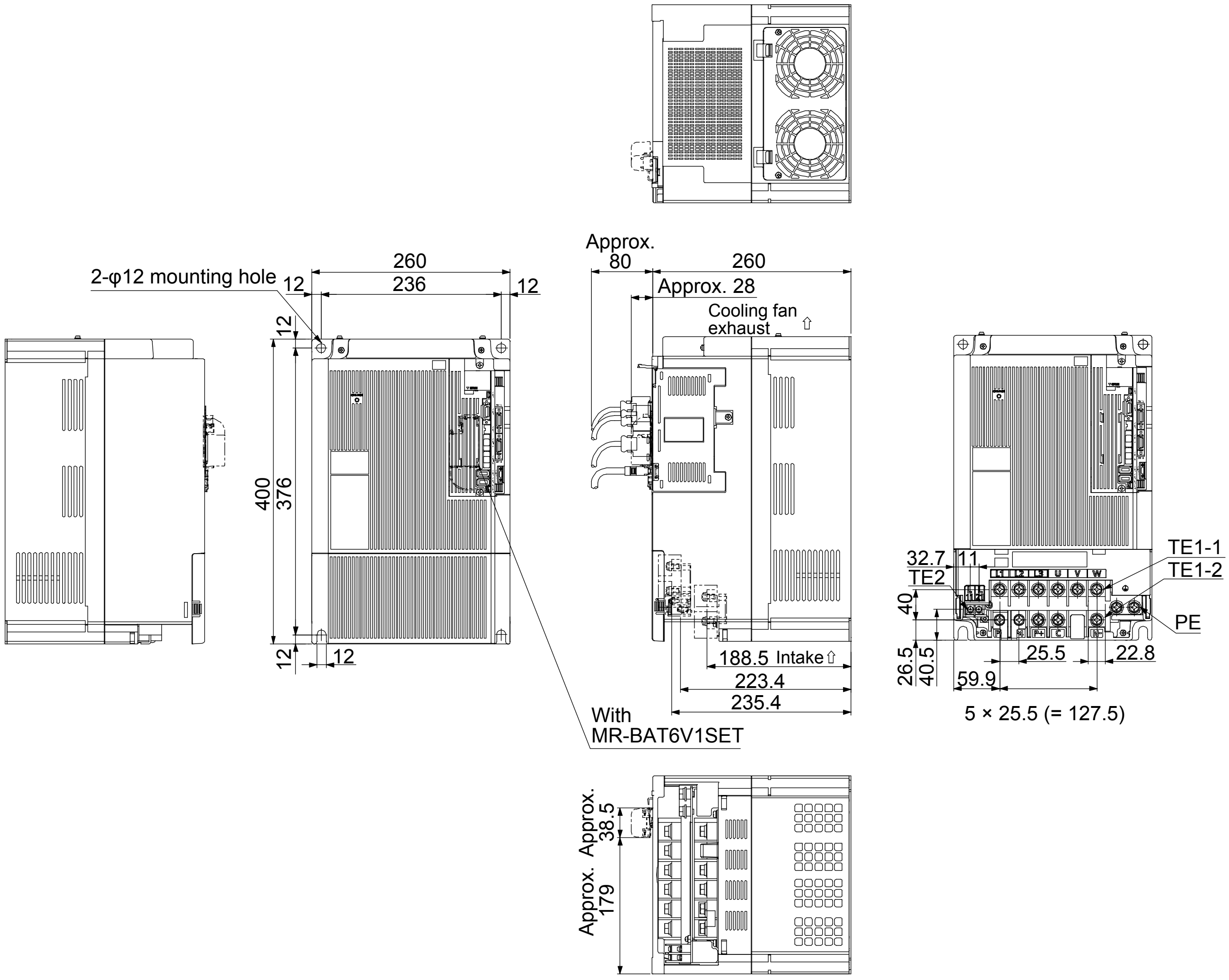
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(13) MR-J4-22KB-RJ020/MR-J4-22KB4-RJ020

[Unit: mm]



Mass: 18.2 [kg]

Terminal

TE1-1 L1 L2 L3 U V W

TE1-2 P3 P4 P+ C ╲ N-

PE ⏚ ⏚ TE2 L11 L21

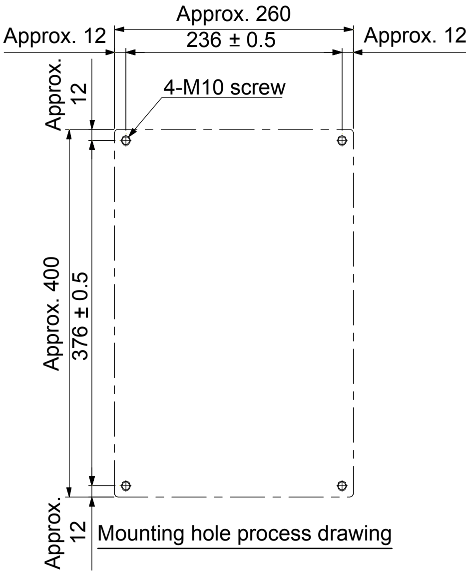
TE1-1 Screw size: M8
Tightening torque: 6.0 [N•m]

TE1-2 Screw size: M8
Tightening torque: 6.0 [N•m]

TE2 Screw size: M4
Tightening torque: 1.2 [N•m]

PE Screw size: M8
Tightening torque: 6.0 [N•m]

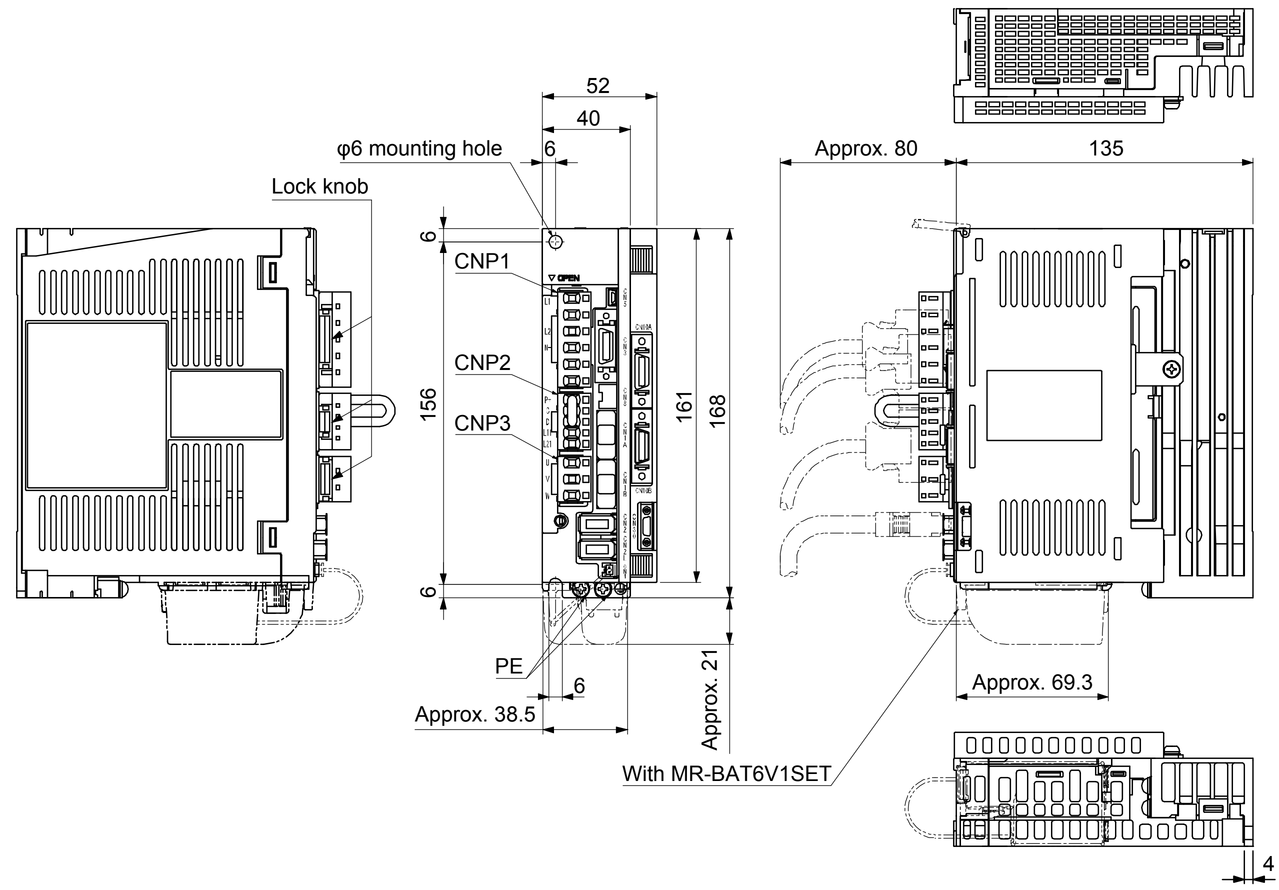
Mounting screw
Screw size: M10
Tightening torque: 26.5 [N•m]



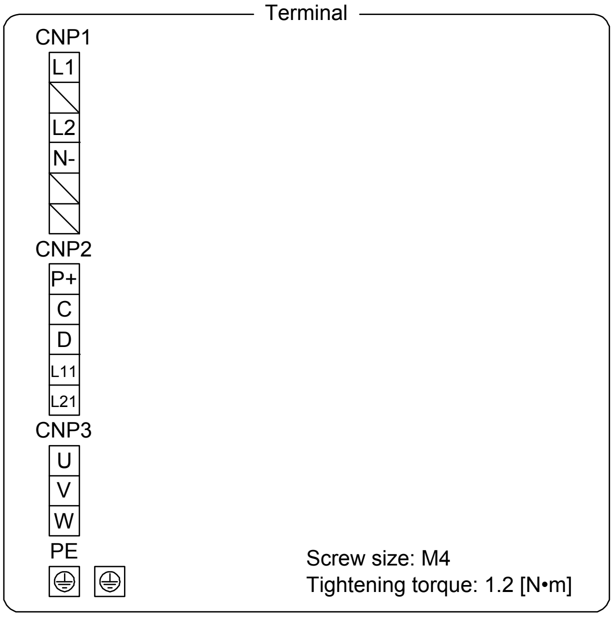
Mounting hole process drawing

(14) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020

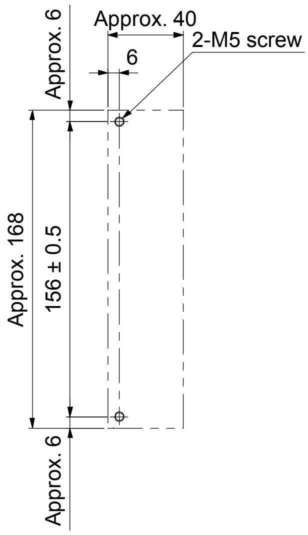
[Unit: mm]



Mass: 0.8 [kg] (servo amplifier only)



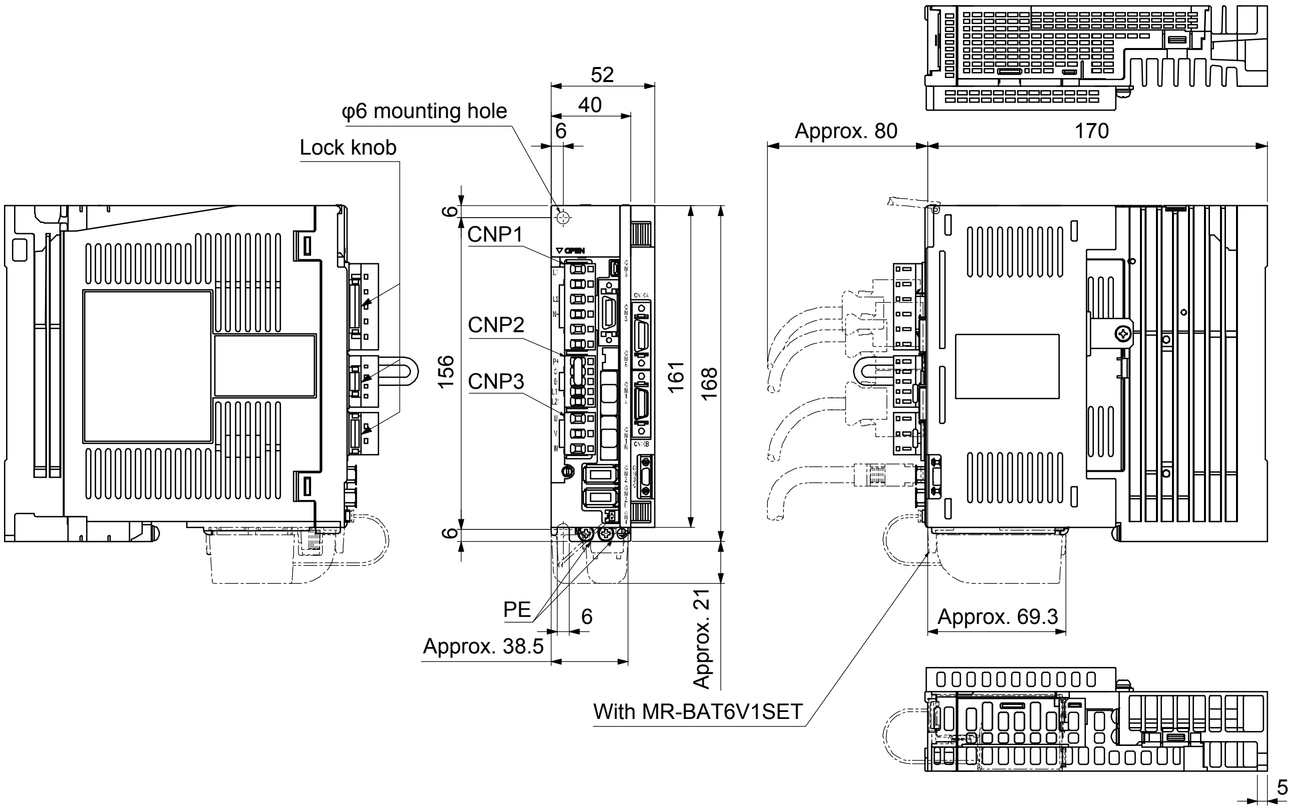
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(15) MR-J4-40B1-RJ020

[Unit: mm]

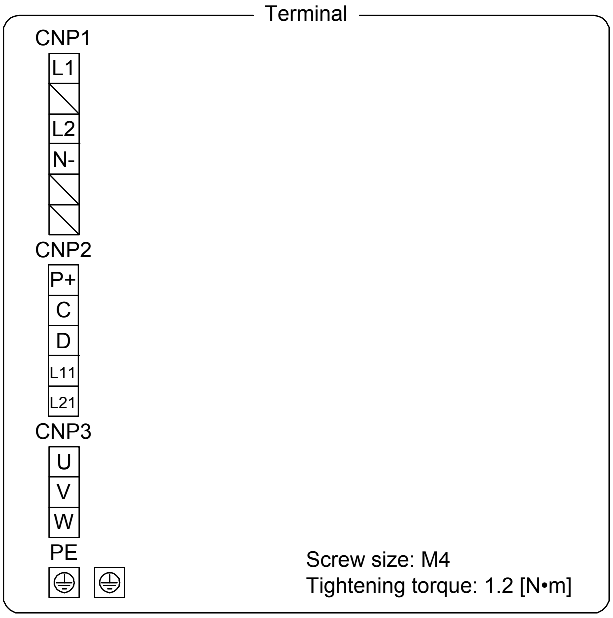


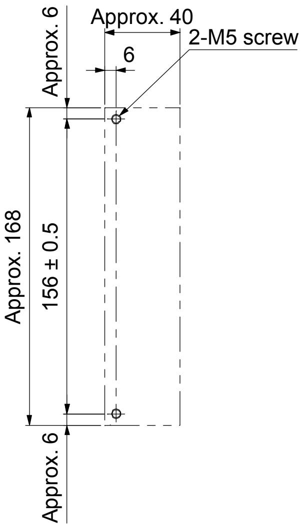
Mass: 1.0 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

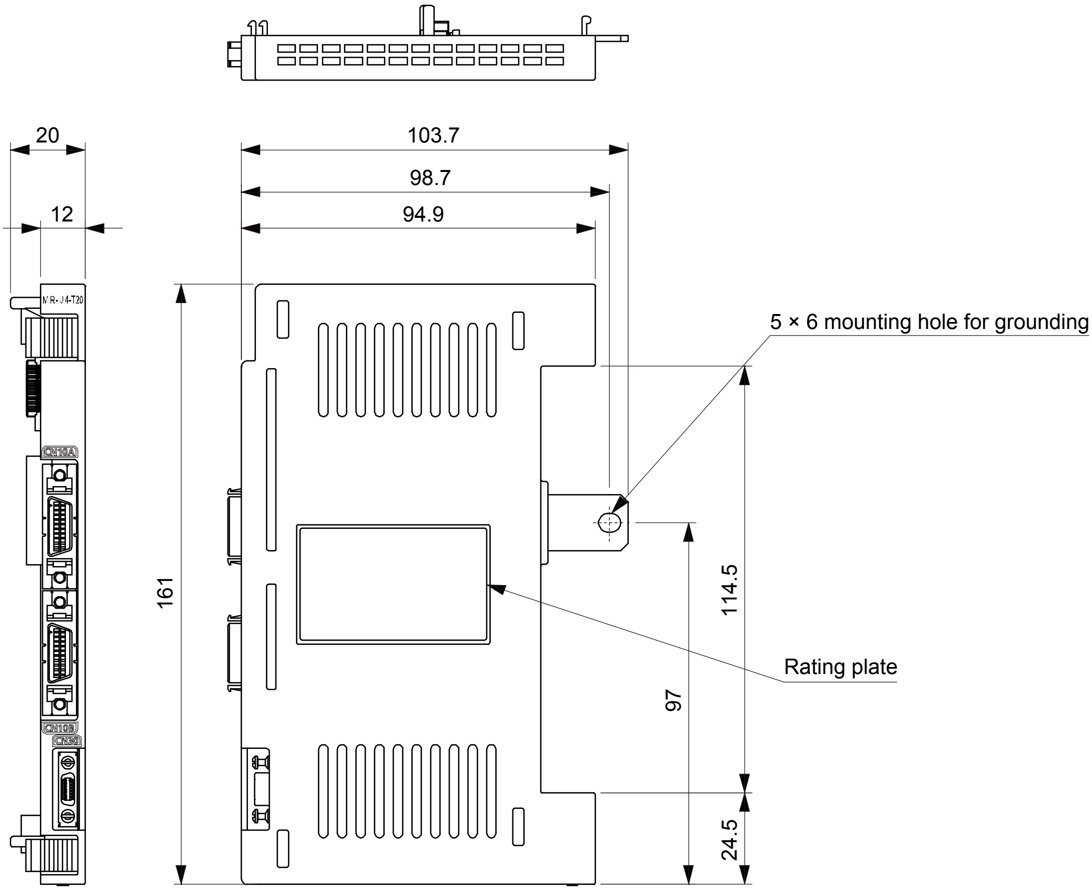




Mounting hole process drawing

9.2 MR-J4-T20

[Unit: mm]



Mass: 0.14 [kg]

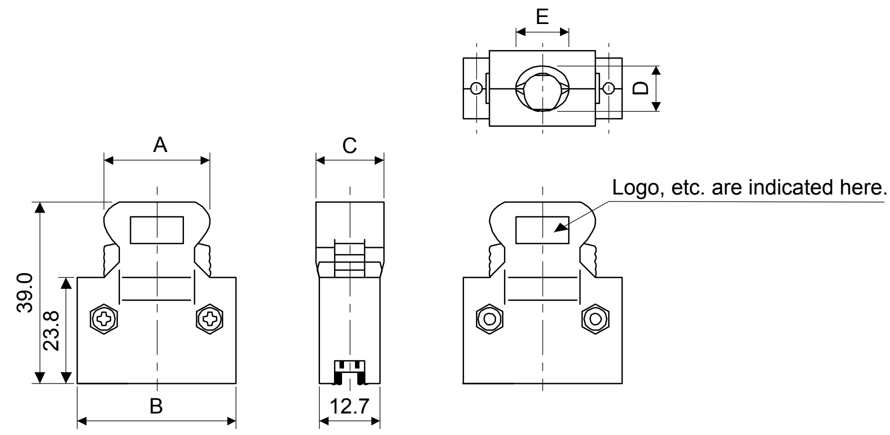
9.3 Connectors

9.3.1 Servo amplifier side connectors

(1) Miniature delta ribbon (MDR) system (3M) for CN3

(a) One-touch lock type

[Unit: mm]

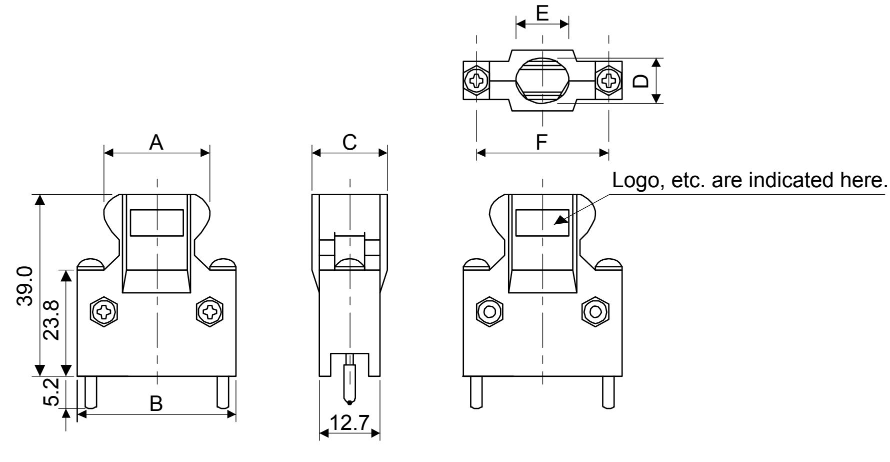


Connector	Shell kit	Variable dimensions				
		A	B	C	D	E
10120-3000PE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0

(b) Jack screw M2.6 type

This is not available as option.

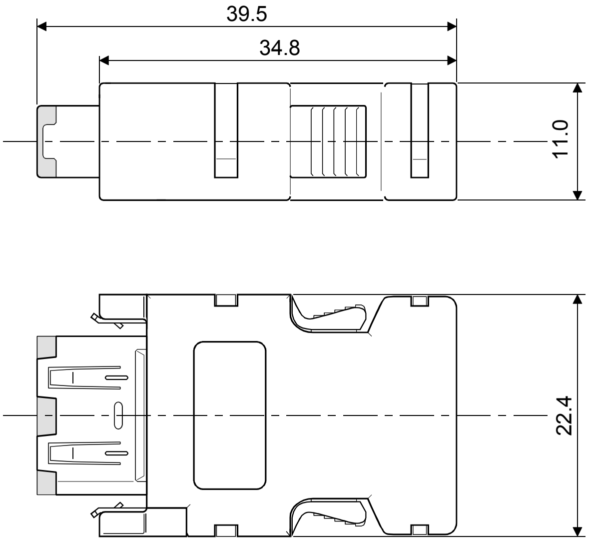
[Unit: mm]



Connector	Shell kit	Variable dimensions					
		A	B	C	D	E	F
10120-3000PE	10320-52A0-008	22.0	33.3	14.0	10.0	12.0	27.4

(2) SCR connector system (3M) for CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008

[Unit: mm]

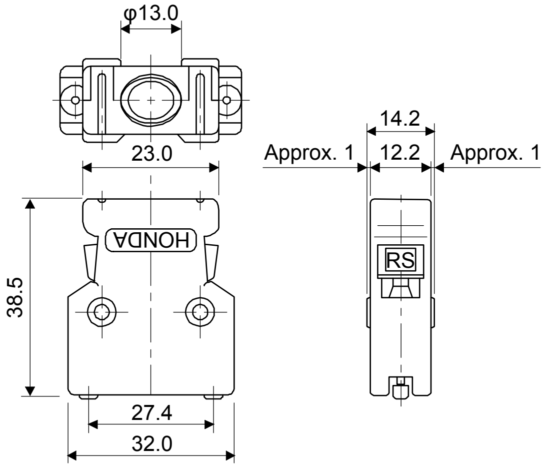


9.3.2 MR-J4-T20 connectors

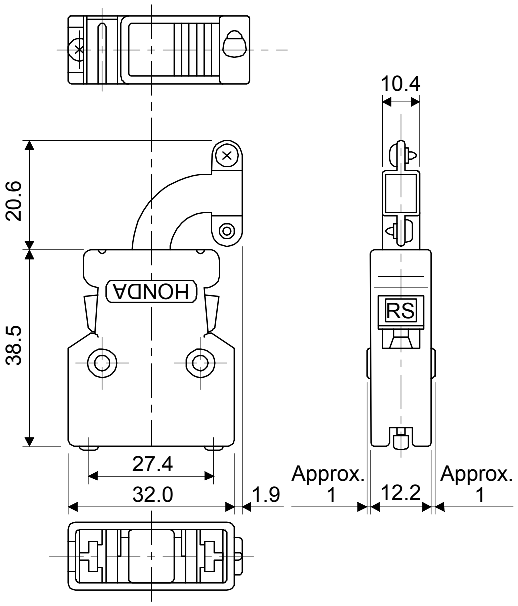
(1) Connector for CN10A/CN10B (Honda Tsushin Kogyo)

[Unit: mm]

PCR-LS20LA1



PCR-LS20LA1W



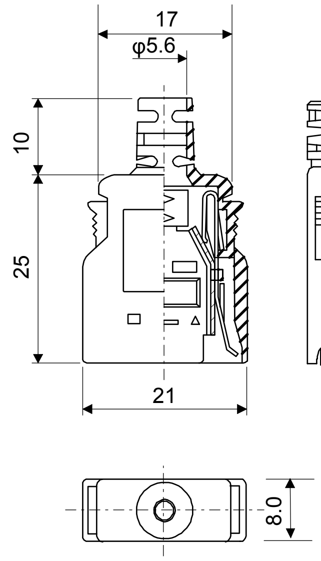
Number of pins	Model		
	Connector	Case	Crimping terminal
20	PCR-S20FS + (soldered type)	PCR-LS20LA1 PCR-LS20LA1W (Note)	FHAT-002A
	PCR-S20F (crimped type) (Note)		

Note. PCR-S20F and PCR-LS20LA1W are not options. They are to be supplied by the customer.

(2) Connector for CN30A (JAE)

[Unit: mm]

Connector: HDR-E14MG1+
Case: HDR-E14LPA5



Number of pins	Model		
	Connector	Case	(Note) Tool
14	HDR-E14MG1+	HDR-E14LPA5	Wire straightening tool: FHAT-0029 Crimping terminal: FHPT-0004C

Note. Not available from us. They are to be supplied by the customer.

10. CHARACTERISTICS

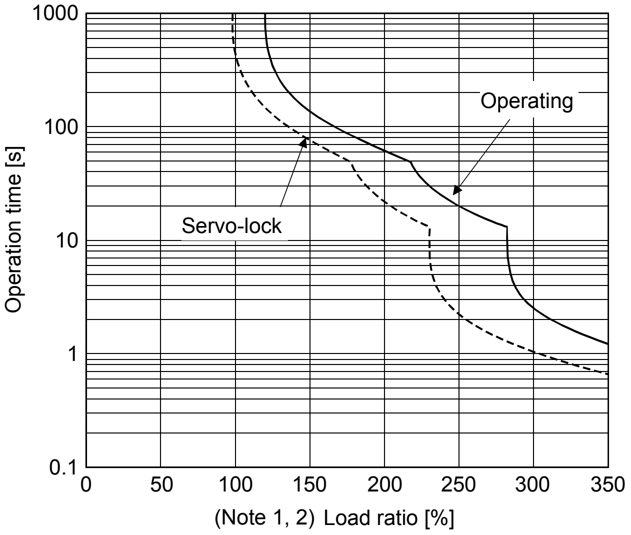
10.1 Overload protection characteristics

An electronic thermal is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power wires from overloads.
[AL. 50 Overload 1] occurs if an overload operation performed is above the electronic thermal protection curve shown in fig. 10.1. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.
For the system where the unbalanced torque occurs, such as a vertical axis system, the unbalanced torque of the machine should be kept at 70% or less of the rated torque.
This servo amplifier has a servo motor overload protective function. (The servo motor overload current (full load current) is set on the basis of 115% rated current of the servo amplifier.)

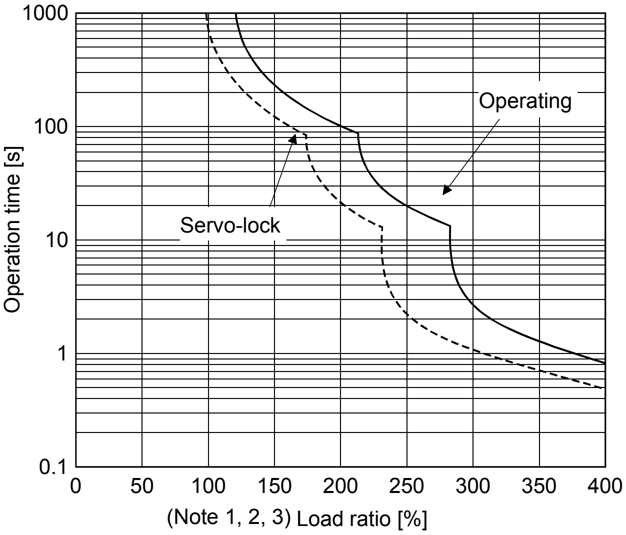
The following table shows combinations of each servo motor and graph of overload protection characteristics.

Servo motor							Graph of overload protection characteristics
HG-KR	HG-MR	HG-SR	HG-UR	HG-RR	HG-JR	HG-JR (When the maximum torque is 400%)	
053 13	053 13		72				Characteristics a
23 43 73	23 43 73	51 81 52 102			53 73 103	53	Characteristics b
		121 201 152 202 301 352	152 202	103 153 203	153 203 353	73 103 153 203	Characteristics c
		421 502 702	352 502	353 503	601 701M 503 703	353 503	Characteristics d
					801 12K1 15K1 20K1 25K1 11K1M 15K1M 22K1M 903		Characteristics e
		524 1024			534 734 1034	534	Characteristics b
		1524 2024 3524			1534 2034 3534	734 1034 1534 2034	Characteristics c
		5024 7024			6014 701M4 5034 7034	3534 5034	Characteristics d
					8014 12K14 15K14 20K14 25K14 11K1M4 15K1M4 22K1M4 9034		Characteristics e

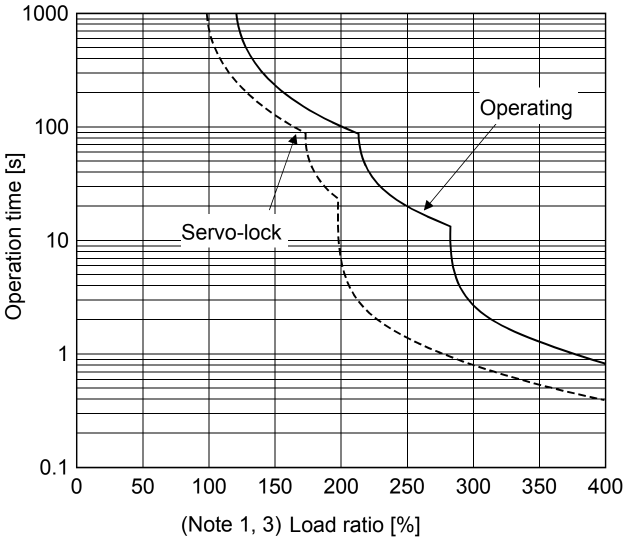
The following graphs show overload protection characteristics.



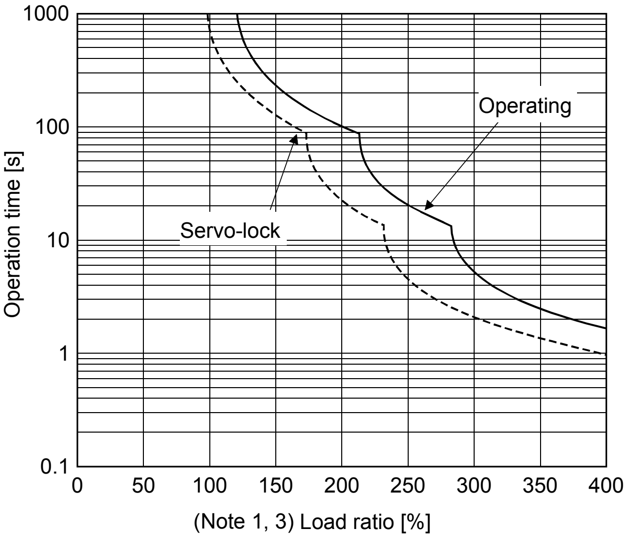
Characteristics a



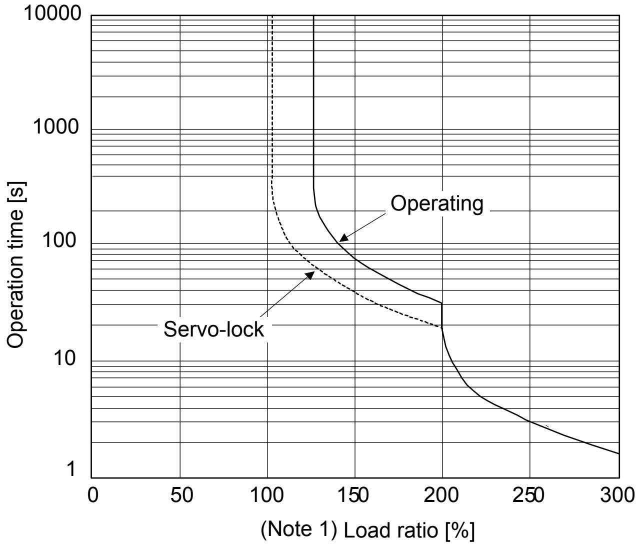
Characteristics b



Characteristics c



Characteristics d



Characteristics e

Note 1. If an operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo-lock status) or in a 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

2. The load ratio ranging from 300% to 350% applies to the HG-KR servo motor.

3. The operation time at the load ratio of 300% to 400% applies when the maximum torque of HG-JR servo motor is increased to 400% of rated torque.

Fig. 10.1 Electronic thermal protection characteristics

10.2 Power supply capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 10.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosed type cabinet, use the values in the table in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo-off according to the duty used during operation. When the servo motor is run at less than the rated speed, the power supply capacity will be smaller than the value in the table, but the servo amplifier's generated heat will not change.

Table 10.1 Power supply capacity and generated loss per servo motor at rated output

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier generated heat [W]			Area required for heat dissipation [m^2]
			At rated output	At rated output [Generated heat in the cabinet when cooled outside the cabinet] (Note 3)	With servo-off	
MR-J4-10B-RJ020	HG-MR053	0.3	25		15	0.5
	HG-MR13	0.3	25		15	0.5
	HG-KR053	0.3	25		15	0.5
	HG-KR13	0.3	25		15	0.5
MR-J4-20B-RJ020	HG-MR23	0.5	25		15	0.5
	HG-KR23	0.5	25		15	0.5
MR-J4-40B-RJ020	HG-MR43	0.9	35		15	0.7
	HG-KR43	0.9	35		15	0.7
MR-J4-60B-RJ020	HG-SR52	1.0	40		15	0.8
	HG-SR51	1.0	40		15	0.8
	HG-JR53	1.0	40		15	0.8
MR-J4-70B-RJ020	HG-MR73	1.3	50		15	1.0
	HG-KR73	1.3	50		15	1.0
	HG-UR72	1.3	50		15	1.0
	HG-JR73	1.3	50		15	1.0
MR-J4-100B-RJ020	HG-SR102	1.7	50		15	1.0
	HG-SR81	1.5	50		15	1.0
	HG-JR103	1.7	50		15	1.0
MR-J4-200B-RJ020	HG-SR152	2.5	90		20	1.8
	HG-SR202	3.5	90		20	1.8
	HG-SR121	2.1	90		20	1.8
	HG-SR201	3.5	90		20	1.8
	HG-RR103	1.7	50		15	1.0
	HG-RR153	2.5	90		20	1.8
	HG-UR152	2.5	90		20	1.8
	HG-JR153	2.5	90		20	1.8
	HG-JR203	3.5	90		20	1.8
MR-J4-350B-RJ020	HG-SR352	5.5	130		20	2.6
	HG-SR301	4.8	120		20	2.4
	HG-RR203	3.5	90		20	1.8
	HG-UR202	3.5	90		20	1.8
	HG-JR353	5.5	160		20	2.7
MR-J4-500B-RJ020	HG-SR502	7.5	195		25	3.9
	HG-SR421	6.3	160		25	3.2
	HG-RR353	5.5	135		25	2.7
	HG-RR503	7.5	195		25	3.9
	HG-UR352	5.5	195		25	3.9
	HG-UR502	7.5	195		25	3.9
	HG-JR503	7.5	195		25	3.9
MR-J4-700B-RJ020	HG-SR702	10	300		25	6.0
	HG-JR703	10	300		25	6.0

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier generated heat [W]			Area required for heat dissipation [m^2]
			At rated output	At rated output [Generated heat in the cabinet when cooled outside the cabinet] (Note 3)	With servo-off	
MR-J4-11KB-RJ020	HG-JR903	13	435	130	45	8.7
	HG-JR11K1M	16	530	160	45	11.0
	HG-JR801	12	370	110	45	7.0
	HG-JR12K1	18	570	170	45	11.5
MR-J4-15KB-RJ020	HG-JR15K1M	22	640	195	45	13.0
	HG-JR15K1	22	640	195	45	12.8
MR-J4-22KB-RJ020	HG-JR22K1M	33	850	260	55	17.0
	HG-JR20K1	30	800	240	55	16.0
	HG-JR25K1	38	900	270	55	19.0
MR-J4-60B4-RJ020	HG-SR524	1.0	40		18	0.8
	HG-JR534	1.0	40		18	0.8
MR-J4-100B4-RJ020	HG-SR1024	1.7	60		18	1.2
	HG-JR734	1.3	60		18	1.2
	HG-JR1034	1.7	60		18	1.2
MR-J4-200B4-RJ020	HG-SR1524	2.5	90		20	1.8
	HG-SR2024	3.5	90		20	1.8
	HG-JR1534	2.5	90		20	1.8
	HG-JR2034	3.5	90		20	1.8
MR-J4-350B4-RJ020	HG-SR3524	5.5	130		20	2.6
	HG-JR3534	5.5	160		20	2.7
MR-J4-500B4-RJ020	HG-SR5024	7.5	195		25	3.9
	HG-JR5034	7.5	195		25	3.9
MR-J4-700B4-RJ020	HG-SR7024	10	300		25	6.0
	HG-JR7034	10	300		25	6.0
	HG-JR701M4	10	300		25	6.0
	HG-JR6014	8.6	250		25	5.0
MR-J4-11KB4-RJ020	HG-JR9034	13	435	130	45	8.7
	HG-JR11K1M4	16	530	160	45	11.0
	HG-JR8014	12	370	110	45	7.0
	HG-JR12K14	18	570	170	45	11.5
MR-J4-15KB4-RJ020	HG-JR15K1M4	22	640	195	45	13.0
	HG-JR15K14	22	640	195	45	12.8
MR-J4-22KB4-RJ020	HG-JR22K1M4	33	850	260	55	17.0
	HG-JR20K14	30	800	240	55	16.0
	HG-JR25K14	38	900	270	55	19.0
MR-J4-10B1-RJ020	HG-MR053	0.3	25		15	0.5
	HG-MR13	0.3	25		15	0.5
	HG-KR053	0.3	25		15	0.5
	HG-KR13	0.3	25		15	0.5
MR-J4-20B1-RJ020	HG-MR23	0.5	25		15	0.5
	HG-KR23	0.5	25		15	0.5
MR-J4-40B1-RJ020	HG-MR43	0.9	35		15	0.7
	HG-KR43	0.9	35		15	0.7

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value is applicable when the power factor improving AC reactor or power factor improving DC reactor is not used.

2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, refer to section 11.2.

3. This value is applicable when the servo amplifier is cooled by using the panel through attachment.

(2) Heat dissipation area for an enclosed type cabinet

The enclosed type cabinet (hereafter called the cabinet) which will contain the servo amplifier should be designed to ensure that its temperature rise is within +10 ˚C at the ambient temperature of 40 ˚C. (With an approximately 5 ˚C safety margin, the system should operate within a maximum 55 ˚C limit.) The necessary cabinet heat dissipation area can be calculated by equation 10.1.

$$A = \frac{P}{K \bullet \Delta T} \quad \cdots\cdots\cdots\cdots (10.1)$$

A: Heat dissipation area [m^2]
P: Loss generated in the cabinet [W]
ΔT: Difference between the internal and ambient temperatures [˚C]
K: Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with equation 10.1, assume that P is the sum of all losses generated in the cabinet. Refer to table 10.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the cabinet is directly installed on an insulated wall, that extra amount must be added to the cabinet's surface area. The required heat dissipation area will vary with the conditions in the cabinet. If convection in the cabinet is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the cabinet and the use of a cooling fan should be considered. Table 10.1 lists the cabinet dissipation area for each servo amplifier (guideline) when the servo amplifier is operated at the ambient temperature of 40 ˚C under rated load.

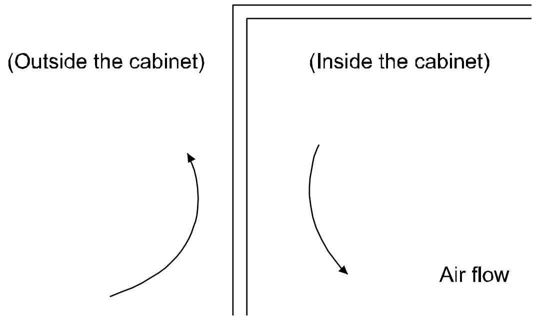


Fig. 10.2 Temperature distribution in an enclosed type cabinet

When air flows along the outer wall of the cabinet, effective heat exchange will be possible, because the temperature slope inside and outside the cabinet will be steeper.

10.3 Dynamic brake characteristics

POINT

- Do not use the dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- Be sure to enable EM1 (Forced stop) after servo motor stops when using EM1 (Forced stop) frequently in other than emergency.
- Servo motors for MR-J4 may have the different coasting distance from that of the previous model.
- The electronic dynamic brake operates in the initial state for the HG series servo motors of 600 W or smaller capacity. The time constant "τ" for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to [Pr. 39] and [Pr. 56].
- When an HG series servo motor is used with a servo amplifier of 11 kW or more, use the external dynamic brake for MR-J4. The external dynamic brake for MR-J2S cannot be used.

10.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 10.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 10.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (2) of this section.)

A working part generally has a friction force. Therefore, actual coasting distance will be shorter than a maximum coasting distance calculated with the following equation.

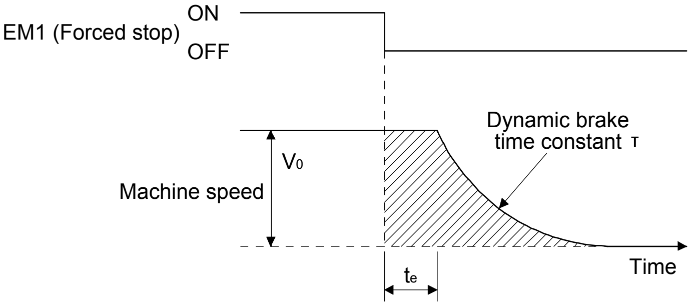


Fig. 10.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \cdots\cdots (10.2)$$

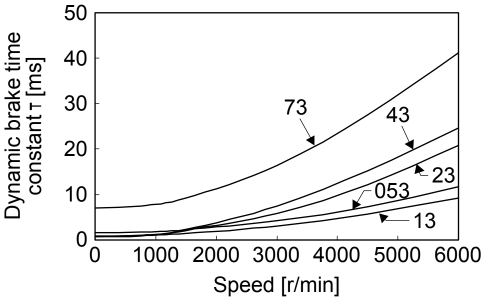
L_{max} : Maximum coasting distance ···· [mm]
V_0 : Machine's fast feed speed ···· [mm/min]
J_M : Moment of inertia of the servo motor ···· [$\times 10^{-4}$ kg•m^2]
J_L : Load moment of inertia converted into equivalent value on servo motor shaft ···· [$\times 10^{-4}$ kg•m^2]
τ : Dynamic brake time constant ···· [s]
t_e : Delay time of control section ···· [s]

For 7 kW or lower servo amplifiers, there is internal relay delay time of about 10 ms. For 11 kW to 22 kW servo amplifiers, there is delay caused by magnetic contactor built into the external dynamic brake (about 50 ms) and delay caused by the external relay.

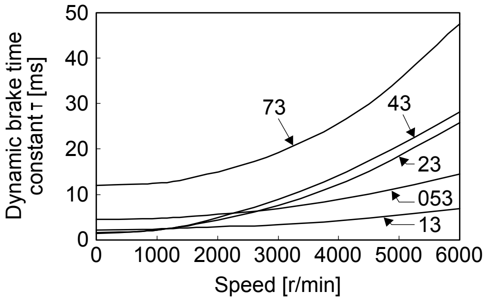
(2) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 10.2.

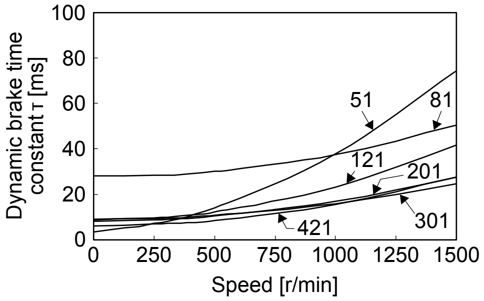
(a) 200 V class



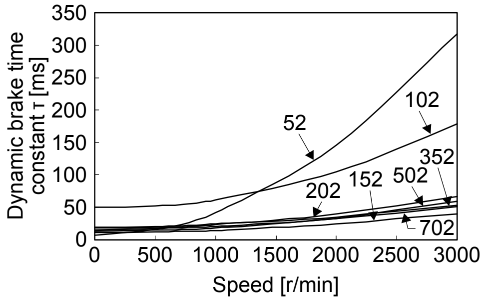
HG-MR series



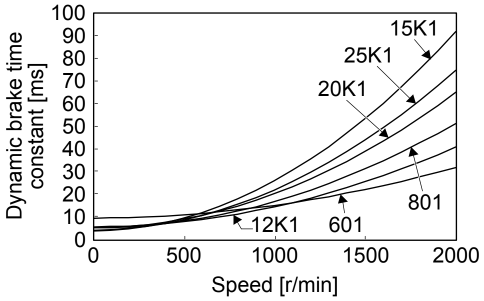
HG-KR series



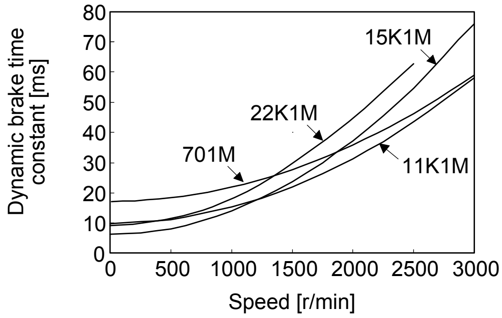
HG-SR 1000 r/min series



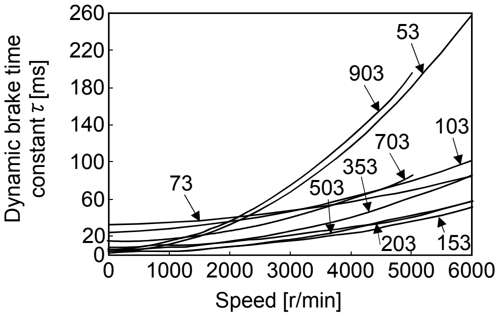
HG-SR 2000 r/min series



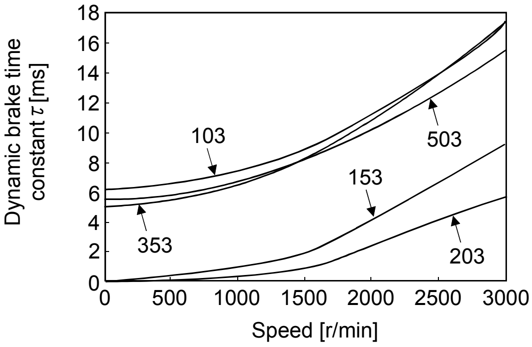
HG-JR1000 r/min series



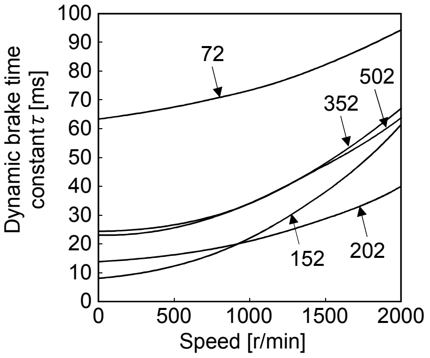
HG-JR1500 r/min series



HG-JR3000 r/min series

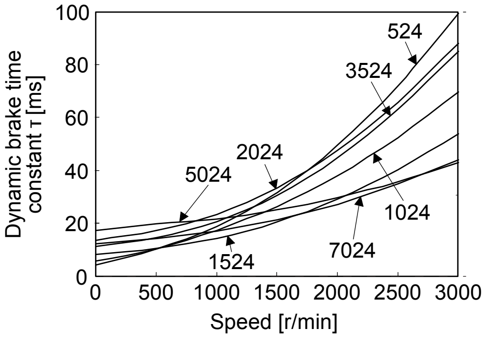


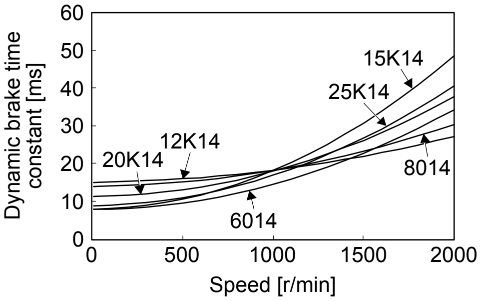
HG-RR series



HG-UR series

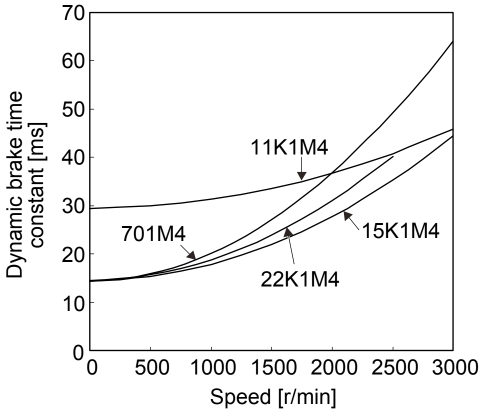
(b) 400 V class

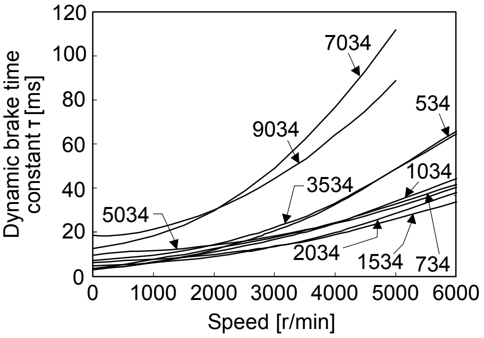




HG-SR series

HG-JR1000 r/min series





HG-JR1500 r/min series

HG-JR3000 r/min series

10.3.2 Permissible load to motor inertia when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the load inertia moment is higher than this value, the dynamic brake may burn. If the load to motor inertia ratio exceeds the indicated value, contact your local sales office.
The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor. The value in the parenthesis shows the value at the rated speed.

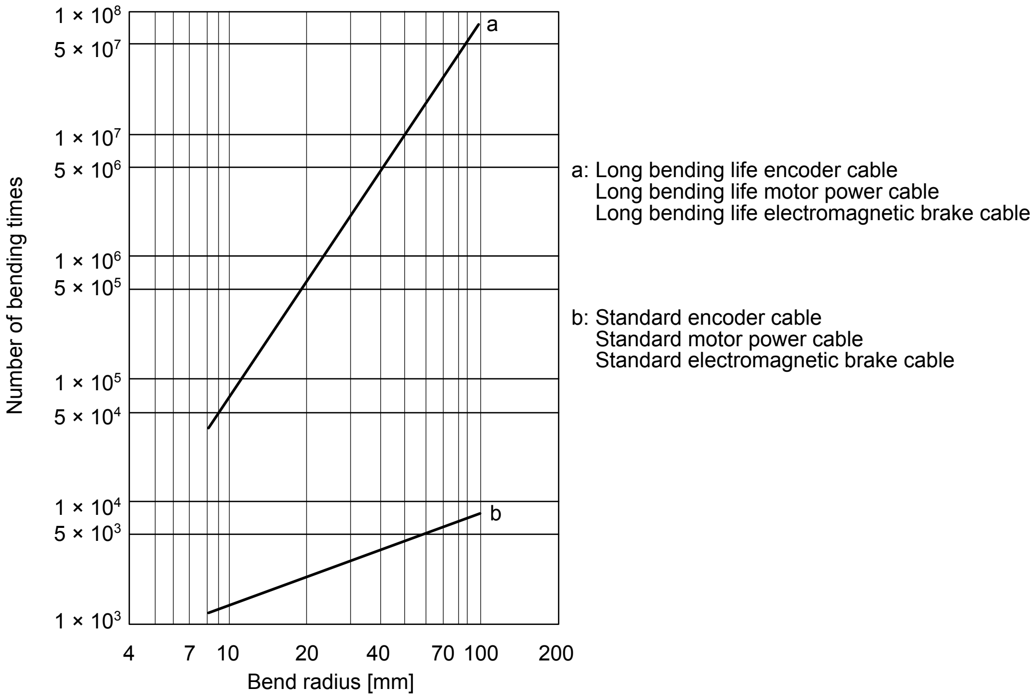
Servo motor	Permissible load to motor inertia ratio [multiplier]
HG-KR053	30
HG-KR13	
HG-KR23	
HG-KR43	
HG-KR73	
HG-MR053	35
HG-MR13	32
HG-MR23	
HG-MR43	
HG-MR73	
HG-SR51	30
HG-SR81	
HG-SR121	
HG-SR201	
HG-SR301	16
HG-SR421	15
HG-SR52	30
HG-SR102	
HG-SR152	21
HG-SR202	
HG-SR352	13 (15)
HG-SR502	
HG-SR702	5 (15)
HG-SR524	5 (15)
HG-SR1024	5 (17)
HG-SR1524	
HG-SR2024	5 (15)
HG-SR3524	
HG-SR5024	
HG-SR7024	
HG-UR72	30
HG-UR152	
HG-UR202	16
HG-UR352	
HG-UR502	15
HG-RR103	30
HG-RR153	
HG-RR203	16
HG-RR353	15
HG-RR503	

Servo motor	Permissible load to motor inertia ratio [multiplier]
HG-JR53	30
HG-JR73	
HG-JR103	
HG-JR153	
HG-JR203	
HG-JR353	16 (30)
HG-JR503	15 (30)
HG-JR703	11 (30)
HG-JR903	18 (30)
HG-JR701M	5
HG-JR11K1M	10 (30)
HG-JR15K1M	
HG-JR22K1M	20 (30)
HG-JR601	5
HG-JR801	30
HG-JR12K1	20 (30)
HG-JR15K1	17 (30)
HG-JR20K1	26 (30)
HG-JR25K1	21 (30)
HG-JR534	30 (30)
HG-JR734	
HG-JR1034	
HG-JR1534	
HG-JR2034	
HG-JR3534	20 (30) (Note)
HG-JR5034	15 (30)
HG-JR7034	11 (30)
HG-JR9034	18 (30)
HG-JR701M4	7 (10)
HG-JR11K1M4	10 (30)
HG-JR15K1M4	
HG-JR22K1M4	20 (30)
HG-JR6014	10
HG-JR8014	30
HG-JR12K14	20 (30)
HG-JR15K14	30 (30)
HG-JR20K14	26 (30)
HG-JR25K14	21 (30)

Note. When the maximum torque is increased to 400%, the permissible load to motor inertia ratio at the maximum speed of the servo motor is 25 times.

10.4 Cable bending life

The bending life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



10.5 Inrush currents at power-on of main circuit and control circuit

POINT

- For a servo amplifier of 600 W or less, the inrush current values can change depending on frequency of turning on/off the power and ambient temperature.

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to section 11.10.)
When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

(1) 200 V class

The following table indicates the inrush current (reference data) that will flow when 240 V AC is applied to the servo amplifier with the power supply capacity of 2500 kVA and the wiring length of 1 m. Even when you use a 1-phase 200 V AC power supply with MR-J4-10B-RJ020 to MR-J4-70B-RJ020, the inrush current of the main circuit power supply will be the same.

Servo amplifier	Inrush current (A_{0-P})	
	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-40B-RJ020 MR-J4-60B-RJ020	30 A (attenuated to approx. 3 A in 20 ms)	20 A to 30 A (attenuated to approx. 1 A in 20 ms)
MR-J4-70B-RJ020 MR-J4-100B-RJ020	34 A (attenuated to approx. 7 A in 20 ms)	
MR-J4-200B-RJ020 MR-J4-350B-RJ020	113 A (attenuated to approx. 12 A in 20 ms)	
MR-J4-500B-RJ020	42 A (attenuated to approx. 20 A in 20 ms)	34 A (attenuated to approx. 2 A in 20 ms)
MR-J4-700B-RJ020	85 A (attenuated to approx. 20 A in 30 ms)	
MR-J4-11KB-RJ020	226 A (attenuated to approx. 30 A in 30 ms)	42 A (attenuated to approx. 2 A in 30 ms)
MR-J4-15KB-RJ020	226 A (attenuated to approx. 50 A in 30 ms)	
MR-J4-22KB-RJ020	226 A (attenuated to approx. 70 A in 30 ms)	

(2) 400 V class

The following table indicates the inrush current (reference data) that will flow when 480 V AC is applied to the servo amplifier with the power supply capacity of 2500 kVA and the wiring length of 1 m.

Servo amplifier	Inrush current (A_{0-P})	
	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	65 A (attenuated to approx. 5 A in 10 ms)	40 A to 50 A (attenuated to approx. 0 A in 2 ms)
MR-J4-200B4-RJ020	80 A (attenuated to approx. 5 A in 10 ms)	
MR-J4-350B4-RJ020	100 A (attenuated to approx. 20 A in 10 ms)	
MR-J4-500B4-RJ020	65 A (attenuated to approx. 9 A in 20 ms)	41 A (attenuated to approx. 0 A in 3 ms)
MR-J4-700B4-RJ020	68 A (attenuated to approx. 34 A in 20 ms)	
MR-J4-11KB4-RJ020	339 A (attenuated to approx. 10 A in 30 ms)	38 A (attenuated to approx. 1 A in 30 ms)
MR-J4-15KB4-RJ020	339 A (attenuated to approx. 15 A in 30 ms)	
MR-J4-22KB4-RJ020	339 A (attenuated to approx. 20 A in 30 ms)	

(3) 100 V class

The following table indicates the inrush currents (reference data) that will flow when 120 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m.

Servo amplifier	Inrush currents (A_{0-P})	
	Main circuit power supply (L1 and L2)	Control circuit power supply (L11 and L21)
MR-J4-10B1-RJ020 MR-J4-20B1-RJ020 MR-J4-40B1-RJ020	38 A (attenuated to approx. 14 A in 10 ms)	20 A to 30 A (attenuated to approx. 0 A in 1 ms to 2 ms)

MEMO

11. OPTIONS AND PERIPHERAL EQUIPMENT

⚠WARNING

- Before connecting any option or peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

- Use the specified peripheral equipment and options to prevent a malfunction or a fire.

POINT

- We recommend using HIV wires to wire the servo amplifiers, options, and peripheral equipment. Therefore, the recommended wire sizes may differ from those used for the previous servo amplifiers.

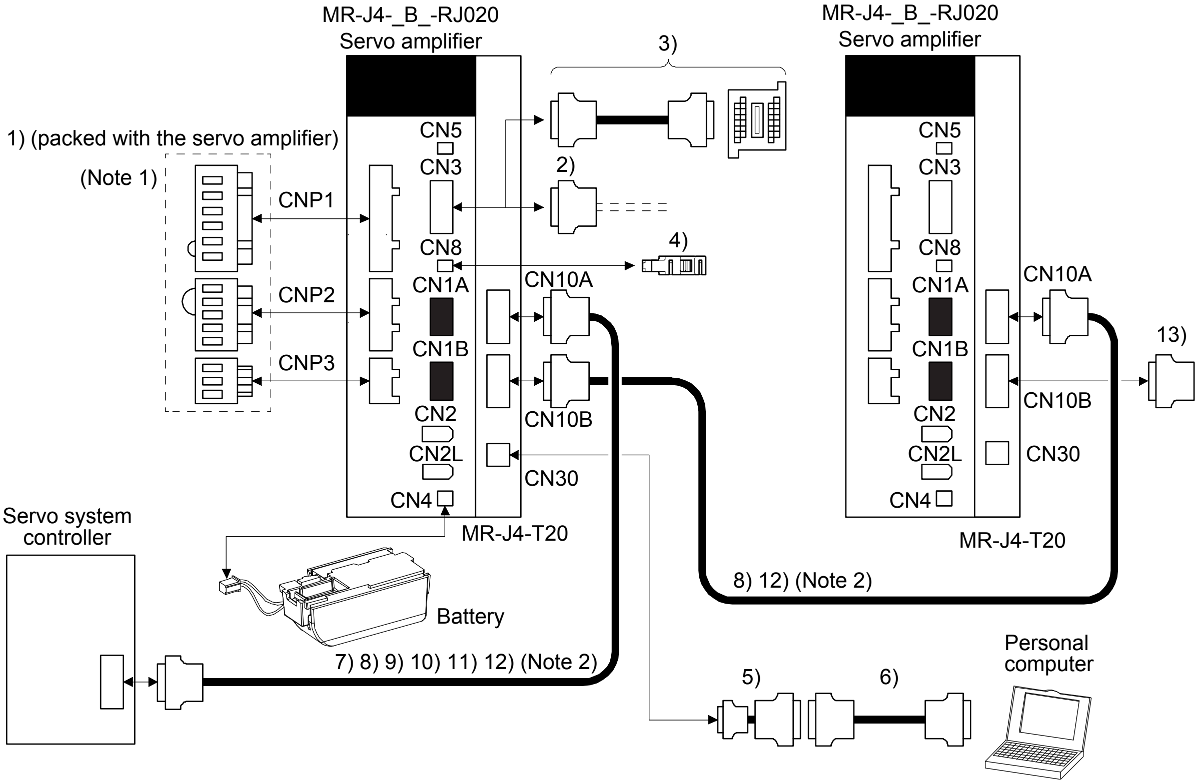
11.1 Cable/connector sets

POINT

- The IP rating indicated for cables and connectors is their protection against ingress of dust and raindrops when they are connected to a servo amplifier or servo motor. If the IP rating of the cable, connector, servo amplifier and servo motor vary, the overall IP rating depends on the lowest IP rating of all components.
- The CN1A and CN1B connectors are not used in the J2S compatibility mode. Always put caps came with the servo amplifier.
- The CN8 connector is not used in the J2S compatibility mode. Always attach the short-circuit connector came with the servo amplifier.
- For connecting the servo amplifier with the HG series servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".

Please purchase the cable and connector options indicated in this section.

11.1.1 Combinations of cable/connector sets

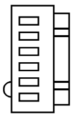
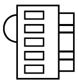
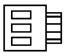
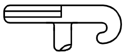
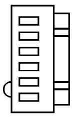
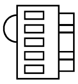
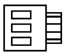
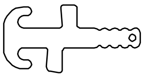
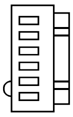
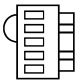
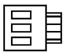
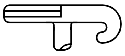
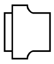
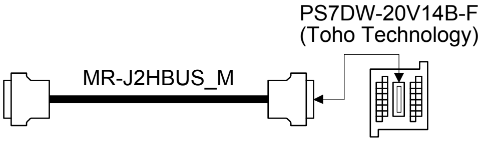
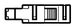


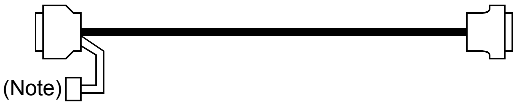
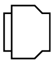
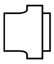
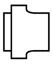
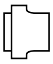
Note 1. Connectors for 3.5 kW or less. For 5 kW or more, it is a terminal block.
2. The SSCNET cables vary depending on servo system controllers connected. Refer to the following table for selecting SSCNET cables.

Servo system controller		Servo amplifier MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5
Positioning module	QD75M	8) MR-J2HBUS_M 12) MR-J2CN1
	A1SD75M	7) MR-J2HBUS_M-A 11) MR-J2CN1-A
Motion controller	Q172CPU(N)	9) Q172J2BCBL_M(-B)
	Q173CPU(N)	10) Q173J2B_CBL_M
	A171SHCPU(N) A172SHCPU(N) A173UHCPU A273UHCPU	7) MR-J2HBUS_M-A 11) MR-J2CN1-A

Additionally, select a SSCNET cable from the followings to connect previous and next axis servo amplifiers.

Previous axis servo amplifier	Next servo amplifier MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5
MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5	8) MR-J2HBUS_M 12) MR-J2CN1

No.	Product name	Model	Description	Remark
1)	Servo amplifier power connector set		   CNP1 connector: 06JFAT-SAXGDK-H7.5 (JST) CNP2 connector: 05JFAT-SAXGDK-H5.0 (JST) CNP3 connector: 03JFAT-SAXGDK-H7.5 (JST) Applicable wire size: 0.8 mm^2 to 2.1 mm^2 (AWG 18 to 14) Insulator OD: to 3.9 mm  Open tool J-FAT-OT (N) or J-FAT-OT (JST)	Supplied with 200 V class and 100 V class servo amplifiers of 1 kW or less
			   CNP1 connector: 06JFAT-SAXGFK-XL (JST) CNP2 connector: 05JFAT-SAXGDK-H5.0 (JST) CNP3 connector: 03JFAT-SAXGFK-XL (JST) (CNP1 and CNP3) Applicable wire size: 1.25 mm^2 to 5.5 mm^2 (AWG 16 to 10) Insulator OD: to 4.7 mm (CNP2) Applicable wire size: 0.8 mm^2 to 2.1 mm^2 (AWG 18 to 14) Insulator OD: to 3.9 mm  Open tool Quantity: 1 Model: J-FAT-OT-EXL (JST)	Supplied with 200 V class servo amplifiers of 2 kW and 3.5 kW
			   CNP1 connector: 06JFAT-SAXGDK-HT10.5 (JST) CNP2 connector: 05JFAT-SAXGDK-HT7.5 (JST) CNP3 connector: 03JFAT-SAXGDK-HT10.5 (JST) Applicable wire size: 1.25 mm^2 to 2.1 mm^2 (AWG 16 to 14) Insulator OD: to 3.9 mm  Open tool J-FAT-OT-XL (JST)	Supplied with 400 V class servo amplifiers of 3.5 kW or less
2)	Connector set	MR-CCN1	 Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)	
3)	Junction terminal block (recommended)		 The junction terminal block PS7DW-20V14B-F is not provided as an option. For using the junction terminal block, the optional MR-J2HBUS_M is necessary. Refer to section 11.6 for details.	
4)	Short-circuit connector			Supplied with servo amplifiers

No.	Product name	Model	Description	Remark
5)	Junction cable for RS-232C	MR-J4T20CH00	Connector: HDR-E14MG1+ Case: HDR-E14LPA5 (Honda Tsushin Kogyo) Receptacle: 10220-0200EL Shell kit: 10320-E2W0-008 (3M)  Refer to section 11.1.3 for details.	For junction with a PC-AT compatible personal computer
6)	Personal computer communication cable (RS-232C cable)	MR-CPCATCBL3M	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: DE-9SF-N Connector case: DE-C1-J6-S6 (JAE)  Refer to section 11.1.3 for details.	For connection with a PC-AT compatible personal computer
7)	SSCNET cable	MR-J2HBUS_M-A	Connector: PCR-S20FS+ Case: PCR-LS20LA1 (Honda Tsushin Kogyo) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent)  Refer to section 11.1.2 (1) for details.	
8)	SSCNET cable	MR-J2HBUS_M	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent)  Refer to section 11.1.2 (2) for details.	
9)	SSCNET cable	Q172J2BCBL_M (-B)	Connector: HDR-E14MG1+ Case: HDR-E14LPA5 (Honda Tsushin Kogyo) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent)  Socket: HNC2-2.5S-2 Terminal: HNC2-2.5S-D-B (Hirose Electric) Note. For the battery unit Q170BAT, use Q172J2BCBL_M-B. Refer to section 11.1.2 (3) for details.	
10)	SSCNET cable	Q173J2B_CBL_M	Connector: HDR-E26MG1+ Case: HDR-E26LPA5 (Honda Tsushin Kogyo) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent)  Refer to section 11.1.2 (4) for details.	
11)	Connector set	MR-J2CN1-A	Connector: PCR-S20FS+ Case: PCR-LS20LA1 (Honda Tsushin Kogyo) Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)   Refer to section 11.1.2 (1) for details.	
12)	Connector set	MR-J2CN1	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)  Quantity: 2 each Refer to section 11.1.2 (2) for details.	
13)	Terminal connector	MR-A-TM		

11.1.2 SSCNET cable

⚠CAUTION ●If you have fabricated the SSCNET cable, connect it correctly. Otherwise, it may cause an unexpected operation and malfunction.

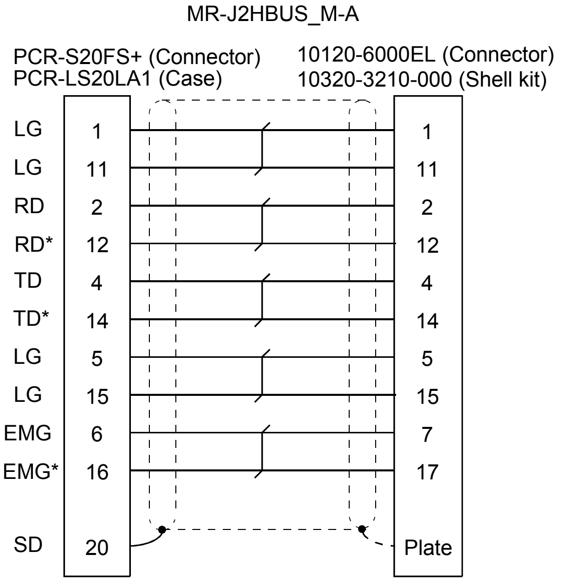
(1) MR-J2HBUS_M-A

(a) Model explanations

Model: MR－J2HBUS05M－A

Symbol	Cable length [m]
05	0.5
1	1
5	5

(b) Cable internal wiring diagram



(c) SSCNET cable fabrication

Use the MR-J2CN1-A connector set to fabricate the cable according to the wiring diagram in (b). The overall cable length in the same SSCNET system should be within 30 m. Refer to section 11.9 for the specifications of the cable to use.

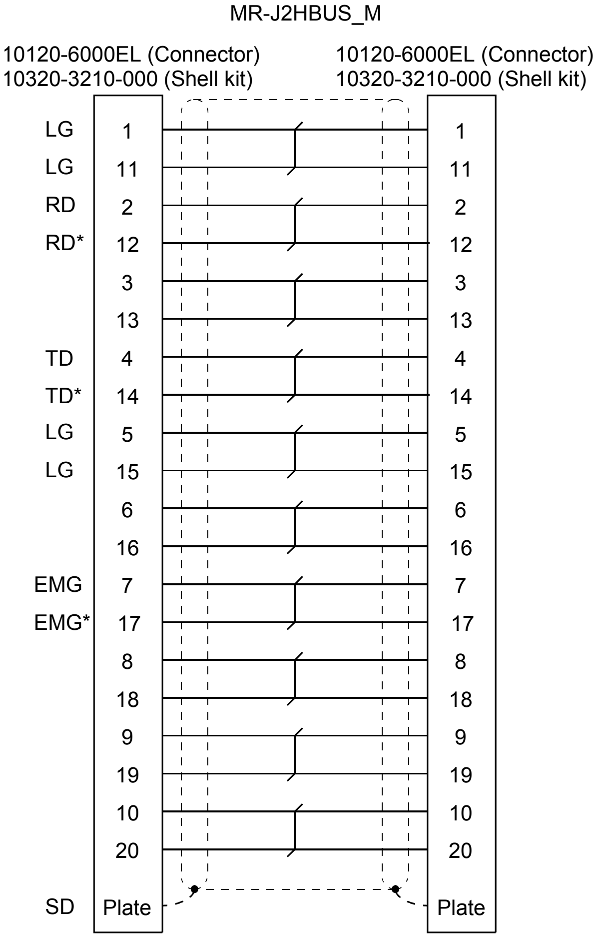
(2) MR-J2HBUS_M

(a) Model explanations

Model: MR－J2HBUS05M

Symbol	Cable length [m]
05	0.5
1	1
5	5

(b) Cable internal wiring diagram



(c) SSCNET cable fabrication

Use the MR-J2CN1 connector set to fabricate the cable according to the wiring diagram in (b). The overall cable length in the same SSCNET system should be within 30 m. Refer to section 11.9 for the specifications of the cable to use.

(3) Q172J2BCBL_M(-B)

For the battery unit Q170BAT, use Q172J2BCBL_M-B. For Q170BAT, refer to the "motion controller Q series user's manual" of (IB(NA)0300040).

(a) Model explanations

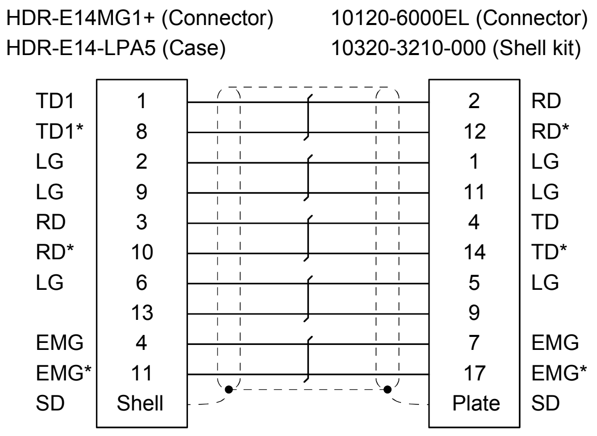
Model: Q172J2BCBL05M−B

Symbol	Connection of battery unit
None	None
-B	Yes

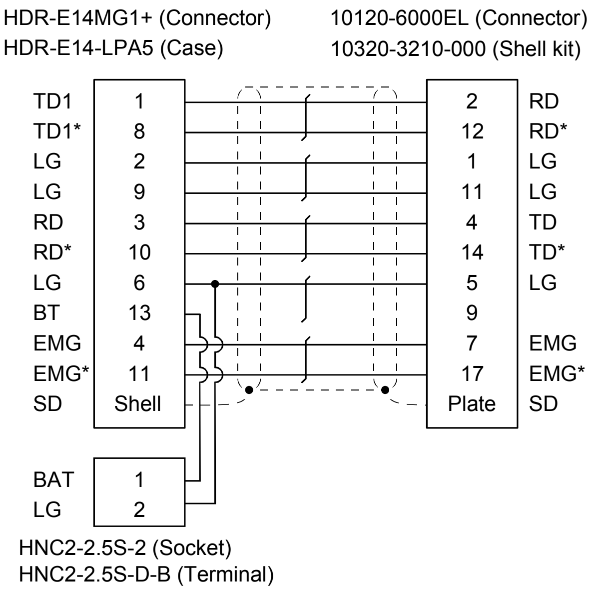
Symbol	Cable length [m]
05	0.5
1	1
5	5

(b) Cable internal wiring diagram

Q172J2BCBL_M



Q172J2BCBL_M-B



(4) Q173J2B_CBL_M

(a) Model explanations

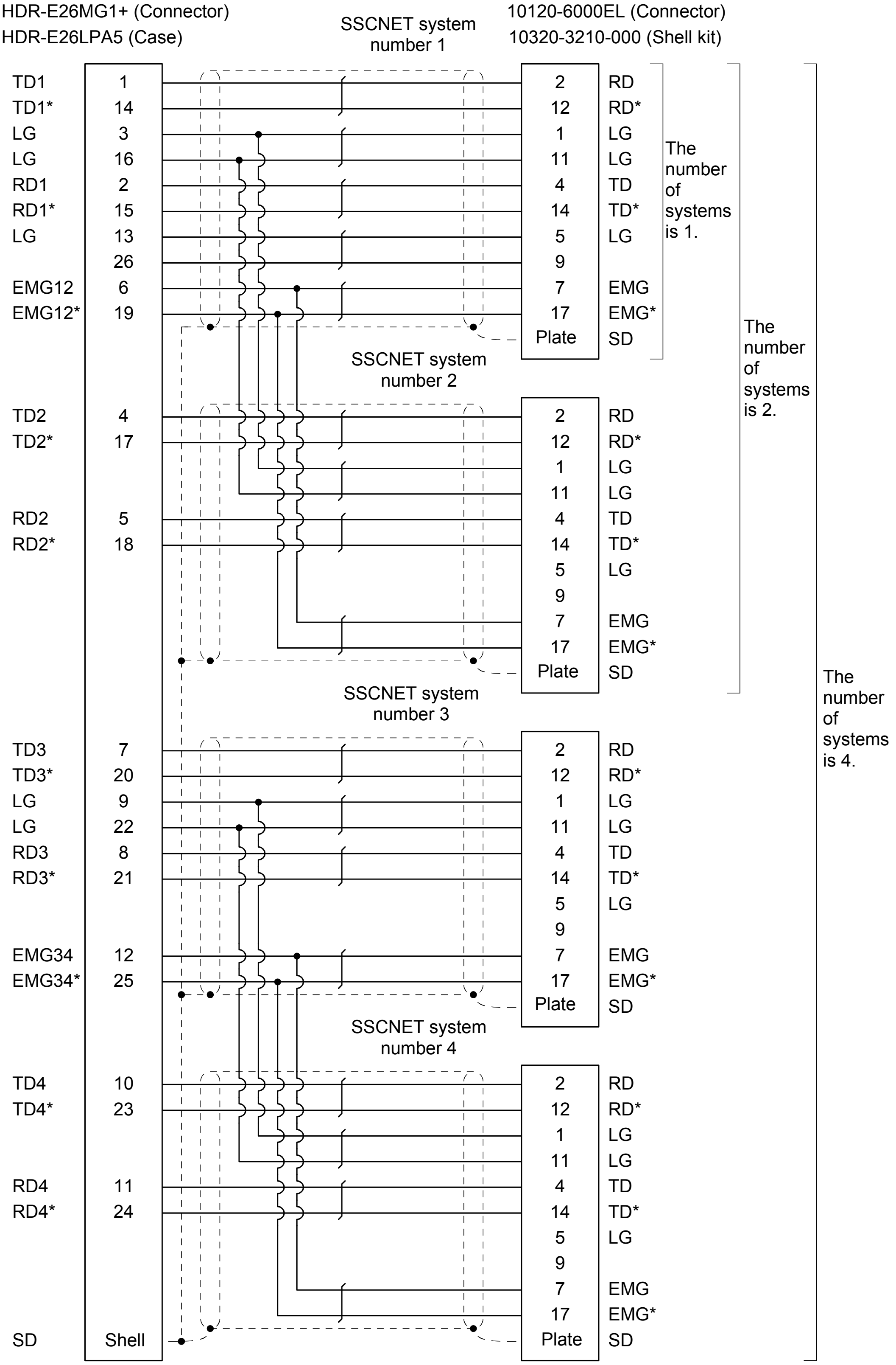
Model: Q173J2B2CBL05M

Symbol	Cable length [m]
05	0.5
1	1
5	5

Symbol	The number of SSCNET system
None	1
2	2
4	4

(b) Cable internal wiring diagram

Q173J2B_CBL_M

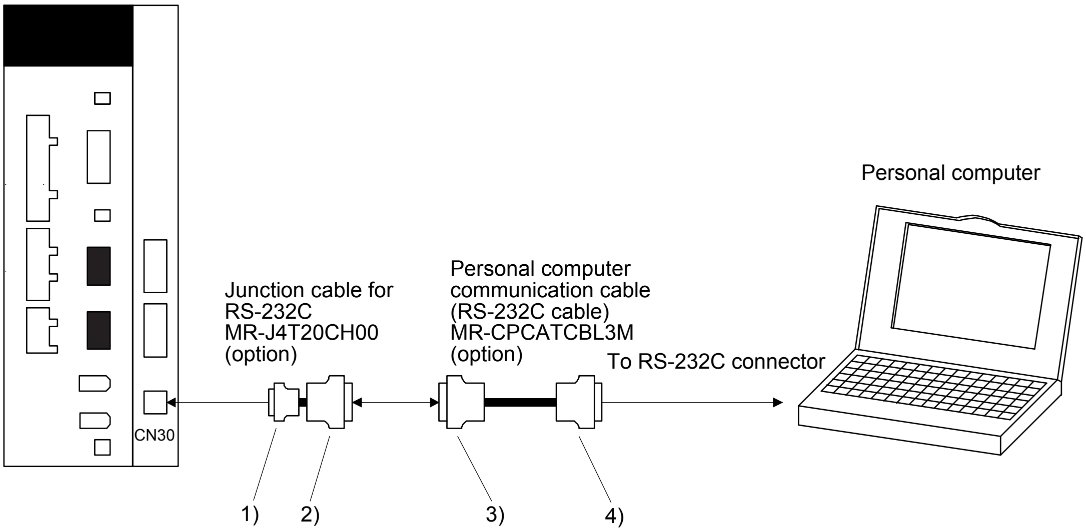


11.1.3 RS-232C communication cable

This section indicates the cable which connects MR-J4-T20 to a personal computer via RS-232C communication. The RS-232C communication cable consists of the following two cables.

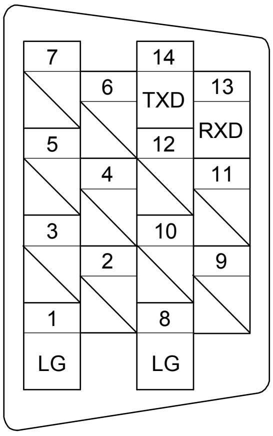
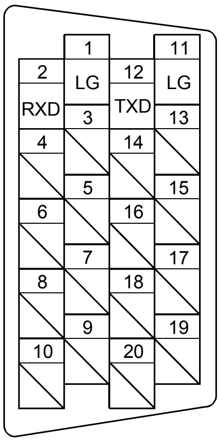
Cable model	Cable length	Product name
MR-J4T20CH00	0.2 m	Junction cable for RS-232C
MR-CPCATCBL3M	3 m	Personal computer communication cable (RS-232C cable)

(1) Connection of MR-J4-T20 with a personal computer

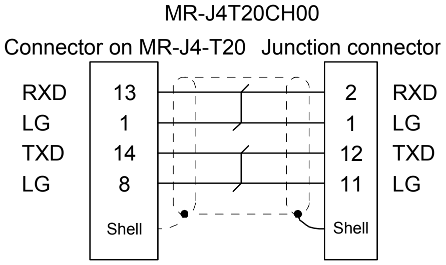


(2) MR-J4T20CH00

(a) Cable specifications

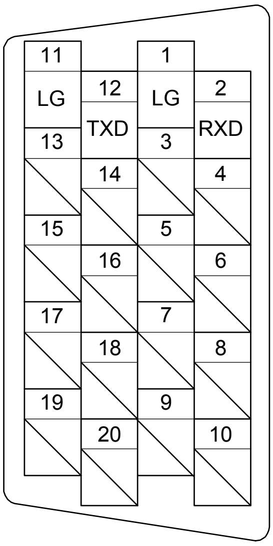
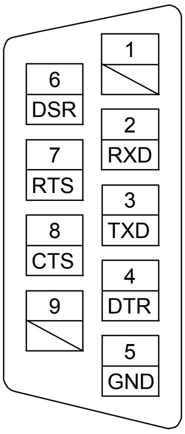
Cable model	1) MR-J4-T20 connector	2) Junction connector
MR-J4T20CH00	Connector: HDR-E14MG1+ Connector case: HDR-E14LPA5 (Honda Tsushin Kogyo)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⧅.	Connector: 10220-0200EL Shell kit: 10320-E2W0-008 (3M)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⧅.

(b) Cable internal wiring diagram

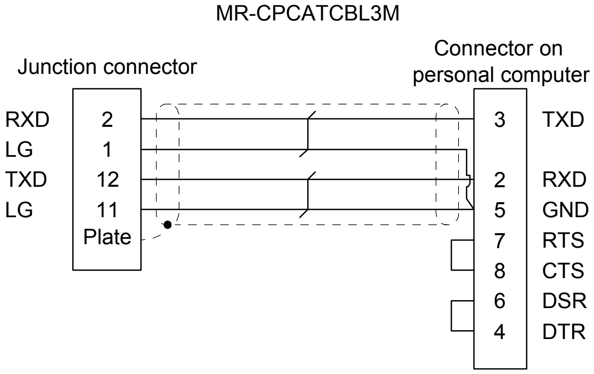


(3) MR-CPCATCBL3M

(a) Cable specifications

Cable model	3) Junction connector	4) Personal computer side connector
MR-CPCATCBL3M	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⧅.	Connector: DE-9SF-N Case: DE-C1-J6-S6 (JAE)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⧅.

(b) Cable internal wiring diagram



11.2 Regenerative option

⚠CAUTION

- ●Do not use servo amplifiers with regenerative options other than the combinations specified below. Otherwise, it may cause a fire.

11.2.1 Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

(1) 200 V class

Servo amplifier	Regenerative power [W]									
	Built-in regenerative resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]	MR-RB30 [13 Ω]	MR-RB3N [9 Ω]	MR-RB31 [6.7 Ω]	MR-RB32 [40 Ω]	(Note 1) MR-RB50 [13 Ω]	(Note 1) MR-RB5N [9 Ω]	(Note 1) MR-RB51 [6.7 Ω]
MR-J4-10B-RJ020		30								
MR-J4-20B-RJ020	10	30	100							
MR-J4-40B-RJ020	10	30	100							
MR-J4-60B-RJ020	10	30	100							
MR-J4-70B-RJ020	20	30	100				300			
MR-J4-100B-RJ020	20	30	100				300			
MR-J4-200B-RJ020	100			300				500		
MR-J4-350B-RJ020	100				300				500	
MR-J4-500B-RJ020	130					300				500
MR-J4-700B-RJ020	170					300				500

Servo amplifier	(Note 2) Regenerative power [W]			
	External regenerative resistor (accessory)	MR-RB5R [3.2 Ω]	MR-RB9F [3 Ω]	MR-RB9T [2.5 Ω]
MR-J4-11KB-RJ020	500 (800)	500 (800)		
MR-J4-15KB-RJ020	850 (1300)		850 (1300)	
MR-J4-22KB-RJ020	850 (1300)			850 (1300)

Note 1. Always install a cooling fan.
2. Values in parentheses assume the installation of a cooling fan.

(2) 400 V class

Servo amplifier	Regenerative power [W]								
	Built-in regenerative resistor	MR-RB1H-4 [82 Ω]	(Note 1) MR-RB3M-4 [120 Ω]	(Note 1) MR-RB3G-4 [47 Ω]	(Note 1) MR-RB5G-4 [47 Ω]	(Note 1) MR-RB34-4 [26 Ω]	(Note 1) MR-RB54-4 [26 Ω]	(Note 1) MR-RB3U-4 [22 Ω]	(Note 1) MR-RB5U-4 [22 Ω]
MR-J4-60B4-RJ020	15	100	300						
MR-J4-100B4-RJ020	15	100	300						
MR-J4-200B4-RJ020	100			300	500				
MR-J4-350B4-RJ020	100			300	500				
MR-J4-500B4-RJ020	130					300	500		
MR-J4-700B4-RJ020	170							300	500

Servo amplifier	(Note 2) Regenerative power [W]		
	External regenerative resistor (accessory)	MR-RB5K-4 [10 Ω]	MR-RB6K-4 [10 Ω]
MR-J4-11KB4-RJ020	500 (800)	500 (800)	
MR-J4-15KB4-RJ020	850 (1300)		850 (1300)
MR-J4-22KB4-RJ020	850 (1300)		850 (1300)

Note 1. Always install a cooling fan.

2. Values in parentheses assume the installation of a cooling fan.

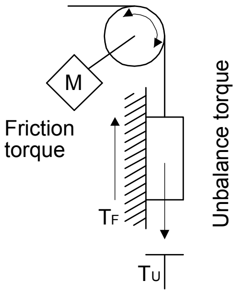
(3) 100 V class

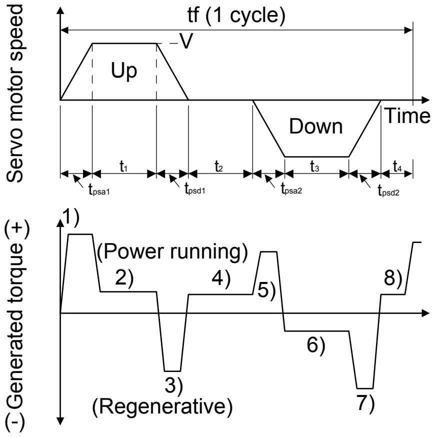
Servo amplifier	Regenerative power [W]		
	Built-in regenerative resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]
MR-J4-10B1-RJ020		30	
MR-J4-20B1-RJ020	10	30	100
MR-J4-40B1-RJ020	10	30	100

11.2.2 Selection of the regenerative option

Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make an in-depth selection of the regenerative option.

(1) Regenerative energy calculation





Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N•m] (Note)	Energy E [J]
1)	$T_1 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2} \cdot V \cdot T_1 \cdot t_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot V \cdot T_2 \cdot t_1$
3)	$T_3 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd1}} + T_U + T_F$	$E_3 = \frac{0.1047}{2} \cdot V \cdot T_3 \cdot t_{psd1}$
4), 8)	T_4, $T_8 = T_U$	E_4, $E_8 \geq 0$ (No regeneration)
5)	$T_5 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2} \cdot V \cdot T_5 \cdot t_{psa2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047 \cdot V \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2} \cdot V \cdot T_7 \cdot t_{psd2}$

Note. η: Drive system efficiency

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

(2) Losses of the servo motor and servo amplifier in regenerative mode
The following table lists the efficiencies and other data of the servo motor and servo amplifier in the regenerative mode.

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-J4-10B-RJ020	55	9
MR-J4-20B-RJ020	75	9
MR-J4-40B-RJ020	85	11
MR-J4-60B-RJ020	85	11
MR-J4-70B-RJ020	85	18
MR-J4-100B-RJ020	85	18
MR-J4-200B-RJ020	85	36
MR-J4-350B-RJ020	85	40
MR-J4-500B-RJ020	90	45
MR-J4-700B-RJ020	90	70
MR-J4-11KB-RJ020	90	120
MR-J4-15KB-RJ020	90	170
MR-J4-22KB-RJ020	90	250

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-J4-60B4-RJ020	85	12
MR-J4-100B4-RJ020	85	12
MR-J4-200B4-RJ020	85	25
MR-J4-350B4-RJ020	85	43
MR-J4-500B4-RJ020	90	45
MR-J4-700B4-RJ020	90	70
MR-J4-11KB4-RJ020	90	120
MR-J4-15KB4-RJ020	90	170
MR-J4-22KB4-RJ020	90	250
MR-J4-10B1-RJ020	55	4
MR-J4-20B1-RJ020	75	4
MR-J4-40B1-RJ020	85	10

Inverse efficiency (η_m): Efficiency including some efficiencies of the servo motor and servo amplifier when the rated (regenerative) torque is generated at the rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging (Ec): Energy charged into the electrolytic capacitor in the servo amplifier

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative option.

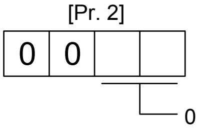
$ER\ [J] = \eta_m \cdot Es - Ec$

Calculate the power consumption of the regenerative option on the basis of one-cycle operation period tf [s] to select the necessary regenerative option.

$PR\ [W] = ER/tf$

11.2.3 Parameter setting

Set [Pr. 2] according to the option to be used.



00: Regenerative option is not used.
    ・For servo amplifier of 100 W, regenerative option is not used.
    ・For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
    ・Supplied regenerative resistors or regenerative option is used with the servo amplifier of 11 kW to 22 kW.
01: FR-RC/FR-RC-H/FR-CV/FR-CV-H/FR-BU2/FR-BU2-H
05: MR-RB32
08: MR-RB30
09: MR-RB50 (Cooling fan is required.)
0B: MR-RB31
0C: MR-RB51 (Cooling fan is required.)
0E: When the supplied regenerative resistors are cooled by the cooling fan to increase the ability with the servo amplifier of 11 kW to 22 kW.
10: MR-RB032
11: MR-RB12
13: MR-RB5E
14: MR-RB5E (Cooling fan is required.)
17: MR-RB9F
18: MR-RB9F (Cooling fan is required.)
20: MR-RB3N
21: MR-RB5N (Cooling fan is required.)
23: MR-RB5R
24: MR-RB5R (Cooling fan is required.)
25: MR-RB9P
26: MR-RB9P (Cooling fan is required.)
27: MR-RB9T
28: MR-RB9T (Cooling fan is required.)
80: MR-RB3H-4 (Cooling fan is required.)
81: MR-RB5H-4 (Cooling fan is required.)
82: MR-RB3G-4 (Cooling fan is required.)
83: MR-RB5G-4 (Cooling fan is required.)
84: MR-RB34-4 (Cooling fan is required.)
85: MR-RB54-4 (Cooling fan is required.)
86: MR-RB1L-4
87: MR-RB3M-4 (Cooling fan is required.)
90: MR-RB1H-4
9C: MR-RB3U-4 (Cooling fan is required.)
9D: MR-RB5U-4 (Cooling fan is required.)

11.2.4 Selection of the regenerative option

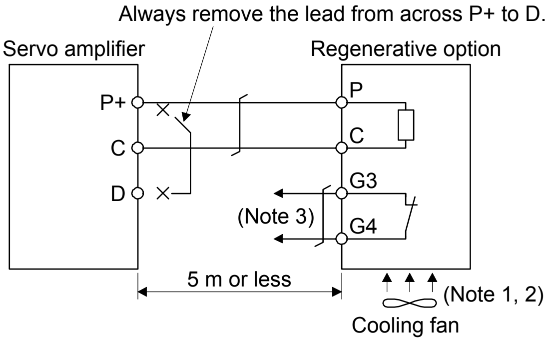
POINT

- ●When MR-RB50, MR-RB51, MR-RB5N, MR-RB3M-4, MR-RB3G-4, MR-RB5G-4, MR-RB34-4, MR-RB54-4, MR-RB3U-4, or MR-RB5U-4 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer.
- ●For the wire sizes used for wiring, refer to section 11.9.

The regenerative option generates heat of 100 ˚C higher than the ambient temperature. Fully consider heat dissipation, installation position, wires used, etc. before installing the option. For wiring, use flame-resistant wires or make the wires flame-resistant and keep them away from the regenerative option. Use twisted wires with a maximum length of 5 m for a connection with the servo amplifier.

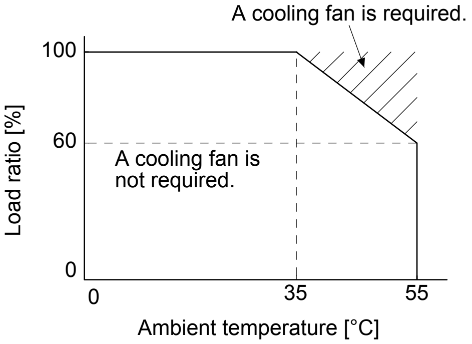
(1) MR-J4-500B-RJ020 or less/MR-J4-350B4-RJ020 or less

Always remove the wiring across P+ and D and fit the regenerative option between P+ and C. G3 and G4 are terminals for a thermal sensor. The connection between G3 and G4 is opened when the regenerative option overheats abnormally.



Note 1. When using the MR-RB50, MR-RB5N, MR-RB51, MR-RB3M-4, MR-RB3G-4, or MR-RB5G-4, forcedly cool it with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm).

2. When the ambient temperature is more than 55 °C and the regenerative load ratio is more than 60% in MR-RB30, MR-RB31, MR-RB32, and MR-RB3N, forcedly cool the air with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm). A cooling fan is not required if the ambient temperature is 35 °C or less. (A cooling fan is required for the shaded area in the following graph.)



3. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

G3-G4 contact specifications

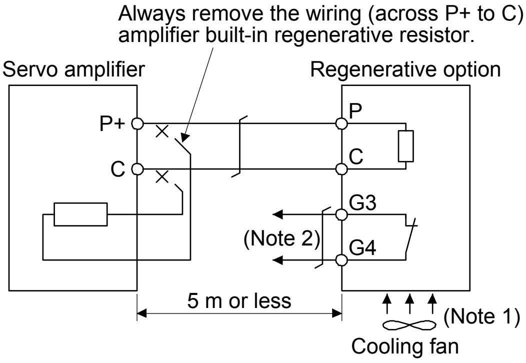
Maximum voltage: 120 V AC/DC

Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

(2) MR-J4-700B-RJ020/MR-J4-500B4-RJ020/MR-J4-700B4-RJ020

Always remove the wiring (between P+ and C) of the servo amplifier built-in regenerative resistor and fit the regenerative option between P+ and C. G3 and G4 are terminals for a thermal sensor. The connection between G3 and G4 is opened when the regenerative option overheats abnormally.



Note 1. When using the MR-RB51, MR-RB34-4, MR-RB54-4, MR-RB3U-4, or MR-RB5U-4, forcibly cool it with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm).

2. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

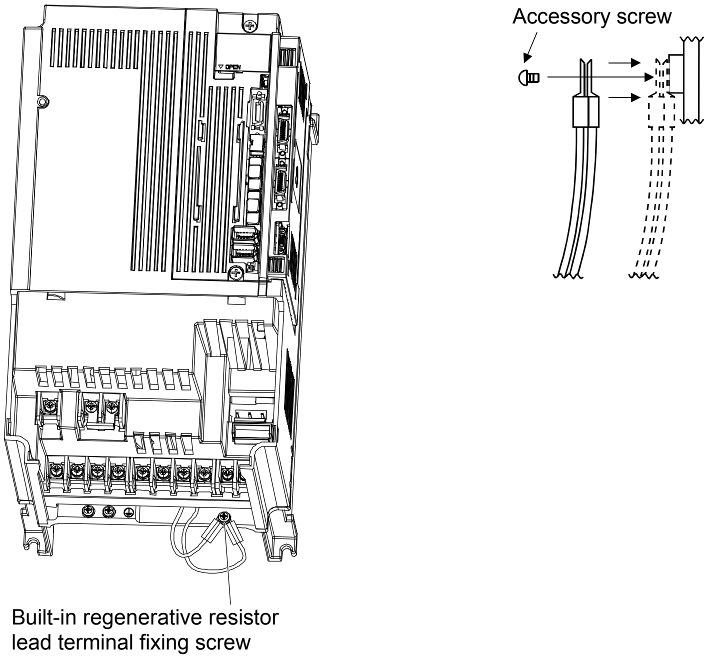
G3-G4 contact specifications

Maximum voltage: 120 V AC/DC

Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

When using the regenerative option, remove the servo amplifier's built-in regenerative resistor wires (across P+ to C), fit them back to back, and secure them to the frame with the accessory screw as shown below.

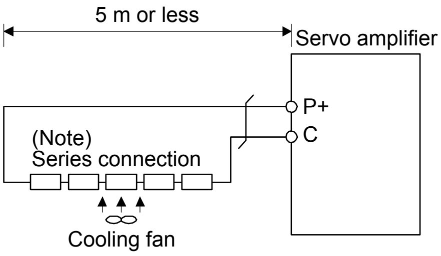


(3) MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020 (when using the supplied regenerative resistor)

⚠CAUTION

- The regenerative resistor supplied with 11 kW to 22 kW servo amplifiers does not have a protective cover. Touching the resistor (including wiring/screw hole area) may cause a burn injury and electric shock. Even if the power was shut-off, be careful until the bus voltage discharged and the temperature decreased because of the following reasons.
  - It may cause a burn injury due to very high temperature without cooling.
  - It may cause an electric shock due to charged capacitor of the servo amplifier.

When using the regenerative resistors supplied to the servo amplifier, the specified number of resistors (4 or 5 resistors) must be connected in series. If they are connected in parallel or in less than the specified number, the servo amplifier may become faulty and/or the regenerative resistors burn. Install the resistors at intervals of about 70 mm. Cooling the resistors with two cooling fans (92 × 92, minimum air flow: 1.0 m^3) improves the regeneration capability. In this case, set "_ _ 0 E" in [Pr. 2].



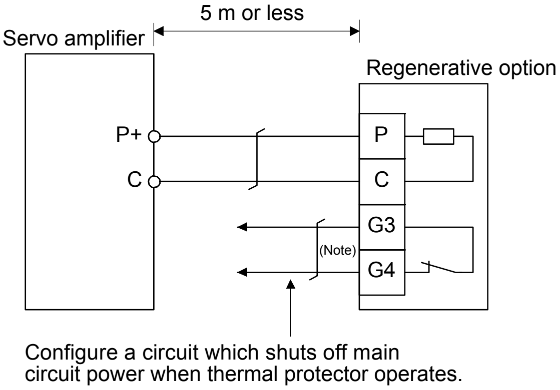
Note. The number of resistors connected in series depends on the resistor type. The thermal sensor is not mounted on the attached regenerative resistor. An abnormal heating of resistor may be generated at a regenerative circuit failure. Install a thermal sensor near the resistor and establish a protective circuit to shut off the main circuit power supply when abnormal heating occurs. The detection level of the thermal sensor varies according to the settings of the resistor. Set the thermal sensor in the most appropriate position on your design basis, or use the thermal sensor built-in regenerative option. (MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, or MR-RB6K-4)

Servo amplifier	Regenerative resistor	Regenerative power [W]		Resultant resistance [Ω]	Number of resistors
		Normal	Cooling		
MR-J4-11KB-RJ020	GRZG400-0.8Ω	500	800	3.2	4
MR-J4-15KB-RJ020	GRZG400-0.6Ω	850	1300	3	5
MR-J4-22KB-RJ020	GRZG400-0.5Ω			2.5	
MR-J4-11KB4-RJ020	GRZG400-2.5Ω	500	800	10	4
MR-J4-15KB4-RJ020 MR-J4-22KB4-RJ020	GRZG400-2Ω	850	1300	10	5

(4) MR-J4-11KB-RZ020 to MR-J4-22KB-RZ020/MR-J4-11KB4-RZ020 to MR-J4-22KB4-RZ020 (when using the regenerative option)

MR-J4-11KB-RZ020 to MR-J4-22KB-RZ020/MR-J4-11KB4-RZ020 to MR-J4-22KB4-RZ020 are not supplied with regenerative resistors. When using any of these servo amplifiers, always use the MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, or MR-RB6K-4.

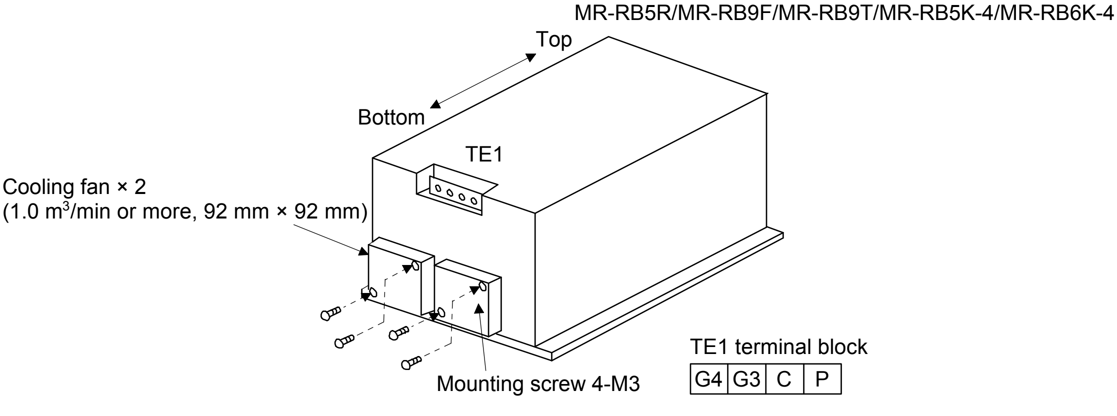
Cooling the regenerative option with cooling fans improves regenerative capability. G3 and G4 are terminals for thermal sensor. Between G3 and G4 is opened when the regenerative option overheats abnormally.



Note. G3-G4 contact specifications
Maximum voltage: 120 V AC/DC
Maximum current: 0.5 A/4.8 V DC
Maximum capacity: 2.4 VA

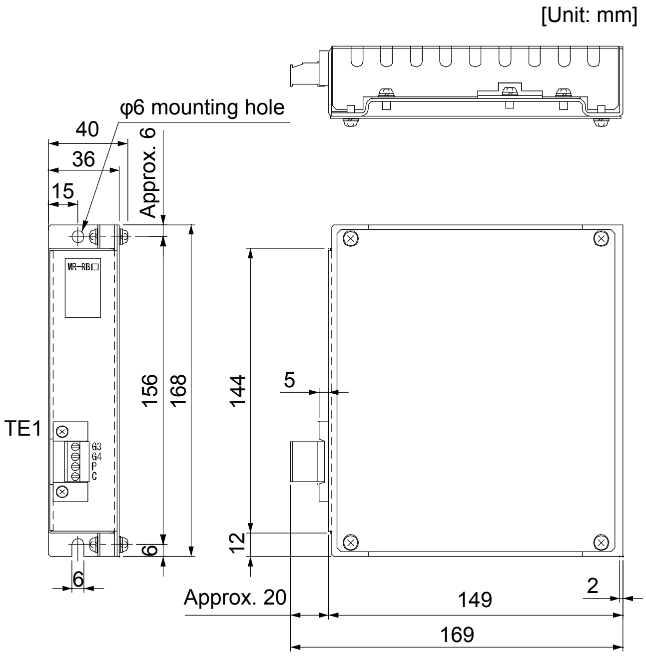
Servo amplifier	Regenerative option	Resistance [Ω]	Regenerative power [W]	
			Without cooling fans	With cooling fans
MR-J4-11KB-RZ020	MR-RB5R	3.2	500	800
MR-J4-15KB-RZ020	MR-RB9F	3	850	1300
MR-J4-22KB-RZ020	MR-RB9T	2.5	850	1300
MR-J4-11KB4-RZ020	MR-RB5K-4	10	500	800
MR-J4-15KB4-RZ020 MR-J4-22KB4-RZ020	MR-RB6K-4	10	850	1300

When using cooling fans, install them using the mounting holes provided in the bottom of the regenerative option.



11.2.5 Dimensions

(1) MR-RB12



- TE1 terminal

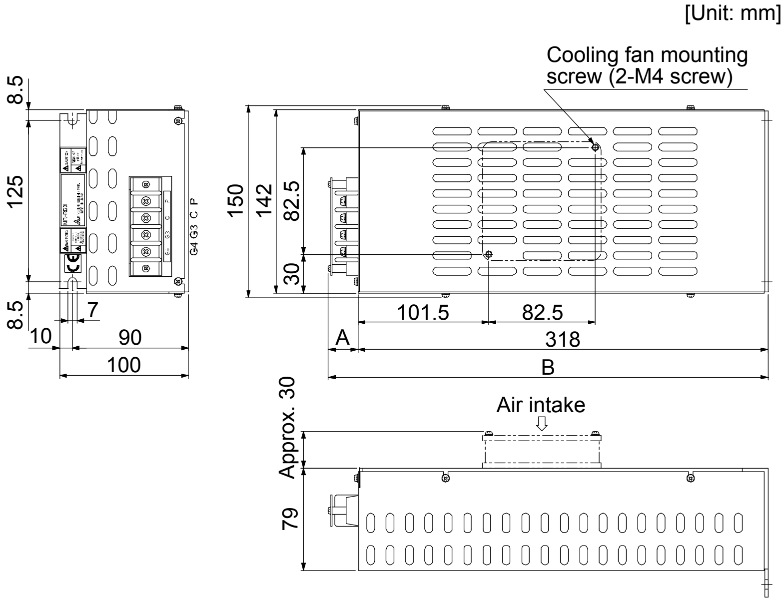
G3
G4
P
C

Applicable wire size: 0.2 mm^2 to 2.5 mm^2
(AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
  Screw size: M5
  Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(2) MR-RB30/MR-RB31/MR-RB32/MR-RB3N/MR-RB34-4/MR-RB3M-4/MR-RB3G-4/ MR-RB3U-4



- Terminal

P
C
G3
G4

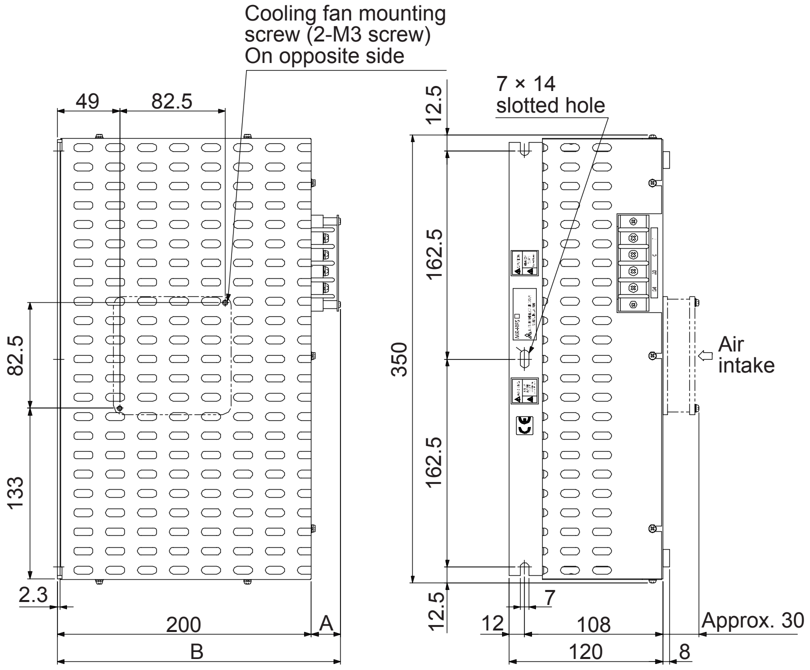
Terminal screw size: M4
Tightening torque: 1.2 [N•m]

- Mounting screw
  Screw size: M6
  Tightening torque: 5.4 [N•m]

Regenerative option	Variable dimensions		Mass [kg]
	A	B	
MR-RB30	17	335	2.9
MR-RB31			
MR-RB32			
MR-RB3N			
MR-RB34-4	23	341	
MR-RB3M-4			
MR-RB3G-4			
MR-RB3U-4			

(3) MR-RB50/MR-RB51/MR-RB5N/MR-RB54-4/MR-RB5G-4/MR-RB5U-4

[Unit: mm]



- Terminal block

P
C
G3
G4

Terminal screw size: M4
Tightening torque: 1.2 [N•m]

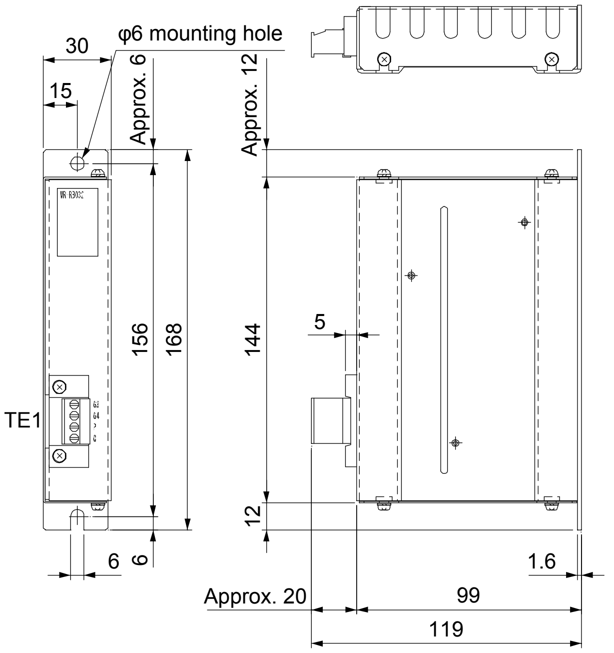
- Mounting screw

Screw size: M6
Tightening torque: 5.4 [N•m]

Regenerative option	Variable dimensions		Mass [kg]
	A	B	
MR-RB50	17	217	5.6
MR-RB51			
MR-RB5N			
MR-RB54-4	23	223	
MR-RB5G-4			
MR-RB5U-4			

(4) MR-RB032

[Unit: mm]



- TE1 terminal

G3
G4
P
C

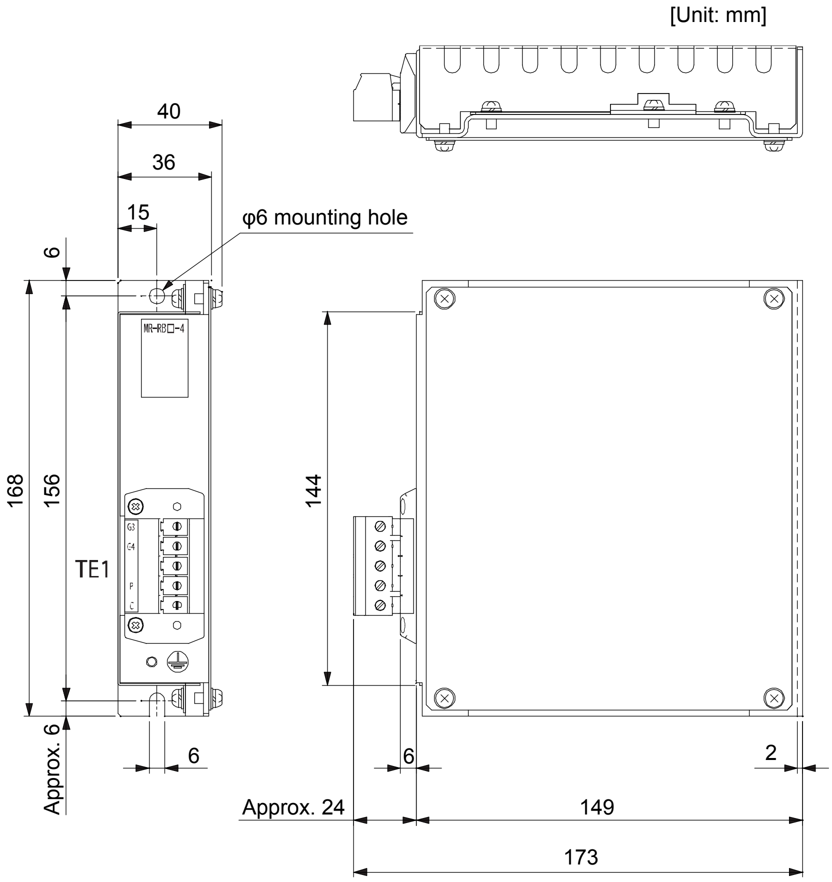
Applicable wire size: 0.2 mm^2 to 2.5 mm^2
(AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw

Screw size: M5
Tightening torque: 3.24 [N•m]

Mass: 0.5 [kg]

(5) MR-RB1H-4



- TE1 terminal

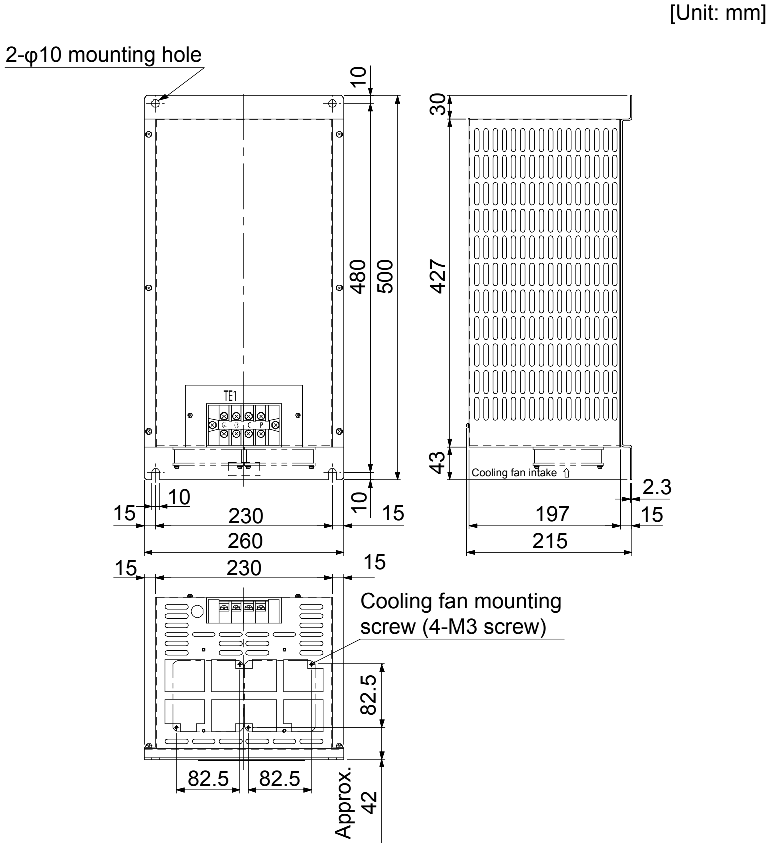
G3
G4
P
C

Applicable wire size: AWG 24 to 10
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
  Screw size: M5
  Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(6) MR-RB5R/MR-RB9F/MR-RB9T/MR-RB5K-4/MR-RB6K-4



- TE1 terminal block

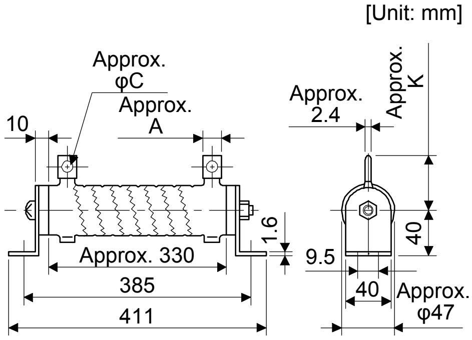
G4	G3	C	P

Terminal screw size: M5
Tightening torque: 2.0 [N•m]

- Mounting screw
Screw size: M8
Tightening torque: 13.2 [N•m]

Regenerative option	Mass [kg]
MR-RB5R	10
MR-RB9F	11
MR-RB9T	
MR-RB5K-4	10
MR-RB6K-4	11

(7) GRZG400-0.8Ω/GRZG400-0.6Ω/GRZG400-0.5Ω/GRZG400-2.5Ω/GRZG400-2.0Ω (standard accessories)



Regenerative resistor	Variable dimensions			Mounting screw size	Tightening torque [N•m]	Mass [kg]
	A	C	K			
GRZG400-0.8Ω	10	5.5	39	M8	13.2	0.8
GRZG400-0.6Ω GRZG400-0.5Ω	16	8.2	46			
GRZG400-2.5Ω GRZG400-2.0Ω	10	5.5	39			

11.3 FR-BU2-(H) brake unit

POINT

- Use a 200 V class brake unit and a resistor unit with a 200 V class servo amplifier, and a 400 V class brake unit and a resistor unit with a 400 V class servo amplifier. Combination of different voltage class units cannot be used.
- When a brake unit and a resistor unit are installed horizontally or diagonally, the heat dissipation effect diminishes. Install them on a flat surface vertically.
- The temperature of the resistor unit case will be higher than the ambient temperature by 100 ˚C or over. Keep cables and flammable materials away from the case.
- The ambient temperature condition for the brake unit is between -10 ˚C and 50 ˚C. Note that the condition is different from the ambient temperature condition of the servo amplifier (between 0 ˚C and 55 ˚C).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and the resistor unit under abnormal condition.
- Use the brake unit with a combination indicated in section 11.3.1.
- For executing a continuous regenerative operation, use the FR-RC-(H) power regeneration converter or FR-CV-(H) power regeneration common converter.
- Brake unit and regenerative options (Regenerative resistor) cannot be used simultaneously.

Connect the brake unit to the bus of the servo amplifier. As compared to the MR-RB regenerative option, the brake unit can return larger power. Use the brake unit when the regenerative option cannot provide sufficient regenerative capability.
When using the brake unit, set "_ _ 0 1" in [Pr. 2].
When using the brake unit, always refer to "FR-BU2 Brake Unit Instruction Manual".

11.3.1 Selection

Use a combination of the servo amplifier, brake unit and resistor unit listed below.

Brake unit		Resistor unit	Number of connected units	Permissible continuous power [kW]	Resultant resistance [Ω]	Applicable servo amplifier (Note 3)
200 V class	FR-BU2-15K	FR-BR-15K	1	0.99	8	MR-J4-500B-RJ020 (Note 1)
			2 (parallel)	1.98	4	MR-J4-500B-RJ020 MR-J4-700B-RJ020 MR-J4-11KB-RJ020 MR-J4-15KB-RJ020
	FR-BU2-30K	FR-BR-30K	1	1.99	4	MR-J4-500B-RJ020 MR-J4-700B-RJ020 MR-J4-11KB-RJ020 MR-J4-15KB-RJ020
	FR-BU2-55K	FR-BR-55K	1	3.91	2	MR-J4-11KB-RJ020 MR-J4-15KB-RJ020 MR-J4-22KB-RJ020
		MT-BR5-55K	1	5.5	2	MR-J4-22KB-RJ020
400 V class	FR-BU2-H30K	FR-BR-H30K	1	1.99	16	MR-J4-500B4-RJ020 MR-J4-700B4-RJ020 MR-J4-11KB4-RJ020 (Note 2)
	FR-BU2-H55K	FR-BR-H55K	1	3.91	8	MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020 MR-J4-22KB4-RJ020
	FR-BU2-H75K	MT-BR5-H75K	1	7.5	6.5	MR-J4-22KB4-RJ020

Note 1. Only when using the HG-RR353/HG-UR352 servo motor
2. When HG-JR11K1M4 servo motor is used, limit the torque during power running to 180% or less, or the servo motor speed to 1800 r/min or less.
3. When the brake unit is selected by using the capacity selection software, other combinations may be shown. Refer to the display on the capacity selection software for detailed combinations.

11.3.2 Brake unit parameter setting

Whether a parameter can be changed or not is listed below.

Parameter		Change possible/ impossible	Remark
No.	Name		
0	Brake mode switchover	Impossible	Do not change the parameter.
1	Monitor display data selection	Possible	Refer to "FR-BU2 Brake Unit Instruction Manual".
2	Input terminal function selection 1	Impossible	Do not change the parameter.
3	Input terminal function selection 2		
77	Parameter write selection		
78	Cumulative energization time carrying-over times		
CLr	Parameter clear		
ECL	Alarm history clear		
C1	For manufacturer setting		

11.3.3 Connection example

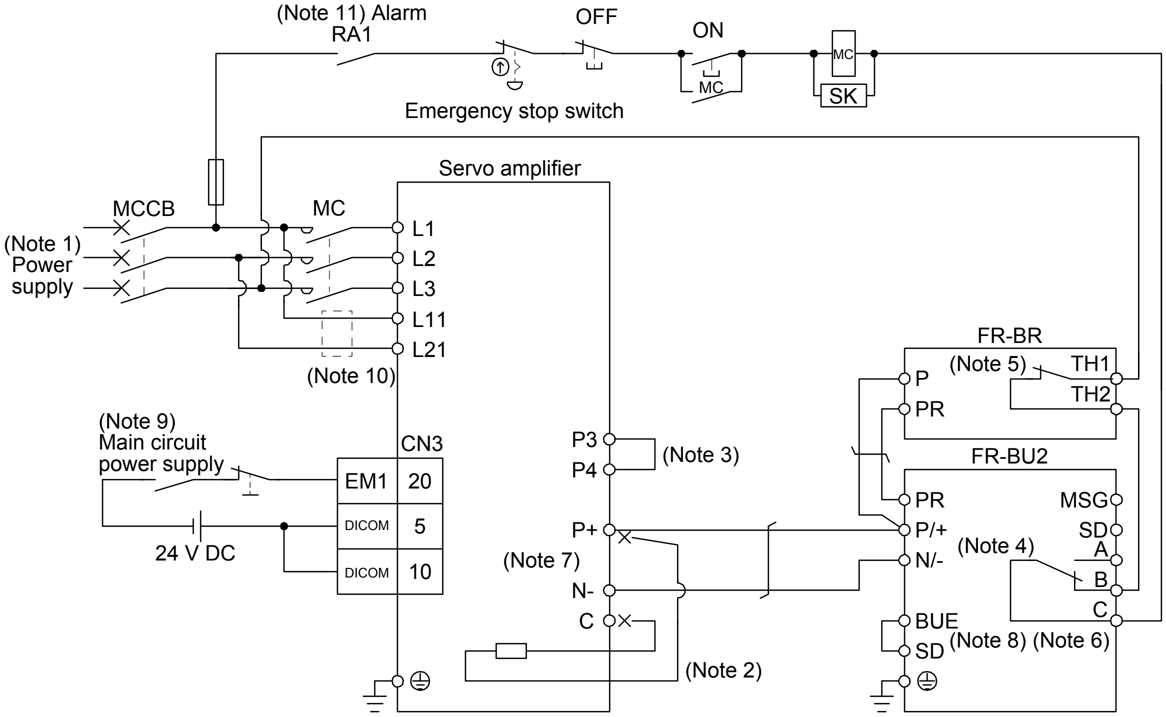
POINT

- Connecting the PR terminal of the brake unit to the P+ terminal of the servo amplifier results in a brake unit malfunction. Always connect the PR terminal of the brake unit to the PR terminal of the resistor unit.

(1) Combination of the FR-BU2-(H) brake unit and FR-BR-(H) resistor unit

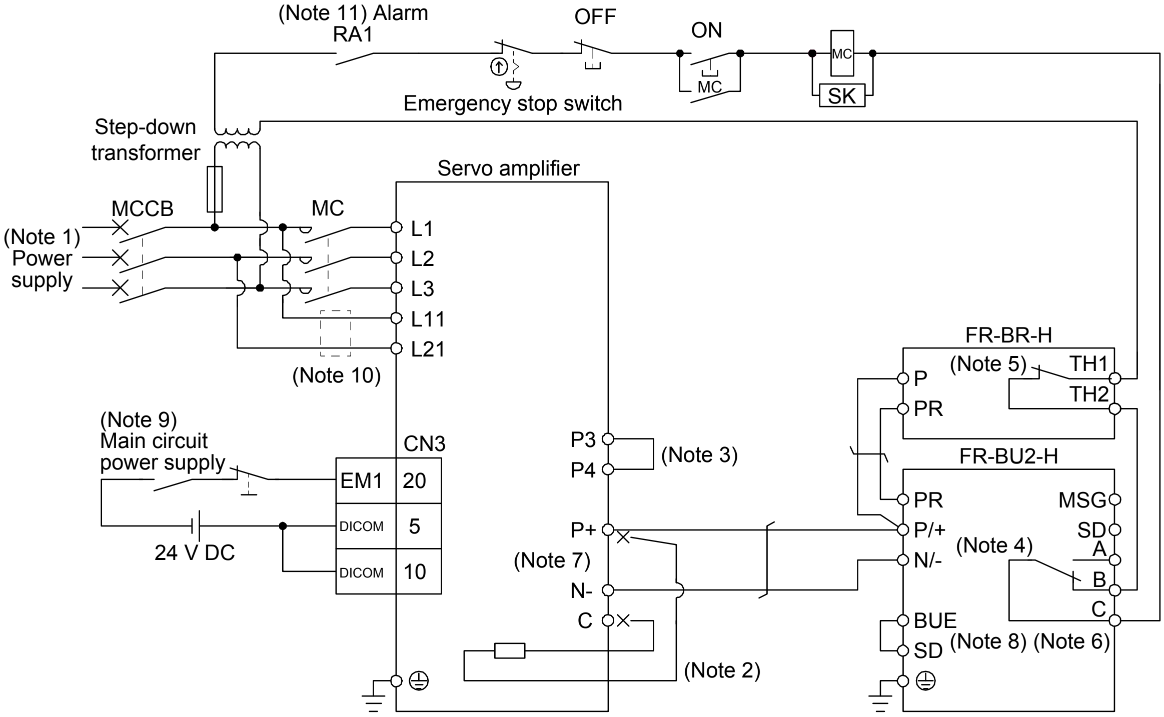
(a) When connecting a brake unit to a servo amplifier

1) 200 V class



Note 1. For the power supply specifications, refer to section 1.3.
2. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C). For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect the P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each of the P+ and N- terminals of the servo amplifier.
8. Always connect the wiring between BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.

2) 400 V class

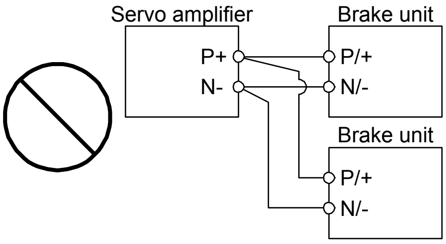


Note 1. For the power supply specifications, refer to section 1.3.
2. For the servo amplifier of 5 kW and 7 kW, always disconnect the lead wire of the built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect the P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each of the P+ and N- terminals of the servo amplifier.
8. Always connect the wiring between BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.

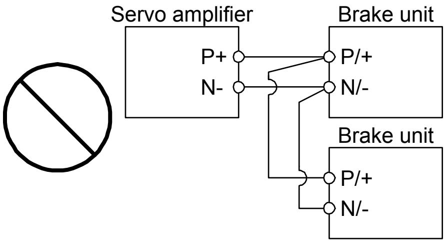
(b) When connecting two brake units to a servo amplifier

POINT

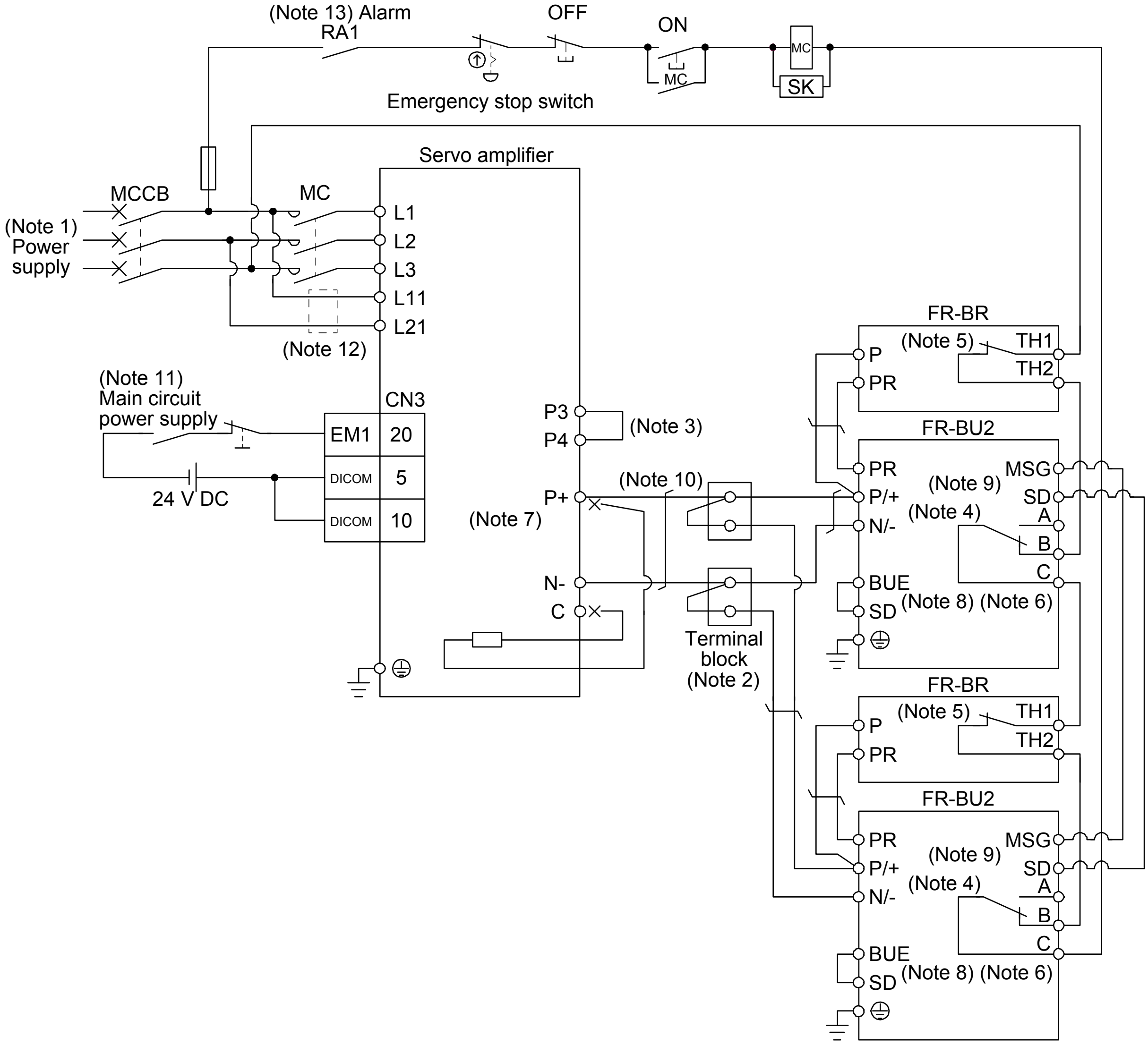
- For 400 V class servo amplifiers, two brake units cannot be connected with one servo amplifier.
- For parallel connection, use two sets of FR-BU2 brake unit. Combination with other brake unit results in alarm occurrence or malfunction.
- Always connect the terminals for master/slave (MSG to MSG, SD to SD) between the two brake units.
- Do not connect the servo amplifier and brake units as below. Connect the cables with a terminal block to distribute as indicated in this section.



Connecting two cables to P+ and N- terminals



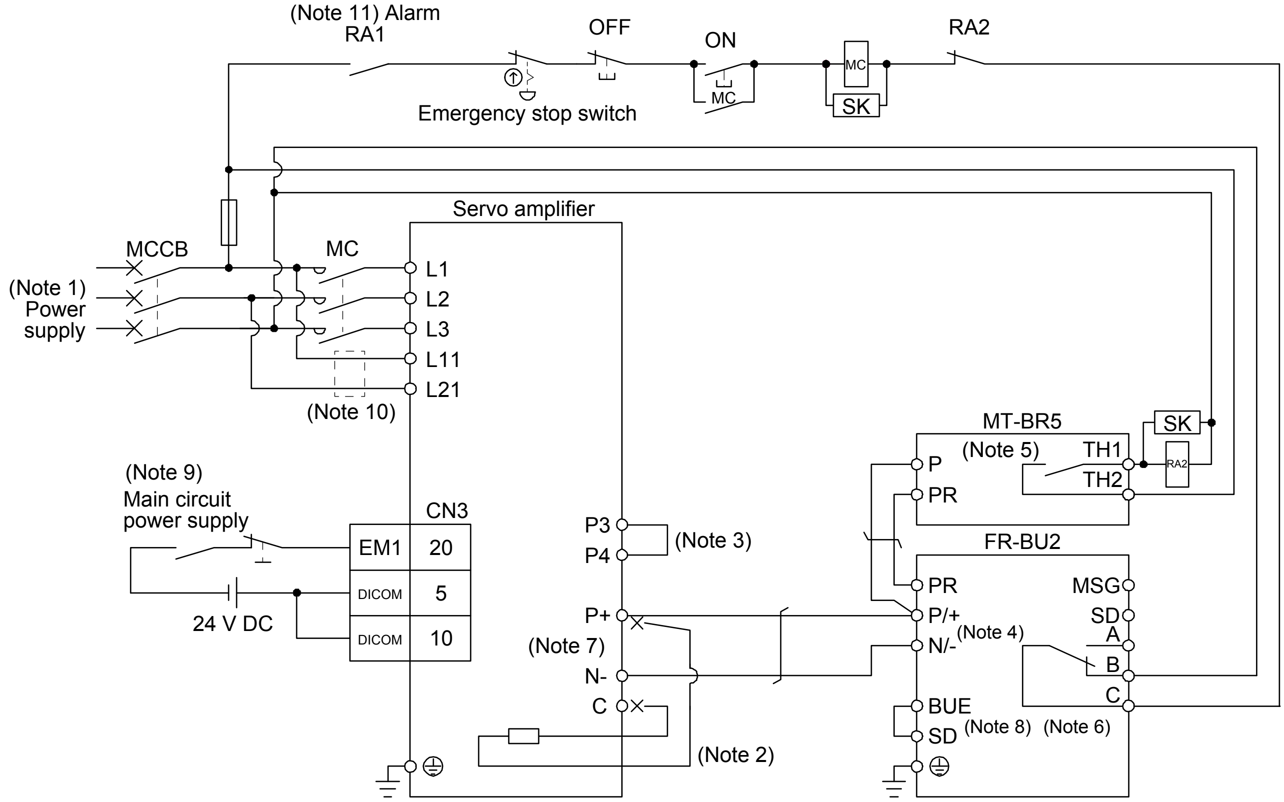
Passing wiring



Note
1. For the power supply specifications, refer to section 1.3.
2. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C). For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect the P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
7. Do not connect more than one cable to each of the P+ and N- terminals of the servo amplifier.
8. Always connect the wiring between BUE and SD terminals. (factory-wired)
9. Connect the MSG and SD terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
10. For connecting the P+ and N- terminals of the servo amplifier to the terminal block, use the cable indicated in (3) (b) of this section.
11. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
12. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
13. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.

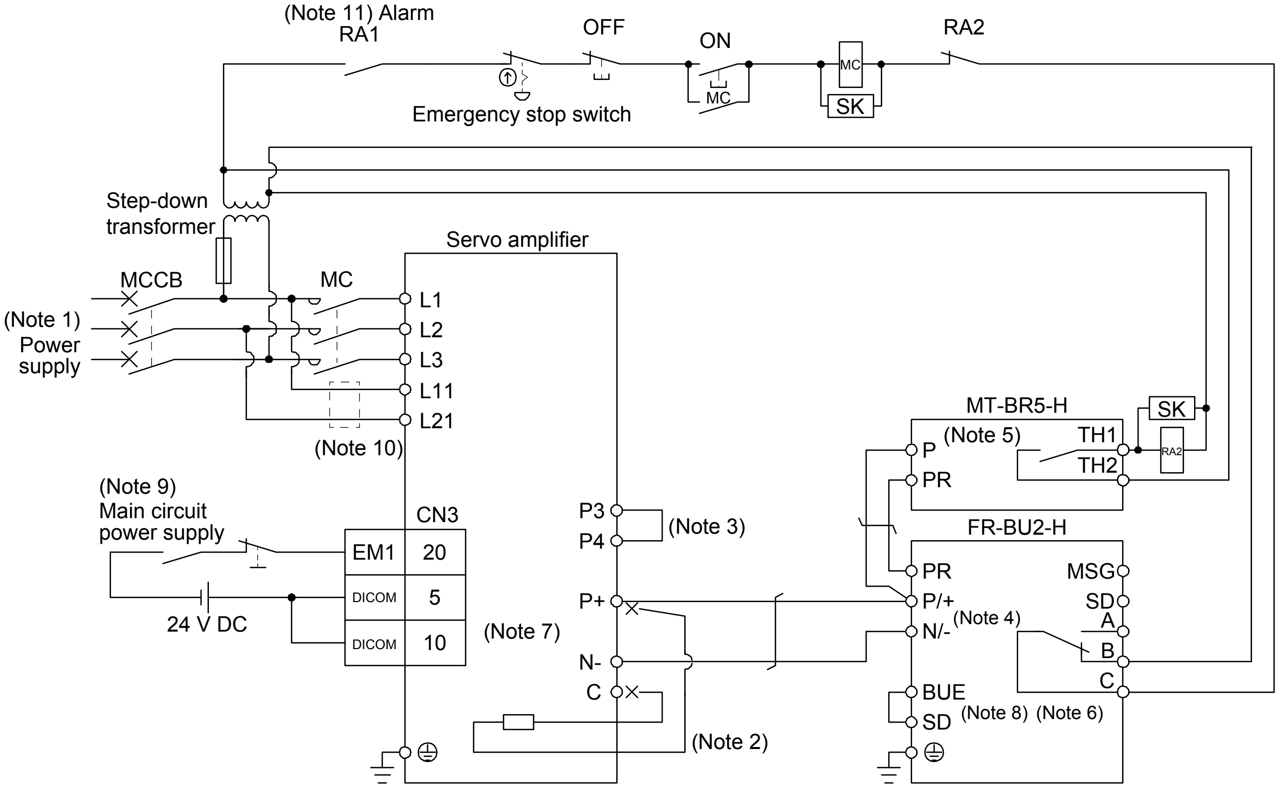
(2) Combination with MT-BR5-(H) resistor unit

1) 200 V class



Note
1. For the power supply specifications, refer to section 1.3.
2. Please do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
5. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
8. Always connect BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

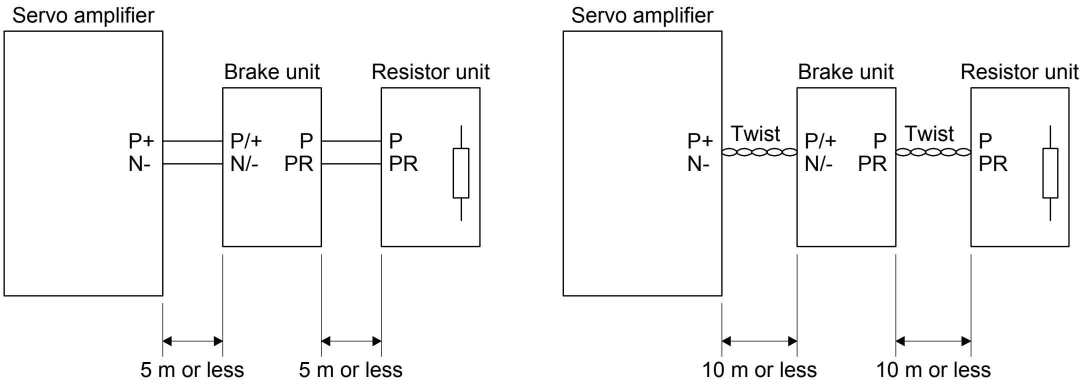
2) 400 V class



Note
1. For the power supply specifications, refer to section 1.3.
2. Please do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
5. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
8. Always connect BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

(2) Connection instructions

Keep the wires between the servo amplifier and the brake unit, and between the resistor unit and the brake unit as short as possible. For wires longer than 5 m, twist the wires five times or more per meter. The wires should not exceed 10 m even when the wires are twisted. If wires exceeding 5 m without twisted or exceeding 10 m with or without twisted are used, the brake unit may malfunction.

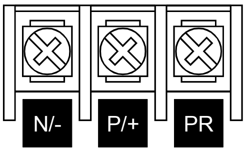


(3) Wires

(a) Wires for the brake unit

For the brake unit, the HIV wire (600 V grade heat-resistant polyvinyl chloride insulated wire) is recommended.

1) Main circuit terminal



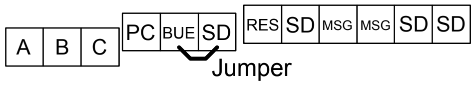
Terminal block

Brake unit		Main circuit terminal screw size	Crimp terminal	Tightening torque [N•m]	Wire size	
			N/-, P/+, PR, ⏚		N/-, P/+, PR, ⏚	
					HIV wire [mm^2]	AWG
200 V class	FR-BU2-15K	M4	5.5-4	1.5	3.5	12
	FR-BU2-30K	M5	5.5-5	2.5	5.5	10
	FR-BU2-55K	M6	14-6	4.4	14	6
400 V class	FR-BU2-H30K	M4	5.5-4	1.5	3.5	12
	FR-BU2-H55K	M5	5.5-5	2.5	5.5	10
	FR-BU2-H75K	M6	14-6	4.4	14	6

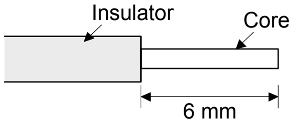
2) Control circuit terminal

POINT

- ●Under tightening can cause a cable disconnection or malfunction. Over tightening can cause a short circuit or malfunction due to damage to the screw or the brake unit.



Terminal block



Wire the stripped cable after twisting to prevent the cable from becoming loose. In addition, do not solder it.

Screw size: M3

Tightening torque: 0.5 N•m to 0.6 N•m

Wire size: 0.3 mm^2 to 0.75 mm^2

Screw driver: Small flat-blade screwdriver

(Tip thickness: 0.4 mm/Tip width 2.5 mm)

(b) Cables for connecting the servo amplifier and a distribution terminal block when connecting two sets of the brake unit

Brake unit	Wire size	
	HIV wire [mm^2]	AWG
FR-BU2-15K	8	8

(4) Crimp terminals for the P+ and N- terminals of servo amplifier

(a) Recommended crimp terminals

POINT

- Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

Servo amplifier		Brake unit	Number of connected units	Crimp terminal (Manufacturer)	(Note 1) Applicable tool
200 V class	MR-J4-500B-RJ020	FR-BU2-15K	1	FVD5.5-S4 (JST)	a
			2	8-4NS (JST) (Note 2)	b
		FR-BU2-30K	1	FVD5.5-S4 (JST)	a
	MR-J4-700B-RJ020	FR-BU2-15K	2	8-4NS (JST) (Note2)	b
		FR-BU2-30K	1	FVD5.5-S4 (JST)	a
	MR-J4-11KB-RJ020	FR-BU2-15K	2	FVD8-6 (JST)	c
		FR-BU2-30K	1	FVD5.5-6 (JST)	a
		FR-BU2-55K	1	FVD14-6 (JST)	d
	MR-J4-15KB-RJ020	FR-BU2-15K	2	FVD8-6 (JST)	c
		FR-BU2-30K	1	FVD5.5-6 (JST)	a
		FR-BU2-55K	1	FVD14-6 (JST)	d
	MR-J4-22KB-RJ020	FR-BU2-55K	1	FVD14-8 (JST)	d
400 V class	MR-J4-500B4-RJ020	FR-BU2-H30K	1	FVD5.5-S4 (JST)	a
	MR-J4-700B4-RJ020	FR-BU2-H30K	1	FVD5.5-S4 (JST)	a
	MR-J4-11KB4-RJ020	FR-BU2-H30K	1	FVD5.5-6 (JST)	a
		FR-BU2-H55K	1	FVD5.5-6 (JST)	a
	MR-J4-15KB4-RJ020	FR-BU2-H55K	1	FVD5.5-6 (JST)	a
	MR-J4-22KB4-RJ020	FR-BU2-H55K	1	FVD5.5-8 (JST)	a
		FR-BU2-H75K	1	FVD14-8 (JST)	d

Note 1. Symbols in the applicable tool field indicate applicable tools in (4)(b) of this section.

2. Coat the crimped part with an insulation tube.

(b) Applicable tool

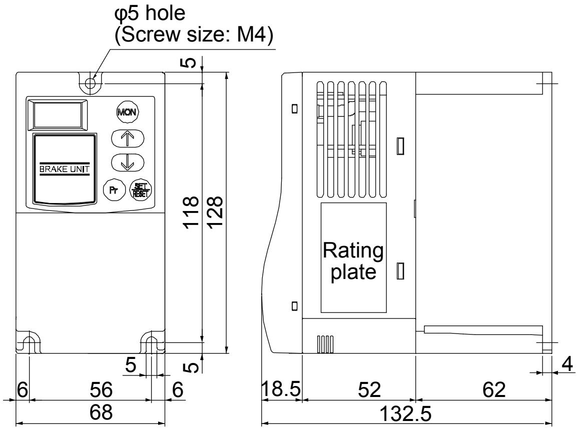
Symbol	Servo amplifier-side crimp terminals				
	Crimp terminal	Applicable tool			Manufacturer
		Body	Head	Dice	
a	FDV5.5-S4 FDV5.5-6	YNT-1210S			JST
b	8-4NS	YHT-8S			
c	FVD8-6	YF-1 E-4	YNE-38	DH-111 DH-121	
d	FVD14-6 FVD14-8	YF-1 E-4	YNE-38	DH-112 DH-122	

11.3.4 Dimensions

(1) FR-BU2-(H) brake unit

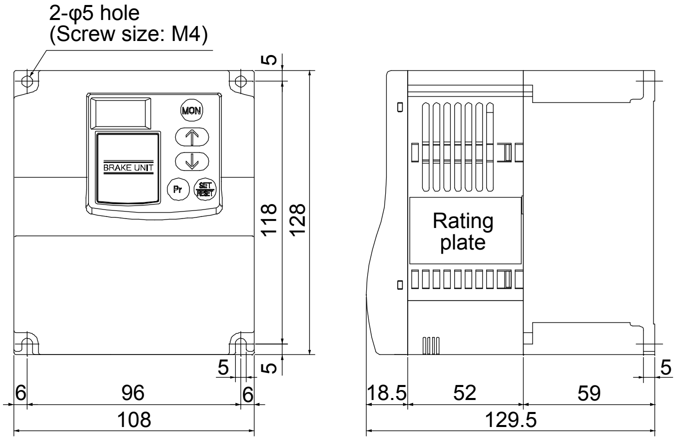
FR-BU2-15K

[Unit: mm]



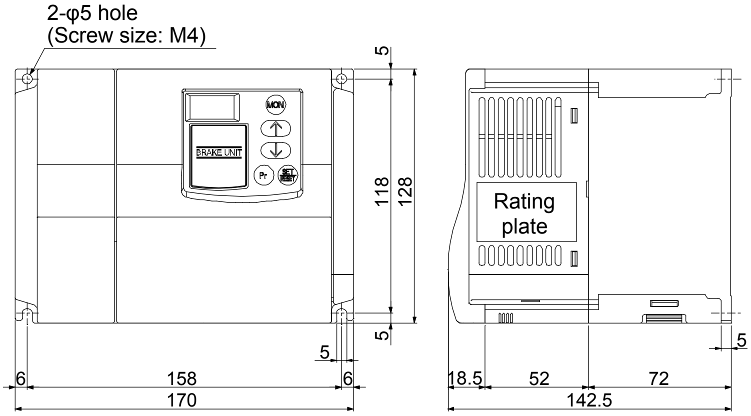
FR-BU2-30K/FR-BU2-H30K

[Unit: mm]



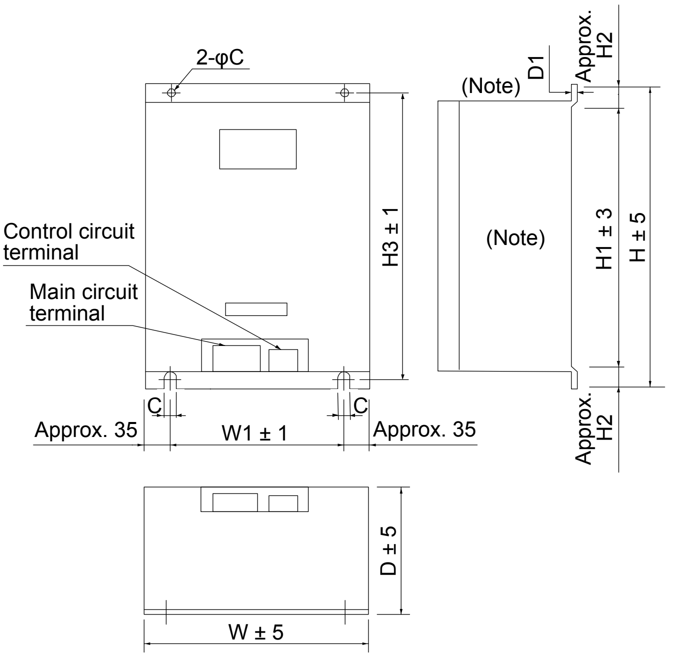
FR-BU2-55K/FR-BU2-H55K/FR-BU2-H75K

[Unit: mm]



(2) FR-BR-(H) resistor unit

[Unit: mm]

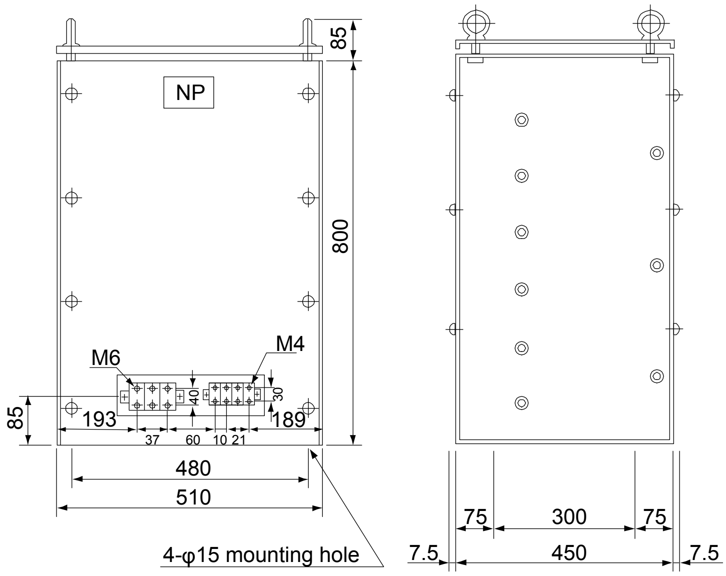


Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Resistor unit		W	W1	H	H1	H2	H3	D	D1	C	Approximate mass [kg]
200 V class	FR-BR-15K	170	100	450	410	20	432	220	3.2	6	15
	FR-BR-30K	340	270	600	560	20	582	220	4	10	30
	FR-BR-55K	480	410	700	620	40	670	450	3.2	12	70
400 V class	FR-BR-H30K	340	270	600	560	20	582	220	4	10	30
	FR-BR-H55K	480	410	700	620	40	670	450	3.2	12	70

(3) MT-BR5-(H) resistor unit

[Unit: mm]



Resistor unit		Resistance	Approximate mass [kg]
200 V class	MT-BR5-55K	2.0 Ω	50
400 V class	MT-BR5-H75K	6.5 Ω	70

11.4 FR-RC-(H) power regeneration converter

POINT

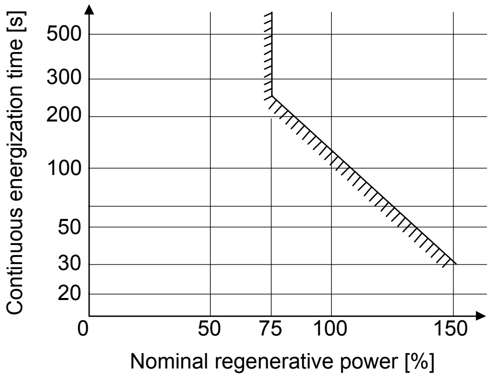
- ●When using the FR-RC-(H) power regeneration converter, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

When using the FR-RC-(H) power regeneration converter, set "_ _ 0 1" in [Pr. 2].

(1) Selection

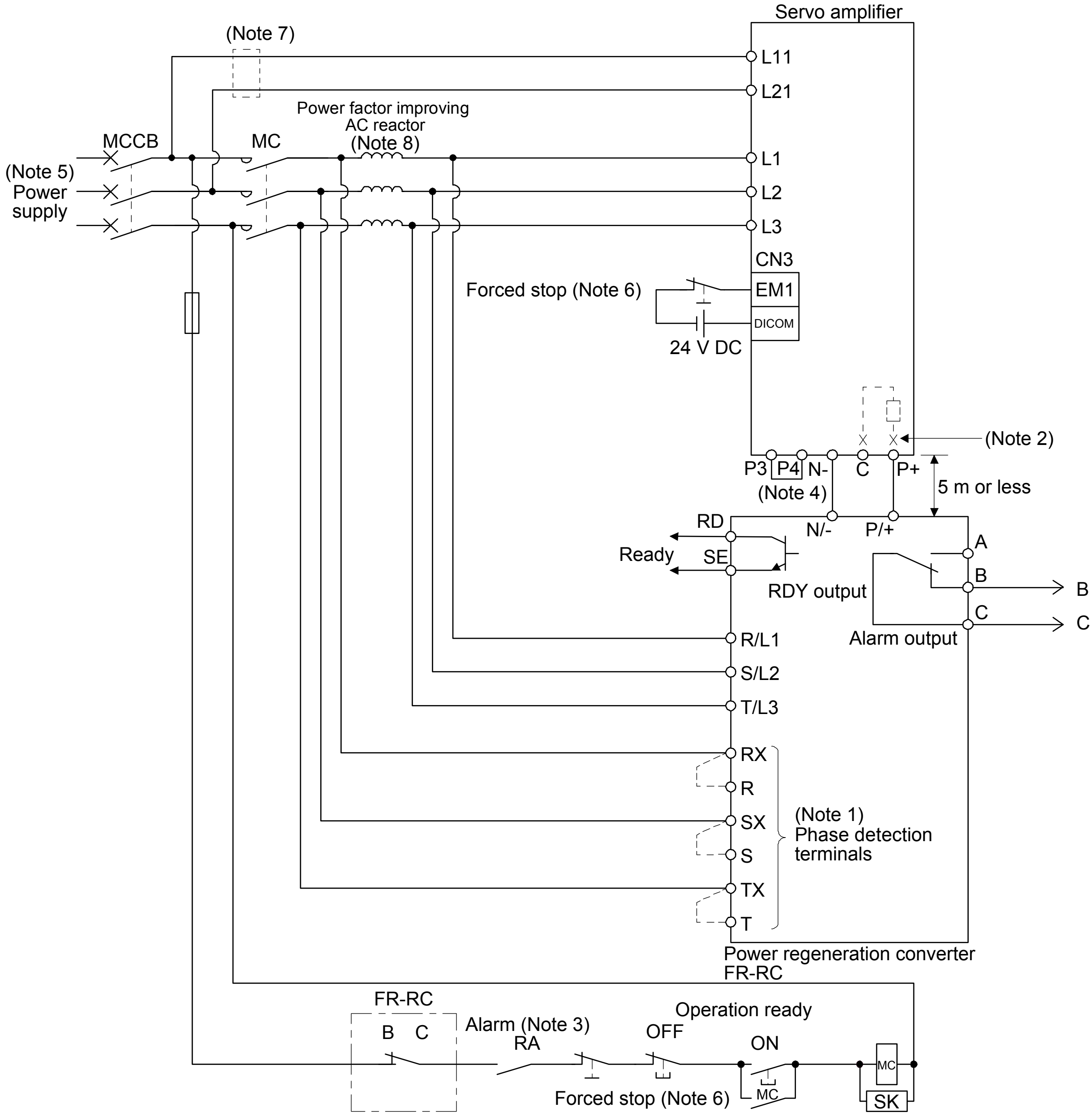
The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of 5 kW to 22 kW.

Power regeneration converter	Nominal regenerative power [kW]	Servo amplifier
FR-RC-15K	15	MR-J4-500B-RJ020 MR-J4-700B-RJ020
FR-RC-30K	30	MR-J4-11KB-RJ020 MR-J4-15KB-RJ020
FR-RC-55K	55	MR-J4-22KB-RJ020
FR-RC-H15K	15	MR-J4-500B4-RJ020 MR-J4-700B4-RJ020
FR-RC-H30K	30	MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020
FR-RC-H55K	55	MR-J4-22KB4-RJ020



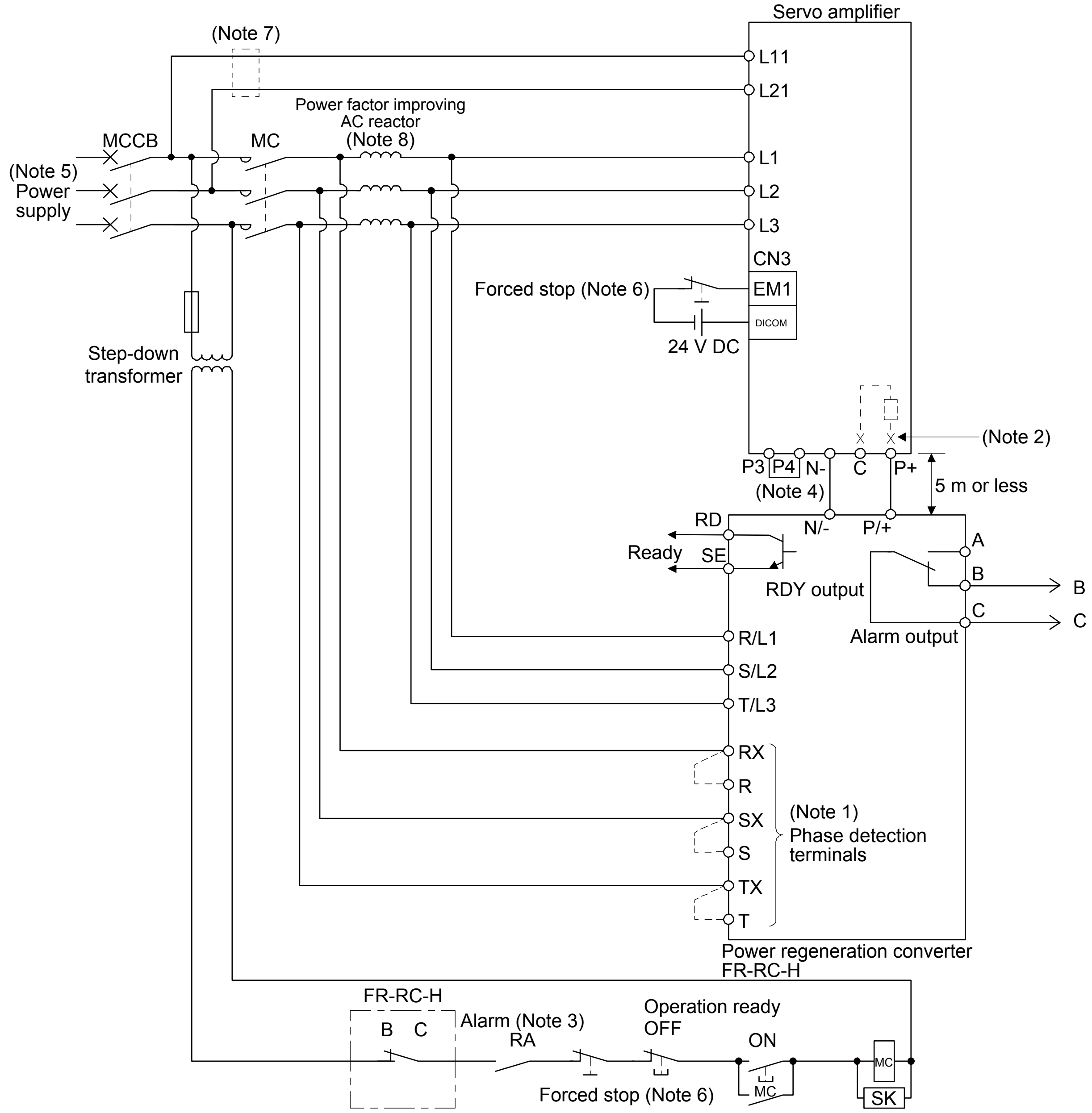
(2) Connection example

(a) 200 V class



Note
1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC will not operate.
2. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C). For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.
4. Between P3 and P4 is connected by default.
5. For the power supply specifications, refer to section 1.3.
6. Configure the circuit which shuts off main circuit power with external circuit at EM1 (Forced stop) off.
7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
8. For selection of power factor improving AC reactors, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

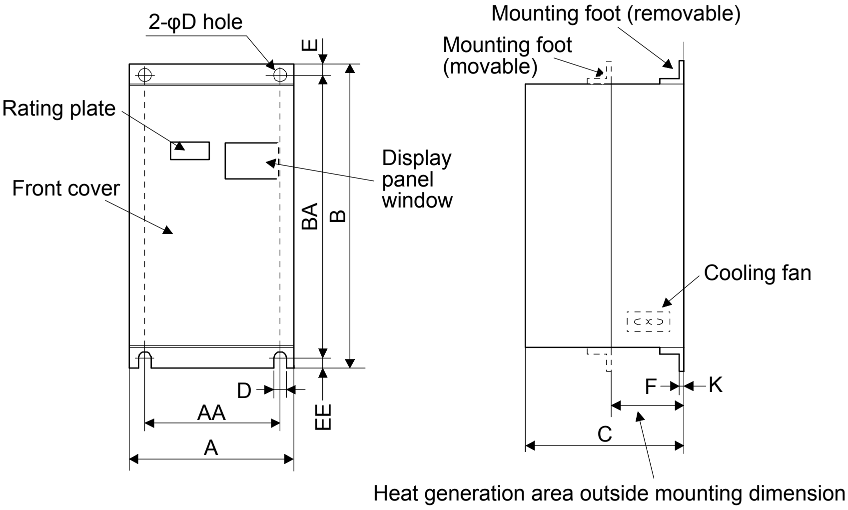
(b) 400 V class



Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC-H will not operate.

2. When using the servo amplifier of 7 kW and 5 kW, make sure to disconnect the wiring of built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.
4. Between P3 and P4 is connected by default.
5. For the power supply specifications, refer to section 1.3.
6. Configure the circuit which shuts off main circuit power with external circuit at EM1 (Forced stop) off.
7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
8. For selection of power factor improving AC reactors, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

(3) Dimensions

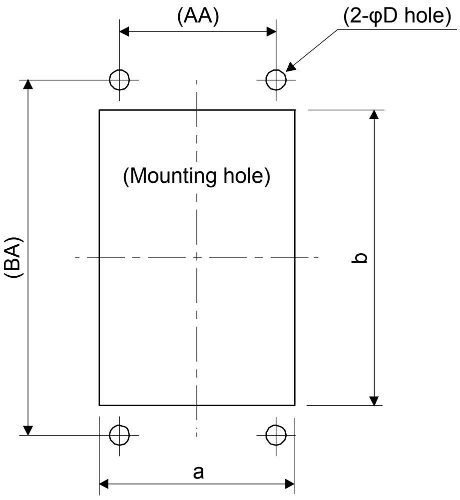


[Unit: mm]

Power regeneration converter	A	AA	B	BA	C	D	E	EE	K	F	Approximate mass [kg]
FR-RC-15K	270	200	450	432	195	10	10	8	3.2	87	19
FR-RC-30K	340	270	600	582	195	10	10	8	3.2	90	31
FR-RC-55K	480	410	700	670	250	12	15	15	3.2	135	55
FR-RC-H15K	340	270	600	582	195	10	10	8	3.2	90	31
FR-RC-H30K											
FR-RC-H55K	480	410	700	670	250	12	15	15	3.2	135	55

(4) Mounting hole machining dimensions

The following shows mounting hole dimensions for mounting the heat generation area of the power regeneration converter outside a cabinet as measures against heat generation when the converter is mounted in an enclosed type cabinet.



[Unit: mm]

Power regeneration converter	a	b	D	AA	BA
FR-RC-15K	260	412	10	200	432
FR-RC-30K	330	562	10	270	582
FR-RC-55K	470	642	12	410	670
FR-RC-H15K	330	562	10	270	582
FR-RC-H30K					
FR-RC-H55K	470	642	12	410	670

11.5 FR-CV-(H) power regeneration common converter

POINT

- ●For details of the power regeneration common converter FR-CV-(H), refer to "FR-CV Instruction Manual (IB(NA)0600075)".
- ●Do not supply power to the main circuit power supply terminals (L1, L2, and L3) of the servo amplifier. Doing so will cause a malfunction of the servo amplifier and FR-CV-(H).
- ●Connect the DC power supply between the FR-CV-(H) and servo amplifier with correct polarity. Connection with incorrect polarity will cause a malfunction of the FR-CV-(H) and servo amplifier.
- ●Using two or more FR-CV-(H)s will not improve regeneration capability. Two or more FR-CV-(H)s cannot be connected to the same DC power supply line.

When using the FR-CV-(H) power regeneration common converter, set "_ _ 0 1" in [Pr. 2].

11.5.1 Model definition

The following describes what each block of a model name indicates.

FR－CV－H7.5K

Capacity

Symbol	Capacity [kW]
7.5K	7.5
11K	11
15K	15
22K	22
30K	30
37K	37
55K	55

Symbol	Voltage class
None	200 V class
H	400 V class

11.5.2 Selection

(1) 200 V class

FR-CV power regeneration common converter can be used for the servo amplifier of 100 W to 22 kW. The following shows the restrictions on using the FR-CV.

(a) Up to six servo amplifiers can be connected to one FR-CV.

(b) FR-CV capacity [W] ≥ Total of the rated capacities of servo amplifiers connected to FR-CV [W] × 2

(c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV.

(d) Among the servo amplifiers connected to the FR-CV, the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

Item	FR-CV-_						
	7.5K	11K	15K	22K	30K	37K	55K
Maximum number of connected servo amplifiers	6						
Total capacity of connectable servo amplifiers [kW]	3.75	5.5	7.5	11	15	18.5	27.5
Total rated current of connectable servo motors [A]	33	46	61	90	115	145	215
Maximum servo amplifier capacity [kW]	3.5	5	7	11	15	15	22

When using FR-CV, always install the dedicated stand-alone reactor (FR-CVL).

Power regeneration common converter	Dedicated stand-alone reactor
FR-CV-7.5K(-AT)	FR-CVL-7.5K
FR-CV-11K(-AT)	FR-CVL-11K
FR-CV-15K(-AT)	FR-CVL-15K
FR-CV-22K(-AT)	FR-CVL-22K
FR-CV-30K(-AT)	FR-CVL-30K
FR-CV-37K	FR-CVL-37K
FR-CV-55K	FR-CVL-55K

(2) 400 V class

FR-CV-H power regeneration common converter can be used for the servo amplifier of 11 kW to 22 kW. The following shows the restrictions on using the FR-CV-H.

(a) Up to two servo amplifiers can be connected to one FR-CV-H.

(b) FR-CV-H capacity [W] ≥ Total of rated capacities [W] × 2 of servo amplifiers connected to FR-CV-H.

(c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV-H.

(d) Among the servo amplifiers connected to the FR-CV-H, the servo amplifier of the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

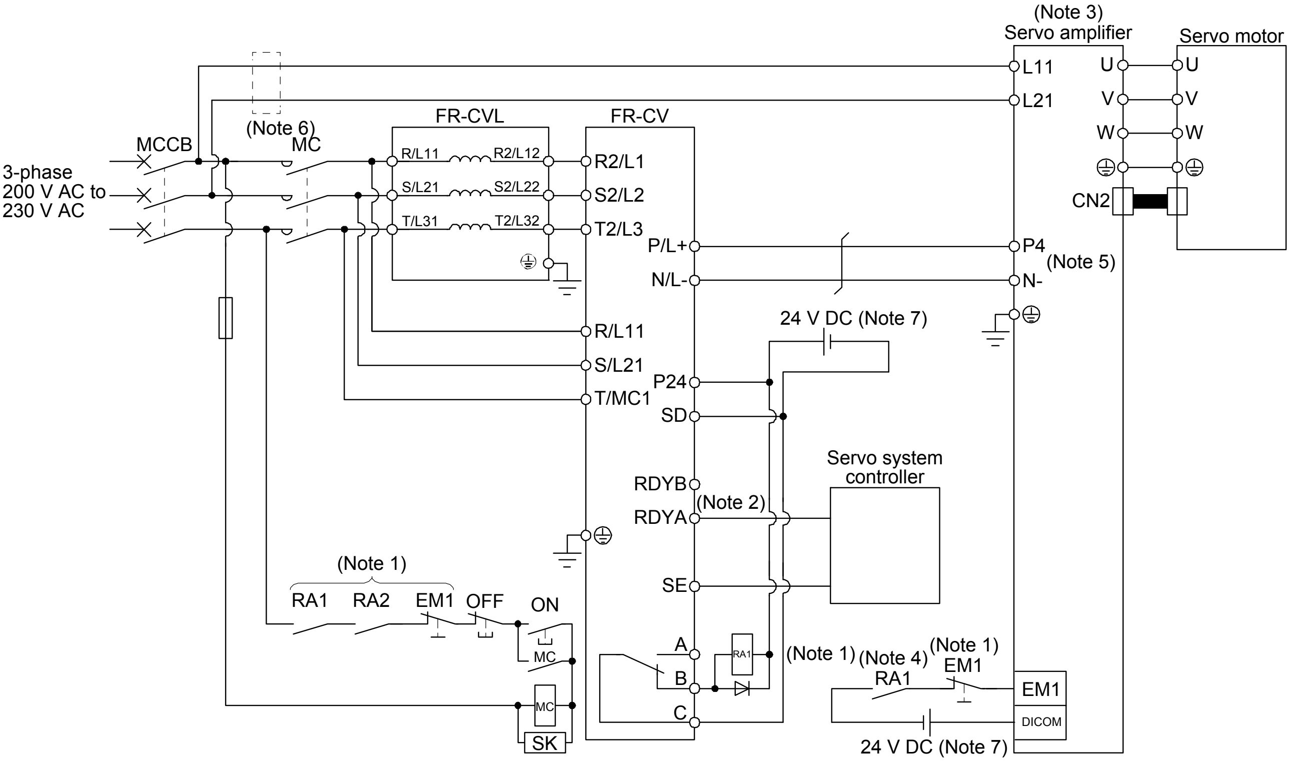
Item	FR-CV-H_			
	22K	30K	37K	55K
Maximum number of connected servo amplifiers	1			2
Total capacity of connectable servo amplifiers [kW]	11	15	18.5	27.5
Total rated current of connectable servo motors [A]	43	57	71	110
Maximum servo amplifier capacity [kW]	11	15	15	22

When using the FR-CV-H, always install the dedicated stand-alone reactor (FR-CVL-H).

Power regeneration common converter	Dedicated stand-alone reactor
FR-CV-H22K(-AT)	FR-CVL-H22K
FR-CV-H30K(-AT)	FR-CVL-H30K
FR-CV-H37K	FR-CVL-H37K
FR-CV-H55K	FR-CVL-H55K

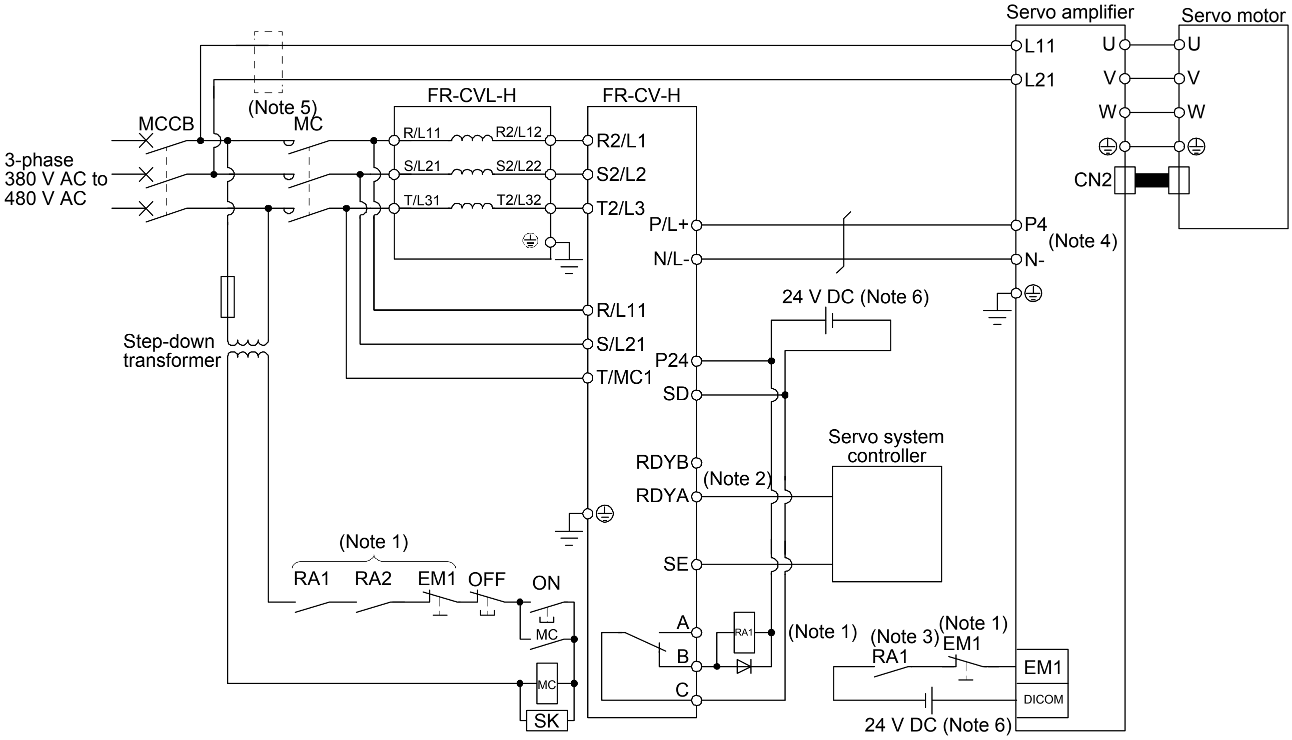
(3) Connection diagram

(a) 200 V class



Note
1. Configure a sequence that will shut off main circuit power in the following.
    - An alarm occurred at FR-CV or the servo amplifier.
    - EM1 (Forced stop) is enabled.
2. For the servo amplifier, configure a sequence that will switch the servo-on after FR-CV is ready.
3. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C).
4. Configure a sequence that will stop the servo amplifier with the emergency stop input of the servo system controller if an alarm occurs in the FR-CV. When the servo system controller does not have an emergency stop input, use the forced stop input of the servo amplifier to stop the servo amplifier as shown in the diagram.
5. When using FR-CV, always disconnect the wiring between P3 and P4 terminals.
6. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
7. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(b) 400 V class



Note 1. Configure a sequence that will shut off main circuit power in the following.

- An alarm occurred at FR-CV-H or servo amplifier.
- EM1 (Forced stop) is enabled.

2. For the servo amplifier, configure a sequence that will switch the servo-on after the FR-CV-H is ready.
3. Configure a sequence that will make a stop with the emergency stop input of the servo system controller if an alarm occurs in the FR-CV-H. When the servo system controller does not have an emergency stop input, use the forced stop input of the servo amplifier to make a stop as shown in the diagram.
4. When using FR-CV-H, always disconnect wiring between P3 and P4 terminals.
5. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
6. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(4) Selection example of wires used for wiring

POINT

- Selection conditions of wire size are as follows.
  Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
  Construction condition: single wire set in midair

(a) Wire size

1) Between P and P4, and between N and N-

The following table indicates the connection wire size for the DC power supply (P4, N- terminals) between the FR-CV and servo amplifier.

Total of servo amplifier capacities [kW]	Wire [mm^2]
1 or less	2 (AWG 14)
2	3.5 (AWG 12)
5	5.5 (AWG 10)
7	8 (AWG 8)
11	14 (AWG 6)
15	22 (AWG 4)
22	50 (AWG 2)

The following table indicates the connection wire size for the DC power supply (P4, N- terminals) between the FR-CV-H and servo amplifier.

Total of servo amplifier capacities [kW]	Wire [mm^2]
11	8 (AWG 8)
15	8 (AWG 8)
22	14 (AWG 6)

2) Grounding

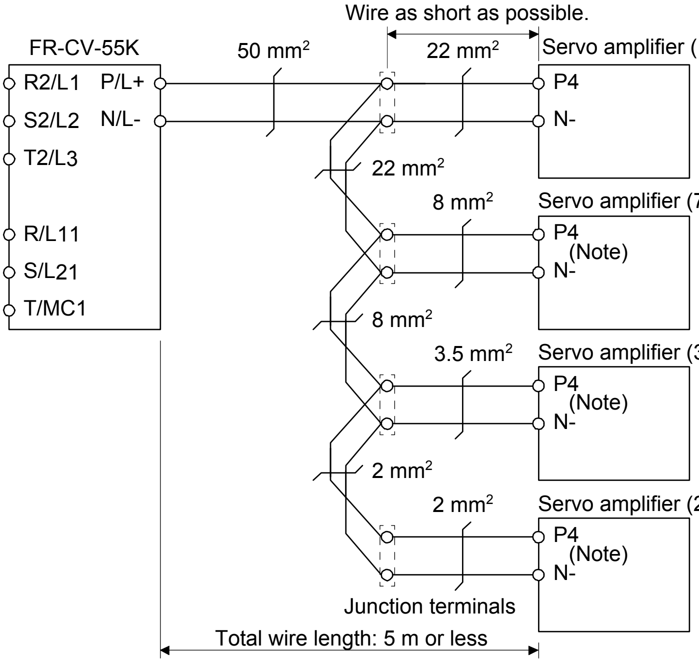
For grounding, use the wire of the size equal to or greater than that indicated in the following table, and make it as short as possible.

Power regeneration common converter	Grounding wire size [mm^2]
FR-CV-7.5K to FR-CV-15K	8 (AWG 8)
FR-CV-22K/FR-CV-30K	22 (AWG 4)
FR-CV-37K/FR-CV-55K	38 (AWG 2)
FR-CV-H22K/FR-CV-H30K	8 (AWG 8)
FR-CV-H37K/FR-CV-H55K	14 (AWG 6)

(b) Example of the wire size selection

1) 200 V class

When connecting multiple servo amplifiers, always use junction terminals for wiring to the servo amplifier terminals P4 and N-. Also, connect the servo amplifiers in the order of larger to smaller capacities.



First unit: total of connectable servo amplifier capacities
50 mm² for 27.5 kW
since 15 kW + 7 kW + 3.5 kW + 2.0 kW = 27.5 kW

Second unit: total of connectable servo amplifier capacities
22 mm² for 15 kW
since 7 kW + 3.5 kW + 2.0 kW = 12.5 kW

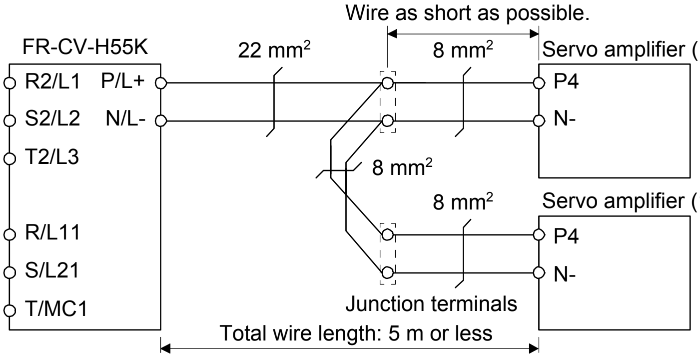
Third unit: total of connectable servo amplifier capacities
8 mm² for 7 kW
since 3.5 kW + 2.0 kW = 5.5 kW

Fourth unit: total of connectable servo amplifier capacities
2 mm² for 2 kW
since 2.0 kW = 2.0 kW

Note. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: across P+ and D, 7 kW: across P+ and C).

2) 400 V class

When connecting two servo amplifiers of 11 kW, always use junction terminals for wiring the servo amplifier terminals P4 and N-.



First unit: total of connectable servo amplifier capacities
22 mm² for 22 kW
since 11 kW + 11 kW = 22 kW

Second unit: total of connectable servo amplifier capacities
8 mm² for 11 kW
since 11 kW = 11 kW

(5) Other precautions

(a) When using the FR-CV-(H), always install the dedicated stand-alone reactor (FR-CVL-(H)). Do not use the power factor improving AC reactor (FR-HAL-(H)) or power factor improving DC reactor (FR-HEL-(H)).

(b) The inputs/outputs (main circuits) of the FR-CV-(H) and servo amplifiers include high-frequency components and may provide electromagnetic wave interference to communication equipment (such as AM radios) used near them. In this case, interference can be reduced by installing the radio noise filter (FR-BIF(-H)) or line noise filter (FR-BSF01, FR-BLF).

(c) The overall wiring length for connection of the DC power supply between the FR-CV-(H) and servo amplifiers should be 5 m or less, and the wiring must be twisted.

(6) Specifications

Power regeneration common converter FR-CV-_ Item			7.5K	11K	15K	22K	30K	37K	55K
Total capacity of connectable servo amplifiers [kW]			3.75	5.5	7.5	11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			3.5	5	7	11	15	15	22
Output	Total of connectable servo motor rated currents [A]		33	46	61	90	115	145	215
	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60 s (Note 1)						
		Continuous rating	100% torque						
Power supply	Rated input AC voltage/frequency		3-phase 200 V AC to 220 V AC, 50 Hz, 200 V AC to 230 V AC, 60 Hz						
	Permissible AC voltage fluctuation		3-phase 170 V AC to 242 V AC, 50 Hz, 170 V AC to 253 V AC, 60 Hz						
	Permissible frequency fluctuation		±5%						
	Power supply capacity (Note 2) [kVA]		17	20	28	41	52	66	100
IP rating (JEM 1030), cooling method			Open type (IP00), forced cooling						
Environ-ment	Ambient temperature		-10 ˚C to 50 ˚C (non-freezing)						
	Ambient humidity		90 %RH or less (non-condensing)						
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt						
Altitude, vibration resistance			1000 m or less above sea level, 5.9 m/s^2						
Molded-case circuit breaker or earth-leakage current breaker			30AF 30A	50AF 50A	100AF 75A	100AF 100A	125AF 125A	125AF 125A	225AF 175A
Magnetic contactor			S-N20 S-T21	S-N35 S-T35	S-N50 S-T50	S-N65 S-T65	S-N80 S-T80	S-N95 S-T100	S-N125

Power regeneration common converter FR-CV-H_ Item			22K	30K	37K	55K
Total of connectable servo amplifier capacities [kW]			11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			11	15	15	22
Output	Total of connectable servo motor rated currents [A]		43	57	71	110
	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60 s (Note 1)			
		Continuous rating	100% torque			
Power supply	Rated input AC voltage/frequency		3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz			
	Permissible AC voltage fluctuation		3-phase 323 V AC to 528 V AC, 50 Hz/60 Hz			
	Permissible frequency fluctuation		±5%			
	Power supply capacity (Note 2) [kVA]		41	52	66	100
IP rating (JEM 1030), cooling method			Open type (IP00), forced cooling			
Environ-ment	Ambient temperature		-10 ˚C to 50 ˚C (non-freezing)			
	Ambient humidity		90 %RH or less (non-condensing)			
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt			
Altitude, vibration resistance			1000 m or less above sea level, 5.9 m/s^2			
Molded-case circuit breaker or earth-leakage current breaker			50AF 50A	60AF 60A	100AF 75A	100AF 100A
Magnetic contactor			S-N25 S-T25	S-N35 S-T35	S-N50 S-T50	S-N65 S-T65

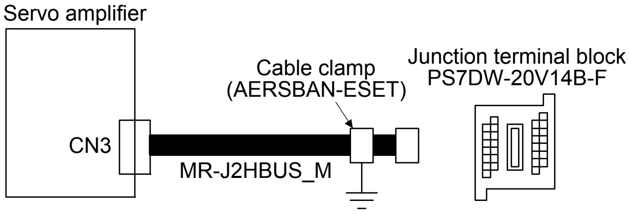
Note 1. This is the time when the protective function of the FR-CV-(H) is activated. The protective function of the servo amplifier is activated in the time indicated in section 10.1.

2. The specified value is the power supply capacity of FR-CV-(H). The total power supply capacities of the connected servo amplifiers are actually required.

11.6 Junction terminal block PS7DW-20V14B-F (recommended)

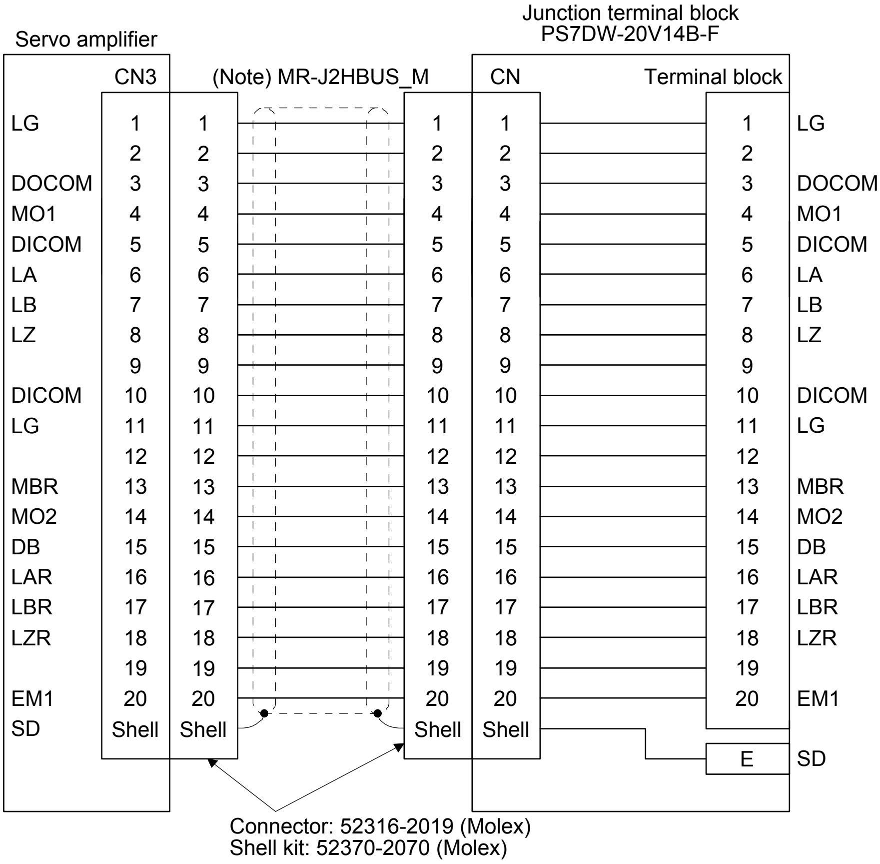
(1) Usage

Always use the junction terminal block PS7DW-20V14B-F (Toho Technology) with the option cable (MR-J2HBUS_M). A connection example is shown below.



Ground the option cable on the junction terminal block side with the cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to section 11.14, (2) (c).

(2) Connection of MR-J2HBUS_M cable and junction terminal block



Servo amplifier signal	CN3	MR-J2HBUS_M	MR-J2HBUS_M	CN	Terminal block	Signal
LG	1	1	1	1	1	LG
	2	2	2	2	2	
DOCOM	3	3	3	3	3	DOCOM
MO1	4	4	4	4	4	MO1
DICOM	5	5	5	5	5	DICOM
LA	6	6	6	6	6	LA
LB	7	7	7	7	7	LB
LZ	8	8	8	8	8	LZ
	9	9	9	9	9	
DICOM	10	10	10	10	10	DICOM
LG	11	11	11	11	11	LG
	12	12	12	12	12	
MBR	13	13	13	13	13	MBR
MO2	14	14	14	14	14	MO2
DB	15	15	15	15	15	DB
LAR	16	16	16	16	16	LAR
LBR	17	17	17	17	17	LBR
LZR	18	18	18	18	18	LZR
	19	19	19	19	19	
EM1	20	20	20	20	20	EM1
SD	Shell	Shell	Shell	Shell	E	SD

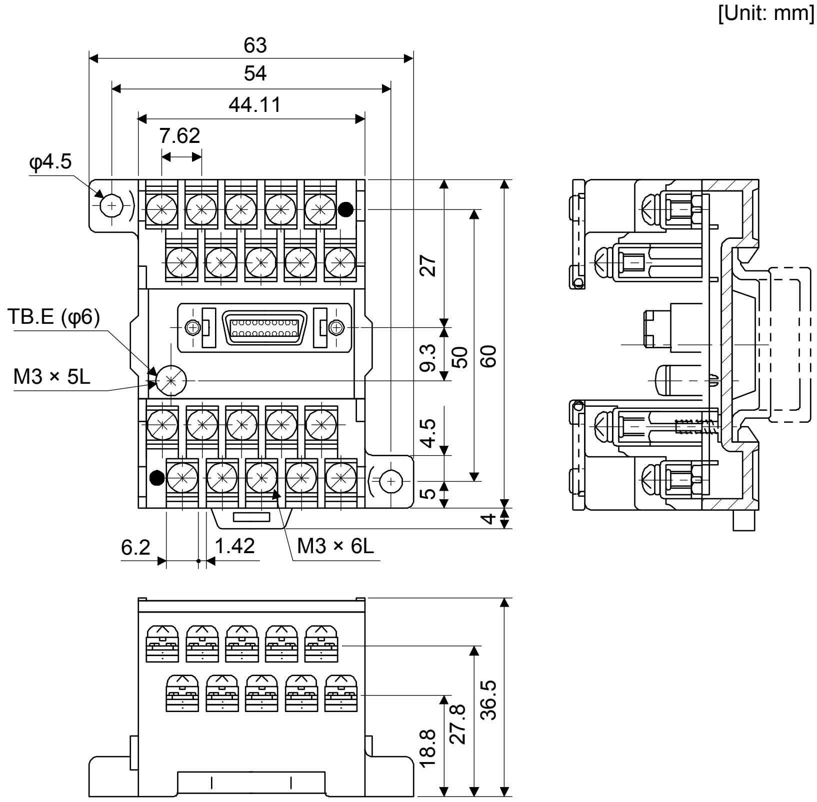
Note. The symbol indicating cable length is put in _.

05: 0.5 m

1: 1 m

5: 5 m

(3) Dimensions of the junction terminal block



11.7 MR Configurator

POINT

- ●For using MR Configurator with MR-J4-_B_-RJ020 servo amplifier, the restrictions apply to the MR-J2S-_B_ servo amplifier. Refer to section 11.7.2 for details.
- ●When using MR Configurator (MRZJW3-SETUP161E) with an operating system of Windows Vista®, Windows® 7, Windows® 8, and Windows® 8.1, refer to section 11.7.3 (2) and (3).

MR Configurator (MRZJW3-SETUP161E) uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

11.7.1 Specifications

Item	Description
Communication signal	RS-232C
Baud rate [bps]	57600/38400/19200/9600
Monitor	Batch display, high speed display, graph display (Minimum resolution changes with the processing speed of the personal computer.)
Alarm	Alarm display, alarm history, alarm occurrence time
Diagnosis	Digital I/O, no motor rotation, total power-on time, software No., servo motor information (Note 1), tuning data, ABS data display, Axis name setting.
Parameter	Parameter setting, turning, change list, detailed information
Test operation function (Note 2)	JOG operation, positioning operation, DO forced output, and program operation
Advanced function (Note 3)	Machine analyzer
File operation	Data read, save, print
Others	Automatic demo, help display

Note 1. The HG series servo motor information will not be displayed.
2. The motor-less operation using MR Configurator is not available. To use motor-less operation, set "_ 1 _ _" in [Pr. 24]. (Refer to section 4.5.2.)
3. Machine simulation and gain search functions are not available.

11.7.2 Additional instructions

Item	Description	Display	Restrictions	
			MR-J4-_B_-RJ020	MR-J2S-_B_
Monitor	Batch display	Batch monitor display	Regardless of the [Pr. 7] setting, the display of the cumulative command pulses and command pulse frequency is as follows. ・When the servo motor rotation direction is forward rotation (CCW), the + sign is indicated. ・When the servo motor rotation direction is reverse rotation (CW), the - sign is indicated.	[Pr. 7] setting affects cumulative command pulses and command pulse frequency, and the display is as follows. When "0" is set in [Pr. 7]. ・When the servo motor rotation direction is forward (CCW) due to increase in the positioning address, the + sign is indicated. ・When the servo motor rotation direction is reverse (CW) due to decrease in the positioning address, the - sign is indicated. When "1" is set in [Pr. 7]. ・When the servo motor rotation direction is reverse (CW) due to increase in the positioning address, the + sign is indicated. ・When the servo motor rotation direction is forward (CCW) due to decrease in the positioning address, the - sign is indicated.
	High speed display	High speed monitor display		
Alarm	At alarm occurrence	Data batch display at alarm occurrence		
Test operation	Positioning operation	Positioning operation	Regardless of the [Pr. 7] setting, the operation is as follows. ・Click the "Forward" button changes the servo motor rotation direction to forward (CCW). ・Click the "Reverse" button changes the servo motor rotation direction to reverse (CW).	MR-J2S-700B or less The function operates as follows by the [Pr. 7] setting. When "0" is set in [Pr. 7]. ・Click the "Forward" button changes the servo motor rotation direction to forward (CCW). ・Click the "Reverse" button changes the servo motor rotation direction to reverse (CW). When "1" is set in [Pr. 7]. ・Click the "Forward" button changes the servo motor rotation direction to reverse (CW). ・Click the "Reverse" button changes the servo motor rotation direction to forward (CCW).
	DO forced output	DO forced output	MR-J4-11KB-RJ020 or more/MR-J4-11KB4-RJ020 or more To forcibly output the output signal CN3-13 pin, turn on/off the CON2-3 pin of the DO forced output screen. To forcibly output the output signal CN3-15 pin, turn on/off the CON2-4 pin of the DO forced output screen.	MR-J2S-11KB or more/MR-J2S-11KB4 or more To forcibly output the output signal CON2-3 pin, turn on/off the CON2-3 pin of the DO forced output screen. To forcibly output the output signal CON2-4 pin, turn on/off the CON2-4 pin of the DO forced output screen.
Diagnosis	DI/DO display	DI/DO batch display	MR-J4-11KB-RJ020 or more/MR-J4-11KB4-RJ020 or more The CON2-2 pin of the DI/DO batch display screen displays the status of the input signal CN3-20 pin. The CON2-3 pin of the DI/DO batch display screen displays the status of the output signal CN3-13 pin. The CON2-4 pin of the DI/DO batch display screen displays the status of the output signal CN3-15 pin.	MR-J2S-11KB or more/MR-J2S-11KB4 or more The CON2-2 pin of the DI/DO batch display screen displays the status of the input signal CN2-2 pin. The CON2-3 pin of the DI/DO batch display screen displays the status of the output signal CN2-3 pin. The CON2-4 pin of the DI/DO batch display screen displays the status of the output signal CN2-4 pin.

11.7.3 System requirements

(1) Components

To use MR Configurator (MRZJW3-SETUP161E), the following components are required in addition to the servo amplifier and servo motor.

Model	Description
(Note) Personal computer	IBM PC/AT compatible where the English version of Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional Windows® XP Professional, Windows® XP Home Edition, Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise, Windows® 7 Starter, Windows® 7 Home Premium, Windows® 7 Professional, Windows® 7 Ultimate, Windows® 7 Enterprise, Windows® 8 Enterprise, Windows® 8 Pro, Windows® 8, Windows® 8.1 Enterprise, Windows® 8.1 Pro, Windows® 8.1 operates Processor: Pentium® 133 MHz or more (Windows® 95, Windows® 98, Windows NT® Workstation 4.0, Windows®2000 Professional) Pentium® 150 MHz or more (Windows® Me) Pentium® 300 MHz or more (Windows® XP Professional, Windows® XP Home Edition) Memory: 16 MB or more (Windows® 95), 24 MB or more (Windows®98) 32 MB or more (Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional) 128 MB or more (Windows® XP Professional, Windows® XP Home Edition) Free hard disk space: 60 MB or more Serial port used
OS	Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional, Windows® XP Professional, Windows® XP Home Edition, Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise, Windows® 7 Starter, Windows® 7 Home Premium, Windows® 7 Professional, Windows® 7 Ultimate, Windows® 7 Enterprise, Windows® 8 Enterprise, Windows® 8 Pro, Windows® 8, Windows® 8.1 Enterprise, Windows® 8.1 Pro, Windows® 8.1 (English version)
Display	With 800 × 600 or more resolution and a high color (16 bit) display. Connectable with the above personal computer.
Keyboard	Connectable with the above personal computer.
Mouse	Connectable with the above personal computer. Do not use a serial mouse.
Printer	Connectable with the above personal computer.
Communication cable	MR-CPCATCBL3M and MR-J4T20CH00

Note. On some personal computers, MR Configurator may not run properly.

(2) Warnings for installation and startup

POINT

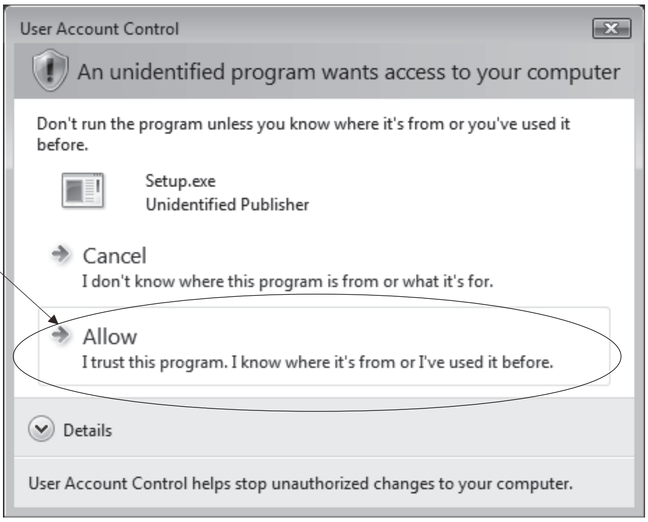
- For installation and startup of MR Configurator (MRZJW3-SETUP161E), log in as a user having Administrator authority (for computer control).

The security functions of Windows Vista®, Windows® 7, Windows® 8, and Windows® 8.1 are greatly enhanced compared to the conventional operating system.

Therefore, when you use MR Configurator (MRZJW3-SETUP161E) with an operating system of Windows Vista®, Windows® 7, Windows® 8, and Windows® 8.1, a warning window will be displayed at the time of installation and startup for MR Configurator. Even if the warning window is displayed, MR Configurator will operate properly. For details of warning windows, refer to the following.

(a) For Windows Vista®

On installation, the following "User Account Control" window is displayed. In this case, click "Allow". After that, installation will start normally.



User Account Control

An unidentified program wants access to your computer

Don't run the program unless you know where it's from or you've used it before.

Setup.exe
Unidentified Publisher

Cancel
I don't know where this program is from or what it's for.

Allow
I trust this program. I know where it's from or I've used it before.

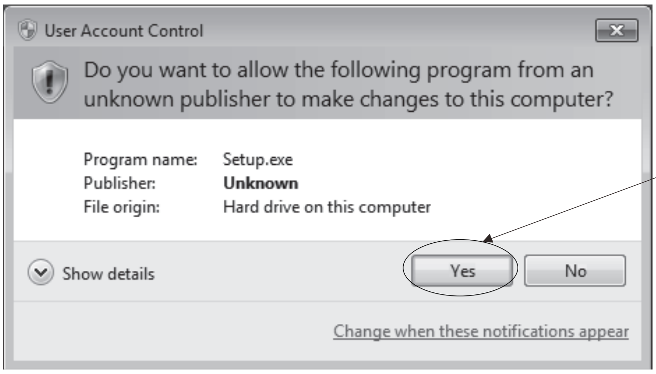
User Account Control helps stop unauthorized changes to your computer.

Click

When you start MR Configurator, the "User Account Control" window is displayed in the same way as with installation. In this case, click "Allow". After that, MR Configurator will start normally.

(b) For Windows® 7, Windows® 8, and Windows® 8.1

On installation, the following "User Account Control" window is displayed. In this case, click "Yes". After that, installation will start normally.



User Account Control

Do you want to allow the following program from an unknown publisher to make changes to this computer?

Program name: Setup.exe
Publisher: **Unknown**
File origin: Hard drive on this computer

Click

When you start MR Configurator, The same "User Account Control" window is displayed in the same way as with installation. In this case, click "Yes". After that, MR Configurator will start normally.

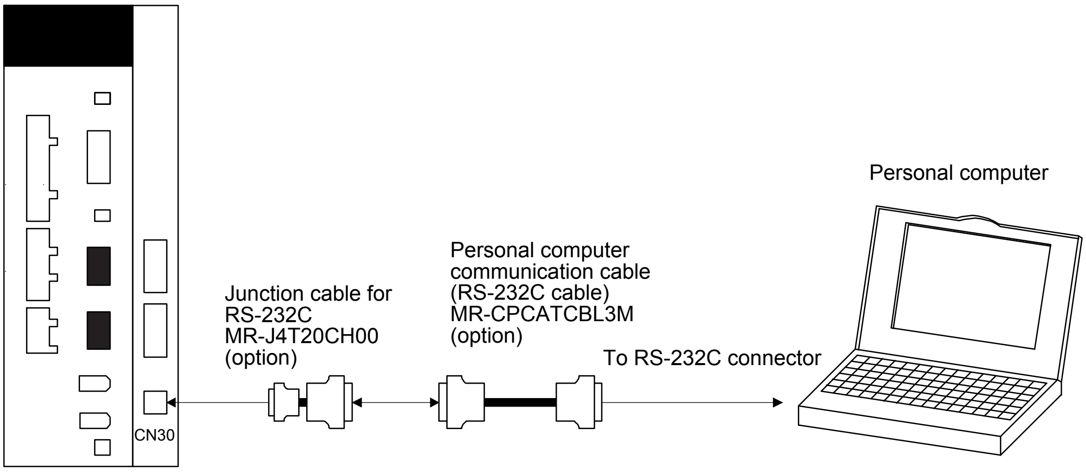
(3) Help

POINT

- We have checked that the Windows Help program (WinHlp32.exe) operates normally with the MR Configurator (MRZJW3-SETUP161E) version F2.

Installing the Windows Help program (WinHlp32.exe) enables you to use Windows Help. Download the Windows Help program (WinHlp32.exe) from the Microsoft® download site.
When you start help with MR Configurator, "Windows Help and support" window is displayed. From this window, you can also access to the web site for download.

(4) Connection with the servo amplifier



11.7.4 Precautions for using RS-232C communication function

Note the following to prevent an electric shock and malfunction of the servo amplifier.

(1) Power connection of personal computers
Connect your personal computer with the following procedures.

(a) When you use a personal computer with AC power supply

1) When using a personal computer with a three-core power plug or power plug with grounding wire, use a three-pin socket or ground the grounding wire.

2) When your personal computer has two-core plug and has no grounding wire, connect the personal computer to the servo amplifier with the following procedures.

a) Disconnect the power plug of the personal computer from an AC power socket.

b) Check that the power plug was disconnected and connect the device to the servo amplifier.

c) Connect the power plug of the personal computer to the AC power socket.

(b) When you use a personal computer with battery
You can use as it is.

(2) Connection with other devices using servo amplifier communication function
When the servo amplifier is charged with electricity due to connection with a personal computer and the charged servo amplifier is connected with other devices, the servo amplifier or the connected devices may malfunction. Connect the servo amplifier and other devices with the following procedures.

(a) Shut off the power of the device for connecting with the servo amplifier.

(b) Shut off the power of the servo amplifier which was connected with the personal computer and check the charge lamp is off.

(c) Connect the device with the servo amplifier.

(d) Turn on the power of the servo amplifier and the device.

11.8 Battery

POINT

- Refer to app. 4 and 5 for battery transportation and the new EU Battery Directive.

This battery is used to construct an absolute position detection system. Refer to chapter 12 for construction of the absolute position detection system.

11.8.1 Selection of battery

The available batteries vary depending on servo amplifiers. Select a required battery.

(1) Applications of the batteries

Model	Name	Application	Built-in battery
MR-BAT6V1SET	Battery	For absolute position data backup	MR-BAT6V1
MR-BAT6V1BJ	Battery for junction battery cable	For transporting a servo motor and machine apart	
MR-BT6VCASE	Battery case	For absolute position data backup of multi-axis servo motor	MR-BAT6V1

(2) Combinations of batteries and the servo amplifier

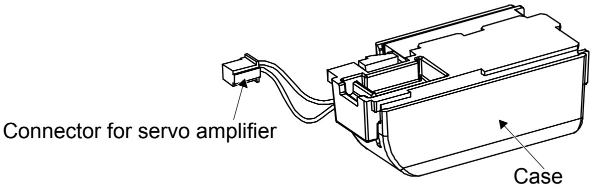
Model	MR-J4-_B_(-RJ020)
MR-BAT6V1SET	○
MR-BAT6V1BJ	○
MR-BT6VCASE	○

11.8.2 MR-BAT6V1SET battery

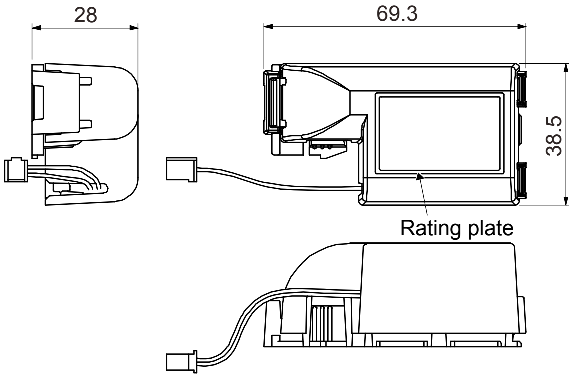
POINT

- For the specifications and year and month of manufacture of the built-in MR-BAT6V1 battery, refer to section 11.8.5.

(1) Parts identification and dimensions



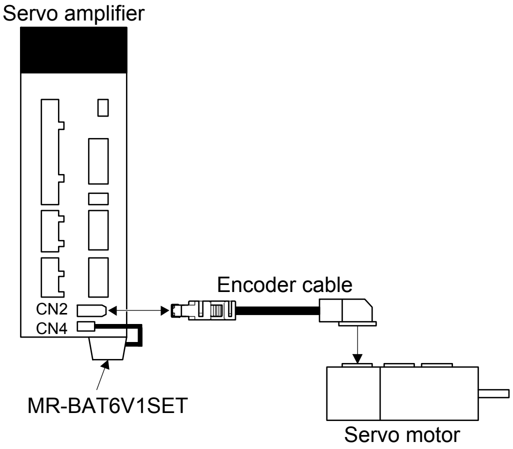
[Unit: mm]



Mass: 34 [g] (including MR-BAT6V1 battery)

(2) Battery mounting

Connect as follows.



(3) Battery replacement procedure

⚠WARNING

●Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.

- Ground human body and work bench.
- Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

POINT

●Replacing battery with the control circuit power off will erase the absolute position data.

●Before replacing batteries, check that the new battery is within battery life.

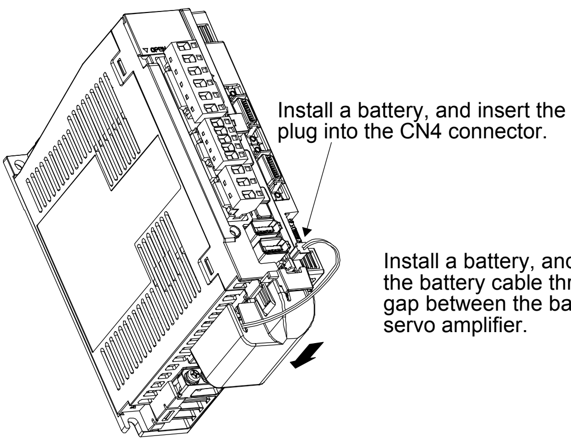
Replace the battery while only control circuit power is on. Replacing battery with the control circuit power on triggers [AL. 9F Battery warning]. However, the absolute position data will not be erased.

(a) Battery installation and removal procedure

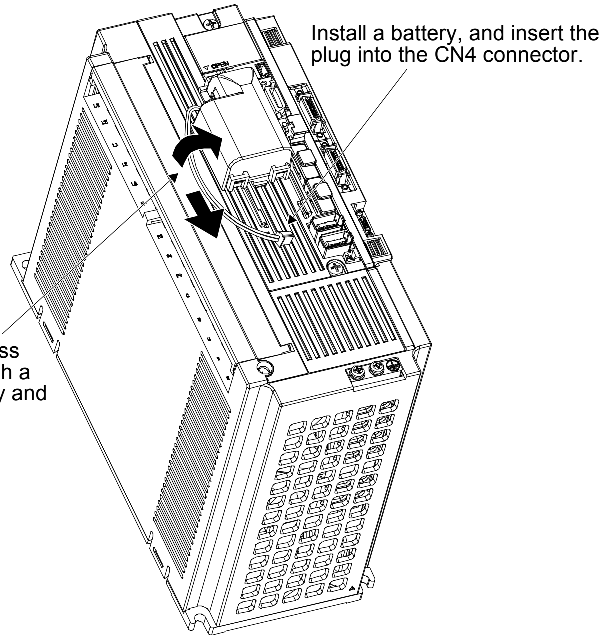
1) Installation procedure

POINT

- For the servo amplifier with a battery holder on the bottom, it is not possible to wire for the earth with the battery installed. Insert the battery after executing the earth wiring of the servo amplifier.



For the servo amplifier
with a battery holder on the bottom

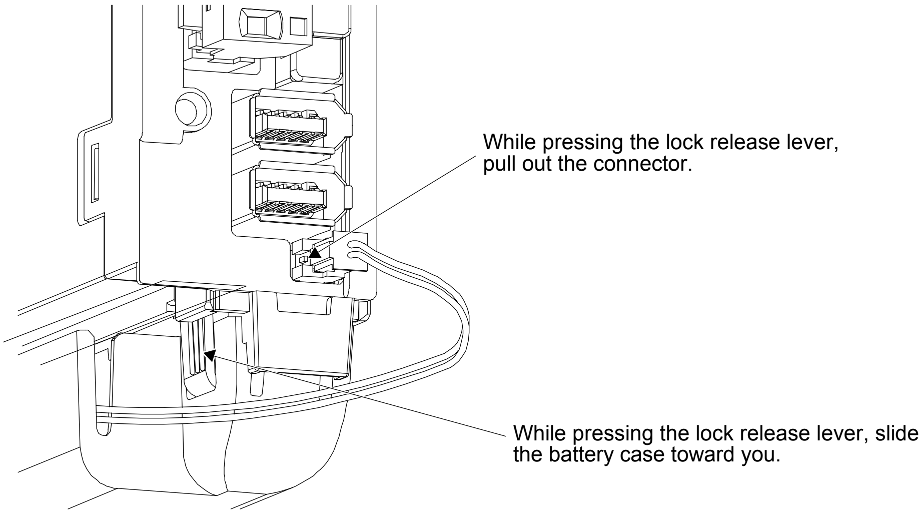


For the servo amplifier
with a battery holder on the front

2) Removal procedure

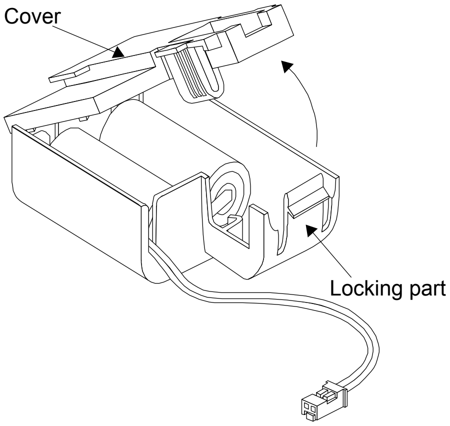
⚠CAUTION

- Pulling out the connector of the battery without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the battery.

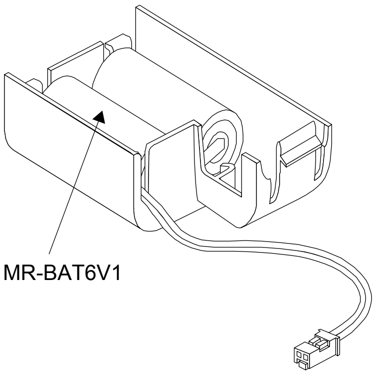


(4) Replacement procedure of the built-in battery

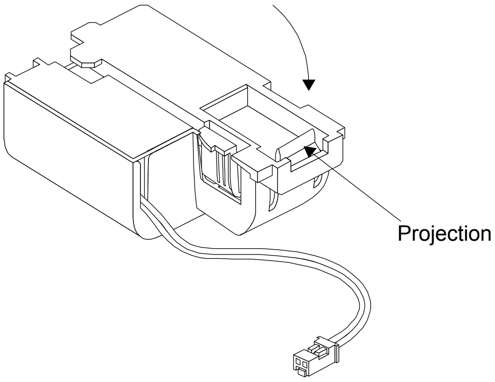
When the MR-BAT6V1SET reaches the end of its life, replace the MR-BAT6V1 battery in the MR-BAT6V1SET.



1) While pressing the locking part, open the cover.



2) Replace the battery with a new MR-BAT6V1.



3) Press the cover until it is fixed with the projection of the locking part to close the cover.

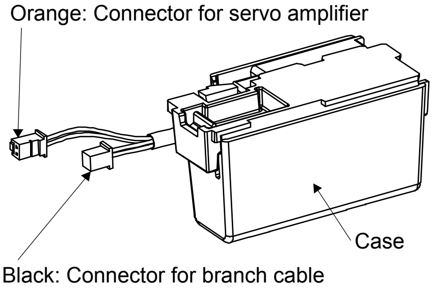
11.8.3 MR-BAT6V1BJ battery for junction battery cable

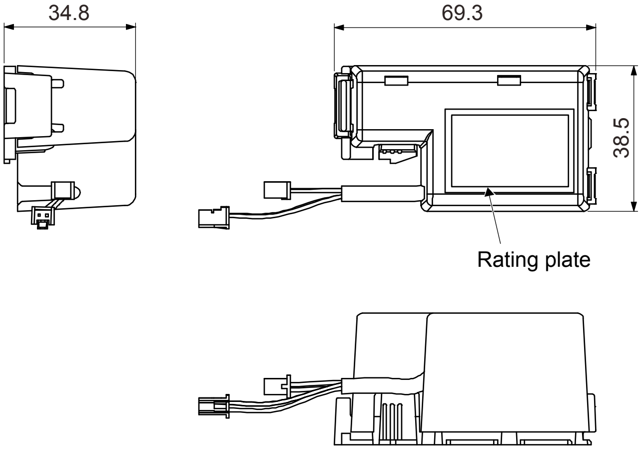
POINT

- ●MR-BAT6V1BJ is compatible only with HG series servo motors.
- ●MR-BAT6V1BJ cannot be used for fully closed loop system.

(1) Parts identification and dimensions

[Unit: mm]





Mass: 66 [g]

(2) Year and month of manufacture of battery

Production year and month are indicated in a serial number (SERIAL) on the rating plate. The second digit from left in the number indicates the first digit of the dominical year, the third digit from left indicates a month (Oct: X, Nov: Y, Dec.: Z). For November 2013, the serial is like, "SERIAL: _ 3Y _ _ _ _ _ _".

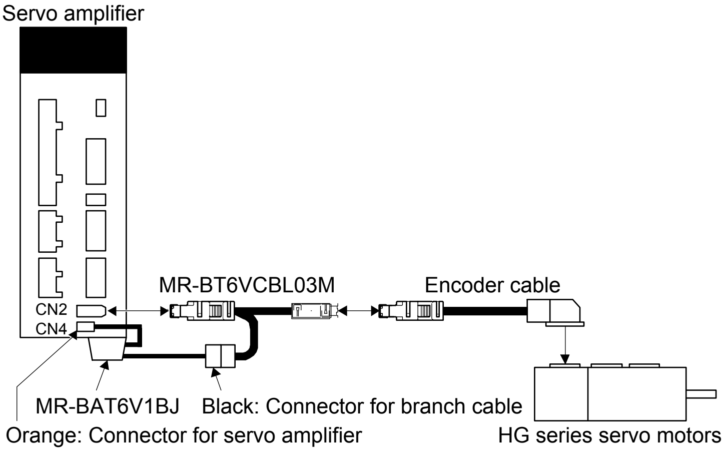
(3) Specification list

Item		Description
Battery pack		2CR17335A 2CR17335A (CR17335A × 2 pcs. connected in series)
Nominal voltage	[V]	6
Nominal capacity	[mAh]	1650
Storage temperature	[°C]	0 to 55
Operating temperature	[°C]	0 to 55
Lithium content	[g]	1.2
Mercury content		Less than 1 ppm
Dangerous goods class		Not subject to the dangerous goods (Class 9) (Refer to app. 4 for details.)
Operating humidity and storage humidity		90 %RH or less (non-condensing)
(Note) Battery life		5 years from date of manufacture
Mass	[g]	66

Note. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

(4) Battery mounting

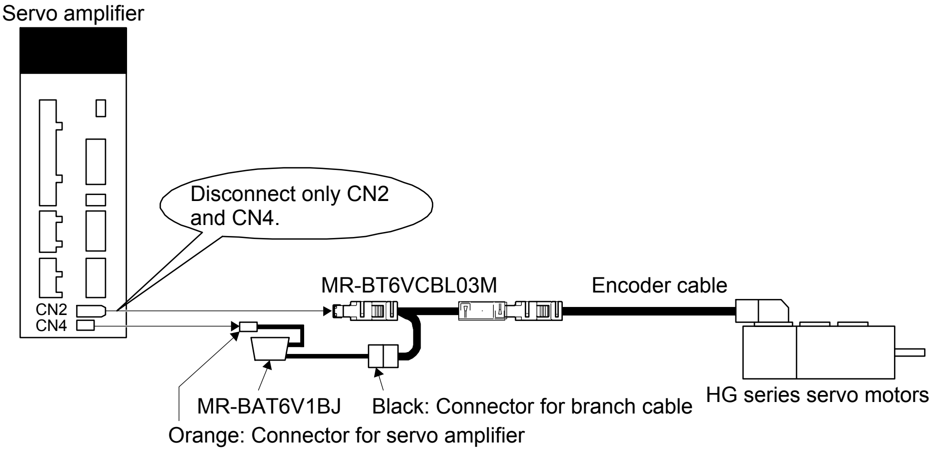
Connect the MR-BAT6V1BJ using the MR-BT6VCBL03M junction battery cable as follows.



(5) Transporting a servo motor and machine apart

POINT
●Be sure to connect the connector for branch cable connection (black) when transporting a servo motor and machine apart. When the connector for branch cable connection (black) is not connected to the MR-BT6VCBL03M junction battery cable, no alarm will occur. However, the absolute position data will be erased when you transport a servo motor and machine apart.

When you transport a servo motor and machine apart, disconnect only CN2 and CN4 of the servo amplifier. When other connectors or cables are disconnected between the servo motor and battery, the absolute position data will be deleted.



(6) Battery replacement procedure

⚠WARNING

- ●Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

- ●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.
  - ･Ground human body and work bench.
  - ･Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.
- ●The battery built in MR-BAT6V1BJ cannot be replaced. Do not disassemble the MR-BAT6V1BJ. Otherwise, it may cause a malfunction.

POINT

- ●To replace the MR-BAT6V1BJ, follow the procedures given in this section to avoid erasing absolute position data.
- ●Before replacing batteries, check that the new battery is within battery life.

For MR-BAT6V1BJ, the battery can be replaced with the control circuit power supply off.

(a) Battery installation and removal procedure

The battery installation and removal procedure to the servo amplifier are the same as for the MR-BAT6V1SET battery. Refer to (3) of section 11.8.2.

(b) Preparation for replacing MR-BAT6V1BJ

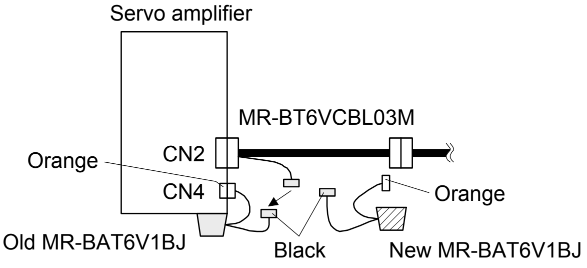
Prepare a new MR-BAT6V1BJ as follows.

Model	Number and use	Remark
MR-BAT6V1BJ	1 for replacement	Battery within two years from the production date.

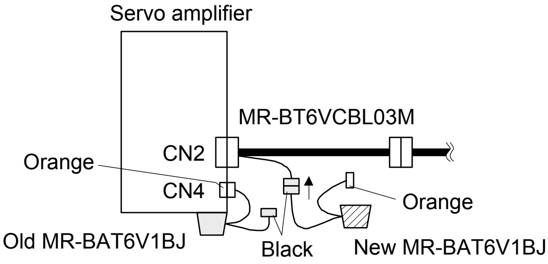
(c) Procedures of replacing MR-BAT6V1BJ

Replace the product as follows regardless of on/off of the control circuit power supply. When it is replaced with other procedures, the absolute position data will be erased.

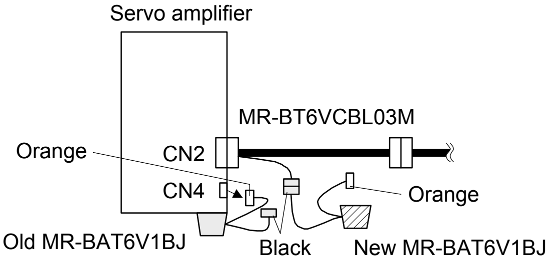
1) Remove the connector for branch cable connection (black) of the old MR-BAT6V1BJ.



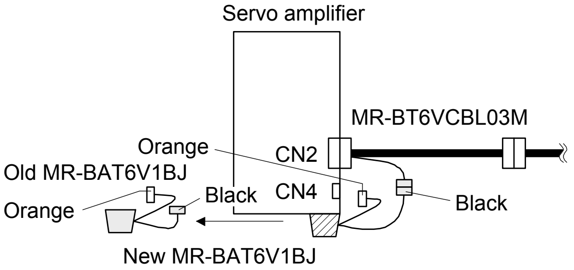
2) Connect the connector for branch cable connection (black) of the new MR-BAT6V1BJ.



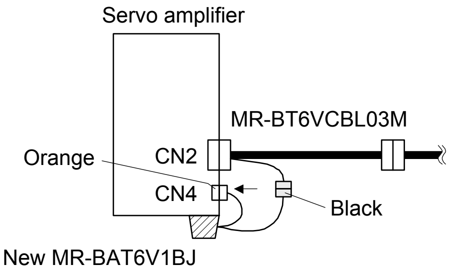
3) Remove the connector for servo amplifier (orange) of the old MR-BAT6V1BJ. When the control circuit power supply is on, performing 3) without [AL. 9F Battery warning] will trigger [AL. 9F].



4) Remove the old MR-BAT6V1BJ from servo amplifier and mount the new MR-BAT6V1BJ. When the control circuit power supply is on, [AL. 9F] will occur after 3).



5) Mount the connector for servo amplifier (orange) of the new MR-BAT6V1BJ. When the control circuit power supply is on, [AL. 9F] will be canceled.



11.8.4 MR-BT6VCASE battery case

POINT

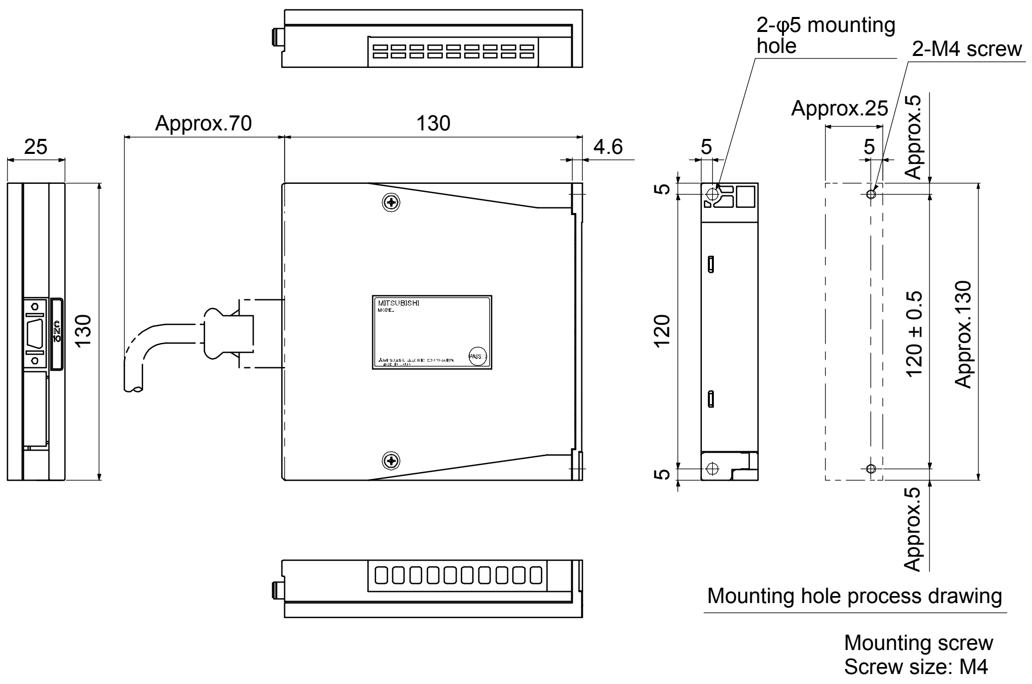
- ●The battery unit consists of an MR-BT6VCASE battery case and five MR-BAT6V1 batteries.
- ●For the specifications and year and month of manufacture of MR-BAT6V1 battery, refer to section 11.8.5.

MR-BT6VCASE is a case used for connecting and mounting five MR-BAT6V1 batteries. A battery case does not have any batteries. Please prepare MR-BAT6V1 batteries separately.

(1) The number of connected servo motors
One MR-BT6VCASE holds absolute position data up to eight axes servo motors. Servo motors in the incremental system are included as the axis Nos.

(2) Dimensions

[Unit: mm]



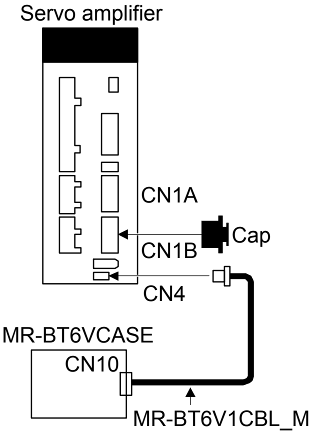
[Mass: 0.18 kg]

(3) Battery mounting

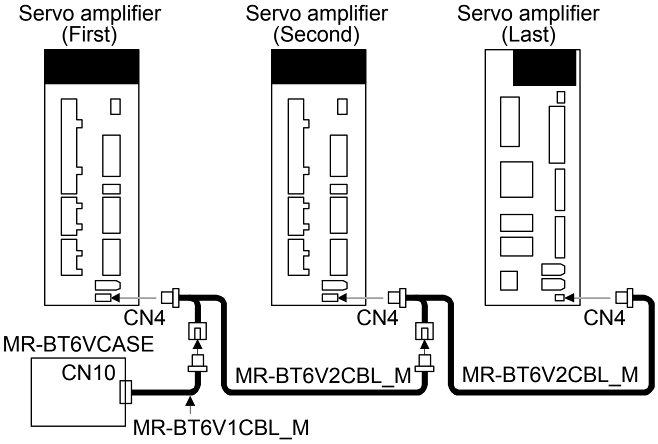
POINT

- ●One battery unit can be connected to up to 8-axis servo motors. Servo motors in the incremental system are included as the axis Nos.

(a) When using 1-axis servo amplifier



(b) When using up to 8-axis servo amplifiers



(4) Battery replacement procedure

⚠WARNING

- ●Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

- ●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.
  - ・Ground human body and work bench.
  - ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

POINT

- ●Replacing battery with the control circuit power off will erase the absolute position data.
- ●Before replacing batteries, check that the new battery is within battery life.

Replace the battery while only control circuit power is on. Replacing battery with the control circuit power on triggers [AL. 9F Battery warning]. However, the absolute position data will not be erased.

(a) Assembling a battery unit

⚠CAUTION
- ●Do not mount new and old batteries together.
- ●When you replace a battery, replace all batteries at the same time.

POINT
- ●Always install five MR-BAT6V1 batteries to an MR-BT6VCASE battery case.

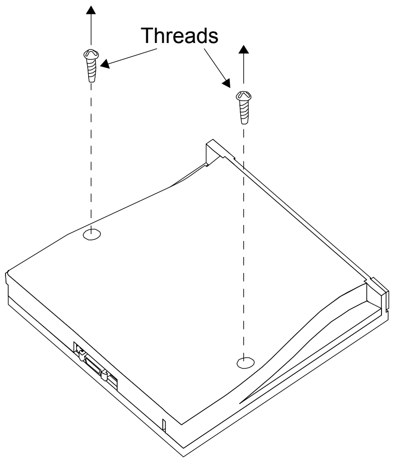
1) Required items

Product name	Model	Quantity	Remark
Battery case	MR-BT6VCASE	1	MR-BT6VCASE is a case used for connecting and mounting five MR-BAT6V1 batteries.
Battery	MR-BAT6V1	5	Lithium battery (primary battery, nominal + 6 V)

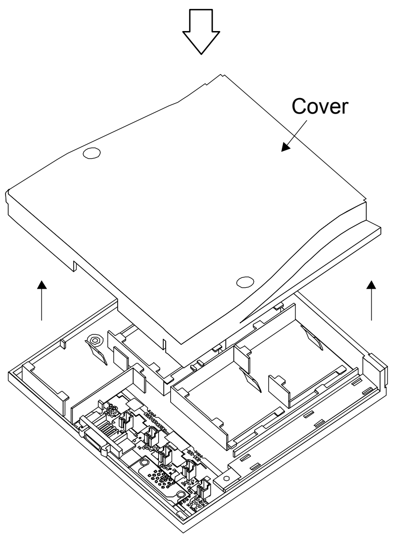
2) Disassembly and assembly of the battery case MR-BT6VCASE

a) Disassembly of the case

MR-BT6VCASE is shipped assembled. To mount MR-BAT6V1 batteries, the case needs to be disassembled.

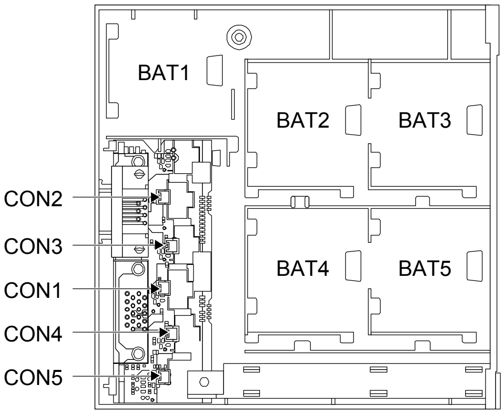


Remove the two screws using a Phillips screwdriver.

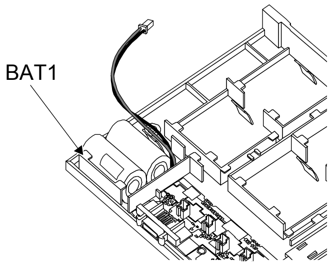


Remove the cover.

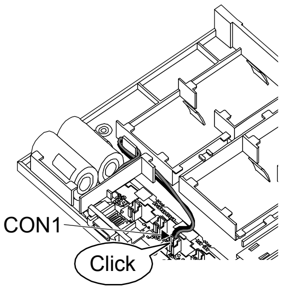
Parts identification



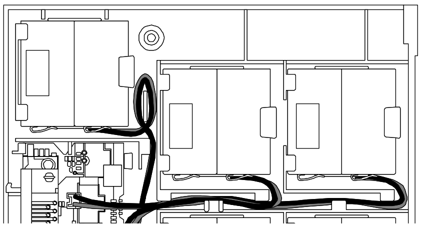
b) Mounting MR-BAT6V1



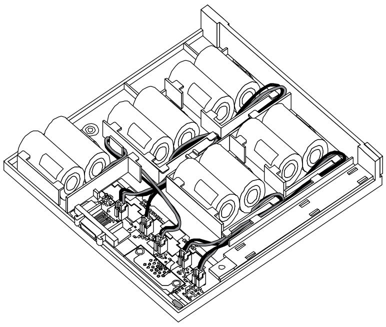
Securely mount a MR-BAT6V1 to the BAT1 holder.



Insert the MR-BAT6V1 connector mounted on BAT1 holder to CON1.
Confirm the click sound at this point.
The connector has to be connected in the right direction.
If the connector is pushed forcefully in the incorrect direction, the connector will break.
Place the MR-BAT6V1 lead wire to the duct designed to store lead wires.
Insert MR-BAT6V1 to the holder in the same procedure in the order from BAT2 to BAT5.



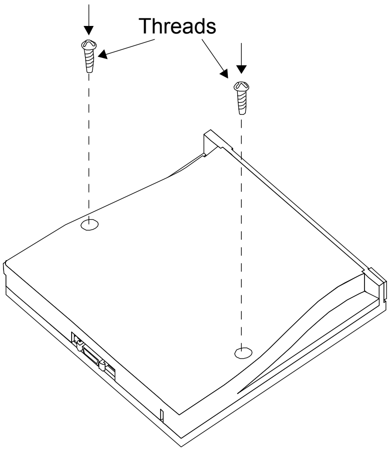
Bring out the lead wire from the space between the ribs, and bend it as shown above to store it in the duct. Connect the lead wire to the connector. Be careful not to get the lead wire caught in the case or other parts.
When the lead wire is damaged, external short circuit may occur, and the battery can become hot.



c) Assembly of the case
After all MR-BAT6V1 batteries are mounted, fit the cover and insert screws into the two holes and tighten them. Tightening torque is 0.71 N•m.

POINT

- ●When assembling the case, be careful not to get the lead wires caught in the fitting parts or the screwing parts.

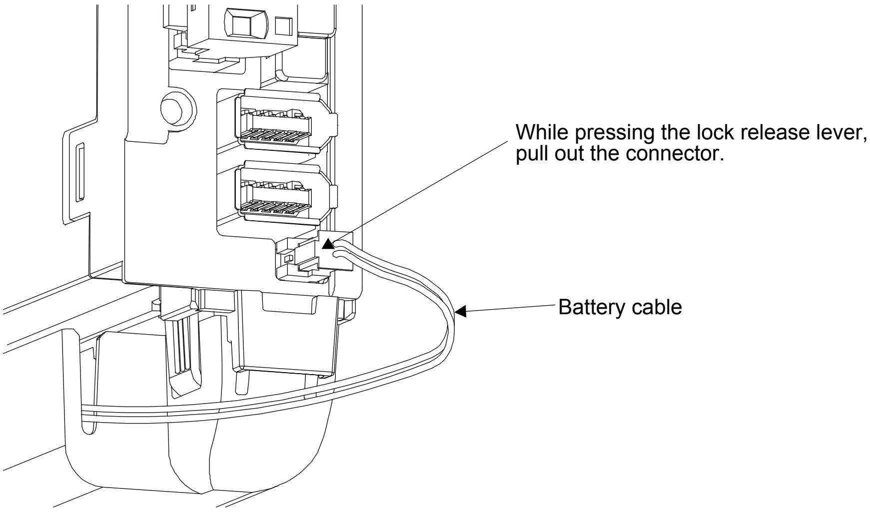


d) Precautions for removal of battery
The connector attached to the MR-BAT6V1 battery has the lock release lever. When removing the connector, pull out the connector while pressing the lock release lever.

3) Battery cable removal

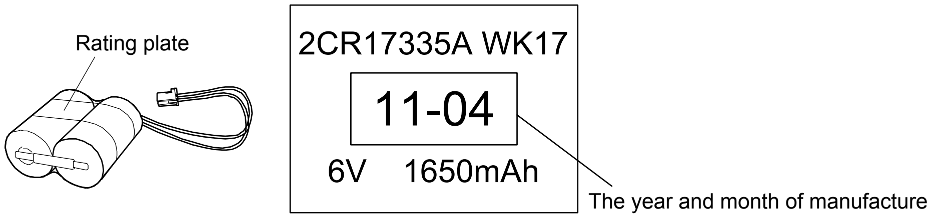
⚠CAUTION

- ●Pulling out the connector of the MR-BT6V1CBL and the MR-BT6V2CBL without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the MR-BT6V1CBL or MR-BT6V2CBL.



11.8.5 MR-BAT6V1 battery

The MR-BAT6V1 battery is a battery for replacing MR-BAT6V1SET and a primary lithium battery built-in MR-BT6VCASE. Store the MR-BAT6V1 in the case to use.
The year and month of manufacture of MR-BAT6V1 battery have been described to the rating plate put on a MR-BAT6V1 battery.



Item	Description
Battery pack	2CR17335A (CR17335A × 2 pcs. connected in series)
Nominal voltage [V]	6
Nominal capacity [mAh]	1650
Storage temperature [°C]	0 to 55
Operating temperature [°C]	0 to 55
Lithium content [g]	1.2
Mercury content	Less than 1 ppm
Dangerous goods class	Not subject to the dangerous goods (Class 9) Refer to app. 4 for details.
Operating humidity and storage humidity	90 %RH or less (non-condensing)
(Note) Battery life	5 years from date of manufacture
Mass [g]	34

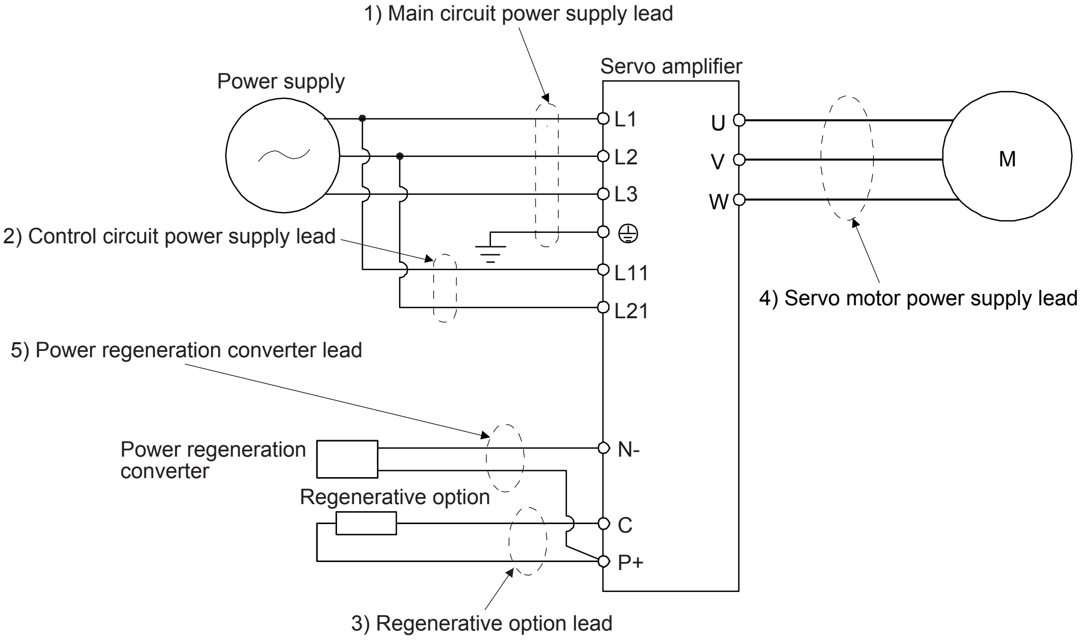
Note. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

11.9 Selection example of wires

POINT

- ●To comply with the IEC/EN/UL/CSA standard, use the wires shown in app. 6 for wiring. To comply with other standards, use a wire that is complied with each standard.
- ●Selection conditions of wire size are as follows.
  Construction condition: single wire set in midair
  Wiring length: 30 m or less

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



(1) Example of selecting the wire sizes
Use the 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

(a) 200 V class

Table 11.1 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2] (Note 1)			
	1) L1/L2/L3/⏚	2) L11/L21	3) P+/C	4) U/V/W/⏚ (Note 3)
MR-J4-10B-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 4)	2 (AWG 14)	AWG 18 to 14 (Note 4)
MR-J4-20B-RJ020				
MR-J4-40B-RJ020				
MR-J4-60B-RJ020				
MR-J4-70B-RJ020				
MR-J4-100B-RJ020				
MR-J4-200B-RJ020				AWG 16 to 10
MR-J4-350B-RJ020	3.5 (AWG 12)			
MR-J4-500B-RJ020 (Note 2)	5.5 (AWG 10): a	1.25 (AWG 16): a 2 (AWG 14): d (Note 4)	2 (AWG 14): c	2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a
MR-J4-700B-RJ020 (Note 2)	8 (AWG 8): b			2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a 8 (AWG 8): b
MR-J4-11KB-RJ020 (Note 2)	14 (AWG 6): f	1.25 (AWG 16): c 2 (AWG 14): c	3.5 (AWG 12): g	14 (AWG 6): f 8 (AWG 8): k
MR-J4-15KB-RJ020 (Note 2)	22 (AWG 4): h		5.5 (AWG 10): g	22 (AWG 4): h
MR-J4-22KB-RJ020 (Note 2)	38 (AWG 2): i		5.5 (AWG 10): j	38 (AWG 2): i

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.
2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
3. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to each servo motor instruction manual.
4. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

Use wires (5)) of the following sizes with the power regeneration converter (FR-RC).

Model	Wire [mm^2]
FR-RC-15K	14 (AWG 6)
FR-RC-30K	14 (AWG 6)
FR-RC-55K	22 (AWG 4)

(b) 400 V class

Table 11.2 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2] (Note 1)			
	1) L1/L2/L3/⏚	2) L11/L21	3) P+/C	4) U/V/W/⏚ (Note 3)
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 4)	2 (AWG 14)	AWG 16 to 14
MR-J4-200B4-RJ020				
MR-J4-350B4-RJ020				
MR-J4-500B4-RJ020 (Note 2)	2 (AWG 14): b	1.25 (AWG 16): a 2 (AWG 14): c (Note 4)	2 (AWG 14): b	3.5 (AWG 12): a
MR-J4-700B4-RJ020 (Note 2)	3.5 (AWG 12): a			5.5 (AWG 10): a
MR-J4-11KB4-RJ020 (Note 2)	5.5 (AWG 10): d	1.25 (AWG 16): b 2 (AWG 14): b (Note 4)	2 (AWG 14): f	8 (AWG 8): g
MR-J4-15KB4-RJ020 (Note 2)	8 (AWG 8): g		3.5 (AWG 12): d	
MR-J4-22KB4-RJ020 (Note 2)	14 (AWG 6): i		3.5 (AWG 12): e	14 (AWG 6): i

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.

2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.

3. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".

4. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

Use wires (5)) of the following sizes with the power regeneration converter (FR-RC-H).

Model	Wire [mm^2]
FR-RC-H15K	14 (AWG6)
FR-RC-H30K	
FR-RC-H55K	

(c) 100 V class

Table 11.3 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2]			
	1) L1/L2/⏚	2) L11/L21	3) P+/C	4) U/V/W/⏚ (Note 1)
MR-J4-10B1-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 2)	2 (AWG 14)	AWG 18 to 14 (Note 4)
MR-J4-20B1-RJ020				
MR-J4-40B1-RJ020				

Note 1. The wire size shows applicable size of the servo amplifier connector. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".

2. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

(2) Selection example of crimp terminals

(a) 200 V class

Symbol	Servo amplifier-side crimp terminals				
	(Note 2) Crimp terminal	Applicable tool			Manufacturer
		Body	Head	Dice	
a	FVD5.5-4	YNT-1210S			JST
b (Note 1)	8-4NS	YHT-8S			
c	FVD2-4	YNT-1614			
d	FVD2-M3				
e	FVD1.25-M3	YNT-2216			
f	FVD14-6	YF-1	YNE-38	DH-122 DH-112	
g	FVD5.5-6	YNT-1210S			
h	FVD22-6	YF-1	YNE-38	DH-123 DH-113	
i	FVD38-8	YF-1	YNE-38	DH-124 DH-114	
j	FVD5.5-8	YNT-1210S			
k	FVD8-6	YF-1 E-4	YNE-38	DH-121 DH-111	

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

(b) 400 V class

Symbol	Servo amplifier-side crimp terminals				Manufacturer
	Crimp terminal (Note)	Applicable tool			
		Body	Head	Dice	
a	FVD5.5-4	YNT-1210S			JST
b	FVD2-4	YNT-1614			
c	FVD2-M3				
d	FVD5.5-6	YNT-1210S			
e	FVD5.5-8	YNT-1210S			
f	FVD2-6	YNT-1614			
g	FVD8-6	YF-1	YNE-38	DH-121 DH-111	
h	FVD8-8				
i	FVD14-8			DH-122 DH-112	

Note. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

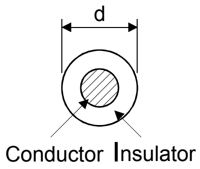
(3) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

Table 11.4 Wires for option cables

Type	Model	Length [m]	Core size [mm^2]	Number of core	Characteristics of one core			(Note 2) Overall diameter [mm]	Wire model
					Structure [Wires/ mm]	Conductor resistance [Ω/km]	Insulator OD d [mm] (Note 1)		
SSCNET cable	MR-J2HBUS_M	0.5 to 5	0.08	20 (10 pairs)	7/0.127	222 or less	0.38	6.1	UL20276 AWG#28 10pair (cream)
	MR-J2HBUS_M-A								

Note 1. d is as shown below.



2. Standard OD. Max. OD is about 10 greater.

11.10 Molded-case circuit breakers, fuses, magnetic contactors

⚠CAUTION

- ●To prevent the servo amplifier from smoke and a fire, select a molded-case circuit breaker which shuts off with high speed.
- ●Always use one molded-case circuit breaker and one magnetic contactor with one servo amplifier.

(1) For main circuit power supply

Always use one molded-case circuit breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section.

Servo amplifier	Molded-case circuit breaker (Note 1, 4)			Fuse			Magnetic contactor (Note 2)
	Frame, rated current		Voltage AC [V]	Class	Current [A]	Voltage AC [V]	
	Power factor improving reactor is not used	Power factor improving reactor is used					
MR-J4-10B-RJ020	30 A frame 5 A	30 A frame 5 A	240	T	10	300	S-N10 S-T10
MR-J4-20B-RJ020	30 A frame 5 A	30 A frame 5 A					
MR-J4-40B-RJ020	30 A frame 10 A	30 A frame 5 A			15		
MR-J4-60B-RJ020	30 A frame 15 A	30 A frame 10 A			20		
MR-J4-70B-RJ020	30 A frame 15 A	30 A frame 10 A					
MR-J4-100B-RJ020	30 A frame 15 A	30 A frame 10 A					
MR-J4-200B-RJ020	30 A frame 20 A	30 A frame 20 A			40		S-N20 (Note 3) S-T21
MR-J4-350B-RJ020	30 A frame 30 A	30 A frame 30 A			70		S-N20 S-T21
MR-J4-500B-RJ020	50 A frame 50 A	50 A frame 50 A			125		S-N35 S-T35
MR-J4-700B-RJ020	100 A frame 75 A	60 A frame 60 A			150		S-N50 S-T50
MR-J4-11KB-RJ020	100 A frame 100 A	100 A frame 100 A			200		
MR-J4-15KB-RJ020	125 A frame 125 A	125 A frame 125 A			250		S-N65 S-T65
MR-J4-22KB-RJ020	225 A frame 175 A	225 A frame 175 A			350		S-N95 S-T100

Servo amplifier	Molded-case circuit breaker (Note 1, 4)			Fuse			Magnetic contactor (Note 2)
	Frame, rated current		Voltage AC [V]	Class	Current [A]	Voltage AC [V]	
	Power factor improving reactor is not used	Power factor improving reactor is used					
MR-J4-60B4-RJ020	30 A frame 5 A	30 A frame 5 A	480	T	10	600	S-N10 S-T10
MR-J4-100B4-RJ020	30 A frame 10 A	30 A frame 5 A			15		
MR-J4-200B4-RJ020	30 A frame 15 A	30 A frame 10 A			25		
MR-J4-350B4-RJ020	30 A frame 20 A	30 A frame 15 A			35		S-N20 (Note 3) S-T21
MR-J4-500B4-RJ020	30 A frame 20 A	30 A frame 20 A			50		
MR-J4-700B4-RJ020	30 A frame 30 A	30 A frame 30 A			65		S-N20 S-T21
MR-J4-11KB4-RJ020	50 A frame 50 A	50 A frame 50 A			100		S-N25 S-T35
MR-J4-15KB4-RJ020	60 A frame 60 A	60 A frame 60 A			150		S-N35 S-T35
MR-J4-22KB4-RJ020	100 A frame 100 A	100 A frame 100 A			175		S-N50 S-T50
MR-J4-10B1-RJ020	30 A frame 5 A	30 A frame 5 A	240	T	10	300	S-N10 S-T10
MR-J4-20B1-RJ020	30 A frame 10 A	30 A frame 10 A			15		
MR-J4-40B1-RJ020	30 A frame 15 A	30 A frame 10 A			20		

Note 1. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to app. 6.

2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of the contact) of 80 ms or less.

3. S-N18 can be used when an auxiliary contact is not required.

4. Use a molded-case circuit breaker which has the same or more operation characteristics than our lineup.

(2) For control circuit

When the wiring for the control circuit power supply (L11, L21) is thinner than that for the main circuit power supply (L1, L2, L3), install an overcurrent protection device (molded-case circuit breaker or fuse) to protect the branch circuit.

Servo amplifier	Molded-case circuit breaker (Note)		Fuse (Class T)		Fuse (Class K5)	
	Frame, rated current	Voltage AC [V]	Current [A]	Voltage AC [V]	Current [A]	Voltage AC [V]
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-40B-RJ020 MR-J4-60B-RJ020 MR-J4-70B-RJ020 MR-J4-100B-RJ020 MR-J4-200B-RJ020 MR-J4-350B-RJ020 MR-J4-500B-RJ020 MR-J4-700B-RJ020 MR-J4-11KB-RJ020 MR-J4-15KB-RJ020 MR-J4-22KB-RJ020	30 A frame 5 A	240	1	300	1	250
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020 MR-J4-200B4-RJ020 MR-J4-350B4-RJ020 MR-J4-500B4-RJ020 MR-J4-700B4-RJ020 MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020 MR-J4-22KB4-RJ020	30 A frame 5 A	480	1	600	1	600
MR-J4-10B1-RJ020 MR-J4-20B1-RJ020 MR-J4-40B1-RJ020	30 A frame 5 A	240	1	300	1	250

Note. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to app. 6.

11.11 Power factor improving DC reactor

The following shows the advantages of using the power factor improving DC reactor.

- It improves the power factor by increasing the form factor of the servo amplifier's input current.
- It decreases the power supply capacity.
- The input power factor is improved to about 85%.
- As compared to the power factor improving AC reactor (FR-HAL-(H)), it decreases the loss.

When connecting the power factor improving DC reactor to the servo amplifier, always disconnect the wiring between P3 and P4. If they remain connected, the effect of the power factor improving DC reactor is not produced.

When used, the power factor improving DC reactor generates heat. To release heat, therefore, leave a 10 cm or more clearance at each of the top and bottom, and a 5 cm or more clearance on each side.

(1) 200 V class

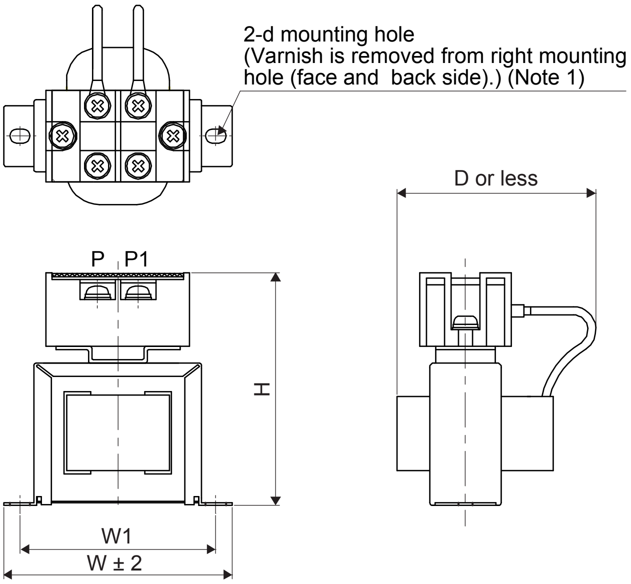


Fig. 11.1

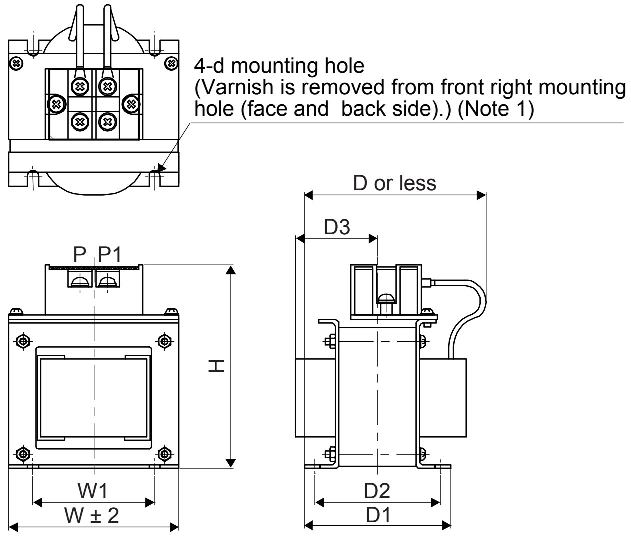


Fig. 11.2

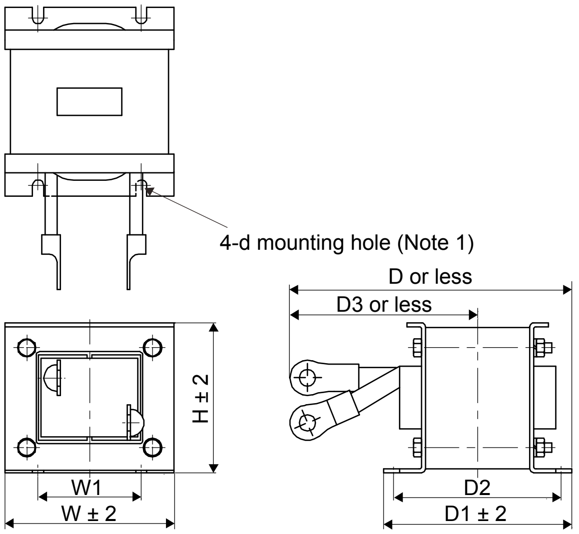
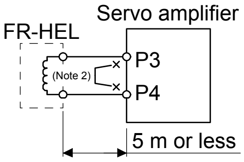


Fig. 11.3



Note 1. Use this for grounding.

2. When using the power factor improving DC reactor, remove the short bar across P3 and P4.

Servo amplifier	Power factor improving DC reactor	Dimensions	Dimensions [mm]								Terminal size	Mass [kg]	Wire [mm^2] (Note 2)
			W	W1	H	D (Note 1)	D1	D2	D3	d			
MR-J4-10B-RJ020 MR-J4-20B-RJ020	FR-HEL-0.4K	Fig. 11.1	70	60	71	61		21		M4	M4	0.4	2 (AWG 14)
MR-J4-40B-RJ020	FR-HEL-0.75K		85	74	81	61		21		M4	M4	0.5	
MR-J4-60B-RJ020 MR-J4-70B-RJ020	FR-HEL-1.5K		85	74	81	70		30		M4	M4	0.8	
MR-J4-100B-RJ020	FR-HEL-2.2K		85	74	81	70		30		M4	M4	0.9	
MR-J4-200B-RJ020	FR-HEL-3.7K	Fig. 11.2	77	55	92	82	66	57	37	M4	M4	1.5	
MR-J4-350B-RJ020	FR-HEL-7.5K		86	60	113	98	81	72	43	M4	M5	2.5	3.5 (AWG 12)
MR-J4-500B-RJ020	FR-HEL-11K		105	64	133	112	92	79	47	M6	M6	3.3	5.5 (AWG 10)
MR-J4-700B-RJ020	FR-HEL-15K		105	64	133	115	97	84	48.5	M6	M6	4.1	8 (AWG 8)
MR-J4-11KB-RJ020	FR-HEL-15K		105	64	133	115	97	84	48.5	M6	M6	4.1	14 (AWG 6)
MR-J4-15KB-RJ020	FR-HEL-22K		105	64	93	175	117	104	115 (Note 1)	M6	M10	5.6	22 (AWG 4)
MR-J4-22KB-RJ020	FR-HEL-30K	Fig. 11.3	114	72	100	200	125	101	135 (Note 1)	M6	M10	7.8	38 (AWG 2)

Note 1. Maximum dimensions. The dimension varies depending on the input/output lines.

2. Selection conditions of wire size are as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: single wire set in midair

(2) 400 V class

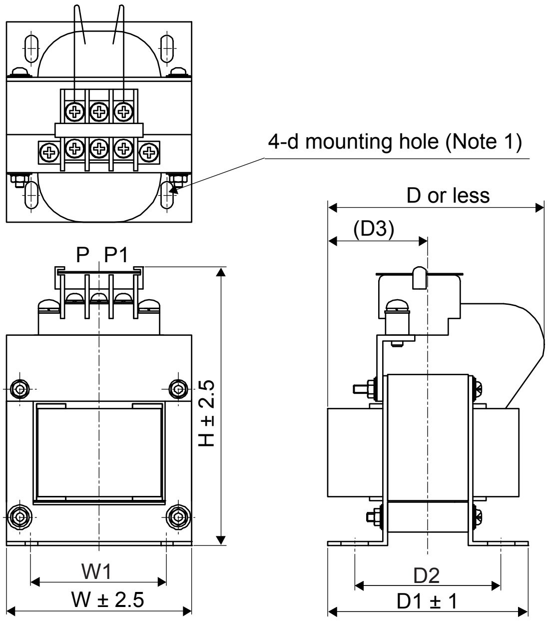


Fig. 11.4

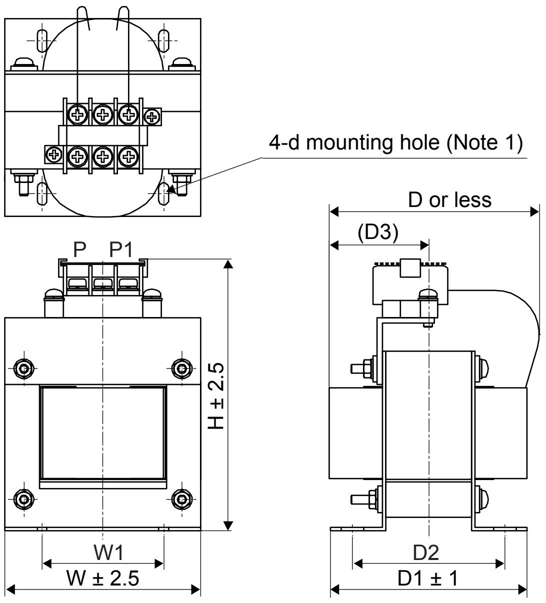


Fig. 11.5

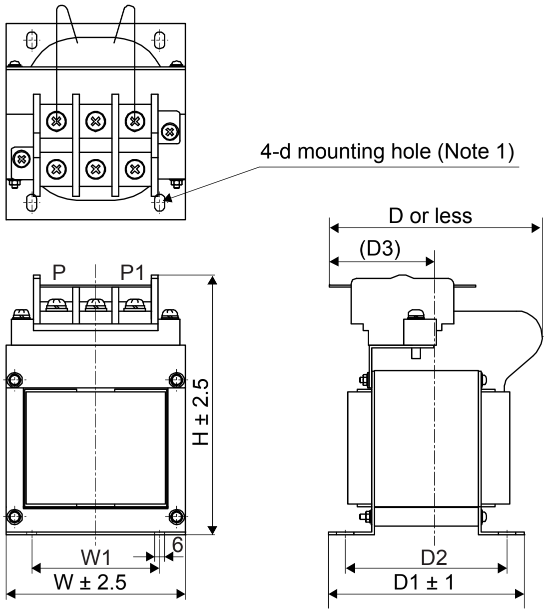
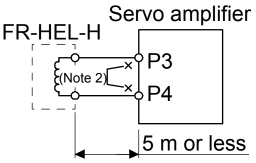


Fig. 11.6



Note 1. Use this for grounding.
2. When using the power factor improving DC reactor, remove the short bar across P3 and P4.

Servo amplifier	Power factor improving DC reactor	Dimensions	Dimensions [mm]								Terminal size	Mass [kg]	Wire [mm^2] (Note)
			W	W1	H	D	D1	D2	D3	d			
MR-J4-60B4-RJ020	FR-HEL-H1.5K	Fig. 11.4	66	50	100	80	74	54	37	M4	M3.5	1.0	2 (AWG 14)
MR-J4-100B4-RJ020	FR-HEL-H2.2K		76	50	110	80	74	54	37	M4	M3.5	1.3	2 (AWG 14)
MR-J4-200B4-RJ020	FR-HEL-H3.7K		86	55	120	95	89	69	45	M4	M4	2.3	2 (AWG 14)
MR-J4-350B4-RJ020	FR-HEL-H7.5K	Fig. 11.5	96	60	128	105	100	80	50	M5	M4	3.5	2 (AWG 14)
MR-J4-500B4-RJ020	FR-HEL-H11K		105	75	137	110	105	85	53	M5	M5	4.5	3.5 (AWG 12)
MR-J4-700B4-RJ020	FR-HEL-H15K	Fig. 11.6	105	75	152	125	115	95	62	M5	M6	5.0	5.5 (AWG 10)
MR-J4-11KB4-RJ020	FR-HEL-H15K		105	75	152	125	115	95	62	M5	M6	5.0	8 (AWG 8)
MR-J4-15KB4-RJ020	FR-HEL-H22K		133	90	178	120	95	75	53	M5	M6	6.0	8 (AWG 8)
MR-J4-22KB4-RJ020	FR-HEL-H30K		133	90	178	120	100	80	56	M5	M6	6.5	14 (AWG 6)

Note. Selection conditions of wire size are as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: single wire set in midair

11.12 Power factor improving AC reactor

The following shows the advantages of using the power factor improving AC reactor.

- It improves the power factor by increasing the form factor of the servo amplifier's input current.
- It decreases the power supply capacity.
- The input power factor is improved to about 80%.

When using power factor improving reactors for two or more servo amplifiers, be sure to connect a power factor improving reactor to each servo amplifier. If using only one power factor improving reactor, enough improvement effect of phase factor cannot be obtained unless all servo amplifiers are operated.

(1) 200 V/100 V class

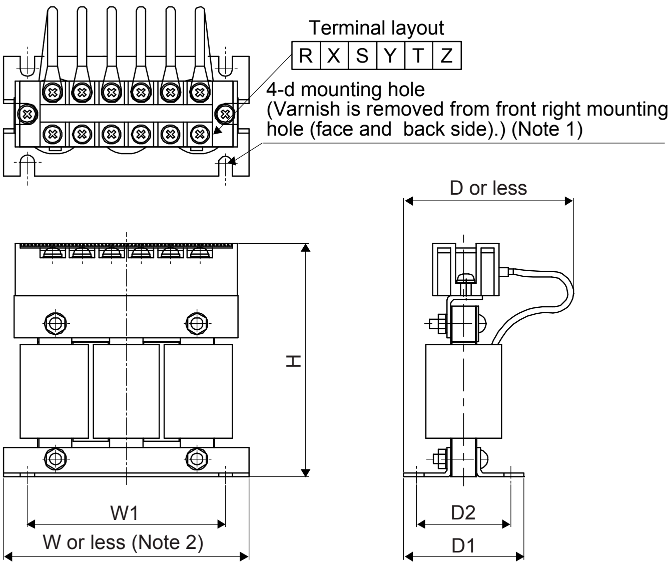
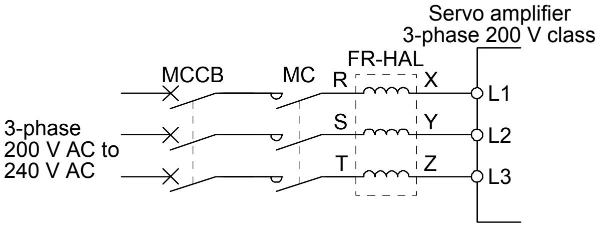
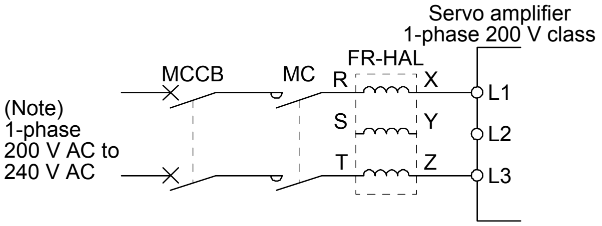
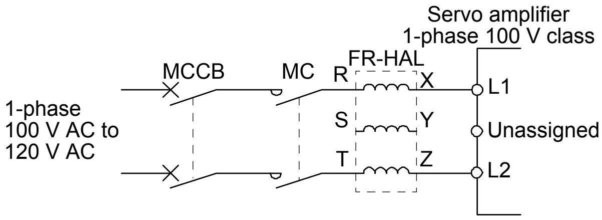


Fig. 11.7







Note 1. Use this for grounding.
2. W ± 2 is applicable for FR-HAL-0.4K to FR-HAL-1.5K.

Note. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.

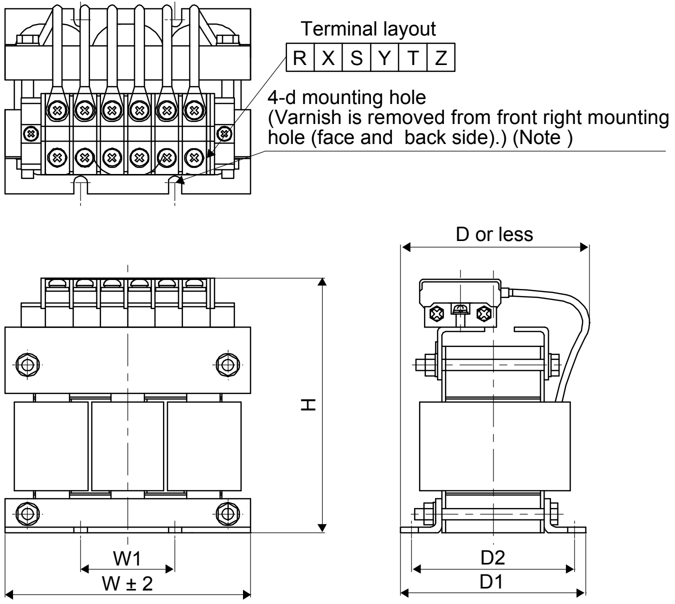


Fig. 11.8

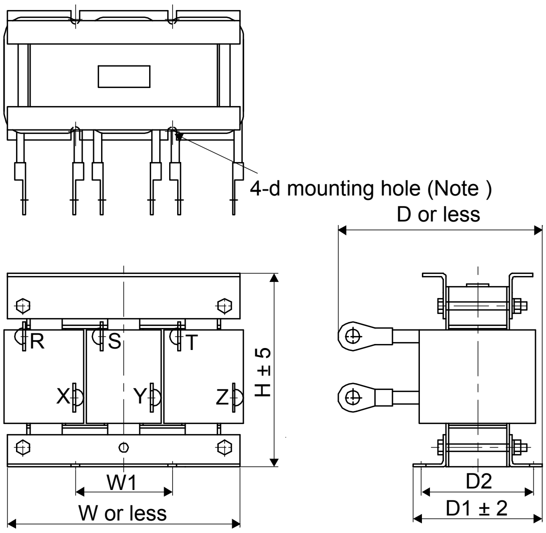


Fig. 11.9

Note. Use this for grounding.

Servo amplifier	Power factor improving AC reactor	Dimensions	Dimensions [mm]							Terminal size	Mass [kg]
			W	W1	H	D (Note)	D1	D2	d		
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-10B1-RJ020	FR-HAL-0.4K	Fig. 11.7	104	84	99	72	51	40	M5	M4	0.6
MR-J4-40B-RJ020 MR-J4-20B1-RJ020	FR-HAL-0.75K		104	84	99	74	56	44	M5	M4	0.8
MR-J4-60B-RJ020 MR-J4-70B-RJ020 MR-J4-40B1-RJ020	FR-HAL-1.5K		104	84	99	77	61	50	M5	M4	1.1
MR-J4-100B-RJ020	FR-HAL-2.2K		115 (Note)	40	115	77	71	57	M6	M4	1.5
MR-J4-200B-RJ020	FR-HAL-3.7K		115 (Note)	40	115	83	81	67	M6	M4	2.2
MR-J4-350B-RJ020	FR-HAL-7.5K	Fig. 11.8	130	50	135	100	98	86	M6	M5	4.2
MR-J4-500B-RJ020	FR-HAL-11K		160	75	164	111	109	92	M6	M6	5.2
MR-J4-700B-RJ020	FR-HAL-15K		160	75	167	126	124	107	M6	M6	7.0
MR-J4-11KB-RJ020	FR-HAL-15K		160	75	167	126	124	107	M6	M6	7.0
MR-J4-15KB-RJ020	FR-HAL-22K		185 (Note)	75	150	158	100	87	M6	M8	9.0
MR-J4-22KB-RJ020	FR-HAL-30K	Fig. 11.9	185 (Note)	75	150	168	100	87	M6	M10	9.7

Note. Maximum dimensions. The dimension varies depending on the input/output lines.

(2) 400 V class

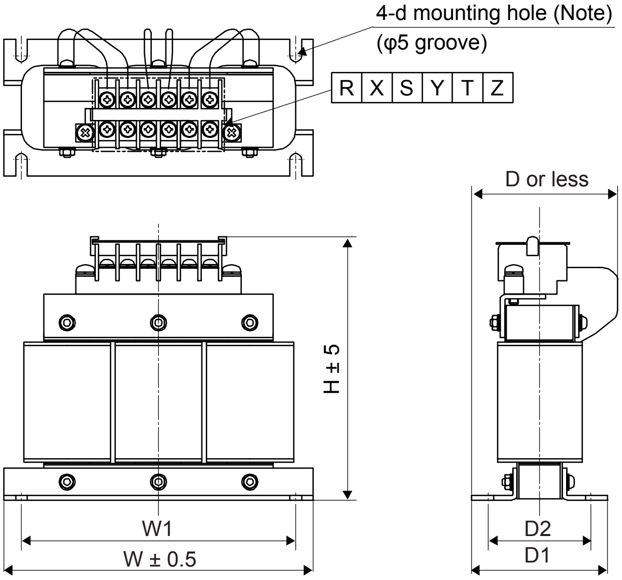
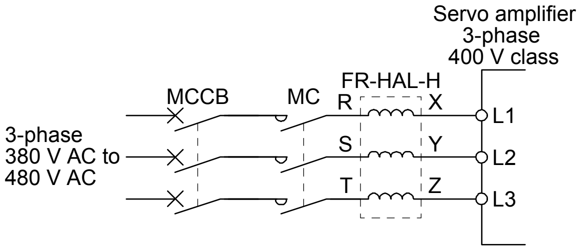


Fig. 11.10



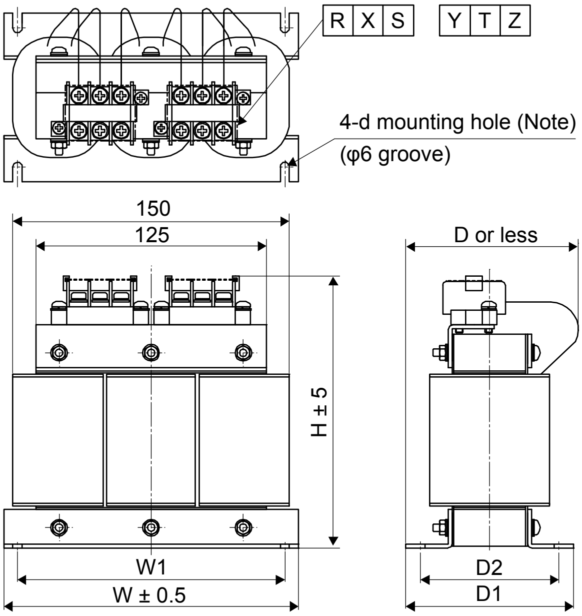


Fig. 11.11

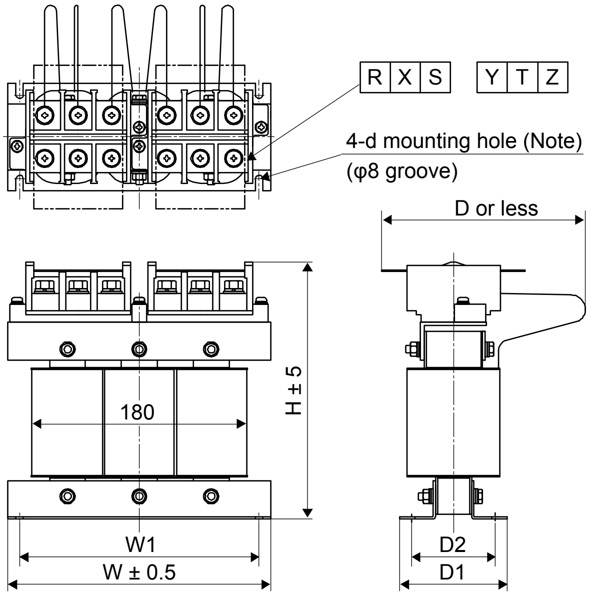


Fig. 11.12

Note. Use this for grounding.

Servo amplifier	Power factor improving AC reactor	Dimensions	Dimensions [mm]							Terminal size	Mass [kg]
			W	W1	H	D (Note)	D1	D2	d		
MR-J4-60B4-RJ020	FR-HAL-H1.5K	Fig. 11.10	135	120	115	59	59.6	45	M4	M3.5	1.5
MR-J4-100B4-RJ020	FR-HAL-H2.2K		135	120	115	59	59.6	45	M4	M3.5	1.5
MR-J4-200B4-RJ020	FR-HAL-H3.7K		135	120	115	69	70.6	57	M4	M3.5	2.5
MR-J4-350B4-RJ020	FR-HAL-H7.5K	Fig. 11.11	160	145	142	91	91	75	M4	M4	5.0
MR-J4-500B4-RJ020	FR-HAL-H11K		160	145	146	91	91	75	M4	M5	6.0
MR-J4-700B4-RJ020 MR-J4-11KB4-RJ020	FR-HAL-H15K		220	200	195	105	90	70	M5	M5	9.0
MR-J4-15KB4-RJ020	FR-HAL-H22K	Fig. 11.12	220	200	215	170	90	70	M5	M8	9.5
MR-J4-22KB4-RJ020	FR-HAL-H30K		220	200	215	170	96	75	M5	M8	11

Note. Maximum dimensions. The dimension varies depending on the input/output lines.

11.13 Relay (recommended)

The following relays should be used with the interfaces.

Interface	Selection example
Digital input (interface DI-1) Relay used for digital input command signals	To prevent defective contacts, use a relay for small signal (twin contacts). (Ex.) Omron: type G2A, type MY
Digital output (interface DO-1) Relay used for digital output signals	Small relay with 12 V DC or 24 V DC of rated current 40 mA or less (Ex.) Omron: type MY

11.14 Noise reduction techniques

Noises are classified into external noises which enter the servo amplifier to cause it to malfunction and those radiated by the servo amplifier to cause peripheral equipment to malfunction. Since the servo amplifier is an electronic device which handles small signals, the following general noise reduction techniques are required. Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral equipment malfunctions due to noises produced by the servo amplifier, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

- Avoid bundling power lines (input/output) and signal cables together or running them in parallel to each other. Separate the power lines from the signal cables.
- Use a shielded twisted pair cable for connection with the encoder and for control signal transmission, and connect the external conductor of the cable to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point. (Refer to section 3.9.)

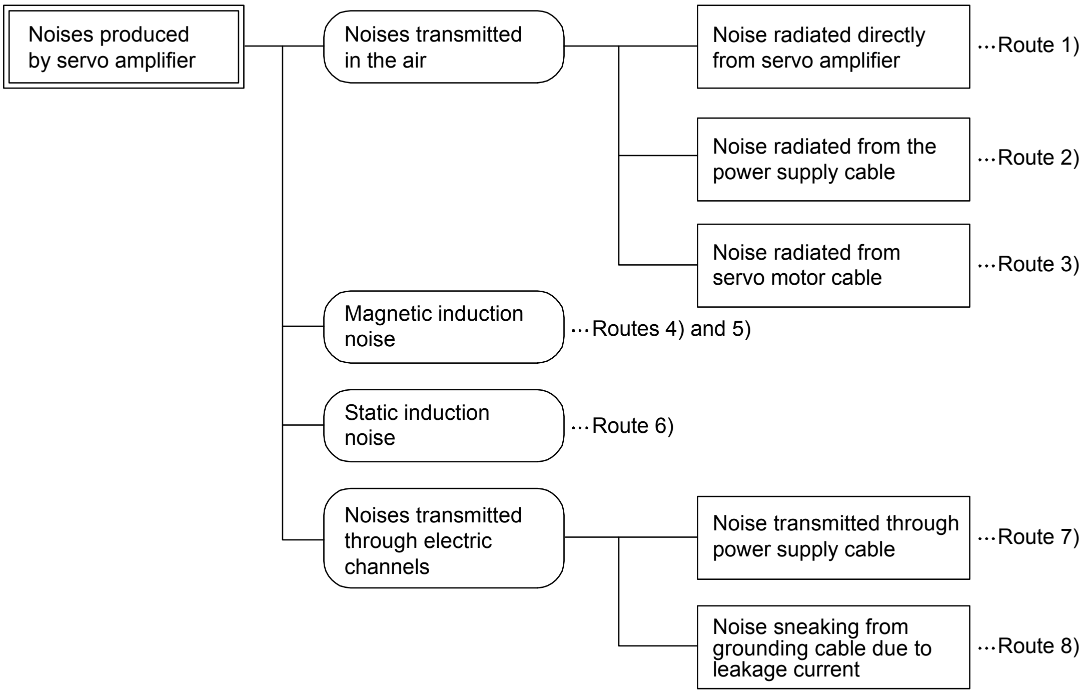
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

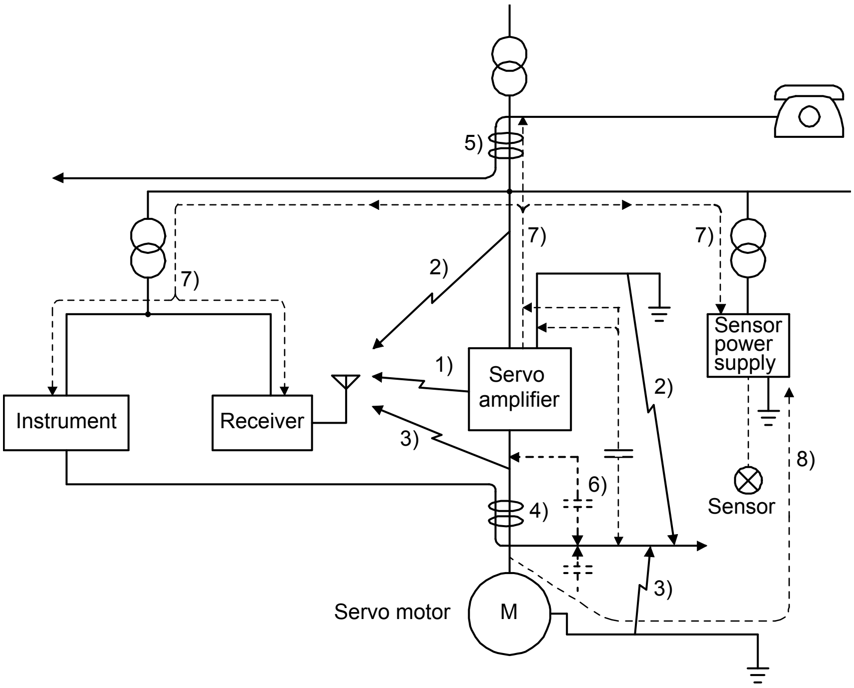
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.

- Provide surge killers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
- Although a surge absorber is built into the servo amplifier, to protect the servo amplifier and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.

(c) Techniques for noises radiated by the servo amplifier that cause peripheral equipment to malfunction

Noises produced by the servo amplifier are classified into those radiated from the cables connected to the servo amplifier and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral equipment located near the main circuit cables, and those transmitted through the power supply cables.





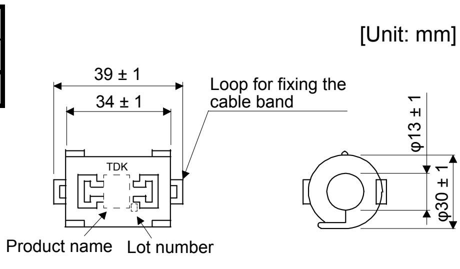
Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a cabinet together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid wiring the power lines (input/output lines of the servo amplifier) and signal lines side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
4) 5) 6)	When the power lines and the signal lines are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid wiring the power lines (input/output lines of the servo amplifier) and signal lines side by side or bundling them together. 4. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
7)	When the power supply of peripheral equipment is connected to the power supply of the servo amplifier system, noises produced by the servo amplifier may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. 1. Install the radio noise filter (FR-BIF(-H)) on the power lines (Input lines) of the servo amplifier. 2. Install the line noise filter (FR-BSF01/FR-BLF) on the power lines of the servo amplifier.
8)	If the grounding wires of the peripheral equipment and the servo amplifier make a closed loop circuit, leakage current may flow through, causing the equipment to malfunction. In this case, the malfunction may be prevented by the grounding wires disconnected from the equipment.

(2) Noise reduction techniques

(a) Data line filter (recommended)

Noise can be prevented by installing a data line filter onto the encoder cable, etc.
For example, ZCAT3035-1330 by TDK, ESD-SR-250 by NEC TOKIN, GRFC-13 by Kitagawa Industries, and E04SRM563218 by SEIWA ELECTRIC are available as data line filters.
As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below. These impedances are reference values and not guaranteed values.

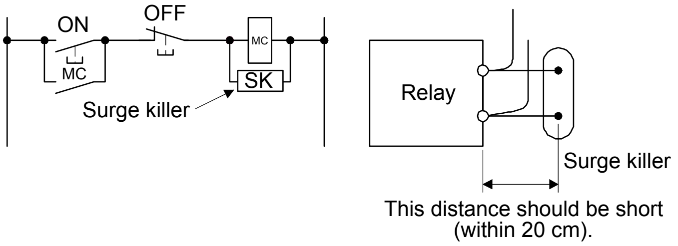
Impedance [Ω]	
10 MHz to 100 MHz	100 MHz to 500 MHz
80	150



Outline drawing (ZCAT3035-1330)

(b) Surge killer (recommended)

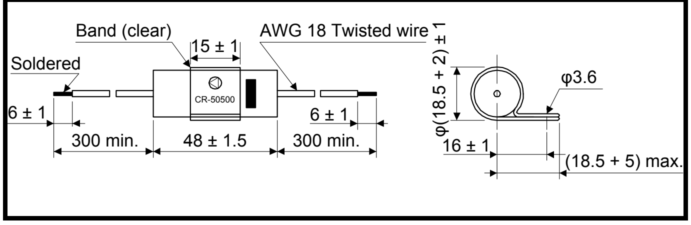
Use of a surge killer is recommended for AC relay, magnetic contactor or the like near the servo amplifier. Use the following surge killer or equivalent.



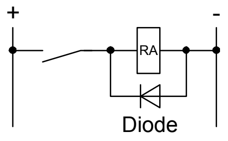
(Ex.) CR-50500 (Okaya Electric Industries)

Rated voltage AC [V]	C [μF ± 20%]	R [Ω ± 30%]	Test voltage
250	0.5	50 (1/2 W)	Between terminals: 625 V AC, 50/60 Hz 60 s Between terminal and case: 2000 V AC 50/60 Hz 60 s

Dimensions [Unit: mm]



Note that a diode should be installed to a DC relay or the like.
Maximum voltage: not less than four times the drive voltage of the relay or the like
Maximum current: not less than two times the drive current of the relay or the like



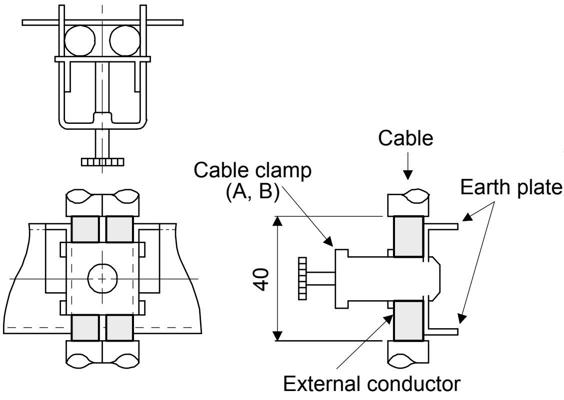
(c) Cable clamp fitting AERSBAN-_SET

Generally, connecting the grounding of the shielded wire to the SD terminal of the connector provides a sufficient effect. However, the effect can be increased when the shielded wire is connected directly to the grounding plate as shown below.

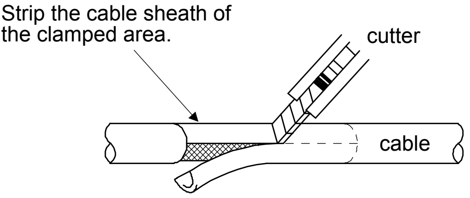
Install the grounding plate near the servo amplifier for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the grounding plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The cable clamp comes as a set with the grounding plate.

[Unit: mm]



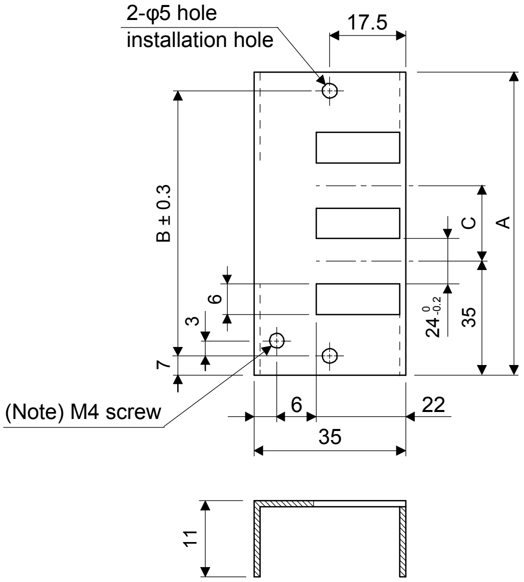
Clamp section diagram



- Dimensions

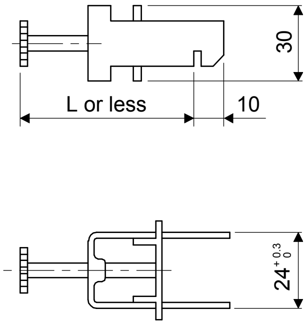
[Unit: mm]

Earth plate



[Unit: mm]

Clamp section diagram



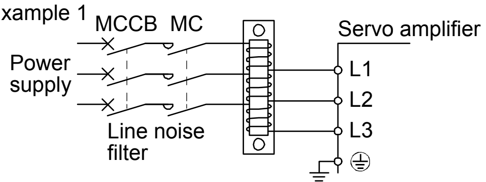
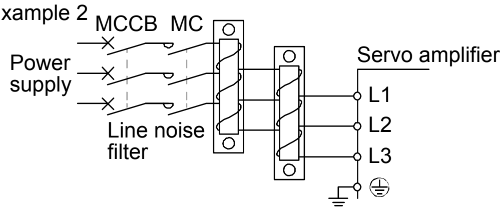
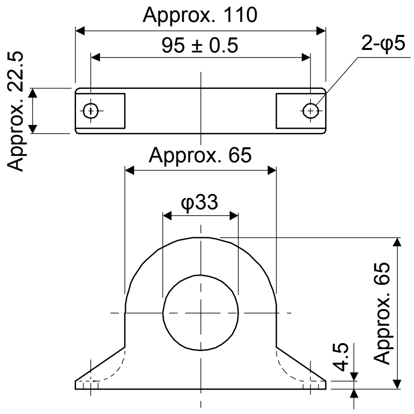
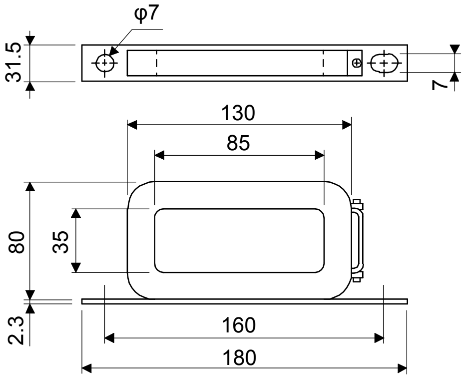
Note. Screw hole for grounding. Connect it to the grounding plate of the cabinet.

Model	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	Clamp A: 2pcs.
AERSBAN-ESET	70	56		Clamp B: 1pc.

Clamp fitting	L
A	70
B	45

(d) Line noise filter (FR-BSF01/FR-BLF)

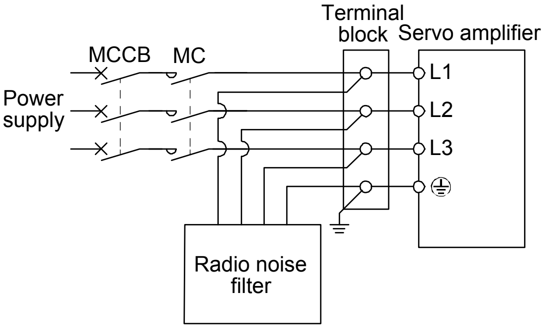
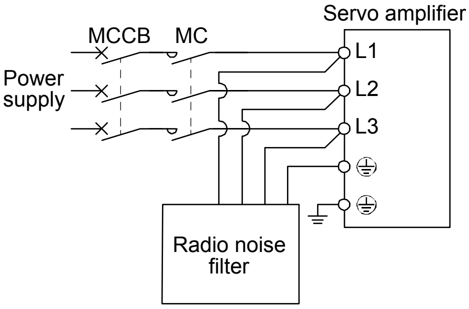
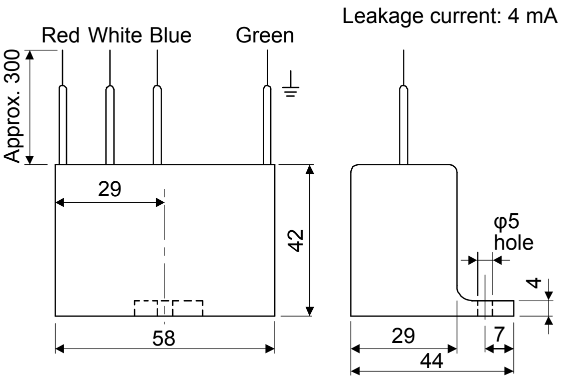
This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (0-phase current). It especially affects the noises between 0.5 MHz and 5 MHz band.

Connection diagram	Dimensions [Unit: mm]
The line noise filters can be mounted on lines of the main power supply (L1, L2, and L3) and of the servo motor power (U, V, and W). Pass each of the wires through the line noise filter an equal number of times in the same direction. For the power line of the servo amplifier, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the servo motor power lines, passes must be four times or less. Do not pass the grounding wire through the filter. Otherwise, the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance. Noise-reducing effect will be enhanced. Example 1  (Number of passes: 4) Example 2  Two filters are used (Total number of passes: 4)	FR-BSF01 (for wire size 3.5 mm^2 (AWG 12) or less)  FR-BLF (for wire size 5.5 mm^2 (AWG 10) or more) 

(e) Radio noise filter (FR-BIF(-H))

This filter is effective in suppressing noises radiated from the power supply side of the servo amplifier especially in 10 MHz and lower radio frequency bands. The (FR-BIF(-H)) is designed for the input only.

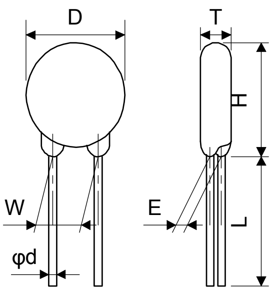
200 V/100 V class: FR-BIF
400 V class: FR-BIF-H

Connection diagram	Dimensions [Unit: mm]
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase power supply, always insulate the lead wires that are not used for wiring. ・MR-J4-350B-RJ020 or less/MR-J4-350B4-RJ020 or less/ MR-J4-40B1-RJ020 or less  ・MR-J4-500B-RJ020 or more/MR-J4-500B4-RJ020 or more 	

(f) Varistor for input power supply (recommended)

Varistors are effective to prevent exogenous noise and lightning surge from entering the servo amplifier. When using a varistor, connect it between each phase of the input power supply of the equipment. For varistors, the TND20V-431K, TND20V-471K and TND20V-102K, manufactured by Nippon Chemi-Con, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power supply voltage	Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1 mA
		Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power	[A]	[V]		
		AC [Vrms]	DC [V]	8/20 μs [A]	2 ms [J]	[W]			[pF]	[V]
200 V/ 100 V class	TND20V-431K	275	350	10000/1 time 7000/2 times	195	1.0	100	710	1300	430 (387 to 473)
	TND20V-471K	300	385		215			775	1200	470 (423 to 517)
400 V class	TND20V-102K	625	825	7500/1 time 6500/2 times	400	1.0	100	1650	560	1000 (900 to 1100)



[Unit: mm]

Model	D Max.	H Max.	T Max.	E ±1.0	(Note) L min.	φd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K			6.6	3.5			
TND20V-102K	22.5	25.5	9.5	6.4	20	0.8	10.0

Note. For items with special lead length (L), contact the manufacturer.

11.15 Earth-leakage current breaker

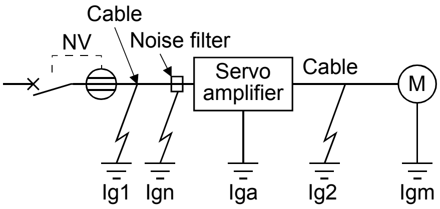
(1) Selection method

High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select an earth-leakage current breaker according to the following formula, and ground the servo amplifier, servo motor, etc. securely.

To minimize leakage currents, make the input and output cables as short as possible, and make the grounding cable longer than 30 cm.

Rated sensitivity current ≥ 10 • {Ig1 + Ign + Iga + K • (Ig2 + Igm)} [mA] ································· (11.1)



Earth-leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-HW	1
General models	BV-C1 NFB NV-L	3

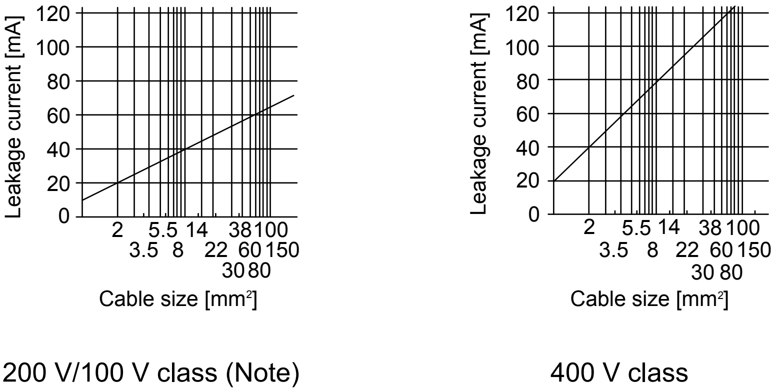
Ig1: Leakage current on the electric channel from the earth-leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 11.13.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (found from Fig. 11.13.)

Ign: Leakage current when a filter is connected to the input side (4.4 mA per one FR-BIF or FR-BIF-H)

Iga: Leakage current of the servo amplifier (Found from table 11.6.)

Igm: Leakage current of the servo motor (Found from table 11.5.)



200 V/100 V class (Note)

400 V class

Note. "Ig1" of 100 V class servo amplifiers will be 1/2 of 200 V class servo amplifiers.

Fig. 11.13 Example of leakage current per km (Ig1, Ig2) for CV cable run in metal conduit

Table 11.5 Servo motor leakage current example (Igm)

Servo motor power [kW]	Leakage current [mA]
0.05 to 1	0.1
1.2 to 2	0.2
3 to 3.5	0.3
4.2 to 5	0.5
6 to 7	0.7
8 to 11	1.0
12 to 15	1.3
20 to 22	2.3

Table 11.6 Servo amplifier leakage current example (Iga)

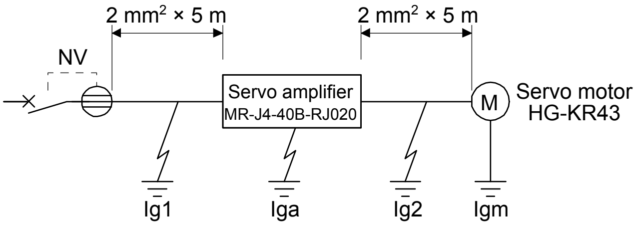
Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.6	0.1
0.75 to 3.5	0.15
5/7	2
11/15	5.5
22	7

Table 11.7 Earth-leakage current breaker selection example

Servo amplifier	Rated sensitivity current of earth-leakage current breaker [mA]
MR-J4-10B-RJ020 to MR-J4-350B-RJ020 MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020 MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020	15
MR-J4-500B-RJ020 MR-J4-500B4-RJ020	30
MR-J4-700B-RJ020 MR-J4-700B4-RJ020	50
MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020 MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020	100

(2) Selection example

Indicated below is an example of selecting an earth-leakage current breaker under the following conditions.



Use an earth-leakage current breaker designed for suppressing harmonics/surges.

Find the terms of equation (11.1) from the diagram.

$$Ig1 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$Ig2 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

Ign = 0 (not used)

Iga = 0.1 [mA]

Igm = 0.1 [mA]

Insert these values in equation (11.1).

$$\begin{aligned} Ig &\geq 10 \cdot \{0.1 + 0 + 0.1 + 1 \cdot (0.1 + 0.1)\} \\ &\geq 4 \text{ [mA]} \end{aligned}$$

According to the result of calculation, use an earth-leakage current breaker having the rated sensitivity current (Ig) of 4.0 mA or more.

An earth-leakage current breaker having Ig of 15 mA is used with the NV-SP/SW/CP/CW/HW series.

11.16 EMC filter (recommended)

POINT

- For when multiple servo amplifiers are connected to one EMC filter, refer to section 6.4 of "EMC Installation Guidelines".

It is recommended that one of the following filters be used to comply with EN EMC directive. Some EMC filters have large in leakage current.

(1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J4-10B-RJ020 to MR-J4-100B-RJ020	(Note) HF3010A-UN	10	250	5	3.5
MR-J4-200B-RJ020 MR-J4-350B-RJ020	(Note) HF3030A-UN	30			5.5
MR-J4-500B-RJ020 MR-J4-700B-RJ020	(Note) HF3040A-UN	40		6.5	6
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020 MR-J4-22KB-RJ020	(Note) HF3100A-UN	100			12
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	TF3005C-TX	5	500	5.5	6
MR-J4-200B4-RJ020 to MR-J4-700B4-RJ020	TF3020C-TX	20			
MR-J4-11KB4-RJ020	TF3030C-TX	30			7.5
MR-J4-15KB4-RJ020	TF3040C-TX	40			12.5
MR-J4-22KB4-RJ020	TF3060C-TX	60			
MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020	(Note) HF3010A-UN	10	250	5	3.5

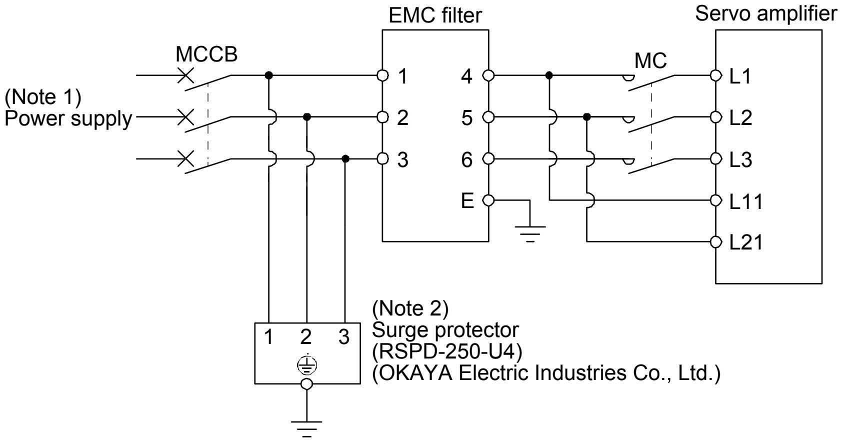
Note. To use any of these EMC filters, the surge protector RSPD-500-U4 (Okaya Electric Industries) is required.

Servo amplifier	Recommended filter (COSEL)				Mass [kg]
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020	(Note) FTB-100-355-L	100	500	40	5.3
MR-J4-22KB4-RJ020	(Note) FTB-80-355-L	80	500	80	5.3

Note. To use any of these EMC filters, the surge protector RSPD-500-U4 (Okaya Electric Industries) is required.

(2) Connection example

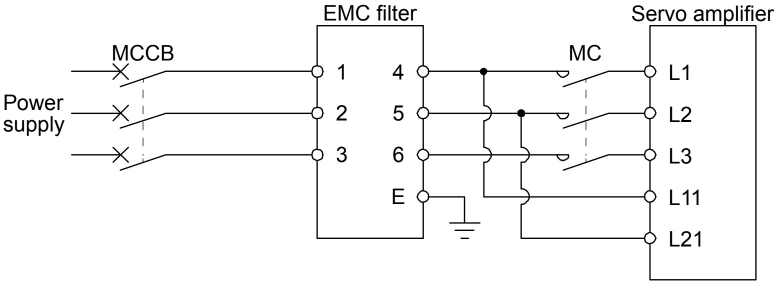
(a) 200 V/100 V class



Note 1. For power supply specifications, refer to section 1.3.1.

2. The example is when a surge protector is connected.

(b) 400 V class

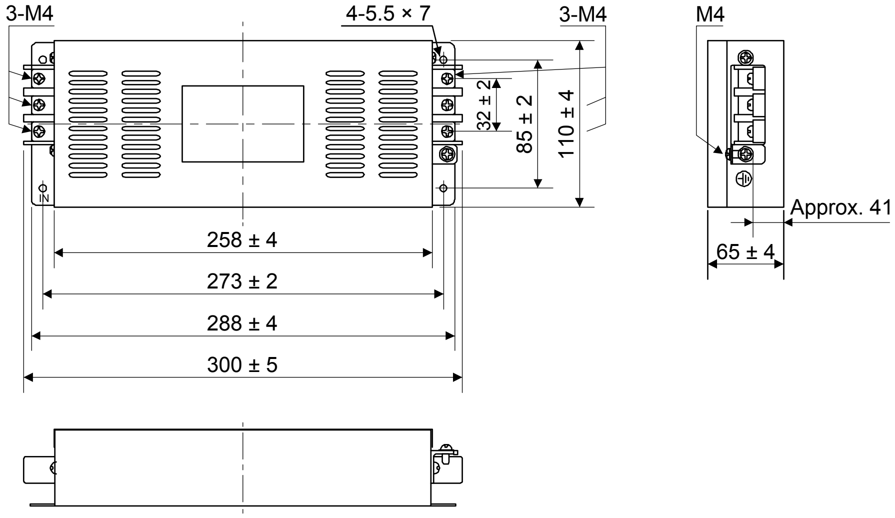


(3) Dimensions

(a) EMC filter

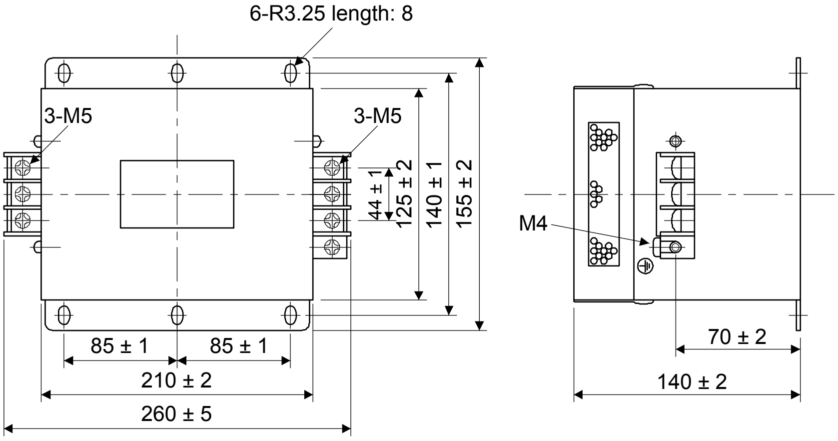
HF3010A-UN

[Unit: mm]



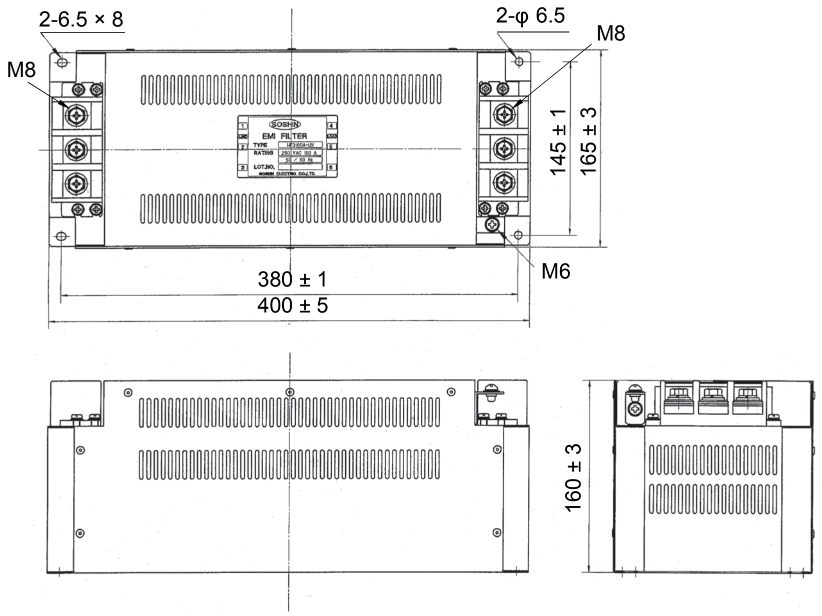
HF3030A-UN/HF-3040A-UN

[Unit: mm]



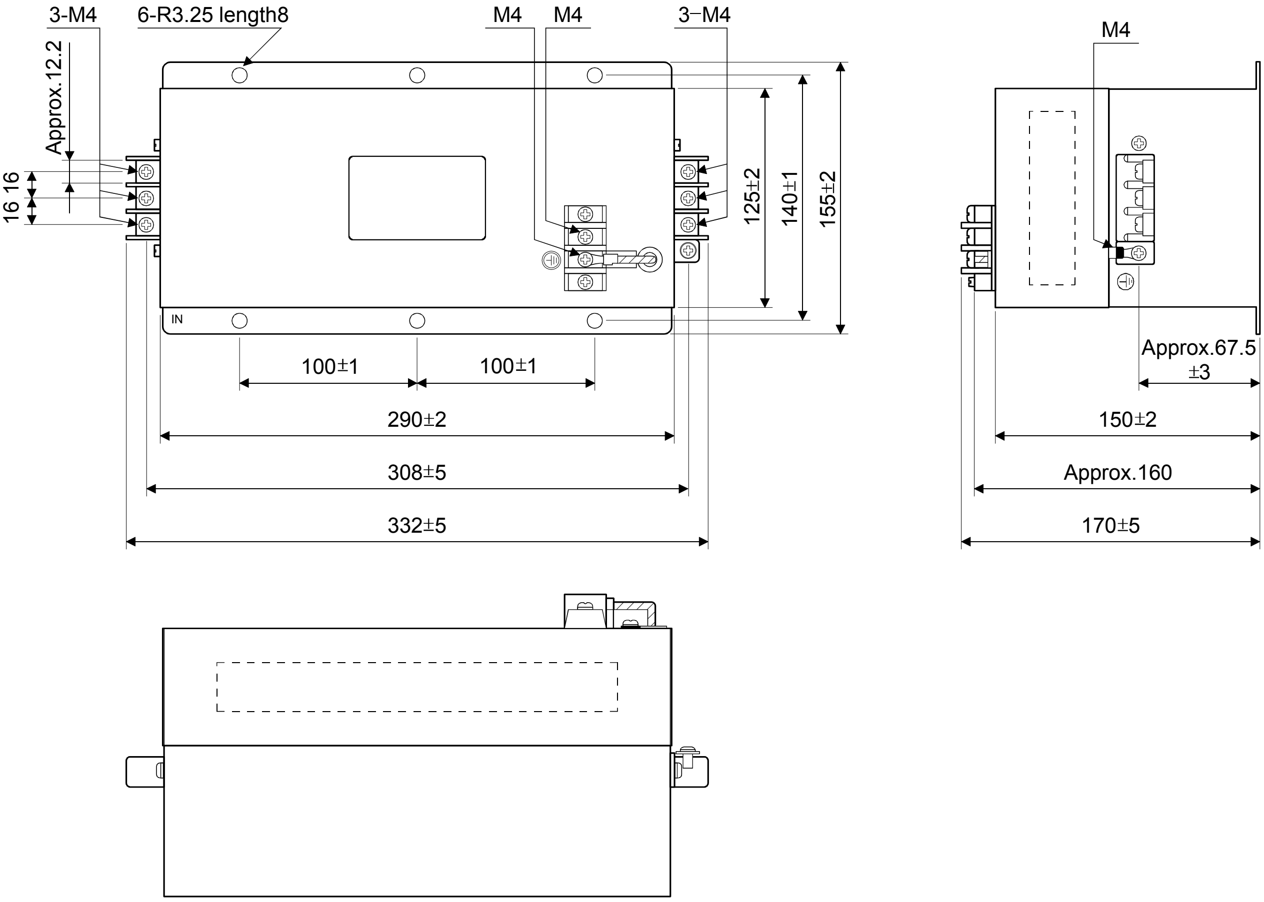
HF3100A-UN

[Unit: mm]



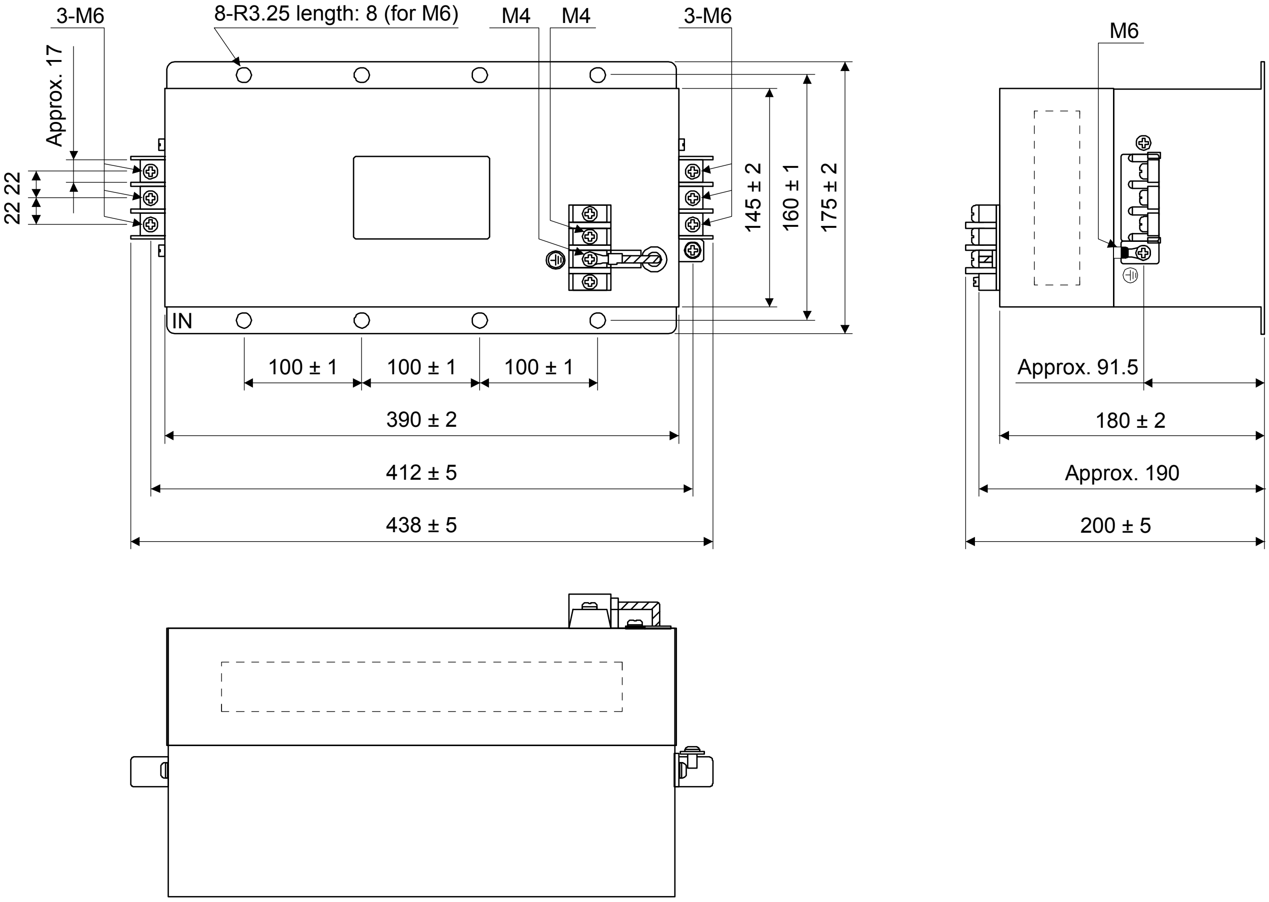
TF3005C-TX/TF3020C-TX/TF3030C-TX

[Unit: mm]



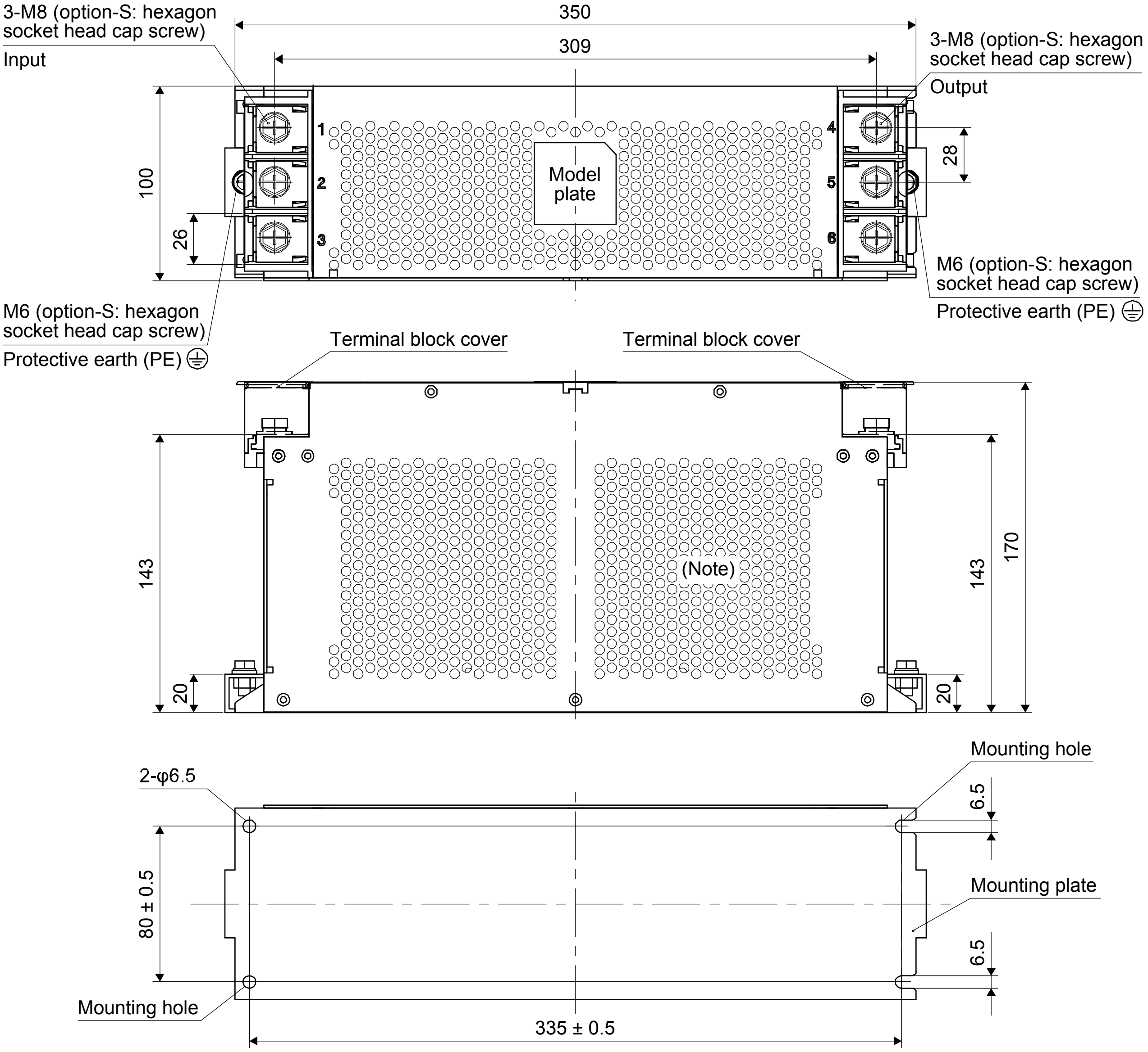
TF3040C-TX/TF3060C-TX

[Unit: mm]



FTB-100-355-L/FTB-80-355-L

[Unit: mm]

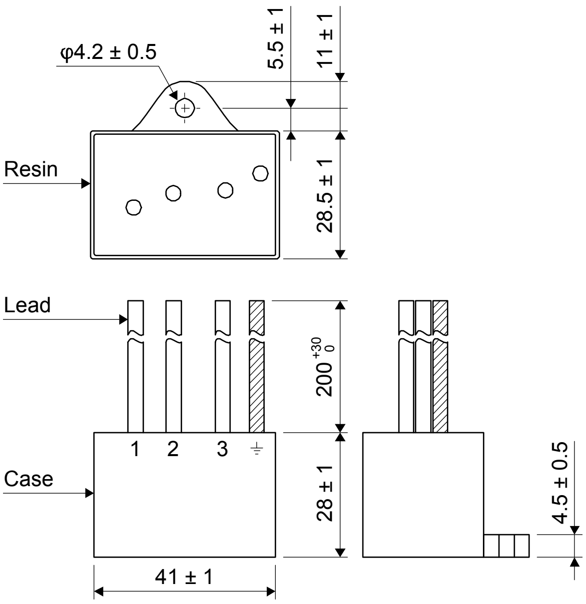


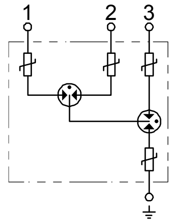
Note. No heat radiation holes on the opposite face.

(b) Surge protector

RSPD-250-U4

[Unit: mm]





11.17 External dynamic brake

⚠CAUTION

- ●Use an external dynamic brake for a servo amplifier of MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment.

POINT

- ●Configure a sequence which switches off the magnetic contactor of the external dynamic brake after (or as soon as) servo-on command has been turned off at a power failure or a malfunction.
- ●For the braking time taken when the dynamic brake is operated, refer to section 10.3.
- ●The external dynamic brake is rated for a short duration. Do not use it very frequently.
- ●When using the 400 V class external dynamic brake, the power supply voltage is restricted to 1-phase 380 V AC to 463 V AC (50 Hz/60 Hz).
- ●When an alarm, [AL. E6 Servo forced stop warning], or [AL. E6 Controller forced stop warning] occurs, or the power is turned off, the external dynamic brake will operate. Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- ●For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- ●Be sure to enable EM1 (Forced stop) after servo motor stops when using EM1 (Forced stop) frequently in other than emergency.

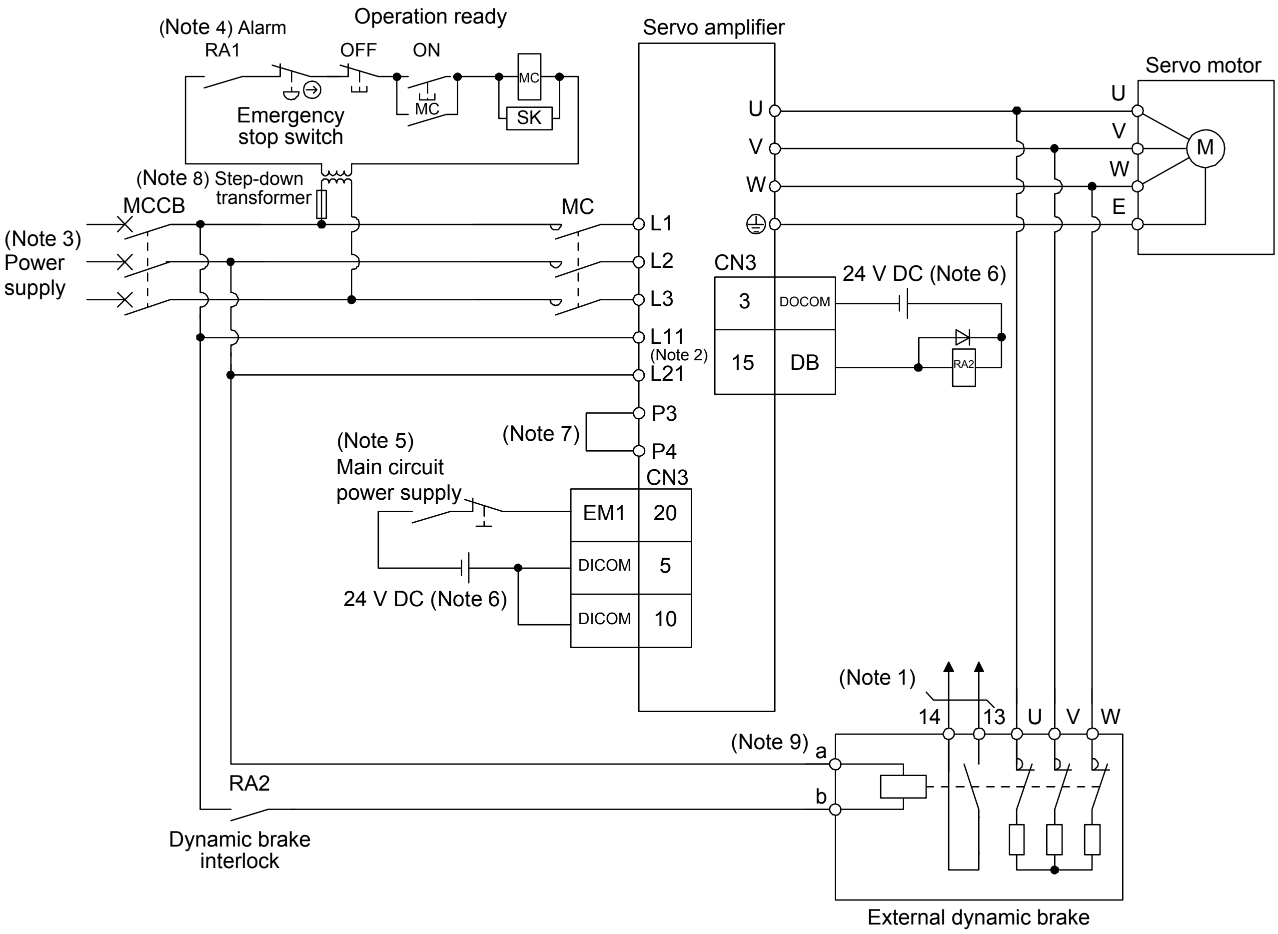
(1) Selection of external dynamic brake

The dynamic brake is designed to bring the servo motor to a sudden stop when a power failure occurs or the protective circuit is activated, and is built in the 7 kW or less servo amplifier. Since it is not built in the 11 kW or more servo amplifier, purchase it separately. Set [Pr. 2] to "_ 1 _ _".

Servo amplifier	External dynamic brake
MR-J4-11KB-RJ020	DBU-11K
MR-J4-15KB-RJ020	DBU-15K
MR-J4-22KB-RJ020	DBU-22K-R1
MR-J4-11KB4-RJ020	DBU-11K-4
MR-J4-15KB4-RJ020	DBU-22K-4
MR-J4-22KB4-RJ020	

(2) Connection example

(a) 200 V class



Note 1. Terminals 13 and 14 are normally open contact outputs. If the external dynamic brake is seized, terminals 13 and 14 will open. Therefore, configure an external sequence to prevent servo-on.

2. To enable DB (Dynamic brake interlock), set [Pr. 2] to "_ 1 _ _".

3. For the power supply specifications, refer to section 1.3.

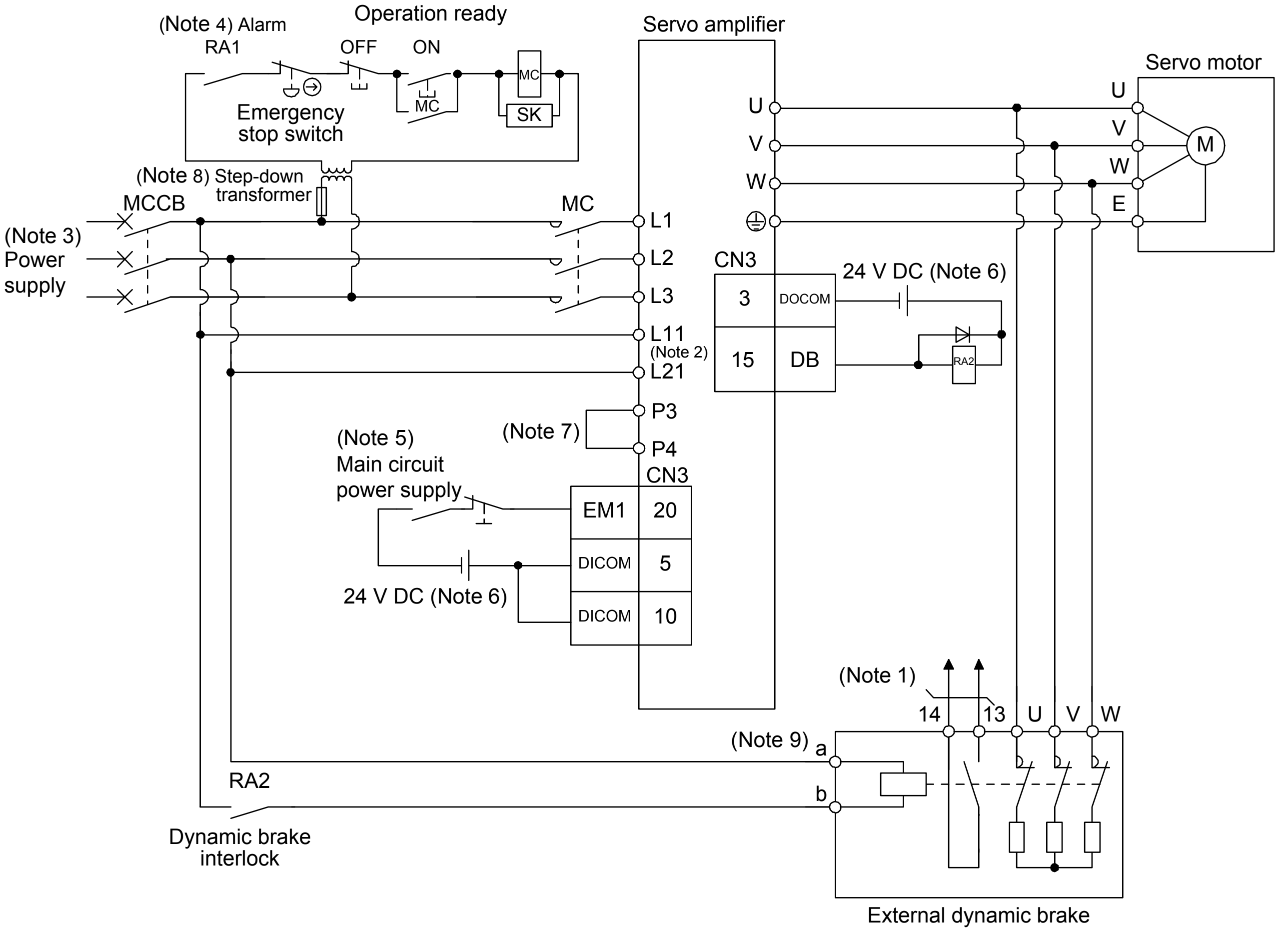
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

5. Turn off EM1 when the main power circuit power supply is off.

6. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

7. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

(b) 400 V class

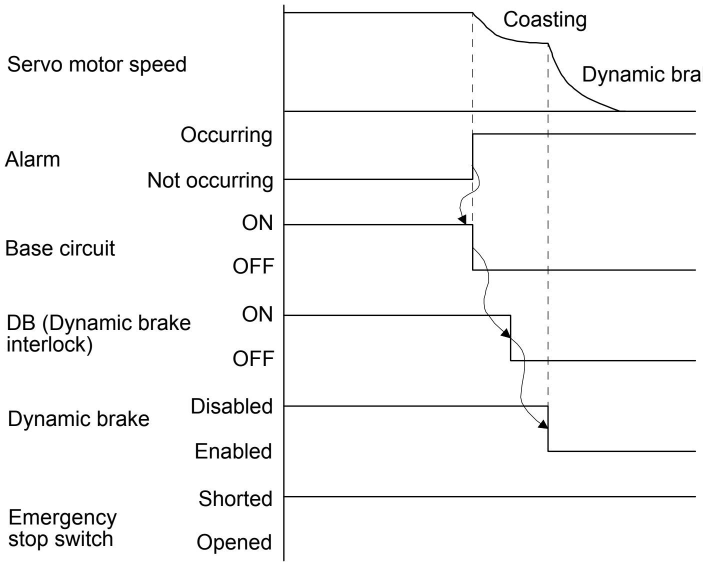


Note 1. Terminals 13 and 14 are normally open contact outputs. If the external dynamic brake is seized, terminals 13 and 14 will open. Therefore, configure an external sequence to prevent servo-on.

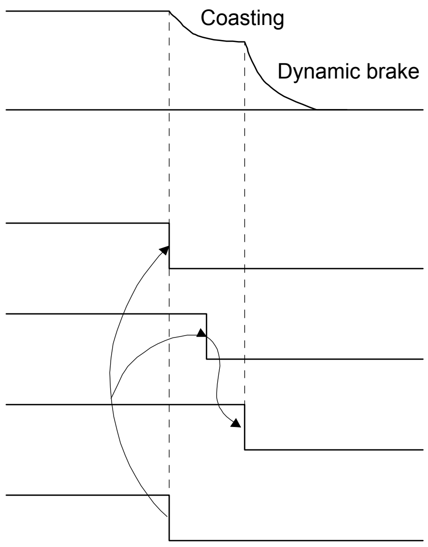
2. To enable DB (Dynamic brake interlock), set [Pr. 2] to "_ 1 _ _".
3. For the power supply specifications, refer to section 1.3.
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. Turn off EM1 when the main power circuit power supply is off.
6. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
7. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
8. Stepdown transformer is required when the coil voltage of the magnetic contactor is 200 V class.
9. The power supply voltage of the inside magnet contactor for 400 V class external dynamic brake DBU-11K-4 and DBU-22K-4 is restricted as follows. When using these external dynamic brakes, use them within the range of the power supply.

External dynamic brake	Power supply voltage
DBU-11K-4 DBU-22K-4	1-phase 380 V AC to 463 V AC, 50 Hz/60 Hz

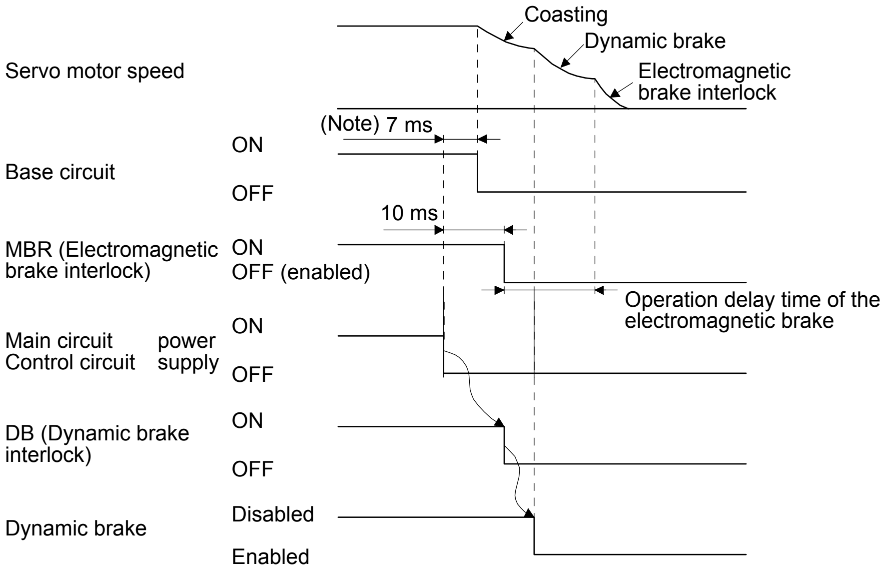
(3) Timing chart



a. Timing chart at alarm occurrence



b. Timing chart at Emergency stop switch enabled



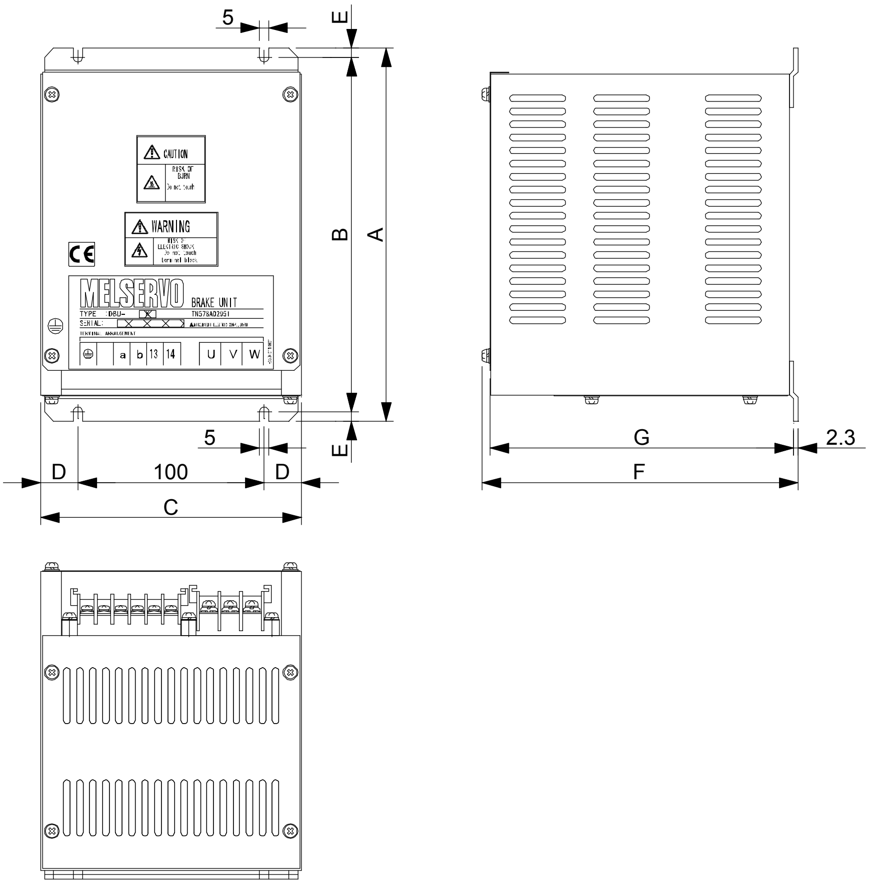
Note. When powering off, DB (Dynamic brake interlock) will be turned off, and the base circuit is turned off earlier than usual before an output shortage occurs.

c. Timing chart when both of the main and control circuit power are off

(4) Dimensions

(a) DBU-11K/DBU-15K/DBU-22K-R1

[Unit: mm]



Terminal block

⏚	╲	a	b	13	14

Screw: M3.5
Tightening torque: 0.8 [N•m]

U	V	W

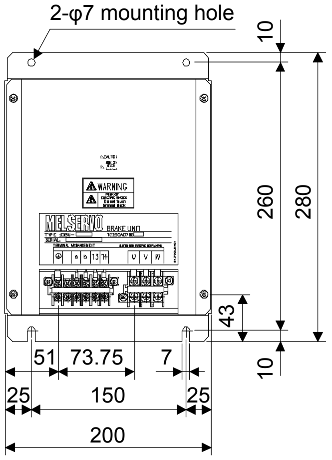
Screw: M4
Tightening torque: 1.2 [N•m]

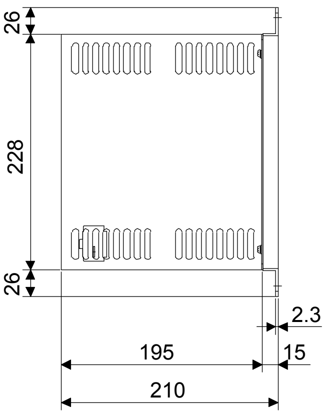
External dynamic brake	A	B	C	D	E	F	G	Mass [kg]	(Note) Connection wire [mm^2]	
									U/V/W	Except U/V/W
DBU-11K	200	190	140	20	5	170	163.5	2	5.5 (AWG 10)	2 (AWG 14)
DBU-15K/DBU-22K-R1	250	238	150	25	6	235	228	6	5.5 (AWG 10)	2 (AWG 14)

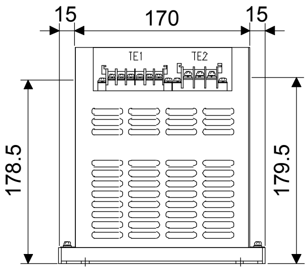
Note. Selection conditions of wire size are as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: single wire set in midair

(b) DBU-11K-4/DBU-22K-4

[Unit: mm]







Mass: 6.7 [kg]

Terminal block

TE1

⏚	⧄	a	b	13	14

Screw: M3.5

Tightening torque: 0.8 [N•m]

TE2

U	V	W

Screw: M4

Tightening torque: 1.2 [N•m]

External dynamic brake	(Note) Connection wire [mm^2]	
	U/V/W	Except U/V/W
DBU-11K-4	5.5 (AWG 10)	2 (AWG 14)
DBU-22K-4	5.5 (AWG 10)	2 (AWG 14)

Note. Selection conditions of wire size are as follows.

Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)

Construction condition: single wire set in midair

11.18 Panel through attachment (MR-J4ACN15K/MR-J3ACN)

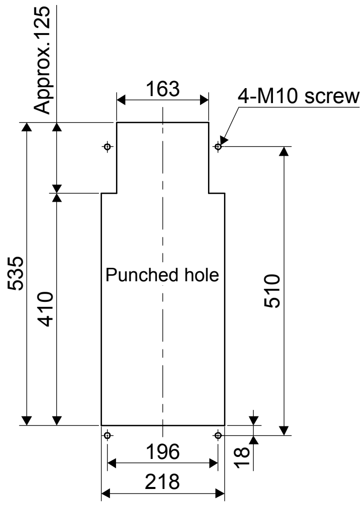
Use the panel through attachment to mount the heat generation area of the servo amplifier in the outside of the cabinet to dissipate servo amplifier-generated heat to the outside of the cabinet and reduce the amount of heat generated in the cabinet. In addition, designing a compact cabinet is allowed.
In the cabinet, machine a hole having the panel cut dimensions, fit the panel through attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier to the cabinet.
Please prepare screws for mounting. They do not come with.
The environment outside the cabinet when using the panel through attachment should be within the range of the servo amplifier operating environment.
The panel through attachment can be used for MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020.
The following shows the combinations.

Servo amplifier	Panel through attachment
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020	MR-J4ACN15K
MR-J4-22KB-RJ020	MR-J3ACN
MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020	MR-J4ACN15K
MR-J4-22KB4-RJ020	MR-J3ACN

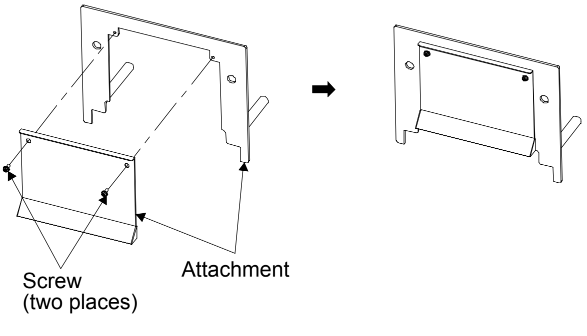
(1) MR-J4ACN15K

(a) Panel cut dimensions

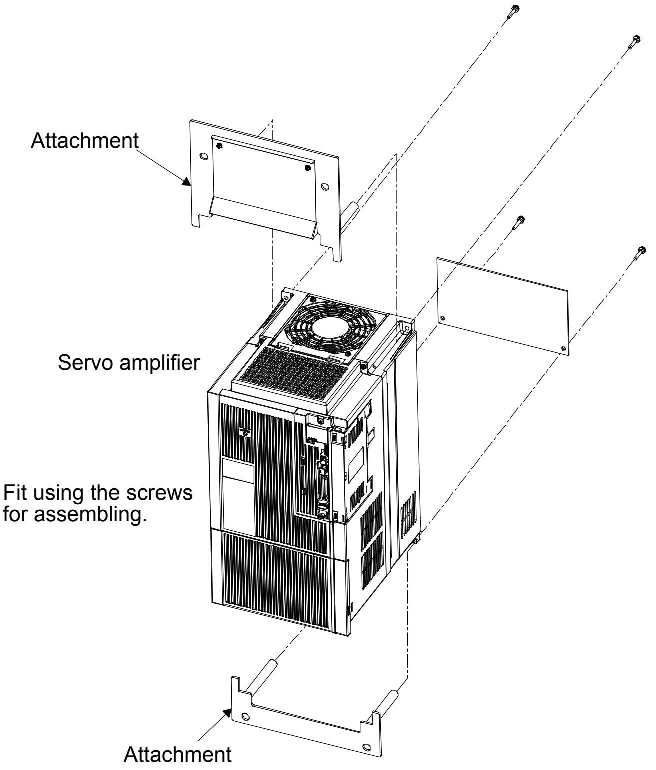
[Unit: mm]



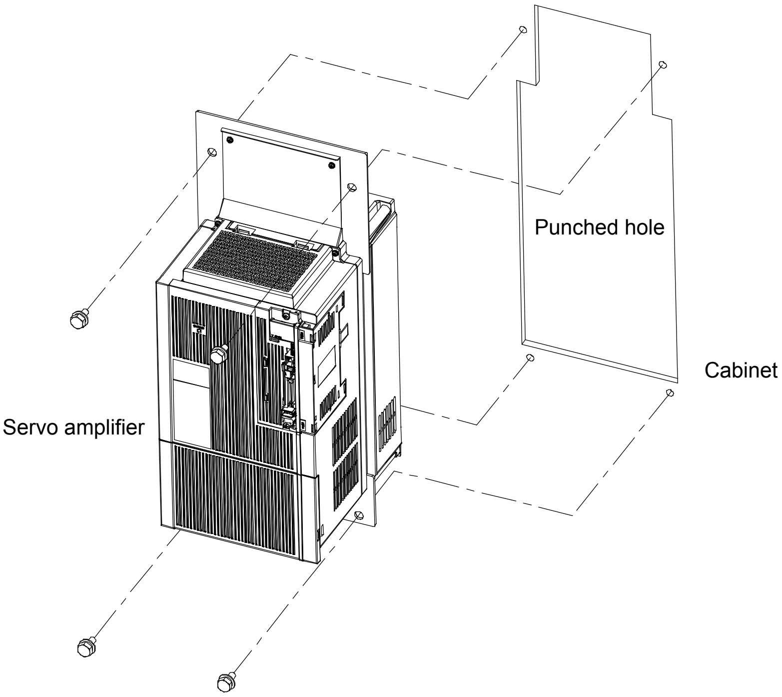
(b) How to assemble the attachment for panel through attachment



(c) Mounting method



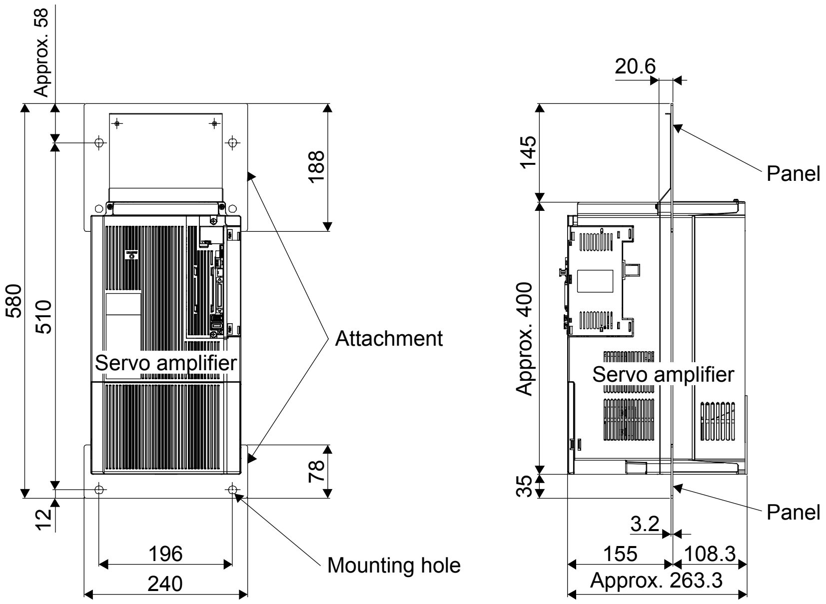
a. Assembling the panel through attachment



b. Mounting it to inside cabinet

(d) Mounting dimensional diagram

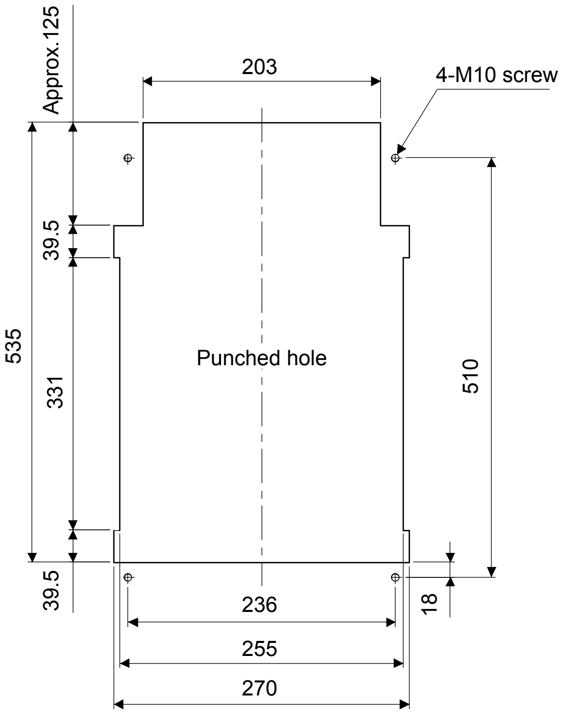
[Unit: mm]



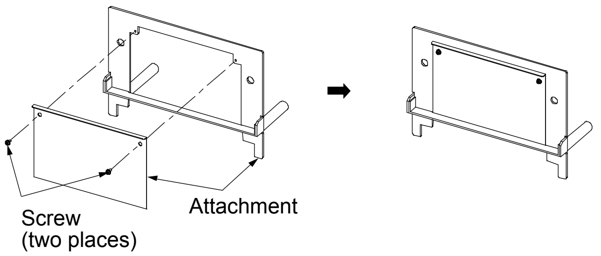
(2) MR-J3ACN

(a) Panel cut dimensions

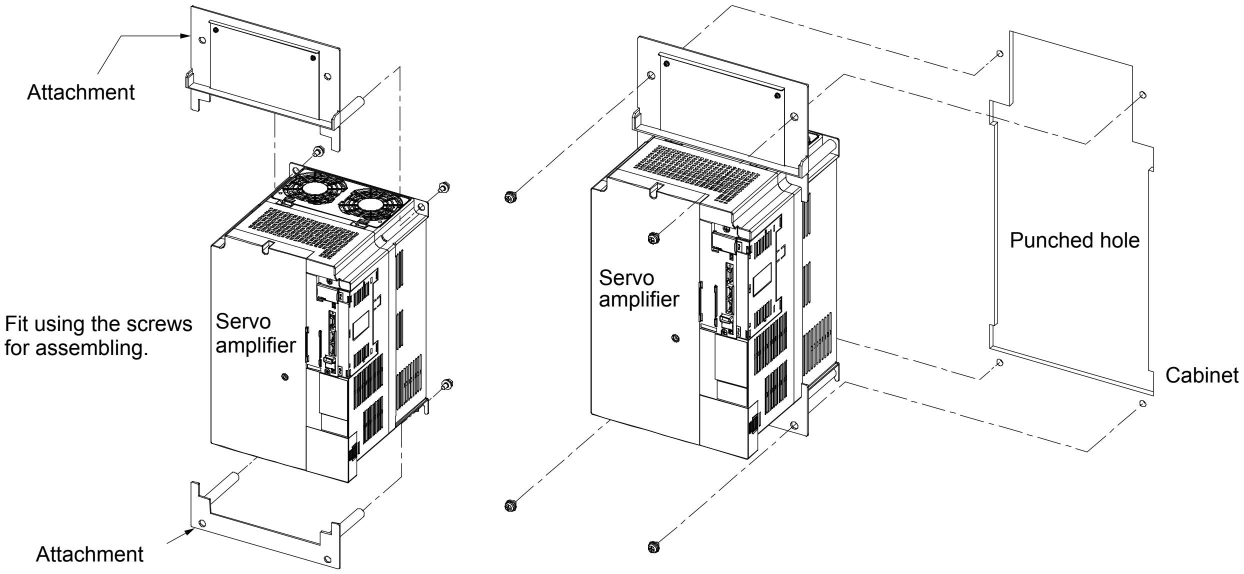
[Unit: mm]



(b) How to assemble the attachment for panel through attachment



(c) Mounting method

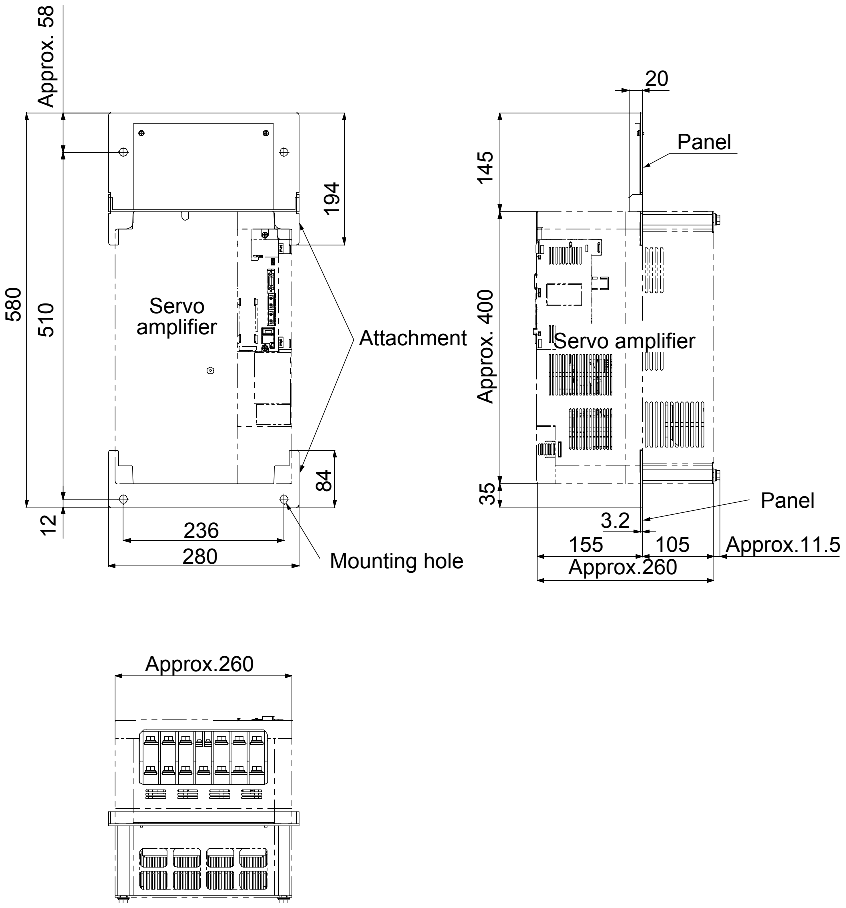


a. Assembling the panel through attachment

b. Mounting it to inside cabinet

(d) Mounting dimensional diagram

[Unit: mm]



MEMO

12. ABSOLUTE POSITION DETECTION SYSTEM

⚠CAUTION

- ●If [AL. 25 Absolute position erased] or [AL. E3 Absolute position counter warning] has occurred, always perform home position setting again. Otherwise, it may cause an unexpected operation.
- ●If [AL. 25], [AL. 92], or [AL. 9F] occurs due to such as short circuit of the battery, the MR-BAT6V1 battery can become hot. Use the MR-BAT6V1 battery with case to prevent getting burnt.

POINT

- ●Refer to section 12.5 for the replacement procedure of the battery.
- ●For configuring the absolute position detection system, there are three batteries of MR-BAT6V1SET, MR-BAT6V1BJ and MR-BT6VCASE. Compared with other batteries, MR-BAT6V1BJ has the following advantages.
  - ･You can disconnect the encoder cable from the servo amplifier.
  - ･You can change the battery with the control circuit power supply off.
- ●When absolute position data is erased from the encoder, always execute home position setting before operation. The absolute position data of the encoder will be erased in the followings. Additionally, when the battery is used out of specification, the absolute position data can be erased.

  When an MR-BAT6V1SET and MR-BT6VCASE are used...
  - ･The encoder cable was disconnected.
  - ･The battery was replaced when the control circuit power supply was off.

  When an MR-BAT6V1BJ is used...
  - ･A connector or cable was disconnected between the servo motor and battery.
  - ･The battery was replaced with procedures other than those of (3) in section 12.2.2.
- ●MR-BAT6V1BJ is only for the HG series servo motors.
- ●Power is not supplied from the SSCNET cable connection connector to the encoder. When using the servo amplifier in absolute position detection system, always connect a battery to the CN4 connector.

12.1 Summary

12.1.1 Features

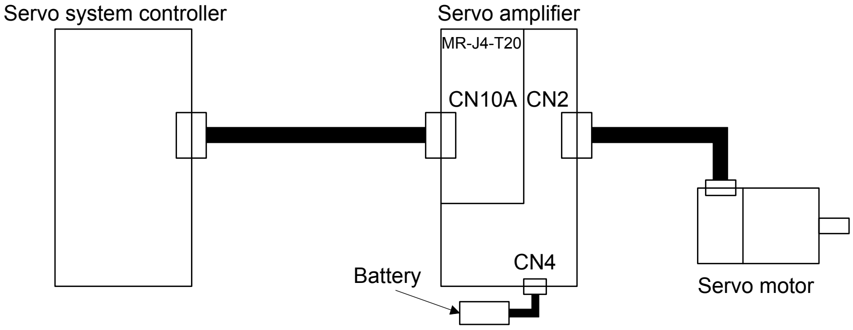
For normal operation, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.

The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the servo system controller power is on or off. Therefore, once home position return is made at the time of machine installation, home position return is not needed when power is switched on thereafter.

Even at a power failure or a malfunction, the system can be easily restored.

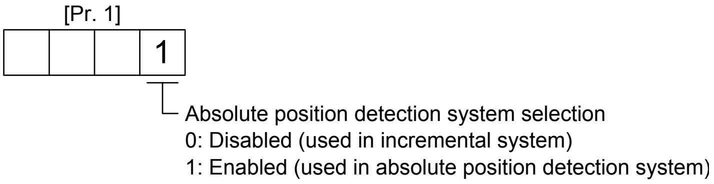
12.1.2 Structure

The following shows a configuration of the absolute position detection system. For the battery connection, refer to (2) (b) of section 12.2.1 for the MR-BAT6V1SET battery. For the battery connection, refer to (2) (b) of section 12.2.2 for the MR-BAT6V1BJ battery for junction battery cable.



12.1.3 Parameter setting

Set "_ _ _ 1" in [Pr. 1] to enable the absolute position detection system.

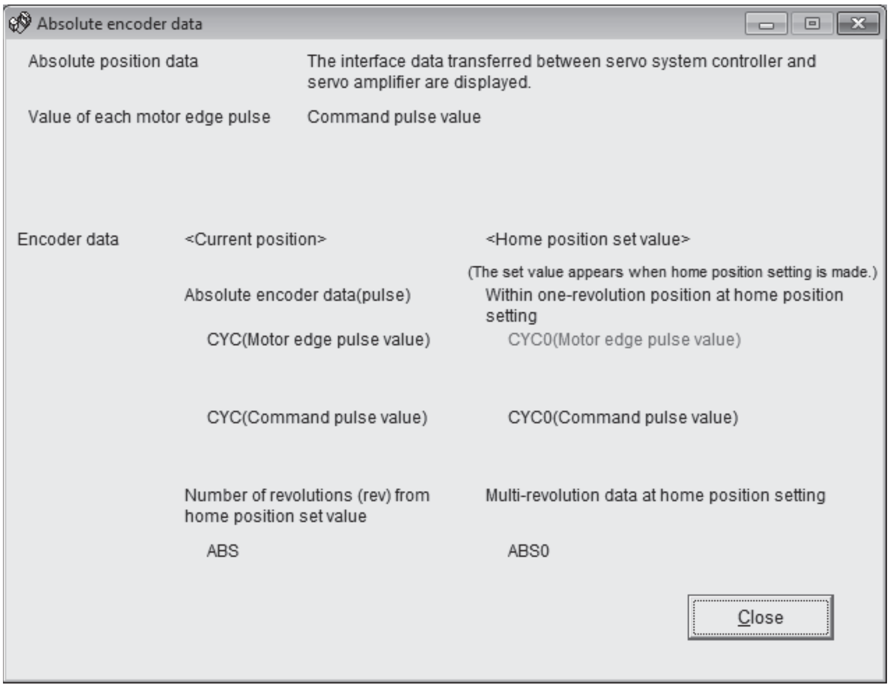


12.1.4 Confirmation of absolute position detection data

POINT

- When using MR Configurator with the MR-J4-_B_-RJ020 servo amplifier, select "System" - "system settings" and set model selection" to "MR-J2S-B".

You can check the absolute position data with MR Configurator.
Choose "Diagnostics" and "Absolute encoder data" to open the absolute position data display screen.



Absolute encoder data

Absolute position data — The interface data transferred between servo system controller and servo amplifier are displayed.

Value of each motor edge pulse — Command pulse value

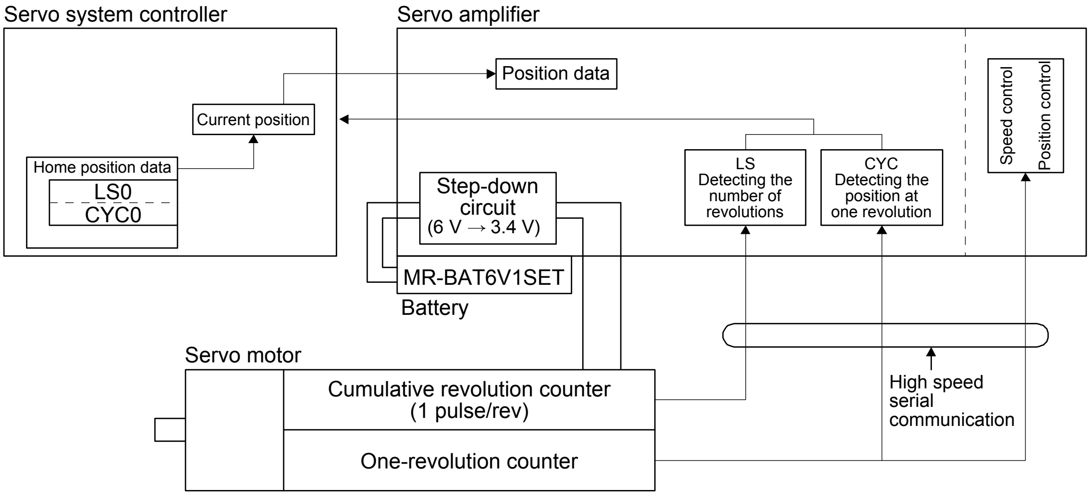
Encoder data

<Current position>	<Home position set value>
	(The set value appears when home position setting is made.)
Absolute encoder data(pulse)	Within one-revolution position at home position setting
CYC(Motor edge pulse value)	CYC0(Motor edge pulse value)
CYC(Command pulse value)	CYC0(Command pulse value)
Number of revolutions (rev) from home position set value	Multi-revolution data at home position setting
ABS	ABS0

12.2 Battery

12.2.1 Using MR-BAT6V1SET battery

(1) Configuration diagram



(2) Specifications

(a) Specification list

Item	Description
System	Electronic battery backup type
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure [r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or more)
(Note 2) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 3)

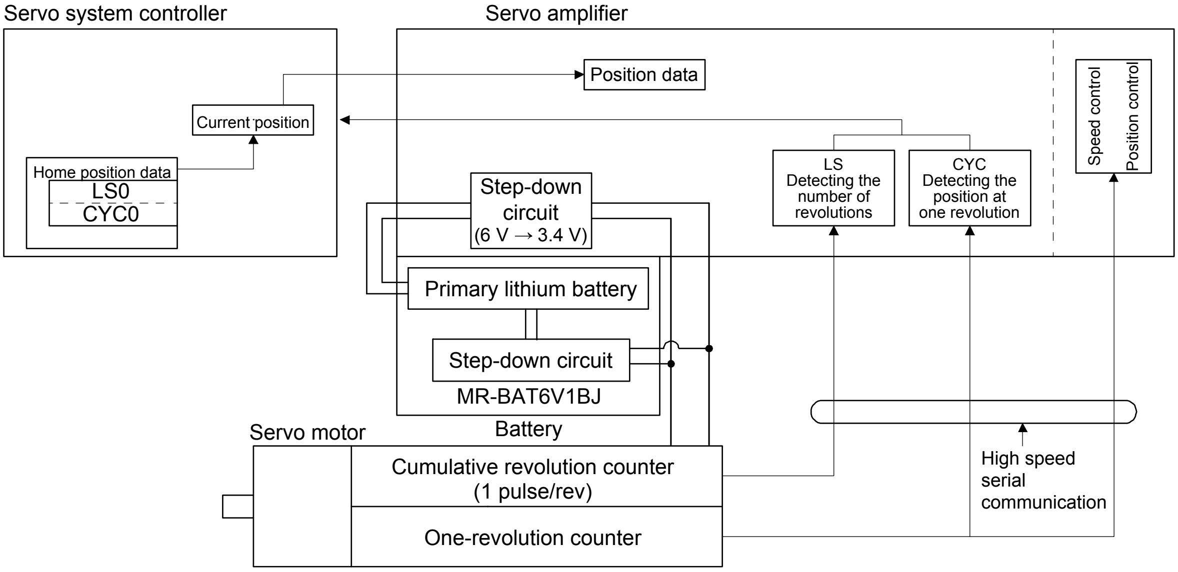
Note
1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.
2. The data-holding time by the battery using MR-BAT6V1SET. Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.
3. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

12.2.2 Using MR-BAT6V1BJ battery for junction battery cable

POINT

- ●MR-BAT6V1BJ is compatible only with HG series servo motors.
- ●MR-BAT6V1BJ cannot be used for fully closed loop system.

(1) Configuration diagram



(2) Specifications

(a) Specification list

Item	Description
System	Electronic battery backup type
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure [r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or more)
(Note 2) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 ˚C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 3)

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.

2. The data-holding time by the battery using MR-BAT6V1BJ. Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.

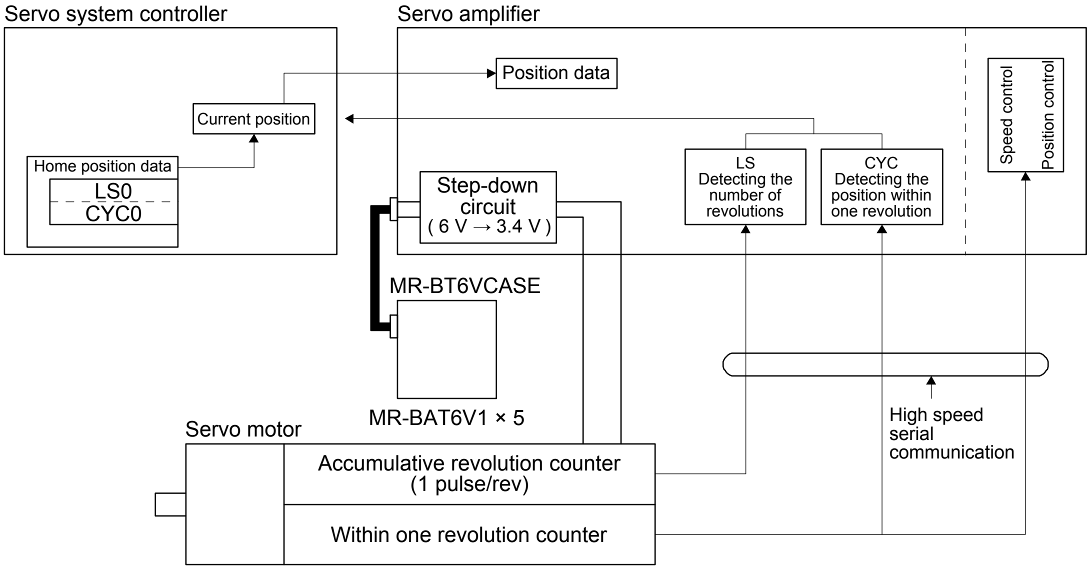
3. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

12.2.3 Using MR-BT6VCASE battery case

POINT

- ●One MR-BT6VCASE holds absolute position data up to eight axes servo motors.
- ●Always install five MR-BAT6V1 batteries to an MR-BT6VCASE.

(1) Configuration diagram



(2) Specification list

Item	Description
System	Electronic battery backup type
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure [r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or more)
(Note 2) Battery backup time	Approximately 40,000 hours/2 axes or less, 30,000 hours/3 axes, or 10,000 hours/8 axes (equipment power supply: off, ambient temperature: 20 ˚C) Approximately 55,000 hours/2 axes or less, 38,000 hours/3 axes, or 15,000 hours/8 axes (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 4)

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.

2. The data-holding time by the battery using five MR-BAT6V1s. The battery life varies depending on the number of axes (including axis for using in the incremental system). Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.

3. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

13. USING THE MR-J4-(DU)_B_-RJ020 IN THE J4 MODE

POINT

- The MR-J4-_B_-RJ020 amplifier used in the J4 mode has restrictions in terms of functions as follows as compared to the MR-J4-_B_ servo amplifier. Other functions are the same as ones for the MR-J4-_B_ servo amplifier.

Function	Availability for use	
	MR-J4-_B_	MR-J4-_B_-RJ020
CN2L connector	None	Provided (not available)
Linear servo system	Available	Not available
Direct drive servo system	Available	Not available
Fully closed loop system	Available	Not available
Scale measurement function	Available	Not available
MR-D30 functional safety unit	Available	Not available
Servo motor with functional safety	Available	Not available

- The fully closed loop control is not available in J4 mode. It is available only in J2S compatibility mode.

This chapter explains the mode switching procedure when the MR-J4-_B_-RJ020 servo amplifier or MR-J4-DU_B_-RJ020 drive unit is used in the J4 mode, the list of parameters, and the list of alarms. For other usages, refer to the explanation on the MR-J4-_B_ servo amplifier in "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
When you use the MR-J4-_B_-RJ020 servo amplifier or MR-J4-DU_B_-RJ020 drive unit in the J4 mode, it is required to switch to the J4 mode using the application "MR-J4(W)-B Change mode" came with MR Configurator2 version 1.17T or later. The application "MR-J4(W)-B Change mode" is designed for USB connection only.

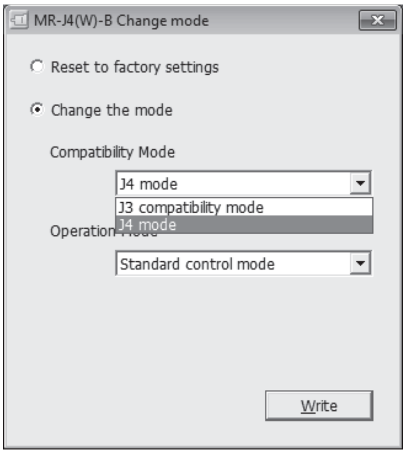
13.1 Mode switching procedure

13.1.1 Switching from the J2S compatibility mode to the J4 mode

(1) Turn on the servo amplifier or drive unit with MR-J4-T20 disconnected.

(2) Start the application "MR-J4(W)-B Change mode" and check that "J2S compatibility mode" is not displayed in the "compatibility mode". If it is displayed, repeat the procedure from (1) in this section again.

(3) After selecting "Change the mode", select "J4 mode". Never select other than "Standard control mode" for "Operation Mode".

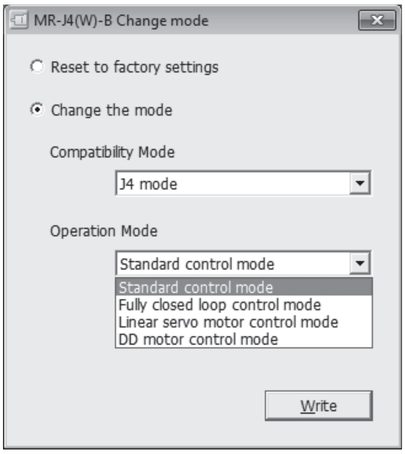

MR-J4(W)-B Change mode

○ Reset to factory settings

● Change the mode

Compatibility Mode: J4 mode

Operation Mode: Standard control mode


MR-J4(W)-B Change mode

○ Reset to factory settings

● Change the mode

Compatibility Mode: J4 mode

Operation Mode: Standard control mode

(4) Press the "Write" button.

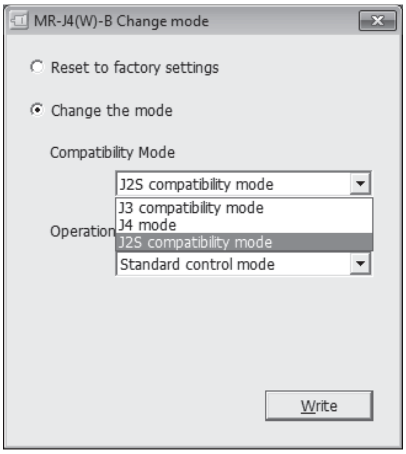
(5) Cycling the power of the servo amplifier or drive unit switches the mode to the J4 mode.

13.1.2 Switching from the J4 mode to the J2S compatibility mode

(1) Turn on the servo amplifier or drive unit with MR-J4-T20 connected.

(2) Start the application "MR-J4(W)-B Change mode" and check that "J2S compatibility mode" is displayed in the "compatibility mode". If it is not displayed, repeat the procedure from (1) in this section again.

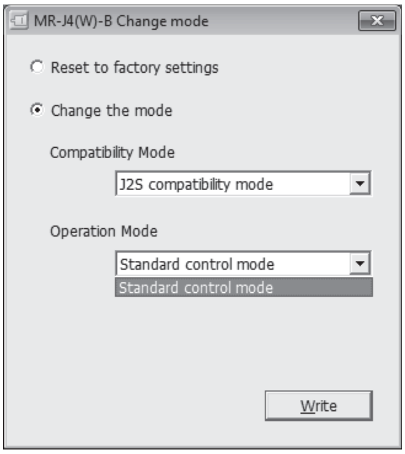
(3) After selecting "switching mode", select "J2S compatibility mode". Only "Standard control mode" can be selected for "operation mode".



● Change the mode

Compatibility Mode: J2S compatibility mode

Operation Mode: Standard control mode



● Change the mode

Compatibility Mode: J2S compatibility mode

Operation Mode: Standard control mode

(4) Press the "Write" button.

(5) Cycling the power of the servo amplifier or drive unit switches the mode to the J2S compatibility mode.

13.2 Parameter

⚠CAUTION

- Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- If fixed values are written in the digits of a parameter, do not change these values.
- Do not change parameters for manufacturer setting.
- Do not set a value other than the described values to each parameter.
- The parameters of J4 mode are different from those of J2S compatibility mode.

POINT

- When you connect the amplifier to a servo system controller, servo parameter values of the servo system controller will be written to each parameter.
- Setting may not be made to some parameters and their ranges depending on the servo system controller model, servo amplifier software version, and MR Configurator2 software version. For details, refer to the servo system controller user's manual. Check the software version of the servo amplifier or drive unit using MR Configurator2.

13.2.1 Parameters for converter unit

(1) Parameter list

POINT

- ●To enable a parameter whose symbol is preceded by *, cycle the power after setting it.

No.	Symbol	Name	Initial value	Unit
PA01	*REG	Regenerative option	0000h	
PA02	*MCC	Magnetic contactor drive output selection	0001h	
PA03		For manufacturer setting	0001h	
PA04			0	
PA05			100	
PA06			0	
PA07			100	
PA08	*DMD	Status display selection	0000h	
PA09	*BPS	Alarm history clear	0000h	
PA10		For manufacturer setting	0	
PA11			0000h	
PA12	*DIF	Input filter setting	0002h	
PA13		For manufacturer setting	0000h	
PA14			0000h	
PA15	AOP3	Function selection A-3	0000h	
PA16		For manufacturer setting	0000h	
PA17	*AOP5	Function selection A-5	0001h	
PA18	CVAT	SEMI-F47 function - Instantaneous power failure detection time	200	[ms]
PA19		For manufacturer setting	0000h	

(2) Detailed list of parameters

POINT

- ●Set a value to each "x" in the "Setting digit" columns.

No./symbol/ name	Setting digit	Function	Initial value [unit]
PA01 *REG Regenerative option	_ _ x x	Regenerative option Select a regenerative option. Incorrect setting will trigger [AL. 37 Parameter error]. 00: Regenerative option is not used. When using the FR-BU2-(H) brake unit, select the value. 01: MR-RB139 02: MR-RB137 (3 pcs.) 13: MR-RB137-4 14: MR-RB13V-4 (3 pcs.)	00h
	_ x _ _	For manufacturer setting	0h
	x _ _ _		0h
PA02 *MCC Magnetic contactor drive output selection	_ _ _ x	Magnetic contactor drive output selection Select the magnetic contactor drive output. 0: Disabled 1: Enabled	1h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA08 *DMD Status display selection	_ _ _ x	Status display selection Select a status display shown at power-on. 0: Status 1: Bus voltage 2: Effective load ratio 3: Peak load ratio 4: Regenerative load ratio 5: Unit power consumption 1 6: Unit total power consumption 1 7: Unit total power consumption 2	0h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA09 *BPS Alarm history clear	_ _ _ x	Alarm history clear Used to clear the alarm history. 0: Disabled 1: Enabled When you select "Enabled", the alarm history will be cleared at next power-on. After the alarm history is cleared, the setting is automatically disabled.	0h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h

No./symbol/ name	Setting digit	Function	Initial value [unit]
PA12 *DIF Input filter setting	_ _ _ x	Input filter setting Select the input filter. If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 1.777 [ms] 2: 3.555 [ms] 3: 5.333 [ms]	2h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA15 AOP3 Function selection A-3	_ _ _ x	Selection of unit power consumption display unit 0: increment of 1 kW 1: increment of 0.1 kW	0h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA17 *AOP5 Function selection A-5		The [Pr. PA17 SEMI-F47 function selection] and [Pr. PA18 SEMI-F47 function - Instantaneous power failure detection time] settings of the converter unit must be the same as [Pr. PA20 SEMI-F47 function selection] and [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time] settings of the drive unit.	
	_ _ _ x	[AL. 10 Undervoltage] detection method selection Set this parameter when [AL. 10 Undervoltage] occurs due to distorted power supply voltage waveform. 0: [AL. 10] not occurrence 1: [AL. 10] occurrence	1h
	_ _ x _	SEMI-F47 function selection 0: Disabled 1: Enabled Selecting "1" enables to avoid triggering [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. In [Pr. PA18 SEMI-F47 function - Instantaneous power failure detection time], set the time until the occurrence of [AL. 10 Undervoltage].	0h
	_ x _ _	For manufacturer setting	0h
	x _ _ _		0h
PA18 CVAT SEMI-F47 function - Instantaneous power failure detection time		The [Pr. PA17 SEMI-F47 function selection] and [Pr. PA18 SEMI-F47 function - Instantaneous power failure detection time] settings of the converter unit must be the same as [Pr. PA20 SEMI-F47 function selection] and [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time] settings of the drive unit.	
		Set the time until the occurrence of [AL. 10 Undervoltage]. To disable the parameter setting value, select "Disabled (_ _ 0 _)" of "SEMI-F47 function selection" in [Pr. PA17]. Setting range: 30 to 200	200 [ms]

13.2.2 Parameters for converter unit/drive unit

(1) Parameter list

POINT

- The parameter whose symbol is preceded by * is enabled under the following conditions:
  *: After setting the parameter, cycle the power or reset the controller.
  **: After setting the parameter, cycle the power.

(a) Basic setting parameters ([Pr. PA_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PA01	**STY	Operation mode	1000h					
PA02	**REG	Regenerative option	0000h		○			
PA03	*ABS	Absolute position detection system	0000h		○			
PA04	*AOP1	Function selection A-1	2000h		○			
PA05		For manufacturer setting	10000					
PA06			1					
PA07			1					
PA08	ATU	Auto tuning mode	0001h		○			
PA09	RSP	Auto tuning response	16		○			
PA10	INP	In-position range	1600	[pulse]	○			
PA11		For manufacturer setting	1000.0					
PA12			1000.0					
PA13			0000h					
PA14	*POL	Rotation direction selection	0		○			
PA15	*ENR	Encoder output pulses	4000	[pulse/rev]	○			
PA16	*ENR2	Encoder output pulses 2	1		○			
PA17	**MSR	Servo motor series setting	0000h					
PA18	**MTY	Servo motor type setting	0000h					
PA19	*BLK	Parameter writing inhibit	00ABh		○			
PA20	*TDS	Tough drive setting	0000h		○			
PA21	*AOP3	Function selection A-3	0001h		○			
PA22		For manufacturer setting	0000h					
PA23	DRAT	Drive recorder arbitrary alarm trigger setting	0000h		○			
PA24	AOP4	Function selection A-4	0000h		○			
PA25	OTHOV	One-touch tuning - Overshoot permissible level	0	[%]	○			
PA26	*AOP5	Function selection A-5	0000h		○			
PA27		For manufacturer setting	0000h					
PA28			0000h					
PA29			0000h					
PA30			0000h					
PA31			0000h					
PA32			0000h					

(b) Gain/filter setting parameters ([Pr. PB_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PB01	FILT	Adaptive tuning mode (adaptive filter II)	0000h		○			
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)	0000h		○			
PB03	TFBGN	Torque feedback loop gain	18000	[rad/s]	○			
PB04	FFC	Feed forward gain	0	[%]	○			
PB05		For manufacturer setting	500					
PB06	GD2	Load to motor inertia ratio	7.00	[Multiplier]	○			
PB07	PG1	Model loop gain	15.0	[rad/s]	○			
PB08	PG2	Position loop gain	37.0	[rad/s]	○			
PB09	VG2	Speed loop gain	823	[rad/s]	○			
PB10	VIC	Speed integral compensation	33.7	[ms]	○			
PB11	VDC	Speed differential compensation	980		○			
PB12	OVA	Overshoot amount compensation	0	[%]	○			
PB13	NH1	Machine resonance suppression filter 1	4500	[Hz]	○			
PB14	NHQ1	Notch shape selection 1	0000h		○			
PB15	NH2	Machine resonance suppression filter 2	4500	[Hz]	○			
PB16	NHQ2	Notch shape selection 2	0000h		○			
PB17	NHF	Shaft resonance suppression filter	0000h		○			
PB18	LPF	Low-pass filter setting	3141	[rad/s]	○			
PB19	VRF11	Vibration suppression control 1 - Vibration frequency	100.0	[Hz]	○			
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	100.0	[Hz]	○			
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.00		○			
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.00		○			
PB23	VFBF	Low-pass filter selection	0000h		○			
PB24	*MVS	Slight vibration suppression control	0000h		○			
PB25		For manufacturer setting	0000h					
PB26	*CDP	Gain switching function	0000h		○			
PB27	CDL	Gain switching condition	10	[kpulse/s]/[pulse]/[r/min]	○			
PB28	CDT	Gain switching time constant	1	[ms]	○			
PB29	GD2B	Load to motor inertia ratio after gain switching	7.00	[Multiplier]	○			
PB30	PG2B	Position loop gain after gain switching	0.0	[rad/s]	○			
PB31	VG2B	Speed loop gain after gain switching	0	[rad/s]	○			
PB32	VICB	Speed integral compensation after gain switching	0.0	[ms]	○			
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching	0.0	[Hz]	○			
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching	0.0	[Hz]	○			
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.00		○			
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.00		○			
PB37		For manufacturer setting	1600					
PB38			0.00					
PB39			0.00					
PB40			0.00					
PB41			0					
PB42			0					
PB43			0000h					
PB44			0.00					
PB45	CNHF	Command notch filter	0000h		○			

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PB46	NH3	Machine resonance suppression filter 3	4500	[Hz]	○			
PB47	NHQ3	Notch shape selection 3	0000h		○			
PB48	NH4	Machine resonance suppression filter 4	4500	[Hz]	○			
PB49	NHQ4	Notch shape selection 4	0000h		○			
PB50	NH5	Machine resonance suppression filter 5	4500	[Hz]	○			
PB51	NHQ5	Notch shape selection 5	0000h		○			
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	100.0	[Hz]	○			
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	100.0	[Hz]	○			
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.00		○			
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.00		○			
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	0.0	[Hz]	○			
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	0.0	[Hz]	○			
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.00		○			
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.00		○			
PB60	PG1B	Model loop gain after gain switching	0.0	[rad/s]	○			
PB61		For manufacturer setting	0.0					
PB62			0000h					
PB63			0000h					
PB64			0000h					

(c) Extension setting parameters ([Pr. PC_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PC01	ERZ	Error excessive alarm level	0	[rev]	○			
PC02	MBR	Electromagnetic brake sequence output	0	[ms]	○			
PC03	*ENRS	Encoder output pulse selection	0000h		○			
PC04	**COP1	Function selection C-1	0000h		○			
PC05	**COP2	Function selection C-2	0000h		○			
PC06	*COP3	Function selection C-3	0000h		○			
PC07	ZSP	Zero speed	50	[r/min]	○			
PC08	OSL	Overspeed alarm detection level	0	[r/min]	○			
PC09	MOD1	Analog monitor 1 output	0000h		○			
PC10	MOD2	Analog monitor 2 output	0001h		○			
PC11	MO1	Analog monitor 1 offset	0	[mV]	○			
PC12	MO2	Analog monitor 2 offset	0	[mV]	○			
PC13	MOSDL	Analog monitor - Feedback position output standard data - Low	0	[pulse]	○			
PC14	MOSDH	Analog monitor - Feedback position output standard data - High	0	[10000 pulses]	○			
PC15		For manufacturer setting	0					
PC16			0000h					
PC17	**COP4	Function selection C-4	0000h		○			
PC18	*COP5	Function selection C-5	0000h		○			
PC19		For manufacturer setting	0000h					
PC20	*COP7	Function selection C-7	0000h		○			

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PC21	*BPS	Alarm history clear	0000h		○			
PC22		For manufacturer setting	0					
PC23			0000h					
PC24	RSBR	Forced stop deceleration time constant	100	[ms]	○			
PC25		For manufacturer setting	0					
PC26	**COP8	Function selection C-8	0000h					
PC27	**COP9	Function selection C-9	0000h					
PC28		For manufacturer setting	0000h					
PC29	*COPB	Function selection C-B	0000h		○			
PC30		For manufacturer setting	0					
PC31	RSUP1	Vertical axis freefall prevention compensation amount	0	[0.0001 rev]	○			
PC32		For manufacturer setting	0000h					
PC33			0					
PC34			100					
PC35			0000h					
PC36			0000h					
PC37			0000h					
PC38	ERW	Error excessive warning level (Note)	0	[rev]	○			
PC39		For manufacturer setting	0000h					
PC40			0000h					
PC41			0000h					
PC42			0000h					
PC43			0000h					
PC44			0000h					
PC45			0000h					
PC46			0000h					
PC47			0000h					
PC48			0000h					
PC49			0000h					
PC50			0000h					
PC51			0000h					
PC52			0000h					
PC53			0000h					
PC54			0000h					
PC55			0000h					
PC56			0000h					
PC57			0000h					
PC58			0000h					
PC59			0000h					
PC60			0000h					
PC61			0000h					
PC62			0000h					
PC63			0000h					
PC64			0000h					

Note. This is available with servo amplifiers with software version A4 or later.

(d) I/O setting parameters ([Pr. PD_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PD01		For manufacturer setting	0000h					
PD02	*DIA2	Input signal automatic on selection 2	0000h		○			
PD03		For manufacturer setting	0020h					
PD04			0021h					
PD05			0022h					
PD06			0000h					
PD07	*DO1	Output device selection 1	0005h		○			
PD08	*DO2	Output device selection 2	0004h		○			
PD09	*DO3	Output device selection 3	0003h		○			
PD10		For manufacturer setting	0000h					
PD11	*DIF	Input filter setting (Note 1)	0004h		○			
PD12	*DOP1	Function selection D-1	0000h		○			
PD13	*DOP2	Function selection D-2 (Note 3)	0000h		○			
PD14	*DOP3	Function selection D-3	0000h		○			
PD15	*IDCS	Driver communication setting (Note 2)	0000h		○			
PD16	*MD1	Driver communication setting - Master - Transmit data selection 1 (Note 2)	0000h		○			
PD17	*MD2	Driver communication setting - Master - Transmit data selection 2 (Note 2)	0000h		○			
PD18		For manufacturer setting	0000h					
PD19			0000h					
PD20	*SLA1	Driver communication setting - Slave - Master axis No. selection 1 (Note 2)	0		○			
PD21		For manufacturer setting	0					
PD22			0					
PD23			0					
PD24			0000h					
PD25			0000h					
PD26			0000h					
PD27			0000h					
PD28			0000h					
PD29			0000h					
PD30	TLC	Master-slave operation - Torque command coefficient on slave (Note 2)	0		○			
PD31	VLC	Master-slave operation - Speed limit coefficient on slave (Note 2)	0		○			
PD32	VLL	Master-slave operation - Speed limit adjusted value on slave (Note 2)	0	[r/min]	○			
PD33		For manufacturer setting	0000h					
PD34			0000h					
PD35			0000h					
PD36			0000h					
PD37			0000h					
PD38			0000h					
PD39			0000h					
PD40			0000h					
PD41			0000h					
PD42			0000h					
PD43			0000h					
PD44			0000h					
PD45			0000h					
PD46			0000h					
PD47			0000h					
PD48			0000h					

Note 1. Refer to the servo system controller instruction manual for the setting.
2. Used by servo amplifiers with software version A2 or later.
3. This is available with servo amplifiers with software version A4 or later.

(e) Extension setting 2 parameters ([Pr. PE_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PE01	**FCT1	Fully closed loop function selection 1	0000h					
PE02		For manufacturer setting	0000h					
PE03	*FCT2	Fully closed loop function selection 2	0003h					
PE04	**FBN	Fully closed loop control - Feedback pulse electronic gear 1 - Numerator	1					
PE05	**FBD	Fully closed loop control - Feedback pulse electronic gear 1 - Denominator	1					
PE06	BC1	Fully closed loop control - Speed deviation error detection level	400	[r/min]				
PE07	BC2	Fully closed loop control - Position deviation error detection level	100	[kpulse]				
PE08	DUF	Fully closed loop dual feedback filter	10	[rad/s]				
PE09		For manufacturer setting	0000h					
PE10	FCT3	Fully closed loop function selection 3	0000h					
PE11		For manufacturer setting	0000h					
PE12			0000h					
PE13			0000h					
PE14			0111h					
PE15			20					
PE16			0000h					
PE17			0000h					
PE18			0000h					
PE19			0000h					
PE20			0000h					
PE21			0000h					
PE22			0000h					
PE23			0000h					
PE24			0000h					
PE25			0000h					
PE26			0000h					
PE27			0000h					
PE28			0000h					
PE29			0000h					
PE30			0000h					
PE31			0000h					
PE32			0000h					
PE33			0000h					
PE34	**FBN2	Fully closed loop control - Feedback pulse electronic gear 2 - Numerator	1					
PE35	**FBD2	Fully closed loop control - Feedback pulse electronic gear 2 - Denominator	1					
PE36		For manufacturer setting	0.0					
PE37			0.00					
PE38			0.00					
PE39			20					
PE40			0000h					
PE41	EOP3	Function selection E-3	0000h		○			
PE42		For manufacturer setting	0					
PE43			0.0					
PE44	LMCP	Lost motion compensation positive-side compensation value selection (Note)	0	[0.01%]				
PE45	LMCN	Lost motion compensation negative-side compensation value selection (Note)	0	[0.01%]				
PE46	LMFLT	Lost motion filter setting (Note)	0	[0.1 ms]				
PE47	TOF	Torque offset (Note)	0	[0.01%]				

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PE48	*LMOP	Lost motion compensation function selection (Note)	0000h					
PE49	LMCD	Lost motion compensation timing (Note)	0	[0.1 ms]				
PE50	LMCT	Lost motion compensation non-sensitive band (Note)	0	[pulse]/ [kpulse]				
PE51		For manufacturer setting	0000h					
PE52			0000h					
PE53			0000h					
PE54			0000h					
PE55			0000h					
PE56			0000h					
PE57			0000h					
PE58			0000h					
PE59			0000h					
PE60			0000h					
PE61			0.00					
PE62			0.00					
PE63			0.00					
PE64			0.00					

Note. This is available with servo amplifiers with software version A4 or later.

(f) Extension setting 3 parameters ([Pr. PF_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PF01		For manufacturer setting	0000h					
PF02			0000h					
PF03			0000h					
PF04			0					
PF05			0000h					
PF06	*FOP5	Function selection F-5	0000h		○			
PF07		For manufacturer setting	0000h					
PF08			0000h					
PF09			0					
PF10			0					
PF11			0					
PF12	DBT	Electronic dynamic brake operating time	2000	[ms]	○			
PF13		For manufacturer setting	0000h					
PF14			10					
PF15			0000h					
PF16			0000h					
PF17			0000h					
PF18			0000h					
PF19			0000h					
PF20			0000h					
PF21	DRT	Drive recorder switching time setting	0	[s]	○			
PF22		For manufacturer setting	200					
PF23	OSCL1	Vibration tough drive - Oscillation detection level	50	[%]	○			
PF24	*OSCL2	Vibration tough drive function selection	0000h		○			
PF25	CVAT	SEMI-F47 function - Instantaneous power failure detection time	200	[ms]	○			

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PF26		For manufacturer setting	0					
PF27			0					
PF28			0					
PF29			0000h					
PF30			0					
PF31	FRIC	Machine diagnosis function - Friction judgement speed	0	[r/min]	○			
PF32		For manufacturer setting	50					
PF33			0000h					
PF34			0000h					
PF35			0000h					
PF36			0000h					
PF37			0000h					
PF38			0000h					
PF39			0000h					
PF40			0000h					
PF41			0000h					
PF42			0000h					
PF43			0000h					
PF44			0000h					
PF45			0000h					
PF46			0000h					
PF47			0000h					
PF48			0000h					

(g) Linear servo motor/DD motor setting parameters ([Pr. PL_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PL01	**LIT1	Linear servo motor/DD motor function selection 1	0301h					
PL02	**LIM	Linear encoder resolution - Numerator	1000	[μm]				
PL03	**LID	Linear encoder resolution - Denominator	1000	[μm]				
PL04	*LIT2	Linear servo motor/DD motor function selection 2	0003h					
PL05	LB1	Position deviation error detection level	0	[mm]/[0.01 rev]				
PL06	LB2	Speed deviation error detection level	0	[r/min]/[mm/s]				
PL07	LB3	Torque/thrust deviation error detection level	100	[%]				
PL08	*LIT3	Linear servo motor/DD motor function selection 3	0010h					
PL09	LPWM	Magnetic pole detection voltage level	30	[%]				
PL10		For manufacturer setting	5					
PL11			100					
PL12			500					
PL13			0000h					
PL14			0					
PL15			20					
PL16			0					
PL17	LTSTS	Magnetic pole detection - Minute position detection method - Function selection	0000h					
PL18	IDLV	Magnetic pole detection - Minute position detection method - Identification signal amplitude	0	[%]				

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PL19		For manufacturer setting	0					
PL20			0					
PL21			0					
PL22			0					
PL23			0000h					
PL24			0					
PL25			0000h					
PL26			0000h					
PL27			0000h					
PL28			0000h					
PL29			0000h					
PL30			0000h					
PL31			0000h					
PL32			0000h					
PL33			0000h					
PL34			0000h					
PL35			0000h					
PL36			0000h					
PL37			0000h					
PL38			0000h					
PL39			0000h					
PL40			0000h					
PL41			0000h					
PL42			0000h					
PL43			0000h					
PL44			0000h					
PL45			0000h					
PL46			0000h					
PL47			0000h					
PL48			0000h					

(2) Detailed list of parameters

POINT
●Set a value to each "x" in the "Setting digit" columns.

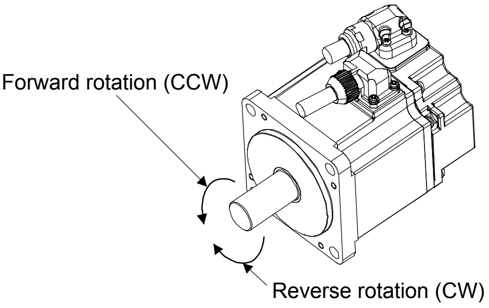
(a) Basic setting parameters ([Pr. PA_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA02</td><td>**REG</td><td>Regenerative option
Select a regenerative option.
Incorrect setting may cause the regenerative option to burn.
If a selected regenerative option is not for use with the servo amplifier, [AL. 37 Parameter error] occurs.
For the drive unit, select the regenerative option with the converter unit. With the converter unit, selecting other than "_ _ 0 0" or "_ _ 0 1" will trigger [AL. 37 Parameter error].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Regenerative option selection
00: Regenerative option is not used.
・For servo amplifier of 100 W, regenerative option is not used.
・For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
・Supplied regenerative resistors or regenerative option is used with the servo amplifier of 11 kW to 22 kW.
The regenerative option is used with the drive unit (set with the converter unit).
01: FR-RC-(H)/FR-CV-(H)/FR-BU2-(H)
When you use FR-RC-(H) or FR-CV-(H), select "Mode 2 (_ _ _ 1)" of "Undervoltage alarm detection mode selection" in [Pr. PC20].
02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30
06: MR-RB50 (Cooling fan is required.)
08: MR-RB31
09: MR-RB51 (Cooling fan is required.)
0B: MR-RB3N
0C: MR-RB5N (Cooling fan is required.)
80: MR-RB1H-4
81: MR-RB3M-4 (Cooling fan is required.)
82: MR-RB3G-4 (Cooling fan is required.)
83: MR-RB5G-4 (Cooling fan is required.)
84: MR-RB34-4 (Cooling fan is required.)
85: MR-RB54-4 (Cooling fan is required.)
91: MR-RB3U-4 (Cooling fan is required.)
92: MR-RB5U-4 (Cooling fan is required.)
FA: When the supplied regenerative resistor or a regenerative option used with the servo amplifier of 11 kW to 22 kW is cooled by a cooling fan to increase regenerative ability.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA03</td><td>*ABS</td><td>Absolute position detection system
Set this parameter when using the absolute position detection system.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Absolute position detection system selection
0: Disabled (used in incremental system)
1: Enabled (used in absolute position detection system)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA04</td><td>*AOP1</td><td>Function selection A-1
Select a forced stop input and forced stop deceleration function.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Servo forced stop selection
0: Enabled (The forced stop input EM2 or EM1 is used.)
1: Disabled (The forced stop input EM2 and EM1 are not used.)
Refer to table 13.1 for details.</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Forced stop deceleration function selection
0: Forced stop deceleration function disabled (EM1)
2: Forced stop deceleration function enabled (EM2)
Refer to table 13.1 for details.</td><td>2h</td></tr>
</table>
Table 13.1 Deceleration method
<table>
<tr><th rowspan="2">Setting value</th><th rowspan="2">EM2/EM1</th><th colspan="2">Deceleration method</th></tr>
<tr><th>EM2 or EM1 is off</th><th>Alarm occurred</th></tr>
<tr><td>0 0 _ _</td><td>EM1</td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td></tr>
<tr><td>2 0 _ _</td><td>EM2</td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td></tr>
<tr><td>0 1 _ _</td><td>Not using EM2 or EM1</td><td></td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td></tr>
<tr><td>2 1 _ _</td><td>Not using EM2 or EM1</td><td></td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA08</td><td>ATU</td><td>Auto tuning mode
Select the gain adjustment mode.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Gain adjustment mode selection
0: 2 gain adjustment mode 1 (interpolation mode)
1: Auto tuning mode 1
2: Auto tuning mode 2
3: Manual mode
4: 2 gain adjustment mode 2
Refer to table 13.2 for details.</td><td>1h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
Table 13.2 Gain adjustment mode selection
<table>
<tr><th>Setting value</th><th>Gain adjustment mode</th><th>Automatically adjusted parameter</th></tr>
<tr><td>_ _ _ 0</td><td>2 gain adjustment mode 1 (interpolation mode)</td><td>[Pr. PB06 Load to motor inertia ratio]
[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 1</td><td>Auto tuning mode 1</td><td>[Pr. PB06 Load to motor inertia ratio]
[Pr. PB07 Model loop gain]
[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 2</td><td>Auto tuning mode 2</td><td>[Pr. PB07 Model loop gain]
[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 3</td><td>Manual mode</td><td></td></tr>
<tr><td>_ _ _ 4</td><td>2 gain adjustment mode 2</td><td>[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA09</td><td>RSP</td><td>Auto tuning response
Set a response of the auto tuning.
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>1</td><td rowspan="2">Low response</td><td>2.7</td></tr>
<tr><td>2</td><td>3.6</td></tr>
<tr><td>3</td><td rowspan="16"></td><td>4.9</td></tr>
<tr><td>4</td><td>6.6</td></tr>
<tr><td>5</td><td>10.0</td></tr>
<tr><td>6</td><td>11.3</td></tr>
<tr><td>7</td><td>12.7</td></tr>
<tr><td>8</td><td>14.3</td></tr>
<tr><td>9</td><td>16.1</td></tr>
<tr><td>10</td><td>18.1</td></tr>
<tr><td>11</td><td>20.4</td></tr>
<tr><td>12</td><td>23.0</td></tr>
<tr><td>13</td><td>25.9</td></tr>
<tr><td>14</td><td>29.2</td></tr>
<tr><td>15</td><td>32.9</td></tr>
<tr><td>16</td><td>37.0</td></tr>
<tr><td>17</td><td>41.7</td></tr>
<tr><td>18</td><td>47.0</td></tr>
<tr><td>19</td><td rowspan="2">Middle response</td><td>52.9</td></tr>
<tr><td>20</td><td>59.6</td></tr>
</table>
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>21</td><td rowspan="2">Middle response</td><td>67.1</td></tr>
<tr><td>22</td><td>75.6</td></tr>
<tr><td>23</td><td rowspan="16"></td><td>85.2</td></tr>
<tr><td>24</td><td>95.9</td></tr>
<tr><td>25</td><td>108.0</td></tr>
<tr><td>26</td><td>121.7</td></tr>
<tr><td>27</td><td>137.1</td></tr>
<tr><td>28</td><td>154.4</td></tr>
<tr><td>29</td><td>173.9</td></tr>
<tr><td>30</td><td>195.9</td></tr>
<tr><td>31</td><td>220.6</td></tr>
<tr><td>32</td><td>248.5</td></tr>
<tr><td>33</td><td>279.9</td></tr>
<tr><td>34</td><td>315.3</td></tr>
<tr><td>35</td><td>355.1</td></tr>
<tr><td>36</td><td>400.0</td></tr>
<tr><td>37</td><td>446.6</td></tr>
<tr><td>38</td><td>501.2</td></tr>
<tr><td>39</td><td rowspan="2">High response</td><td>571.5</td></tr>
<tr><td>40</td><td>642.7</td></tr>
</table>
</td><td>16</td><td>1
to
40</td></tr>
<tr><td>PA10</td><td>INP</td><td>In-position range
Set an in-position range per command pulse.</td><td>1600
[pulse]</td><td>0
to
65535</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA14</td><td>*POL</td><td>
Rotation direction selection
Select the rotation direction of command input pulse.
For the setting for the master-slave operation function, refer to section 17.2 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>Positioning address increase</th><th>Positioning address decrease</th></tr>
<tr><td>0</td><td>CCW</td><td>CW</td></tr>
<tr><td>1</td><td>CW</td><td>CCW</td></tr>
</table>
The following shows the servo motor rotation directions.


</td><td>0</td><td>0
to
1</td></tr>
<tr><td>PA15</td><td>*ENR</td><td>
Encoder output pulses
Set the encoder output pulses from the servo amplifier by using the number of output pulses per revolution, dividing ratio, or electronic gear ratio. (after multiplication by 4)
To set a numerator of the electronic gear, select "A-phase/B-phase pulse electronic gear setting (_ _ 3 _)" of "Encoder output pulse setting selection" in [Pr. PC03].
The maximum output frequency is 4.6 Mpulses/s. Set the parameter within this range.
</td><td>4000 [pulse/rev]</td><td>1
to
65535</td></tr>
<tr><td>PA16</td><td>*ENR2</td><td>
Encoder output pulses 2
Set a denominator of the electronic gear for the A/B-phase pulse output. To set a denominator of the electronic gear, select "A-phase/B-phase pulse electronic gear setting (_ _ 3 _)" of "Encoder output pulse setting selection" in [Pr. PC03].
</td><td>1</td><td>1
to
65535</td></tr>
<tr><td>PA19</td><td>*BLK</td><td>
Parameter writing inhibit
Select a reference range and writing range of the parameter.
Refer to table 13.3 for settings.
Table 13.3 [Pr. PA19] setting value and reading/writing range
<table>
<tr><th>PA19</th><th>Setting operation</th><th>PA</th><th>PB</th><th>PC</th><th>PD</th><th>PF</th></tr>
<tr><td rowspan="2">Other than below</td><td>Reading</td><td>○</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>○</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000Ah</td><td>Reading</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000Bh</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr>
<tr><td rowspan="2">000Ch</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td rowspan="2">00ABh (initial value)</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td rowspan="2">100Bh</td><td>Reading</td><td>○</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">100Ch</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">10ABh</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>00ABh</td><td>Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA20</td><td>*TDS</td><td>Tough drive setting
Alarms may not be avoided with the tough drive function depending on the situations of the power supply and load fluctuation.
You can assign MTTR (During tough drive) to pins CN3-9, CN3-13, and CN3-15 with [Pr. PD07] to [Pr. PD09].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Vibration tough drive selection
0: Disabled
1: Enabled

Selecting "1" enables to suppress vibrations by automatically changing setting values of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] in case that the vibration exceed the value of the oscillation level set in [Pr. PF23].
For details, refer to section 7.3 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>SEMI-F47 function selection
The [Pr. PA20 SEMI-F47 function selection] and [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time] settings of the drive unit must be the same as [Pr. PA17 SEMI-F47 function selection] and [Pr. PA18 SEMIF47 function - Instantaneous power failure detection time] settings of the converter unit.
0: Disabled
1: Enabled

Selecting "1" enables to avoid triggering [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. In [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time], set the time until the occurrence of [AL. 10.1 Voltage drop in the control circuit power].</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA21</td><td>*AOP3</td><td>Function selection A-3
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>One-touch tuning function selection
0: Disabled
1: Enabled

When the digit is "0", the one-touch tuning with MR Configurator2 will be disabled.</td><td>1h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA23</td><td>DRAT</td><td>Drive recorder arbitrary alarm trigger setting
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Alarm detail No. setting
Set the digits when you execute the trigger with arbitrary alarm detail No. for the drive recorder function.
When these digits are "0 0", only the arbitrary alarm No. setting will be enabled.</td><td>00h</td></tr>
<tr><td>x x _ _</td><td>Alarm No. setting
Set the digits when you execute the trigger with arbitrary alarm No. for the drive recorder function.
When "0 0" are set, arbitrary alarm trigger of the drive recorder will be disabled.</td><td>00h</td></tr>
</table>
Setting example:
To activate the drive recorder when [AL. 50 Overload 1] occurs, set "5 0 0 0".
To activate the drive recorder when [AL. 50.3 Thermal overload error 4 during operation] occurs, set "5 0 0 3".</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA24</td><td>AOP4</td><td>Function selection A-4
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Vibration suppression mode selection
0: Standard mode
1: 3 inertia mode
2: Low response mode
When two low resonance frequencies are generated, select "3 inertia mode (_ _ _ 1)". When the load to motor inertia ratio exceeds the recommended load to motor inertia ratio, select "Low response mode (_ _ _ 2)".
When you select the standard mode or low response mode, "Vibration suppression control 2" is not available.
When you select the 3 inertia mode, the feed forward gain is not available.
Before changing the control mode with the controller during the 3 inertia mode or low response mode, stop the motor.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA25</td><td>OTHOV</td><td>One-touch tuning - Overshoot permissible level
Set a permissible value of overshoot amount for one-touch tuning as a percentage of the in-position range.
However, setting "0" will be 50%.</td><td>0
[%]</td><td>0
to
100</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PA26	*AOP5	Function selection A-5	Refer to Name and function column.	

Setting digit	Explanation	Initial value
_ _ _ x	Torque limit function selection at instantaneous power failure 0: Disabled 1: Enabled When an instantaneous power failure occurs during operation, you can save electric energy charged in the capacitor in the servo amplifier by limiting torque at acceleration. You can also delay the time until [AL. 10.2 Voltage drop in the main circuit power] occurs with instantaneous power failure tough drive function. Doing this will enable you to set a longer time in [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time]. The torque limit function at instantaneous power failure is enabled when "SEMI-F47 function selection" in [Pr. PA20] is "Enabled (_ 1 _ _)".	0h
_ _ x _	For manufacturer setting	0h
_ x _ _		0h
x _ _ _		0h

(b) Gain/filter setting parameters ([Pr. PB_ _])

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB01	FILT	Adaptive tuning mode (adaptive filter II) Set the adaptive filter tuning.	Refer to Name and function column.	

Setting digit	Explanation	Initial value
_ _ _ x	Filter tuning mode selection Select the adjustment mode of the machine resonance suppression filter 1. For details, refer to section 7.1.2 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual". 0: Disabled 1: Automatic setting 2: Manual setting	0h
_ _ x _	For manufacturer setting	0h
_ x _ _		0h
x _ _ _		0h

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB02</td><td>VRFT</td><td>Vibration suppression control tuning mode (advanced vibration suppression control II)
This is used to set the vibration suppression control tuning. For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Vibration suppression control 1 tuning mode selection
Select the tuning mode of the vibration suppression control 1.
0: Disabled
1: Automatic setting
2: Manual setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Vibration suppression control 2 tuning mode selection
Select the tuning mode of the vibration suppression control 2. To enable the digit, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24 Function selection A-4].
0: Disabled
1: Automatic setting
2: Manual setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB03</td><td>TFBGN</td><td>Torque feedback loop gain
Set a torque feedback loop gain in the continuous operation to torque control mode.
Decreasing the setting value will also decrease a collision load during continuous operation to torque control mode.
Setting a value less than 6 rad/s will be 6 rad/s.</td><td>18000
[rad/s]</td><td>0
to
18000</td></tr>
<tr><td>PB04</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain.
When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. When the super trace control is enabled, constant speed and uniform acceleration/deceleration droop pulses will be almost 0. However, sudden acceleration/ deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1 s or more as the acceleration time constant up to the rated speed.</td><td>0
[%]</td><td>0
to
100</td></tr>
<tr><td>PB06</td><td>GD2</td><td>Load to motor inertia ratio
Set a load to motor inertia ratio.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details. When the parameter is automatic setting, the value will vary between 0.00 and 100.00.
<table>
<tr><th>Pr. PA08</th><th>This parameter</th></tr>
<tr><td>_ _ _ 0 (2 gain adjustment mode 1 (interpolation mode))</td><td rowspan="2">Automatic setting</td></tr>
<tr><td>_ _ _ 1 (Auto tuning mode 1)</td></tr>
<tr><td>_ _ _ 2 (Auto tuning mode 2)</td><td rowspan="3">Manual setting</td></tr>
<tr><td>_ _ _ 3 (Manual mode)</td></tr>
<tr><td>_ _ _ 4 (2 gain adjustment mode 2)</td></tr>
</table>
</td><td>7.00
[Multiplier]</td><td>0.00
to
300.00</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB07</td><td>PG1</td><td>Model loop gain
Set the response gain up to the target position.
Increasing the setting value will also increase the response level to the position command but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.
<table>
<tr><th>Pr. PA08</th><th>This parameter</th></tr>
<tr><td>_ _ _ 0 (2 gain adjustment mode 1 (interpolation mode))</td><td>Manual setting</td></tr>
<tr><td>_ _ _ 1 (Auto tuning mode 1)</td><td rowspan="2">Automatic setting</td></tr>
<tr><td>_ _ _ 2 (Auto tuning mode 2)</td></tr>
<tr><td>_ _ _ 3 (Manual mode)</td><td rowspan="2">Manual setting</td></tr>
<tr><td>_ _ _ 4 (2 gain adjustment mode 2)</td></tr>
</table>
</td><td>15.0
[rad/s]</td><td>1.0
to
2000.0</td></tr>
<tr><td>PB08</td><td>PG2</td><td>Position loop gain
Set the gain of the position loop.
Set this parameter to increase the position response to level load disturbance.
Increasing the setting value will also increase the response level to the load disturbance but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.
<table>
<tr><th>Pr. PA08</th><th>This parameter</th></tr>
<tr><td>_ _ _ 0 (2 gain adjustment mode 1 (interpolation mode))</td><td rowspan="3">Automatic setting</td></tr>
<tr><td>_ _ _ 1 (Auto tuning mode 1)</td></tr>
<tr><td>_ _ _ 2 (Auto tuning mode 2)</td></tr>
<tr><td>_ _ _ 3 (Manual mode)</td><td>Manual setting</td></tr>
<tr><td>_ _ _ 4 (2 gain adjustment mode 2)</td><td>Automatic setting</td></tr>
</table>
</td><td>37.0
[rad/s]</td><td>1.0
to
2000.0</td></tr>
<tr><td>PB09</td><td>VG2</td><td>Speed loop gain
Set the gain of the speed loop.
Set this parameter when vibration occurs on machines of low rigidity or large backlash. Increasing the setting value will also increase the response level but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.</td><td>823
[rad/s]</td><td>20
to
65535</td></tr>
<tr><td>PB10</td><td>VIC</td><td>Speed integral compensation
Set the integral time constant of the speed loop.
Decreasing the setting value will increase the response level but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.</td><td>33.7
[ms]</td><td>0.1
to
1000.0</td></tr>
<tr><td>PB11</td><td>VDC</td><td>Speed differential compensation
Set the differential compensation.
To enable the parameter, select "Continuous PID control enabled (_ _ 3 _)" of "PI-PID switching control selection" in [Pr. PB24].</td><td>980</td><td>0
to
1000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB12</td><td>OVA</td><td>Overshoot amount compensation
Set a percentage of viscous friction torque against the servo motor rated value or thrust against the linear servo motor rated value.
When the response level is low, or when the torque is limited, the efficiency of the parameter may be lower.</td><td>0
[%]</td><td>0
to
100</td></tr>
<tr><td>PB13</td><td>NH1</td><td>Machine resonance suppression filter 1
Set the notch frequency of the machine resonance suppression filter 1.
When you select "Automatic setting (_ _ _ 1)" of "Filter tuning mode selection" in [Pr. PB01], this parameter will be adjusted automatically.
When you select "Manual setting (_ _ _ 2)" of "Filter tuning mode selection" in [Pr. PB01], the setting value will be enabled.</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
<tr><td>PB14</td><td>NHQ1</td><td>Notch shape selection 1
Set the shape of the machine resonance suppression filter 1.
When you select "Automatic setting (_ _ _ 1)" of "Filter tuning mode selection" in [Pr. PB01], this parameter will be adjusted automatically.
Set manually for the manual setting.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB15</td><td>NH2</td><td>Machine resonance suppression filter 2
Set the notch frequency of the machine resonance suppression filter 2.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 2 selection" in [Pr. PB16].</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
<tr><td>PB16</td><td>NHQ2</td><td>Notch shape selection 2
Set the shape of the machine resonance suppression filter 2.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Machine resonance suppression filter 2 selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB17	NHF	Shaft resonance suppression filter Set the shaft resonance suppression filter. Use this to suppress a high-frequency machine vibration. When you select "Automatic setting (_ _ _ 0)" of "Shaft resonance suppression filter selection" in [Pr. PB23], the value will be calculated automatically from the servo motor you use and load to motor inertia ratio. When "Manual setting (_ _ _ 1)" is selected, the value set in this parameter will be used. When "Shaft resonance suppression filter selection" is "Disabled (_ _ _ 2)" in [Pr. PB23], the setting value of this parameter will be disabled. When you select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49], the shaft resonance suppression filter is not available.	Refer to Name and function column.	

Setting digit	Explanation	Initial value
_ _ x x	Shaft resonance suppression filter setting frequency selection Refer to table 13.4 for settings. Set the value closest to the frequency you need.	00h
_ x _ _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h
x _ _ _	For manufacturer setting	0h

Table 13.4 Shaft resonance suppression filter setting frequency selection

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
00	Disabled	10	562
01	Disabled	11	529
02	4500	12	500
03	3000	13	473
04	2250	14	450
05	1800	15	428
06	1500	16	409
07	1285	17	391
08	1125	18	375
09	1000	19	360
0A	900	1A	346
0B	818	1B	333
0C	750	1C	321
0D	692	1D	310
0E	642	1E	300
0F	600	1F	290

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB18	LPF	Low-pass filter setting Set the low-pass filter. The following shows a relation of a required parameter to this parameter.	3141 [rad/s]	100 to 18000

[Pr. PB23]	[Pr. PB18]
_ _ 0 _ (Initial value)	Automatic setting
_ _ 1 _	Setting value enabled
_ _ 2 _	Setting value disabled

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PB19</td><td>VRF11</td><td>Vibration suppression control 1 - Vibration frequency
Set the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When you select “Automatic setting (_ _ _ 1)” of “Vibration suppression control 1 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ _ 2)” is selected, the value set in this parameter will be used. For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>100.0
[Hz]</td><td>0.1
to
300.0</td></tr>
<tr><td>PB20</td><td>VRF12</td><td>Vibration suppression control 1 - Resonance frequency
Set the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When you select “Automatic setting (_ _ _ 1)” of “Vibration suppression control 1 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ _ 2)” is selected, the value set in this parameter will be used. For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>100.0
[Hz]</td><td>0.1
to
300.0</td></tr>
<tr><td>PB21</td><td>VRF13</td><td>Vibration suppression control 1 - Vibration frequency damping
Set a damping of the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When you select “Automatic setting (_ _ _ 1)” of “Vibration suppression control 1 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ _ 2)” is selected, the value set in this parameter will be used. For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>0.00</td><td>0.00
to
0.30</td></tr>
<tr><td>PB22</td><td>VRF14</td><td>Vibration suppression control 1 - Resonance frequency damping
Set a damping of the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When you select “Automatic setting (_ _ _ 1)” of “Vibration suppression control 1 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ _ 2)” is selected, the value set in this parameter will be used. For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>0.00</td><td>0.00
to
0.30</td></tr>
<tr><td>PB23</td><td>VFBF</td><td>Low-pass filter selection
Select the shaft resonance suppression filter and low-pass filter.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Shaft resonance suppression filter selection
0: Automatic setting
1: Manual setting
2: Disabled
When you select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49], the shaft resonance suppression filter is not available.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Low-pass filter selection
0: Automatic setting
1: Manual setting
2: Disabled</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PB24</td><td>*MVS</td><td>Slight vibration suppression control
Select the slight vibration suppression control and PI-PID switching control.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Slight vibration suppression control selection
0: Disabled
1: Enabled
To enable the slight vibration suppression control, select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Slight vibration suppression control cannot be used in the speed control mode.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>PI-PID switching control selection
0: PI control enabled
(Switching to PID control is possible with commands of servo system controller.)
3: Continuous PID control enabled
If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the PC (Proportion control) upon positioning completion will suppress the unnecessary torque generated to compensate for a position shift.</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB26</td><td>*CDP</td><td>Gain switching function
Select the gain switching condition.
Set conditions to enable the gain switching values set in [Pr. PB29] to [Pr. PB36] and [Pr. PB56] to [Pr. PB60].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Gain switching selection
0: Disabled
1: Control command from controller is enabled
2: Command frequency
3: Droop pulses
4: Servo motor speed</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Gain switching condition selection
0: Gain after switching is enabled with gain switching condition or more
1: Gain after switching is enabled with gain switching condition or less</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB27</td><td>CDL</td><td>Gain switching condition
Set the value of the gain switching (command frequency, droop pulses, or servo motor speed) selected in [Pr. PB26].
The set value unit differs depending on the switching condition item. (Refer to "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" section 7.2.3.)</td><td>10
[kpulse/s]
/[pulse]
/[r/min]</td><td>0
to
65535</td></tr>
<tr><td>PB28</td><td>CDT</td><td>Gain switching time constant
Set the time constant at which the gains will change in response to the conditions set in [Pr. PB26] and [Pr. PB27].</td><td>1
[ms]</td><td>0
to
100</td></tr>
<tr><td>PB29</td><td>GD2B</td><td>Load to motor inertia ratio after gain switching
Set a load to motor inertia ratio for when gain switching is enabled.
This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].</td><td>7.00
[Multiplier]</td><td>0.00
to
300.00</td></tr>
</table>

No.	Symbol	Name and function	Initial value [Unit]	Setting range
PB30	PG2B	Position loop gain after gain switching Set the position loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB08]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].	0.0 [rad/s]	0.0 to 2000.0
PB31	VG2B	Speed loop gain after gain switching Set the speed loop gain when the gain switching is enabled. When you set a value less than 20 rad/s, the value will be the same as [Pr. PB09]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].	0 [rad/s]	0 to 65535
PB32	VICB	Speed integral compensation after gain switching Set the speed integral compensation when the gain changing is enabled. When you set a value less than 0.1 ms, the value will be the same as [Pr. PB10]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].	0.0 [ms]	0.0 to 5000.0
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching Set the vibration frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB19]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching Set the resonance frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB20]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching Set a damping of the vibration frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching Set a damping of the resonance frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30

No.	Symbol	Name and function	Initial value [Unit]	Setting range
PB45	CNHF	Command notch filter Set the command notch filter.	Refer to Name and function column.	

Setting digit	Explanation	Initial value
_ _ x x	Command notch filter setting frequency selection Refer to table 13.5 for the relation of setting values to frequency.	00h
_ x _ _	Notch depth selection Refer to table 13.6 for details.	0h
x _ _ _	For manufacturer setting	0h

Table 13.5 Command notch filter setting frequency selection

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
00	Disabled	20	70	40	17.6
01	2250	21	66	41	16.5
02	1125	22	62	42	15.6
03	750	23	59	43	14.8
04	562	24	56	44	14.1
05	450	25	53	45	13.4
06	375	26	51	46	12.8
07	321	27	48	47	12.2
08	281	28	46	48	11.7
09	250	29	45	49	11.3
0A	225	2A	43	4A	10.8
0B	204	2B	41	4B	10.4
0C	187	2C	40	4C	10
0D	173	2D	38	4D	9.7
0E	160	2E	37	4E	9.4
0F	150	2F	36	4F	9.1
10	140	30	35.2	50	8.8
11	132	31	33.1	51	8.3
12	125	32	31.3	52	7.8
13	118	33	29.6	53	7.4
14	112	34	28.1	54	7.0
15	107	35	26.8	55	6.7
16	102	36	25.6	56	6.4
17	97	37	24.5	57	6.1
18	93	38	23.4	58	5.9
19	90	39	22.5	59	5.6
1A	86	3A	21.6	5A	5.4
1B	83	3B	20.8	5B	5.2
1C	80	3C	20.1	5C	5.0
1D	77	3D	19.4	5D	4.9
1E	75	3E	18.8	5E	4.7
1F	72	3F	18.2	5F	4.5

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB45</td><td>CNHF</td><td>Table 13.6 Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth [dB]</th></tr>
<tr><td>0</td><td>-40.0</td></tr>
<tr><td>1</td><td>-24.1</td></tr>
<tr><td>2</td><td>-18.1</td></tr>
<tr><td>3</td><td>-14.5</td></tr>
<tr><td>4</td><td>-12.0</td></tr>
<tr><td>5</td><td>-10.1</td></tr>
<tr><td>6</td><td>-8.5</td></tr>
<tr><td>7</td><td>-7.2</td></tr>
<tr><td>8</td><td>-6.0</td></tr>
<tr><td>9</td><td>-5.0</td></tr>
<tr><td>A</td><td>-4.1</td></tr>
<tr><td>B</td><td>-3.3</td></tr>
<tr><td>C</td><td>-2.5</td></tr>
<tr><td>D</td><td>-1.8</td></tr>
<tr><td>E</td><td>-1.2</td></tr>
<tr><td>F</td><td>-0.6</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB46</td><td>NH3</td><td>Machine resonance suppression filter 3
Set the notch frequency of the machine resonance suppression filter 3.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 3 selection" in [Pr. PB47].</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
<tr><td>PB47</td><td>NHQ3</td><td>Notch shape selection 3
Set the shape of the machine resonance suppression filter 3.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Machine resonance suppression filter 3 selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB48</td><td>NH4</td><td>Machine resonance suppression filter 4
Set the notch frequency of the machine resonance suppression filter 4.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49].</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
</table>

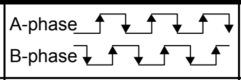
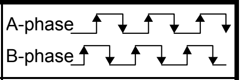
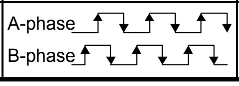
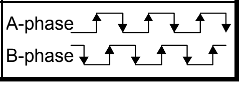
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB49</td><td>NHQ4</td><td>Notch shape selection 4
Set the shape of the machine resonance suppression filter 4.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Machine resonance suppression filter 4 selection
0: Disabled
1: Enabled
When you select "Enabled" of this digit, [Pr. PB17 Shaft resonance suppression filter] is not available.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB50</td><td>NH5</td><td>Machine resonance suppression filter 5
Set the notch frequency of the machine resonance suppression filter 5.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 5 selection" in [Pr. PB51].</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
<tr><td>PB51</td><td>NHQ5</td><td>Notch shape selection 5
Set the shape of the machine resonance suppression filter 5.
When you select "Enabled (_ _ _ 1)" of "Robust filter selection" in [Pr. PE41], the machine resonance suppression filter 5 is not available.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Machine resonance suppression filter 5 selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB52</td><td>VRF21</td><td>Vibration suppression control 2 - Vibration frequency
Set the vibration frequency for vibration suppression control 2 to suppress low-frequency machine vibration.
When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled.
When you select “Automatic setting (_ _ 1 _)” of “Vibration suppression control 2 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ 2 _)” is selected, the value set in this parameter will be used.</td><td>100.0
[Hz]</td><td>0.1
to
300.0</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB53	VRF22	Vibration suppression control 2 - Resonance frequency Set the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. When you select “Automatic setting (_ _ 1 _)” of “Vibration suppression control 2 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ 2 _)” is selected, the value set in this parameter will be used.	100.0 [Hz]	0.1 to 300.0
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping Set a damping of the vibration frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. When you select “Automatic setting (_ _ 1 _)” of “Vibration suppression control 2 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ 2 _)” is selected, the value set in this parameter will be used.	0.00	0.00 to 0.30
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping Set a damping of the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. When you select “Automatic setting (_ _ 1 _)” of “Vibration suppression control 2 tuning mode selection” in [Pr. PB02], this parameter will be set automatically. When “Manual setting (_ _ 2 _)” is selected, the value set in this parameter will be used.	0.00	0.00 to 0.30
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching Set the vibration frequency for vibration suppression control 2 when the gain switching is enabled. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching Set the resonance frequency for vibration suppression control 2 when the gain switching is enabled. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching Set a damping of the vibration frequency for vibration suppression control 2 when the gain switching is enabled. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching Set a damping of the resonance frequency for vibration suppression control 2 when the gain switching is enabled. When you select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24] the setting value in this parameter will be enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30
PB60	PG1B	Model loop gain after gain switching Set the model loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB07]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [rad/s]	0.0 to 2000.0

(c) Extension setting parameters ([Pr. PC_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC01</td><td>ERZ</td><td>Error excessive alarm level
Set an error excessive alarm level.
Set this per rev for rotary servo motors. Setting "0" will be 3 rev. Setting over 200 rev will be clamped at 200 rev.

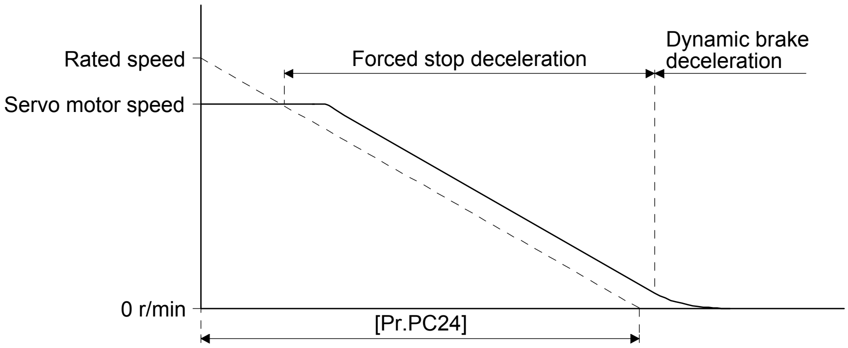
Note. Setting can be changed in [Pr. PC06].</td><td>0
[rev]
(Note)</td><td>0
to
1000</td></tr>
<tr><td>PC02</td><td>MBR</td><td>Electromagnetic brake sequence output
Set the delay time from when MBR (Electromagnetic brake interlock) turns off till when the base drive circuit is shut-off.</td><td>0
[ms]</td><td>0
to
1000</td></tr>
<tr><td>PC03</td><td>*ENRS</td><td>Encoder output pulse selection
Select an encoder pulse direction and encoder output pulse setting.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Encoder output pulse phase selection
0: Increasing A-phase 90° in CCW
1: Increasing A-phase 90° in CW
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>CCW</th><th>CW</th></tr>
<tr><td>0</td><td> </td><td> </td></tr>
<tr><td>1</td><td> </td><td> </td></tr>
</table>
</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Encoder output pulse setting selection
0: Output pulse setting
When "_ 1 0 _" is set in this parameter, [AL. 37 Parameter error] will occur.
1: Dividing ratio setting
3: A-phase/B-phase pulse electronic gear setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC04</td><td>**COP1</td><td>Function selection C-1
Select the encoder cable communication method selection.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Encoder cable communication method selection
0: Two-wire type
1: Four-wire type</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC05</td><td>**COP2</td><td>Function selection C-2
Set the motor-less operation and [AL. 9B Error excessive warning].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Motor-less operation selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>[AL. 9B Error excessive warning] selection
0: [AL. 9B Error excessive warning] disabled
1: [AL. 9B Error excessive warning] enabled
The setting of this digit is used by servo amplifier with software version A4 or later.</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC06</td><td>*COP3</td><td>Function selection C-3
Select the error excessive alarm level unit for the [Pr. PC01] setting. The parameter is not available in the speed control mode and torque control mode.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Error excessive alarm level unit selection
0: 1 rev unit
1: 01 rev unit
2: 001 rev unit
3: 0001 rev unit</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC07</td><td>ZSP</td><td>Zero speed
Set an output range of ZSP (Zero speed detection).
ZSP (Zero speed detection) has hysteresis of 20 r/min.</td><td>50
[r/min]</td><td>0
to
10000</td></tr>
<tr><td>PC08</td><td>OSL</td><td>Overspeed alarm detection level
Set an overspeed alarm detection level.
When you set a value more than "servo motor maximum speed × 120%", the set value will be clamped.
When you set "0", the value of "servo motor maximum speed × 120%" will be set.</td><td>0
[r/min]</td><td>0
to
20000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC09</td><td>MOD1</td><td>Analog monitor 1 output
Select a signal to output to MO1 (Analog monitor 1). Refer to app. 11 (3) of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" for the detection point of output selection.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Analog monitor 1 output selection
Refer to table 13.7 for settings.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
Table 13.7 Analog monitor setting value
<table>
<tr><th>Setting value</th><th>Item</th></tr>
<tr><td>00</td><td>Servo motor speed (±8 V/max. speed)</td></tr>
<tr><td>01</td><td>Torque (±8 V/max. torque)</td></tr>
<tr><td>02</td><td>Servo motor speed (+8 V/max. speed)</td></tr>
<tr><td>03</td><td>Torque (+8 V/max. torque)</td></tr>
<tr><td>04</td><td>Current command (±8 V/max. current command)</td></tr>
<tr><td>05</td><td>Speed command (±8 V/max. speed)</td></tr>
<tr><td>06</td><td>Servo motor-side droop pulses (±10 V/100 pulses) (Note)</td></tr>
<tr><td>07</td><td>Servo motor-side droop pulses (±10 V/1000 pulses) (Note)</td></tr>
<tr><td>08</td><td>Servo motor-side droop pulses (±10 V/10000 pulses) (Note)</td></tr>
<tr><td>09</td><td>Servo motor-side droop pulses (±10 V/100000 pulses) (Note)</td></tr>
<tr><td>0A</td><td>Feedback position (±10 V/1 Mpulse) (Note)</td></tr>
<tr><td>0B</td><td>Feedback position (±10 V/10 Mpulses) (Note)</td></tr>
<tr><td>0C</td><td>Feedback position (±10 V/100 Mpulses) (Note)</td></tr>
<tr><td>0D</td><td>Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V)</td></tr>
<tr><td>0E</td><td>Speed command 2 (±8 V/max. speed)</td></tr>
<tr><td>17</td><td>Internal temperature of encoder (±10 V/±128 ˚C)</td></tr>
</table>
Note. Encoder pulse unit</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC10</td><td>MOD2</td><td>Analog monitor 2 output
Select a signal to output to MO2 (Analog monitor 2). Refer to app. 11 (3) of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" for the detection point of output selection.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Analog monitor 2 output selection
Refer to [Pr. PC09] for settings.</td><td>01h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC11</td><td>MO1</td><td>Analog monitor 1 offset
Set the offset voltage of MO1 (Analog monitor 1).</td><td>0
[mV]</td><td>-999
to
999</td></tr>
<tr><td>PC12</td><td>MO2</td><td>Analog monitor 2 offset
Set the offset voltage of MO2 (Analog monitor 2).</td><td>0
[mV]</td><td>-999
to
999</td></tr>
<tr><td>PC13</td><td>MOSDL</td><td>Analog monitor - Feedback position output standard data - Low
Set a monitor output standard position (lower 4 digits) for the feedback position when selecting "Feedback position" for MO1 (Analog monitor 1) and MO2 (Analog monitor 2).
Monitor output standard position = [Pr. PC14] setting × 10000 + [Pr. PC13] setting</td><td>0
[pulse]</td><td>-9999
to
9999</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC14</td><td>MOSDH</td><td>Analog monitor - Feedback position output standard data - High
Set a monitor output standard position (higher 4 digits) for the feedback position when selecting "Feedback position" for MO1 (Analog monitor 1) and MO2 (Analog monitor 2).
Monitor output standard position = [Pr. PC14] setting × 10000 + [Pr. PC13] setting</td><td>0
[10000 pulses]</td><td>-9999
to
9999</td></tr>
<tr><td>PC17</td><td>**COP4</td><td>Function selection C-4
Select a home position setting condition.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Selection of home position setting condition
0: Need to pass servo motor Z-phase after power on
1: Not need to pass servo motor Z-phase after power on</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC18</td><td>*COP5</td><td>Function selection C-5
Select an occurring condition of [AL. E9 Main circuit off warning].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>[AL. E9 Main circuit off warning] selection
0: Detection with the ready-on and servo-on command
1: Detection only with the servo-on command</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC20</td><td>*COP7</td><td>Function selection C-7
Select the detection method of [AL. 10 Undervoltage].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Undervoltage alarm detection method selection
Set this parameter when [AL. 10 undervoltage] occurs due to distorted power supply voltage waveform while using FR-RC-(H) or FR-CV-(H).
0: [AL. 10] not occurrence
1: [AL. 10] occurrence</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Undervoltage alarm selection
Select the alarm and warning that occurs when the bus voltage drops to the
undervoltage alarm level.
0: [AL. 10] regardless of servo motor speed
1: [AL. E9] at servo motor speed 50 r/min or less, [AL. 10] at over 50 r/min</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC21</td><td>*BPS</td><td>Alarm history clear
Used to clear the alarm history.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Alarm history clear selection
0: Disabled
1: Enabled
When you select "Enabled", the alarm history will be cleared at next power-on. After the alarm history is cleared, the setting is automatically disabled.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC24</td><td>RSBR</td><td>Forced stop deceleration time constant
Set a deceleration time constant for the forced stop deceleration function.
Set the time taken to reach 0 r/min from the rated speed in ms unit.

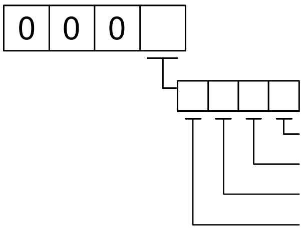


[Precautions]
・If the servo motor torque is saturated at the maximum torque during forced stop deceleration because the set time is too short, the time to stop will be longer than the set time constant.
・[AL. 50 Overload alarm 1] or [AL. 51 Overload alarm 2] may occur during forced stop deceleration, depending on the set value.
・After an alarm that leads to a forced stop deceleration, if an alarm that does not lead to a forced stop deceleration occurs or if the control circuit power supply is cut, dynamic braking will start regardless of the deceleration time constant setting.
・Set a longer time than deceleration time at quick stop of the controller. If a shorter time is set, [AL. 52 Error excessive] may occur.</td><td>100
[ms]</td><td>0
to
20000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC29</td><td>*COPB</td><td>Function selection C-B
Select the POL reflection at torque control.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>POL reflection selection at torque control
0: Enabled
1: Disabled</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC31</td><td>RSUP1</td><td>Vertical axis freefall prevention compensation amount
Set the compensation amount of the vertical axis freefall prevention function.
Set it in the unit of servo motor rotation amount.
When a positive value is set, compensation is performed to increase the command address. When a negative value is set, compensation is performed to decrease the command address.
The vertical axis freefall prevention function is performed when all of the following conditions are met.
1) Position control mode
2) The value of the parameter is other than "0".
3) The forced stop deceleration function is enabled.
4) An alarm has occurred or EM2 has turned off when the servo motor speed is zero speed or less.
5) MBR (Electromagnetic brake interlock) was enabled in [Pr. PD07] to [Pr. PD09], and the base circuit shut-off delay time was set in [Pr. PC16].</td><td>0
[0.0001 rev]</td><td>-25000
to
25000</td></tr>
<tr><td>PC38</td><td>ERW</td><td>Error excessive warning level
Set an error excessive warning level.
To enable the parameter, select "Enabled (1 _ _ _)" of "[AL. 9B Error excessive warning] selection" in [Pr. PC05].
You can change the setting unit with "Error excessive alarm/error excessive warning level unit selection" in [Pr. PC06].
Set the level in rev unit. When "0" is set, 1 rev will be applied. Setting over 200 rev will be clamped to 200 rev.

When an error reaches the set value, [AL. 9B Error excessive warning] will occur. When the error decreases lower than the set value, the warning will be canceled automatically. The minimum pulse width of the warning signal is 100 [ms].
Set as follows.: [Pr. PC38 Error excessive warning level] < [Pr. PC01 Error excessive alarm level] When you set as follows, [AL. 52 Error excessive] will occur earlier than the warning.: [Pr. PC38 Error excessive warning level] ≥ [Pr. PC01 Error excessive alarm level]
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[rev]</td><td>0
to
1000</td></tr>
</table>

(d) I/O setting parameters ([Pr. PD_ _])

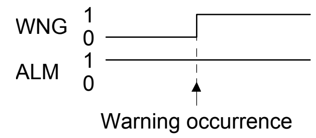
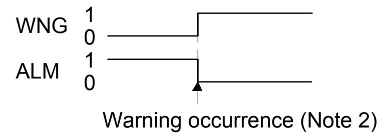
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD02</td><td>*DIA2</td><td>
Input signal automatic on selection 2
<table>
<tr><th colspan="2">Setting digit</th><th rowspan="2">Explanation</th><th rowspan="2">Initial value</th></tr>
<tr><th>HEX.</th><th>BIN.</th></tr>
<tr><td rowspan="4">_ _ _ x</td><td>_ _ _ x</td><td>FLS (Upper stroke limit) selection
0: Disabled
1: Enabled</td><td rowspan="4">0h</td></tr>
<tr><td>_ _ x _</td><td>RLS (Lower stroke limit) selection
0: Disabled
1: Enabled</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td></tr>
<tr><td>x _ _ _</td></tr>
<tr><td>_ _ x _</td><td rowspan="3"></td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
Convert the setting value into hexadecimal as follows.


<table>
<tr><th rowspan="2">Signal name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>FLS (Upper stroke limit) selection</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>RLS (Lower stroke limit) selection</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Use for an external input signal.
BIN 1: Automatic on
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

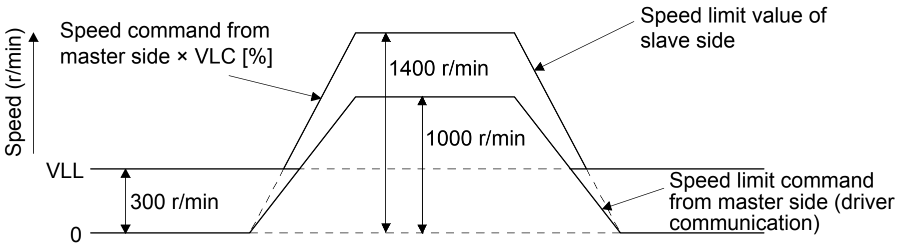
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD07</td><td>*DO1</td><td>Output device selection 1
You can assign any output device to the CN3-13 pin. As the initial value, MBR (Electromagnetic brake interlock) is assigned to the pin.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Device selection
Refer to table 13.8 for settings.</td><td>05h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
Table 13.8 Selectable output devices
<table>
<tr><th>Setting value</th><th>Output device</th></tr>
<tr><td>00</td><td>Always off</td></tr>
<tr><td>02</td><td>RD (Ready)</td></tr>
<tr><td>03</td><td>ALM (Malfunction)</td></tr>
<tr><td>04</td><td>INP (In-position)</td></tr>
<tr><td>05</td><td>MBR (Electromagnetic brake interlock)</td></tr>
<tr><td>06</td><td>DB (Dynamic brake interlock)</td></tr>
<tr><td>07</td><td>TLC (Limiting torque)</td></tr>
<tr><td>08</td><td>WNG (Warning)</td></tr>
<tr><td>09</td><td>BWNG (Battery warning)</td></tr>
<tr><td>0A</td><td>SA (Speed reached)</td></tr>
<tr><td>0C</td><td>ZSP (Zero speed detection)</td></tr>
<tr><td>0F</td><td>CDPS (Variable gain selection)</td></tr>
<tr><td>11</td><td>ABSV (Absolute position undetermined)</td></tr>
<tr><td>17</td><td>MTTR (During tough drive)</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD08</td><td>*DO2</td><td>Output device selection 2
You can assign any output device to the CN3-9 pin. INP (In-position) is assigned as the initial value.
The devices that can be assigned and the setting method are the same as in [Pr. PD07].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Device selection
Refer to table 13.8 in [Pr. PD07] for settings.</td><td>04h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD09</td><td>*DO3</td><td>Output device selection 3
You can assign any output device to the CN3-15 pin. ALM (Malfunction) is assigned as the initial value.
The devices that can be assigned and the setting method are the same as in [Pr. PD07].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Device selection
Refer to table 13.8 in [Pr. PD07] for settings.</td><td>03h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD11</td><td>*DIF</td><td>Input filter setting
Select the input filter.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Input signal filter selection
Refer to the servo system controller instruction manual for the setting.
If external input signal causes chattering due to noise, etc., input filter is used to suppress it.
0: None
1: 0.888 [ms]
2: 1.777 [ms]
3: 2.666 [ms]
4: 3.555 [ms]</td><td>4h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD12</td><td>*DOP1</td><td>Function selection D-1
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Servo motor thermistor enabled/disabled selection
0: Enabled
1: Disabled
For servo motors without thermistor, the setting will be disabled.
This parameter is used by servo amplifier with software version A1 or later.</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD13</td><td>*DOP2</td><td>Function selection D-2
Select a condition to turn on INP (In-position).
This parameter is supported with software version A4 or later.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>INP (In-position) on condition selection
Select a condition that INP (In-position) is turned on.
0: Droop pulses are within the in-position range.
1: The command pulse frequency is 0, and droop pulses are within the in-position range.
When the position command is not inputted for about 1 ms, the command pulse frequency is decided as 0.</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to the Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD14</td><td>*DOP3</td><td>Function selection D-3
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Selection of the output device at warning occurrence
Select WNG (Warning) and ALM (Malfunction) output status at warning occurrence.

Servo amplifier output
<table>
<tr><th>Setting value</th><th>(Note 1) Device status</th></tr>
<tr><td>0</td><td>
</td></tr>
<tr><td>1</td><td>
</td></tr>
</table>
Note 1. 0: Off
1: On
2. Although ALM is turned off upon occurrence of the warning, the forced stop deceleration is performed.</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD15</td><td>*IDCS</td><td>Driver communication setting
Select master/slave axis for the driver communication.
This is available only when the deceleration to a stop function is disabled. When the deceleration to a stop function is enabled, [AL. 37] will occur.
This parameter is supported with software version A2 or later.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Master axis operation selection
Setting "1" other than in standard control mode will trigger [AL. 37].
0: Disabled (not using master-slave operation function)
1: Enabled (this servo amplifier: master axis)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Slave axis operation selection
Setting "1" other than in standard control mode will trigger [AL. 37].
0: Disabled (not using master-slave operation function)
1: Enabled (this servo amplifier: slave axis)</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table>
<table>
<tr><th colspan="2">Master-slave operation function</th><th>Setting value</th></tr>
<tr><td>Not used</td><td></td><td>0000</td></tr>
<tr><td rowspan="2">Used</td><td>Master</td><td>0001</td></tr>
<tr><td>Slave</td><td>0010</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD16</td><td>*MD1</td><td>Driver communication setting - Master - Transmit data selection 1
Select transmit data from master axis to slave axis.
When setting this amplifier as master axis ([Pr. PD15] is "_ _ 0 1".), select "_ _ 3 8 (torque command)" with this parameter.
This parameter is supported with software version A2 or later.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Transmission data selection
00: Disabled
38: Torque command</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD17</td><td>*MD2</td><td>Driver communication setting - Master - Transmit data selection 2
Select transmit data from master axis to slave axis.
When setting this amplifier as master axis ([Pr. PD15] is "_ _ 0 1".), select "_ _ 3 A (speed limit command)" with this parameter.
This parameter is supported with software version A2 or later.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Transmission data selection
00: Disabled
3A: speed limit command</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD20</td><td>*SLA1</td><td>Driver communication setting - Slave - Master axis No. selection 1
Select a master axis when this amplifier is slave axis.
When setting this amplifier as slave axis ([Pr. PD15] is "_ _ 1 0".), set the axis No. of the servo amplifier of master. Refer to section 4.3.1 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" for details of axis Nos. Setting "0" disables this parameter.
This parameter is supported with software version A2 or later.</td><td>0</td><td>0 to 32</td></tr>
<tr><td>PD30</td><td>TLC</td><td>Master-slave operation - Torque command coefficient on slave
Set an internal torque command coefficient to torque command value received from master axis.
This parameter is enabled when this amplifier is set as slave axis ([Pr. PD15] is "_ _ 1 0".). The maximum value is 500. Setting over 500 will be 500.
Setting 100 [%] means multiplication of one. The torque ratio will be 100 (master) to 100 (slave).
Setting 90 [%] means multiplication of 0.9. The torque ratio will be 100 (master) to 90 (slave).
This parameter is supported with software version A2 or later.</td><td>0 [%]</td><td>0 to 500</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PD31	VLC	Master-slave operation - Speed limit coefficient on slave Set an internal speed limit value coefficient to speed limit command value received from master axis. This parameter is enabled when this amplifier is set as slave axis ([Pr. PD15] is "_ _ 1 0".). The maximum value is 500. Setting over 500 will be 500. Setting 100 [%] means multiplication of one. Setting example: [Pr. PD31 (VLC)] = 140 [%], [Pr. PD32 (VLL)] = 300 [r/min], and master side acceleration/deceleration at 1000 [r/min]  This parameter is supported with software version A2 or later.	0 [%]	0 to 500
PD32	VLL	Master-slave operation - Speed limit adjusted value on slave Set a minimum value for internal speed limit value. This parameter is enabled when this amplifier is set as slave axis ([Pr. PD15] is "_ _ 1 0".). The speed limit value will not be this setting value or lower. This parameter ensures torque control range at low speed driving (avoid area likely to reach speed limit). Set 100 to 500 [r/min] normally as a reference. Refer to [Pr. PD31] for the setting example. This parameter is supported with software version A2 or later.	0 [r/min]	0 to 32767

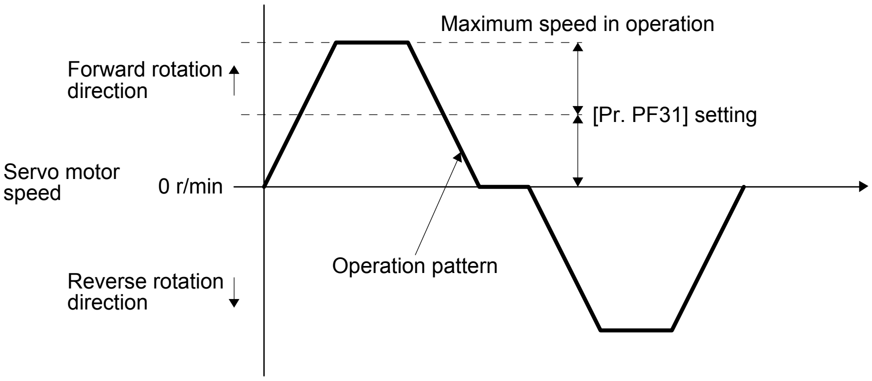
(e) Extension setting 2 parameters ([Pr. PE_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PE41</td><td>EOP3</td><td>Function selection E-3
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Robust filter selection
0: Disabled
1: Enabled
When you select "Enabled" of this digit, the machine resonance suppression filter 5 set in [Pr. PB51] is not available.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PE44</td><td>LMCP</td><td>Lost motion compensation positive-side compensation value selection
Set the lost motion compensation for when reverse rotation (CW) switches to forward rotation (CCW) in increments of 0.01% assuming the rated torque as 100%.
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[0.01%]</td><td>0
to
30000</td></tr>
<tr><td>PE45</td><td>LMCN</td><td>Lost motion compensation negative-side compensation value selection
Set the lost motion compensation for when forward rotation (CCW) switches to reverse rotation (CW) in increments of 0.01% assuming the rated torque as 100%.
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[0.01%]</td><td>0
to
30000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PE46</td><td>LMFLT</td><td>Lost motion filter setting
Set the time constant of the lost motion compensation filter in increments of 0.1 ms.
When "0" is set, the torque is compensated with the value set in [Pr. PE44] and [Pr. PE45]. When other than "0" is set, the torque is compensated with the high-pass filter output value of the set time constant, and the lost motion compensation will continue.
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[0.1 ms]</td><td>0
to
30000</td></tr>
<tr><td>PE47</td><td>TOF</td><td>Torque offset
Set this when canceling unbalanced torque of vertical axis. Set this assuming the rated torque of the servo motor as 100%.
The torque offset does not need to be set for a machine not generating unbalanced torque. The torque offset set with this parameter will be enabled in the position control mode, speed control mode, and torque control mode. Input commands assuming torque offset for the torque control mode.
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[0.01%]</td><td>-10000
to
10000</td></tr>
<tr><td>PE48</td><td>*LMOP</td><td>Lost motion compensation function selection
Select the lost motion compensation function.
This parameter setting is available with servo amplifiers with software version A4 or later.
<table>
<tr><th>Setting value</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Lost motion compensation selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Unit setting of lost motion compensation non-sensitive band
0: 1 pulse unit
1: 1 kpulse unit</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to the Name and function column.</td></tr>
<tr><td>PE49</td><td>LMCD</td><td>Lost motion compensation timing
Set the lost motion compensation timing in increments of 0.1 ms.
You can delay the timing to perform the lost motion compensation for the set time.
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[0.1 ms]</td><td>0
to
30000</td></tr>
<tr><td>PE50</td><td>LMCT</td><td>Lost motion compensation non-sensitive band
Set the lost motion compensation non-sensitive band. When the fluctuation of droop pulses equals to or less than the setting value, the speed will be 0. Setting can be changed in [Pr. PE48]. Set the parameter per encoder unit.
This parameter setting is available with servo amplifiers with software version A4 or later.</td><td>0
[pulse]/
[kpulse]</td><td>0
to
65535</td></tr>
</table>

(f) Extension setting 3 parameters ([Pr. PF_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PF06</td><td>*FOP5</td><td>Function selection F-5
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Electronic dynamic brake selection
0: Automatic (enabled only for specified servo motors)
2: Disabled
Refer to the following table for the specified servo motors.
<table>
<tr><th>Series</th><th>Servo motor</th></tr>
<tr><td>HG-KR</td><td>HG-KR053/HG-KR13/HG-KR23/HG-KR43</td></tr>
<tr><td>HG-MR</td><td>HG-MR053/HG-MR13/HG-MR23/HG-MR43</td></tr>
<tr><td>HG-SR</td><td>HG-SR51/HG-SR52</td></tr>
</table></td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PF12</td><td>DBT</td><td>Electronic dynamic brake operating time
Set an operating time for the electronic dynamic brake.</td><td>2000
[ms]</td><td>0
to
10000</td></tr>
<tr><td>PF21</td><td>DRT</td><td>Drive recorder switching time setting
Set a drive recorder switching time.
When a USB communication is cut during using a graph function, the function will be changed to the drive recorder function after the setting time of this parameter.
When a value from "1" to "32767" is set, it will switch after the setting value.
However, when "0" is set, it will switch after 600 s.
When "-1" is set, the drive recorder function is disabled.</td><td>0
[s]</td><td>-1
to
32767</td></tr>
<tr><td>PF23</td><td>OSCL1</td><td>Vibration tough drive - Oscillation detection level
Set a filter readjustment sensitivity of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] while the vibration tough drive is enabled.
Example: When you set "50" to the parameter, the filter will be readjusted at the time of 50% or more oscillation level.</td><td>50
[%]</td><td>0
to
100</td></tr>
<tr><td>PF24</td><td>*OSCL2</td><td>Vibration tough drive function selection
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Oscillation detection alarm selection
0: [AL. 54 Oscillation detection] will occur at oscillation detection.
1: [AL. F3.1 Oscillation detection warning] will occur at oscillation detection.
2: Oscillation detection function disabled
Select alarm or warning when an oscillation continues at a filter readjustment sensitivity level of [Pr. PF23].
The digit is continuously enabled regardless of the vibration tough drive in [Pr. PA20].</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PF25	CVAT	SEMI-F47 function - Instantaneous power failure detection time Set the time of the [AL. 10.1 Voltage drop in the control circuit power] occurrence. To disable the parameter, select "Disabled (_ 0 _ _)" of "SEMI-F47 function selection" in [Pr. PA20]. The [Pr. PA20 SEMI-F47 function selection] and [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time] settings of the drive unit must be the same as [Pr. PA17 SEMI-F47 function selection] and [Pr. PA18 SEMIF47 function - Instantaneous power failure detection time] settings of the converter unit.	200 [ms]	30 to 200
PF31	FRIC	Machine diagnosis function - Friction judgement speed Set a servo motor speed to divide a friction estimation area into high and low for the friction estimation process of the machine diagnosis. However, setting "0" will be the value half of the rated speed. When your operation pattern is under rated speed, we recommend that you set half value to the maximum speed with this. 	0 [r/min]	0 to Permissible speed

13.3 Troubleshooting

POINT

- ●Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.
- ●As soon as an alarm occurs, make the Servo-off status and interrupt the main circuit power.
- ●[AL. 37 Parameter error] and warnings (except [AL. F0 Tough drive warning]) are not recorded in the alarm history.

When an error occurs during operation, the corresponding alarm and warning are displayed. When an alarm or warning is displayed, refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure. When an alarm occurs, ALM will turn off.

13.3.1 Explanation for the lists

(1) No./Name/Detail No./Detail name
Indicates each No./Name/Detail No./Detail name of alarms or warnings.

(2) Stop method
For the alarms and warnings in which "SD" is written in the stop method column, the servo motor stops with the dynamic brake after forced stop deceleration. For the alarms and warnings in which "DB" or "EDB" is written in the stop method column, the servo motor stops with the dynamic brake without forced stop deceleration.

(3) Alarm deactivation
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column. Warnings are automatically canceled after the cause of occurrence is removed. Alarms are deactivated with alarm reset, CPU reset, or cycling the power.

Alarm deactivation	Explanation
Alarm reset	1. Reset command from controller 2. Click the "Occurring Alarm Reset" in the "Alarm Display" window of MR Configurator2
CPU reset	Resetting the controller itself
Cycling the power	Turning off the power and on again

13.3.2 Alarm list

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	10	Undervoltage	10.1	Voltage drop in the control circuit power	EDB	○	○	○
			10.2	Voltage drop in the main circuit power	SD	○	○	○
	11	Switch setting error	11.1	Axis number setting error/ Station number setting error	DB			○
			11.2	Disabling control axis setting error	DB			○
	12	Memory error 1 (RAM)	12.1	RAM error 1	DB			○
			12.2	RAM error 2	DB			○
			12.3	RAM error 3	DB			○
			12.4	RAM error 4	DB			○
			12.5	RAM error 5	DB			○
			12.6	RAM error 6	DB			○
	13	Clock error	13.1	Clock error 1	DB			○
			13.2	Clock error 2	DB			○
	14	Control process error	14.1	Control process error 1	DB			○
			14.2	Control process error 2	DB			○
			14.3	Control process error 3	DB			○
			14.4	Control process error 4	DB			○
			14.5	Control process error 5	DB			○
			14.6	Control process error 6	DB			○
			14.7	Control process error 7	DB			○
			14.8	Control process error 8	DB			○
			14.9	Control process error 9	DB			○
			14.A	Control process error 10	DB			○
			14.B	Control process error 11	DB			○
	15	Memory error 2 (EEP-ROM)	15.1	EEP-ROM error at power on	DB			○
			15.2	EEP-ROM error during operation	DB			○
			15.4	Home position information read error	DB			○
	16	Encoder initial communication error 1	16.1	Encoder initial communication - Receive data error 1	DB			○
			16.2	Encoder initial communication - Receive data error 2	DB			○
			16.3	Encoder initial communication - Receive data error 3	DB			○
			16.5	Encoder initial communication - Transmission data error 1	DB			○
			16.6	Encoder initial communication - Transmission data error 2	DB			○
			16.7	Encoder initial communication - Transmission data error 3	DB			○
			16.A	Encoder initial communication - Process error 1	DB			○
			16.B	Encoder initial communication - Process error 2	DB			○
			16.C	Encoder initial communication - Process error 3	DB			○
			16.D	Encoder initial communication - Process error 4	DB			○
			16.E	Encoder initial communication - Process error 5	DB			○
			16.F	Encoder initial communication - Process error 6	DB			○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	17	Board error	17.1	Board error 1	DB			○
			17.3	Board error 2	DB			○
			17.4	Board error 3	DB			○
			17.5	Board error 4	DB			○
			17.6	Board error 5	DB			○
			17.7	Board error 7	DB			○
			17.8	Board error 6 (Note 6)	EDB			○
			17.9	Board error 8	DB			○
	19	Memory error 3 (Flash-ROM)	19.1	Flash-ROM error 1	DB			○
			19.2	Flash-ROM error 2	DB			○
			19.3	Flash-ROM error 3	DB			○
	1A	Servo motor combination error	1A.1	Servo motor combination error 1	DB			○
			1A.2	Servo motor control mode combination error	DB			○
			1A.4	Servo motor combination error 2	DB			○
	1B	Converter error	1B.1	Converter unit error	DB			○
	1E	Encoder initial communication error 2	1E.1	Encoder malfunction	DB			○
			1E.2	Load-side encoder malfunction	DB			○
	1F	Encoder initial communication error 3	1F.1	Incompatible encoder	DB			○
			1F.2	Incompatible load-side encoder	DB			○
	20	Encoder normal communication error 1	20.1	Encoder normal communication - Receive data error 1	EDB			○
			20.2	Encoder normal communication - Receive data error 2	EDB			○
			20.3	Encoder normal communication - Receive data error 3	EDB			○
			20.5	Encoder normal communication - Transmission data error 1	EDB			○
			20.6	Encoder normal communication - Transmission data error 2	EDB			○
			20.7	Encoder normal communication - Transmission data error 3	EDB			○
			20.9	Encoder normal communication - Receive data error 4	EDB			○
			20.A	Encoder normal communication - Receive data error 5	EDB			○
	21	Encoder normal communication error 2	21.1	Encoder data error 1	EDB			○
			21.2	Encoder data update error	EDB			○
			21.3	Encoder data waveform error	EDB			○
			21.4	Encoder non-signal error	EDB			○
			21.5	Encoder hardware error 1	EDB			○
			21.6	Encoder hardware error 2	EDB			○
			21.9	Encoder data error 2	EDB			○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	24	Main circuit error	24.1	Ground fault detected by hardware detection circuit	DB			○
			24.2	Ground fault detected by software detection function	DB	○	○	○
	25	Absolute position erased	25.1	Servo motor encoder - Absolute position erased	DB			○
			25.2	Scale measurement encoder - Absolute position erased	DB			○
	27	Initial magnetic pole detection error	27.1	Initial magnetic pole detection - Abnormal termination	DB	○		○
			27.2	Initial magnetic pole detection - Time out error	DB	○		○
			27.3	Initial magnetic pole detection - Limit switch error	DB	○		○
			27.4	Initial magnetic pole detection - Estimated error	DB	○		○
			27.5	Initial magnetic pole detection - Position deviation error	DB	○		○
			27.6	Initial magnetic pole detection - Speed deviation error	DB	○		○
			27.7	Initial magnetic pole detection - Current error	DB	○		○
	28	Linear encoder error 2	28.1	Linear encoder - Environment error	EDB			○
	2A	Linear encoder error 1	2A.1	Linear encoder error 1-1	EDB			○
			2A.2	Linear encoder error 1-2	EDB			○
			2A.3	Linear encoder error 1-3	EDB			○
			2A.4	Linear encoder error 1-4	EDB			○
			2A.5	Linear encoder error 1-5	EDB			○
			2A.6	Linear encoder error 1-6	EDB			○
			2A.7	Linear encoder error 1-7	EDB			○
			2A.8	Linear encoder error 1-8	EDB			○
	2B	Encoder counter error	2B.1	Encoder counter error 1	EDB			○
			2B.2	Encoder counter error 2	EDB			○
	30	Regenerative error	30.1	Regeneration heat error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			30.2	Regeneration signal error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			30.3	Regeneration feedback signal error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	31	Overspeed	31.1	Abnormal motor speed	SD	○	○	○
	32	Overcurrent	32.1	Overcurrent detected at hardware detection circuit (during operation)	DB			○
			32.2	Overcurrent detected at software detection function (during operation)	DB	○	○	○
			32.3	Overcurrent detected at hardware detection circuit (during a stop)	DB			○
			32.4	Overcurrent detected at software detection function (during a stop)	DB	○	○	○
	33	Overvoltage	33.1	Main circuit voltage error	EDB	○	○	○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	34	SSCNET receive error 1	34.1	SSCNET receive data error	SD	○	○ (Note 5)	○
			34.2	SSCNET connector connection error	SD	○	○	○
			34.3	SSCNET communication data error	SD	○	○	○
			34.4	Hardware error signal detection	SD	○	○	○
			34.5	SSCNET receive data error (safety observation function)	SD	○	○	○
			34.6	SSCNET communication data error (safety observation function)	SD	○	○	○
	35	Command frequency error	35.1	Command frequency error	SD	○	○	○
	36	SSCNET receive error 2	36.1	Continuous communication data error	SD	○	○	○
			36.2	Continuous communication data error (safety observation function)	SD	○	○	○
	37	Parameter error	37.1	Parameter setting range error	DB		○	○
			37.2	Parameter combination error	DB		○	○
			37.3	Point table setting error	DB			○
	39	Program error	39.1	Program error	DB			○
			39.2	Instruction argument external error	DB			○
			39.3	Register No. error	DB			○
			39.4	Non-correspondence instruction error	DB			○
	3A	Inrush current suppression circuit error	3A.1	Inrush current suppression circuit error	EDB			○
	3D	Parameter setting error for driver communication	3D.1	Parameter combination error for driver communication on slave	DB			○
			3D.2	Parameter combination error for driver communication on master	DB			○
	3E	Operation mode error	3E.1	Operation mode error	DB		○	○
			3E.6	Operation mode switch error	DB			○
	42	Servo control error (for linear servo motor and direct drive motor)	42.1	Servo control error by position deviation	EDB	(Note 4)	(Note 4)	○
			42.2	Servo control error by speed deviation	EDB	(Note 4)	(Note 4)	○
			42.3	Servo control error by torque/thrust deviation	EDB	(Note 4)	(Note 4)	○
		Fully closed loop control error (for fully closed loop control)	42.8	Fully closed loop control error by position deviation	EDB	(Note 4)	(Note 4)	○
			42.9	Fully closed loop control error by speed deviation	EDB	(Note 4)	(Note 4)	○
			42.A	Fully closed loop control error by position deviation during command stop	EDB	(Note 4)	(Note 4)	○
	45	Main circuit device overheat	45.1	Main circuit device overheat error 1	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			45.2	Main circuit device overheat error 2	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	46	Servo motor overheat	46.1	Abnormal temperature of servo motor 1	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.2	Abnormal temperature of servo motor 2	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.3	Thermistor disconnected error	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.4	Thermistor circuit error	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.5	Abnormal temperature of servo motor 3	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.6	Abnormal temperature of servo motor 4	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	47	Cooling fan error	47.1	Cooling fan stop error	SD			○
			47.2	Cooling fan speed reduction error	SD			○
	50	Overload 1	50.1	Thermal overload error 1 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.2	Thermal overload error 2 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.3	Thermal overload error 4 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.4	Thermal overload error 1 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.5	Thermal overload error 2 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.6	Thermal overload error 4 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
	51	Overload 2	51.1	Thermal overload error 3 during operation	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			51.2	Thermal overload error 3 during a stop	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	52	Error excessive	52.1	Excess droop pulse 1	SD	○	○	○
			52.3	Excess droop pulse 2	SD	○	○	○
			52.4	Error excessive during 0 torque limit	SD	○	○	○
			52.5	Excess droop pulse 3	EDB	○	○	○
	54	Oscillation detection	54.1	Oscillation detection error	EDB	○	○	○
	56	Forced stop error	56.2	Over speed during forced stop	EDB	○	○	○
			56.3	Estimated distance over during forced stop	EDB	○	○	○
	61	Operation error	61.1	Point table setting range error	DB	○		○
	63	STO timing error	63.1	STO1 off	DB	○	○	○
			63.2	STO2 off	DB	○	○	○
			63.5	STO by functional safety unit	DB	○	○	○
	64	Functional safety unit setting error	64.1	STO input error	DB			○
			64.2	Compatibility mode setting error	DB			○
			64.3	Operation mode setting error	DB			○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	65	Functional safety unit connection error	65.1	Functional safety unit communication error 1	SD			○
			65.2	Functional safety unit communication error 2	SD			○
			65.3	Functional safety unit communication error 3	SD			○
			65.4	Functional safety unit communication error 4	SD			○
			65.5	Functional safety unit communication error 5	SD			○
			65.6	Functional safety unit communication error 6	SD			○
			65.7	Functional safety unit communication error 7	SD			○
			65.8	Functional safety unit shut-off signal error 1	DB			○
			65.9	Functional safety unit shut-off signal error 2	DB			○
	66	Encoder initial communication error (safety observation function)	66.1	Encoder initial communication - Receive data error 1 (safety observation function)	DB			○
			66.2	Encoder initial communication - Receive data error 2 (safety observation function)	DB			○
			66.3	Encoder initial communication - Receive data error 3 (safety observation function)	DB			○
			66.7	Encoder initial communication - Transmission data error 1 (safety observation function)	DB			○
			66.9	Encoder initial communication - Process error 1 (safety observation function)	DB			○
	67	Encoder normal communication error 1 (safety observation function)	67.1	Encoder normal communication - Receive data error 1 (safety observation function)	DB			○
			67.2	Encoder normal communication - Receive data error 2 (safety observation function)	DB			○
			67.3	Encoder normal communication - Receive data error 3 (safety observation function)	DB			○
			67.4	Encoder normal communication - Receive data error 4 (safety observation function)	DB			○
			67.7	Encoder normal communication - Transmission data error 1 (safety observation function)	DB			○
	68	STO diagnosis error	68.1	Mismatched STO signal error	DB			○
	69	Command error	69.1	Forward rotation-side software limit detection - Command excess error	SD	○	○	○
			69.2	Reverse rotation-side software limit detection - Command excess error	SD	○	○	○
			69.3	Forward rotation stroke end detection - Command excess error	SD	○	○	○
			69.4	Reverse rotation stroke end detection - Command excess error	SD	○	○	○
			69.5	Upper stroke limit detection - Command excess error	SD	○	○	○
			69.6	Lower stroke limit detection - Command excess error	SD	○	○	○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	70	Load-side encoder initial communication error 1	70.1	Load-side encoder initial communication - Receive data error 1	DB			○
			70.2	Load-side encoder initial communication - Receive data error 2	DB			○
			70.3	Load-side encoder initial communication - Receive data error 3	DB			○
			70.5	Load-side encoder initial communication - Transmission data error 1	DB			○
			70.6	Load-side encoder initial communication - Transmission data error 2	DB			○
			70.7	Load-side encoder initial communication - Transmission data error 3	DB			○
			70.A	Load-side encoder initial communication - Process error 1	DB			○
			70.B	Load-side encoder initial communication - Process error 2	DB			○
			70.C	Load-side encoder initial communication - Process error 3	DB			○
			70.D	Load-side encoder initial communication - Process error 4	DB			○
			70.E	Load-side encoder initial communication - Process error 5	DB			○
			70.F	Load-side encoder initial communication - Process error 6	DB			○
	71	Load-side encoder normal communication error 1	71.1	Load-side encoder normal communication - Receive data error 1	EDB			○
			71.2	Load-side encoder normal communication - Receive data error 2	EDB			○
			71.3	Load-side encoder normal communication - Receive data error 3	EDB			○
			71.5	Load-side encoder normal communication - Transmission data error 1	EDB			○
			71.6	Load-side encoder normal communication - Transmission data error 2	EDB			○
			71.7	Load-side encoder normal communication - Transmission data error 3	EDB			○
			71.9	Load-side encoder normal communication - Receive data error 4	EDB			○
			71.A	Load-side encoder normal communication - Receive data error 5	EDB			○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	72	Load-side encoder normal communication error 2	72.1	Load-side encoder data error 1	EDB			○
			72.2	Load-side encoder data update error	EDB			○
			72.3	Load-side encoder data waveform error	EDB			○
			72.4	Load-side encoder non-signal error	EDB			○
			72.5	Load-side encoder hardware error 1	EDB			○
			72.6	Load-side encoder hardware error 2	EDB			○
			72.9	Load-side encoder data error 2	EDB			○
	74	Option card error 1	74.1	Option card error 1	DB			○
			74.2	Option card error 2	DB			○
			74.3	Option card error 3	DB			○
			74.4	Option card error 4	DB			○
			74.5	Option card error 5	DB			○
	75	Option card error 2	75.3	Option card connection error	EDB			○
			75.4	Option card disconnected	DB			○
	79	Functional safety unit diagnosis error	79.1	Functional safety unit power voltage error	DB	○ (Note 7)		○
			79.2	Functional safety unit internal error	DB			○
			79.3	Abnormal temperature of functional safety unit	SD	○ (Note 7)		○
			79.4	Servo amplifier error	SD			○
			79.5	Input device error	SD			○
			79.6	Output device error	SD			○
			79.7	Mismatched input signal error	SD			○
			79.8	Position feedback fixing error	DB			○
	7A	Parameter setting error (safety observation function)	7A.1	Parameter verification error (safety observation function)	DB			○
			7A.2	Parameter setting range error (safety observation function)	DB			○
			7A.3	Parameter combination error (safety observation function)	DB			○
			7A.4	Functional safety unit combination error (safety observation function)	DB			○
	7B	Encoder diagnosis error (safety observation function)	7B.1	Encoder diagnosis error 1 (safety observation function)	DB			○
			7B.2	Encoder diagnosis error 2 (safety observation function)	DB			○
			7B.3	Encoder diagnosis error 3 (safety observation function)	DB			○
			7B.4	Encoder diagnosis error 4 (safety observation function)	DB			○
	7C	Functional safety unit communication diagnosis error (safety observation function)	7C.1	Functional safety unit communication cycle error (safety observation function)	SD	○ (Note 7)	○	○
			7C.2	Functional safety unit communication data error (safety observation function)	SD	○ (Note 7)	○	○
	7D	Safety observation error	7D.1	Stop observation error	DB	○ (Note 3)		○
			7D.2	Speed observation error	DB	○ (Note 7)		○
	82	Master-slave operation error 1	82.1	Master-slave operation error 1	EDB	○	○	○

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation		
						Alarm reset	CPU reset	Cycling the power
Alarm	84	Network module initialization error	84.1	Network module undetected error	DB			○
			84.2	Network module initialization error 1	DB			○
			84.3	Network module initialization error 2	DB			○
	85	Network module error	85.1	Network module error 1	SD			○
			85.2	Network module error 2	SD			○
			85.3	Network module error 3	SD			○
	86	Network communication error	86.1	Network communication error 1	SD	○		○
			86.2	Network communication error 2	SD	○		○
			86.3	Network communication error 3	SD	○		○
	8A	USB communication time-out error/serial communication time-out error/Modbus-RTU communication time-out error	8A.1	USB communication time-out error/serial communication time-out error	SD	○	○	○
			8A.2	Modbus-RTU communication time-out error	SD	○	○	○
	8D	CC-Link IE communication error	8D.1	CC-Link IE communication error 1	SD	○		○
			8D.2	CC-Link IE communication error 2	SD	○		○
			8D.3	Master station setting error 1	DB	○		○
			8D.5	Master station setting error 2	DB			○
			8D.6	CC-Link IE communication error 3	SD	○		○
			8D.7	CC-Link IE communication error 4	SD	○		○
			8D.8	CC-Link IE communication error 5	SD	○		○
			8D.9	Synchronization error 1	SD			○
			8D.A	Synchronization error 2	SD			○
	8E	USB communication error/serial communication error/Modbus-RTU communication error	8E.1	USB communication receive error/serial communication receive error	SD	○	○	○
			8E.2	USB communication checksum error/serial communication checksum error	SD	○	○	○
			8E.3	USB communication character error/serial communication character error	SD	○	○	○
			8E.4	USB communication command error/serial communication command error	SD	○	○	○
			8E.5	USB communication data number error/serial communication data number error	SD	○	○	○
			8E.6	Modbus-RTU communication receive error	SD	○	○	○
			8E.7	Modbus-RTU communication message frame error	SD	○	○	○
			8E.8	Modbus-RTU communication CRC error	SD	○	○	○
	88888	Watchdog	8888._	Watchdog	DB			○

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

2. The following shows three stop methods of DB, EDB, and SD.

DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
Coasts for MR-J4-03A6(-RJ) and MR-J4W2-0303B6. Note that EDB is applied when an alarm below occurs;
[AL. 30.1], [AL. 32.2], [AL. 32.4], [AL. 51.1], [AL. 51.2], [AL. 888]

EDB: Electronic dynamic brake stop (available with specified servo motors)
Refer to the following table for the specified servo motors. The stop method for other than the specified servo motors will be DB.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52
HG-AK	HG-AK0136/HG-AK0236/HG-AK0336

SD: Forced stop deceleration

3. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].
4. The alarm can be canceled by setting as follows:
For the fully closed loop control: set [Pr. PE03] to "1 _ _ _".
When a linear servo motor or direct drive motor is used: set [Pr. PL04] to "1 _ _ _".
5. In some controller communication status, the alarm factor may not be removed.
6. This alarm will occur only in the J3 compatibility mode.
7. Reset this while all the safety observation functions are stopped.

13.3.3 Warning list

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	90	Home position return incomplete warning	90.1	Home position return incomplete	
			90.2	Home position return abnormal termination	
			90.5	Z-phase unpassed	
	91	Servo amplifier overheat warning (Note 1)	91.1	Main circuit device overheat warning	
	92	Battery cable disconnection warning	92.1	Encoder battery cable disconnection warning	
			92.3	Battery degradation	
	93	ABS data transfer warning	93.1	ABS data transfer requirement warning during magnetic pole detection	
	95	STO warning	95.1	STO1 off detection	DB
			95.2	STO2 off detection	DB
			95.3	STO warning 1 (safety observation function)	DB
			95.4	STO warning 2 (safety observation function)	DB
			95.5	STO warning 3 (safety observation function)	DB
	96	Home position setting warning	96.1	In-position warning at home positioning	
			96.2	Command input warning at home positioning	
			96.3	Servo off warning at home positioning	
			96.4	Home positioning warning during magnetic pole detection	
	97	Positioning specification warning	97.1	Program operation disabled warning	
			97.2	Next station position warning	
	98	Software limit warning	98.1	Forward rotation-side software stroke limit reached	
			98.2	Reverse rotation-side software stroke limit reached	
	99	Stroke limit warning	99.1	Forward rotation stroke end off	(Note 4, 5)
			99.2	Reverse rotation stroke end off	(Note 4, 5)
			99.4	Upper stroke limit off	(Note 5)
			99.5	Lower stroke limit off	(Note 5)
	9A	Optional unit input data error warning	9A.1	Optional unit input data sign error	
			9A.2	Optional unit BCD input data error	
	9B	Error excessive warning	9B.1	Excess droop pulse 1 warning	
			9B.3	Excess droop pulse 2 warning	
			9B.4	Error excessive warning during 0 torque limit	
	9C	Converter error	9C.1	Converter unit error	
	9D	CC-Link IE warning 1	9D.1	Station number switch change warning	
			9D.2	Master station setting warning	
			9D.3	Overlapping station number warning	
			9D.4	Mismatched station number warning	

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	9E	CC-Link IE warning 2	9E.1	CC-Link IE communication warning	
	9F	Battery warning	9F.1	Low battery	
			9F.2	Battery degradation warning	
	E0	Excessive regeneration warning	E0.1	Excessive regeneration warning	
	E1	Overload warning 1	E1.1	Thermal overload warning 1 during operation	
			E1.2	Thermal overload warning 2 during operation	
			E1.3	Thermal overload warning 3 during operation	
			E1.4	Thermal overload warning 4 during operation	
			E1.5	Thermal overload error 1 during a stop	
			E1.6	Thermal overload error 2 during a stop	
			E1.7	Thermal overload error 3 during a stop	
			E1.8	Thermal overload error 4 during a stop	
	E2	Servo motor overheat warning	E2.1	Servo motor temperature warning	
	E3	Absolute position counter warning	E3.1	Multi-revolution counter travel distance excess warning	
			E3.2	Absolute position counter warning	
			E3.4	Absolute positioning counter EEP-ROM writing frequency warning	
			E3.5	Encoder absolute positioning counter warning	
	E4	Parameter warning	E4.1	Parameter setting range error warning	
	E5	ABS time-out warning	E5.1	Time-out during ABS data transfer	
			E5.2	ABSM off during ABS data transfer	
			E5.3	SON off during ABS data transfer	
	E6	Servo forced stop warning	E6.1	Forced stop warning	SD
			E6.2	SS1 forced stop warning 1 (safety observation function)	SD
			E6.3	SS1 forced stop warning 2 (safety observation function)	SD
	E7	Controller forced stop warning	E7.1	Controller forced stop warning	SD
	E8	Cooling fan speed reduction warning	E8.1	Decreased cooling fan speed warning	
			E8.2	Cooling fan stop	
	E9	Main circuit off warning	E9.1	Servo-on signal on during main circuit off	DB
			E9.2	Bus voltage drop during low speed operation	DB
			E9.3	Ready-on signal on during main circuit off	DB
			E9.4	Converter unit forced stop	DB
	EA	ABS servo-on warning	EA.1	ABS servo-on warning	
	EB	The other axis error warning	EB.1	The other axis error warning	DB
	EC	Overload warning 2	EC.1	Overload warning 2	

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	ED	Output watt excess warning	ED.1	Output watt excess warning	
	F0	Tough drive warning	F0.1	Instantaneous power failure tough drive warning	
			F0.3	Vibration tough drive warning	
	F2	Drive recorder - Miswriting warning	F2.1	Drive recorder - Area writing time-out warning	
			F2.2	Drive recorder - Data miswriting warning	
	F3	Oscillation detection warning	F3.1	Oscillation detection warning	
	F4	Positioning warning	F4.4	Target position setting range error warning	
			F4.6	Acceleration time constant setting range error warning	
			F4.7	Deceleration time constant setting range error warning	
	F5	Simple cam function - Cam data miswriting warning	F5.1	Cam data - Area writing time-out warning	
			F5.2	Cam data - Area miswriting warning	
			F5.3	Cam data checksum error	
	F6	Simple cam function - Cam control warning	F6.1	Cam axis one cycle current value restoration failed	
			F6.2	Cam axis feed current value restoration failed	
			F6.3	Cam unregistered error	
			F6.4	Cam control data setting range error	
			F6.5	Cam No. external error	
			F6.6	Cam control inactive	

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

2. The following shows two stop methods of DB and SD.

DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
Coasts for MR-J4-03A6(-RJ) and MR-J4W2-0303B6.

SD: Forced stop deceleration

3. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].

4. For MR-J4-_A_ servo amplifier, quick stop or slow stop can be selected using [Pr. PD30].

5. For MR-J4-_GF_ servo amplifier, quick stop or slow stop can be selected using [Pr. PD12]. (I/O mode only)

13.3.4 Troubleshooting at power on

When the servo system does not boot and system error occurs at power on of the servo system controller, improper boot of the servo amplifier might be the cause. Check the display of the servo amplifier, and take actions according to this section.

Display	Description	Cause	Checkpoint	Action
AA	Communication with the servo system controller has disconnected.	The power of the servo system controller was turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.
		An SSCNET III cable was disconnected.	"AA" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.
		The power of the servo amplifier was turned off.	"AA" is displayed in the corresponding axis and following axes.	Check the power of the servo amplifier.
				Replace the servo amplifier of the corresponding axis.
Ab	Initialization communication with the servo system controller has not completed.	The control axis is disabled.	Check if the disabling control axis switch (SW2-2) is on.	Turn off the disabling control axis switch (SW2-2).
		The setting of the axis No. is incorrect.	Check that the other servo amplifier is not assigned to the same axis No.	Set it correctly.
		Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Set it correctly.
		Information about the servo series has not set in the simple motion module.	Check the value set in Servo series (Pr. 100) in the simple motion module.	Set it correctly.
		Communication cycle does not match.	Check the communication cycle at the servo system controller side. When using 8 axes or less: 0.222 ms When using 16 axes or less: 0.444 ms When using 32 axes or less: 0.888 ms	Set it correctly.
		An SSCNET III cable was disconnected.	"Ab" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.
		The power of the servo amplifier was turned off.	"Ab" is displayed in an axis and the following axes.	Check the power of the servo amplifier.
		The servo amplifier is malfunctioning.	"Ab" is displayed in an axis and the following axes.	Replace the servo amplifier of the corresponding axis.
b##. (Note)	The system has been in the test operation mode.	Test operation mode has been enabled.	Test operation setting switch (SW2-1) is turned on.	Turn off the test operation setting switch (SW2-1).
off	Operation mode for manufacturer setting is set.	Operation mode for manufacturer setting is enabled.	Check if all of the control axis setting switches (SW2) are on.	Set the control axis setting switches (SW2) correctly.

Note. ## indicates an axis No.

MEMO

14. MR-J4-DU_B_-RJ020 DRIVE UNIT/MR-CR55K_ CONVERTER UNIT

The following items are the same as those of MR-J4-_B_-RJ020 servo amplifiers. Refer to each chapter of the detailed explanation field for details.

Item	Detailed explanation
Normal gain adjustment	Chapter 6
Special adjustment functions	Chapter 7
Absolute position detection system	Chapter 12
Using MR-J4-(DU)_B_-RJ020 in J4 mode	Chapter 13
Using fully closed loop control	Chapter 15

14.1 Functions and configuration

The following items are the same as those of MR-J4-_B_-RJ020. Refer to each section of the detailed explanation field for details.

Item	Detailed explanation
Conversion unit for SSCNET of MR-J2S-B	Section 1.3.2
Function list	Section 1.5
Parts identification of MR-J4-T20	Section 1.7.2
Installation and removal of MR-J4-T20	Section 1.8 (3)

14.1.1 Summary

This section explains MR-J4-DU_B_-RJ020 drive unit compatible with conversion unit for SSCNET of MR-J2S-B and MR-J4-T20 conversion unit for SSCNET of MR-J2S-B.
Always use MR-J4-T20 with MR-J4-DU_B_-RJ020.
Using MR-J4-T20 with an MR-J4-DU_B_-RJ020 enables the MR-J4-DU_B_-RJ020 to connect to SSCNET of MR-J2S-B.
MR-J4-DU_B_-RJ020 drive unit has "J2S compatibility mode (factory setting)" and "J4 mode" as the operation mode. "J2S compatibility mode" is the operation mode compatible with the previous functions of MR-J2S-B series.
This section explains a case where the drive unit is used in "J2S compatibility mode".
When using it in "J4 mode", refer to chapter 13.
When you use an MR-J4-DU_B_-RJ020 drive unit, please note the following items.

(1) When an HG series servo motor is used in the J2S compatibility mode, the encoder resolution per servo motor revolution will be 131072 pulses/rev (17 bits), not 4194303 pulses/rev (22 bits).

(2) It may be required to change existing equipment program because the initialization time after power on is different between MR-J2S-_B_ servo amplifier and MR-J4-DU_B_-RJ020 drive unit. Especially when using it in vertical motion applications, please be careful of electromagnetic brake release time. The moving part may fall.

(3) Motor-less operation cannot be used with MR Configurator. To use motor-less operation, set "_ 1 _ _" in [Pr. 24].

(4) When using [Pr. 13 Position loop gain 1] of MR-J4-DU_B_-RJ020 and MR-J2S-_B_ simultaneously such as in the interpolation mode, check droop pulses for each axis and readjust gains as necessary.

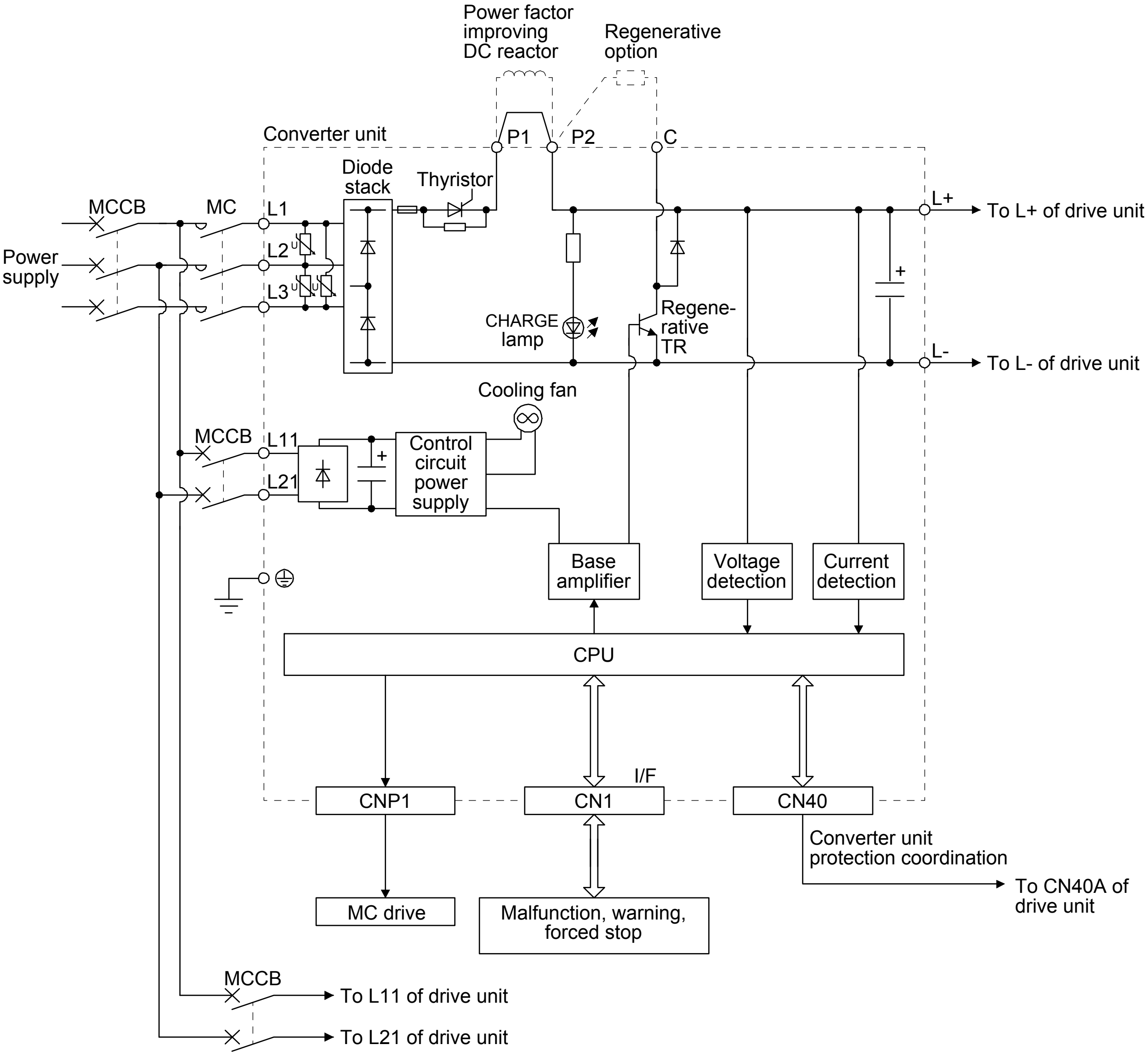
(5) MR-J4-DU_B_-RJ020 drive unit is not compatible with adaptive vibration suppression control.

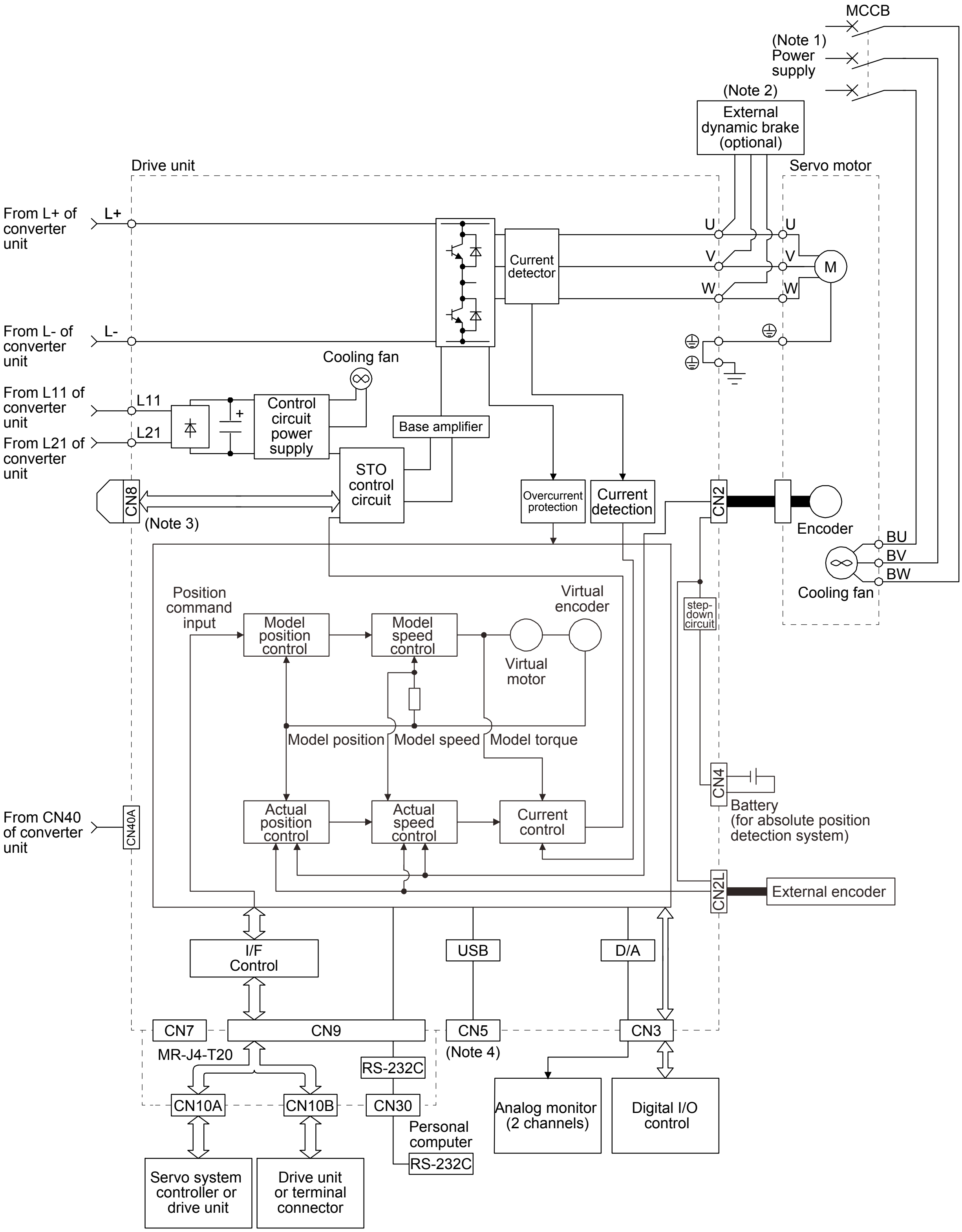
(6) Power is not supplied from the SSCNET cable connection connector to the encoder. When using it in absolute position detection system, always connect a battery to the CN4 connector of the MR-J4-DU_B_-RJ020 drive unit.

(7) When the servo amplifier is set to the J2S compatibility mode, it supports the fully closed loop system. In the fully closed loop control mode, when an HG series servo motor is used for the load-side encoder, the resolution of the load-side encoder will be 131072 pulses/rev (17 bits), which is the same as that of the servo motor side. Refer to chapter 15 for details.

14.1.2 Function block diagram

The function block diagram of this servo is shown below.





Note 1. For specifications of the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".

2. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.

3. This is not used when the drive unit is in the J2S compatibility mode. Always attach the short-circuit connector came with the drive unit.

4. This is used to change the drive unit mode. Refer to section 13.1 for the mode selection procedure.

14.1.3 Standard specifications

(1) Converter unit

Model: MR-CR_			55K	55K4
Output	Rated voltage		270 V DC to 324 V DC	513 V DC to 648 V DC
	Rated current [A]		215.9	113.8
Main circuit power supply input	Voltage/Frequency		3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz
	Rated current [A]		191.3	100.7
	Permissible voltage fluctuation		3-phase 170 V AC to 264 V AC	3-phase 323 V AC to 528 V AC
	Permissible frequency fluctuation		Within ±5%	
	Power supply capacity [kVA]		Refer to section 14.8.2.	
	Inrush current [A]		Refer to section 14.8.4.	
Control circuit power supply	Voltage/Frequency		1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz
	Rated current [A]		0.3	0.2
	Permissible voltage fluctuation		1-phase 170 V AC to 264 V AC	1-phase 323 V AC to 528 V AC
	Permissible frequency fluctuation		Within ±5%	
	Power consumption [W]		45	
	Inrush current [A]		Refer to section 14.8.4.	
Interface power supply	Voltage		24 V DC ± 10%	
	Current capacity [A]		(Note 1) 0.15	
Rated output [kW]			55	
Regenerative power (regenerative option)			One MR-RB139: 1300 W Three MR-RB137: 3900 W	One MR-RB137-4: 1300 W Three MR-RB13V-4: 3900 W
Protective functions			Regenerative overvoltage shut-off, overload shut-off (electronic thermal), regenerative error protection, undervoltage protection, and instantaneous power failure protection	
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3	
	UL standard		UL 508C	
Structure (IP rating)			Force cooling, open (IP20) (Note 2)	
Environment	Ambient temperature	Operation	0 °C to 55 °C (non-freezing)	
		Storage	-20 °C to 65 °C (non-freezing)	
	Ambient humidity	Operation	90 %RH or less (non-condensing)	
		Storage		
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt	
	Altitude		2000 m or less above sea level (Note 3)	
	Vibration resistance		5.9 m/s^2 or less, at 10 Hz to 55 Hz (directions of X, Y and Z axes)	
Mass [kg]			22	

Note 1. When all I/O signals are used, the applicable value is 0.15 A. The current capacity can be decreased by reducing the number of I/O points.

2. Except for the terminal block.

3. Follow the restrictions in section 14.2.5 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

(2) Drive unit

(a) 200 V class

Model: MR-J4-DU_-RJ020			30KB	37KB
Output	Rated voltage		3-phase 170 V AC	
	Rated current [A]		174	204
Main circuit power supply input			The main circuit power of the drive unit is supplied by the converter unit.	
Control circuit power supply	Voltage/Frequency		1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	
	Rated current [A]		0.3	
	Permissible voltage fluctuation		1-phase 170 V AC to 264 V AC	
	Permissible frequency fluctuation		Within ±5%	
	Power consumption [W]		45	
	Inrush current [A]		Refer to section 14.8.4.	
Interface power supply	Voltage		24 V DC ± 10%	
	Current capacity [A]		0.1	
Control method			Sine-wave PWM control, current control method	
Dynamic brake			External option (Note 3)	
Fully closed loop control			Compatible (Note 4)	
Load-side encoder interface			Mitsubishi high-speed serial communication/A/B/Z-phase differential input signal (Note 4)	
Communication function	USB		Connection with a personal computer (compatible with an application software "MR-J4(W)-B mode selection" (Note 2))	
Encoder output pulses			Compatible (A/B/Z-phase pulse)	
Analog monitor			Two channels	
Protective functions			Overcurrent shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection	
Functional safety			Not compatible	
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061	
	UL standard		UL 508C	
Structure (IP rating)			Force cooling, open (IP20) (Note 1)	
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)	
		Storage	-20 ˚C to 65 ˚C (non-freezing)	
	Ambient humidity	Operation	90 %RH or less (non-condensing)	
		Storage		
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt	
	Altitude		2000 m or less above sea level (Note 5)	
	Vibration resistance		5.9 m/s^2 or less, at 10 Hz to 55 Hz (directions of X, Y and Z axes)	
Mass [kg]			21	

Note
1. Except for the terminal block.
2. The application software "MR-J4(W)-B mode selection" is necessary for using MR-J4-DU_B-RJ020 in J4 mode. It is unnecessary when using MR-J4-DU_B-RJ020 in J2S compatibility mode. Use the application software "MR-J4(W)-B mode selection" which packed with MR Configurator2 of software version 1.27D or later.
3. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.
4. The fully closed loop control is available only in J2S compatibility mode. Use the drive unit with software version A6 or later.
5. Follow the restrictions in section 14.2.5 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

(b) 400 V class

Model: MR-J4-DU_-RJ020			30KB4	37KB4	45KB4	55KB4
Output	Rated voltage		3-phase 323 V AC			
	Rated current [A]		87	102	131	143
Main circuit power supply input			The main circuit power of the drive unit is supplied by the converter unit.			
Control circuit power supply	Voltage/Frequency		1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz			
	Rated current [A]		0.2			
	Permissible voltage fluctuation		1-phase 323 V AC to 528 V AC			
	Permissible frequency fluctuation		Within ±5%			
	Power consumption [W]		45			
	Inrush current [A]		Refer to section 14.8.4.			
Interface power supply	Voltage		24 V DC ± 10%			
	Current capacity [A]		0.1			
Control method			Sine-wave PWM control, current control method			
Dynamic brake			External option (Note 3)			
Fully closed loop control			Compatible (Note 4)			
Load-side encoder interface			Mitsubishi high-speed serial communication/A/B/Z-phase differential input signal (Note 4)			
Communication function	USB		Connection with a personal computer (compatible with an application software "MR-J4(W)-B mode selection" (Note 2))			
Encoder output pulses			Compatible (A/B/Z-phase pulse)			
Analog monitor			Two channels			
Protective functions			Overcurrent shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection			
Functional safety			Not compatible			
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061			
	UL standard		UL 508C			
Structure (IP rating)			Force cooling, open (IP20) (Note 1)			
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)			
		Storage	-20 ˚C to 65 ˚C (non-freezing)			
	Ambient humidity	Operation	90 %RH or less (non-condensing)			
		Storage				
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt			
	Altitude		2000 m or less above sea level (Note 5)			
	Vibration resistance		5.9 m/s^2 or less, at 10 Hz to 55 Hz (directions of X, Y and Z axes)			
Mass [kg]			16		21	

Note 1. Except for the terminal block.

2. The application software "MR-J4(W)-B mode selection" is necessary for using MR-J4-DU_B4-RJ020 in J4 mode. It is unnecessary when using MR-J4-DU_B4-RJ020 in J2S compatibility mode. Use the application software "MR-J4(W)-B mode selection" which packed with MR Configurator2 of software version 1.27D or later.

3. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.

4. The fully closed loop control is available only in J2S compatibility mode. Use the drive unit with software version A6 or later.

5. Follow the restrictions in section 14.2.5 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

14.1.4 Combinations of converter units, drive units and servo motors

(1) 200 V class

Converter unit	Drive unit	Servo motor	
		HG-JR_	
		1000 r/min series	1500 r/min series
MR-CR55K	MR-J4-DU30KB-RJ020	30K1	30K1M
	MR-J4-DU37KB-RJ020	37K1	37K1M

(2) 400 V class

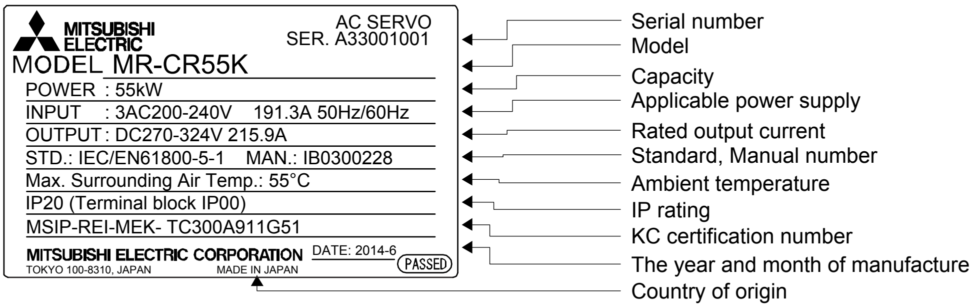
Converter unit	Drive unit	Servo motor	
		HG-JR_	
		1000 r/min series	1500 r/min series
MR-CR55K4	MR-J4-DU30KB4-RJ020	30K14	30K1M4
	MR-J4-DU37KB4-RJ020	37K14	37K1M4
	MR-J4-DU45KB4-RJ020		45K1M4
	MR-J4-DU55KB4-RJ020		55K1M4

14.1.5 Model definition

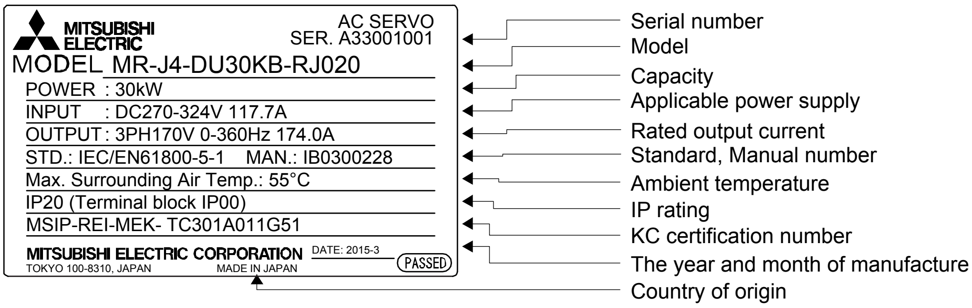
(1) Rating plate

The following shows examples of rating plates for explanation of each item.

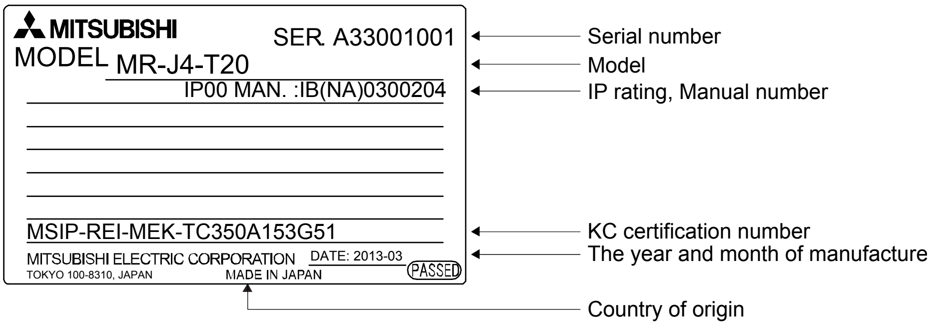
(a) Converter unit



(b) Drive unit



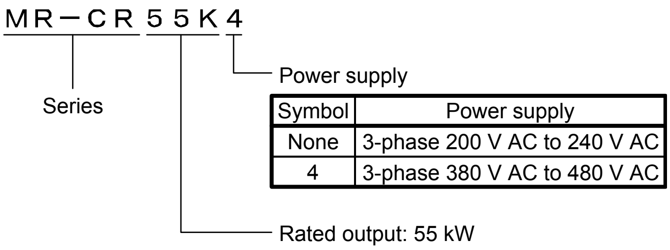
(c) Conversion unit for SSCNET of MR-J2S-B



(2) Model

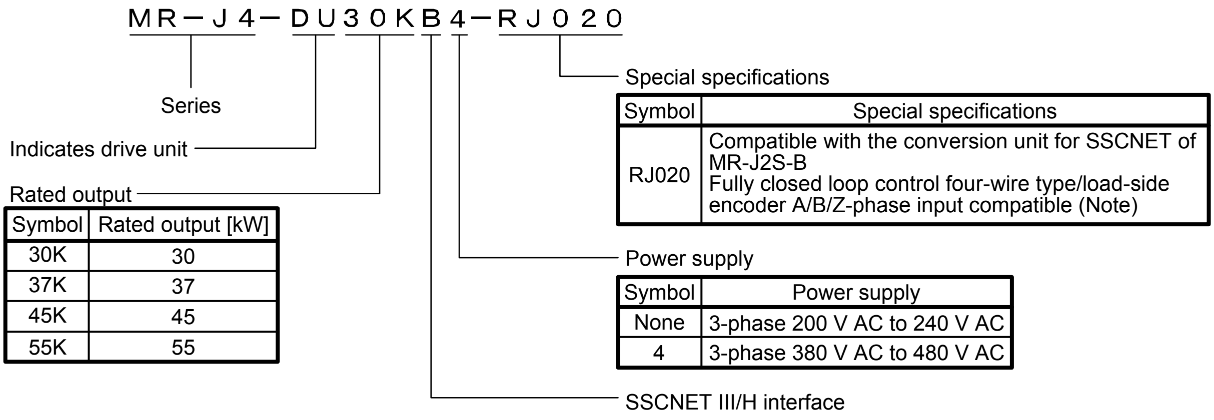
The following describes what each block of a model name indicates. Not all combinations of the symbols are available.

(a) Converter unit



Symbol	Power supply
None	3-phase 200 V AC to 240 V AC
4	3-phase 380 V AC to 480 V AC

(b) Drive unit



Symbol	Rated output [kW]
30K	30
37K	37
45K	45
55K	55

Symbol	Special specifications
RJ020	Compatible with the conversion unit for SSCNET of MR-J2S-B Fully closed loop control four-wire type/load-side encoder A/B/Z-phase input compatible (Note)

Symbol	Power supply
None	3-phase 200 V AC to 240 V AC
4	3-phase 380 V AC to 480 V AC

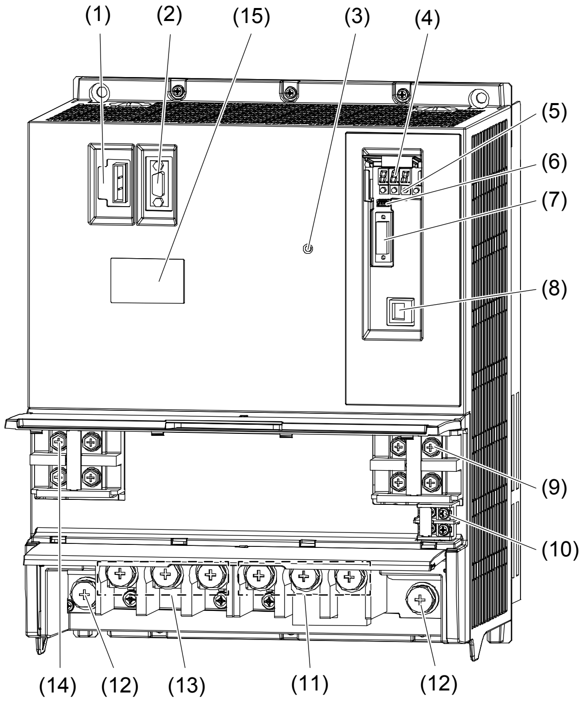
Note. Only with the servo amplifier with software version A6 or later.

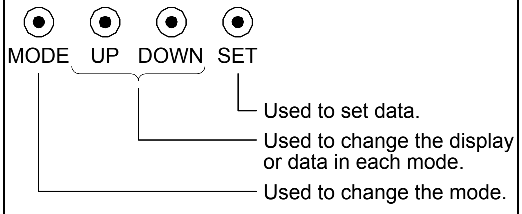
14.1.6 Structure

(1) Parts identification

(a) Converter unit (MR-CR55K(4))

POINT
●The converter unit is shown with the terminal cover open. For opening or closing of the terminal cover, refer to section 14.1.6 (2).



No.	Name/Application	Detailed explanation
(1)	Magnetic contactor control connector (CNP1) Used to connect the coil of the magnetic contactor.	Section 14.3.3 (1)
(2)	I/O signal connector (CN1) Used to connect digital I/O signals.	
(3)	Charge lamp Lights up when the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
(4)	Display The 3-digit, 7-segment LED display shows the converter unit status and the alarm number.	Section 14.4.3
(5)	Operation section Used to perform status display, diagnostic, alarm, and parameter setting operations.  MODE UP DOWN SET Used to set data. Used to change the display or data in each mode. Used to change the mode.	
(6)	Manufacturer setting connector (CN6) This is for manufacturer setting. Although the shape is similar to the analog monitor connector (CN6) of the drive unit, do not connect anything including an analog monitor.	
(7)	Protection coordination connector (CN40) Used to connect CN40A of the drive unit.	Section 14.3.1
(8)	Manufacturer setting connector (CN3) This is for manufacturer setting. Although the shape is similar to the RS-422 communication connector (CN3) of the drive unit, do not connect anything, including a personal computer and parameter unit.	
(9)	L+/L- terminal (TE2-2) Used to connect a drive unit using a bus bar supplied with the drive unit.	Section 14.3.1 Section 14.3.2
(10)	Control circuit terminal L11 and L21 (TE3) Used to connect the control circuit power supply.	
(11)	Regenerative option/Power factor improving DC reactor (TE1-2) Used to connect a regenerative option or a power factor improving DC reactor.	
(12)	Protective earth (PE) terminal	
(13)	Main circuit terminal block (TE1-1) Used to connect the input power supply.	
(14)	L+/L- terminal (TE2-1) When using a brake unit, connect it to this terminal. Do not connect anything other than the brake unit.	Section 14.9.10
(15)	Rating plate	Section 14.1.5

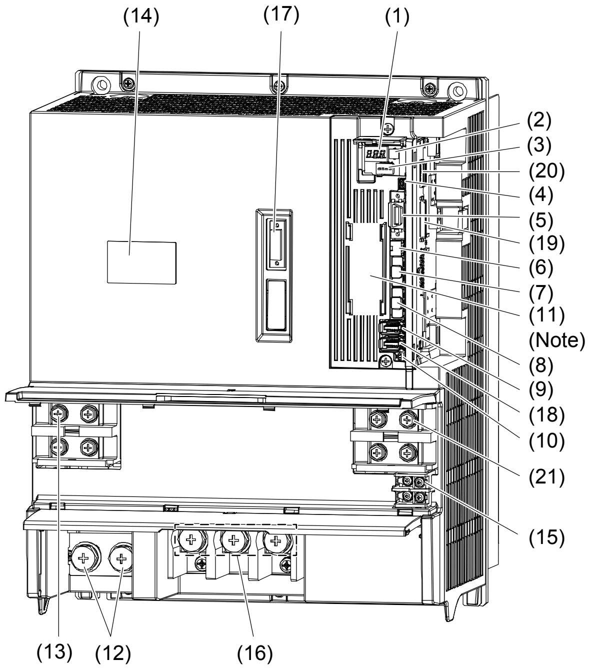
(b) Drive unit (MR-J4-DU_B_-RJ020)

POINT

- ●The drive unit is shown with the terminal cover open. For opening or closing of the terminal cover, refer to section 14.1.6 (2).

1) 200 V class

a) MR-J4-DU30KB-RJ020/MR-J4-DU37KB-RJ020

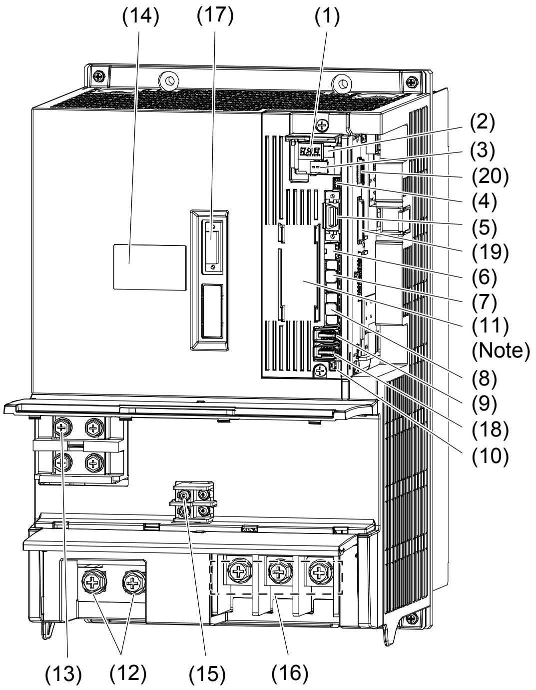


No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, 7-segment LED display shows the drive unit status and the alarm number.	Section 4.3
(2)	Axis selection rotary switch (SW1) Used to set the axis No. of the drive unit.	
(3)	Control axis setting switch (SW2) Not used in J2S compatibility mode. Turn all switches "OFF (down)".	
(4)	USB communication connector (CN5) Used to connect a personal computer. This is used to change the drive unit mode.	Section 13.1
(5)	I/O signal connector (CN3) Used to connect digital I/O signals. The pin assignment is different from that of MR-J2S series. Wire it correctly in accordance with section 3.4.	Section 3.2 Section 3.4
(6)	STO input signal connector (CN8) Not used in J2S compatibility mode. Always attach the supplied short-circuit connector.	
(7)	SSCNET III cable connector (CN1A) Not used in J2S compatibility mode. Always cap the connector.	
(8)	SSCNET III cable connector (CN1B) Not used in J2S compatibility mode. Always cap the connector.	
(9)	Encoder connector (CN2) Connect to the servo motor encoder.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
(10)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
(11)	Battery holder Used to house the battery for absolute position data backup.	Section 12.2
(12)	Protective earth (PE) terminal	Section 14.3.1 Section 14.3.2
(13)	L+/L- terminal (TE2-1) Used to connect the L+ and L- terminals of the converter unit using the bus bars supplied.	
(14)	Rating plate	Section 14.1.4
(15)	Control circuit terminal L11/L21 (TE3) Used to connect the control circuit power supply.	Section 14.3.1 Section 14.3.2
(16)	Servo motor power output terminal (TE1) Used to connect the servo motor.	
(17)	Protection coordination connector (CN40A) Used to connect CN40 of the converter unit.	Section 14.3.1
(18)	External encoder connector (CN2L) Used only for the fully closed loop system.	Section 14.3.3 Chapter 15
(19)	Optional unit connector (CN7) Connector used for connection with the CN70 connector of MR-J4-T20	
(20)	Optional unit connector (CN9) Connector used for connection with the CN90 connector of MR-J4-T20	
(21)	Manufacturer setting terminal (TE2-2) This is for manufacturer setting. Leave this open.	

Note. Lines for slots around the battery holder are omitted from the illustration.

2) 400 V class

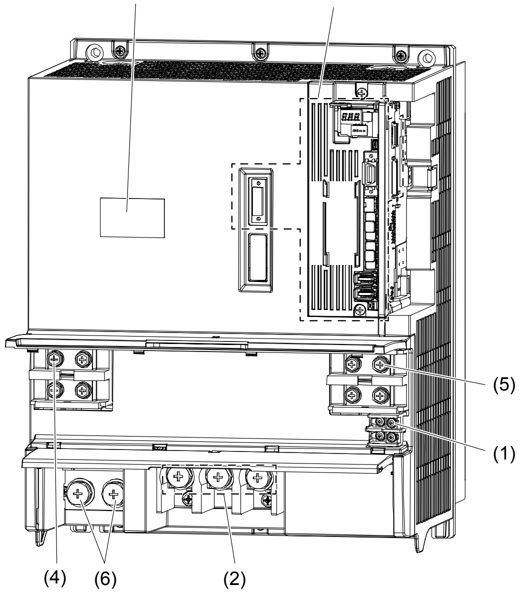
a) MR-J4-DU30KB4-RJ020/MR-J4-DU37KB4-RJ020



No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, 7-segment LED display shows the drive unit status and the alarm number.	Section 4.3
(2)	Axis selection rotary switch (SW1) Used to set the axis No. of the drive unit.	
(3)	Control axis setting switch (SW2) Not used in J2S compatibility mode. Turn all switches "OFF (down)".	
(4)	USB communication connector (CN5) Used to connect a personal computer. This is used to change the drive unit mode.	Section 13.1
(5)	I/O signal connector (CN3) Used to connect digital I/O signals. The pin assignment is different from that of MR-J2S series. Wire it correctly in accordance with section 3.4.	Section 3.2 Section 3.4
(6)	STO input signal connector (CN8) Not used in J2S compatibility mode. Always attach the supplied short-circuit connector.	
(7)	SSCNET III cable connector (CN1A) Not used in J2S compatibility mode. Always cap the connector.	
(8)	SSCNET III cable connector (CN1B) Not used in J2S compatibility mode. Always cap the connector.	
(9)	Encoder connector (CN2) Connect to the servo motor encoder.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
(10)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
(11)	Battery holder Used to house the battery for absolute position data backup.	Section 12.4
(12)	Protective earth (PE) terminal	Section 14.3.1 Section 14.3.2
(13)	L+/L- terminal (TE2-1) Used to connect the L+ and L- terminals of the converter unit using the bus bars supplied.	
(14)	Rating plate	Section 14.1.4
(15)	Control circuit terminal L11/L21 (TE3) Used to connect the control circuit power supply.	Section 14.3.1 Section 14.3.2
(16)	Servo motor power output terminal (TE1) Used to connect the servo motor.	
(17)	Protection coordination connector (CN40A) Used to connect CN40 of the converter unit.	Section 14.3.1
(18)	External encoder connector (CN2L) Used only for the fully closed loop system.	Section 14.3.3 Chapter 15
(19)	Optional unit connector (CN7) Connector used for connection with the CN70 connector of MR-J4-T20	
(20)	Optional unit connector (CN9) Connector used for connection with the CN90 connector of MR-J4-T20	

Note. Lines for slots around the battery holder are omitted from the illustration.

b) MR-J4-DU45KB4-RJ020/MR-J4-DU55KB4-RJ020



The broken line area is the same as MR-J4-DU30KB4-RJ020/MR-J4-DU37KB4-RJ020.

No.	Name/Application	Detailed explanation
(1)	Control circuit terminal L11/L21 (TE3) Used to connect the control circuit power supply.	Section 14.3.1 Section 14.3.2
(2)	Servo motor power output terminal (TE1) Used to connect the servo motor.	
(3)	Rating plate	Section 14.1.4
(4)	L+/L- terminal (TE2-1) Used to connect the L+ and L- terminals of the converter unit using the bus bars supplied.	Section 14.3.1 Section 14.3.2
(5)	Manufacturer setting terminal (TE2-2) This is for manufacturer setting. Leave this open.	
(6)	Protective earth (PE) terminal	Section 14.3.1 Section 14.3.2

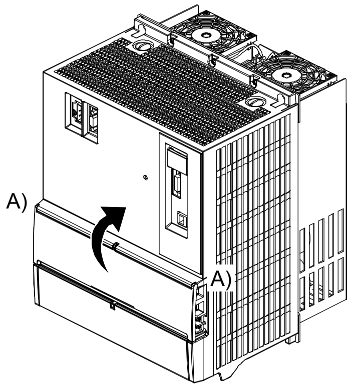
(2) Opening and closing of the terminal block cover

⚠WARNING	●Before opening or closing the terminal block cover, turn off the power and wait for 20 minutes or more until the charge lamp turns off. Then, confirm that the voltage between L+ and L- is safe with a voltage tester or others. Otherwise, an electric shock may occur. In addition, always confirm that the charge lamp is off from the front of the converter unit.

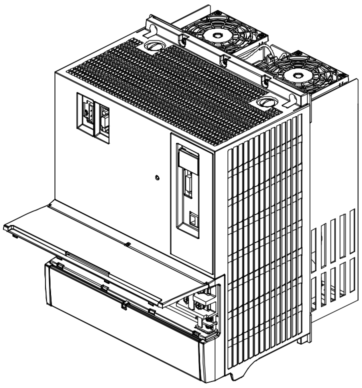
The following shows how to open and close the terminal block cover using illustrations of converter units as an example. For a drive unit, the shape of the main unit is different. However, the terminal block cover can be opened or closed in the same procedure.

(a) Upper terminal block cover

1) How to open

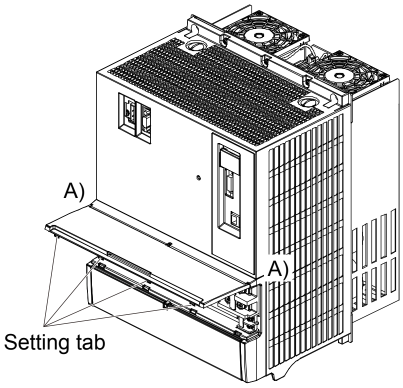


a) Pull up the cover using point A) as a support.

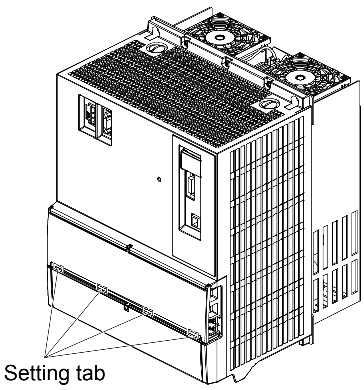


b) The cover is fixed when pulled up to the position as shown in the illustration.

2) How to close



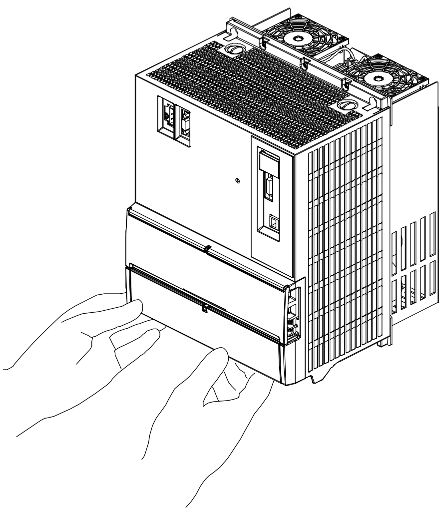
a) Close the cover using point A) as a support.



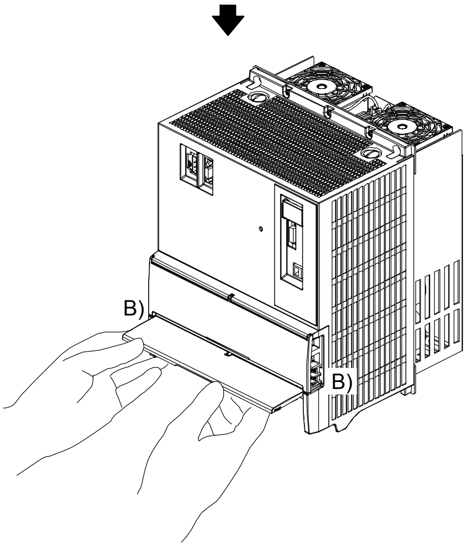
b) Press the cover against the terminal box until the installing knobs click.

(b) Lower terminal block cover

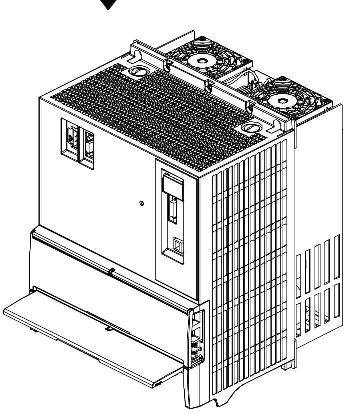
1) How to open



a) Hold the bottom of the terminal block cover with both hands.

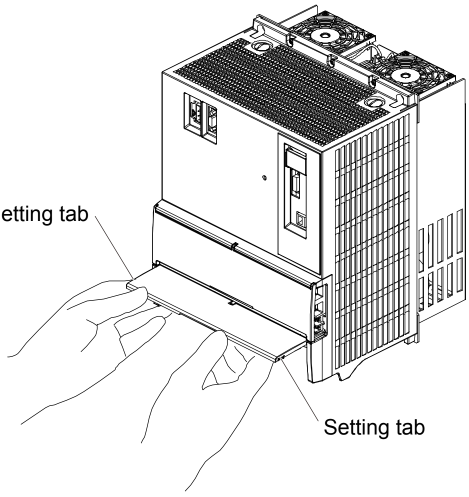


b) Pull up the cover using point B) as a support.

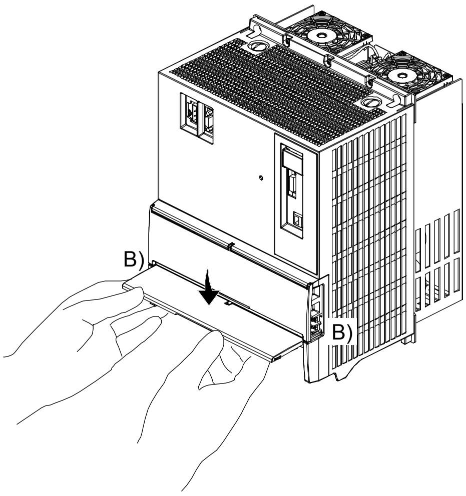


c) The cover is fixed when pulled up to the top.

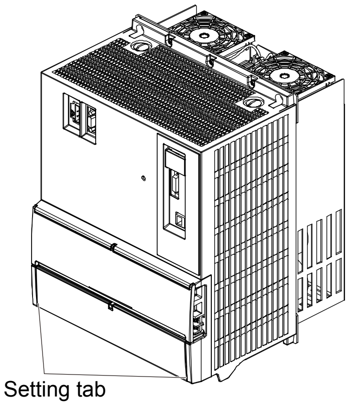
2) How to close



a) Hold the bottom of the terminal block cover with both hands.



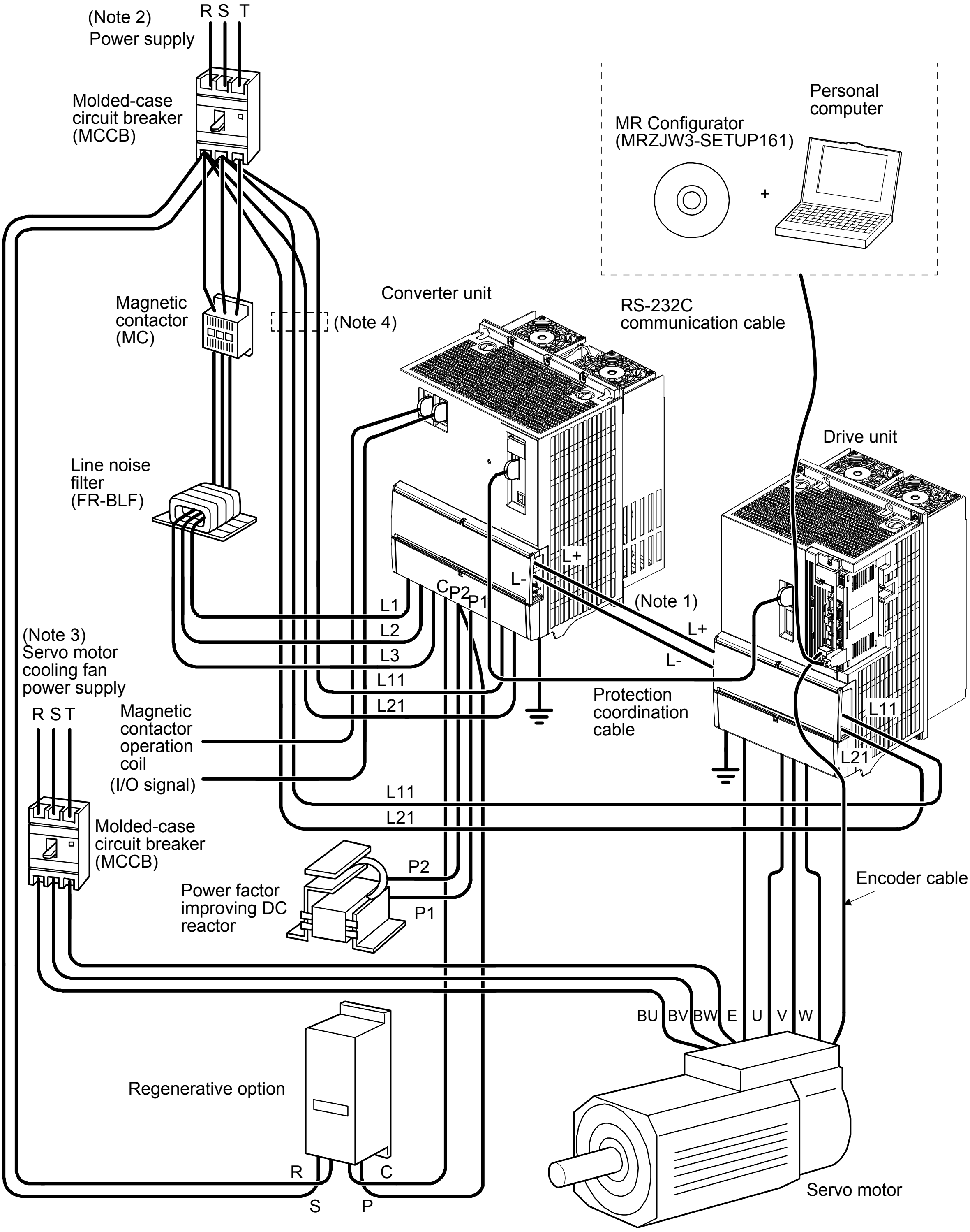
b) Close the cover using point B) as a support.



c) Press the cover against the terminal box until the installing knobs click.

14.1.7 Configuration including peripheral equipment

The diagram shows MR-J4-DU30KB4-RJ020 and MR-J4-DU37KB4-RJ020. The connection for the interface of MR-J4-DU_B_-RJ020 is the same as in the case of MR-J4-_B_-RJ020. Refer to section 1.9.



Note
1. The L+ and L- bus bars used to connect a converter unit to a drive unit are standard accessories. The converter unit is attached to the drive unit actually.
2. For power supply specifications, refer to section 14.1.3.
3. For specifications of the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Install an overcurrent protection device (molded-case circuit breaker, fuse, or others) to protect the branch circuit. (Refer to section 14.9.5.)

14.2 Installation

⚠WARNING

- To prevent electric shock, ground each equipment securely.

⚠CAUTION

- Stacking in excess of the specified number of product packages is not allowed.
- Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Install the converter unit, the drive unit, and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the equipment. Otherwise, it may cause injury.
- Use the equipment within the specified environment. For the environment, refer to section 1.2.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the converter unit, drive unit, and MR-J4-T20.
- Do not block the intake and exhaust areas of the converter unit, drive unit, and MR-J4-T20. Otherwise, it may cause malfunction.
- Do not drop or strike the converter unit, drive unit, and MR-J4-T20 as they are precision equipment.
- Do not install or operate the converter unit, drive unit, and MR-J4-T20 which have been damaged or have any parts missing.
- When the equipment has been stored for an extended period of time, contact your local sales office.
- When handling the converter unit, drive unit, and MR-J4-T20, be careful about the edged parts such as the corners of the converter unit and drive unit.
- The converter unit, drive unit, and MR-J4-T20 must be installed in a metal cabinet.
- When fumigants that contain halogen materials, such as fluorine, chlorine, bromine, and iodine, are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation, such as heat treatment. Additionally, disinfect and protect wood from insects before packing the products.

The following items are the same as those of MR-J4-_B_-RJ020. Refer to each section of the detailed explanation field for details.

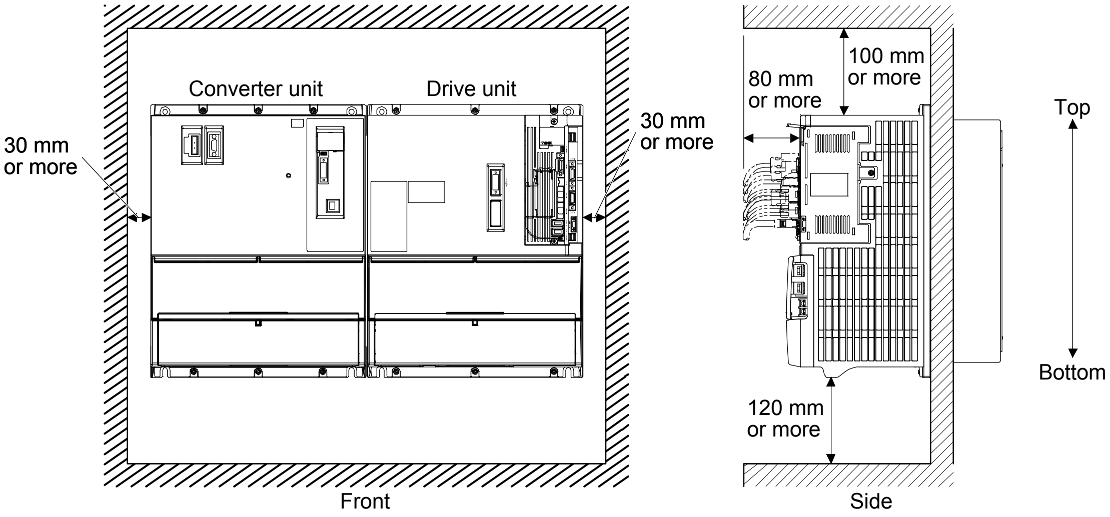
Item	Detailed explanation
Encoder cable stress	Section 2.3

14.2.1 Installation direction and clearances

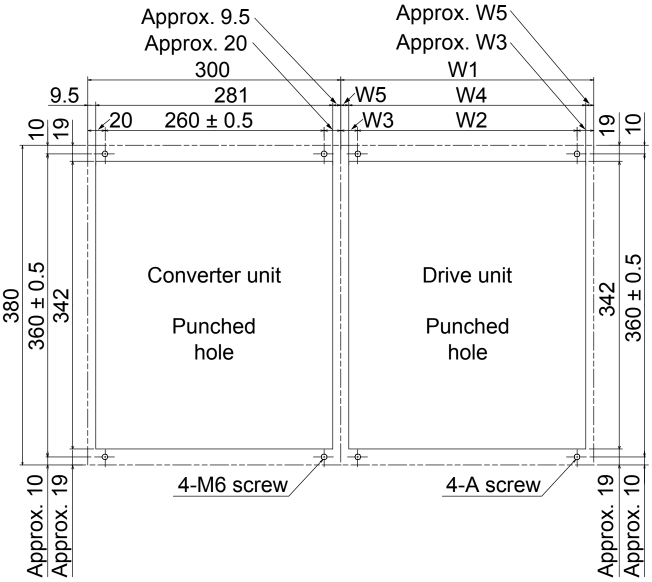
⚠CAUTION	●The equipment must be installed in the specified direction. Otherwise, it may cause malfunction. ●Leave the specified clearances between the converter unit, drive unit, and MR-J4-T20 and the cabinet walls or other equipment. Otherwise, it may cause malfunction.

(1) Installation

POINT
●Make sure to connect a drive unit to the right side of a converter unit as shown in the diagram.



(2) Mounting hole process drawing



Drive unit	Variable dimensions [mm]					Screw size
	W1	W2	W3	W4	W5	A
MR-J4-DU30KB-RJ020 MR-J4-DU37KB-RJ020 MR-J4-DU45KB4-RJ020 MR-J4-DU55KB4-RJ020	300	260 ± 0.5	20	281	9.5	M6
MR-J4-DU30KB4-RJ020 MR-J4-DU37KB4-RJ020	240	120 ± 0.5	60	222	9	M5

(3) Others
When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the converter unit and drive unit are not affected.
Install the converter unit and drive unit on a perpendicular wall in the correct vertical direction.

14.2.2 Keeping out of foreign materials

(1) When drilling in the cabinet, prevent drill chips and wire fragments from entering the converter unit and the drive unit.

(2) Prevent oil, water, metallic dust, etc. from entering the converter unit and the drive unit through openings in the cabinet or a cooling fan installed on the ceiling.

(3) When installing the cabinet in a place where toxic gas, dirt and dust exist, conduct an air purge (that forces clean air into the cabinet from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the cabinet.

14.2.3 Inspection items

⚠WARNING

●Before starting maintenance and/or inspection, turn off the power and wait for 20 minutes or more until the charge lamp turns off. Then, confirm that the voltage between L+ and L- is safe with a voltage tester or others. Otherwise, an electric shock may occur. In addition, always confirm that the charge lamp is off from the front of the converter unit.

●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

⚠CAUTION

●Do not perform insulation resistance test on the converter unit and the drive unit. Otherwise, it may cause a malfunction.

●Do not disassemble and/or repair the equipment on customer side.

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

(2) Check for scratches and cracks of cables and the like. Inspect them periodically according to operating conditions especially when the servo motor is movable.

(3) Check that the connectors are securely connected to the converter unit, drive unit, and MR-J4-T20.

(4) Check that the wires are not coming out from the connector.

(5) Check for dust accumulation on the converter unit, drive unit, and MR-J4-T20.

(6) Check for unusual noise generated from the converter unit, drive unit, and MR-J4-T20.

14.2.4 Parts having service life

Service life of the following parts are listed below. However, the service life varies depending on operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service life. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on, forced stop by EM1 (Forced stop 1), controller forced stop, and on/off for STO: 100,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
Absolute position battery	Refer to section 12.2.

(1) Smoothing capacitor

The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in air-conditioned environment (ambient temperature of 40 ˚C or less).

(2) Relays

Contact faults will occur due to contact wear arisen from switching currents. Relays reach the end of their lives when the number of power-on, forced stop by EM1 (Forced stop 1), controller forced stop, and on/off for STO while the servo motor is stopped under servo-off state reaches 100,000 times. However, the lives of relays may depend on the power supply capacity.

(3) Cooling fan

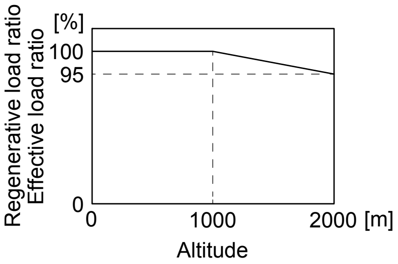
The cooling fan bearings reach the end of their lives in 10,000 hours to 30,000 hours. Therefore, the cooling fan normally must be replaced in a few years of continuous operation as a guideline. It must also be changed if unusual noise or vibration is found during inspection.

The life is calculated under the annual average ambient temperature of 40 ˚C, free from corrosive gas, flammable gas, oil mist, dust and dirt.

14.2.5 Restrictions when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level

(1) Effective load ratio and regenerative load ratio

Heat dissipation effects decrease in proportion to decreasing air density, and hence use the servo amplifiers with the effective load ratio and the regenerative load ratio within the following range.



(2) Input voltage

Generally, withstand voltage decreases as increasing altitude; however, there is no restriction on the withstand voltage.

(3) Parts having service life

(a) Smoothing capacitor

The capacitor will reach the end of its life in 10 years of continuous operation in air-conditioned environment (ambient temperature of 30 ˚C or less).

(b) Relays

There is no restriction. Use in the same manner as in 1000 m or less. (Refer to section 14.2.4.)

(c) Servo amplifier cooling fan

There is no restriction. Use in the same manner as in 1000 m or less. (Refer to section 14.2.4.)

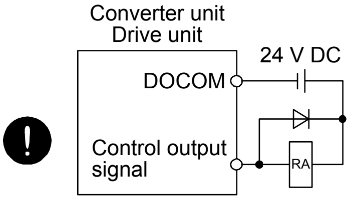
14.3 Signals and wiring

⚠WARNING

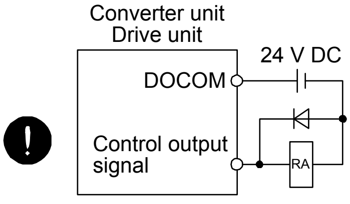
- ●A person who is involved in wiring should be fully competent to do the work.
- ●Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between L+ and L- is safe with a voltage tester or others. Otherwise, an electric shock may occur. In addition, always confirm that the charge lamp is off from the front of the converter unit.
- ●Ground the converter unit, the drive unit and the servo motor securely.
- ●Do not attempt to wire the converter unit, the drive unit, and the servo motor until they have been installed. Otherwise, it may cause an electric shock.
- ●The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- ●To avoid an electric shock, insulate the connections of the power supply terminals.

⚠CAUTION

- ●Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- ●Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- ●Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- ●The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.

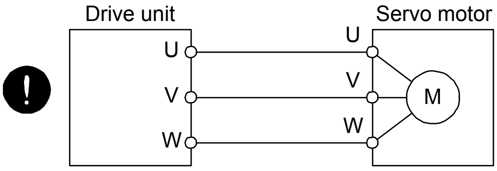


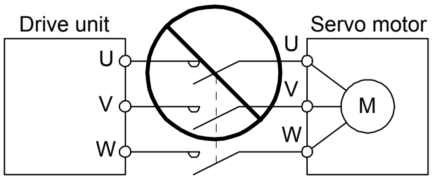
For sink output interface



For source output interface

- ●Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the converter unit and the drive unit.
- ●Do not install a power capacitor, surge killer or radio noise filter (optional FR-BIF (-H)) with the power line of the servo motor.
- ●When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- ●Do not modify the equipment.
- ●Connect the drive unit power outputs (U, V, and W) to the servo motor power inputs (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.





- ●Do not connect the servo motor of a wrong axis to U, V, W, or CN2 of the drive unit. Otherwise, a malfunction may occur.

The following items are the same as those of MR-J4-_B_-RJ020. Refer to each section of the detailed explanation field for details.

Item	Detailed explanation
I/O signal connection example	Section 3.2

14.3.1 Input power supply circuit

⚠WARNING

● Insulate the connections of the power supply terminals. Otherwise, an electric shock may occur.

● Always connect the magnetic contactor wiring connector to CNP1 of the converter unit. If the connector is not connected, an electric shock may occur.

⚠CAUTION

● Always connect the magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the converter unit, in order to configure a circuit that shuts down the power supply on the side of the converter unit power supply. If the magnetic contactor is not connected, a large current keeps flowing and may cause a fire when the converter unit or the drive unit malfunctions.

● Switch main circuit power supply off at detection of an alarm on the controller side. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.

● The converter unit has a built-in surge absorber (varistor) to reduce exogenous noise and to suppress lightning surge. Exogenous noise or lightning surge deteriorates the varistor characteristics, and the varistor may be damaged. To prevent a fire, use a molded-case circuit breaker or fuse for input power supply.

● Do not connect the servo motor of a wrong axis to U, V, W, or CN2 of the drive unit. Otherwise, a malfunction may occur.

● Check the converter unit model, and then input proper voltage to the converter unit power supply. If input voltage exceeds the upper limit, the converter unit and the drive unit will break down.

(1) Magnetic contactor control connector (CNP1)

⚠CAUTION

● Always connect the magnetic contactor wiring connector to the converter unit. If the connector is not connected, an electric shock may occur since CNP1-1 and L11 are always conducting.

By enabling magnetic contactor drive output, the main circuit power supply can be shut off automatically when an alarm occurs in the converter unit or the drive unit.
To enable magnetic contactor drive output, set [Pr. PA02] of the converter unit to "_ _ _ 1" (initial value).

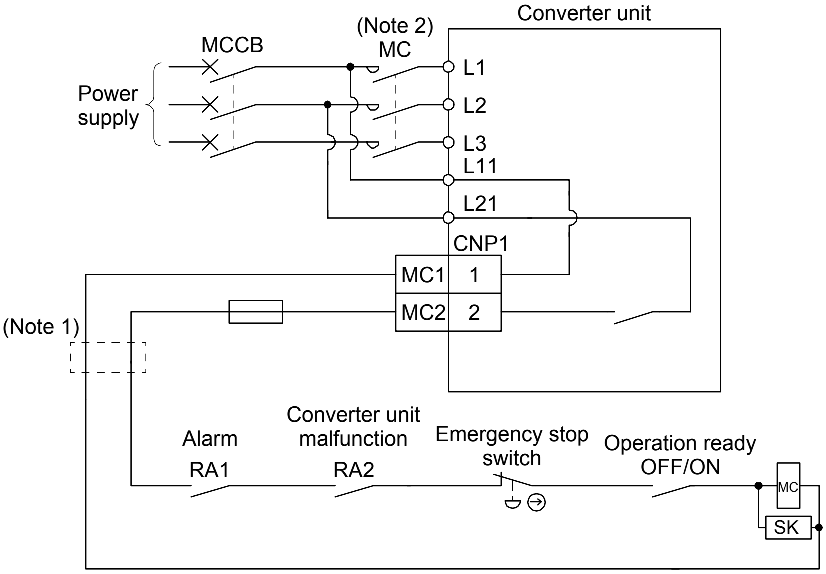
[Pr. PA02]

0	0	0	1

Magnetic contactor drive output selection
0: Disabled
1: Enabled

(a) When magnetic contactor drive output is enabled
To control the magnetic contactor, connect the magnetic contactor control connector (CNP1) to the coil of the magnetic contactor.

Internal connection diagram of CNP1



Note 1. A step-down transformer is required when coil voltage of the magnetic contactor is 200 V class, and the converter unit and the drive unit are 400 V class.
2. When the voltage between L11 and L21 drops due to an instantaneous power failure and others, the magnetic contactor is turned off.

When the converter unit receives a start command from the drive unit, CNP1-2 and L21 are shorted, and the control circuit power is supplied to the magnetic contactor. When the control circuit power is supplied, the magnetic contactor is turned on, and the main circuit power is supplied to the converter unit.
In the following cases, CNP1-2 and L21 in the converter unit are opened, and the main circuit power supply is automatically shut off.

1) An alarm occurred in the converter unit.
2) An alarm occurred in the drive unit.
3) The forced stop (EM1) of the converter unit was disabled.
4) [AL. E6 Servo forced stop warning] occurred in the drive unit.

(b) When magnetic contactor drive output is disabled
The main circuit power supply is not automatically shut off even when an alarm occurs in the converter unit or the drive unit. Therefore, configure an external circuit to shut off the main circuit power supply when detecting an alarm.

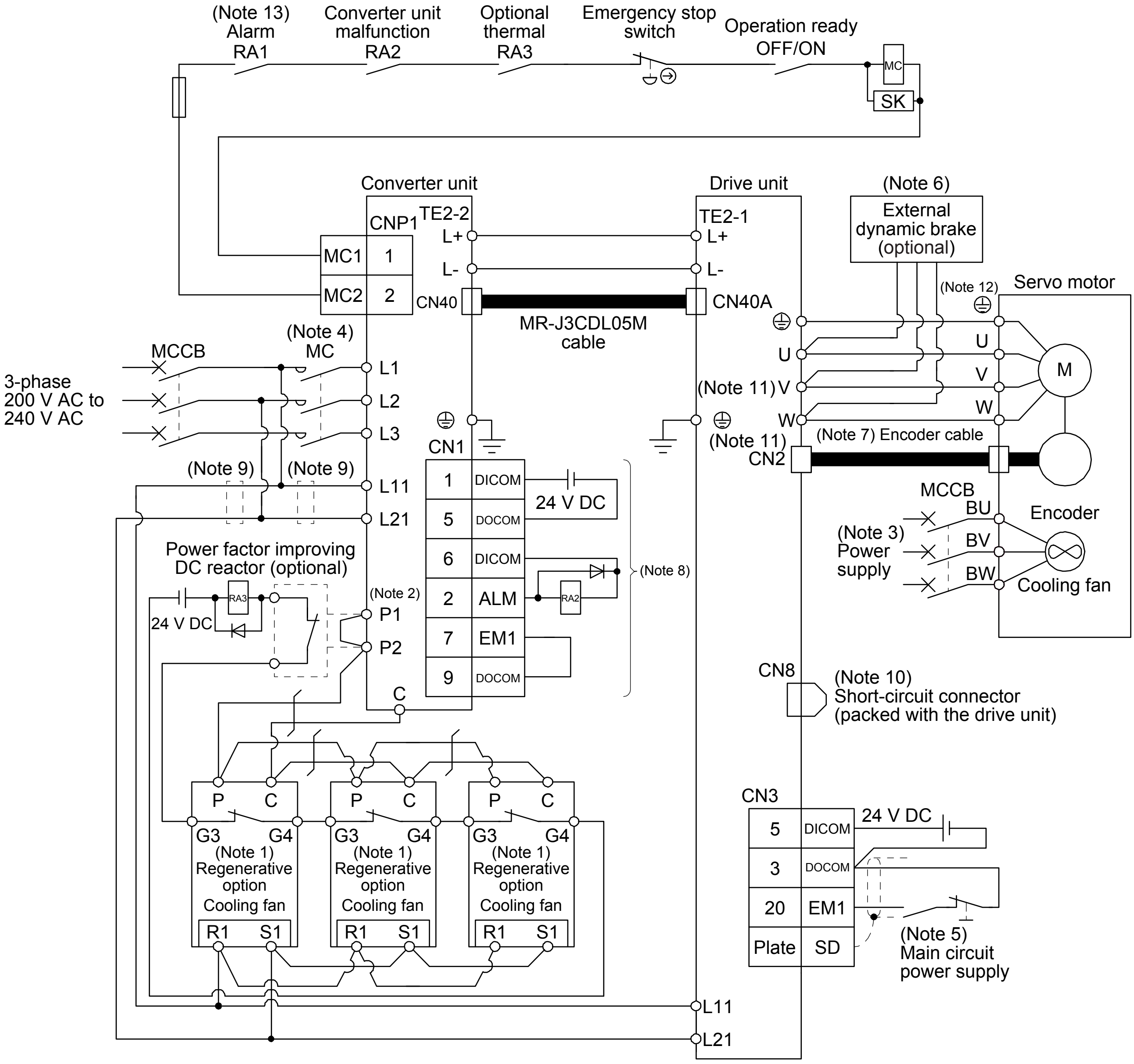
(2) Wiring diagram

(a) When magnetic contactor drive output is enabled (factory setting)

POINT

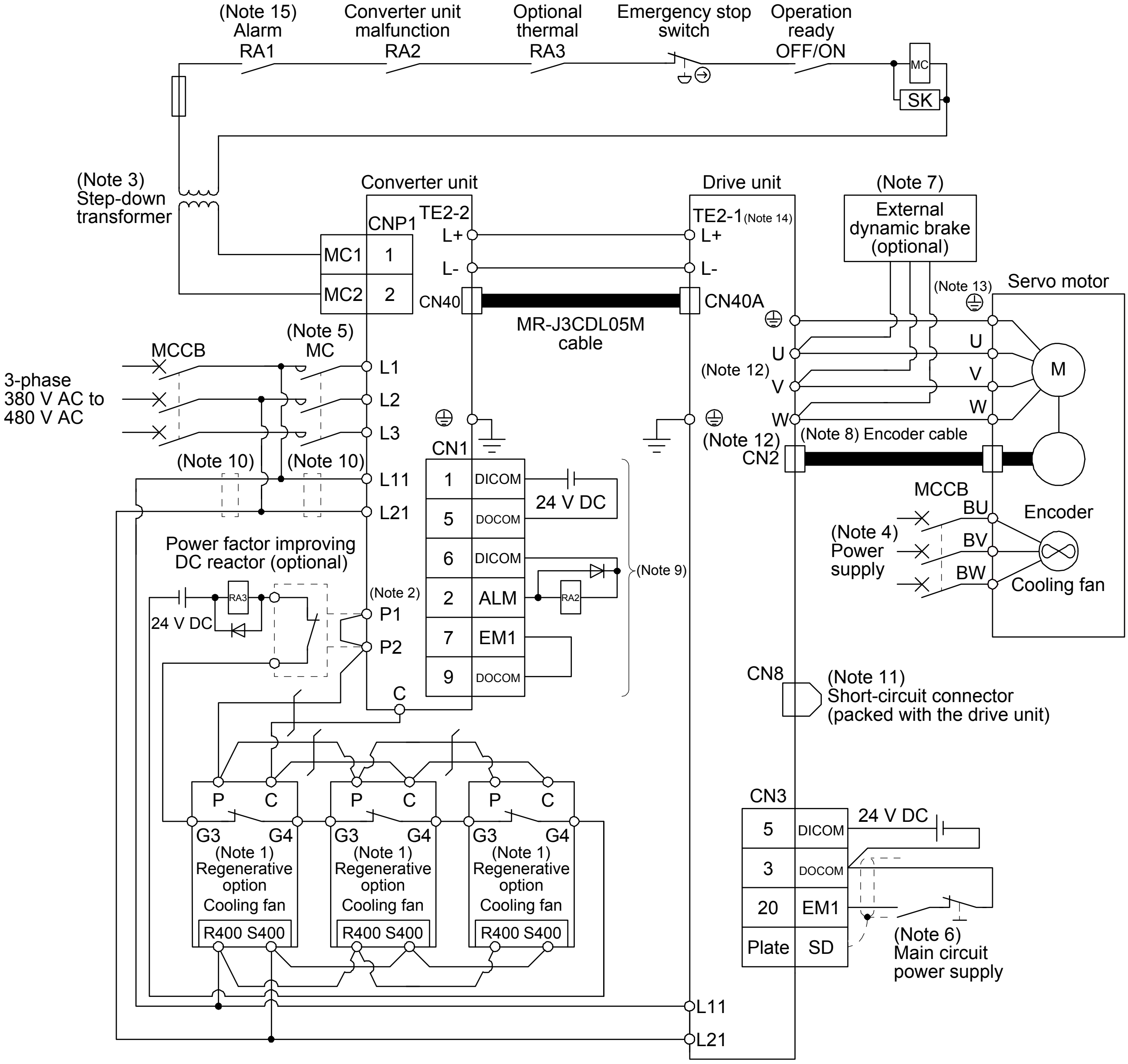
- ●The converter unit controls the magnetic contactor.
- ●Always connect a protection coordination cable (MR-J3CDL05M).
- ●Always turn on or off the control circuit power supplies of the converter unit and the drive unit simultaneously.

1) 200 V class



Note 1. This is for MR-RB137. For the MR-RB137, three units are used as one set (permissible regenerative power: 3900 W).
2. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
3. For specifications of the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
5. To prevent an unexpected restart of the drive unit, configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off.
6. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.
7. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
8. This diagram shows sink I/O interface. For source I/O interface, refer to section 14.3.6 (2).
9. Install an overcurrent protection device (molded-case circuit breaker, fuse, or others) to protect the branch circuit. (Refer to section 14.9.5.)
10. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with the drive unit.
11. Do not connect the servo motor of a wrong axis to U, V, W, or CN2 of the drive unit. Otherwise, a malfunction may occur.
12. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
13. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

2) 400 V class

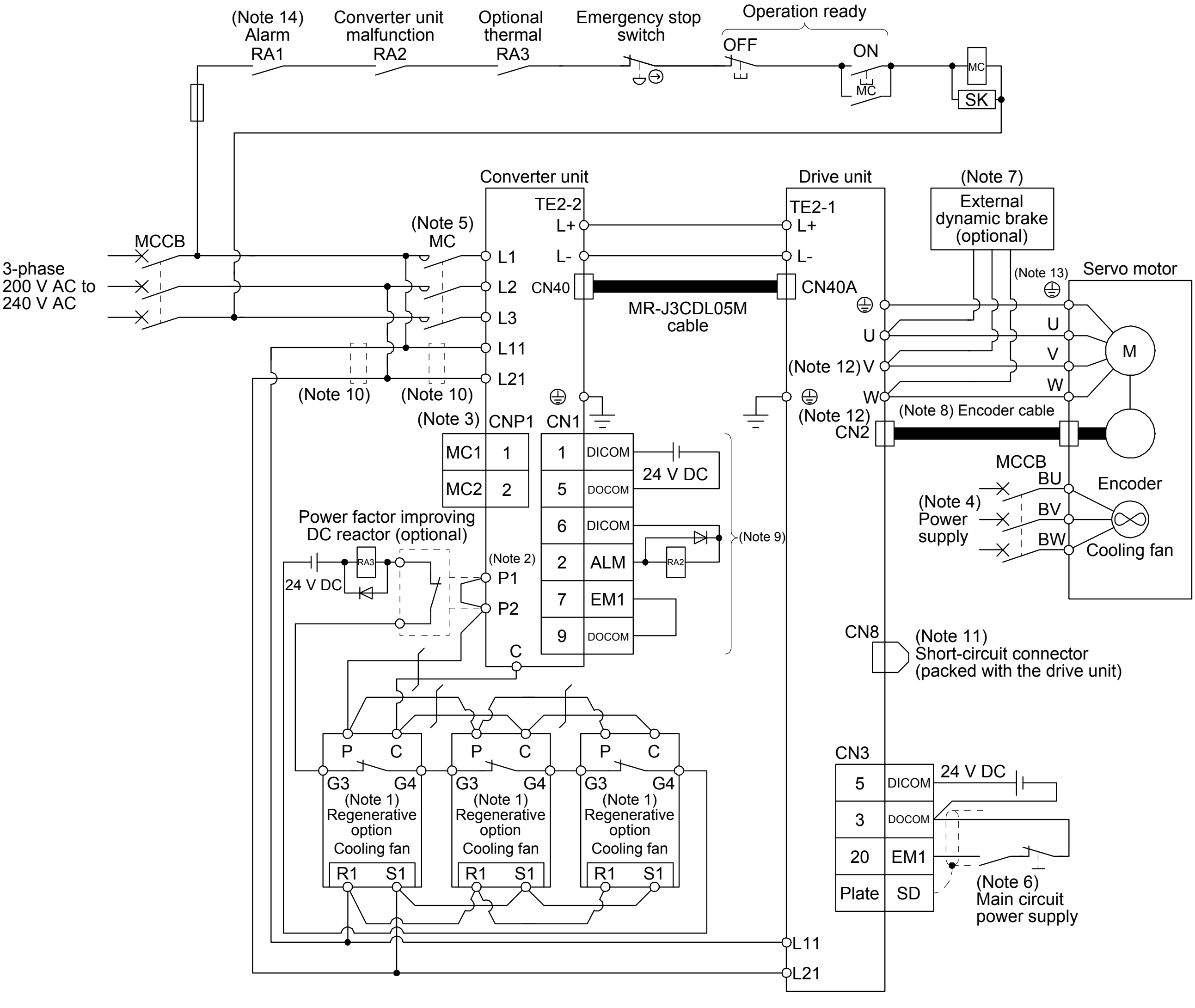

(Note 15) Alarm RA1
Converter unit malfunction RA2
Optional thermal RA3
Emergency stop switch
Operation ready OFF/ON
MC
SK
(Note 3) Step-down transformer
Converter unit
CNP1
MC1 1
MC2 2
TE2-2
L+
L-
CN40
MR-J3CDL05M cable
Drive unit
TE2-1(Note 14)
L+
L-
CN40A
(Note 7) External dynamic brake (optional)
(Note 13)
Servo motor
U
V
W
M
(Note 12)
(Note 12)
CN2
(Note 8) Encoder cable
MCCB
BU
BV
BW
Encoder
(Note 4) Power supply
Cooling fan
3-phase 380 V AC to 480 V AC
MCCB
(Note 5) MC
L1
L2
L3
(Note 10)
(Note 10)
L11
L21
CN1
1 DICOM
5 DOCOM
24 V DC
6 DICOM
2 ALM
RA2
7 EM1
9 DOCOM
(Note 9)
Power factor improving DC reactor (optional)
RA3
24 V DC
(Note 2)
P1
P2
C
CN8
(Note 11) Short-circuit connector (packed with the drive unit)
P C
G3 G4
(Note 1) Regenerative option
Cooling fan
R400 S400
CN3
5 DICOM
3 DOCOM
20 EM1
Plate SD
24 V DC
(Note 6) Main circuit power supply
L11
L21

Note
1. This is for MR-RB13V-4. For the MR-RB13V-4, three units are used as one set (permissible regenerative power: 3900 W).
2. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
3. A step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.
4. For specifications of the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
5. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
6. To prevent an unexpected restart of the drive unit, configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off.
7. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.
8. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
9. This diagram shows sink I/O interface. For source I/O interface, refer to section 14.3.6 (2).
10. Install an overcurrent protection device (molded-case circuit breaker, fuse, or others) to protect the branch circuit. (Refer to section 14.9.5.)
11. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with the drive unit.
12. Do not connect the servo motor of a wrong axis to U, V, W, or CN2 of the drive unit. Otherwise, a malfunction may occur.
13. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
14. For the MR-J4-DU30KB4-RJ020 and MR-J4-DU37KB4-RJ020, the terminal block is TE2.
15. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

(b) When magnetic contactor drive output is disabled

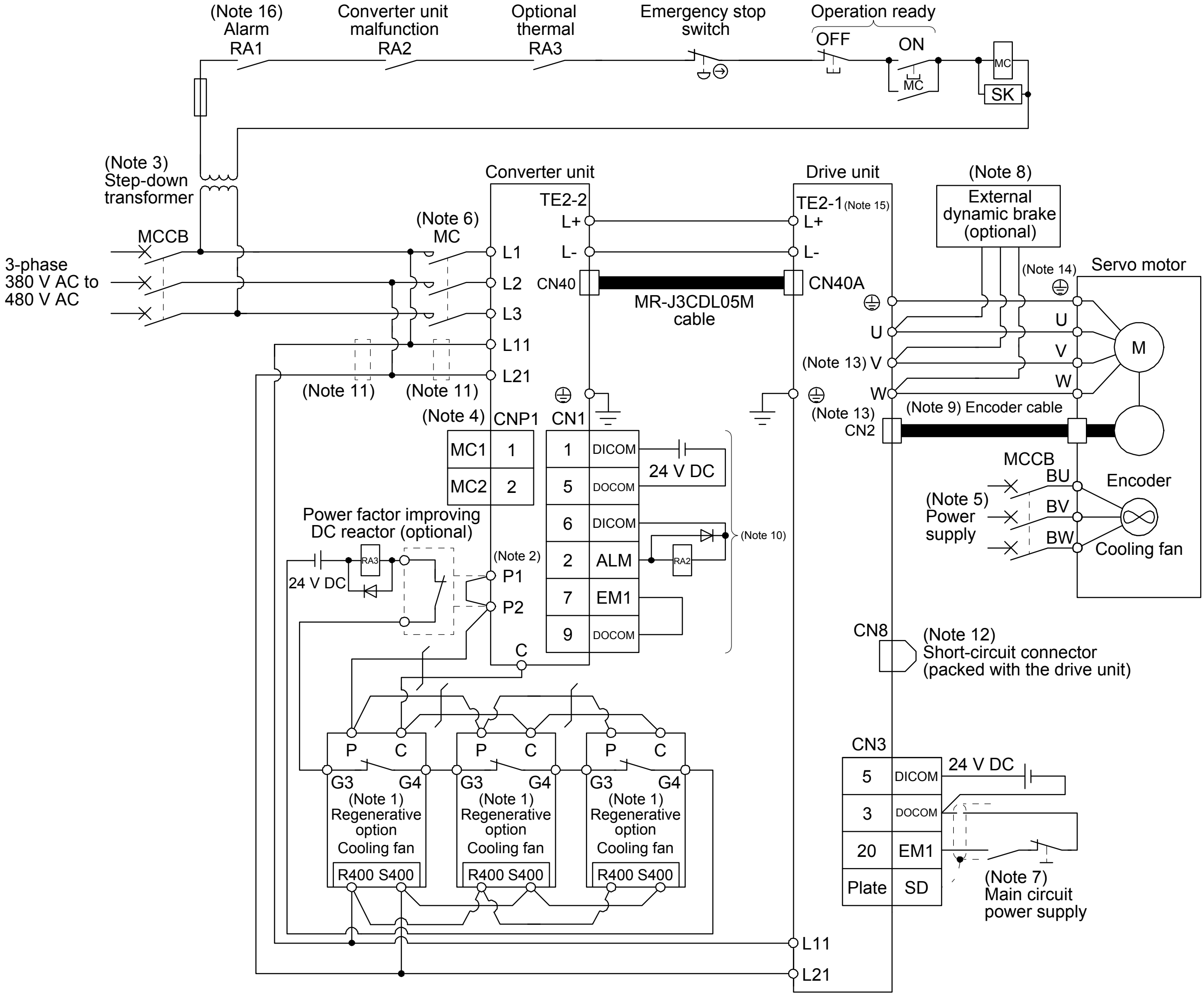
POINT
●Always connect a protection coordination cable (MR-J3CDL05M). ●Always turn on or off the control circuit power supplies of the converter unit and the drive unit simultaneously.

1) 200 V class



Note
1. For the MR-RB137. For the MR-RB137, three units are used as one set (permissible regenerative power: 3900 W).
2. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
3. Always connect the magnetic contactor wiring connector to CNP1 of the converter unit. Disconnected state may cause an electric shock.
4. For specifications of the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
5. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
6. To prevent an unexpected restart of the drive unit, configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off.
7. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.
8. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
9. This diagram shows sink I/O interface. For source I/O interface, refer to section 14.3.6 (2).
10. Install an overcurrent protection device (molded-case circuit breaker, fuse, or others) to protect the branch circuit. (Refer to section 14.9.5.)
11. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with the drive unit.
12. Do not connect the servo motor of a wrong axis to U, V, W, or CN2 of the drive unit. Otherwise, a malfunction may occur.
13. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
14. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

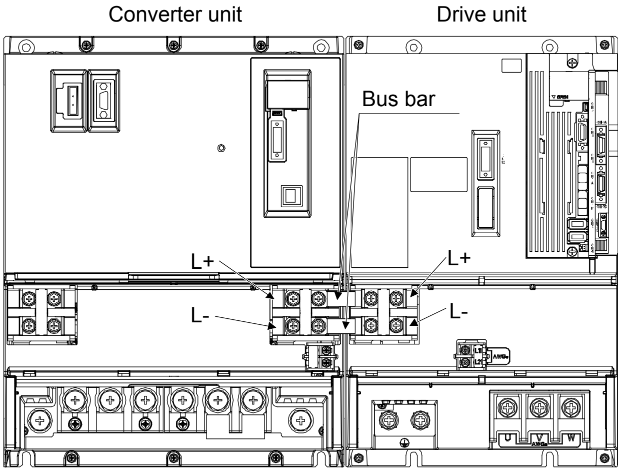
2) 400 V class


(Note 16) Alarm RA1
Converter unit malfunction RA2
Optional thermal RA3
Emergency stop switch
Operation ready
OFF
ON
MC
SK
(Note 3) Step-down transformer
MCCB
3-phase 380 V AC to 480 V AC
(Note 6) MC
Converter unit
TE2-2
L+
L-
L1
L2
L3
L11
L21
CN40
MR-J3CDL05M cable
Drive unit
TE2-1 (Note 15)
CN40A
(Note 8) External dynamic brake (optional)
(Note 14)
Servo motor
U
V
W
M
(Note 13)
(Note 9) Encoder cable
CN2
Encoder
MCCB
BU
BV
BW
(Note 5) Power supply
Cooling fan
(Note 11)
(Note 4) CNP1
CN1
MC1 1
MC2 2
1 DICOM
5 DOCOM
6 DICOM
2 ALM
7 EM1
9 DOCOM
24 V DC
RA2
(Note 10)
Power factor improving DC reactor (optional)
24 V DC
RA3
(Note 2)
P1
P2
C
CN8
(Note 12) Short-circuit connector (packed with the drive unit)
P C
G3 G4
(Note 1) Regenerative option
Cooling fan
R400 S400
CN3
5 DICOM
3 DOCOM
20 EM1
Plate SD
24 V DC
(Note 7) Main circuit power supply
L11
L21

Note 1. This is for MR-RB13V-4. For the MR-RB13V-4, three units are used as one set (permissible regenerative power: 3900 W).
2. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
3. A step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.
4. Always connect the magnetic contactor wiring connector to CNP1 of the converter unit. Disconnected state may cause an electric shock.
5. For specifications of the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
6. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
7. To prevent an unexpected restart of the drive unit, configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off.
8. Use an external dynamic brake for the drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment. For wiring of the external dynamic brake, refer to section 14.9.3.
9. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
10. This diagram shows sink I/O interface. For source I/O interface, refer to section 14.3.6 (2).
11. Install an overcurrent protection device (molded-case circuit breaker, fuse, or others) to protect the branch circuit. (Refer to section 14.9.5.)
12. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with the drive unit.
13. Do not connect the servo motor of a wrong axis to U, V, W, or CN2 of the drive unit. Otherwise, a malfunction may occur.
14. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
15. For the MR-J4-DU30KB4-RJ020 and MR-J4-DU37KB4-RJ020, the terminal block is TE2.
16. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

(3) How to use the bus bars

Make sure to use the supplied bus bars and connect the L+ and L- of the drive unit to those of the converter unit as shown below. Never use bus bars other than the ones supplied with the drive unit. Both the units are shown with the terminal cover open.



14.3.2 Explanation of power supply system

(1) Signal explanations

POINT

- ●For the layout of the terminal block, refer to section 14.7 Dimensions.

(a) Converter unit

Connection target (application)	Symbol	(Note) Terminal block	Description	
			MR-CR55K	MR-CR55K4
Main circuit power supply	L1/L2/L3	TE1-1	Supply 3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz power to L1, L2, and L3.	Supply 3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz power to L1, L2, and L3.
Control circuit power supply	L11/L21	TE3	Supply 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz power to L11 and L21.	Supply 1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz power to L11 and L21.
Power factor improving DC reactor	P1/P2	TE1-2	When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them.	
Regenerative option	P2/C	TE1-2	Connect the regenerative option between P2 and C.	
Brake unit	L+/L-	TE2-1	When using a brake unit, connect it to this terminal. Do not connect anything other than the brake unit.	
Drive unit	L+/L-	TE2-2	Connect the L+ and L- of the drive unit to this terminal. Use the bus bars supplied with the drive unit to connect.	
Protective earth (PE)	⏚	PE	Connect the protective earth (PE) of the cabinet to this terminal.	

Note. The permissible tension applied to any of the terminal blocks TE1-1, TE1-2, TE2-1, TE2-2 is 350 N.

(b) Drive unit

Connection target (application)	Symbol	(Note 1) Terminal block	Description	
			MR-J4-DU30KB-RJ020/ MR-J4-DU37KB-RJ020	MR-J4-DU30KB4-RJ020 to MR-J4-DU55KB4-RJ020
Control circuit power supply	L11/L21	TE3	Supply 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz power to L11 and L21.	Supply 1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz power to L11 and L21.
Converter unit	L+/L-	TE2-1 (TE2) (Note 2)	Connect the L+ and L- of the converter unit to this terminal. Use the bus bars supplied with the drive unit to connect.	
Servo motor power output	U/V/W	TE1	Connect the drive unit power outputs (U, V, and W) to the servo motor power inputs (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.	
Protective earth (PE)	⏚	PE	Connect the grounding terminal of the servo motor and the protective earth (PE) of the cabinet to this terminal.	

Note 1. The permissible tension applied to any of the terminal blocks TE1, TE2-1 (TE2) is 350 N.
2. Explanations in parentheses are for MR-J4-DU30KB4-RJ020 and MR-J4-DU7KB4-RJ020.

(2) Power-on sequence

(a) Power-on procedure

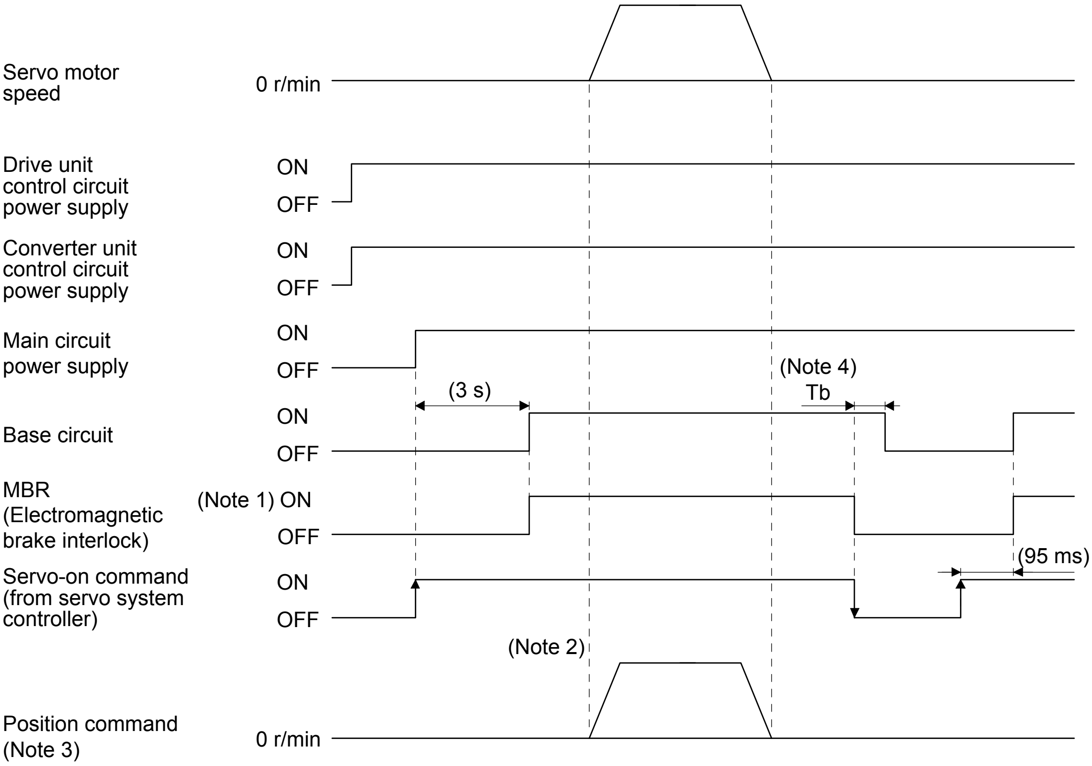
1) Always use a magnetic contactor for the main circuit power supply wiring (L1, L2, and L3) as shown in above section 14.3.1 (2). Configure an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Turn on the control circuit power supplies (L11/L21) of the converter unit and drive unit simultaneously with the main circuit power supply or before turning on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the drive unit will operate properly.

(b) Timing chart

1) When magnetic contactor drive output is enabled and the status remains at ready-on

The main circuit power is not shut off with servo-off.



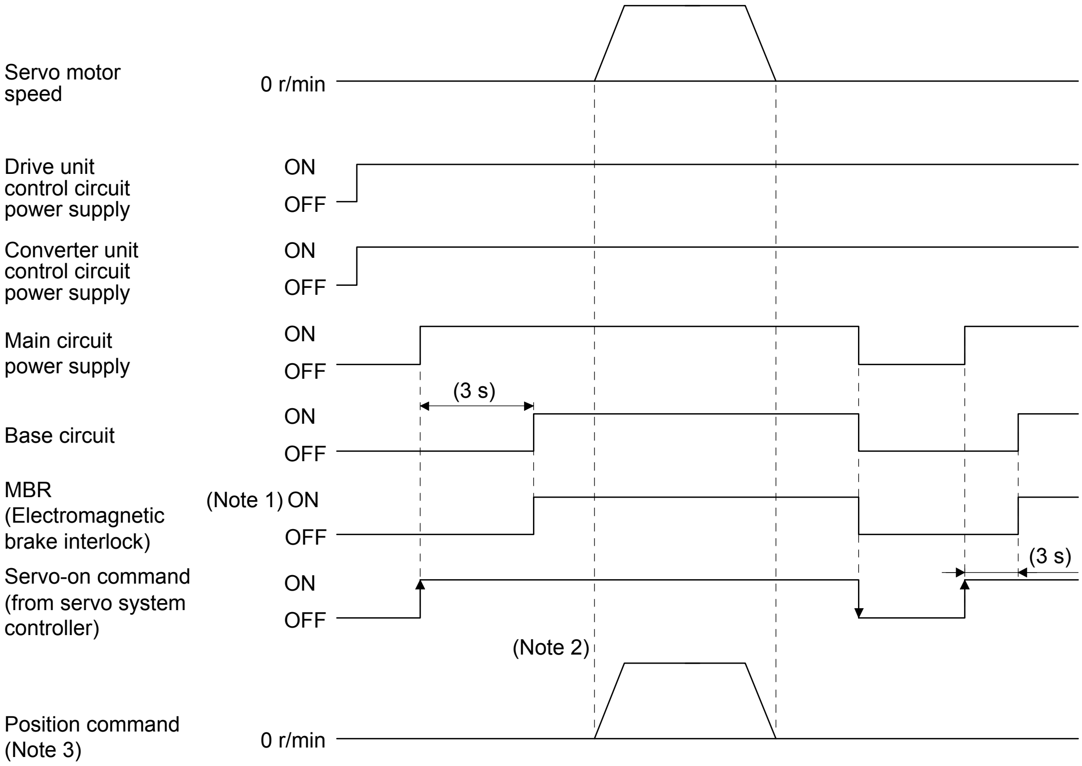
Note 1. When setting up an electromagnetic brake at customer's side, make up a sequence which will operate the electromagnetic brake as follow using MBR (Electromagnetic brake interlock).
ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

2. Give a position command after the external electromagnetic brake is released.

3. This is in position control mode.

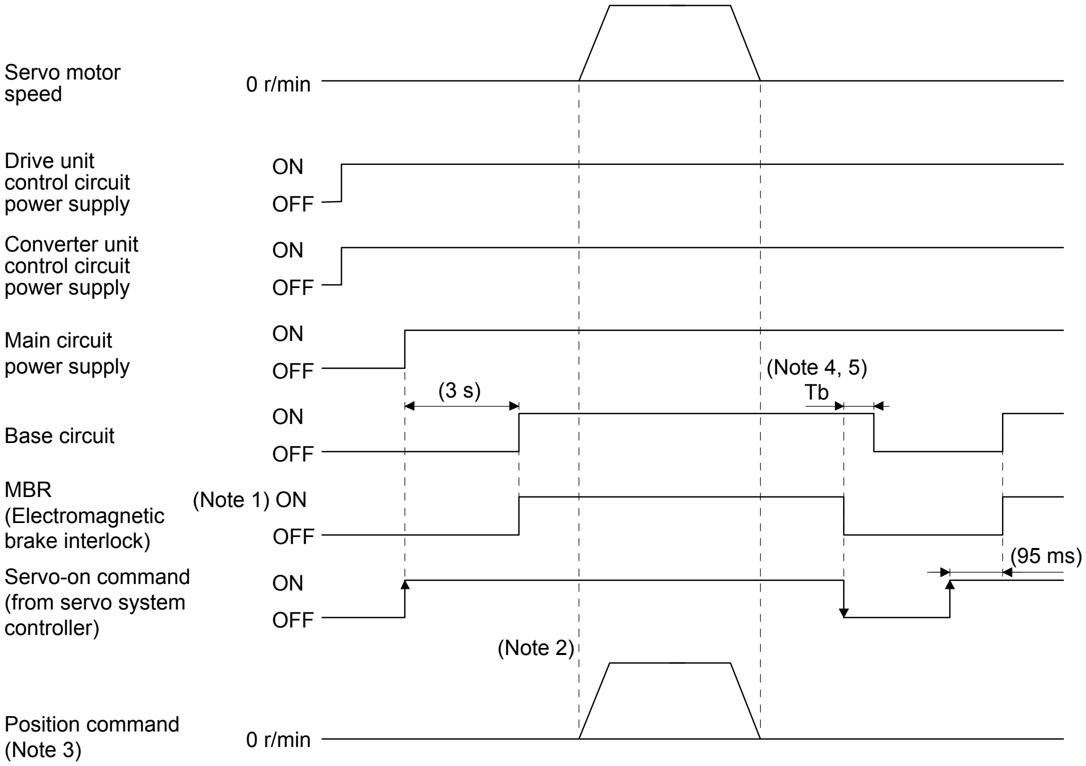
4. In [Pr. 21 Electromagnetic brake sequence output], set a delay time (Tb) from MBR (Electromagnetic brake interlock) off to base circuit shut-off at a servo-off.

2) When magnetic contactor drive output is enabled and the status returns to ready-off
   The magnetic contactor of the converter unit is turned off with servo-off, and the main circuit power supply is shut off.



Note 1. When setting up an electromagnetic brake at customer's side, make up a sequence which will operate the electromagnetic brake as follow using MBR (Electromagnetic brake interlock).
ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.
2. Give a position command after the external electromagnetic brake is released.
3. This is in position control mode.

3) When magnetic contactor drive output is disabled
When an alarm occurs, turn off the magnetic contactor using the external sequence, and shut off the main circuit power supply.



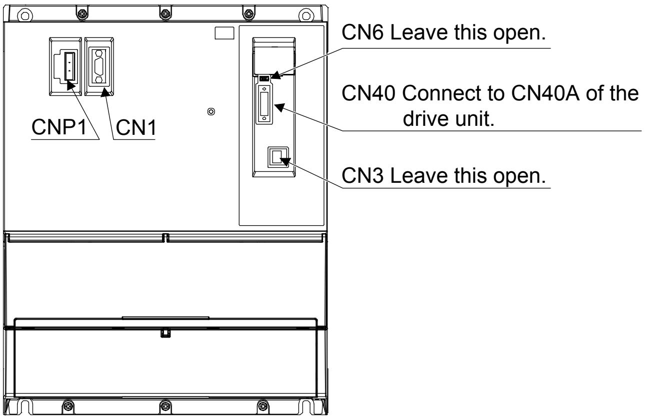
Note 1. When setting up an electromagnetic brake at customer's side, make up a sequence which will operate the electromagnetic brake as follow using MBR (Electromagnetic brake interlock).
ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.
2. Give a position command after the external electromagnetic brake is released.
3. This is in position control mode.
4. In [Pr. 21 Electromagnetic brake sequence output], set a delay time (Tb) from MBR (Electromagnetic brake interlock) off to base circuit shut-off at a servo-off.
5. The base circuit remains ready-on status at servo-off. When the status is ready-off, the base circuit and the servo-on command turn off at the same time. (Tb = 0)

14.3.3 Connectors and pin assignment

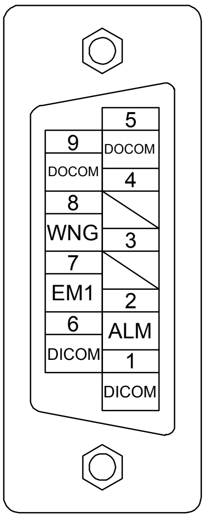
POINT

- The pin assignment of the connectors is as viewed from the cable connector wiring section.

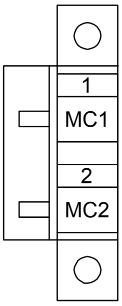
(1) Converter unit



CN1 (Digital I/O connector)
Model: 17JE-23090-02(D8A)K11-CG (D-sub 9 pin or equivalent)
(DDK)

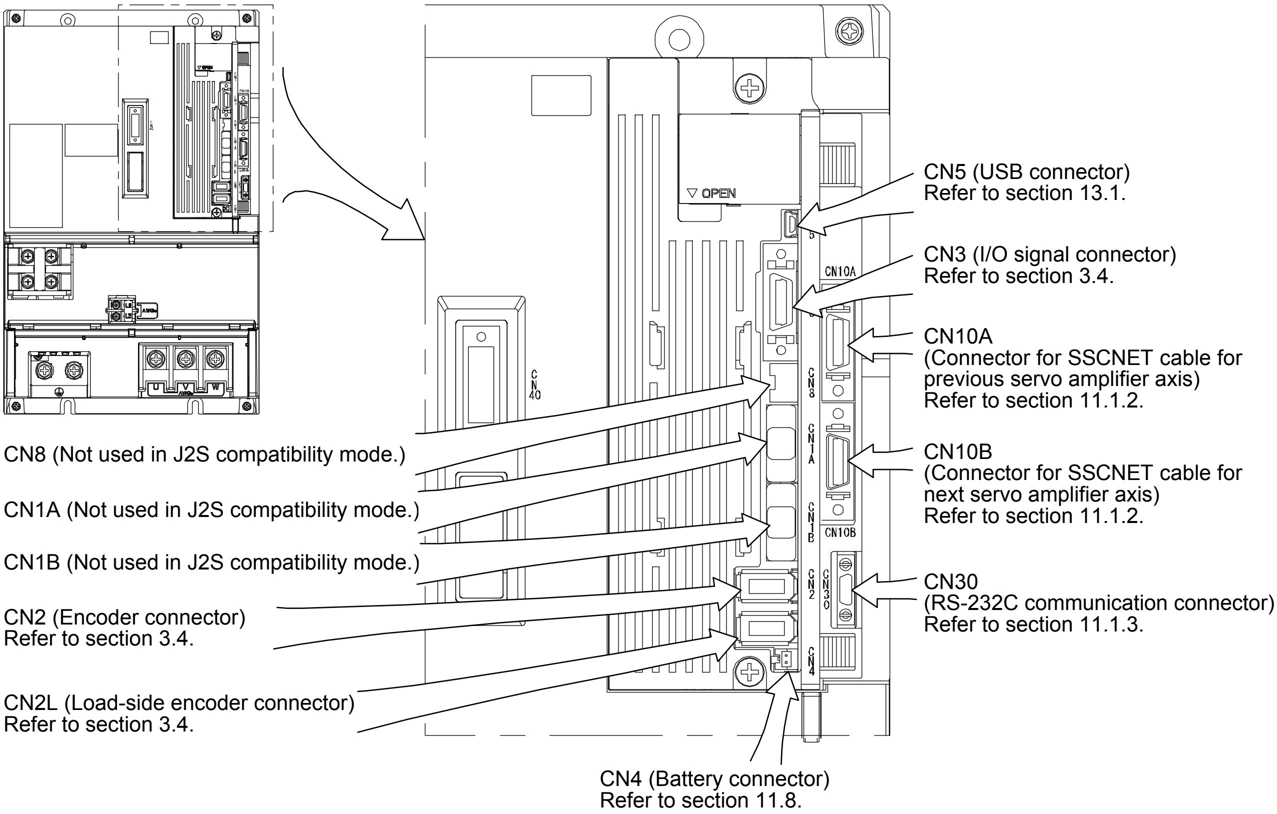


CNP1 (Magnetic contactor wiring connector)
Model: GFKC 2,5/2-STF-7,62
(Phoenix Contact)



(2) Drive unit

The following shows the front view of drive units of MR-J4-DU30KB4-RJ020, MR-J4-DU37KB4-RJ020, and MR-J4-T20. For views of other drive units, connector arrangements, and details, refer to section 3.4.



14.3.4 Signal (device) explanations

Signals (devices) of MR-J4-DU_B_-RJ020 are the same as those of MR-J4-_B_-RJ020. Refer to section 3.5.
The following table lists the converter unit signals (devices).
For the I/O interfaces (symbols in I/O division column in the table), refer to section 14.3.6 (1).

Signal (device)	Symbol	Connector pin No.	Function and application	I/O division
Digital I/F power supply input	DICOM	CN1-1 CN1-6	Input 24 V DC (24 V DC ± 10% 150 mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. For sink interface, connect + of 24 V DC external power supply. For source interface, connect - of 24 V DC external power supply.	
Forced stop	EM1	CN1-7	When MR-CR55K is used with MR-J4-DUB_-RJ020, EM1 is not used. Connect between EM1 and DOCOM externally. Turn EM1 off to bring the converter unit to a forced stop state. In this state, the magnetic connector is turned off, [AL. E9 Main circuit off warning] occurs in the drive unit, and the servo-on turns off. When the converter unit is in the forced stop state, turning EM1 on resets the state.	DI
Malfunction	ALM	CN1-2	ALM turns off when power is switched off or the protective circuit is activated. When no alarm occurs, ALM turns on 1.5 s after power-on.	DO
Warning	WNG	CN1-8	When warning has occurred, WNG turns on.	DO
Digital I/F common	DOCOM	CN1-5 CN1-9	Common terminal for the ALM and WNG output signals of the converter unit. This is separated from LG. Pins are connected internally. For sink interface, connect - of 24 V DC external power supply. For source interface, connect + of 24 V DC external power supply.	
Magnetic contactor drive output	MC1	CNP1-1	Connect it to the coil of the magnetic contactor. Always supplies the control circuit power since it is conducted with L11 in the converter unit. ⚠WARNING ●Always connect the magnetic contactor wiring connector to CNP1 of the converter unit. Disconnected state may cause an electric shock.	
	MC2	CNP1-2	Connect it to the coil of the magnetic contactor. When the converter unit receives a start command from the drive unit, CNP1-2 and L21 are shorted, and the control circuit power is supplied to the magnetic contactor. Set "_ _ _ 0" in [Pr. PA02] when controlling the magnetic contactor without magnetic contactor control connector (CNP1). (Refer to section 14.3.1 (1).)	

14.3.5 Alarm occurrence timing chart

⚠CAUTION

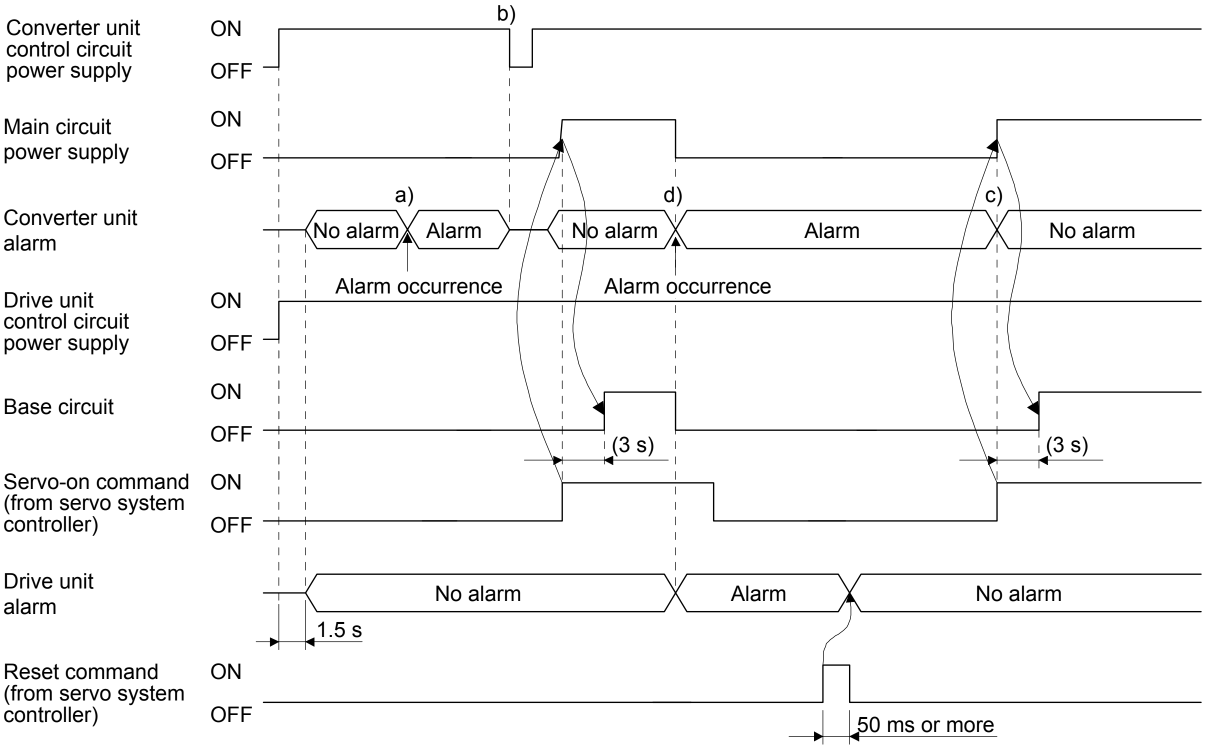
- When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.
- As soon as an alarm occurs, make the Servo-off status and interrupt the main circuit power.

(1) Timing charts of converter unit and drive unit

(a) When magnetic contactor drive output is enabled

1) Converter unit

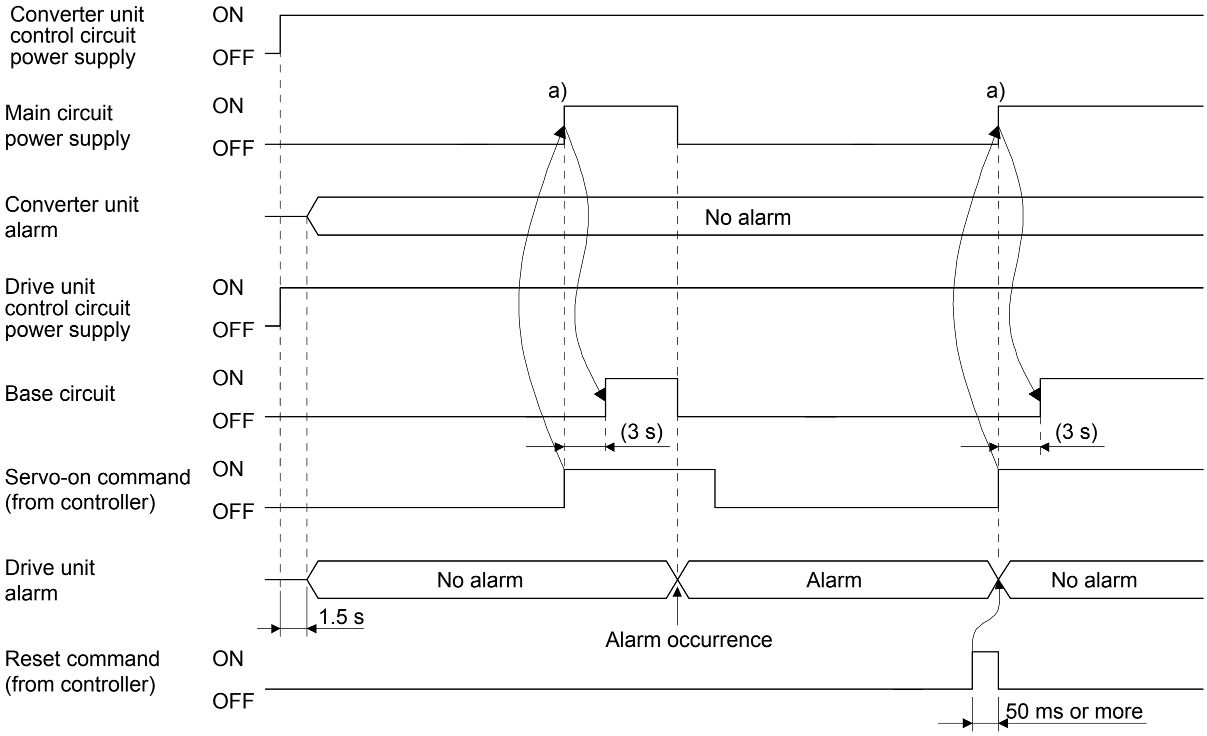
When an alarm occurs in the converter unit, the magnetic contactor is turned off and the main circuit magnetic contactor is shut off. The drive unit in operation stops. To deactivate the alarm, cycle the control circuit power or request the operation from the driver unit. However, the alarm cannot be deactivated unless its cause is removed.



a) in figure	When the drive unit is at servo-off, even if an alarm occurs in the converter, the drive unit does not detect the alarm.
b) and c) in figure	To deactivate the alarm of the converter unit, cycle the power of the converter unit (b)), or turn on the servo-on command (c)).
d) in figure	If an alarm occurs in the converter unit when the drive unit is at servo-on, the alarm also occurs in the drive unit and the drive unit becomes servo-off.

2) Drive unit

When an alarm occurs on the drive unit, the base circuit is shut off and the servo motor coasts. When an external dynamic brake (option) is used, the external dynamic brake is activated to stop the servo motor. To deactivate the alarm, cycle the control circuit power, or give the error reset or CPU reset command from the servo system controller. However, the alarm cannot be deactivated unless its cause is removed.

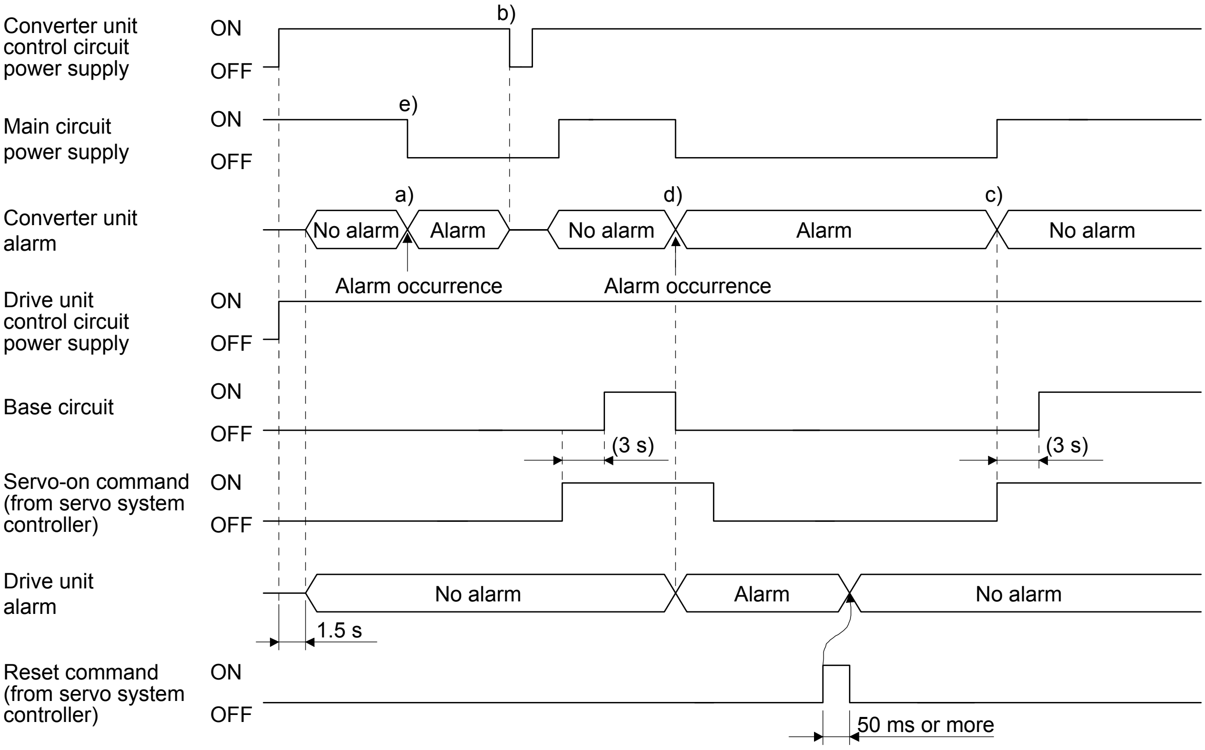


a) in figure	After the start-up of the drive unit is completed, the main circuit power is supplied while the drive unit and the converter unit have no alarm.

(b) When magnetic contactor drive output is disabled

1) Converter unit

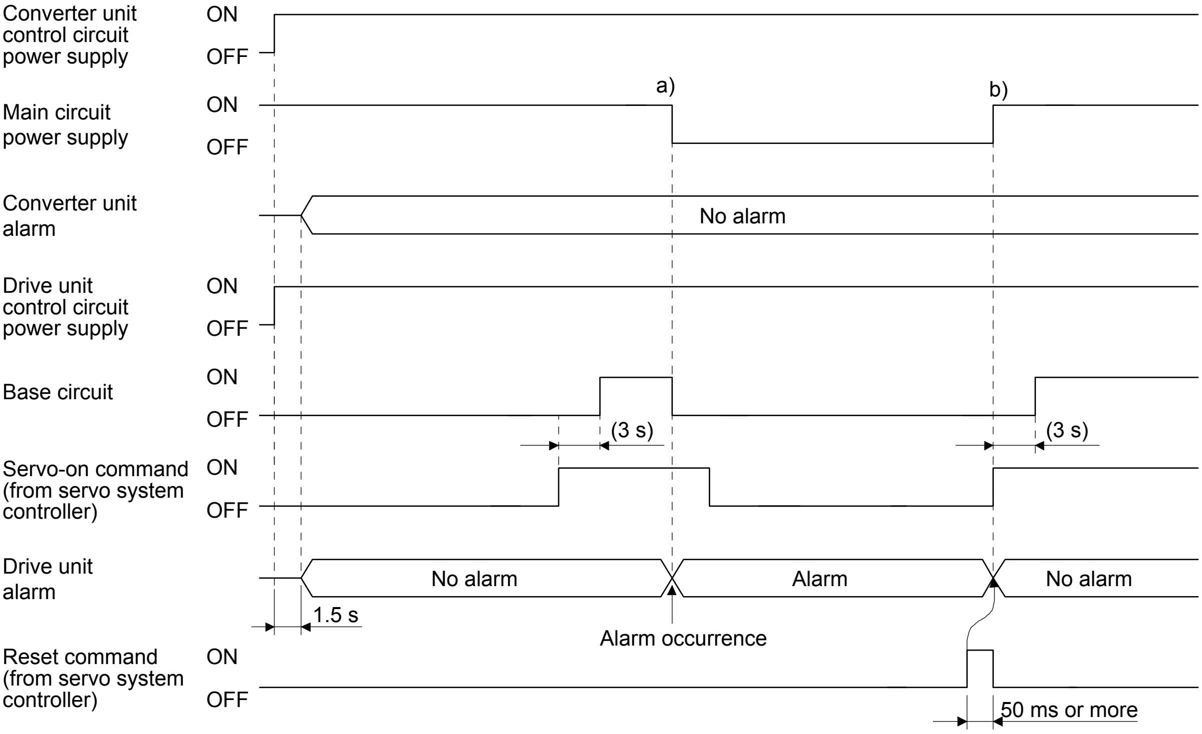
When an alarm occurs in the converter unit, the converter unit turns into servo-off, but the main circuit power supply is not shut off. Therefore, shut off the main circuit power supply using the external sequence. Cancel the alarm in the converter unit. If an alarm also occurs in the drive unit, cancel the alarm in the drive unit as well. Then, turn on the error reset command from the servo system controller to resume the operation.



a) in figure	When the drive unit is at servo-off, even if an alarm occurs in the converter, the drive unit does not detect the alarm.
b) and c) in figure	To deactivate the alarm of the converter unit, cycle the power of the converter unit (b)), or turn on the servo-on command (c)).
d) in figure	If an alarm occurs in the converter unit when the drive unit is at servo-on, the alarm also occurs in the drive unit and the drive unit becomes servo-off.
e) in figure	Shut off the main circuit power supply using the external sequence as soon as an alarm occurs.

2) Drive unit

When an alarm occurs in the drive unit, the drive unit turns into the servo-off, but the main circuit power supply is not shut off. Therefore, shut off the main circuit power supply using the external sequence. After cancelling the alarm in the drive unit, turn on the error reset command from the servo system controller to resume the operation.

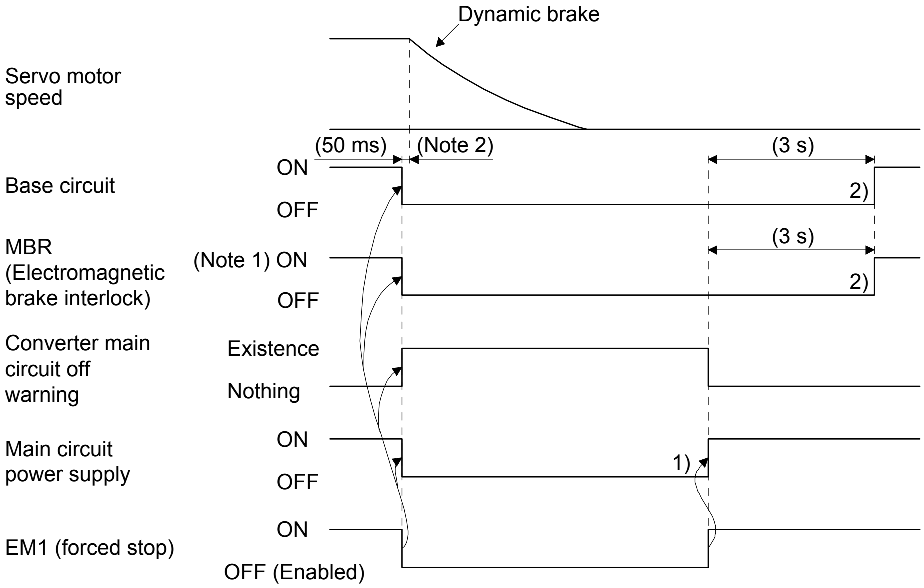


a) in figure	When an alarm occurs in the drive unit, shut off the main circuit power supply using the external sequence.
b) in figure	Turn on the main circuit power supply while an alarm in the drive unit is cancelled.

(2) Forced stop in the converter unit

(a) When magnetic contactor drive output is enabled

When EM1 (Forced stop) is disabled in the converter unit, the magnetic contactor is turned off and the main circuit power supply is shut off. The drive unit in operation stops, and [AL. E9 Main circuit off warning] appears. When EM1 (Forced stop) is enabled in the converter unit, the magnetic contactor is turned on, the main circuit power is supplied, and then the drive unit automatically resumes the operation.



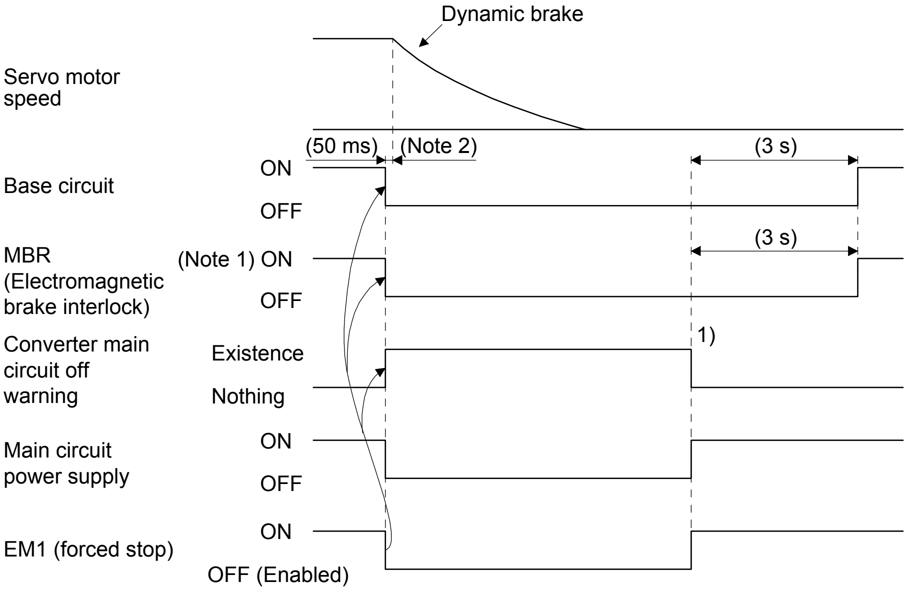
Note 1. When setting up an electromagnetic brake at customer's side, make up a sequence which will operate the electromagnetic brake as follow using MBR (Electromagnetic brake interlock).
ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

2. There is delay caused by magnetic contactor built into the external dynamic brake (about 50 ms) and delay caused by the external relay.

1) in figure	When EM1 (Forced stop) is enabled in the converter unit, the main circuit power is supplied.
2) in figure	After the capacitor in the main circuit is fully charged, the base circuit and MBR (Electromagnetic brake interlock) turn on.

(b) When magnetic contactor drive output is disabled

When EM1 (Forced stop) is disabled in the converter unit, the base circuit of the drive unit that is in operation shuts off, and [AL. E9 Main circuit off warning] appears on the drive unit. When EM1 (Forced stop) is enabled in the converter unit, the drive unit automatically resumes the operation.



Note 1. When setting up an electromagnetic brake at customer's side, make up a sequence which will operate the electromagnetic brake as follow using MBR (Electromagnetic brake interlock).

ON: Electromagnetic brake is not activated.

OFF: Electromagnetic brake is activated.

2. There is delay caused by magnetic contactor built into the external dynamic brake (about 50 ms) and delay caused by the external relay.

1) in figure	When EM1 (Forced stop) is enabled, the main circuit off warning on the drive unit disappears.

14.3.6 Interfaces

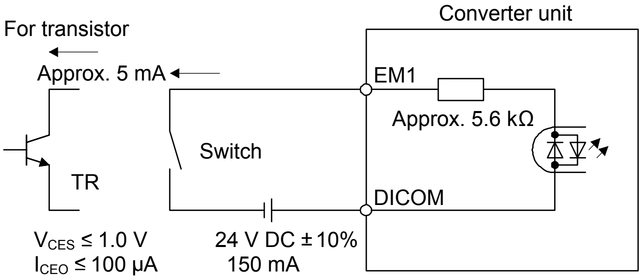
The interface of MR-J4-DU_B_-RJ020 is the same as that of MR-J4-_B_-RJ020. Refer to section 3.8.

(1) Detailed explanation of interfaces

This section (1) provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 14.3.4. Refer to this section and make connections to the external device.

(a) Digital input interface DI

This is an input circuit in which the cathode of the photocoupler is the input terminal. Transmit signals from sink (open-collector) type transistor output, relay switch, etc. The following shows a connection diagram for sink input. Refer to section 14.3.6 (2) for source input.



(b) Digital output interface DO

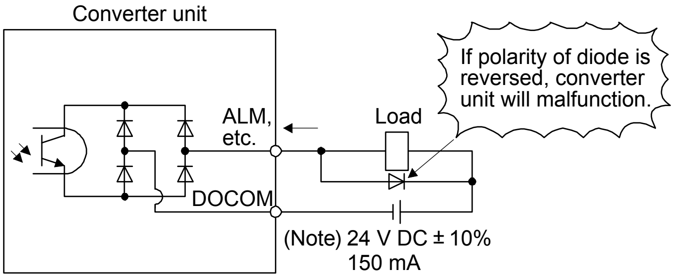
This is a circuit in which the collector of the output transistor is the output terminal. When the output transistor is turned on, the current will flow from the collector terminal.

A lamp, relay, or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load.

(Rated current: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less)

A maximum of 2.6 V voltage drop occurs in the converter unit.

The following shows a connection diagram for sink output. Refer to section 14.3.6 (2) for source output.



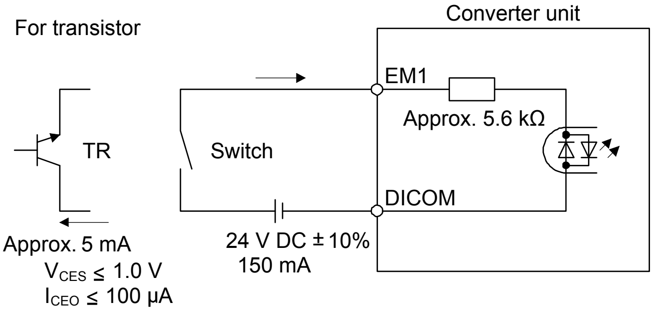
Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(2) Source I/O interfaces

In this converter unit, source type I/O interfaces can be used.

(a) Digital input interface DI

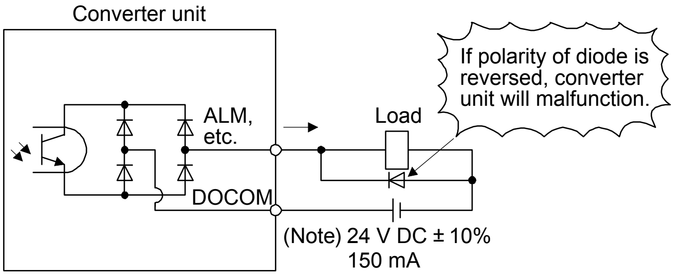
This is an input circuit in which the anode of the photocoupler is the input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.



(b) Digital output interface DO

This is a circuit in which the emitter of the output transistor is the output terminal. When the output transistor is turned on, the current will flow from the output terminal to a load.

A maximum of 2.6 V voltage drop occurs in the converter unit.

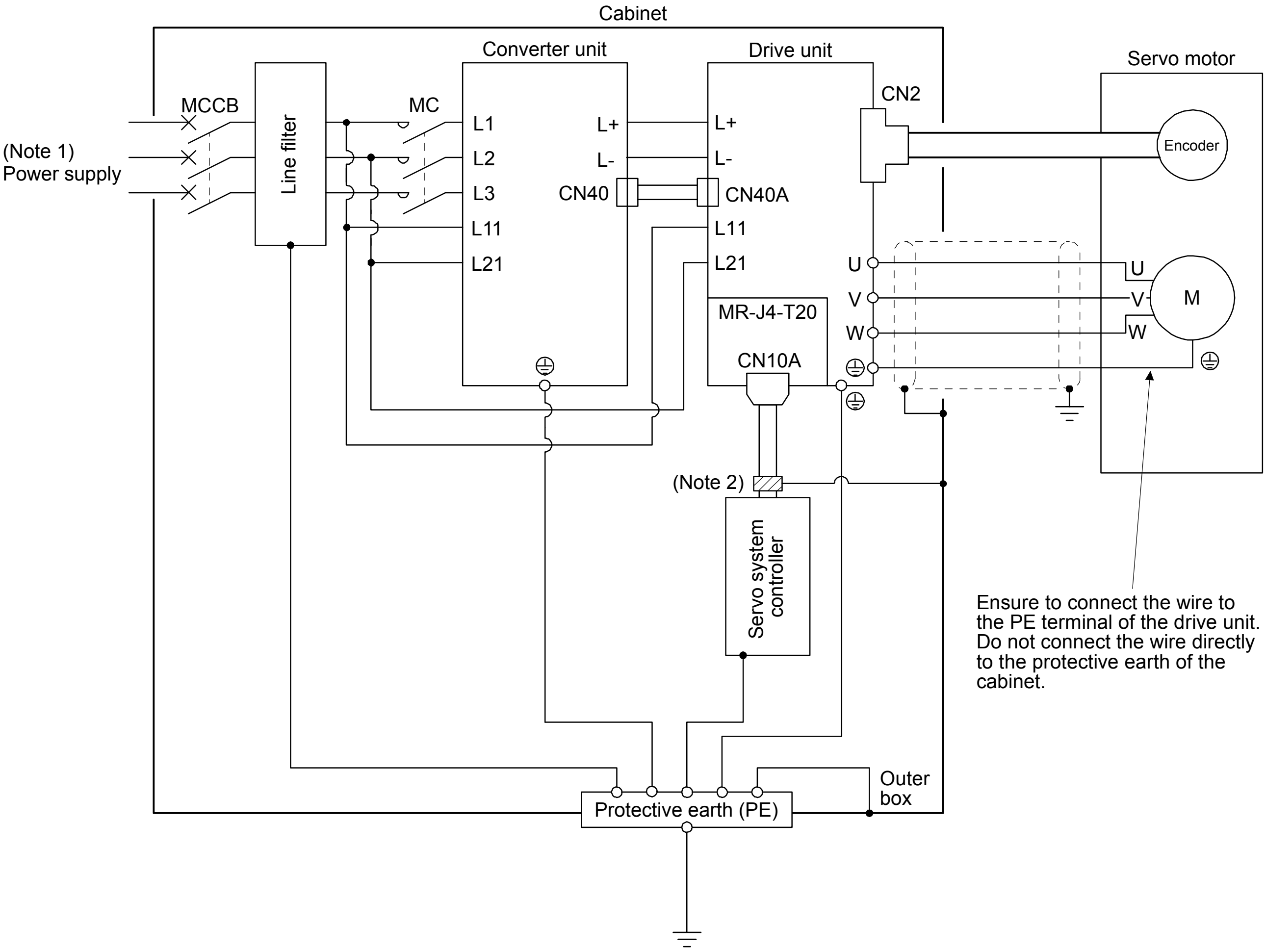


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

14.3.7 Grounding

⚠WARNING	●Ground the converter unit, the drive unit and the servo motor securely. ●To prevent an electric shock, always connect the protective earth (PE) terminal (marked⏚) of the converter unit and drive unit to the protective earth (PE) of the cabinet.

The drive unit switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the drive unit may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to the EMC Installation Guidelines (IB(NA)67310).



Note 1. For power supply specifications, refer to section 14.1.2.
2. To reduce the influence of the external noise, it is recommended that you attach cable clamp fittings to ground the SSCNET cable or connect 3 to 4 data line filters in series near the servo system controller.

14.4 Start up

⚠WARNING

- ●Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.

⚠CAUTION

- ●Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly.
- ●The heat sink of the converter unit, the drive unit, the regenerative resistor, the servo motor, etc. may become hot while power is on and for some time after power-off. Take safety measures, such as providing covers, to avoid accidentally touching the parts (cables, etc.) by hand.
- ●During operation, never touch the rotor of the servo motor. Otherwise, it may cause injury.

POINT

- ●Before switching power on, install MR-J4-T20 to MR-J4-DU_B_-RJ020 drive unit. For MR-J4-T20 installation procedure, refer to section 1.8.

The following items are the same as those of MR-J4-_B_-RJ020. Refer to each section of the detailed explanation field for details. Read the corresponding section by replacing "servo amplifier" to "drive unit".

Item	Detailed explanation
Switch setting and display of the servo amplifier	Section 4.3
Test operation	Section 4.4
Test operation mode	Section 4.5

14.4.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.

(1) Startup procedure

	Description	Reference
Wiring check	Check whether the converter unit, the drive unit, and the servo motor are wired correctly using visual inspection, DO forced output function, etc.	Section 14.4.1 (2)
Surrounding environment check	Check the surrounding environment of the converter unit, the drive unit and the servo motor.	Section 4.1.3
Axis No. settings	Confirm that the control axis No. set with the axis selection rotary switch (SW1) and the control axis No. set with the servo system controller are consistent.	Section 4.3.1
Parameter setting	Set the parameters as necessary, such as the used operation mode and regenerative option selection.	Section 14.5
Test operation of servo motor alone in test operation mode	For the test operation, disconnect the servo motor from the machine, and check whether the servo motor rotates correctly at the slowest speed.	Section 4.5
Test operation of servo motor alone by commands	For the test operation, disconnect the servo motor from the machine, give commands to the drive unit, and check whether the servo motor rotates correctly at the lowest speed.	
Test operation with servo motor and machine connected	Connect the servo motor with the machine, and check machine motions by transmitting operation commands from the servo system controller.	
Gain adjustment	Make gain adjustment to optimize the machine motions.	Chapter 6
Actual operation		
Stop	Stop giving commands and stop operation.	

(2) Wiring check

(a) Power supply system wiring

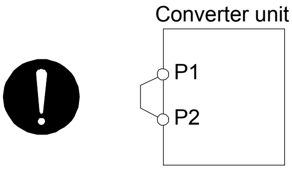
Before turning on the power supplies of the main circuit and the control circuit, check the following items.

1) Power supply system wiring

a) The power supplied to the converter unit power input terminals (L1, L2, L3, L11, and L21) and the drive unit power input terminals (L11 and L21) should satisfy the defined specifications. (Refer to section 14.1.3.)

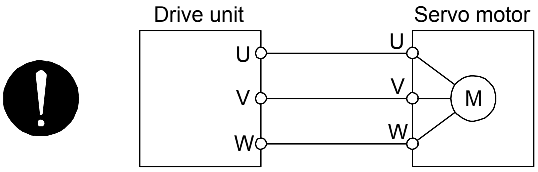
b) When magnetic contactor drive output is enabled, the magnetic contactor control connector (CNP1) should be connected to the coil of the magnetic contactor.

c) When the power factor improving DC reactor is not used, P1 and P2 in the converter unit should be connected.

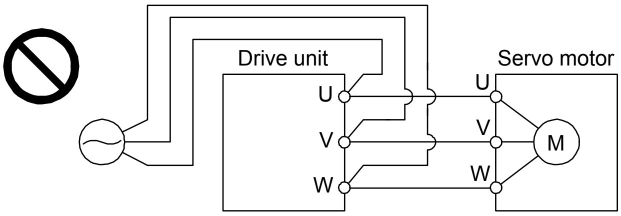


2) Connection of drive unit and servo motor

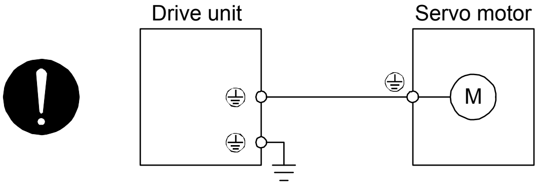
a) The drive unit power outputs (U, V, and W) should match in phase with the servo motor power input terminals (U, V, and W).



b) The power supplied to the converter unit should not be connected to the drive unit power outputs (U, V, and W). Doing so will fail the connected drive unit and servo motor.



c) The grounding terminal of the servo motor is connected to the PE terminal of the drive unit.



d) The CN2 connector of the drive unit should be connected to the encoder of the servo motor securely by using the encoder cable.

3) When using options and peripheral equipment

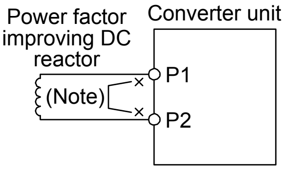
a) When using a regenerative option

- The regenerative option should be connected to P+ and C terminals of the converter unit.
- A twisted wire should be used. (Refer to section 14.9.2 (4).)

b) When using a brake unit

- The brake unit should be connected to L+ and L- terminals of TE2-1 of the converter unit. (Refer to section 14.9.10 (3).)
- A twisted wire should be used for the wiring over 5 m and equal to or less than 10 m when the brake unit is used. (Refer to section 14.9.10 (3).)

c) The power factor improving DC reactor should be connected between P1 and P2 of the converter unit. (Refer to section 14.9.6.)



Note. Always disconnect wiring between P1 and P2.

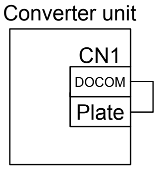
(b) I/O signal wiring

1) Converter unit

a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN1 connector. This function can be used to perform a wiring check. In this case, turn on the control circuit power supply only. For details of I/O signal connection, refer to section 14.3.1 (2). For details of DO forced output, refer to section 14.4.3 (3) (c).

b) A voltage exceeding 24 V DC is not applied to the pins of the CN1 connector.

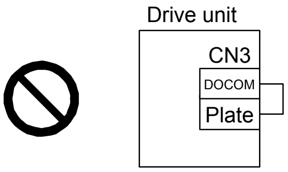
c) Between plate and DOCOM of the CN1 connector should not be shorted.



2) Drive unit
   a) The I/O signals should be connected correctly.
      Use DO forced output to forcibly turn on/off the pins of the CN3 connector. You can use the function to check the wiring. In this case, turn on the control circuit power supply only.
      Refer to section 3.2 for details of I/O signal connection. For details of DO forced output, refer to section 4.5.1.

   b) A voltage exceeding 24 V DC is not applied to the pins of the CN3 connector.

   c) Between plate and DOCOM of the CN3 connector should not be shorted.



14.4.2 Startup

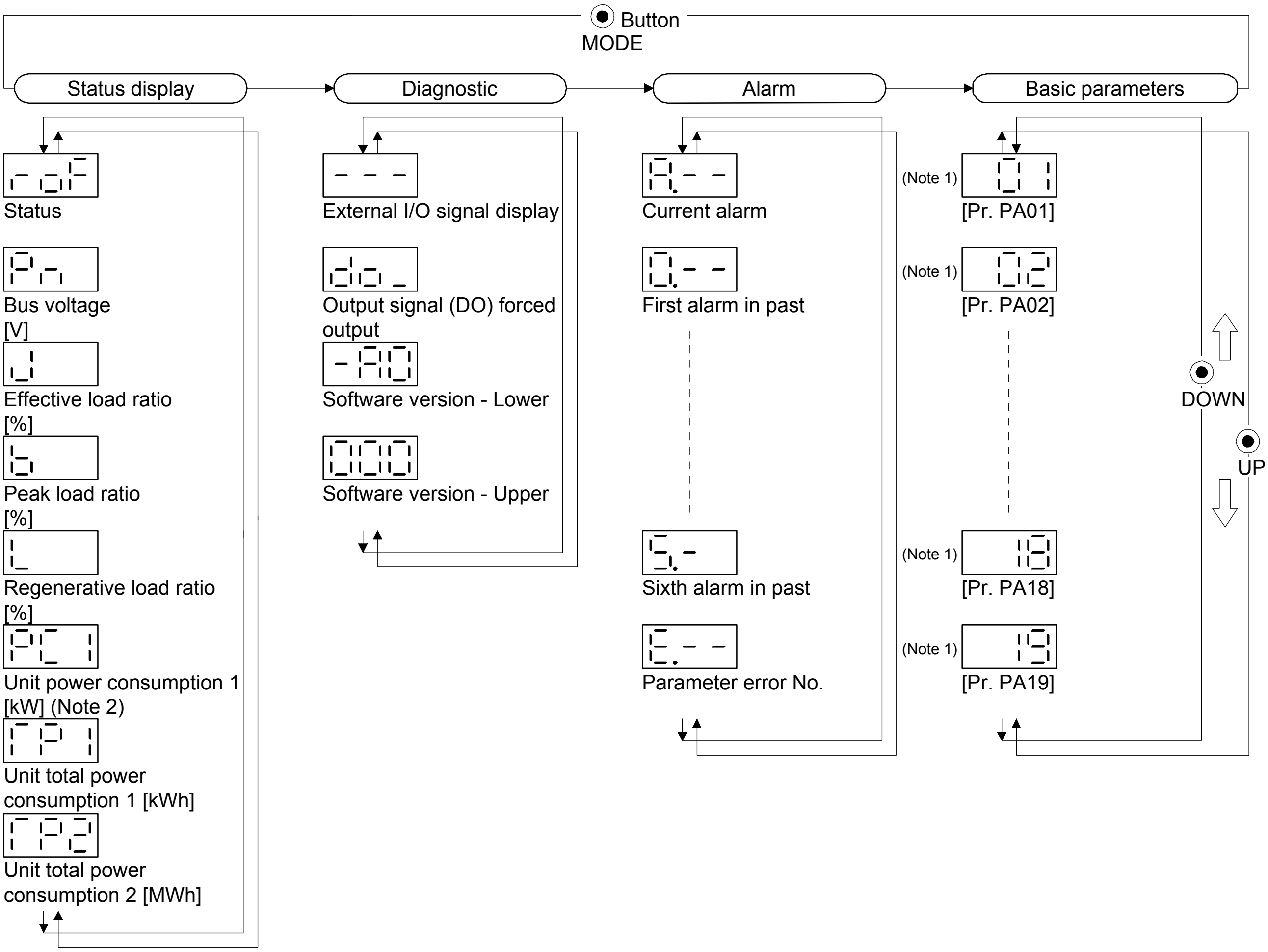
Startup of the MR-J4-DU_B_-RJ020 is the same as that of the MR-J4-_B_-RJ020. Refer to section 4.2 for details.
The converter unit display shows "rof" (ready-off) at power-on.
When an error occurs or EM1 (Forced stop) is disabled in the converter unit, the operation will stop.

14.4.3 Display and operation section of the converter unit

(1) Display flowchart

The converter unit has the display (3-digit, 7-segment LED) and the operation section (4 pushbuttons) for converter unit status display, alarm display, parameter setting, etc. Set the parameters before operation, diagnose an alarm, confirm external sequences, and/or confirm the operation status.

The following shows the operation procedure after power-on.



Note 1. When a parameter is selected, the parameter group and the parameter No. are displayed alternately. Refer to section 14.4.3 (5) for details.

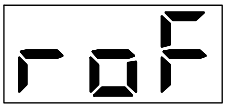
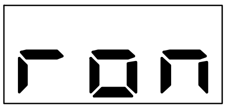
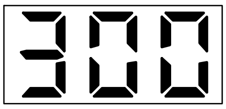
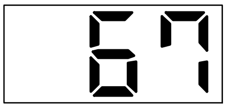
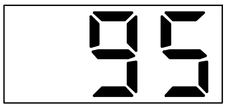
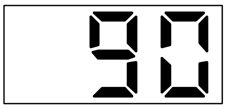
2. The unit of unit power consumption 1 can be changed with [Pr. PA15].

(2) Status display mode

The converter unit status during operation is shown on the 3-digit, 7-segment LED display. Press the "UP" or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol is displayed. Press the "SET" button to display that data.

(a) Display examples

The following table shows the display examples.

Item	State	Displayed data
Status	Ready-off	
	Ready-on	
Bus voltage	300 [V]	
Effective load ratio	67 [%]	
Peak load ratio	95 [%]	
Regenerative load ratio	90 [%]	

(b) Status display list

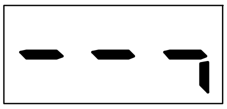
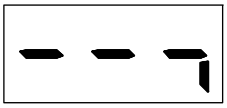
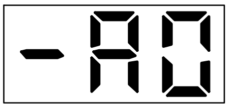
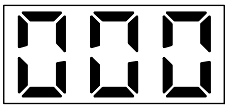
The following table lists the converter unit statuses that may be displayed.

Status display		Symbol	Unit	Description	Indication range
Status	Ready -off			Ready-off is displayed during initialization or alarm occurrence, in the external forced stop status, or when the bus voltage is not established.	roF
	Ready -on			Ready-on is displayed when the servo was switched on after completion of initialization and the converter unit is ready to operate.	ron
Bus voltage		Pn	V	The bus voltage is displayed.	0 to 999
Effective load ratio		J	%	The effective load ratio in the past 15 s is displayed relative to the rated load of 100%.	0 to 300
Peak load ratio		b	%	The peak load ratio in the past 15 s is displayed relative to the rated load of 100%.	0 to 400
Regenerative load ratio		L	%	The ratio of regenerative power to permissible regenerative power is displayed in %.	0 to 300
Unit power consumption 1		PC1	kW (Note)	Unit power consumption is displayed by increment of 1 kW or 0.1 kW.	0 to 999
Unit total power consumption 1		TP1	kWh	Unit total power consumption is displayed by increment of 1 kWh.	0 to 999
Unit total power consumption 2		TP2	MWh	Unit total power consumption is displayed by increment of 1 MWh.	0 to 999

Note. The unit of unit power consumption 1 can be changed with [Pr. PA15].

(3) Diagnostic mode

(a) Diagnostic list

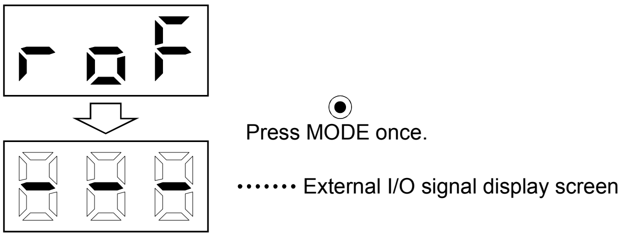
Name	Display	Description
External I/O signal display		Indicates the on/off status of external I/O signal. Refer to (b) of this section for details.
Output signal (DO) forced output		Indicates that the digital output signal can be switched on/off forcibly. Refer to (c) of this section for details.
Software version - Lower		Indicates the version of the software.
Software version - Upper		Indicates the system number of the software.

(b) External I/O signal display

The on/off states of the digital I/O signals connected to the converter unit can be confirmed.

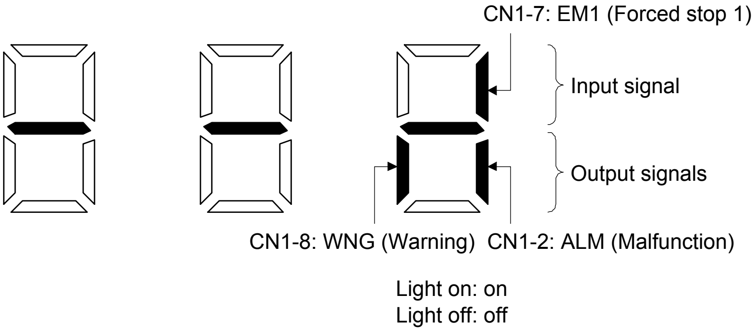
1) Operation

The following shows the display screen at power-on. Using the "MODE" button, display the diagnostic screen.



2) Display definition

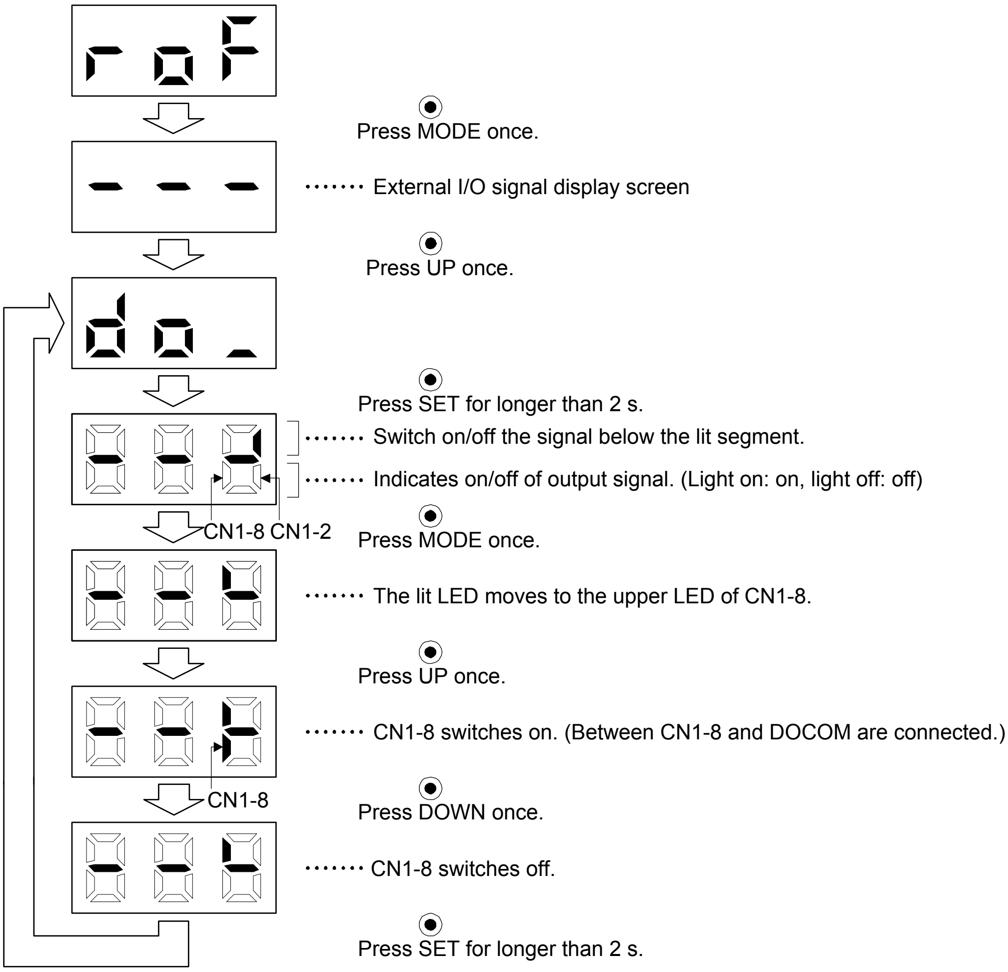
The LED segment corresponding to the pin is lit to indicate on, and is extinguished to indicate off. The 7-segment LED segments and CN1 connector pins correspond as shown below.



(c) Output signal (DO) forced output

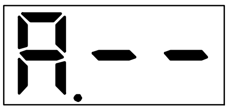
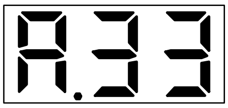
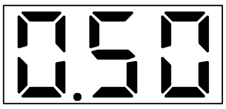
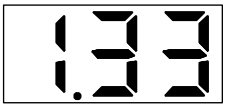
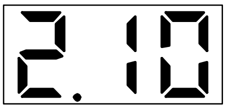
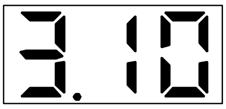
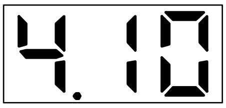
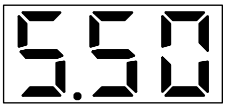
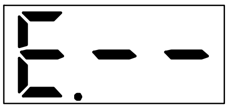
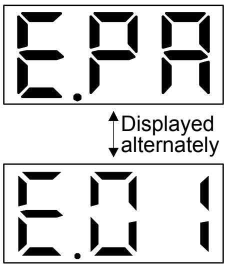
Output signals can be forcibly switched on/off independently of the converter unit status. Use this function for checking output signal wiring, etc. The following shows the display screen at power-on.

When turning CN1-8 on and off



(4) Alarm mode

The current alarm, past alarm history, and parameter error are displayed. The lower 2 digits on the display indicate the alarm number that has occurred or the parameter number in error.

Name	Display	Description
Current alarm		Indicates no occurrence of an alarm.
		Indicates that [AL. 33 Overvoltage] occurred. Flickers at alarm occurrence.
Alarm history		Indicates that the last alarm is [AL. 50 Overload 1].
		Indicates that the second alarm in the past is [AL. 33 Undervoltage].
		Indicates that the third alarm in the past is [AL. 10 Undervoltage].
		Indicates that the fourth alarm in the past is [AL. 10 Undervoltage].
		Indicates that the fifth alarm in the past is [AL. 10 Undervoltage].
		Indicates that the sixth alarm in the past is [AL. 50 Overload 1].
Parameter error No.		Indicates no occurrence of [AL. 37 Parameter error].
		Indicates that the data of [Pr. PA01 Regenerative option] is faulty.

Functions at alarm occurrence

(a) Any mode screen displays the current alarm.

(b) Even during alarm occurrence, the other screen can be viewed by pressing the button in the operation area. At this time, the decimal point in the third digit remains flickering.

(c) For any alarm, remove its cause and clear it in any of the following methods. (Refer to chapter 6 for the alarms that can be cleared.)

1) Switch power off, then on.

2) Press the "SET" button on the current alarm screen.

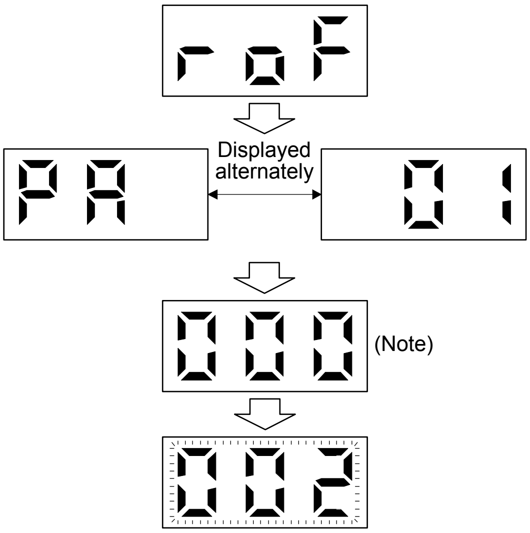
(d) Use [Pr. PA09] to clear the alarm history.

(5) Parameter mode

POINT

- The display of the converter unit has three digits. When a parameter No. is displayed, the parameter group and the parameter No. are displayed alternately. For example, when [Pr. PA01] is displayed, "PA" and "01" are displayed alternately.

The following example shows how to select MR-RB137 in [Pr. PA01 Regenerative option] after power-on.



Press MODE three times.

······· The parameter number is displayed.
For [Pr. PA01], "PA" and "01" are displayed alternately.

Press UP or DOWN to change the number.

Press MODE twice.

······· The set value of the specified parameter number flickers. In this case, the lower three digits of the setting value "0 0 0 0" are displayed.

Press MODE once.

······· During flickering, the set value can be changed.

Use UP or DOWN. When a negative value is set, the decimal point flickers.
(_ _ _ 2: MR-RB137 (3 pcs.) are used.)

Press SET to enter.

Note. When the lower three digits of the four digits are displayed, pressing the "MODE" button displays the fourth digit. However, do not change the setting of the fourth digit. Pressing the "MODE" button again resets the display to the lower three digits.

To shift to the next parameter, press the "UP" or "DOWN" button.

When changing the [Pr. PA01] setting, change its setting value, and then cycle the power to enable the new value.

14.5 Parameters

⚠CAUTION

- ●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- ●If fixed values are written in the digits of a parameter, do not change these values.
- ●Do not change parameters for manufacturer setting.
- ●Do not set a value other than the described values to each parameter.

14.5.1 Parameters for converter unit

(1) Parameter list

POINT

- ●To enable a parameter whose symbol is preceded by *, cycle the power after setting it.

No.	Symbol	Name	Initial value	Unit
PA01	*REG	Regenerative option	0000h	
PA02	*MCC	Magnetic contactor drive output selection	0001h	
PA03		For manufacturer setting	0001h	
PA04			0	
PA05			100	
PA06			0	
PA07			100	
PA08	*DMD	Status display selection	0000h	
PA09	*BPS	Alarm history clear	0000h	
PA10		For manufacturer setting	0	
PA11			0000h	
PA12	*DIF	Input filter setting	0002h	
PA13		For manufacturer setting	0000h	
PA14			0000h	
PA15	AOP3	Function selection A-3	0000h	
PA16		For manufacturer setting	0000h	
PA17	*AOP5	Function selection A-5	0001h	
PA18		For manufacturer setting	200	
PA19			0000h	

(2) Detailed list of parameters

POINT

- Set a value to each "x" in the "Setting digit" columns.

No./symbol/ name	Setting digit	Function	Initial value [unit]
PA01 *REG Regenerative option	_ _ x x	Regenerative option Select a regenerative option. Incorrect setting will trigger [AL. 37 Parameter error]. 00: Regenerative option is not used. When using the FR-BU2-(H) brake unit, select the value. 01: MR-RB139 02: MR-RB137 (3 pcs.) 13: MR-RB137-4 14: MR-RB13V-4 (3 pcs.)	00h
	_ x _ _	For manufacturer setting	0h
	x _ _ _		0h
PA02 *MCC Magnetic contactor drive output selection	_ _ _ x	Magnetic contactor drive output selection Select the magnetic contactor drive output. 0: Disabled 1: Enabled	1h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA08 *DMD Status display selection	_ _ _ x	Status display selection Select a status display shown at power-on. 0: Status 1: Bus voltage 2: Effective load ratio 3: Peak load ratio 4: Regenerative load ratio 5: Unit power consumption 1 6: Unit total power consumption 1 7: Unit total power consumption 2	0h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA09 *BPS Alarm history clear	_ _ _ x	Alarm history clear Used to clear the alarm history. 0: Disabled 1: Enabled When you select "Enabled", the alarm history will be cleared at next power-on. After the alarm history is cleared, the setting is automatically disabled.	0h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h

No./symbol/ name	Setting digit	Function	Initial value [unit]
PA12 *DIF Input filter setting	_ _ _ x	Input filter setting Select the input filter. If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 1.777 [ms] 2: 3.555 [ms] 3: 5.333 [ms]	2h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA15 AOP3 Function selection A-3	_ _ _ x	Selection of unit power consumption display unit 0: increment of 1 kW 1: increment of 0.1 kW	0h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h
PA17 *AOP5 Function selection A-5	_ _ _ x	[AL. 10 Undervoltage] detection method selection Set this parameter when [AL. 10 Undervoltage] occurs due to distorted power supply voltage waveform. 0: [AL. 10] not occurrence 1: [AL. 10] occurrence	1h
	_ _ x _	For manufacturer setting	0h
	_ x _ _		0h
	x _ _ _		0h

14.5.2 Parameters for drive unit

> **POINT**
>
> - When you connect the amplifier to a servo system controller, servo parameter values of the servo system controller will be written to each parameter.
> - Setting may not be made to some parameters and their ranges depending on the servo system controller model, drive unit software version, and MR Configurator software version. For details, refer to the servo system controller user's manual.
> - The parameter whose symbol is preceded by * is enabled with the following conditions:
>   *: After setting the parameter, cycle the power or reset the controller.
>   **: After setting the parameter, cycle the power.
> - Set a value to each "x" in the "Setting digit" columns.

The following shows parameter settings exclusively for the driver unit. Other parameters are the same as those of MR-J4-_B_-RJ020. Refer to chapter 5.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>2</td><td>*REG</td><td>Regenerative option
Select a regenerative option.
For the drive unit, select the regenerative option with the converter unit.
Selecting other than "_ _ 0 0" or "_ _ 0 1" will trigger [AL. 37 Parameter error].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Regenerative option selection
00: Regenerative option is not used, or when you use a regenerative option, set the regenerative option with the converter unit.
01: FR-BU2-(H)</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to the Name and function column.</td></tr>
</table>

14.6 Troubleshooting

POINT

- ●Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for remedies for alarms/warnings of the converter unit.
- ●For lists and remedies for alarms/warnings of the drive unit, refer to chapter 8.
- ●[AL. 37 Parameter error] and warnings are not recorded in the alarm history.

When an error occurs during operation, the corresponding alarm or warning is displayed. When an alarm or warning is displayed, refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure. When an alarm occurs, ALM will turn off.

(1) Explanation for the lists

(a) No./Name

Indicates each No./Name of alarms or warnings.

(b) Alarm deactivation

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column. Warnings are automatically canceled after the cause of occurrence is removed. Alarms are deactivated with alarm reset or cycling the power.

Alarm deactivation	Explanation
Alarm reset	Push the "SET" button on the current alarm screen of the display.
Cycling the power	Turning off the power and on again

(2) Alarm/warning list

	Display	Name	Alarm deactivation	
			Alarm reset	Cycling the power
Alarm	A.10	Undervoltage	○	○
	A.12	Memory error 1 (RAM)		○
	A.15	Memory error 2 (EEP-ROM)		○
	A.17	Board error		○
	A.19	Memory error 3 (Flash-ROM)		○
	A.30	Regenerative error	(Note) ○	(Note) ○
	A.33	Overvoltage	○	○
	A.37	Parameter error		○
	A.38	MC drive circuit error		○
	A.39	Open phase		○
	A.3A	Inrush current suppression circuit error		○
	A.45	Main circuit device overheat	(Note) ○	(Note) ○
	A.47	Cooling fan error		○
	A.50	Overload 1	(Note) ○	(Note) ○
	A.51	Overload 2	(Note) ○	(Note) ○
	888	Watchdog		○

	Display	Name
Warning	A.91	Converter overheat warning
	A.E0	Excessive regeneration warning
	A.E1	Overload warning 1
	A.E6	Converter forced stop warning
	A.E8	Cooling fan speed reduction warning

Note. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

14.7 Dimensions

POINT

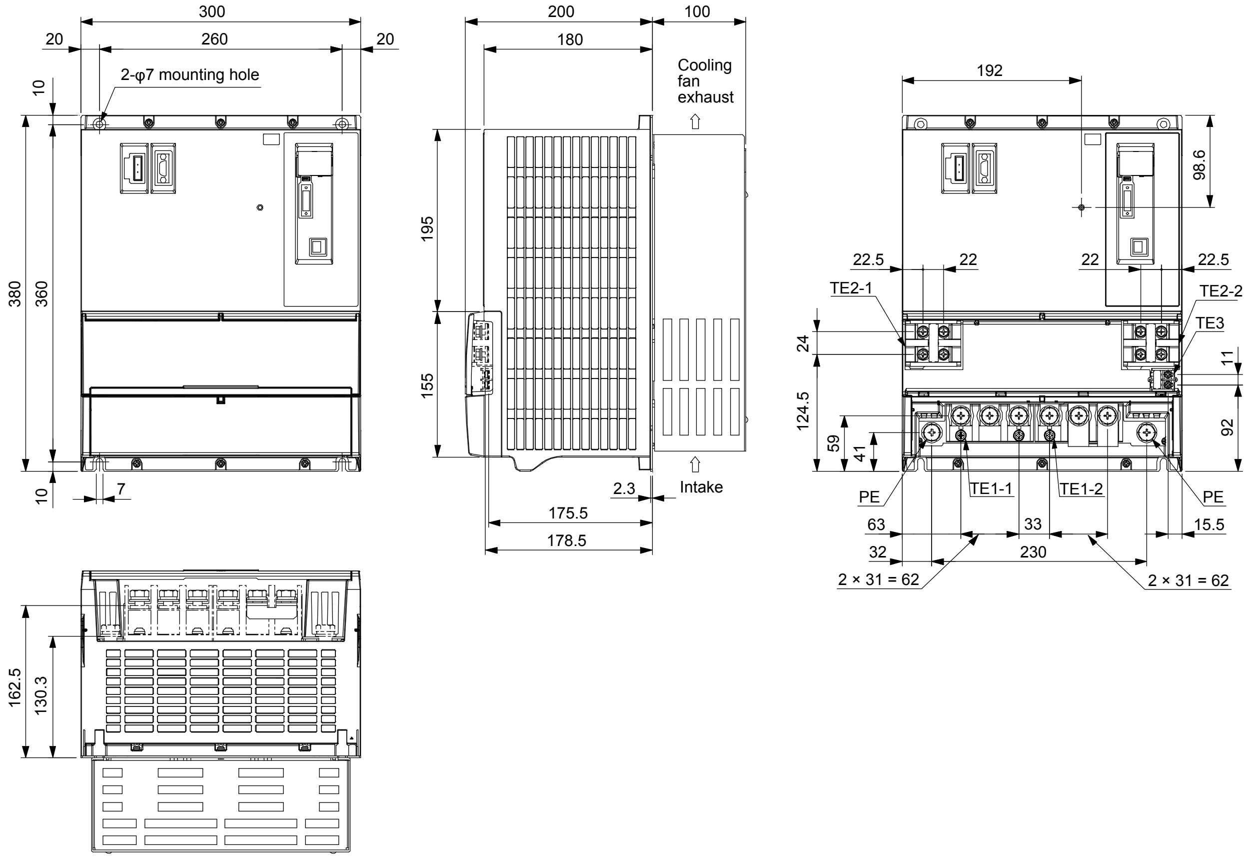
●Refer to section 14.2.1 for the mounting hole process drawing.

The following items are the same as those of MR-J4-_B_-RJ020 servo amplifiers. Refer to each section of the detailed explanation field for details.

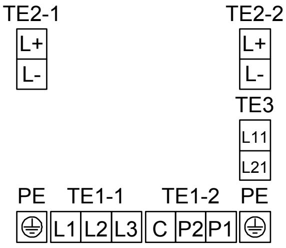
Item	Detailed explanation
MR-J4-T20	Section 9.2
Connector	Section 9.3

14.7.1 Converter unit (MR-CR55K_)

[Unit: mm]



Terminal



TE1-1	Screw size: M10 Tightening torque: 12.0 [N•m]
TE1-2	Screw size: M10 Tightening torque: 12.0 [N•m]
TE2-1	Screw size: M6 Tightening torque: 3.0 [N•m]
TE2-2	Screw size: M6 Tightening torque: 3.0 [N•m]
TE3	Screw size: M4 Tightening torque: 1.2 [N•m]
PE	Screw size: M10 Tightening torque: 12.0 [N•m]

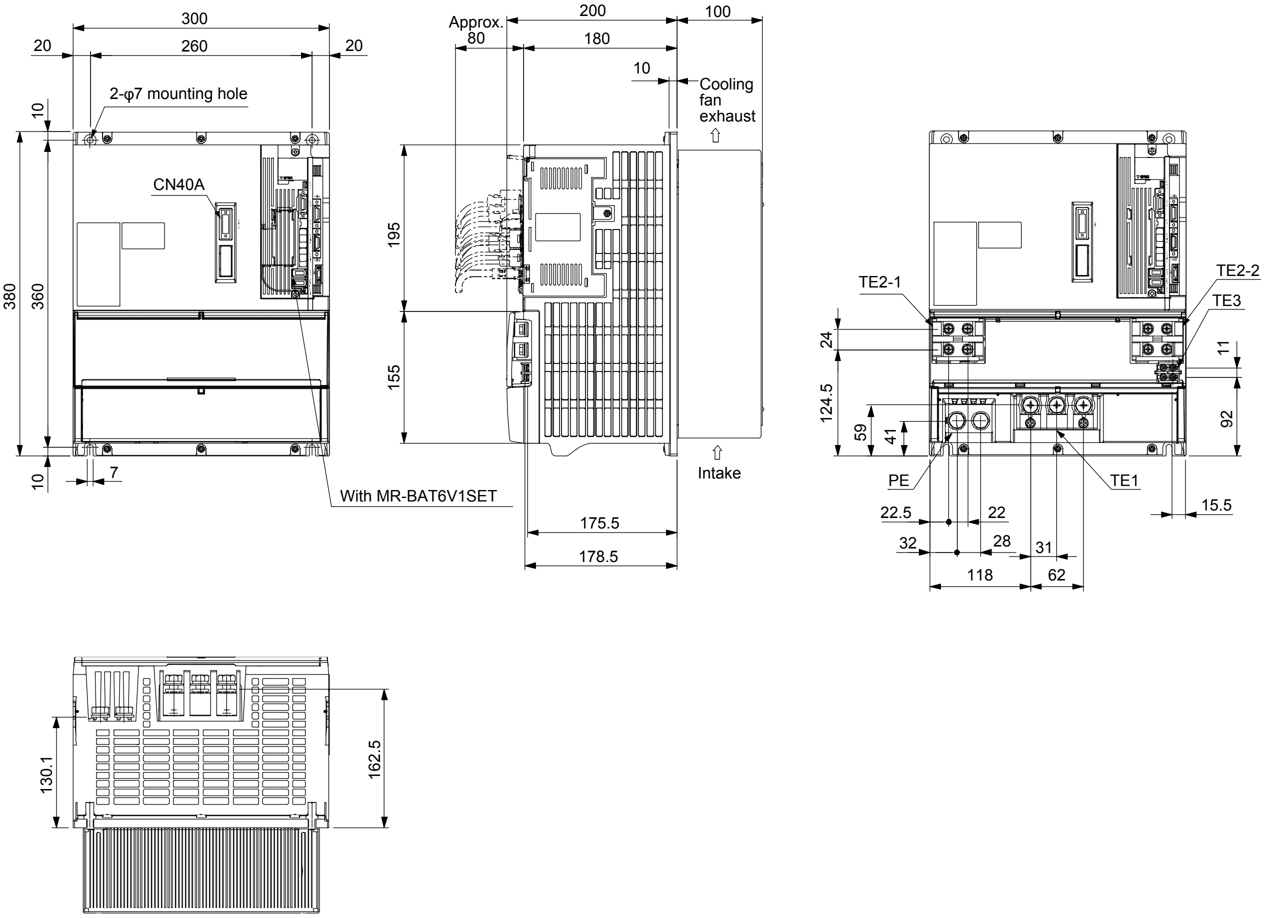
Mass: 22 [kg]

Mounting screw
  Screw size: M6
  Tightening torque: 5.49 [N•m]

14.7.2 Drive unit

(1) MR-J4-DU30KB-RJ020/MR-J4-DU37KB-RJ020/MR-J4-DU45KB4-RJ020/MR-J4-DU55KB4-RJ020

[Unit: mm]



Terminal

TE2-1
L+
L-

TE2-2
L+
L-

TE3
L11
L21

PE
⏚ ⏚

TE1
U V W

TE1 Screw size: M10
Tightening torque: 12.0 [N•m]

TE2-1 Screw size: M6
Tightening torque: 3.0 [N•m]

TE2-2 Screw size: M6
Tightening torque: 3.0 [N•m]

TE3 Screw size: M4
Tightening torque: 1.2 [N•m]

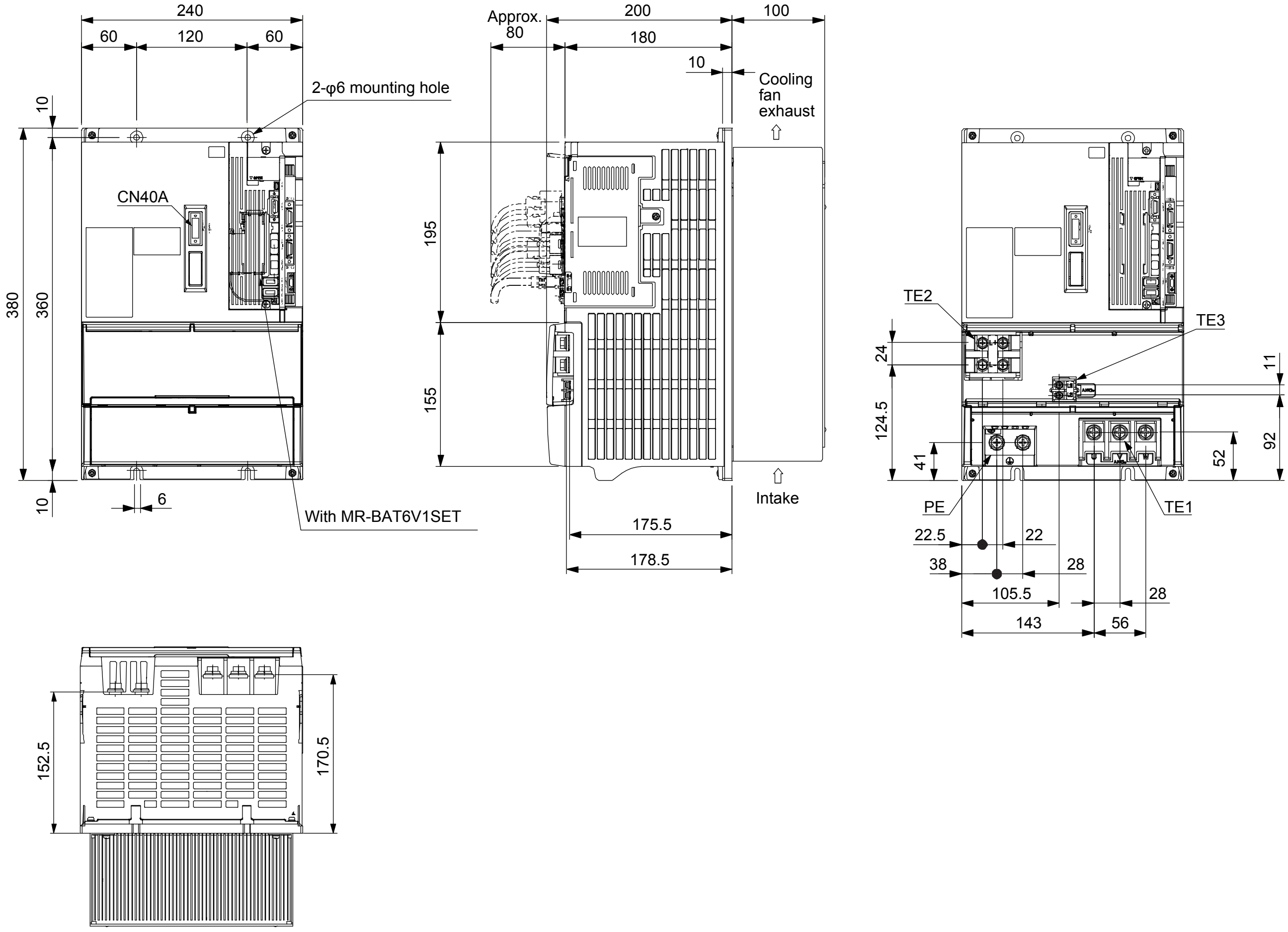
PE Screw size: M10
Tightening torque: 12.0 [N•m]

Mass: 21 [kg]

Mounting screw
Screw size: M6
Tightening torque: 5.49 [N•m]

(2) MR-J4-DU30KB4-RJ020/MR-J4-DU37KB4-RJ020

[Unit: mm]



Terminal

TE2
L+
L-

TE3
L11
L21

PE
⏚ ⏚

TE1
U V W

TE1	Screw size: M8	Tightening torque: 6.0 [N•m]
TE2	Screw size: M6	Tightening torque: 3.0 [N•m]
TE3	Screw size: M4	Tightening torque: 1.2 [N•m]
PE	Screw size: M8	Tightening torque: 6.0 [N•m]

Mass: 16 [kg]

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

14.8 Characteristics

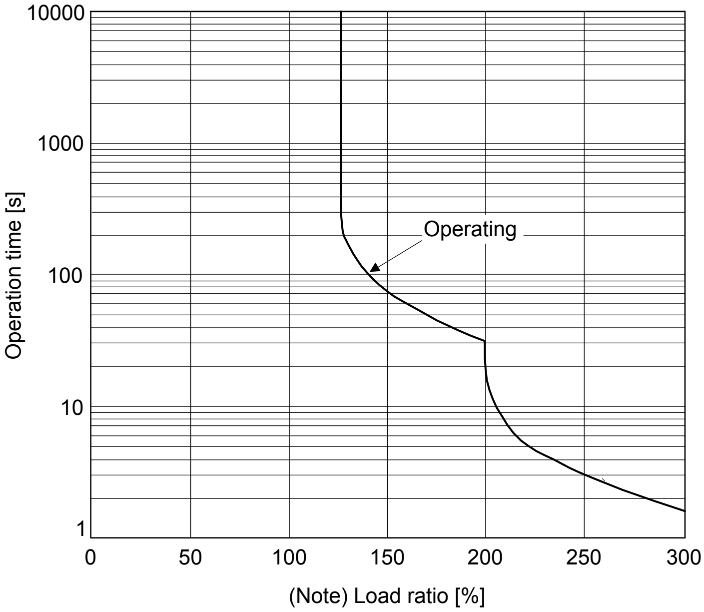
The following items are the same as those of MR-J4-_B_-RJ020. Refer to each section of the detailed explanation field for details.

Item	Detailed explanation
Cable bending life	Section 10.4

14.8.1 Overload protection characteristics

(1) Converter unit

An electronic thermal is built in the converter unit to protect the converter unit from overloads. [AL. 50 Overload 1] occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 14.1. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the graph.



Note. Load ratio 100% indicates the rated output of the converter unit. Refer to section 1.2.1 for rated output.

Fig. 14.1 Electronic thermal protection characteristics

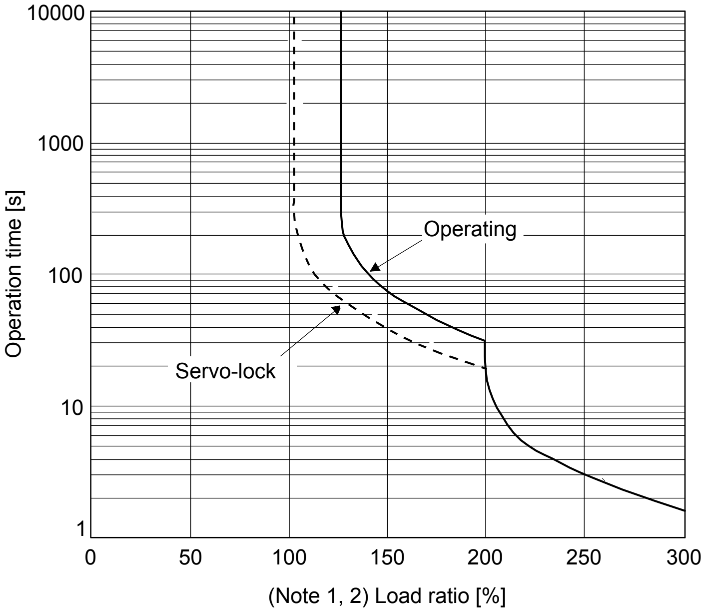
(2) Drive unit

An electronic thermal is built in the drive unit to protect the servo motor, drive unit and servo motor power wires from overloads.

[AL. 50 Overload 1] occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 14.2. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.

For the system where the unbalanced torque occurs, such as a vertical axis system, the unbalanced torque of the machine should be kept at 70% or lower of the motor's rated torque.

The drive unit has the servo motor overload protective function. (The servo motor overload current (full load current) is set on the basis of 120% rated current of the drive unit.)



Note 1. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo-lock status) or in a 30 r/min or less low-speed operation status, the drive unit may malfunction regardless of the electronic thermal protection.

2. Load ratio 100% indicates the rated output of the drive unit. Refer to section 14.1.3 (2) for rated output.

Fig. 14.2 Electronic thermal protection characteristics

14.8.2 Power supply capacity and generated loss

(1) Generated heat of the converter unit/drive unit

Table 14.1 indicates the generated loss and power supply capacity under rated load per combination of the converter unit and drive unit. When the servo motors are run at less than the rated speed, the power supply equipment capacity is lower than the value in the table but the heat generated does not change. Since the servo motor requires 2 times to 2.5 times greater instantaneous power for acceleration, use the power supply which ensures that the voltage lies within the permissible voltage fluctuation at the main circuit power supply terminals (L1, L2, and L3) of the converter unit. The power supply equipment capacity changes with the power supply impedance.

The actually generated heat falls within the ranges at rated output and at servo-off according to the frequencies of use during operation. When designing an enclosed cabinet, use the values in the table, considering the worst operating conditions. The generated heat in table 14.1 does not include heat produced during regeneration.

Table 14.1 Power supply capacity and generated heat per servo motor at rated output

Converter unit	Drive unit	Servo motor	Power supply capacity [kVA]		(Note) Drive unit-generated heat [W]			Area required for heat dissipation [m^2]
			Power factor improving DC reactor is not used	Power factor improving DC reactor is used	At rated output	At rated output [Generated heat in the cabinet when cooled outside the cabinet]	With servo-off	
MR-CR55K	MR-J4-DU30KB-RJ020	HG-JR30K1 HG-JR30K1M	48	40	1350 (900 + 450)	470	60 (30 + 30)	31.0
	MR-J4-DU37KB-RJ020	HG-JR37K1 HG-JR37K1M	59	49	1550 (1000 + 550)	550		36.6
MR-CR55K4	MR-J4-DU30KB4-RJ020	HG-JR30K14 HG-JR30K1M4	48	40	1070 (790 + 280)	390		25.8
	MR-J4-DU37KB4-RJ020	HG-JR37K14 HG-JR37K1M4	59	49	1252 (910 + 342)	470		30.8
	MR-J4-DU45KB4-RJ020	HG-JR45K1M4	71	59	1580 (1110 + 470)	550		42.4
	MR-J4-DU55KB4-RJ020	HG-JR55K1M4	87	72	1940 (1440 + 500)	650		43.0

Note. The heat generated by the drive unit is indicated in the left term within the parentheses, and the heat generated by the converter unit in the right term.

(2) Heat dissipation area for an enclosed type cabinet

The enclosed type cabinet (hereafter called the cabinet) which will contain the converter unit and drive unit should be designed to ensure that its temperature rise is within +10 ˚C at the ambient temperature of 40 ˚C. (With an approximately 5 ˚C safety margin, the system should operate within a maximum 55 ˚C limit.) The necessary cabinet heat dissipation area can be calculated by equation 14.1.

$$A = \frac{P}{K \cdot \Delta T} \quad \cdots\cdots \quad (14.1)$$

A: Heat dissipation area [m^2]
P: Loss generated in the cabinet [W]
ΔT: Difference between internal and ambient temperatures [˚C]
K: Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with equation 14.1, assume that P is the sum of all losses generated in the cabinet. Refer to table 14.1 for the generated heat of the converter unit/drive unit. "A" indicates the effective area for heat dissipation, but if the cabinet is directly installed on an insulated wall, that extra amount must be added to the cabinet's surface area. The required heat dissipation area will vary with the conditions in the cabinet. If convection in the cabinet is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the cabinet and the use of a cooling fan should be considered. Table 14.1 lists the cabinet dissipation area (guideline) when the converter unit and drive unit are operated at the ambient temperature of 40 ˚C under rated load.

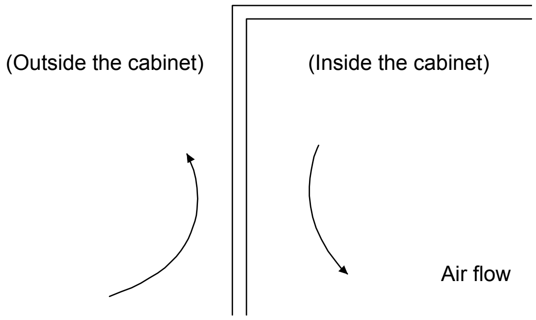


Fig. 14.3 Temperature distribution in an enclosed type cabinet

When air flows along the outer wall of the cabinet, effective heat exchange will be possible, because the temperature slope inside and outside the cabinet will be steeper.

14.8.3 Dynamic brake characteristics

POINT

- Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- Be sure to enable EM1 (Forced stop 1) after servo motor stops when using EM1 (Forced stop 1) frequently in other than emergency.
- Servo motors for MR-J4 may have the different coasting distance from that of the previous model.
- When an HG series servo motor is used with the drive unit, use the external dynamic brake for MR-J4. The external dynamic brake for MR-J2S cannot be used.

(1) Dynamic brake operation

(a) Calculation of coasting distance

Fig. 14.4 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 14.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (b) of this section.)

A working part generally has a friction force. Therefore, actual coasting distance will be shorter than a maximum coasting distance calculated with the following equation.

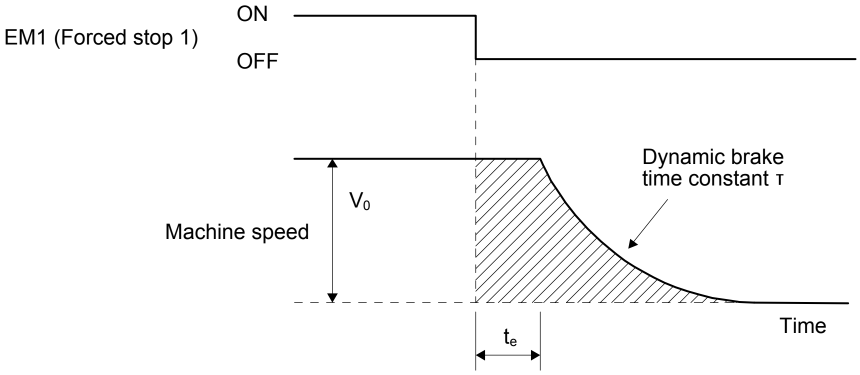


Fig. 14.4 Dynamic brake operation diagram

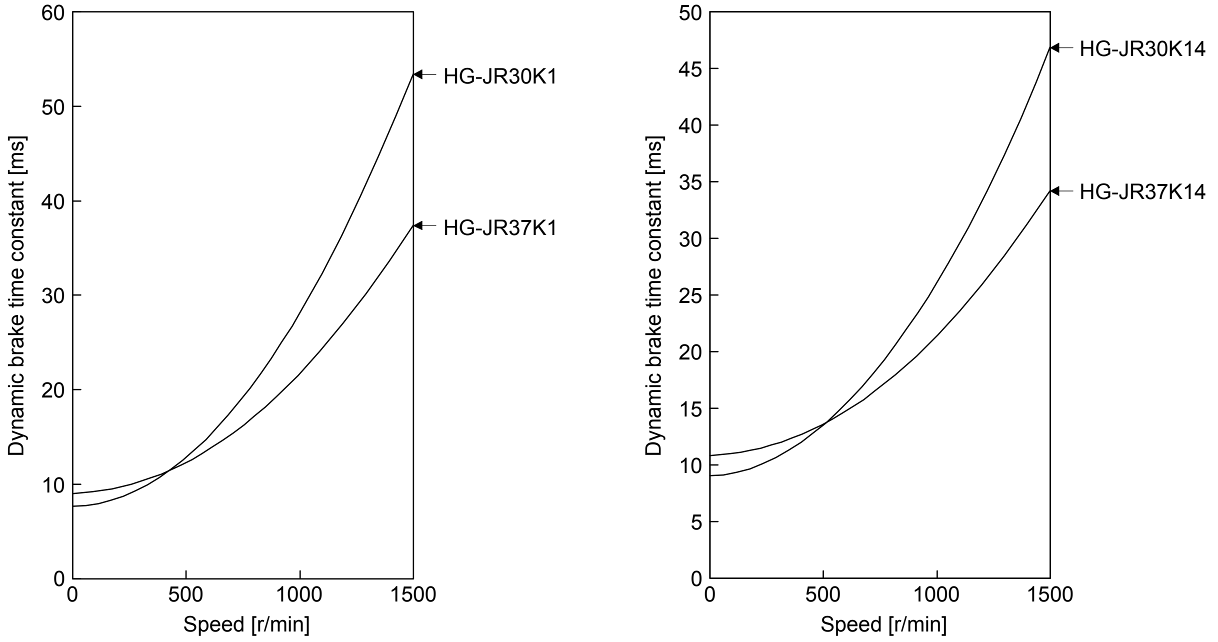
$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \cdots\cdots (14.2)$$

L_{max} : Maximum coasting distance ······ [mm]
V_0 : Machine's fast feed speed ······ [mm/min]
J_M : Moment of inertia of the servo motor ······ [$\times 10^{-4}$ kg•m^2]
J_L : Load moment of inertia converted into equivalent value on servo motor shaft ···· [$\times 10^{-4}$ kg•m^2]
τ : Dynamic brake time constant ······ [s]
t_e : Delay time of control section ······ [s]

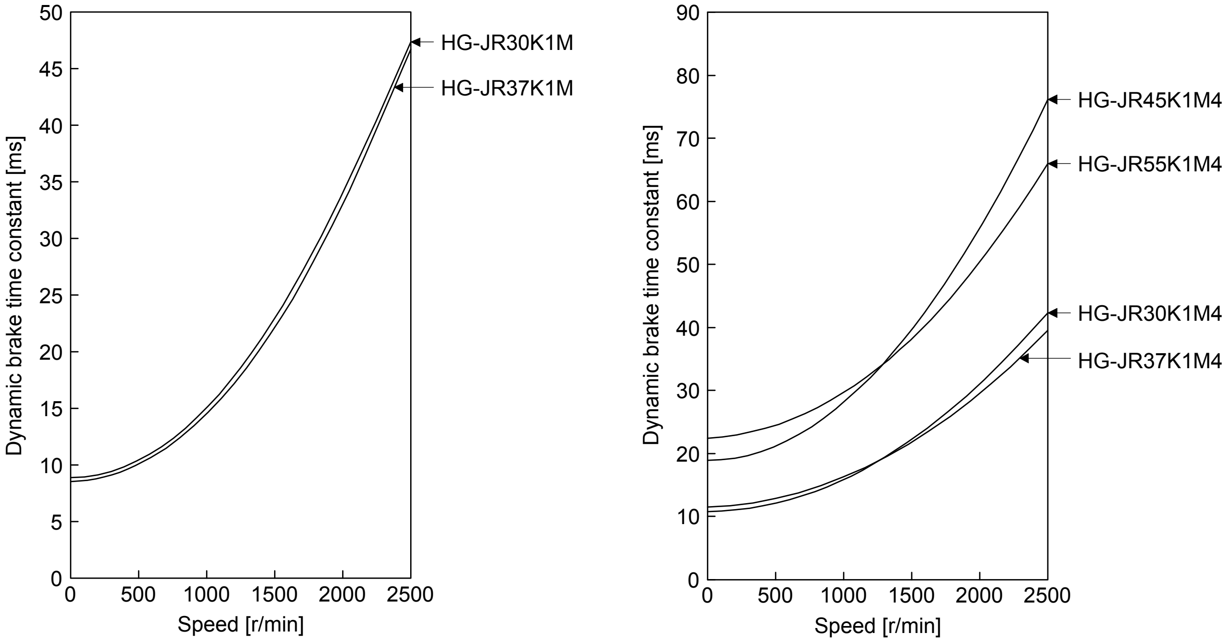
There is delay caused by magnetic contactor built into the external dynamic brake (about 50 ms) and delay caused by the external relay.

(b) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 14.2.



HG-JR1000 r/min series



HG-JR1500 r/min series

(2) Permissible load to motor inertia when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the ratio is higher than this value, the dynamic brake may burn. If there is a possibility that the ratio may exceed the value, contact your local sales office.

The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor. The value in the parenthesis shows the value at the rated speed.

Servo motor	Load to motor inertia ratio [multiplier]
HG-JR30K1	10
HG-JR37K1	
HG-JR30K14	
HG-JR37K14	
HG-JR30K1M	
HG-JR37K1M	
HG-JR30K1M4	
HG-JR37K1M4	
HG-JR45K1M4	8 (10)
HG-JR55K1M4	7 (10)

14.8.4 Inrush currents at power-on of main circuit/control circuit

POINT

- ●The inrush current values can change depending on frequency of turning on/off the power and ambient temperature.

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to section 14.9.5.)
When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

(1) 200 V class

The following table indicates the inrush currents (reference data) that will flow when 240 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m.

(a) Converter unit

Converter unit	Inrush currents (A_{0-P})	
	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)
MR-CR55K	154 A (Attenuated to approx. 20 A in 150 ms)	31 A (attenuated to approx. 2 A in 60 ms)

(b) Drive unit

Drive unit	Inrush currents (A_{0-P})
	Control circuit power supply (L11 and L21)
MR-J4-DU30KB-RJ020	31 A (attenuated to approx. 2 A in 60 ms)
MR-J4-DU37KB-RJ020	

(2) 400 V class

The following table indicates the inrush currents (reference data) that will flow when 480 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m.

(a) Converter unit

Converter unit	Inrush currents (A_{0-P})	
	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)
MR-CR55K4	305 A (attenuated to approx. 20 A in 70 ms)	27 A (attenuated to approx. 2 A in 45 ms)

(b) Drive unit

Drive unit	Inrush currents (A_{0-P})
	Control circuit power supply (L11 and L21)
MR-J4-DU30KB4-RJ020	27 A (attenuated to approx. 2 A in 45 ms)
MR-J4-DU37KB4-RJ020	
MR-J4-DU45KB4-RJ020	
MR-J4-DU55KB4-RJ020	

14.9 Options and peripheral equipment

⚠WARNING
- ●Before connecting any option or peripheral equipment, turn off the power and wait for 20 minutes or more until the charge lamp turns off. Then, confirm that the voltage between L+ and L- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm whether the charge lamp is off or not from the front of the converter unit.

⚠CAUTION
- ●Use the specified peripheral equipment and options to prevent a malfunction or a fire.

POINT
- ●We recommend using HIV wires to wire the converter units, drive units, options, and peripheral equipment. Therefore, the recommended wire sizes may different from those of the used wires for the previous converter units, drive units and others.

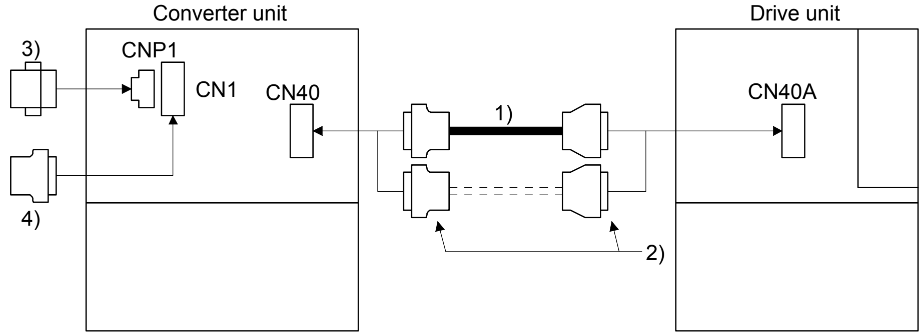
The following items are the same as those of MR-J4-_B_-RJ020. Refer to each section of the detailed explanation field for details.

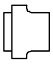
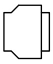
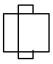
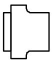
Item	Detailed explanation
SSCNET cable	Section 11.1.2
RS-232C communication cable	Section 11.1.3
Junction terminal block PS7DW-20V14B-F (recommended)	Section 11.6
MR Configurator	Section 11.7
Battery	Section 11.8
Relay (recommended)	Section 11.13

14.9.1 Cable/connector sets

(1) Combinations of cable/connector sets

Parts other than the following cable/connector sets are the same as those of MR-J4-_B_-RJ020. Refer to section 11.1.



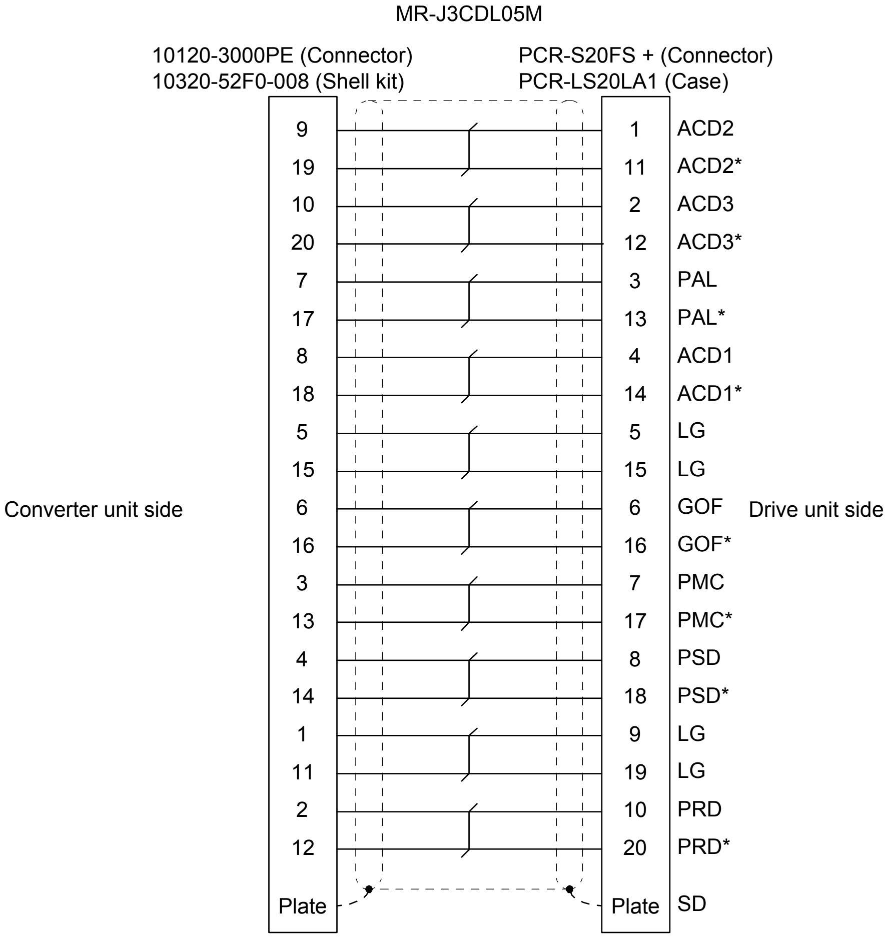
No.	Product name	Model	Description		Application
1)	Protection coordination cable	MR-J3CDL05M (Refer to section 14.9.1 (2).)	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) 	Connector: PCR-S20FS+ Case: PCR-LS20LA1 (Honda Tsushin Kogyo)	
2)	Connector set	MR-J2CN1-A (Refer to section 14.9.1 (2).)	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) 	Connector: PCR-S20FS+ Shell kit: PCR-LS20LA1 (Honda Tsushin Kogyo) 	
3)	Magnetic contactor wiring connector		Converter unit side connector (Phoenix Contact) Socket: GFKC 2,5/ 2-STF-7,62		Supplied with converter unit
4)	Digital I/O connector		Converter unit side connector (DDK) Connector: 17JE23090-02(D8A)K11-CG		

(2) MR-J3CDL05M (0.5 m) protection coordination cable

⚠CAUTION	●Wire protection coordination cables correctly if they are fabricated. Otherwise, it may cause an unexpected operation.

The cable is used to connect a converter unit to a drive unit.

(a) Internal wiring diagram

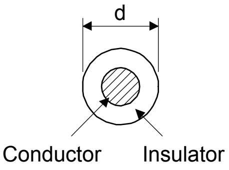


(b) When fabricating a cable

Use MR-J2CN1-A connector set and the following recommended wire to fabricate a cable according to the wiring diagram in (a) of this section.

Model	Length [m]	Core size [mm²]	Number of cores	Characteristics of one core			(Note 2) Cable OD [mm]	Wire model
				Structure [Wires/mm]	Conductor resistance [Ω/km]	(Note 1) Insulator OD d [mm]		
MR-J3CDL05M	0.5	0.08	20 (10 pairs)	7/0.127	222 or less	0.38	6.1	UL 20276 AWG#28 10pair (cream)

Note 1. The following shows the detail of d.



2. Standard OD. Maximum OD is about 10% greater.

14.9.2 Regenerative option

CAUTION ●Do not use the converter unit and drive unit with the regenerative options other than the combinations specified below. Otherwise, it may cause a fire.

(1) Combination and regenerative power

The regenerative power values in the table are the regenerative power of the resistor and are not the rated power.

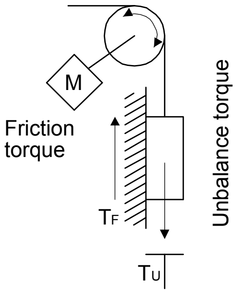
Converter unit	Drive unit	Regenerative power [W]			
		MR-RB139 (1.3 Ω)	(Note 1) Three MR-RB137 (1.3 Ω) in parallel	MR-RB137-4 (4 Ω)	(Note 2) Three MR-RB13V-4 (4 Ω) in parallel
MR-CR55K	MR-J4-DU30KB-RJ020 MR-J4-DU37KB-RJ020	1300	3900		
MR-CR55K4	MR-J4-DU30KB4-RJ020 MR-J4-DU37KB4-RJ020 MR-J4-DU45KB4-RJ020 MR-J4-DU55KB4-RJ020			1300	3900

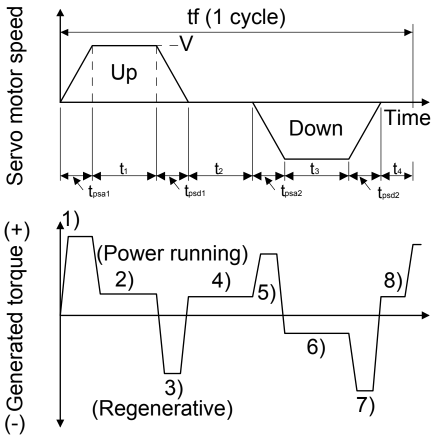
Note 1. The resultant resistance of three options is 1.3 Ω.
2. The resultant resistance of three options is 4 Ω.

(2) Selection of regenerative option

Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make an in-depth selection of the regenerative option.

(a) Regenerative energy calculation





Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor T [N•m]	Energy E [J]
1)	$T_1 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2} \cdot V \cdot T_1 \cdot t_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot V \cdot T_2 \cdot t_1$
3)	$T_3 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa2}} + T_U + T_F$	$E_3 = \frac{0.1047}{2} \cdot V \cdot T_3 \cdot t_{psa2}$
4), 8)	T_4, $T_8 = T_U$	E_4, $E_8 \geq 0$ (No regeneration)
5)	$T_5 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2} \cdot V \cdot T_5 \cdot t_{psd2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047 \cdot V \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2} \cdot V \cdot T_7 \cdot t_{psd2}$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

(b) Regenerative loss of servo motor and drive unit

The following table lists the efficiencies and other data of the servo motor and drive unit in the regenerative mode.

Converter unit	Drive unit	Inverse efficiency [%]	Capacitor charging [J]
MR-CR55K	MR-J4-DU30KB-RJ020	90	450
	MR-J4-DU37KB-RJ020		
MR-CR55K4	MR-J4-DU30KB4-RJ020		
	MR-J4-DU37KB4-RJ020		
	MR-J4-DU45KB4-RJ020		
	MR-J4-DU55KB4-RJ020		

Inverse efficiency (η): Efficiency including some efficiencies of the servo motor and drive unit when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging (Ec): Energy charged into the electrolytic capacitor in the converter unit

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative option.

ER [J] = η • Es - Ec

Calculate the power consumption of the regenerative option on the basis of one-cycle operation period tf [s] to select the necessary regenerative option.

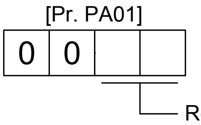
PR [W] = ER/tf

(3) Parameter setting

POINT

- ●The regenerative option cannot be connected to the drive unit. Always set [Pr. 02] of the drive unit to "_ _ 0 0" (the regenerative option is not used).

Set [Pr. PA01] of the converter unit according to the option to be used.



Regenerative option selection
00: Regenerative option is not used.
01: MR-RB139
02: MR-RB137 (3 pcs.)
13: MR-RB137-4
14: MR-RB13V-4 (3 pcs.)

(4) Connection of regenerative option

POINT

- For the wire sizes used for wiring, refer to section 14.9.4.

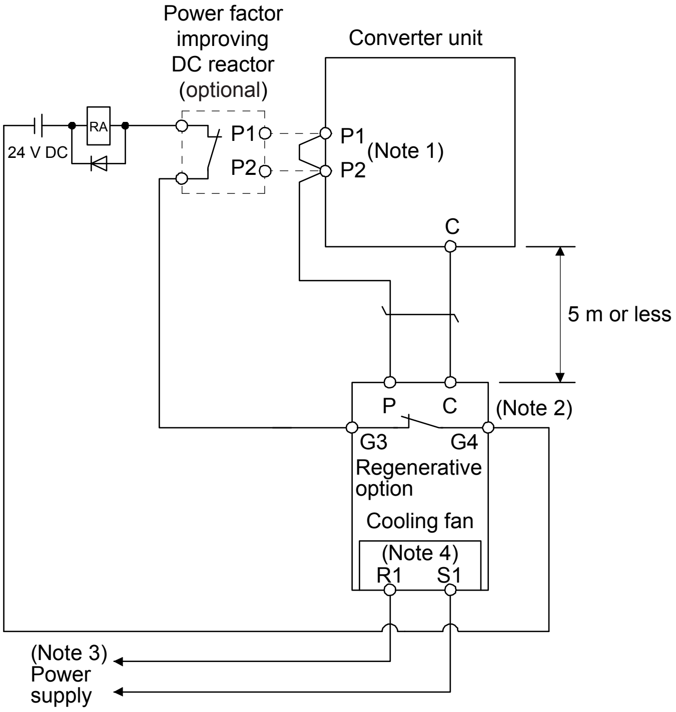
Always supply the following power to a cooling fan.

Table 14.2 Cooling fan

Item	200 V class	400 V class
Model	MR-RB137/MR-RB139	MR-RB137-4/MR-RB13V-4
Voltage/Frequency	1-phase 198 V AC to 242 V AC, 50 Hz/60 Hz	1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz
Power consumption [W]	20 (50 Hz)/18 (60 Hz)	20 (50 Hz)/18 (60 Hz)

The regenerative option generates heat of 100 ˚C higher than the ambient temperature. Fully consider heat dissipation, installation position, wires used, etc. before installing the option. For wiring, use flame-resistant wires or make the wires flame-resistant and keep them away from the regenerative option. The G3 and G4 terminals act as a thermal protector. Between G3 and G4 is opened when the regenerative option overheats abnormally.
Use twisted wires with a maximum length of 5 m for a connection with the converter unit.

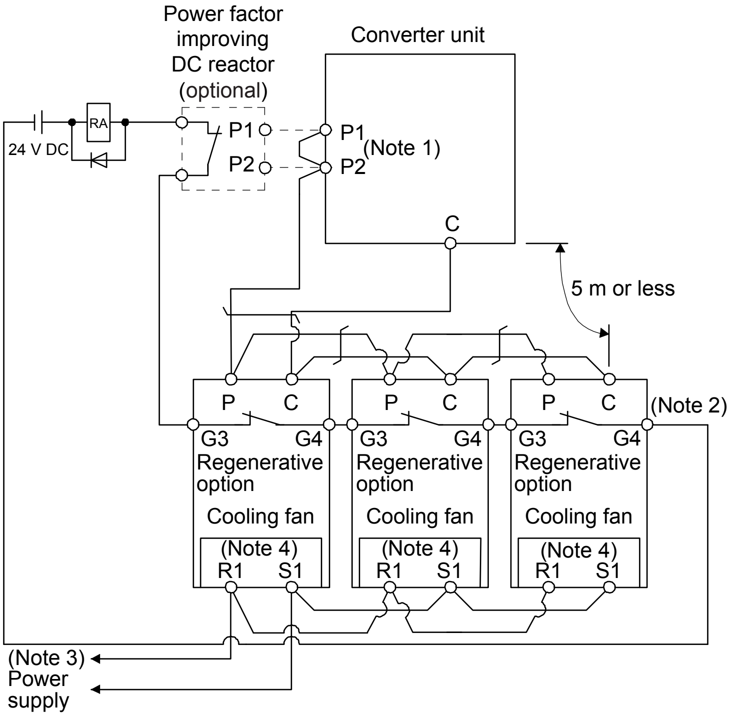
(a) MR-RB139/MR-RB137-4



Note
1. When using the power factor improving DC reactor, remove the short bar across P1 and P2.
2. G3-G4 contact specifications
   Maximum voltage: 120 V AC/DC
   Maximum current: 0.5 A/4.8 V DC
   Maximum capacity: 2.4 VA
3. For specifications of cooling fan power supply, refer to table 14.2.
4. For MR-RB137-4, "R1" is "R400" and "S1" is "S400".

(b) MR-RB137/MR-RB13V-4

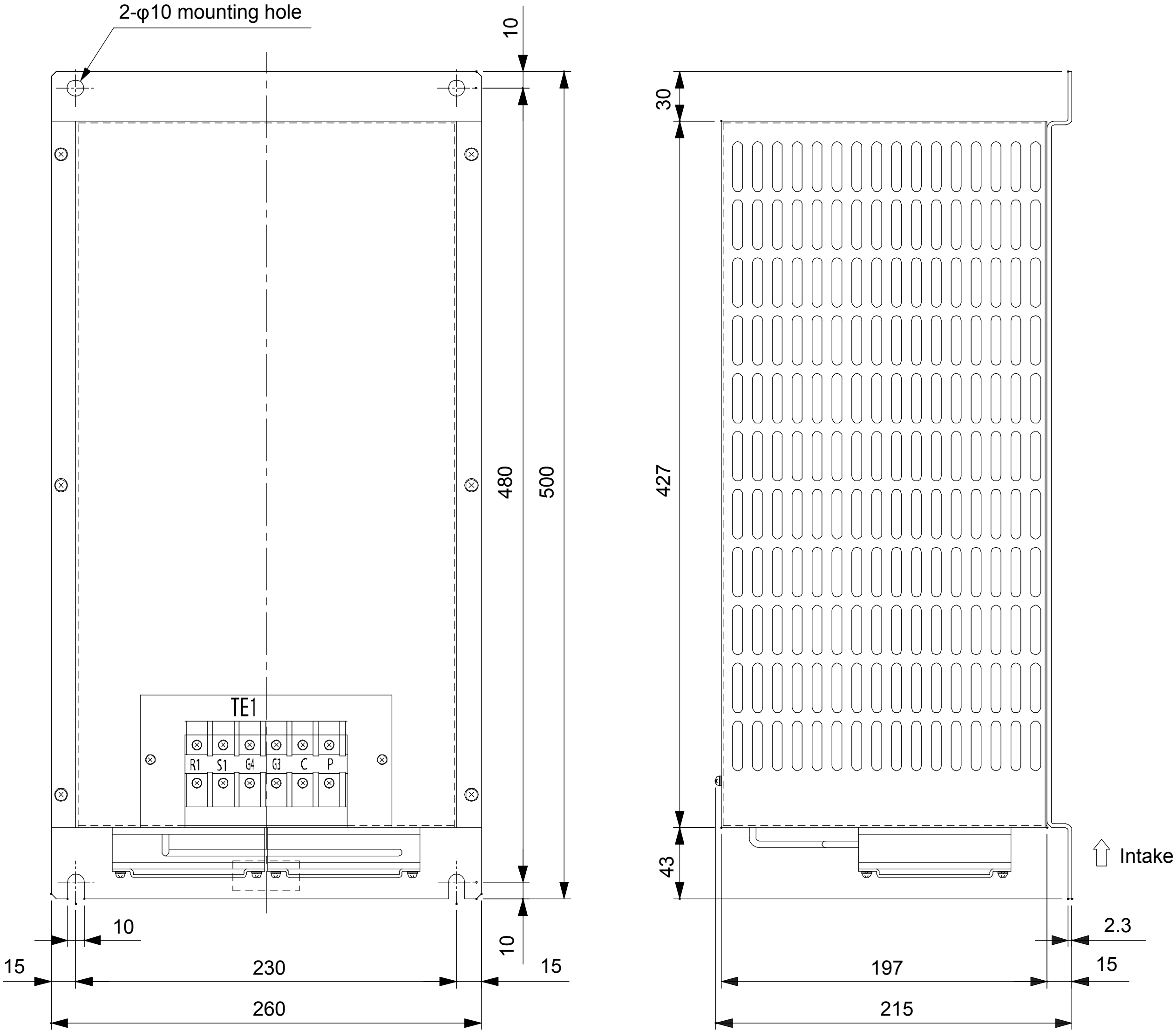
POINT
●Three of MR-RB137 or MR-RB13V-4 are required per converter unit. Please purchase three of MR-RB137 or MR-RB13V-4.

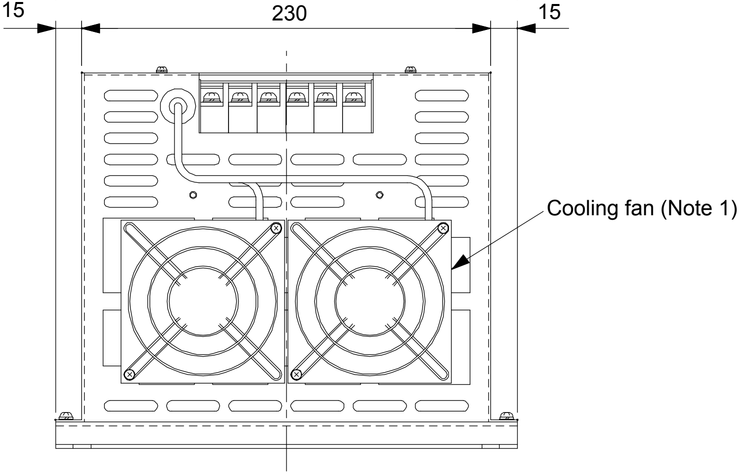


Note
1. When using the power factor improving DC reactor, remove the short bar across P1 and P2.
2. G3-G4 contact specifications
   Maximum voltage: 120 V AC/DC
   Maximum current: 0.5 A/4.8 V DC
   Maximum capacity: 2.4 VA
3. For specifications of cooling fan power supply, refer to table 14.2.
4. For MR-RB13V-4, "R1" is "R400" and "S1" is "S400".

(5) Dimensions

[Unit: mm]





Regenerative option	Mass [kg]
MR-RB139/MR-RB137-4	10
MR-RB137/MR-RB13V-4	11

- Terminal block signal layout

TE1

R1 (Note 2)	S1 (Note 2)	G4	G3	C	P

Terminal screw: M5
Tightening torque: 2.0 [N•m]

- Mounting screw

Screw size: M8
Tightening torque: 13.2 [N•m]

Note 1. One cooling fan for MR-RB137-4/MR-RB13V-4.
2. For MR-RB137-4/MR-RB13V-4, "R1" is "R400" and "S1" is "S400".

14.9.3 External dynamic brake

⚠CAUTION

- ●Use an external dynamic brake for this drive unit. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment.

POINT

- ●Configure a sequence which switches off the magnetic contactor of the external dynamic brake after (or as soon as) servo-on command has been turned off at a power failure or a malfunction.
- ●For the braking time taken when the external dynamic brake is operated, refer to section 14.8.3.
- ●The external dynamic brake is rated for a short duration. Do not use it very frequently.
- ●The specifications of the input power supply for external dynamic brake are the same as those of the converter unit control circuit power supply.
- ●When an alarm, [AL. E6 Servo forced stop warning], or [AL. E7 Controller forced stop warning] occurs, or the power is turned off, the external dynamic brake will operate. Do not use external dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- ●For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the external dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- ●Be sure to enable EM1 (Forced stop 1) after servo motor stops when using EM1 (Forced stop 1) frequently in other than emergency.

(1) Selection of external dynamic brake

The external dynamic brake is designed to bring the servo motor to a sudden stop when a power failure occurs or the protective circuit is activated.

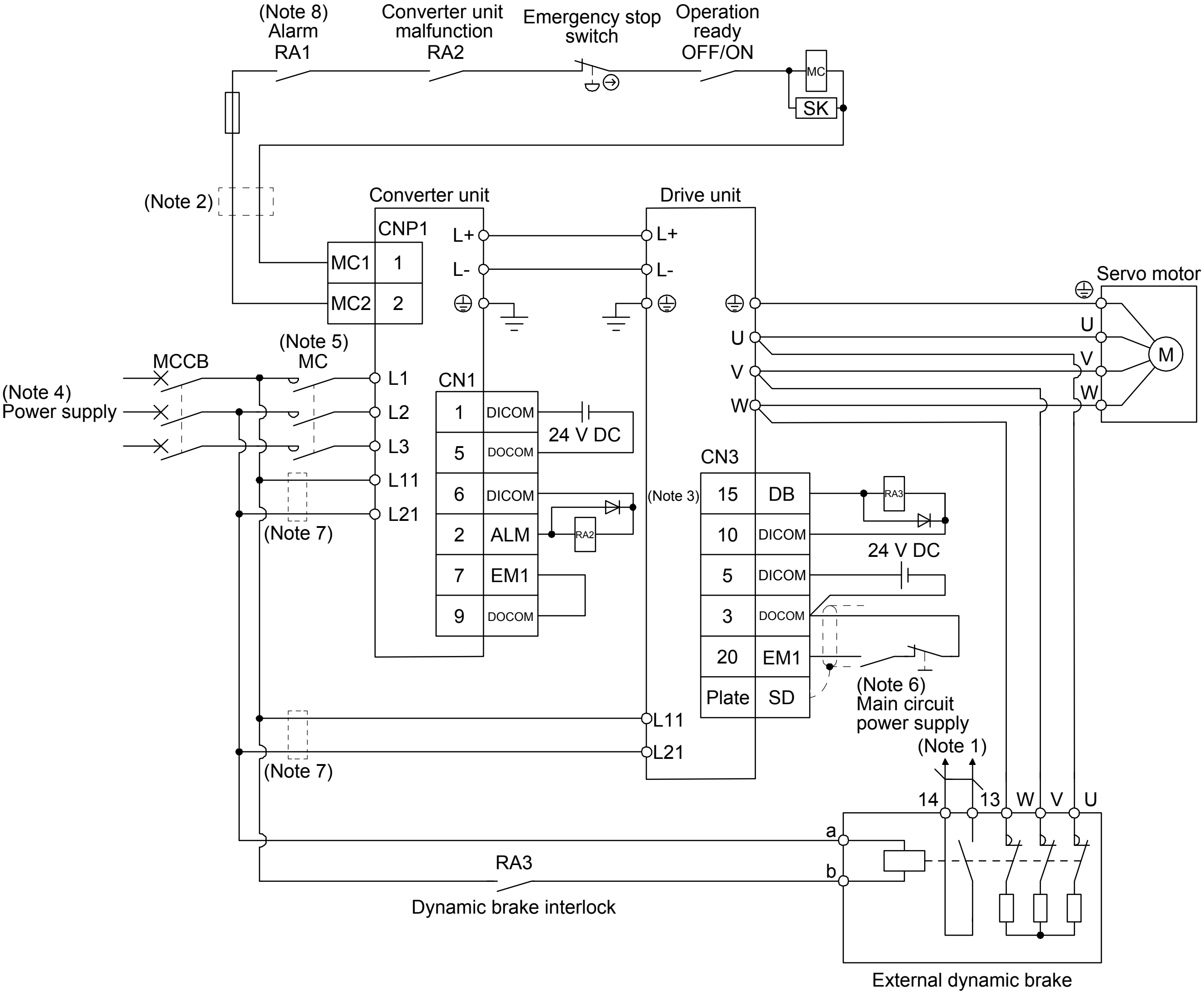
Converter unit	Drive unit	External dynamic brake
MR-CR55K	MR-J4-DU30KB-RJ020	DBU-37K-R1
	MR-J4-DU37KB-RJ020	
MR-CR55K4	MR-J4-DU30KB4-RJ020	DBU-55K-4-R5
	MR-J4-DU37KB4-RJ020	
	MR-J4-DU45KB4-RJ020	
	MR-J4-DU55KB4-RJ020	

(2) Connection example

Use the following wires to connect the dynamic brake.

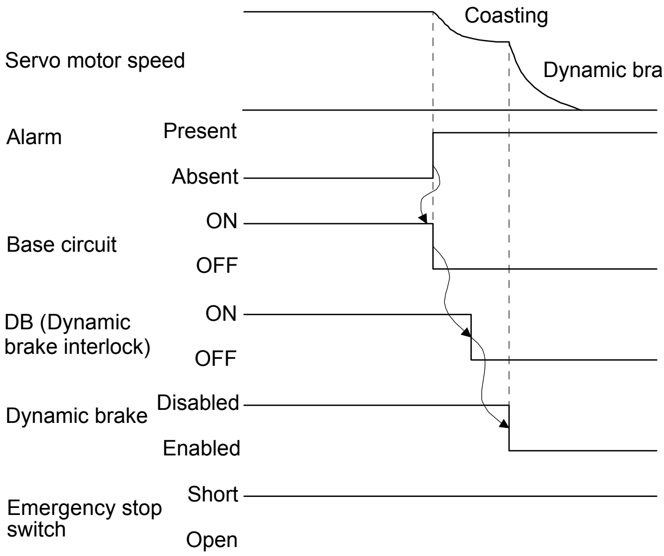
Dynamic brake	Wire [mm^2] (Note)	
	Except U/V/W	U/V/W
DBU-37K-R1	2	14
DBU-55K-4-R5		

Note. Selection conditions of wire size are as follows.
Wire type: 600 V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: Single wire set in midair

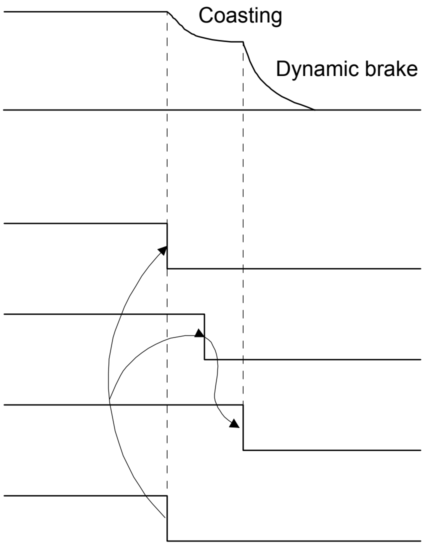


Note
1. Terminals 13 and 14 are normally open contact outputs. If the dynamic brake is seized, terminals 13 and 14 will open. Therefore, configure an external sequence to prevent servo-on.
2. Step-down transformer is required when coil voltage of the magnetic contactor is 200 V class, and the converter unit and the drive unit are 400 V class.
3. To enable DB (Dynamic brake interlock), set [Pr. 2] to "_ 1 _ _".
4. For power supply specifications, refer to section 14.1.3.
5. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
6. Turn off EM1 when the main circuit power supply is off.
7. Install an overcurrent protection device (molded-case circuit breaker, fuse, or others) to protect the branch circuit. (Refer to section 14.9.5.)
8. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

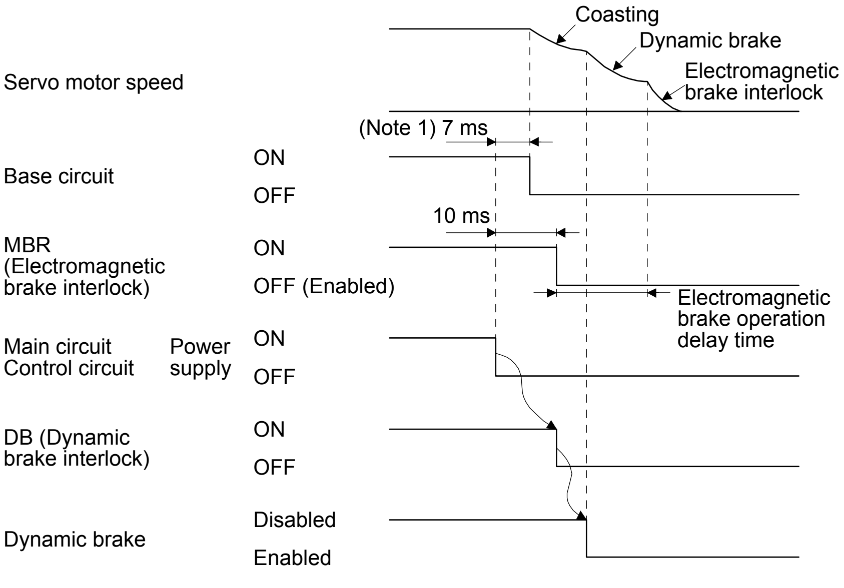
(3) Timing chart



a. Timing chart at alarm occurrence



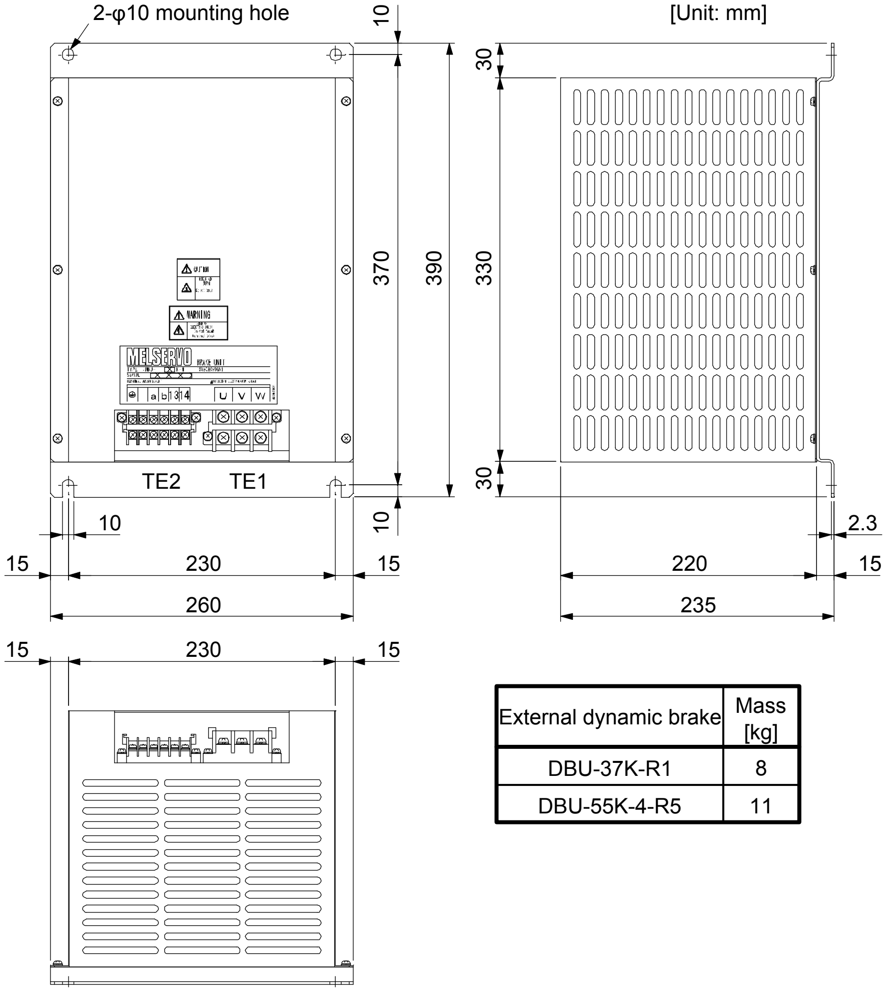
b. Timing chart at emergency stop switch enabled



Note. When powering off, DB (Dynamic brake interlock) will be turned off, and the base circuit is turned off earlier than usual before an output shortage occurs.

c. Timing chart when both of the main and control circuit power supply are off

(4) Dimensions



- Terminal block

TE

U	V	W

Screw size: M5
Tightening torque: 2.0 [N•m]

TE2

⏚		a	b	13	14

Screw size: M3.5
Tightening torque: 0.8 [N•m]

- Mounting screw
  Screw size: M8
  Tightening torque: 13.2 [N•m]

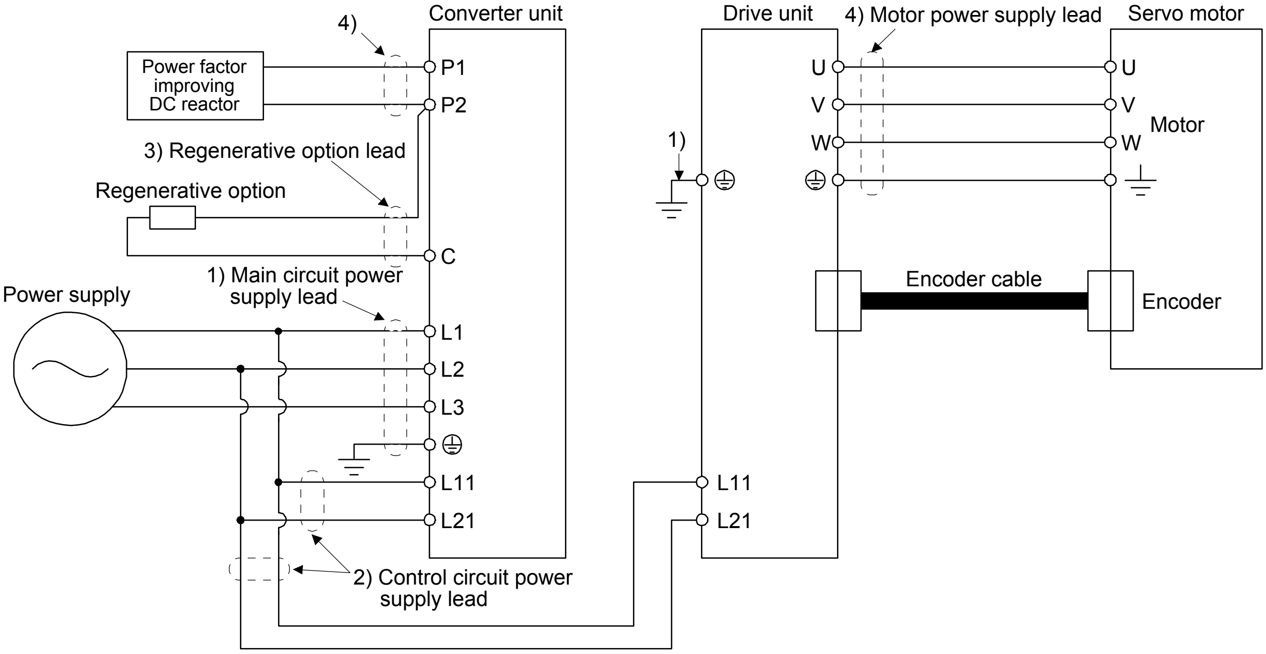
External dynamic brake	Mass [kg]
DBU-37K-R1	8
DBU-55K-4-R5	11

14.9.4 Selection example of wires

POINT

- ●To comply with the IEC/EN/UL/CSA standard, use the wires shown in app. 7 for wiring. To comply with other standards, use a wire that is complied with each standard.
- ●Selection conditions of wire size are as follows.
  Construction condition: Single wire set in midair
  Wire length: 30 m or less

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



(1) Example of selecting the wire sizes

Use the 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

Table 14.3 Wire size selection example (HIV wire)

Converter unit (Note 2)	Drive unit (Note 2)	Wire [mm^2] (Note 1, 3)			
		1) L1/L2/L3/⏚	2) L11/L21	3) P2/C	4) U/V/W P1/P2/⏚
MR-CR55K	MR-J4-DU30KB-RJ020	38 (AWG2): c	1.25 to 2 (AWG 16 to 14): g (Note 4)	5.5 (AWG10): a	60 (AWG2/0): d
	MR-J4-DU37KB-RJ020	60 (AWG2/0): d			60 (AWG2/0): d
MR-CR55K4	MR-J4-DU30KB4-RJ020	22 (AWG4): e			22 (AWG4): e
	MR-J4-DU37KB4-RJ020	22 (AWG4): e			38 (AWG 2): f
	MR-J4-DU45KB4-RJ020	38 (AWG2): c			38 (AWG2): c
	MR-J4-DU55KB4-RJ020	38 (AWG2): c			38 (AWG2): c

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.
2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
3. Wires are selected based on the highest rated current among combining servo motors.
4. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

(2) Selection example of crimp terminals

The following shows the selection example of crimp terminals for terminal blocks of the drive unit and converter unit when you use wires mentioned in (1) of this section.

Symbol	Drive unit/converter unit-side crimp terminal				
	(Note 2) Crimp terminal	Applicable tool			
		Body	Head	Dice	Manufacturer
a	FVD5.5-10	YNT-1210S			JST
b	FVD22-10	YF-1 E-4	YNE-38	DH-123 DH-113	
(Note 1) c	R38-10	YPT-60-21		TD-124 TD-112	
		YF-1 E-4	YET-60-1		
(Note 1) d	R60-10	YPT-60-21		TD-125 TD-113	
		YF-1 E-4	YET-60-1		
e	FVD22-8	YF-1 E-4	YNE-38	DH-123 DH-113	
(Note 1) f	R38-8	YPT-60-21		TD-124 TD-112	
		YF-1 E-4	YET-60-1		
g	FVD2-4	YNT-1614			

Note 1. Coat the crimping part with an insulation tube.
2. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

14.9.5 Molded-case circuit breakers, fuses, magnetic contactors

⚠CAUTION

- ●To prevent the converter unit and the drive unit from smoke and a fire, select a molded-case circuit breaker which shuts off with high speed.
- ●Always use one molded-case circuit breaker and one magnetic contactor with one converter unit.

(1) For main circuit power supply
When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section.

Converter unit	Drive unit	Molded-case circuit breaker (Note 1, 3)			Fuse			Magnetic contactor (Note 2)
		Frame, rated current		Voltage AC [V]	Class	Current [A]	Voltage AC [V]	
		Power factor improving DC reactor is not used	Power factor improving DC reactor is used					
MR-CR55K	MR-J4-DU30B-RJ020	225 A frame 175 A	225 A frame 150 A	240	T	300	300	S-N150
	MR-J4-DU37B-RJ020	225 A frame 225 A	225 A frame 175 A			400		S-N180
MR-CR55K4	MR-J4-DU30KB4-RJ020	100 A frame 100 A	100 A frame 80 A	480	T	175	600	S-N65 S-T65
	MR-J4-DU37KB4-RJ020	125 A frame 125 A	100 A frame 100 A			200		S-N80 S-T80
	MR-J4-DU45KB4-RJ020	225 A frame 150 A	125 A frame 125 A			300		S-N95 S-T100
	MR-J4-DU55KB4-RJ020	225 A frame 175 A	225 A frame 150 A			300		S-N150

Note 1. For compliance with the IEC/EN/UL/CSA standard, refer to app. 7.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
3. Use a molded-case circuit breaker which has the same or more operation characteristics than our lineup.

(2) For control circuit power supply
Install an overcurrent protection device (molded-case circuit breaker or fuse) to protect the branch circuit.

(a) Converter unit

Converter unit	Molded-case circuit breaker (Note)		Fuse (Class T)		Fuse (Class K5)	
	Frame, rated current	Voltage AC [V]	Current [A]	Voltage AC [V]	Current [A]	Voltage AC [V]
MR-CR55K	30 A frame 5 A	240	1	300	1	250
MR-CR55K4	30 A frame 5 A	480	1	600	1	600

Note. When having the converter unit comply with the IEC/EN/UL/CSA standard, refer to app. 7.

(b) Drive unit

Drive unit	Molded-case circuit breaker (Note)		Fuse (Class T)		Fuse (Class K5)	
	Frame, rated current	Voltage AC [V]	Current [A]	Voltage AC [V]	Current [A]	Voltage AC [V]
MR-J4-DU30KB-RJ020	30 A frame 5 A	240	1	300	1	250
MR-J4-DU37KB-RJ020						
MR-J4-DU30KB4-RJ020	30 A frame 5 A	480	1	600	1	600
MR-J4-DU37KB4-RJ020						
MR-J4-DU45KB4-RJ020						
MR-J4-DU55KB4-RJ020						

Note. When having the drive unit comply with the IEC/EN/UL/CSA standard, refer to app. 7.

14.9.6 Power factor improving DC reactor

The following shows the advantages of using power factor improving DC reactor.

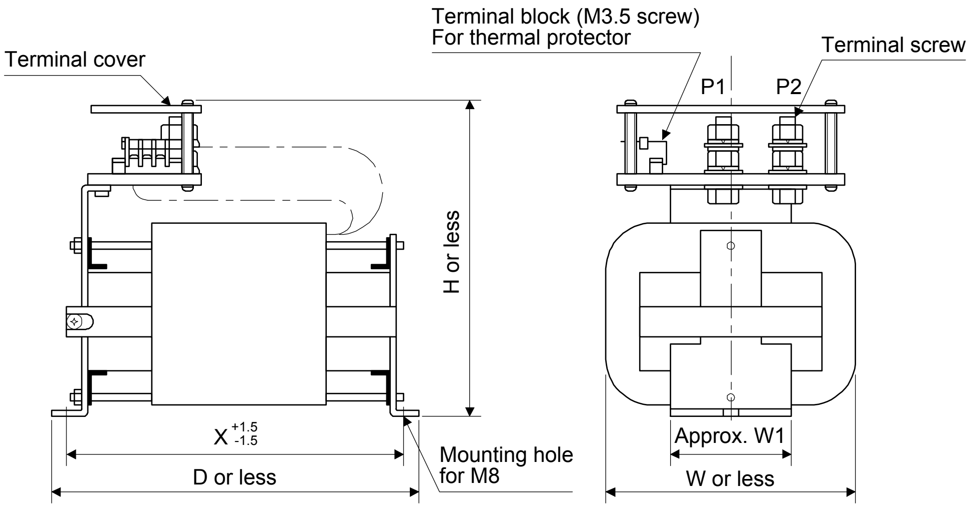
- It improves the power factor by increasing the form factor of the converter unit's input current.
- It decreases the power supply capacity.
- The input power factor is improved to about 95%.

When connecting the power factor improving DC reactor to the converter unit, be sure to remove the short bar across P1 and P2. If it remains connected, the effect of the power factor improving DC reactor is not produced.

When used, the power factor improving DC reactor generates heat. To release heat, therefore, leave a 10 cm or more clearance at each of the top and bottom, and a 5 cm or more clearance on each side.

Converter unit	Drive unit	Power factor improving DC reactor	Variable dimensions [mm]					Terminal screw	Mass [kg]
			W	D	H	W1	X		
MR-CR55K	MR-J4-DU30KB-RJ020	MR-DCL30K	135	255	215	80	232	M12	9.5
	MR-J4-DU37KB-RJ020	MR-DCL37K							
MR-CR55K4	MR-J4-DU30KB4-RJ020	MR-DCL30K-4		205	200	75	175	M8	6.5
	MR-J4-DU37KB4-RJ020	MR-DCL37K-4		225		80	197		7
	MR-J4-DU45KB4-RJ020	MR-DCL45K-4		240			212		7.5
	MR-J4-DU55KB4-RJ020	MR-DCL55K-4		260	215		232		9.5

[Unit: mm]



14.9.7 Noise reduction techniques

Noises are classified into external noises which enter the converter unit and drive unit to cause them to malfunction and those radiated by the converter unit and drive unit to cause peripheral equipment to malfunction. Since the converter unit and drive unit are electronic devices which handle small signals, the following general noise reduction techniques are required.
Also, the drive unit can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral equipment malfunctions due to noise generation, take noise suppression measures. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

- Avoid bundling power lines (input/output) and signal cables of the converter unit/drive unit together or running them in parallel to each other. Separate the power lines from the signal cables.
- Use a shielded twisted pair cable for connection with the encoder and for control signal transmission, and connect the external conductor of the cable to the SD terminal.
- Ground the converter unit, drive unit and the servo motor, etc. together at one point. (Refer to section 3.7.)

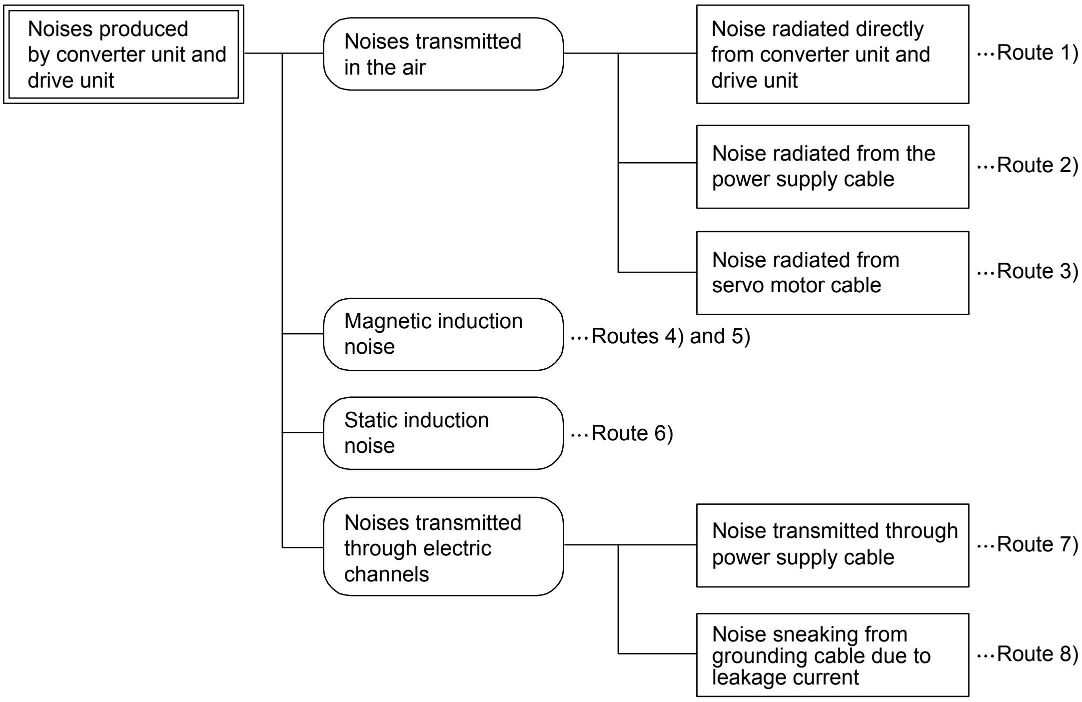
(b) Reduction techniques for external noises that cause the converter unit/drive unit to malfunction

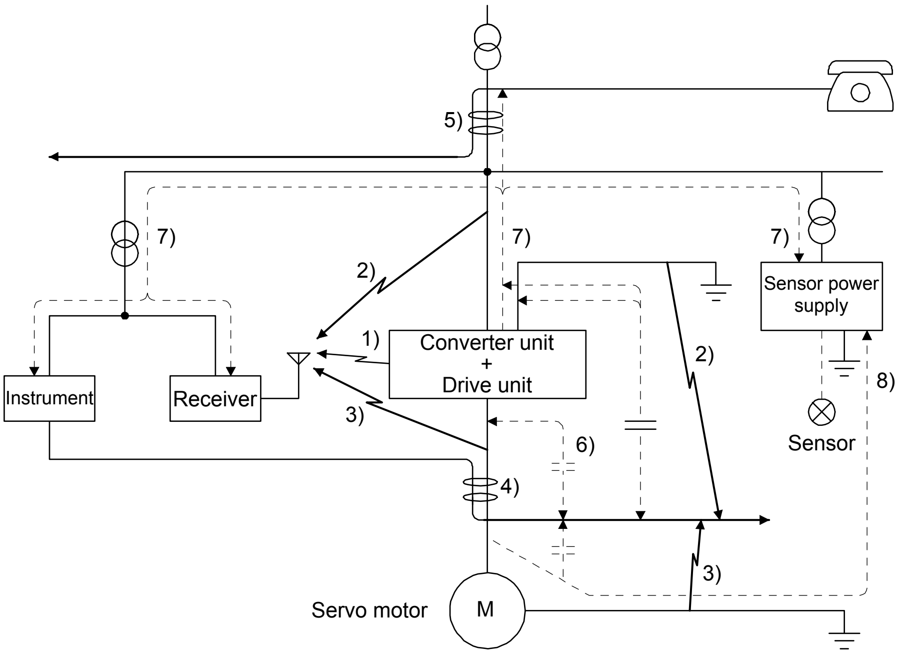
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the converter unit and drive unit and the converter unit/drive unit may malfunction, the following countermeasures are required.

- Provide surge killers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
- Although a surge absorber is built into the converter unit, to protect the converter unit, drive unit and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.

(c) Techniques for noises radiated by the converter unit/drive unit that cause peripheral equipment to malfunction

Noises produced by the converter unit and drive unit are classified into those radiated from the cables connected to the converter unit, drive unit and their main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral equipment located near the main circuit cables, and those transmitted through the power supply cables.



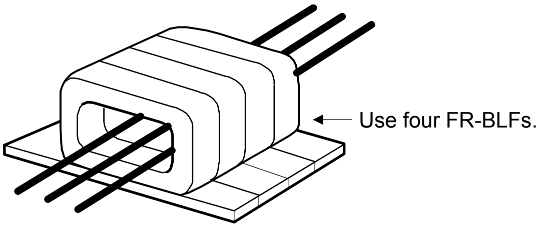


Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a cabinet together with the converter unit and drive unit or run near the converter unit and drive unit, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the converter unit/drive unit. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the converter unit/drive unit. 3. Avoid wiring the power lines (input/output lines of the converter unit/drive unit) and signal lines side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for signal and power lines or put lines in separate metal conduits.
4) 5) 6)	When the power lines and the signal lines are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the converter unit/drive unit. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the converter unit/drive unit. 3. Avoid wiring the power lines (input/output lines of the converter unit/drive unit) and signal lines side by side or bundling them together. 4. Use shielded wires for signal and power lines or put lines in separate metal conduits.
7)	When the power supply of peripheral equipment is connected to the power supply of the converter unit/drive unit systems, noises produced by the converter unit and drive unit may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. 1. Install the radio noise filter (FR-BIF(-H)) on the power lines (Input lines) of the converter unit/drive unit. 2. Install the line noise filter (FR-BSF01/FR-BLF) on the power lines of the converter unit/drive unit.
8)	When the grounding wires of peripheral equipment are connected to the converter unit/drive unit to make a closed loop circuit, leakage current may flow to malfunction the peripheral equipment. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction techniques
The following explains how to use the line noise filter unique to the converter unit and drive unit. Other noise reduction techniques are the same as those of MR-J4-_B_-RJ020. Refer to section 11.14 (2).

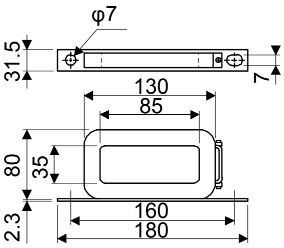
(a) Line noise filter (FR-BLF)
This filter is effective in suppressing noises radiated from the power supply side and output side of the converter unit, drive unit and also in suppressing high-frequency leakage current (0-phase current). It especially affects the noises between 0.5 MHz and 5 MHz band. The filters are used with the main circuit power supply of the converter unit (L1, L2, and L3) and the power output of the drive unit (U, V, and W).

1) Usage
Pass the 3-phase wires through four line noise filters. When you use the line noise filters with the power wires, passing the power wires together with the ground wire will reduce the filter effect. Run the ground wire separately from the power wires.



2) Dimensions

[Unit: mm]



14.9.8 Earth-leakage current breaker

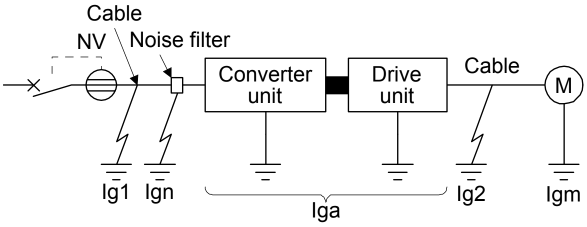
(1) Selection method

High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select an earth-leakage current breaker according to the following formula, and ground the drive unit, servo motor, etc. securely.

To minimize leakage currents, make the input and output cables as short as possible, and make the grounding cable longer than 30 cm.

$$\text{Rated sensitivity current} \geq 10 \cdot \{Igl + Ign + Iga + K \cdot (Ig2 + Igm)\} \text{ [mA]} \cdots\cdots \text{(14.3)}$$



Earth-leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-HW	1
General models	BV-C1 NFB NV-L	3

Igl: Leakage current on the electric channel from the earth-leakage current breaker to the input terminals of the drive unit (found from Fig. 14.5.)

Ig2: Leakage current on the electric channel from the output terminals of the drive unit to the servo motor (found from Fig. 14.5.)

Ign: Leakage current when a filter is connected to the input side (4.4 mA per one FR-BIF(-H))

Iga: Leakage current of the converter unit/drive unit (found from table 14.5.)

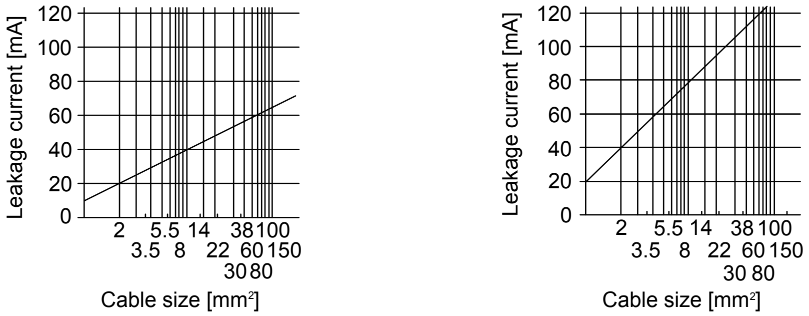
Igm: Leakage current of the servo motor (found from table 14.4.)

Table 14.4 Servo motor leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
30 to 55	2.5

Table 14.5 Converter unit/drive unit's leakage current example (Iga)

Converter unit Drive unit	Leakage current [mA]
All series	5



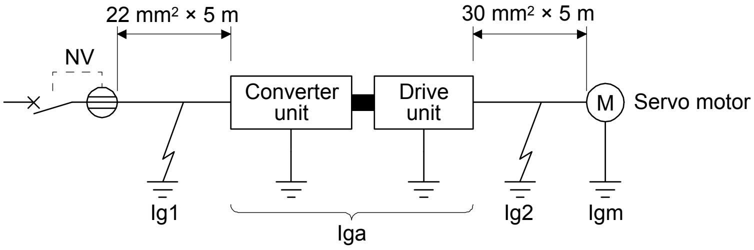
200 V class

400 V class

Fig. 14.5 Example of leakage current per km (Ig1, Ig2) for CV cable run in metal conduit

(2) Selection example

Indicated below is an example of selecting an earth-leakage current breaker under the following conditions.



Use an earth-leakage current breaker designed for suppressing harmonics/surges.

Find the terms of equation (14.3) from the diagram.

$$Igl = 95 \times \frac{5}{1000} = 0.475 \text{ [mA]}$$

$$Ig2 = 105 \times \frac{5}{1000} = 0.525 \text{ [mA]}$$

Ign = 0 (not used)

Iga = 5 [mA]

Igm = 2.5 [mA]

Insert these values in equation (14.3).

$$Ig \geq 10 \bullet \{0.475 + 0 + 5 + 1 \bullet (0.525 + 2.5)\}$$
$$\geq 85 \text{ [mA]}$$

According to the result of calculation, use an earth-leakage current breaker having the rated sensitivity current (Ig) of 85 mA or more. Use an earth-leakage current breaker having Ig of 200 mA with the NV-SP/SW/CP/CW/HW series.

14.9.9 EMC filter (recommended)

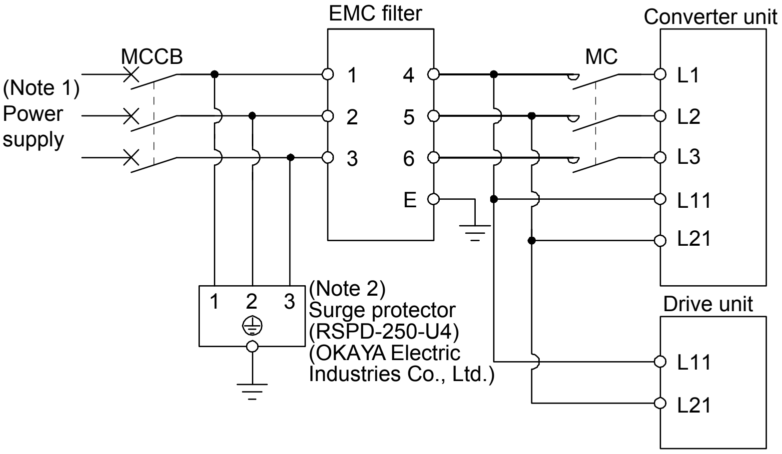
It is recommended that one of the following filters be used to comply with EN EMC directive. Some EMC filters have large in leakage current.

(1) Combinations of converter unit/drive unit

Converter unit	Drive unit	Recommended filter (Soshin Electric)				Mass [kg]
		Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-CR55K	MR-J4-DU30KB-RJ020 MR-J4-DU37KB-RJ020	(Note) HF3200A-UN	200	250	9	18
MR-CR55K4	MR-J4-DU30KB4-RJ020 MR-J4-DU37KB4-RJ020 MR-J4-DU45KB4-RJ020 MR-J4-DU55KB4-RJ020	TF3150C-TX	150	500	5.5	31

Note. A surge protector is separately required to use any of these EMC filters.

(2) Connection example

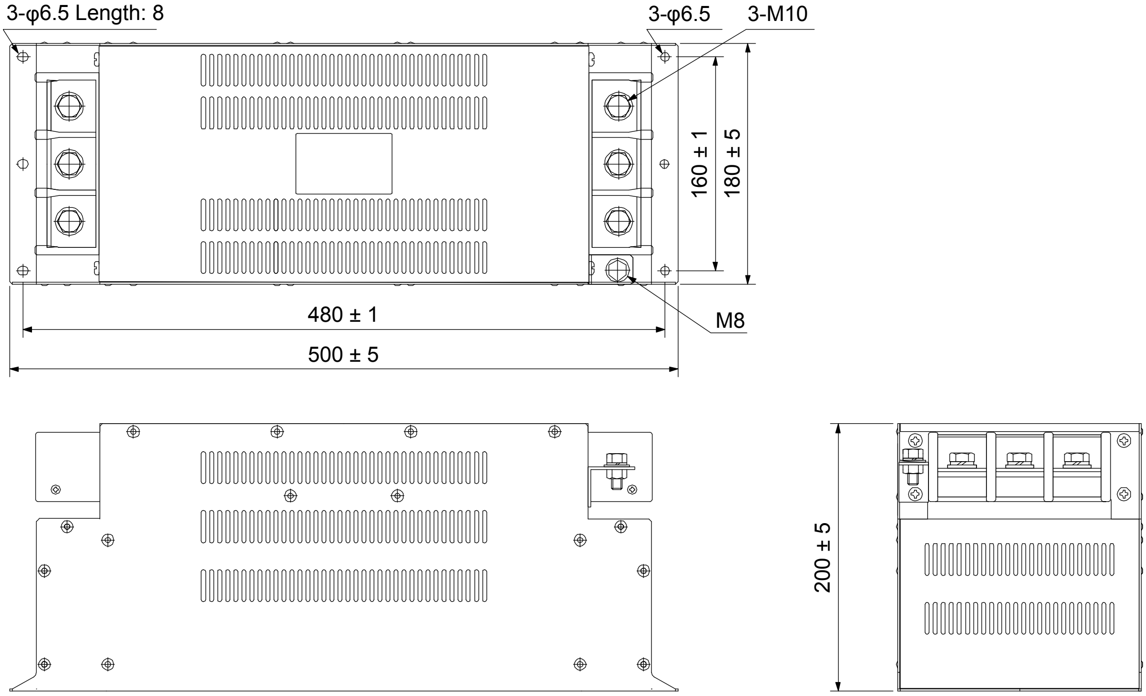


Note 1. For the power supply specifications, refer to section 14.1.2.
2. The example is when a surge protector is connected.

(3) Dimensions

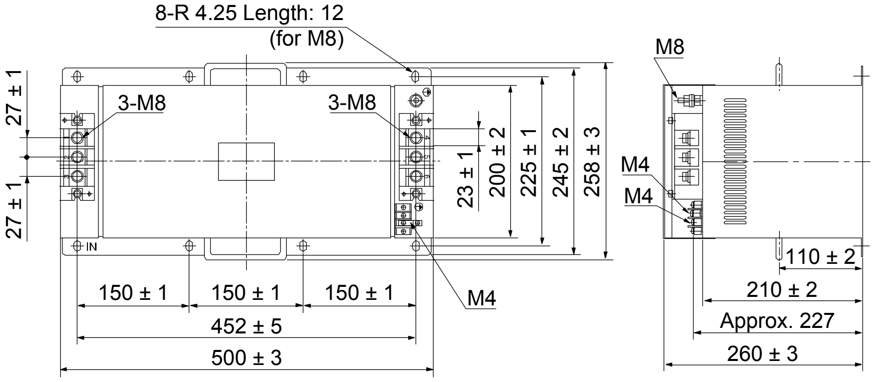
(a) HF3200A-UN

[Unit: mm]



(b) TF3150C-TX

[Unit: mm]



14.9.10 FR-BU2-(H) Brake Unit

POINT

- Use a 200 V class brake unit and a resistor unit with a 200 V class converter unit, and a 400 V class brake unit and a resistor unit with a 400 V class converter unit. Combination of different voltage class units cannot be used.
- When a brake unit and a resistor unit are installed horizontally or diagonally, the heat dissipation effect diminishes. Install them on a flat surface vertically.
- The temperature of the resistor unit case will be higher than the ambient temperature by 100 ˚C or over. Keep cables and flammable materials away from the case.
- Ambient temperature condition of the brake unit is between -10 °C and 50 °C. Note that the condition is different from the ambient temperature condition of the converter unit (between 0 °C and 55 °C).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and the resistor unit under abnormal condition.
- Use the brake unit with a combination indicated in section 14.9.10 (1).
- Brake unit and regenerative options (Regenerative resistor) cannot be used simultaneously.
- When using the brake unit, set the parameters as follows.

Parameter	Setting value
[Pr. PA01 Regenerative option] of the converter unit	_ _ 0 0 (initial value)
[Pr. 2 Regenerative resistor] of the drive unit	_ _ 0 1

Connect the brake unit to the bus of the converter unit (L+ and L- of TE2-1) for use. As compared to the MR-RB regenerative option, the brake unit can return larger power. Use the brake unit when the regenerative option cannot provide sufficient regenerative capability.
When using the brake unit, always refer to "FR-BU2 Brake Unit Instruction Manual".

(1) Selection
Use a combination of converter unit, brake unit and resistor unit listed below.

Brake unit		Resistor unit	Number of connected units	Permissible continuous power [kW]	Resultant resistance [Ω]	Converter unit
200 V class	FR-BU2-55K	FR-BR-55K	2 (parallel)	7.82	1	MR-CR55K
		MT-BR5-55K	2 (parallel)	11.0	1	
400 V class	FR-BU2-H55K	FR-BR-H55K	2 (parallel)	7.82	4	MR-CR55K4
	FR-BU2-H75K	MT-BR5-H75K	2 (parallel)	15.0	3.25	

(2) Brake unit parameter setting

Normally, changing the FR-BU2-(H) parameter is not required. Whether a parameter can be changed or not is listed below.

Parameter		Change possible/ impossible	Remark
No.	Name		
0	Brake mode switchover	Impossible	Do not change the parameter.
1	Monitor display data selection	Possible	Refer to "FR-BU2 Brake Unit Instruction Manual".
2	Input terminal function selection 1	Impossible	Do not change the parameter.
3	Input terminal function selection 2		
77	Parameter write selection		
78	Cumulative energization time carrying-over times		
CLr	Parameter clear		
ECL	Alarm history clear		
C1	For manufacturer setting		

(3) Connection example

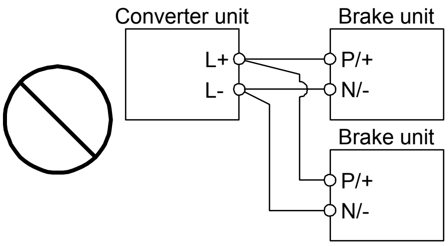
POINT

- Connecting PR terminal of the brake unit to L+ terminal of the converter unit results in a brake unit malfunction. Always connect the PR terminal of the brake unit to the PR terminal of the resistor unit.

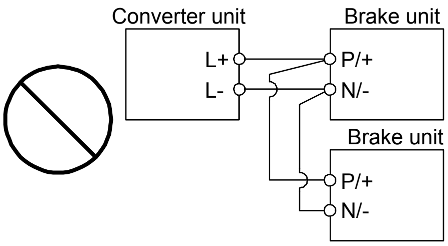
(a) Combination with FR-BR-(H) resistor unit

POINT

- To use brake units with a parallel connection, use two sets of FR-BU2-(H) brake unit. Combination with other brake unit results in alarm occurrence or malfunction.
- Always connect the terminals for master/slave (MSG to MSG, SD to SD) between the two brake units.
- Do not connect as follows.

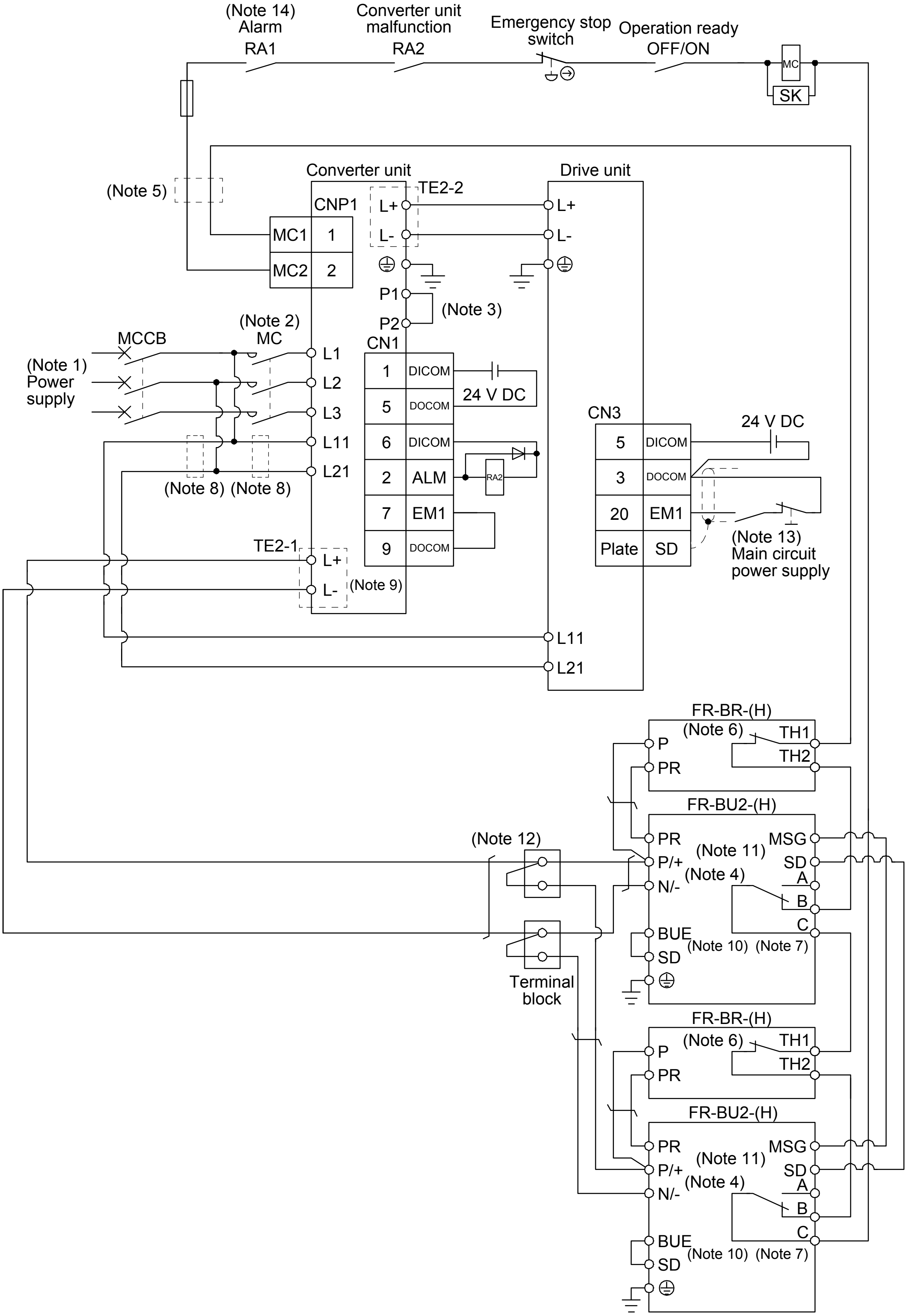


Connecting two cables to L+ and L- terminals



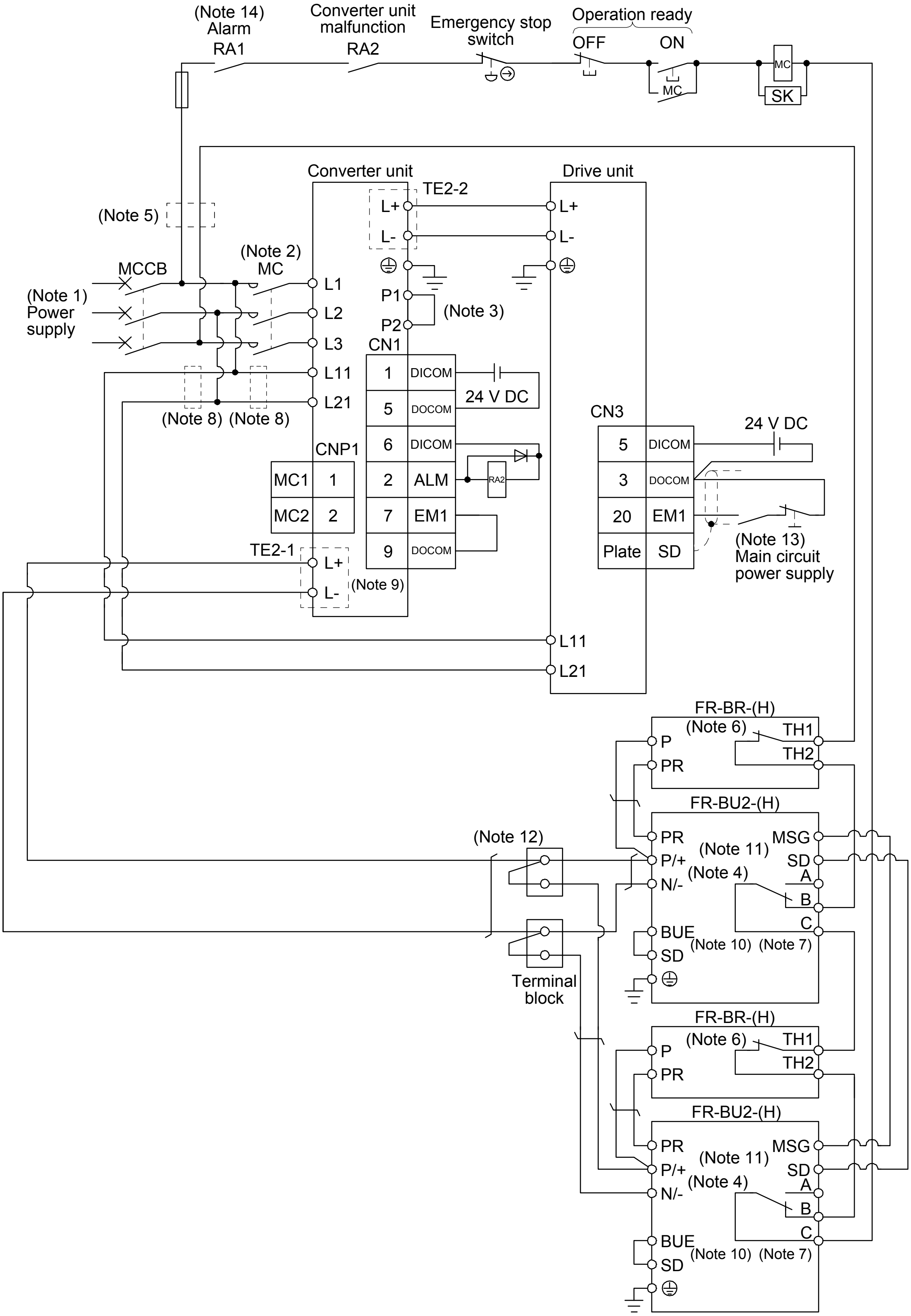
Passing wiring

1) When magnetic contactor drive output is enabled



Note
1. For the power supply specifications, refer to section 14.1.3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
3. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
5. For 400 V class, a step-down transformer is required.
6. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
7. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
8. Install an overcurrent protection device (molded-case circuit breaker, fuse or others) to protect the branch circuit. (Refer to section 14.9.5.)
9. Do not connect more than one cable to each L+ and L- terminals of TE2-1 of the converter unit.
10. Always connect BUE and SD terminals. (factory-wired)
11. Connect MSG and SD terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
12. For connecting L+ and L- terminals of TE2-1 of the converter unit to the terminal block, use the cable indicated in (d) of this section.
13. Configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off to prevent an unexpected restart of the drive unit.
14. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

2) When magnetic contactor drive output is disabled

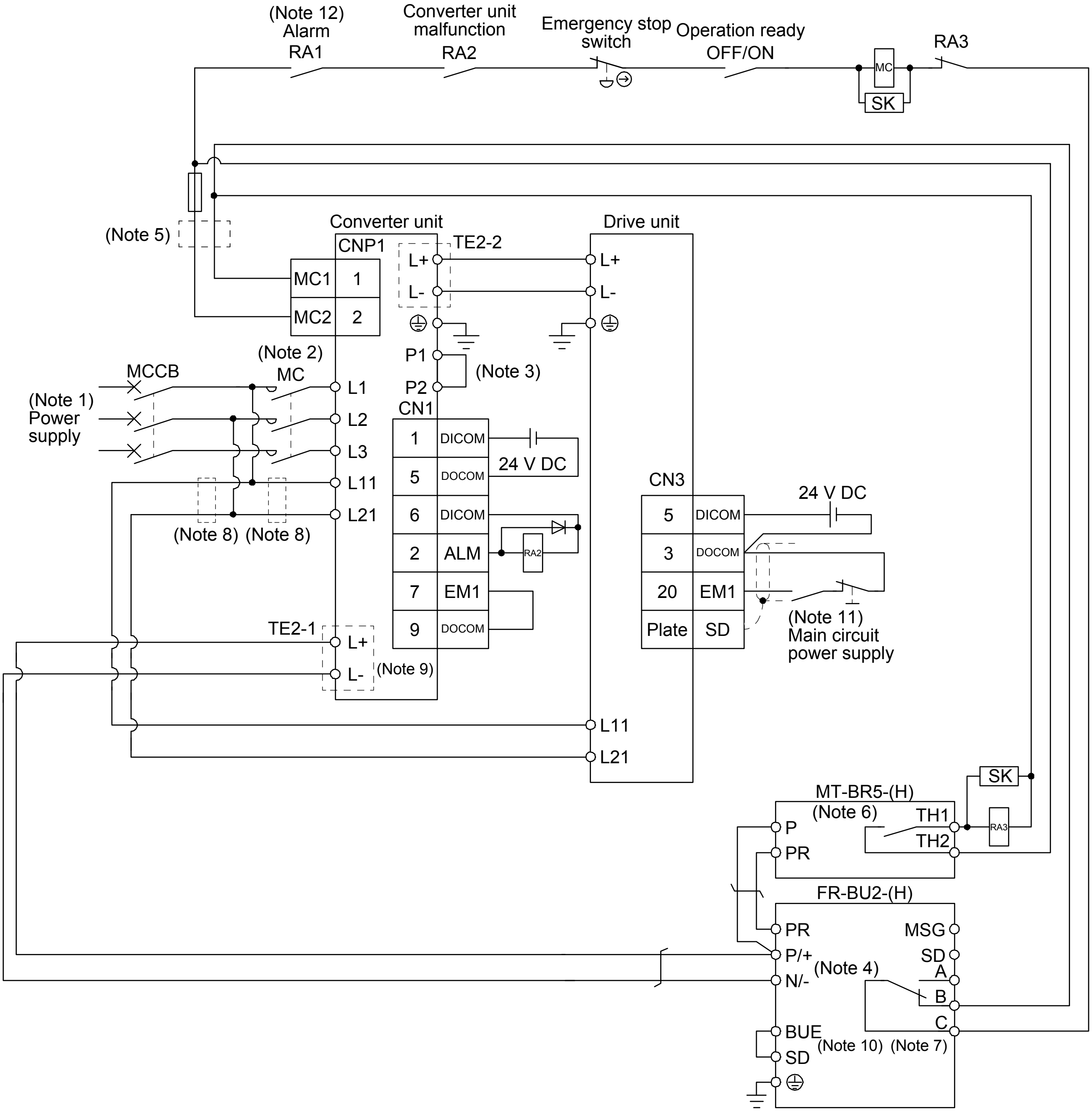


Note
1. For the power supply specifications, refer to section 14.1.3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
3. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
5. For 400 V class, a step-down transformer is required.
6. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
7. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
8. Install an overcurrent protection device (molded-case circuit breaker, fuse or others) to protect the branch circuit. (Refer to section 14.9.5.)
9. Do not connect more than one cable to each L+ and L- terminals of TE2-1 of the converter unit.
10. Always connect BUE and SD terminals. (factory-wired)
11. Connect MSG and SD terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
12. For connecting L+ and L- terminals of TE2-1 of the converter unit to the terminal block, use the cable indicated in (d) of this section.
13. Configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off to prevent an unexpected restart of the drive unit.
14. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

(b) Combination with MT-BR5-(H) resistor unit

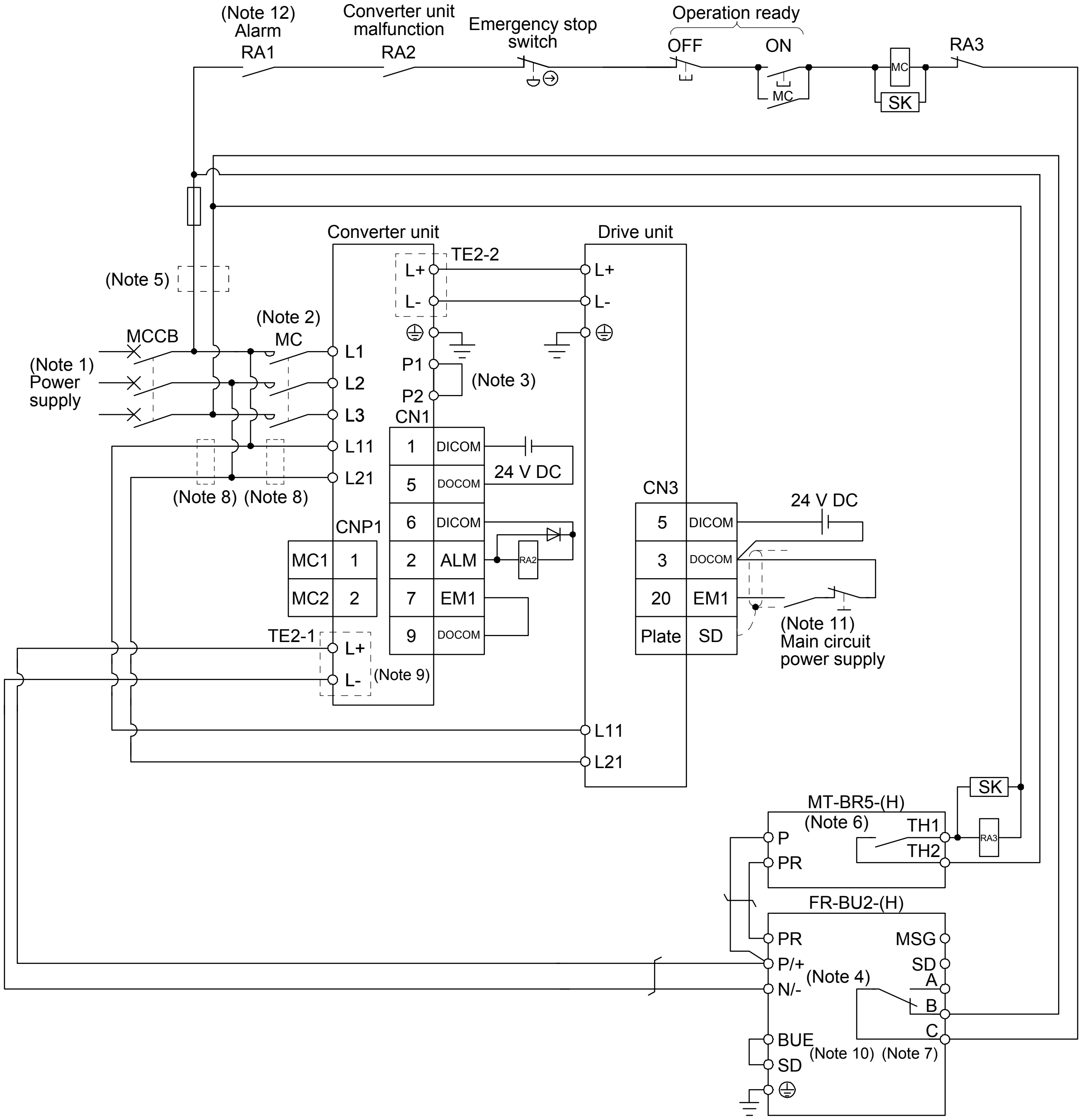
1) When connecting a brake unit to a converter unit

a) When magnetic contactor drive output is enabled



Note
1. For the power supply specifications, refer to section 14.1.3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
3. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
5. For 400 V class, a step-down transformer is required.
6. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
7. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
8. Install an overcurrent protection device (molded-case circuit breaker, fuse or others) to protect the branch circuit. (Refer to section 14.9.5.)
9. Do not connect more than one cable to each L+ and L- terminals of TE2-1 of the converter unit.
10. Always connect BUE and SD terminals. (factory-wired)
11. Configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off to prevent an unexpected restart of the drive unit.
12. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

b) When magnetic contactor drive output is disabled

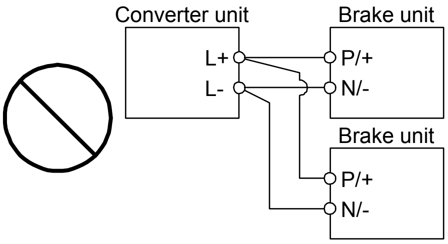


Note 1. For the power supply specifications, refer to section 14.1.3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
3. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
5. For 400 V class, a step-down transformer is required.
6. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
7. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
8. Install an overcurrent protection device (molded-case circuit breaker, fuse or others) to protect the branch circuit. (Refer to section 14.9.5.)
9. Do not connect more than one cable to each L+ and L- terminals of TE2-1 of the converter unit.
10. Always connect BUE and SD terminals. (factory-wired)
11. Configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off to prevent an unexpected restart of the drive unit.
12. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

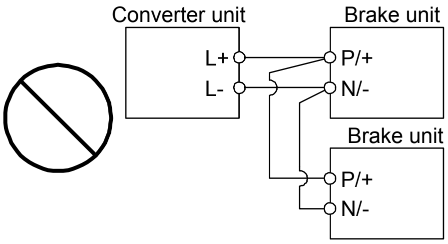
2) When connecting two brake units to a converter unit

POINT

- ●To use brake units with a parallel connection, use two sets of FR-BU2-(H) brake unit. Combination with other brake unit results in alarm occurrence or malfunction.
- ●Always connect the terminals for master/slave (MSG to MSG, SD to SD) between the two brake units.
- ●Do not connect as follows.

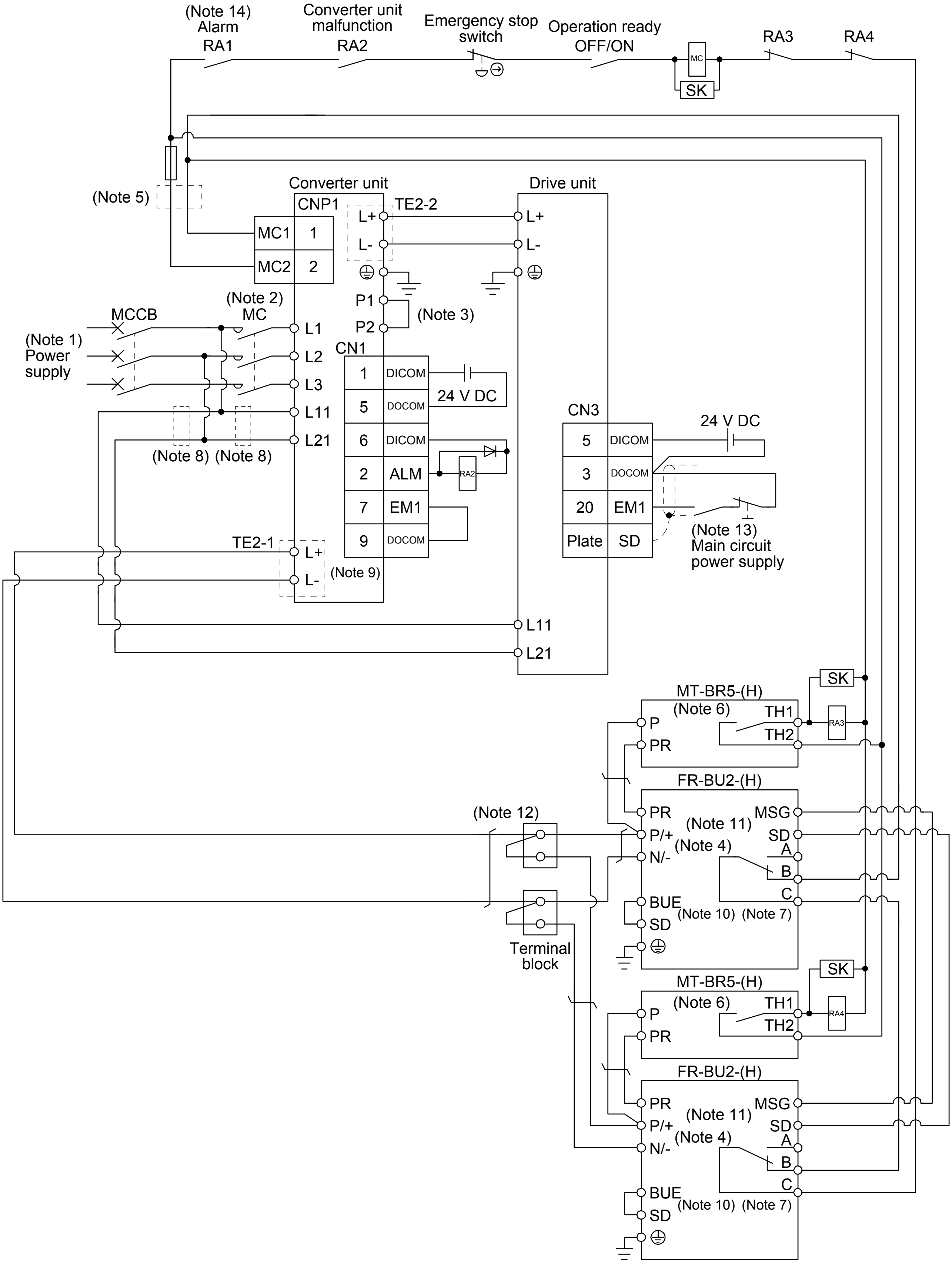


Connecting two cables to L+ and L- terminals



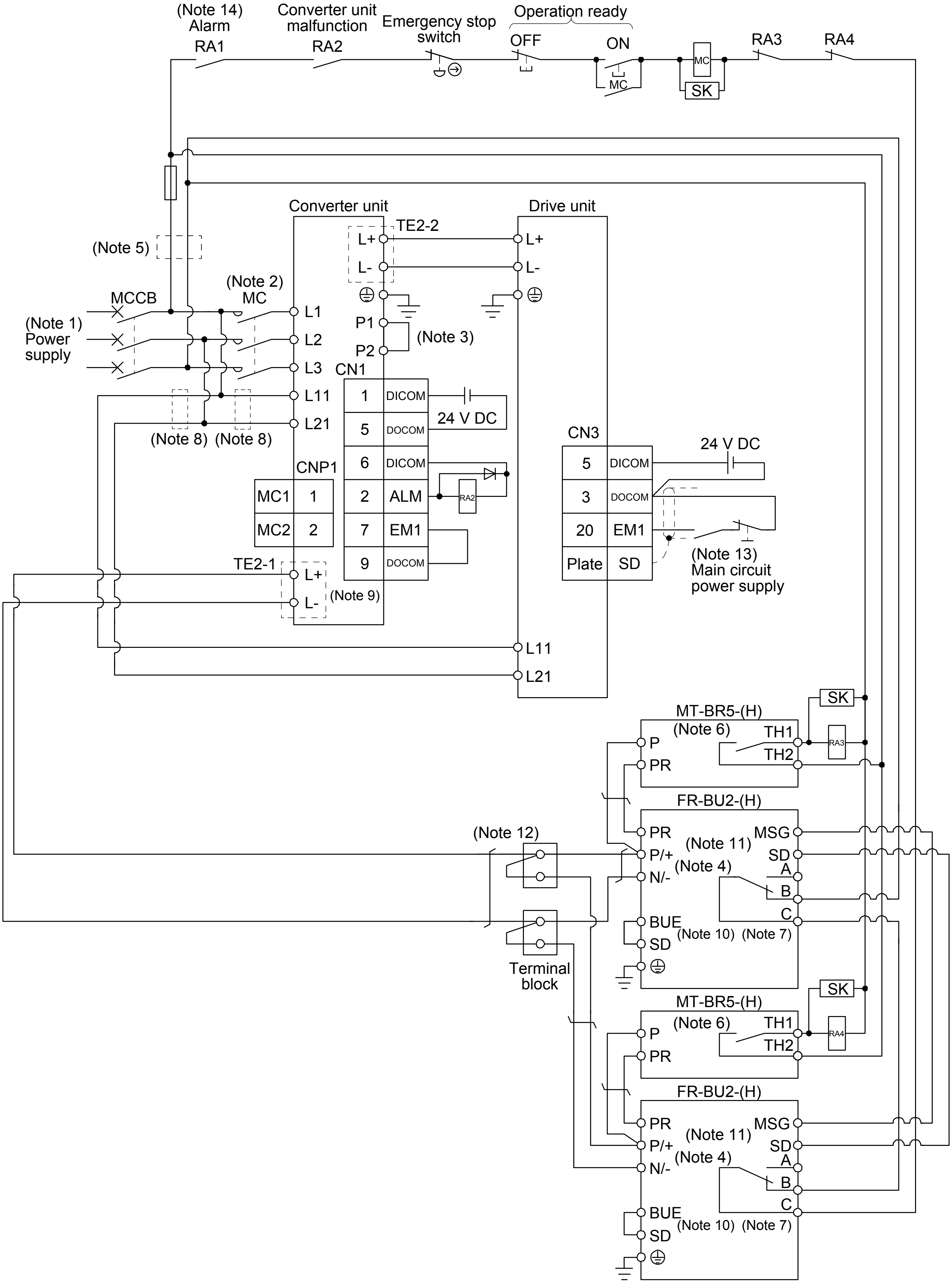
Passing wiring

a) When magnetic contactor drive output is enabled



Note 1. For the power supply specifications, refer to section 14.1.3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
3. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
5. For 400 V class, a step-down transformer is required.
6. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
7. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
8. Install an overcurrent protection device (molded-case circuit breaker, fuse or others) to protect the branch circuit. (Refer to section 14.9.5.)
9. Do not connect more than one cable to each L+ and L- terminals of TE2-1 of the converter unit.
10. Always connect BUE and SD terminals. (factory-wired)
11. Connect MSG and SD terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
12. For connecting L+ and L- terminals of the converter unit to the terminal block, use the cable indicated in (d) of this section.
13. Configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off to prevent an unexpected restart of the drive unit.
14. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

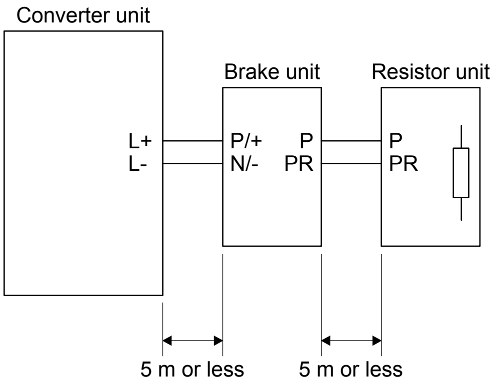
b) When magnetic contactor drive output is disabled

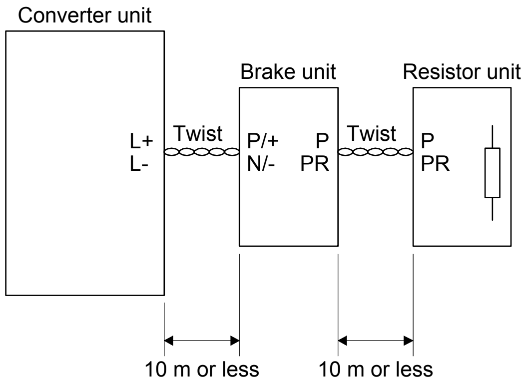


Note
1. For the power supply specifications, refer to section 14.1.3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
3. P1 and P2 are connected by default. When using the power factor improving DC reactor, connect P1 and P2 after removing the short bar across them. Refer to section 14.9.6 for details.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
5. For 400 V class, a step-down transformer is required.
6. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
7. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
8. Install an overcurrent protection device (molded-case circuit breaker, fuse or others) to protect the branch circuit. (Refer to section 14.9.5.)
9. Do not connect more than one cable to each L+ and L- terminals of TE2-1 of the converter unit.
10. Always connect BUE and SD terminals. (factory-wired)
11. Connect MSG and SD terminals of the brake unit to a correct destination. Incorrect connection destination results in the converter unit and brake unit malfunction.
12. For connecting L+ and L- terminals of the converter unit to the terminal block, use the cable indicated in (d) of this section.
13. Configure a circuit to turn off EM1 in the drive unit when the main circuit power is turned off to prevent an unexpected restart of the drive unit.
14. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

(c) Connection instructions

Keep the wires between the converter unit and the brake unit, and between the resistor unit and the brake unit as short as possible. For wires longer than 5 m, twist the wires five times or more per meter. The wires should not exceed 10 m even when the wires are twisted. If wires exceeding 5 m without twisted or exceeding 10 m with or without twisted are used, the brake unit may malfunction.



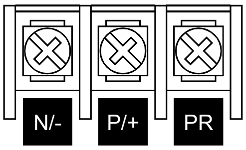


(d) Wires

1) Wires for the brake unit

For the brake unit, HIV wire (600 V Grade heat-resistant polyvinyl chloride insulated wire) is recommended.

a) Main circuit terminal



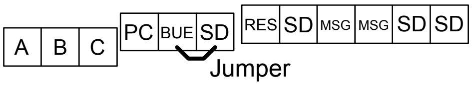
Terminal block

Brake unit		Main circuit terminal screw size	Crimp terminal	Tightening torque [N•m]	Wire size	
			N/-, P/+, PR,⏚		N/-, P/+, PR,⏚	
					HIV wire [mm^2]	AWG
200 V class	FR-BU2-55K	M6	14-6	4.4	14	6
400 V class	FR-BU2-H55K	M5	5.5-5	2.5	5.5	10
	FR-BU2-H75K	M6	14-6	4.4	14	6

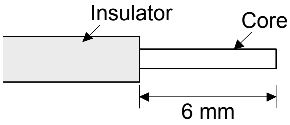
b) Control circuit terminal

POINT

- Under tightening can cause a cable disconnection or malfunction. Over tightening can cause a short circuit or malfunction due to damage to the screw or the brake unit.



Terminal block



Wire the stripped cable after twisting to prevent the cable from becoming loose. In addition, do not solder it.
Screw size: M3
Tightening torque: 0.5 N•m to 0.6 N•m
Wire size: 0.3 mm^2 to 0.75 mm^2
Screw driver: Small flat-blade screwdriver
(Tip thickness: 0.4 mm/Tip width 2.5 mm)

2) Cables for connecting the converter unit and a distribution terminal block when connecting two sets of the brake unit

Brake unit		Wire size	
		HIV wire [mm^2]	AWG
200 V class	FR-BU2-55K	38	2
400 V class	FR-BU2-H55K	14	6
	FR-BU2-H75K	38	2

(e) Crimp terminals for L+ and L- terminals of TE2-1 of converter unit

1) Recommended crimp terminals

POINT

- ●Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

Converter unit		Brake unit	Number of connected units	Crimp terminal (Manufacturer)	(Note 1) Applicable tool
200 V class	MR-CR55K	FR-BU2-55K	2	38-S6 (JST) (Note 2) R38-6S (NICHIFU) (Note 2)	a
400 V class	MR-CR55K4	FR-BU2-H55K	2	FVD14-6 (JST)	b
		FR-BU2-H75K	2	38-S6 (JST) (Note 2) R38-6S (NICHIFU) (Note 2)	a

Note 1. Symbols in the applicable tool field indicate applicable tools in (5) (b) of this section.
2. Coat the crimping part with an insulation tube.

2) Applicable tool

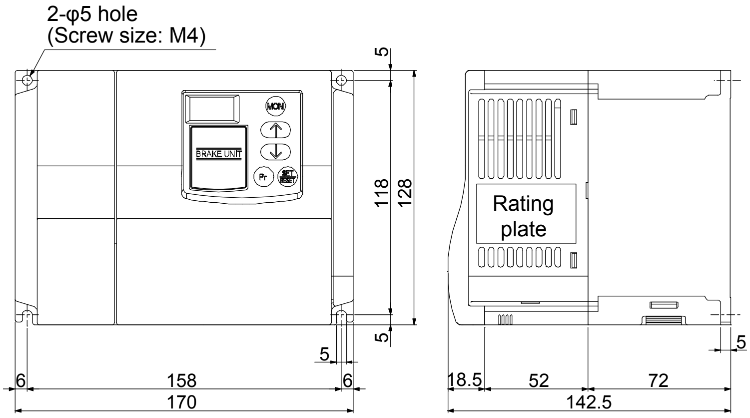
Symbol	Converter unit-side crimp terminal				
	Crimp terminal	Applicable tool			Manufacturer
		Body	Head	Dice	
a	38-S6	YPT-60-21		TD-124 TD-112	JST
		YF-1 E-4	YET-60-1		
	R38-6S	NOP60 NOM60			NICHIFU
b	FDV14-6	YF-1 E-4	YNE-38	DH-112 DH-122	JST

(4) Dimensions

(a) FR-BU2-(H) brake unit

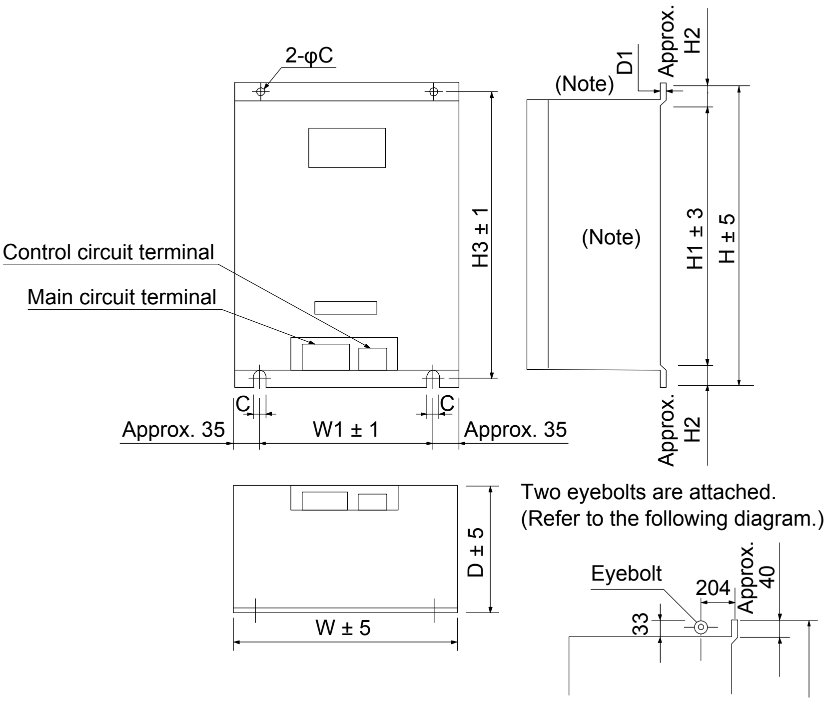
FR-BU2-55K/FR-BU2-H55K/FR-BU2-H75K

[Unit: mm]



(b) FR-BR-(H) resistor unit

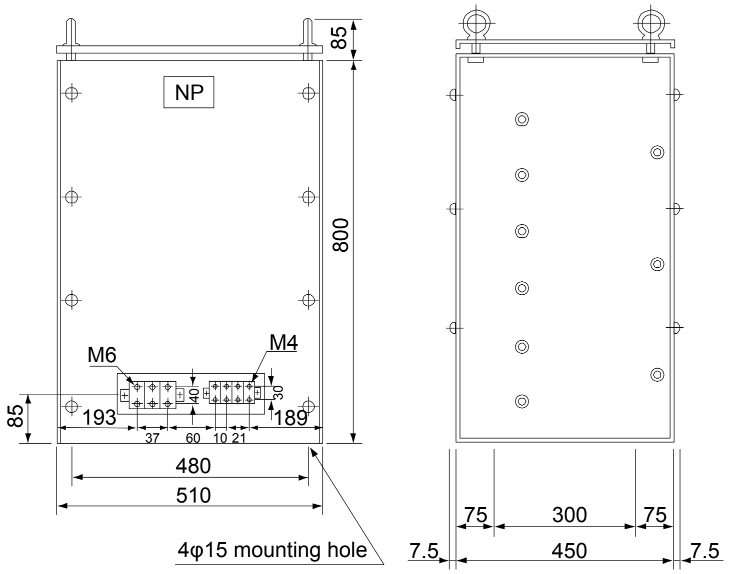
[Unit: mm]



Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Resistor unit		W	W1	H	H1	H2	H3	D	D1	C	Approximate mass [kg]
200 V class	FR-BR-55K	480	410	700	620	40	670	450	3.2	12	70
400 V class	FR-BR-H55K	480	410	700	620	20	670	450	3.2	12	70

(c) MT-BR5-(H) resistor unit



[Unit: mm]

Resistor unit		Resistance	Approximate mass [kg]
200 V class	MT-BR5-55K	2.0 Ω	50
400 V class	MT-BR5-H75K	6.5 Ω	70

15. FULLY CLOSED LOOP SYSTEM

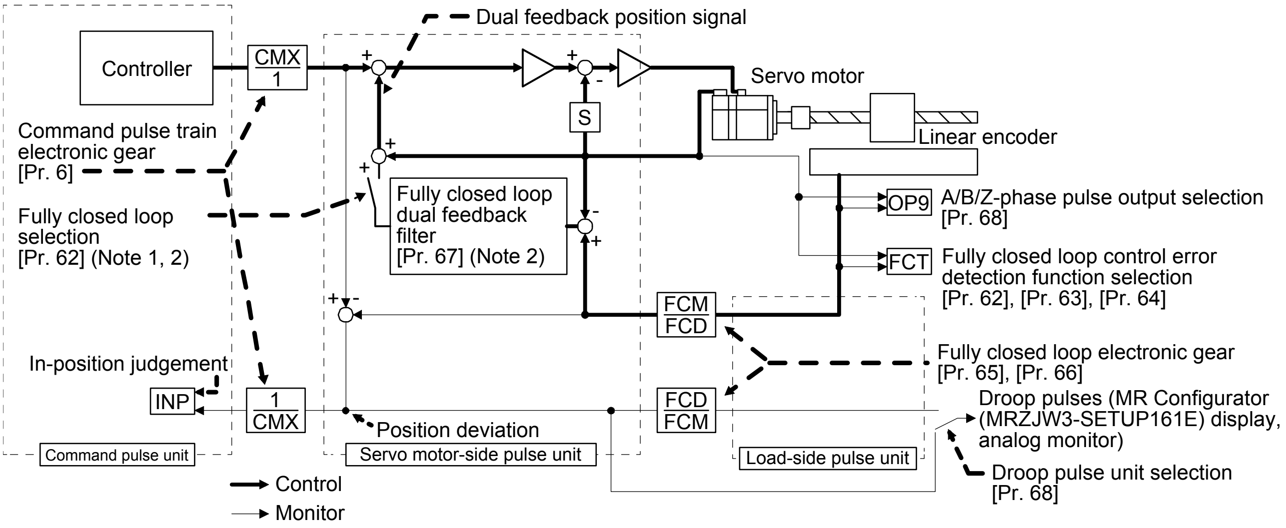
POINT

- The fully closed loop system is enabled only in J2S compatibility mode.
- For the fully closed loop system, use the servo amplifier or the drive unit with following software version:
  - A4 or later for 7 kW or less
  - A6 or later for 11 kW or more
- In the fully closed loop system, the following cable can be used for the servo motor encoder:
  - Two-wire type for software version A4 or later
  - Two-wire and four-wire types for software version A6 or later
- When the fully closed loop system is used with this servo amplifier, "Linear Encoder Instruction Manual" is needed.
- The fully closed loop system is available only in the position control mode.
- When using the fully closed loop system, change the mode to "fully closed loop control mode" by using the application "MR-J4(W)-B mode selection" came with MR Configurator2.

15.1 Functions and configuration

15.1.1 Function block diagram

A fully closed loop control block diagram is shown below.



Note 1. Switching between semi closed loop control and fully closed loop control can be performed by changing the setting of [Pr. 62]. When semi closed loop control is selected, a control is always performed on the bases of the position data of the servo motor encoder independently of whether the servo motor is at a stop or running.

2. When the fully closed loop system is enabled in [Pr. 62], dual feedback control in which the servo motor feedback signal and load-side encoder feedback signal are combined by the fully closed loop dual feedback filter in ([Pr. 67]) is performed.
In this case, fully closed loop control is performed when the servo motor is at a stop, and semi closed loop control is performed when the servo motor is operating to improve control performance. When "1000" is set as the filter value of [Pr. 67 Fully closed loop dual feedback filter], fully closed loop control is always performed.

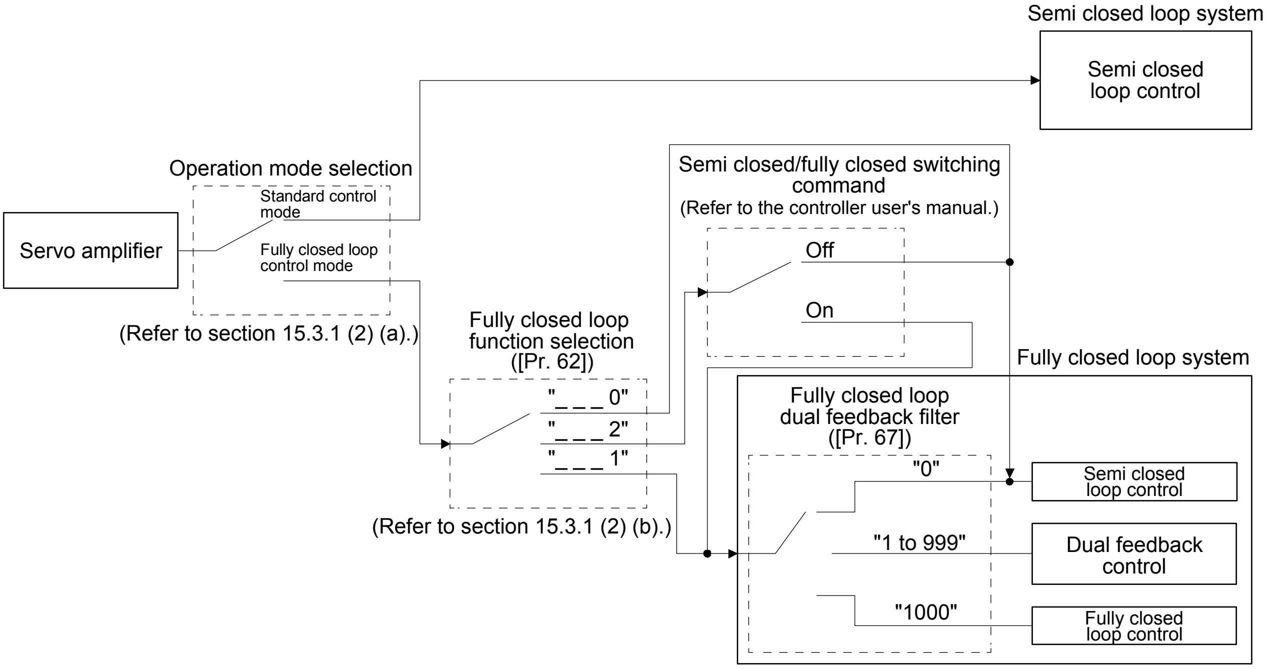
The following table shows the functions of each control mode.

Control	Description	
Semi closed loop control	Feature	Position is controlled according to the servo motor-side data.
	Advantage	Since this control is insusceptible to machine influence (such as machine resonance), the gains of the servo amplifier can be raised and the settling time shortened.
	Disadvantage	If the servo motor side is at a stop, the side may be vibrating or the load-side accuracy not obtained.
Dual feedback control	Feature	Position is controlled according to the servo motor-side data and load-side data.
	Advantage	Control is performed according to the servo motor-side data during operation, and according to the load side-data at a stop in sequence to raise the gains during operation and shorten the settling time. A stop is made with the load-side accuracy.
Fully closed loop control	Feature	Position is controlled according to the load-side data.
	Advantage	The load-side accuracy is obtained not only at a stop but also during operation.
	Disadvantage	Since this control is susceptible to machine resonance or other influences, the gains of the servo amplifier may not rise.

15.1.2 Selecting procedure of control mode

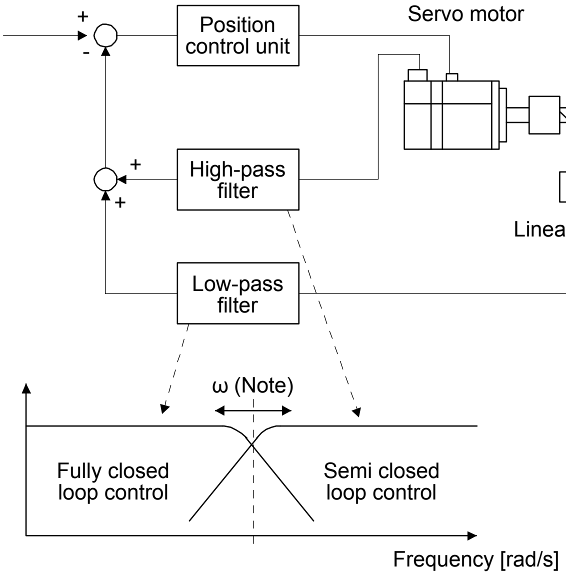
(1) Control mode configuration

In this servo, a semi closed loop system or fully closed loop system can be selected as a control system. In addition, on the fully closed loop system, the semi closed loop control, fully closed loop control and dual feedback control can be selected by the [Pr. 62] settings.



(2) Dual feedback filter equivalent block diagram

A dual feedback filter equivalent block diagram on the dual feedback control is shown below.



Dual feedback filter

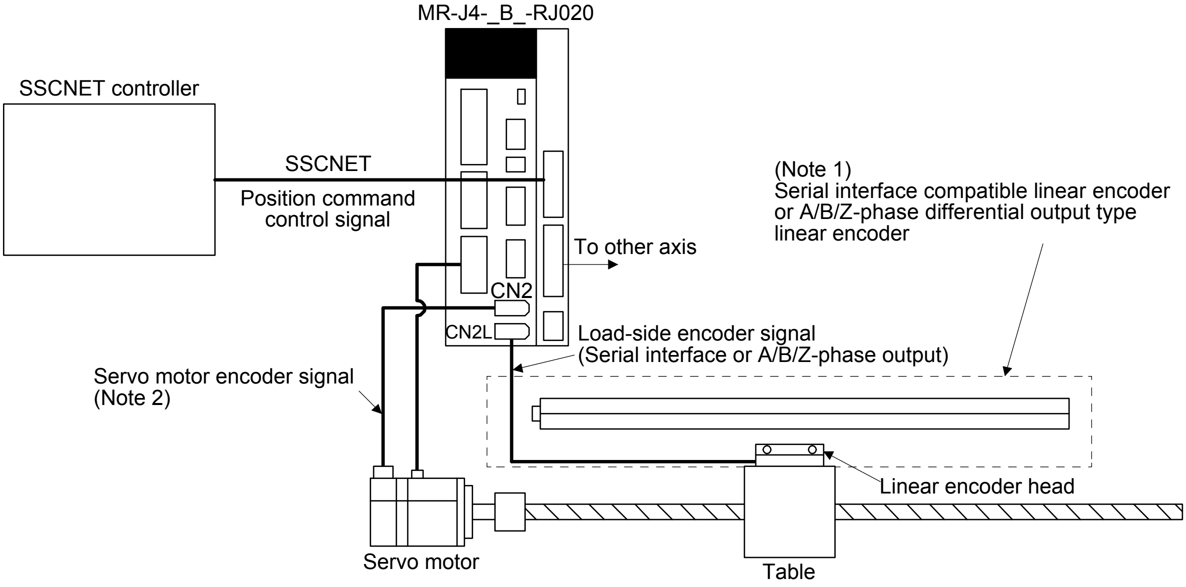
Operation status	Control status
Servo motor during a stop (0 to ω)	Fully closed loop control
In operation (ω or more)	Semi closed loop control

Note. "ω" (a dual feedback filter band) is set by [Pr. 67].

15.1.3 System configuration

POINT
●In the fully closed loop control mode, when an HG series servo motor is used for the load-side encoder, the resolution of the load-side encoder will be 131072 pulses/rev (17 bits), which is the same as that of the servo motor side.

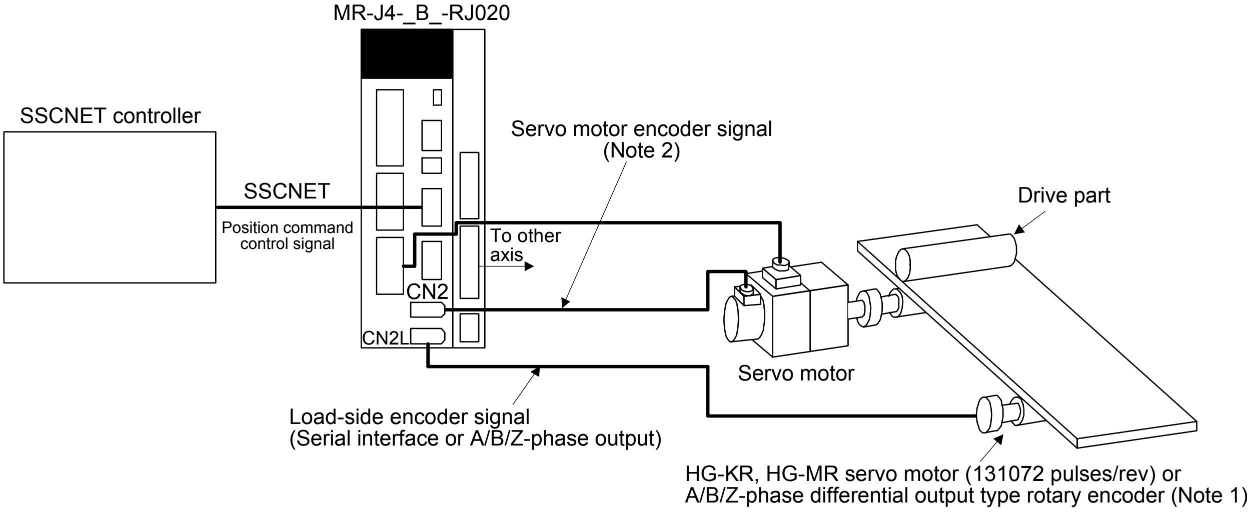
(1) For a linear encoder



Note 1. Applicable for the absolute position detection system when an absolute position linear encoder is used. In that case, a battery is not required. When an A/B/Z-phase differential output type linear encoder is used, the linear encoder without Z-phase cannot be connected. Not applicable for the absolute position detection system.

2. In the fully closed loop system, the following cable can be used for the servo motor encoder:
   - Two-wire type for software version A4 or later
   - Two-wire and four-wire types for software version A6 or later

(2) For a rotary encoder



Note 1. Not applicable for the absolute position detection system when an A/B/Z-phase differential output type rotary encoder is used.

2. In the fully closed loop system, the following cable can be used for the servo motor encoder:
   - Two-wire type for software version A4 or later
   - Two-wire and four-wire types for software version A6 or later

15.2 Load-side encoder

POINT

- ●Always use the load-side encoder cable introduced in this section. Using other products may cause a malfunction.
- ●For details of the load-side encoder specifications, performance and assurance, contact each encoder manufacturer.

15.2.1 Linear encoder

The following table shows compatible linear encoders.
Refer to "Linear Encoder Instruction Manual" for details of each linear encoder.

Linear encoder type		Manufacturer	Model	Resolution	Rated speed (Note 1)	Effective measurement length (maximum) (Note 2)	Communication method	Absolute position detection system
Mitsubishi serial interface compatibility	Absolute position type	Magnescale	SR77	0.05 μm/ 0.01 μm	3.3 m/s	2040 mm	Two-wire type	○
			SR87			3040 mm		
		Mitutoyo	AT343A	0.05 μm	2.0 m/s	3000 mm	Two-wire type	
			AT543A-SC		2.5 m/s	2200 mm		
			AT545A-SC	20 μm/4096 (approx. 0.005 μm)	2.5 m/s	2200 mm		
			ST741A	0.5 μm	4.0 m/s	6000 mm		
			ST742A					
			ST743A	0.1 μm				
			ST744A					
			ST748A					
		Renishaw	RESOLUTE RL40M	1 nm/50 nm	4.0 m/s	10000 mm	Two-wire type	
		Heidenhain	LC 493M	0.05 μm/ 0.01 μm	3.0 m/s	2040 mm	Four-wire type	
			LC 193M			4240 mm		
			LIC 4193M	0.005 μm/ 0.01 μm	4.0 m/s	3040 mm	Two-wire type/ Four-wire type	
			LIC 4195M			28440 mm		
			LIC 4197M			6040 mm		
			LIC 4199M			1020 mm		
	Incremental type	Magnescale	SR75	0.05 μm/ 0.01 μm	3.3 m/s	2040 mm	Two-wire type	×
			SR85			3040 mm		
			SL710 + PL101-RM/RHM	0.1 μm	4.0 m/s	100000 mm		
		Heidenhain	LIDA 483 + EIB 392M (/16384)	20 μm/16384 (approx. 1.22 nm)	4.0 m/s	3040 mm	Four-wire type	
			LIDA 485 + EIB 392M (/16384)			to 30040 mm		
			LIDA 487 + EIB 392M (/16384)			6040 mm		
			LIDA 489 + EIB 392M (/16384)			1020 mm		
			LIDA 287 + EIB 392M (/16384)	200 μm/16384 (approx. 12.2 nm)		10000 mm		
			LIDA 289 + EIB 392M (/16384)					
			LIF 481 + EIB 392M (/4096)	4 μm/4096 (approx. 0.977 nm)	1.2 m/s	1020 mm 1440 mm		
			LIP 581 + EIB 392M (/4096)					
		NIDEC SANKYO	PSLH041 (Note 6)	0.1 μm	5.0 m/s	2400 mm	Two-wire type	
A/B/Z-phase differential output type	Incremental type	Not specified		0.001 μm to 5 μm (Note 3)	Depends on the linear encoder	Depends on the linear encoder	A/B/Z-phase differential output method	

Note 1. The indicated value is the rated speed of linear encoder when combined with MR-J4 servo amplifier. It may be different from the specifications of each manufacturer.

2. The indicated value is the specification value of manufacturer. The encoder cable length between the linear encoder and the servo amplifier is maximum 30 m.

3. Please select a linear encoder within the range.

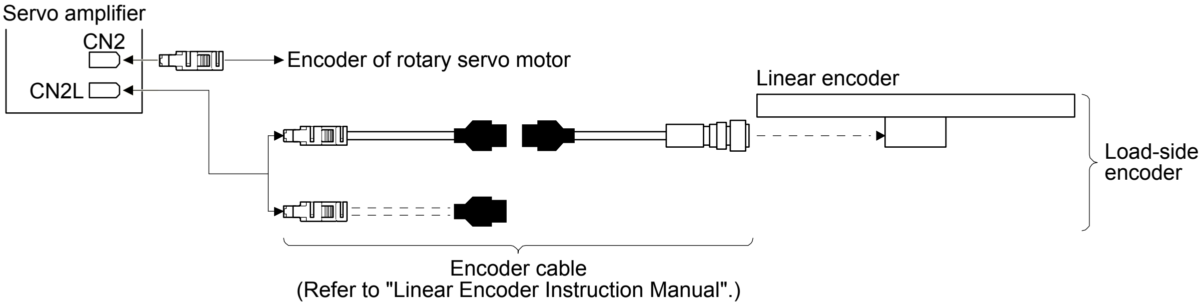
15.2.2 Rotary encoder

When a rotary encoder is used for the load-side encoder, use HG-KR or HG-MR servo motor as an encoder. Two-wire type and four-wire type encoder cables can be used.

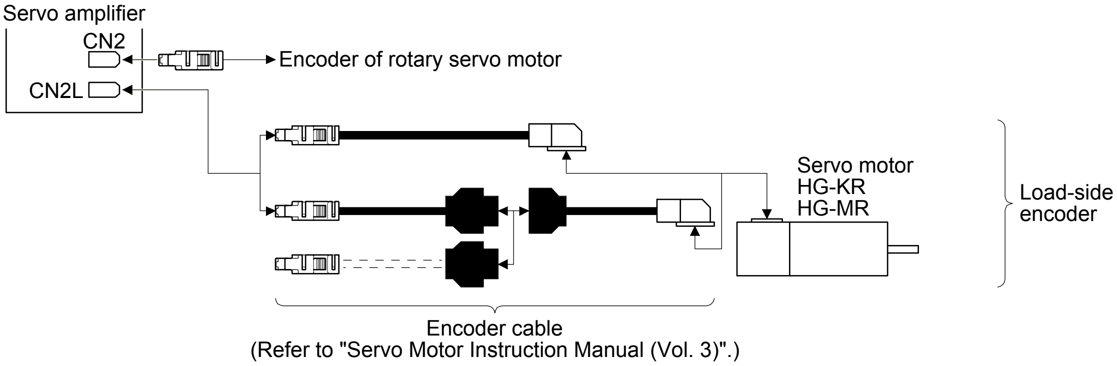
15.2.3 Configuration diagram of encoder cable

Configuration diagram for servo amplifier and load-side encoder is shown below. Cables used vary, depending on the load-side encoder.

(1) Linear encoder



(2) Rotary encoder
Refer to "Servo Motor Instruction Manual (Vol. 3)" for encoder cables for rotary encoders.

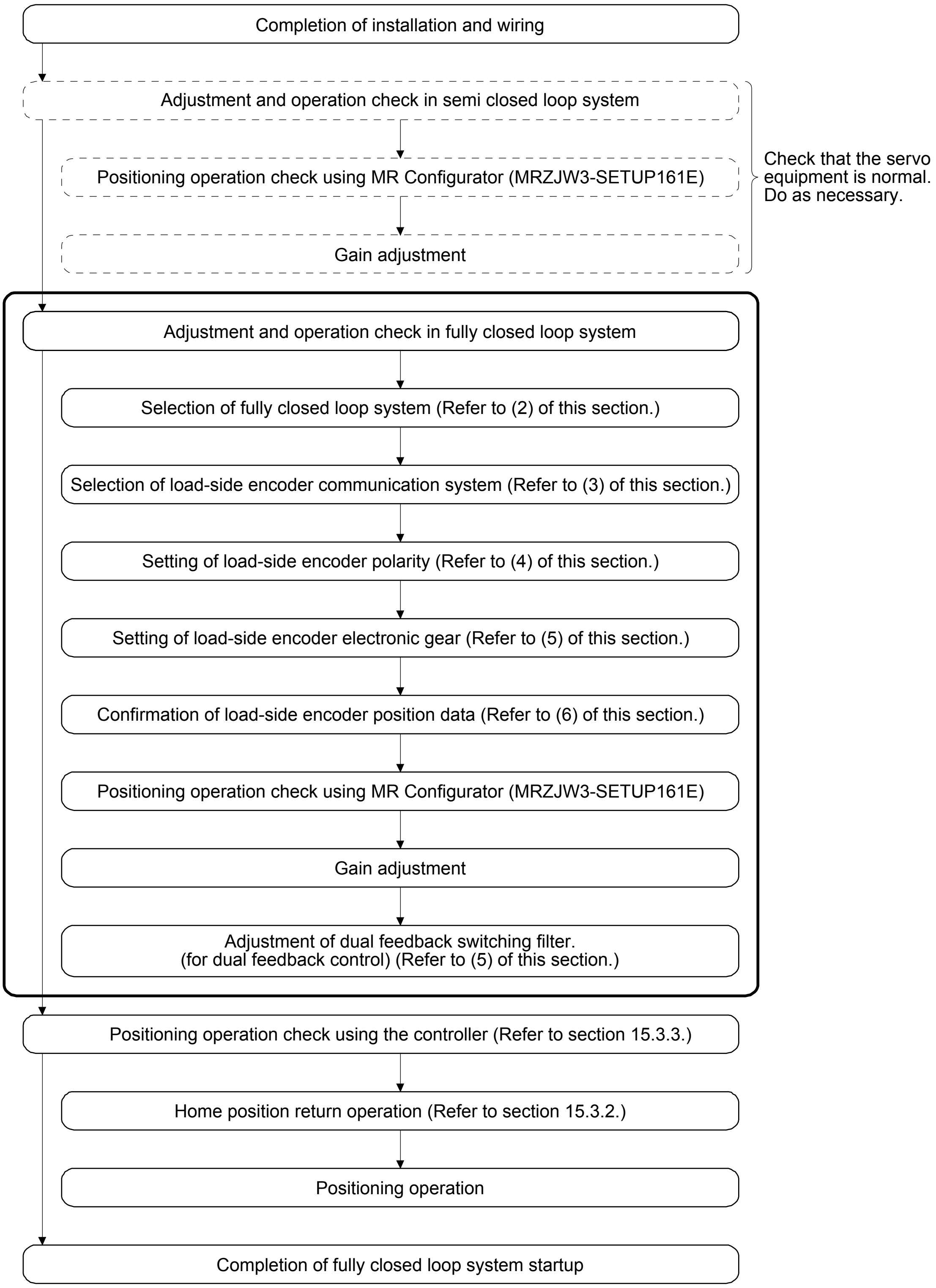


15.3 Operation and functions

15.3.1 Startup

(1) Startup procedure

Start up the fully closed loop system in the following procedure.



(2) Selection of fully closed loop system

POINT
●Changing operation mode initializes parameters. When operation mode is changed, make gain adjustment again. ●To perform fully closed loop control, set [Pr. 62] besides operation mode selection. ●When an incorrect value is set in "Encoder cable communication method selection" in [Pr. 23], [AL. 70] will occur at power on of the servo amplifier. ●For models and specifications of the servo system controller capable of switching semi closed loop control/fully closed loop control, contact your local sales office.

(a) Operation mode switching

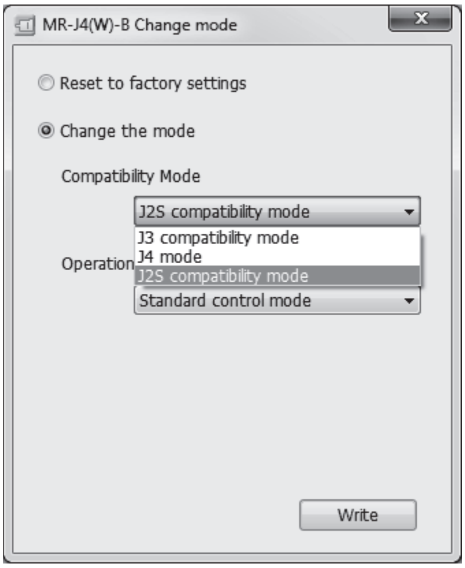
The following explains how to change the MR-J4-_B_-RJ020 mode to J2S compatibility and fully closed loop control mode.

When you use an MR-J4-_B_-RJ020 servo amplifier in J2S compatibility and fully closed loop control mode, use the application software "MR-J4(W)-B mode selection" came with MR Configurator2 whose software version is A3 or later. The application software "MR-J4(W)-B mode selection" is designed for USB connection only.

1) Turn on the servo amplifier with MR-J4-T20 connected.

2) Start the application software "MR-J4(W)-B mode selection" and check that "J2S compatibility mode" is displayed in the "Compatibility Mode". If not displayed, check (5) in this section to repeat the procedure.

3) After selecting "Change the mode", select "J2S compatibility mode".
Select "Fully closed loop control mode" for "Operation Mode".

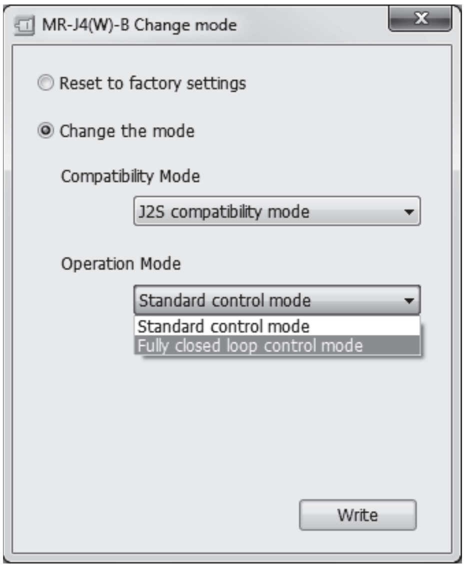

MR-J4(W)-B Change mode

○ Reset to factory settings

● Change the mode

Compatibility Mode: J2S compatibility mode

Operation Mode: Standard control mode


MR-J4(W)-B Change mode

○ Reset to factory settings

● Change the mode

Compatibility Mode: J2S compatibility mode

Operation Mode: Standard control mode

4) Press the "Write" button.

5) Cycling the power of the servo amplifier switches the mode to J2S compatibility and fully closed loop control mode.

6) With the application "MR-J4(W)-B mode selection", check that "Compatibility Mode" and "Operation Mode" are displayed as follows. If not displayed, check (5) in this section to repeat the procedure.
   - Compatibility Mode → "J2S compatibility mode"
   - Operation Mode → "Fully closed loop control mode"

7) Differences in the initial value after the mode is changed to the fully closed loop control mode
   When the operation mode is changed to the fully closed loop control mode, the initial values of the following parameters will be changed.

No.	Name	Initial value	
		Standard control mode	Fully closed loop control mode
6	Feedback pulse number	0	7 kW or less: 0 11 kW or more: 255
62	Fully closed loop selection	0000	1300
64	Fully closed loop control error detection 2	100	10
67	Dual feedback filter	0	10
68	Fully closed loop selection 2	0	0000

(b) Parameter setting method
Semi closed loop control/fully closed loop control can be selected by the combination of [Pr. 62] and [Pr. 67] setting values. To change these setting values, set "000F" in [Pr. 40 Parameter writing inhibit]. [Pr. 62] setting will be enabled after the power is cycled.

[Pr. 62] setting value	Fully closed loop function	[Pr. 67] setting value	Control mode
_ _ _ 0	Disabled		Semi closed loop control
_ _ _ 1	Enabled	1 to 999	Dual feedback control (fully closed loop control)
		1000	Fully closed loop control

The fully closed loop function can be switched (switching semi./full. using the servo system controller) by combining the settings as follows.
At this time, the semi./full. switching signal is disabled and semi closed loop control is always performed in the test operation from MR Configurator (MRZJW3-SETUP161E).

[Pr. 62] setting value	Semi closed loop control/fully closed loop control switching signal	[Pr. 67] setting value	Control method	MR Configurator (Test operation mode)
_ _ _ 2	Semi. selection		Semi closed loop control	Semi closed loop control
_ _ _ 2	Full. selection	1 to 999	Dual feedback control (fully closed loop control)	
		1000	Fully closed loop control	

(c) Semi closed loop control/fully closed loop control selection
Select the semi closed loop control/fully closed loop control.

[Pr. 62]

0	0	0	

Fully closed loop function
0: Disabled (Semi closed loop control)
1: Always enabled
2: Switching using the control command of controller (switching semi./full.)

Selection using the control command of controller	Control method
Off	Semi closed loop control
On	Fully closed loop control

(3) Selection of load-side encoder communication method

POINT

●Incorrect setting will result in [AL. 16 Encoder error 1].

The communication method changes depending on the load-side encoder type. Refer to section 15.4.1 and "Linear Encoder Instruction Manual" for the communication method for each load-side encoder. Select the cable to be connected to CN2L connector in [Pr. 23].

[Pr. 23]

0		0	0

Serial encoder cable selection

Setting value	When the fully closed loop function is disabled ([Pr. 62]: _ _ _ 0)		When the fully closed loop function is enabled ([Pr. 62]: _ _ _ 1 or _ _ _ 2)	
	CN2 side	CN2L side	CN2 side	CN2L side
0	Two-wire type	Unavailable	Two-wire type	Two-wire type/A/B/ Z-phase differential output method
1	Four-wire type	Unavailable	Unavailable (Note)	
2	Two-wire type	Unavailable	Two-wire type	Four-wire type
3	Unavailable	Unavailable	Four-wire type	Two-wire type/A/B/ Z-phase differential output method
4	Unavailable	Unavailable	Four-wire type	Four-wire type

When this is set, [AL. 37 Parameter error] occurs.

(4) Setting of load-side encoder polarity

⚠ CAUTION

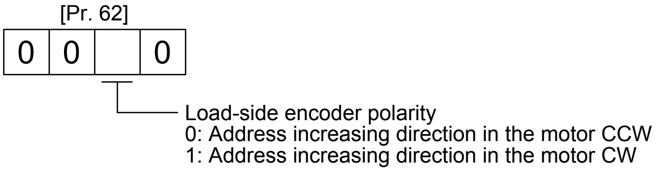
- Do not set an incorrect direction to "Load-side encoder polarity" in [Pr. 62]. An abnormal operation and a machine collision may occur if an incorrect direction is set, which cause a fault and parts damaged. Also, it may cause [AL. 42] during the positioning operation.

POINT

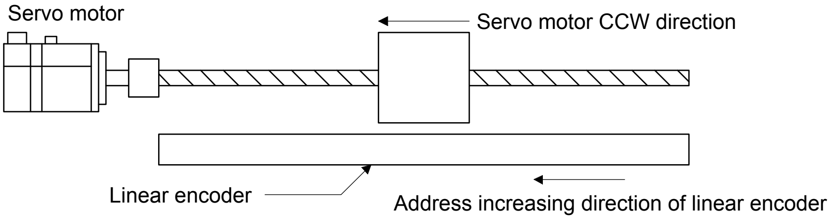
- Setting of load-side encoder polarity is irrelevant to [Pr. 7 Rotation direction selection]. Make sure to set it according to the relationships between servo motor and linear encoder or rotary encoder.

(a) Parameter setting method

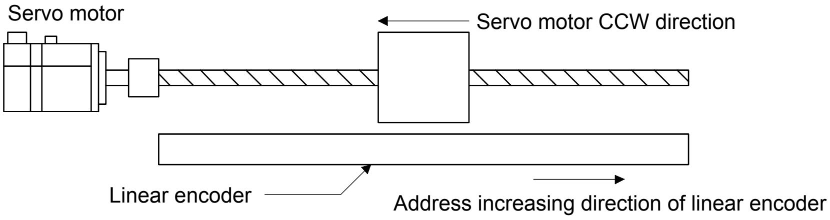
Set the load-side encoder polarity to be connected to CN2L connector in order to match the CCW direction of servo motor and the increasing direction of load-side encoder feedback.



1) Setting encoder address increasing direction ("_ _ 0 _") in the servo motor CCW direction



2) Setting encoder address increasing direction ("_ _ 1 _") in the servo motor CW direction



(b) How to confirm the load-side encoder feedback direction

For the way of confirming the load-side encoder feedback direction, refer to (6) in this section.

(5) Setting of load-side encoder electronic gear

POINT

- ●When an incorrect value is set in the linear encoder electronic gear ([Pr. 65], [Pr. 66]), normal operation may not be performed. Also, it may cause [AL.42] during the positioning operation.
- ●To change setting value, set "000F" in [Pr. 40 Parameter writing inhibit]. Cycling the power will enable the setting value.

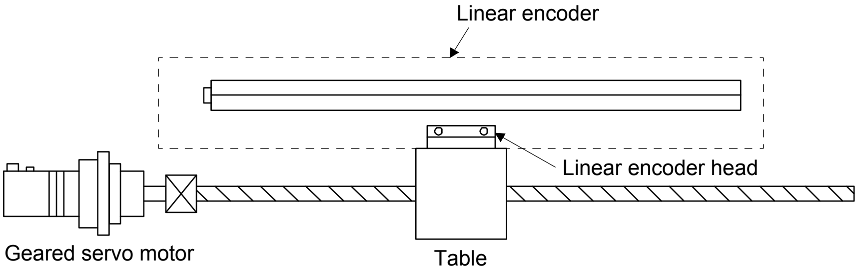
Set the numerator ([Pr. 65]) and denominator ([Pr. 66]) of the electronic gear to the servo motor-side encoder pulse. Set the electronic gear so that the number of servo motor encoder pulses per servo motor revolution is converted to the number of load-side encoder pulses. The relational expression is shown below.

$$\frac{[\text{Pr. }65]}{[\text{Pr. }66]} = \frac{\text{Number of servo motor encoder pulses per servo motor revolutio}}{\text{Number of load-side encoder pulses per servo motor revolution}}$$

Set the fully closed loop electronic gear $\frac{[\text{Pr. }65]}{[\text{Pr. }66]}$ within $\frac{1}{100} < \frac{\text{FCM}}{\text{FCD}} < \frac{100}{1}$

(a) When the servo motor is directly coupled with a ball screw and the linear encoder resolution is 0.05 µm

Conditions
Servo motor resolution: 131072 pulses/rev
Ball screw lead: 4 mm
Linear encoder resolution: 0.05 µm



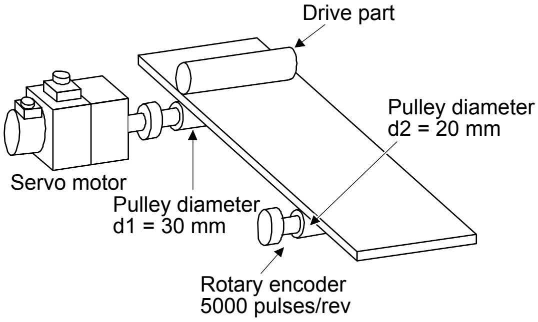
Calculate the number of linear encoder pulses per servo motor revolution.

Number of linear encoder pulses per servo motor revolution
= Ball screw lead/linear encoder resolution
= 4 mm/0.05 µm = 80000 pulses

$$\frac{[\text{Pr. }65]}{[\text{Pr. }66]} = \frac{131072}{80000} = \frac{1024}{625}$$

(b) Setting example when using the rotary encoder for the load-side encoder of roll feeder

Conditions
Servo motor resolution: 131072 pulses/rev
Pulley diameter on the servo motor side: 30 mm
Pulley diameter on the rotary encoder side: 20 mm
Rotary encoder resolution: 5000 pulses/rev
(after multiplication by 4: 20000 pulses/rev)



When the pulley diameters or reduction ratios differ, consider that in calculation.
For the rotary encoder, calculate using the number of pulses multiplied by 4.

$$\frac{[\text{Pr. } 65]}{[\text{Pr. } 66]} = \frac{131072 \times 20}{20000 \times 30} = \frac{8192}{1875}$$

(6) Confirmation of load-side encoder position data

Check the load-side encoder mounting and parameter settings for any problems.

POINT

- Depending on the check items, MR Configurator (MRZJW3-SETUP161E) may be used.
  Refer to section 15.3.9 for the data displayed on the MR Configurator.

When checking the following items, the fully closed loop control mode must be set. For the setting of control mode, refer to (2) in this section.

No.	Check item	Confirmation method and description
1	Read of load-side encoder position data	With the load-side encoder in a normal state (mounting, connection, etc.), the load-side cumulative feedback pulse 2 (on load-side encoder) value is counted normally when the load-side encoder is moved. When it is not counted normally, the following factors can be considered. 1. An alarm occurred. 2. The installation of the load-side encoder was not correct. 3. The encoder cable was not wired correctly.
2	Read of load-side encoder home position (reference mark, Z-phase)	With the home position (reference mark, or Z-phase) of the load-side encoder in a normal condition (mounting, connection, etc.), the within-full-one-revolution position (load-side encoder position within one-revolution) value is cleared to 0 when the home position (reference mark, or Z-phase) is passed through by moving the load-side encoder. When it is not cleared, the following factors can be considered. 1. The installation of the load-side encoder was not correct. 2. The encoder cable was not wired correctly.
3	Confirmation of load-side encoder feedback direction (Setting of load-side encoder polarity)	Confirm the feedback direction at the within-full-one-revolution position (load-side encoder position within one-revolution) by moving the device (load-side encoder) manually in a servo off state. When the servo motor and load-side encoder feedback directions match, rotating the servo motor in the CCW direction (counterclockwise as viewed from the shaft end) increases the position in load-side encoder 1-revolution, and rotating the servo motor in the CW direction (clockwise as viewed from the shaft end) decreases the position in load-side encoder 1-revolution. When the servo motor and load-side encoder directions do not match, operation is performed oppositely.
4	Fully closed loop electronic gear setting	When the servo motor and load-side encoders operate synchronously, the cumulative feedback pulse (on motor encoder) and cumulative feedback pulse 2 (on load-side encoder) values increase in accordance with the setting ratio of the fully closed loop electronic gear ([Pr. 65]/[Pr. 66]). Confirmation example When the servo motor is directly coupled with a ball screw and the linear encoder resolution is 1.0 μm ・Motor encoder resolution = 131072 pulses/rev ・Ball screw lead = 4.0 mm ・Linear encoder resolution = 1.0 μm When the movement is equivalent to one servo motor revolution (Load-side: 4.0 mm), cumulative feedback pulse 2 (on load-side encoder) = 4000 pulses.

(7) Dual feedback filter setting

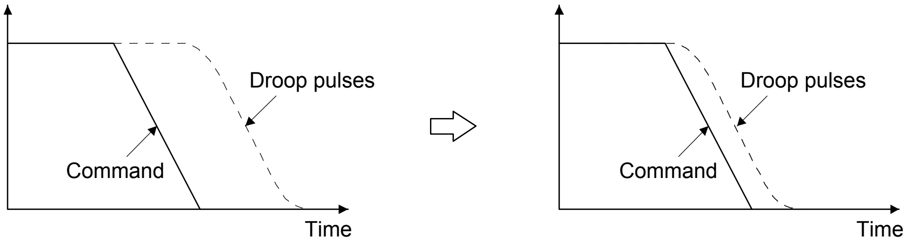
With the initial value (setting = 10) set in [Pr. 67 Dual feedback filter], make gain adjustment by auto tuning, etc. as in semi closed loop control. While observing the servo operation waveform with the graph function, etc. of MR Configurator (MRZJW3-SETUP161E), adjust the dual feedback filter.

The dual feedback filter operates as described below depending on the setting.

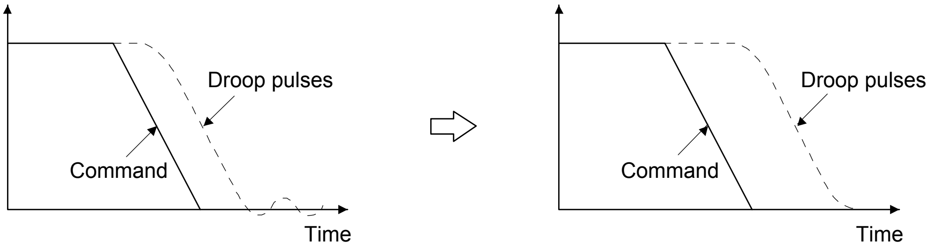
[Pr. 67] setting value	Control mode	Vibration	Settling time
0	Semi closed loop		
1 (initial value = 10) to [Pr. 15] setting value/2	Dual feedback	Seldom occurs to Frequently occurs	Long time to Short time
1000	Fully closed loop		

Increasing the dual feedback filter setting shortens the settling time, but increases servo motor vibration since the motor is more likely to be influenced by the load-side encoder vibration. The maximum setting of the dual feedback filter should be less than half of the PG2 ([Pr. 15]) setting.

Reduction of settling time: Increase the dual feedback filter setting.



Suppression of vibration: Decrease the dual feedback filter setting.



15.3.2 Home position return

(1) General instruction

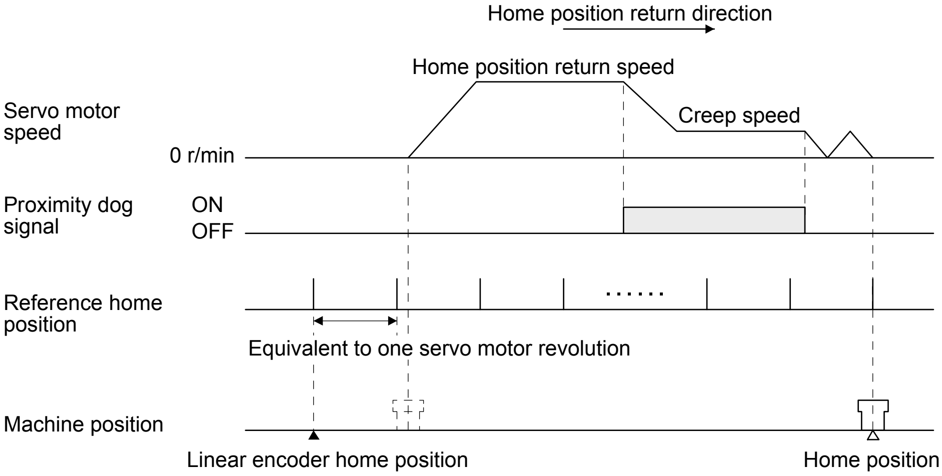
Home position return is all performed according to the load-side encoder feedback data, independently of the load-side encoder type. It is irrelevant to the Z-phase position of the servo motor encoder. In the case of a home position return using a dog signal, the home position (reference mark) must be passed through when an incremental type linear encoder is used, or the Z-phase be passed through when a rotary encoder is used, during a period from a home position return start until the dog signal turns off.

Compatible encoder types are omitted as follows.
Serial interface: Mitsubishi serial interface compatible encoder
General pulse output: A/B/Z-phase differential output encoder
Common to all load-side encoders: Load-side encoders compatible with this model (For details, refer to section 15.1.)

(2) Load-side encoder types and home position return methods (serial Interface)

(a) About proximity dog type home position return using absolute type linear encoder

When an absolute type linear encoder is used, the home position reference position is the position per servo motor revolution to the linear encoder home position (absolute position data = 0).
In the case of a proximity dog type home position return, the nearest position after proximity dog off is the home position.
The linear encoder home position may be set in any position.



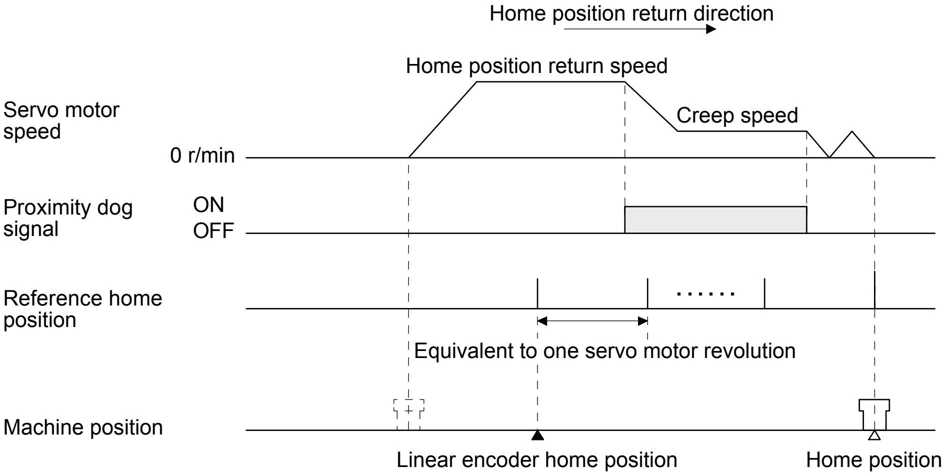
(b) About proximity dog type home position return using incremental linear encoder (serial Interface/general pulse output)

1) When the linear encoder home position (reference mark) exists in the home position return direction

When an incremental linear encoder is used, the home position is the position per servo motor revolution to the linear encoder home position (reference mark) passed through first after a home position return start.

In the case of a proximity dog type home position return, the nearest position after proximity dog off is the home position.

Set one linear encoder home position in the full stroke, and set it in the position that can always be passed through after a home position return start.

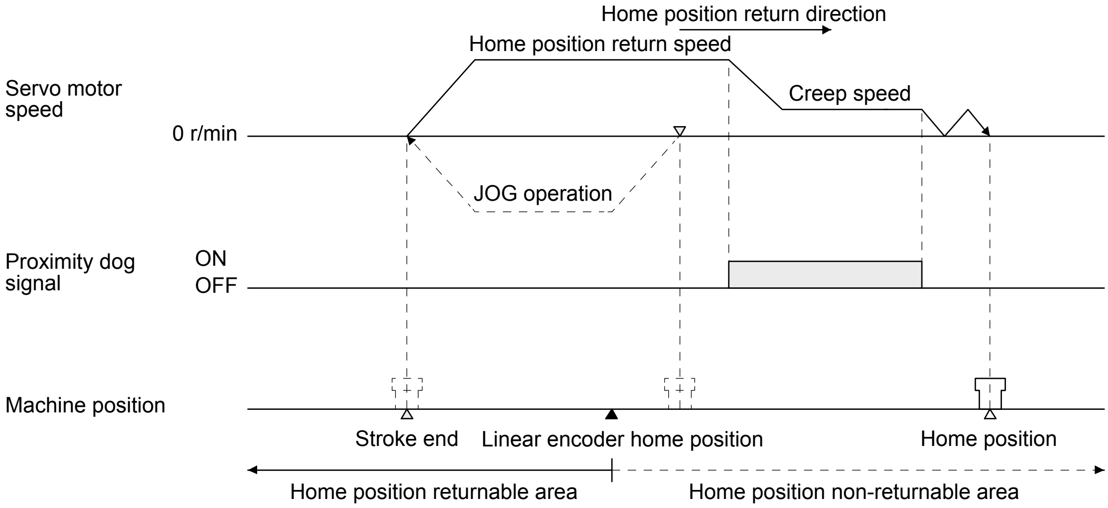


2) When the linear encoder home position does not exist in the home position return direction

POINT

- ●To execute a home position return securely, start a home position return after moving the axis to the opposite stroke end by jog operation, etc. of the controller.
- ●A home position return cannot be made if the incremental linear encoder does not have a linear encoder home position (reference mark). Always provide a linear encoder home position (reference mark). (one place in the fully stroke)

If the home position return is performed from the position where the linear encoder home position (reference mark) does not exist, a home position return error occurs on the controller side. The error contents differ according to the controller type. When starting a home position return at the position where the linear encoder home position (reference mark) does not exist in the home position return direction, move the axis up to the stroke end on the side opposite to the home position return direction by JOG operation, etc. of the controller once, then make a home position return.



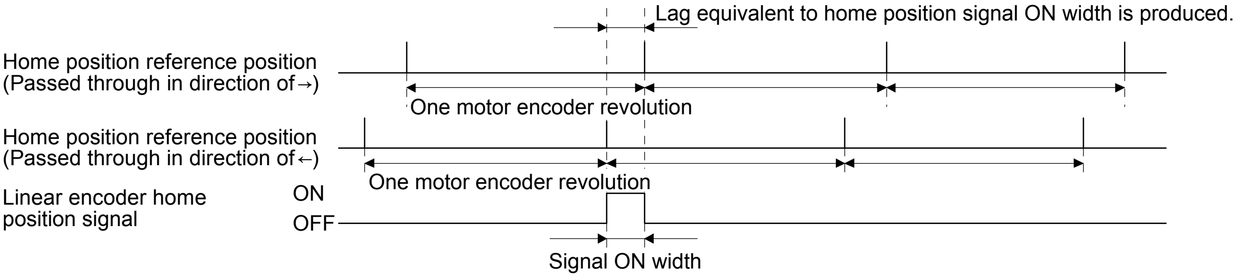
3) Instructions when the system uses the positioning module (QD75M) or VME bus Position Board (MR-MC01) as a servo system controller.

POINT
●The home position return retry function of the positioning module (QD75M) cannot be used.

The linear encoder home position (reference mark) has some width in the region where the signal turns on.

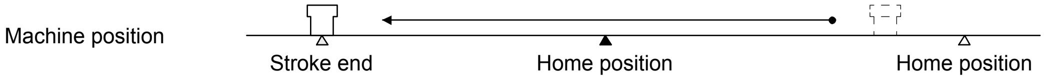
Note. The signal ON width changes depending on the used linear encoder. For details, contact each linear encoder manufacturer.

The positioning module (QD75M) or VME bus Position Board (MR-MC01) determines the home position reference position when the linear encoder home position (reference mark) is passed through first after power-on of the servo amplifier. Therefore, a lag equivalent to the home position signal width is produced in the home position reference position depending on the direction in which the linear encoder home position (reference mark) is passed through.



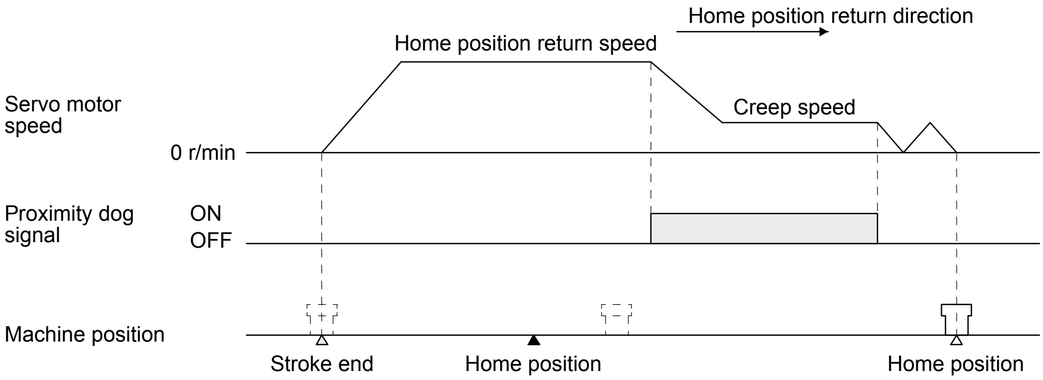
When it is desired to always make a home position return to the same position without a lag equivalent to the home position signal width, a home position return must be performed so that the home position is always passed through in the same direction after power-on.
The following indicates a home position return method in which a lag equivalent to the home position signal width is not produced in the positioning module (QD75M) or VME bus Position Board (MR-MC01).

a) Move it to the position where the stroke end signal on the side opposite to the home position return direction turns on.



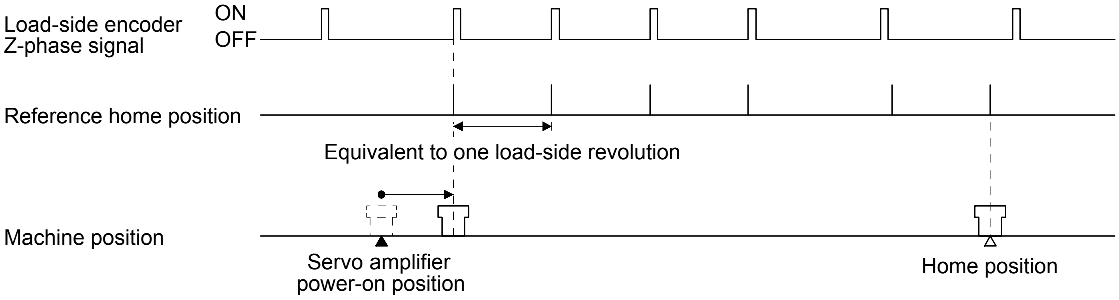
b) Perform the power-on reset of the servo amplifier or reset the controller.

c) After servo-on, make a home position return.



(c) About dog type home position return when using the rotary encoder of a serial communication servo motor (Serial interface/general-purpose pulse output)

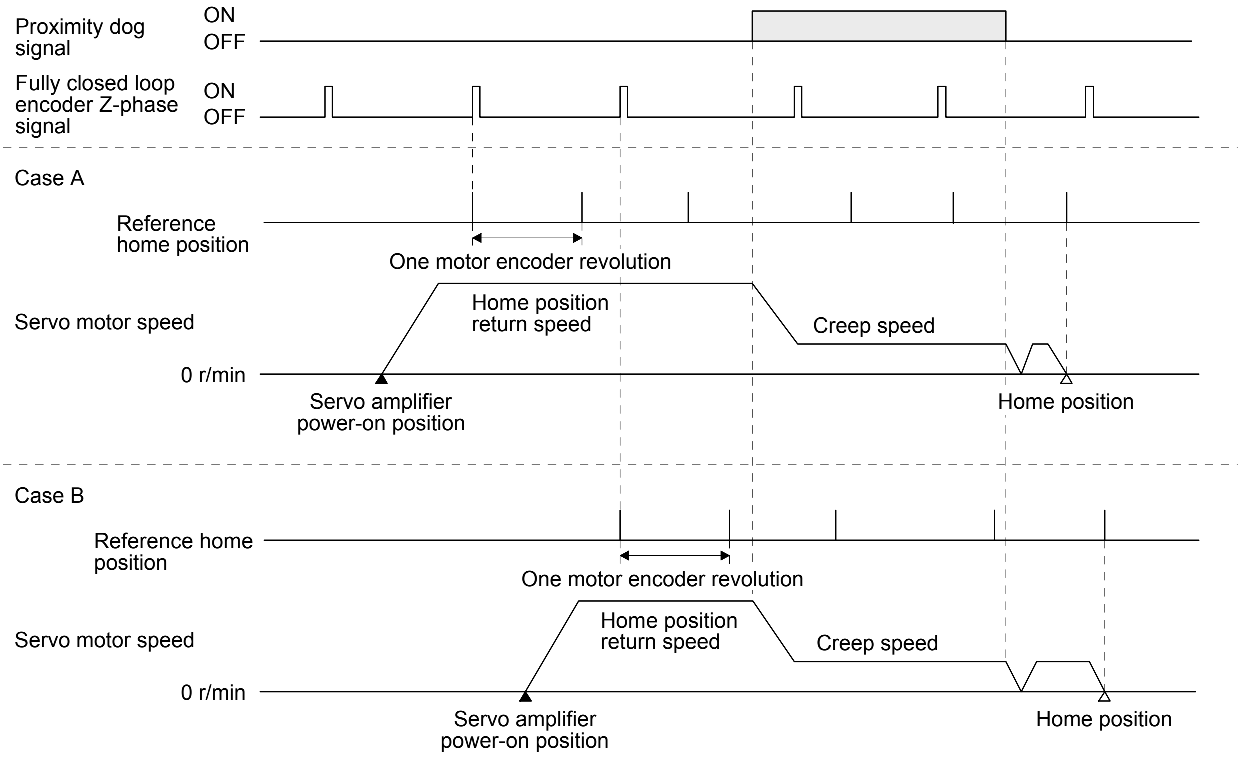
1) The home position for when using the rotary encoder of a serial communication servo motor for the load-side encoder is at the load-side Z-phase position.



2) Precautions for passage of Z-phase

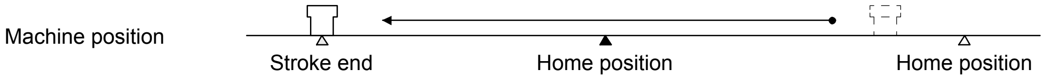
The home position standard position is set relative to the Z-phase position of the load-side encoder that is passed through first after power-on of the servo amplifier.

In Case A and Case B where the power-on position differs as shown below, the power-on position must be noted since the axis cannot stop at the same home position return position.



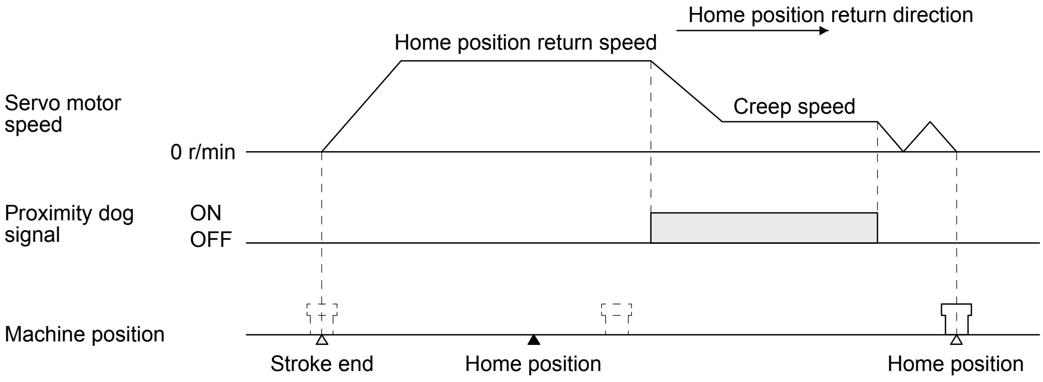
3) Method for always making home position return to the same position

a) Move it to the position where the stroke end signal on the side opposite to the home position return direction turns on.



b) Perform the power-on reset of the servo amplifier or reset the controller.

c) After servo-on, make a home position return.



(b) About data setting type/count type 2 (Common to all load-side encoders)
In the data setting type/count type 2 (QD75M) home position return method, a home position return can be normally made if the home position has been passed through (in either direction) before start of a home position return, since a linear encoder home position (reference mark) or the Z-phase signal of a rotary encoder is not required.
In the data setting type home position return method, pass through a home position (reference mark) and the Z-phase signal of the rotary encoder, and then make a home position return.
When a linear encoder does not have a linear encoder home position (reference mark), or the machine has no distance of one servo motor encoder revolution until the Z-phase of the rotary encoder is passed through, a home position return can be made by changing "Home position setting condition selection" in [Pr. 33] if the home position is not yet passed through.

15.3.3 Operation from controller

The fully closed loop control compatible servo amplifier can be used with any of the following controllers.

Category	Model	Remark
Motion controller	A17_SHCPU/A173UHCPU/ A273UHCPU(-S3)/Q17_CPU	Speed control (II) instructions (VVF and VVR) cannot be used.
Positioning module	QD75M_	AD (A1SD) 75M cannot be used. Home position return must be made with care. (Refer to POINT in section 15.3.2 (2).)
Position board	MR-MC10 (PCI bus-compatible)	
	MR-MC30 (ISA bus-compatible)	
	MR-MC01 (VME bus-compatible)	Home position return must be made with care. (Refer to section 15.3.2 (2) (b) 3).)

An absolute type linear encoder is necessary to configure an absolute position detection system under fully closed loop control using a linear encoder. In this case, the encoder battery need not be installed to the servo amplifier. When a rotary encoder is used, an absolute position detection system can be configured by installing the encoder battery to the servo amplifier. In this case, the battery life will be shorter because the power consumption is increased as the power is supplied to the two encoders of motor side and load side.

(1) Operation from controller
Positioning operation from the controller is basically performed like the semi closed loop control.

(2) Servo system controller setting
When using fully closed loop system, make the following setting.
After values of [Pr. 23], [Pr. 33], [Pr. 62], [Pr. 65], [Pr. 66], and [Pr. 68] are written to the servo amplifier, cycling the servo amplifier power supply enables the settings. For motion controller, resetting enables the servo amplifier setting.

Setting item		Setting	
		Motion controller A17_SH/A173UH/ A273UHQ17_	Positioning module QD75M
Command resolution		Servo motor encoder resolution unit	
Servo parameter	Servo amplifier setting	MR-J2S-_B	
	Motor setting	Automatic setting	
	Serial encoder cable selection ([Pr. 23])	Setting is necessary only when a four-wire type linear encoder is used.	Set with the sequence program.
	Home position setting condition selection ([Pr. 33])	Set the items as required.	
	Fully closed loop selection ([Pr. 62])	Set with MR Configurator (MRZJW3-SETUP161E).	
	Fully closed loop selection 2 ([Pr. 68])		
	Fully closed loop control error detection 1 ([Pr. 63])		
	Fully closed loop control error detection 2 ([Pr. 64])		
	Fully closed loop electronic gear numerator ([Pr. 65])		
	Fully closed loop electronic gear denominator ([Pr. 66])		
	Dual feedback filter ([Pr. 67])		
Positioning control parameter	Unit setting	mm/inch/degree/pulse	
	Travel distance per pulse (AP, AL, AM) Number of pulses per revolution (AP) Travel distance per revolution (AL) Unit multiplying factor (AM)	Set AP, AL and AM as usual with servo motor encoder resolution.	

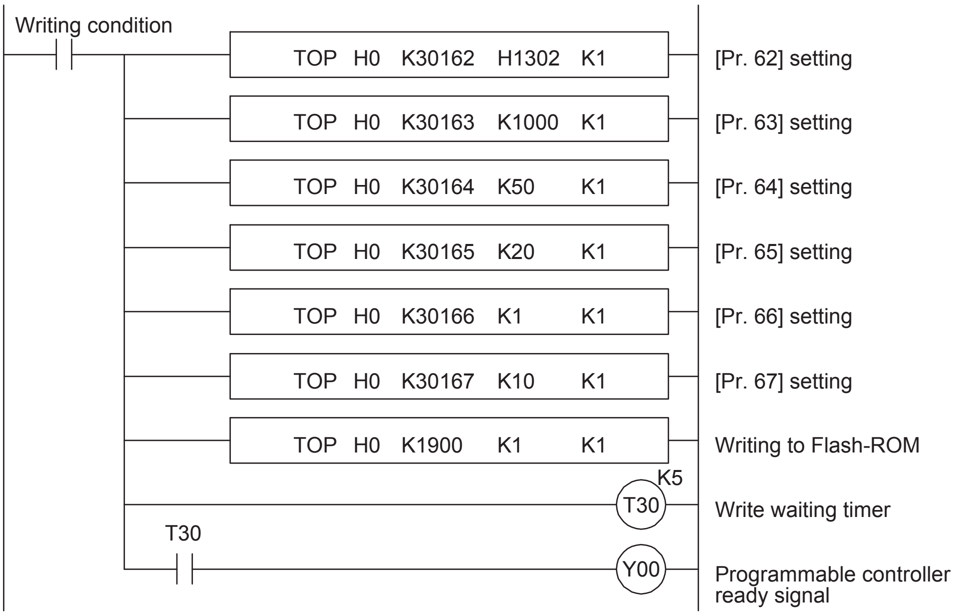
(3) Additional instructions

The positioning module (QD75M) controls the servo parameters [Pr. 0] to [Pr. 75]. Therefore, when setting any of the servo parameters up to [Pr. 75], change the buffer memory setting of the positioning module in a sequence program.

If the settings of the parameters [Pr. 0] to [Pr. 75] are changed using MR Configurator, they are not reflected on the positioning module.

Reference sequence program

Example of writing the servo parameters ([Pr. 62] to [Pr. 67]) of Axis No. 1 to a buffer memory



The number of write times to a Flash-ROM is limited. Therefore, when setting data using a sequence program every time, for example, do not write data to the Flash-ROM.

When controlling multiple axes, write the parameters to all axes.

(4) Position board setting

Setting item		Setting	
		Position board	
		MR-MC01	MR-MC10/MR-MC30
Command resolution		Servo motor encoder resolution unit	
Servo parameter	Motor type ([Pr. 3])	0080h (131072) (Add = 0603h)	0080h (Automatic setting) (Add = 0414h)
	Serial encoder cable selection ([Pr. 23])	Setting is necessary only when a four-wire type linear encoder is used.	
	Home position setting condition selection ([Pr. 33])	Set the items as required.	
	Fully closed loop selection ([Pr. 62])	Set with MR Configurator (MRZJW3-SETUP161E).	
	Fully closed loop control error detection 1 ([Pr. 63])		
	Fully closed loop control error detection 2 ([Pr. 64])		
	Fully closed loop electronic gear numerator ([Pr. 65])		
	Fully closed loop electronic gear denominator ([Pr. 66])		
	Dual feedback filter ([Pr. 67])		
	Fully closed loop selection 2 ([Pr. 68])		
Control parameter	Home position return option (OPZ1)	No setting	1_ _ _ h
	Electronic gear setting (CMX, CDV)	Set as usual with motor encoder resolution.	

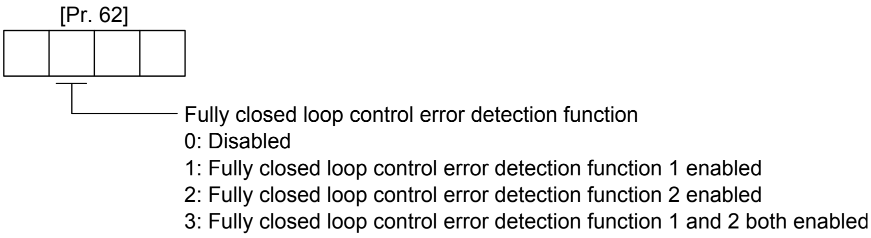
15.3.4 Fully closed loop control error detection functions

POINT

- ●The speed deviation error detection and position deviation error detection are both enabled for the initial setting.
- ●The detection level setting can be changed using [Pr. 63] and [Pr. 64]. To change these setting values, set "000F" in [Pr. 40 Parameter writing inhibit]. [Pr. 62] setting will be enabled after the power is cycled

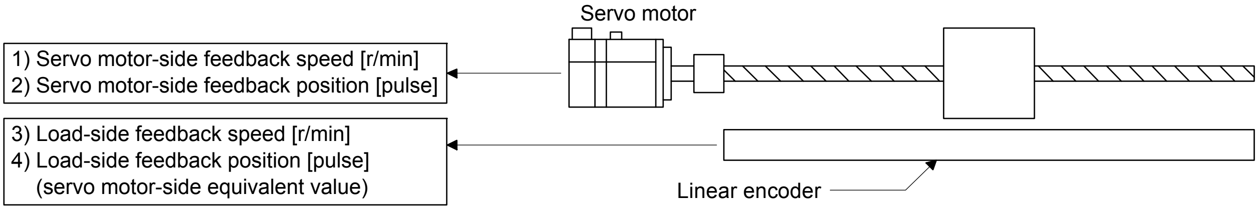
If fully closed loop control becomes unstable for some reason, the speed at servo motor side may increase abnormally. The fully closed loop control error detection function is a protective function designed to pre-detect it and stop operation.
The fully closed loop control error detection function has two different detection methods, speed deviation and position deviation, and errors are detected only when the corresponding functions are enabled by setting "Fully closed loop control error detection function" (_ x _ _) in [Pr. 62 Fully closed loop selection].

(1) Parameter
Select the fully closed loop control error detection function.

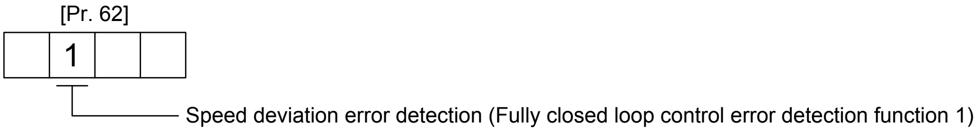


Fully closed loop control error detection function
0: Disabled
1: Fully closed loop control error detection function 1 enabled
2: Fully closed loop control error detection function 2 enabled
3: Fully closed loop control error detection function 1 and 2 both enabled

(2) Fully closed loop control error detection functions

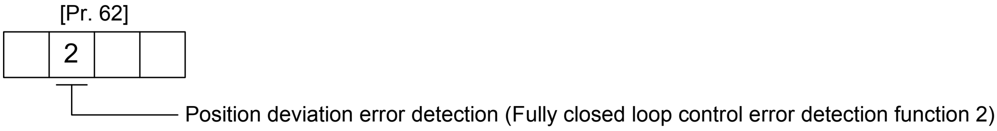


(a) Speed deviation error detection (Fully closed loop control error detection function 1)
Set [Pr. 62] to "_ 1 _ _" to enable the speed deviation error detection.



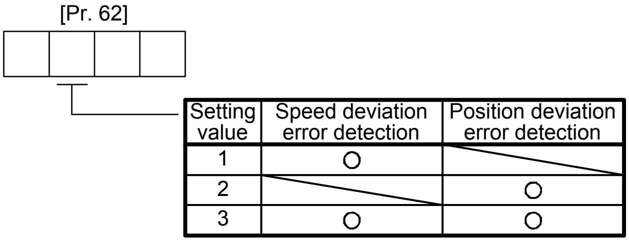
The function compares the servo motor-side feedback speed (1)) and load-side feedback speed (3)). If the deviation is not less than the set value (1 r/min to the permissible speed) of [Pr. 63 Fully closed loop control error detection 1], the function generates [AL. 42 Fully closed loop control error detection] and stops the motor. The initial value of [Pr. 63] is 400 r/min. Change the setting value as necessary.

(b) Position deviation error detection
Set [Pr. 62] to "_ 2 _ _" to enable the position deviation error detection.



The function compares the servo motor-side feedback position (2)) and load-side feedback position (4)). If the deviation is not less than the set value (0.1 rev to 200.0 rev) of [Pr. 64 Fully closed loop control error detection 2], the function generates [AL. 42 Fully closed loop control error detection] and stops the motor. The initial value of [Pr. 64] is 100 kpulses. Change the setting value as necessary.

(c) Detecting multiple deviation errors
When setting [Pr. PE03] as shown below, multiple deviation errors can be detected. For the error detection method, refer to (2) (a), (b) in this section.



Setting value	Speed deviation error detection	Position deviation error detection
1	○	
2		○
3	○	○

15.3.5 Auto tuning function

Refer to section 6.2 for the auto tuning function.

15.3.6 Machine analyzer function

The machine analyzer function of MR Configurator (MRZJW3-SETUP161E) is the same function as when the operation mode is in "standard control mode". It is performed by the feedback of the motor encoder. It is irrelevant to the load-side encoder.
Refer to section 6.1.2 for details.

15.3.7 Test operation mode

Test operation mode is enabled by MR Configurator (MRZJW3-SETUP161E).
Refer to section 4.5 for details.

Function	Item	Usability	Remark
Test operation mode	JOG operation	○	Performed by the feedback of the motor encoder. It is irrelevant to the load-side encoder.
	Positioning operation	○	In a semi closed loop control/fully closed loop control state, operation is performed in the control mode states as set in [Pr. 62], [Pr. 67]. When fully closed loop function switching is enabled (switching semi./full. using the servo system controller), semi closed loop control is always enabled.
	Program operation	○	
	Output signal (DO) forced output	○	The same function as when the operation mode is in "standard control mode".
	Motor-less operation		

15.3.8 Absolute position detection system under fully closed loop system

POINT

- ●When configuring an absolute position detection system in the semi closed loop control, the encoder battery must be installed to the servo amplifier as in the case that the operation mode is in "standard control mode".
  Connect the encoder cable of the servo motor-side encoder directly to the servo amplifier.

An absolute type linear encoder is necessary to configure an absolute position detection system under fully closed loop control using a linear encoder. In this case, the encoder battery need not be installed to the servo amplifier. When a rotary encoder is used, an absolute position detection system can be configured by installing the encoder battery to the servo amplifier. In this case, the battery life will be shorter because the power consumption is increased as the power is supplied to the two encoders of motor side and load side. For the absolute position detection system with linear encoder, the restrictions mentioned in this section apply. Enable the absolute position detection system with "Absolute position detection system selection" (_ _ _ x) in [Pr. 1] and use this servo within the following restrictions.

(1) Using conditions

(a) Use an absolute type linear encoder with the load-side encoder.

(b) Select Always fully closed loop selection ([Pr. 62] = "_ _ _ 1").

(2) Absolute position detection range using encoder

Encoder type	Absolute position detection enabled range
Linear encoder (serial interface)	Movable distance range of linear encoder (within 32-bit absolute position data)

(3) Alarm detection

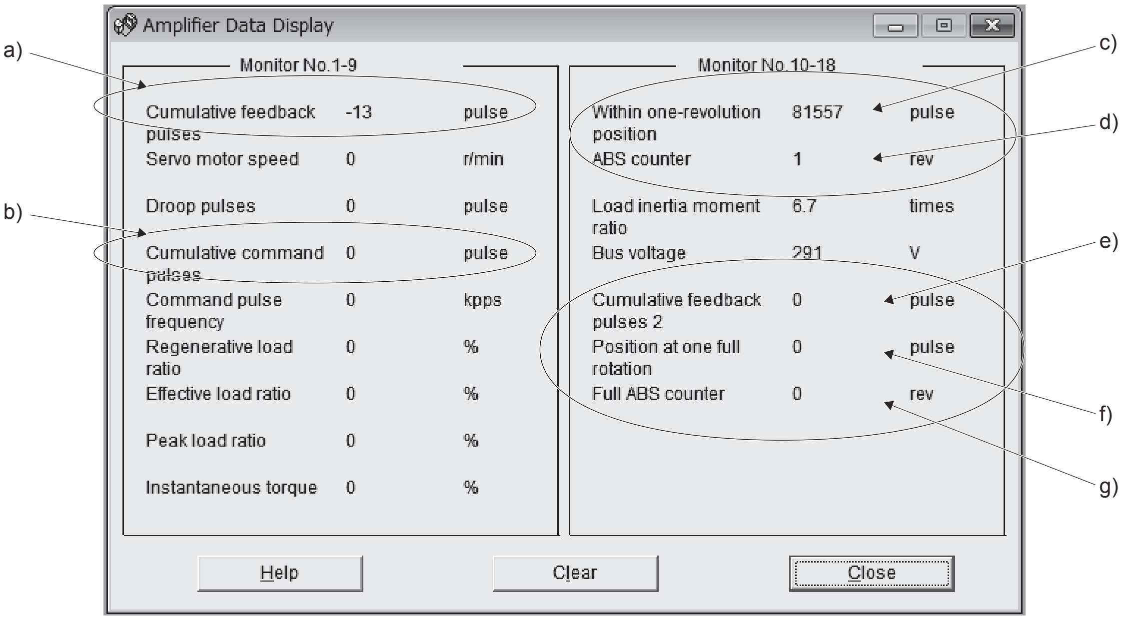
The absolute position-related alarm ([AL. 25]) and warnings ([AL. 92]/[AL. 9F]/[AL. E3]) are not detected.

15.3.9 About MR Configurator

This section explains MR Configurator (MRZJW3-SETUP161E) during use of the fully closed loop system. Items not listed in this section are the same as those for when the operation mode is in "standard control mode".

(1) MR Configurator (MRZJW3-SETUP161E)
Select "MR-J2S-B fully closed loop" in the system setting of MR Configurator.

(a) Batch monitor screen



Monitor No.1-9

Cumulative feedback pulses -13 pulse
Servo motor speed 0 r/min
Droop pulses 0 pulse
Cumulative command pulses 0 pulse
Command pulse frequency 0 kpps
Regenerative load ratio 0 %
Effective load ratio 0 %
Peak load ratio 0 %
Instantaneous torque 0 %

Monitor No.10-18

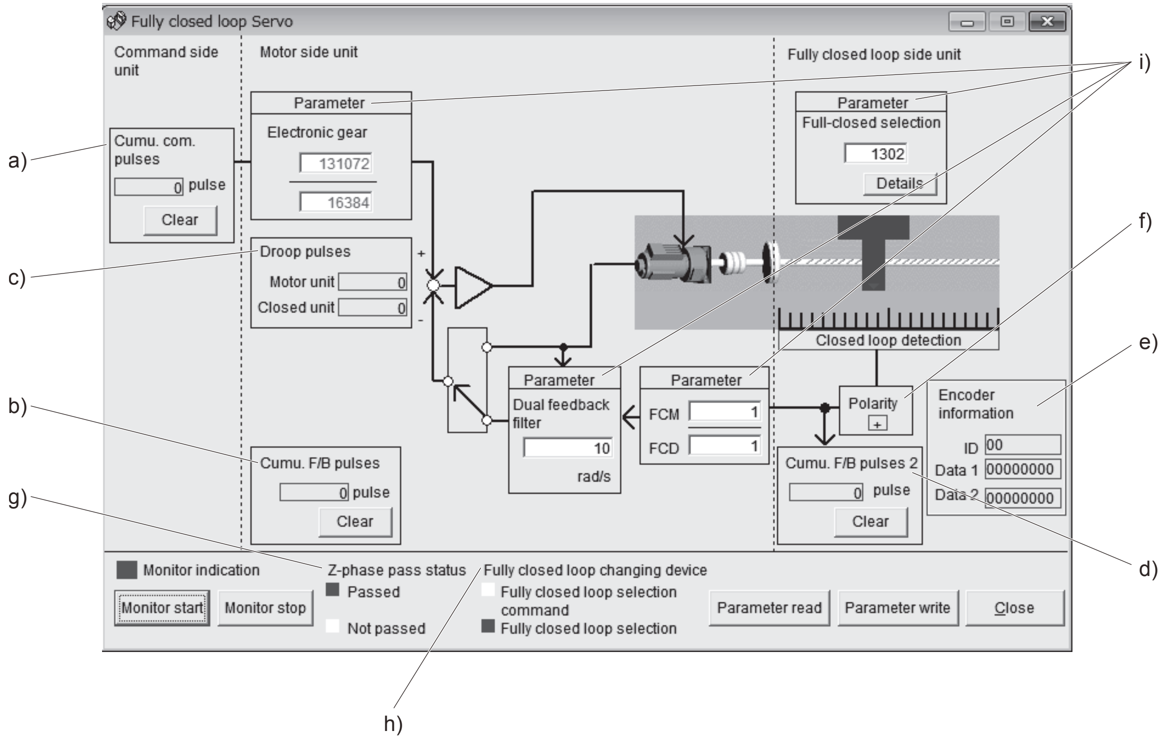
Within one-revolution position 81557 pulse
ABS counter 1 rev
Load inertia moment ratio 6.7 times
Bus voltage 291 V
Cumulative feedback pulses 2 0 pulse
Position at one full rotation 0 pulse
Full ABS counter 0 rev

The following table indicates the display items that are related to the servo motor and load-side encoder.

Symbol	Name	Explanation
a)	Cumulative feedback pulses	Feedback pulses from the motor-side encoder are counted and displayed. Click "Clear" to reset the value to 0.
b)	Cumulative command pulses	Position command inputs from the command controller are counted and displayed. Click "Clear" to reset the value to 0.
c)	Within one-revolution position	The position in motor-side encoder 1-revolution is displayed.
d)	ABS counter	Multi-revolution counter (rotation amount from home position) of the motor-side encoder is displayed. The value is incremented or decremented by 1 per servo motor revolution.
e)	Cumulative feedback pulses 2	Feedback pulses from the load-side encoder are counted and displayed. It is displayed in closed loop encoder pulse unit. Click "Clear" to reset the value to 0.
f)	Position at one full rotation	The position in load-side encoder 1-revolution is displayed. This indicates a Z-phase counter for the INC linear encoder. The value is counted up from 0 based on the home position (reference mark). It is displayed in load-side encoder pulse unit. In the case of an ABS linear encoder, the virtual within-one-revolution position (equivalent to lower 17 bits of the conversion result of 32-bit absolute position data into the motor-side unit, 0 to 131071) is displayed.
g)	Full ABS counter	Multi-revolution counter (rotation amount from home position) of the load-side encoder is displayed. In the case of an ABS linear encoder, the virtual multi-revolution counter (equivalent to upper 15 bits of the conversion result of 32-bit absolute position data into the motor-side unit, 0 to 32767) is displayed.

(b) Diagnosis - Fully closed loop diagnostic screen

The position-related monitor indications and parameters on the fully closed loop function are all displayed on a single screen. For the monitor display item, click "Monitor start" to read it continuously from the servo amplifier. Click "Monitor stop" to stop reading. For the parameter item, click "Parameter read" to read it from the servo amplifier, and click "Parameter write" to write.



Symbol	Name	Explanation	Unit
a)	Cumu. com. pulses	Commands from the servo system controller are counted and displayed. Click "Clear" to reset the value to 0.	pulse
b)	Cumu. F/B pulses	Feedback pulses from the motor-side encoder are counted and displayed. Click "Clear" to reset the value to 0.	pulse
c)	Droop pulses	When "0" (Disabled) is selected in "Fully closed loop function" (_ _ _ x) in [Pr. 62], a deviation from the command that uses the servo motor-side encoder as feedback is displayed. When "1" (Always enabled) or "2" (Switching enabled (switching semi./full. using the host controller)) is selected in "Fully closed loop function" (_ _ _ x), a deviation from the command that uses the load-side encoder as feedback is displayed.	pulse
d)	Cumu. F/B pulses 2	Feedback pulses from the load-side encoder are counted and displayed. It is displayed in load-side encoder pulse unit. Click "Clear" to reset the value to 0.	pulse
e)	Encoder information	The load-side encoder information is displayed. The display contents differ depending on the load-side encoder type. ・ID: The ID No. of the encoder is displayed. ・Data 1: For the incremental type, the counter from powering on is displayed. For the absolute position type linear encoder, the absolute position data is displayed. For the absolute position type rotary encoder, the multi-revolution counter is displayed. ・Data 2: For the incremental type, the distance (number of pulses) from the reference mark (Z-phase) is displayed. For the absolute position type linear encoder, "00000000" is displayed. For the absolute position type rotary encoder, a cycle counter is displayed.	

Symbol	Name	Explanation	Unit
f)	Polarity	A + or - sign is displayed according to the load-side encoder polarity specified in "Load-side encoder polarity" (_ _ x _) in [Pr. 62]. "+" is displayed when the setting is "0" (Address increasing direction in the motor CCW).	
g)	Z-phase pass status	When "0" (Disabled) is selected in "Fully closed loop function" (_ _ _ x) in [Pr. 62], the Z-phase pass state of the servo motor encoder is displayed, and "1" (Always enabled) or "2" (Switching enabled (switching semi./full. using the host controller)) is selected, the Z-phase pass state of the load-side encoder is displayed.	
h)	Fully closed loop changing device	Displayed only when "2" (Switching enabled (switching semi./full. using the controller)) is selected in "Fully closed loop function" (_ _ _ x). The state of the switching device selection command and the internal state during selection are displayed.	
i)	Parameter	The parameter related to the fully closed loop control is displayed. Its setting can be changed and the new value can be written to the servo amplifier. The related parameters are as follows. ・Electronic gear: [Pr. 6 Number of feedback pulses] ・Dual feedback filter: [Pr. 67 Dual feedback filter] ・FCM: [Pr. 65 Fully closed loop electronic gear numerator] ・FCD: [Pr. 66 Fully closed loop electronic gear denominator] ・Fully closed loop selection: [Pr. 62 Fully closed loop selection], [Pr. 63 Fully closed loop control error detection 1], and [Pr. 64 Fully closed loop control error detection 2]	

15.4 Detailed list of parameters

This section explains parameters to be added or modified when the MR-J4-_B_-RJ020 operation mode is changed to "standard control mode". For other parameters, refer to chapter 5 as they are the same as those of "standard control mode".

> POINT
>
> ●Set a value to each "x" in the "Setting digit" columns.

15.4.1 Basic setting parameters

No.	Symbol	Name and function	Initial value [unit]	Setting range
1	*AMS	Amplifier setting Set this parameter when using the absolute position detection system. Setting digit: _ _ _ x — Explanation: Absolute position detection system selection 0: Disabled (used in incremental system) 1: Enabled (used in absolute position detection system) The incremental type linear encoder is compatible with the incremental system only. It is also compatible with the incremental system only when "2: Switching enabled" is selected for the fully closed loop function. When absolute position detection enabled is selected in such cases, [AL. 37] occurs. — Initial value: 0h Setting digit: _ _ x _ — Explanation: For manufacturer setting — Initial value: 0h Setting digit: _ x _ _ — Initial value: 0h Setting digit: x _ _ _ — Initial value: 0h	Refer to the Name and function column.	
6	*FBP	Feedback pulse number Set the number of pulses per revolution of the servo motor in the controller side command unit. Information on the servo motor such as the cumulative feedback pulses, current position, droop pulses and within-one-revolution position are derived from the values converted into the number of pulses set here. If the number of pulses set exceeds the actual servo motor encoder resolution, the servo motor encoder resolution is automatically set.	7 kW or less: 0 11 or more: 255	Refer to Name and function column.

Parameter No. 1 (*AMS) setting digits:

Setting digit	Explanation	Initial value
_ _ _ x	Absolute position detection system selection 0: Disabled (used in incremental system) 1: Enabled (used in absolute position detection system) The incremental type linear encoder is compatible with the incremental system only. It is also compatible with the incremental system only when "2: Switching enabled" is selected for the fully closed loop function. When absolute position detection enabled is selected in such cases, [AL. 37] occurs.	0h
_ _ x _	For manufacturer setting	0h
_ x _ _		0h
x _ _ _		0h

Parameter No. 6 (*FBP):

Setting value	Feedback pulse number
0	16384
1	8192
6	32768
7	131072
255	Depending on the number of servo motor encoder resolution pulses

15.4.2 Adjustment parameters

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>22</td><td>MOD</td><td>Analog monitor output
Select the signals for outputting to MO1 (analog monitor 1) and MO2 (analog monitor 2). Refer to app. 9 (3) for detection point of output selection.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Analog monitor ch2 output selection
Refer to table 15.1 for settings.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Analog monitor ch1 output selection
Refer to table 15.1 for settings.</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
Table 15.1 Analog monitor setting value
<table>
<tr><th>Setting value</th><th>Item</th></tr>
<tr><td>0</td><td>Servo motor speed (±8 V/max. speed)</td></tr>
<tr><td>1</td><td>Torque (±8 V/max. torque) (Note 1)</td></tr>
<tr><td>2</td><td>Servo motor speed (+8 V/max. speed)</td></tr>
<tr><td>3</td><td>Torque (+8 V/max. torque) (Note 1)</td></tr>
<tr><td>4</td><td>Current command (±8 V/max. current command)</td></tr>
<tr><td>5</td><td>Speed command (±8 V/max. speed)</td></tr>
<tr><td>6</td><td>Droop pulses (±10 V/128 pulses) (Note 2)</td></tr>
<tr><td>7</td><td>Droop pulses (±10 V/2048 pulses) (Note 2)</td></tr>
<tr><td>8</td><td>Droop pulses (±10 V/8192 pulses) (Note 2)</td></tr>
<tr><td>9</td><td>Droop pulses (±10 V/32768 pulses) (Note 2)</td></tr>
<tr><td>A</td><td>Droop pulses (±10 V/131072 pulses) (Note 2)</td></tr>
<tr><td>B</td><td>Bus voltage (+8 V/400 V)</td></tr>
<tr><td>C</td><td>Motor-side fully closed loop-side position deviation (±10 V/131072 pulses)</td></tr>
</table>
Note 1. 8 V is outputted at the maximum torque.
2. Encoder pulse unit Droop pulses are in the pulse unit of the motor-side. The difference between the position command and linear encoder is outputted. By setting "Droop pulse unit selection" (_ _ x _) in [Pr. 68], droop pulses can be outputted in the load-side pulse unit.</td><td colspan="2">Refer to the Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>23</td><td>*OP1</td><td>Option function 1
Select the servo forced stop and encoder cable communication method.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Servo forced stop selection
0: Enabled (EM1 (forced stop) is used.)
1: Disabled (EM1 (forced stop) is not used.)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder cable communication method selection
Incorrect setting will result in [AL. 16 Encoder error 1].
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">When the fully closed loop function is disabled ([Pr. 62]: _ _ _ 0)</th><th colspan="2">When the fully closed loop function is enabled ([Pr. 62]: _ _ _ 1 or _ _ _ 2)</th></tr>
<tr><th>CN2 side</th><th>CN2L side</th><th>CN2 side</th><th>CN2L side</th></tr>
<tr><td>0</td><td>Two-wire type</td><td>Unavailable</td><td>Two-wire type</td><td>Two-wire type/A/B/Z-phase differential output method</td></tr>
<tr><td>1</td><td>Four-wire type</td><td>Unavailable</td><td>Four-wire type</td><td>Unavailable (Note)</td></tr>
<tr><td>2</td><td>Two-wire type</td><td>Unavailable</td><td>Two-wire type</td><td>Four-wire type</td></tr>
<tr><td>3</td><td>Unavailable</td><td>Unavailable</td><td>Four-wire type</td><td>Two-wire type/A/B/Z-phase differential output method</td></tr>
<tr><td>4</td><td>Unavailable</td><td>Unavailable</td><td>Four-wire type</td><td>Four-wire type</td></tr>
</table>
When this is set, [AL. 37 Parameter error] occurs.</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to the Name and function column.</td></tr>
</table>

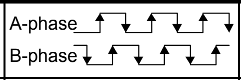
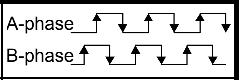
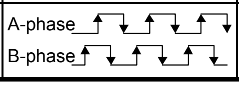
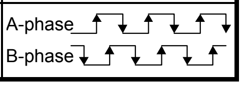
15.4.3 Extension parameters

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>33</td><td>*OP6</td><td>Option function 6
This parameter is for serial communication, encoder output pulse, and home position setting.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Serial communication baud rate selection
0: 9600 [bps]
1: 19200 [bps]
2: 38400 [bps]</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Serial communication response delay time
0: Disabled
1: Enabled (responding after 800 μs or longer delay time)</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder output pulse setting selection (Refer to [Pr. 38].)
0: Output pulse specification
1: Dividing ratio setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Selection of home position setting condition
Select the condition under which a home position setting is from the servo system controller.
0: Need to pass motor Z-phase after power on
1: Not need to pass motor Z-phase after power on
(Used in a data setting type home position return where the Z phase is not passed through.)</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to the Name and function column.</td></tr>
<tr><td>38</td><td>*ENR</td><td>Encoder output pulses
Used to set the encoder pulses (A-phase and B-phase) output by the servo amplifier. Set the value 4 times greater than the A-phase and B-phase pulses.
You can use [Pr. 33] to choose the output pulse setting or output division ratio setting.
The number of A-phase and B-phase pulses actually output is 1/4 times greater than the preset number of pulses.
The maximum output frequency is 1.3 Mpulses/s (after multiplication by 4). Use this parameter within this range.
When the fully closed loop function is enabled in [Pr. 62] (FCT), and the A/B/Z-phase pulse output of the load-side encoder is selected in [Pr. 68] (FC2), consider it as "equivalent to one motor revolution" = "travel distance of the load-side encoder equivalent to one revolution of the semi closed-side motor".
For example, when the linear encoder of 0.1 μm resolution is installed as the load-side encoder to move 10 mm per servo motor revolution,
1. On the assumption that the parameter setting value is "20" for dividing ratio setting

Number of output pulses for 10 mm movement = $\frac{100000 \text{ (Equivalent to one motor revolution)}}{20}$
= 5000

2. On the assumption that the parameter setting value is "20" for output pulse setting

Number of output pulses for 10 mm movement = 20</td><td>4000
[pulse/rev]</td><td>0
to
65535</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>60</td><td>*OPC</td><td>Option function C
Select the encoder output pulse setting.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder output pulse phase selection
0: Increasing A-phase 90° in CCW
1: Increasing A-phase 90° in CW
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>CCW</th><th>CW</th></tr>
<tr><td>0</td><td> </td><td> </td></tr>
<tr><td>1</td><td> </td><td> </td></tr>
</table></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to the Name and function column.</td></tr>
<tr><td>62</td><td>*FCT</td><td>Fully closed loop selection
Select load-side encoder rotation direction, fully closed loop control error detection function 1, and fully closed loop control error detection function 2.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Fully closed loop function
0: Disabled
1: Always enabled
2: Switching enabled (switching semi./full. using the controller)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Load-side encoder polarity
0: Address increasing direction in the motor CCW
1: Address increasing direction in the motor CW</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Fully closed loop control error detection function
0: Disabled
1: Fully closed loop control error detection function 1 enabled
2: Fully closed loop control error detection function 2 enabled
3: Fully closed loop control error detection function 1 and 2 both enabled</td><td>3h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>1h</td></tr>
</table></td><td colspan="2">Refer to the Name and function column.</td></tr>
<tr><td>63</td><td>BC1</td><td>Fully closed loop control error detection 1
Set the speed deviation error detection level of the fully closed loop control error detection function 1. (Set in terms of the servo motor-side speed.)
Enabled/disabled of this function can be selected in [Pr. 62] (_ x _ _).</td><td>400
[r/min]</td><td>1
to
Permis-sible speed</td></tr>
<tr><td>64</td><td>BC2</td><td>Fully closed loop control error detection 2
Set the position deviation error detection level of the fully closed loop control error detection function 2. (Set in terms of the servo motor-side rotation amount.)
Enabled/disabled of this function can be selected in [Pr. 62] (_ x _ _)</td><td>10
[0.1 rev]</td><td>1
to
2000</td></tr>
<tr><td>65</td><td>*FCM</td><td>Fully closed loop electronic gear numerator
Set the numerator of the electronic gear to the load-side encoder pulse.</td><td>1</td><td>1
to
65535</td></tr>
<tr><td>66</td><td>*FCD</td><td>Fully closed loop electronic gear denominator
Set the denominator of the electronic gear to the load-side encoder pulse.</td><td>1</td><td>1
to
65535</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>67</td><td>DUF</td><td>Dual feedback filter
Set a dual feedback filter band.
At 1000 rad/s setting, the fully closed loop control will always be enabled. At 0 rad/s setting, the fully closed loop control will be disabled. About half of [Pr. 15 Position loop gain 2] is the guideline of the upper setting limit.</td><td>10
[rad/s]</td><td>0
to
1000</td></tr>
<tr><td>68</td><td>*FC2</td><td>Fully closed loop selection 2
Select the functions related to fully closed loop control.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Pulse output setting
0: A/B/Z-phase pulse output of the load-side encoder
1: A/B/Z-phase pulse output of the motor-side encoder
When the fully closed loop function is disabled (including when the semi closed loop control is selected at the time of the switching valid setting), A/B/Z-phase pulse output of the motor-side encoder is forcibly set.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Droop pulse unit selection
0: Motor-side encoder pulse unit
1: Load-side encoder pulse unit
With this setting, the droop pulse unit of the MR Configurator batch monitor display, monitor graph data and analog monitor output can be selected.
When the fully closed loop function is disabled (including when the semi closed loop control is selected at the time of the switching valid setting), the motor-side pulse unit is forcibly set.</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
</td><td colspan="2">Refer to the Name and function column.</td></tr>
</table>

15.5 Troubleshooting

POINT

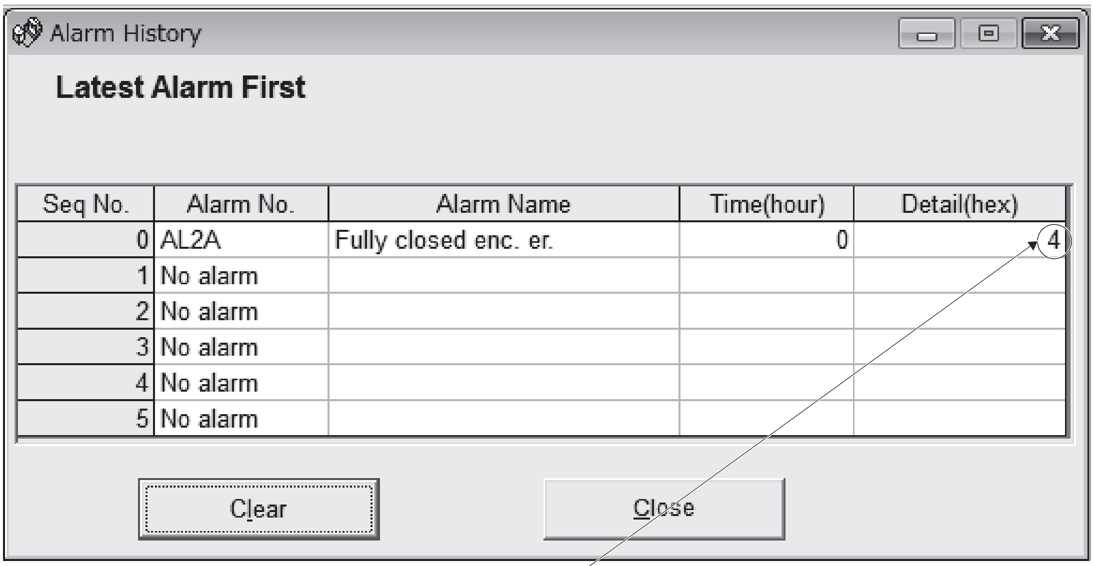
- For lists and remedies for alarms/warnings of the fully closed loop system, refer to chapter 8.

15.6 Details on linear encoder errors ([AL. 2A]) for respective manufacturers

When the occurrence cause of [AL. 2A Fully closed loop encoder error 1] is unknown, check the detail information in the following table based on the alarm detailed information of MR Configurator, and contact the linear encoder manufacturer.

Detail information	[AL. 2A Fully closed loop encoder error 1] details			
	Mitutoyo	Magnescale	Heidenhain	Renishaw
8	Optical overspeed		Overspeed error	
7	ROM/RAM error			Overspeed
6	EEPROM error	Encoder alarm	EEPROM error	
5	CPU error		CPU error	
4	Capacitive error		ABS data error	
3	Photoelectric error		INC data error	
2	Photoelectric/capacitive data mismatch	Encoder warning	Scale level error INC/ABS data mismatch error	Level error
1	Initialization error		Initialization error	

The following shows an example of alarm history display for when [AL. 2A Fully closed loop encoder error 1] occurs in the linear encoder AT343A manufactured by Mitutoyo.



Latest Alarm First

Seq No.	Alarm No.	Alarm Name	Time(hour)	Detail(hex)
0	AL2A	Fully closed enc. er.	0	4
1	No alarm			
2	No alarm			
3	No alarm			
4	No alarm			
5	No alarm			

Alarm detail: 4h

Only the minimum value will be displayed in the alarm detailed information column.
Note the information when contacting the linear encoder manufacturer.
Example: When alarm detailed information "4" and "6" occur simultaneously, only "4" is displayed.

MEMO

APPENDIX

App. 1 Using the HC series/HA series servo motor

POINT

- When using HC series and HA series servo motors, refer to "Instructions and Cautions for Drive of HC/HA Series Servo Motor with MR-J4-(DU)_B_-RJ020" (SH(NA)030127).

When driving HC series and HA series servo motors with the MR-J4-_B_-RJ020 servo amplifier, refer to the following table for the combinations with servo amplifiers.

(1) 200 V class

Servo amplifier	Servo motor						
	HC-KFS	HC-MFS	HC-SFS	HC-RFS	HC-UFS	HA-LFS	HC-LFS
MR-J4-10B-RJ020	053 13	053 13			13		
MR-J4-20B-RJ020	23	23			23		
MR-J4-40B-RJ020	43	43			43		
MR-J4-60B-RJ020			52 53				52
MR-J4-70B-RJ020	46 410 73	73			(Note 2) 72 73		
MR-J4-100B-RJ020			81 102 103				102
MR-J4-200B-RJ020			121 201 152 202 153 203	103 153	(Note 2) 152		152
MR-J4-350B-RJ020			301 352 353	203	(Note 2) 202		202
MR-J4-500B-RJ020			502	(Note 2) 353 503	(Note 2) 352 (Note 2) 502	502	302
MR-J4-700B-RJ020			702			(Note 1) 601 (Note 1) 701M 702	
MR-J4-11KB-RJ020						(Note 1) 801 (Note 1) 11K1M 11K2 (Note 1) 12K1	
MR-J4-15KB-RJ020						(Note 1) 15K1 (Note 1) 15K1M 15K2	
MR-J4-22KB-RJ020						(Note 1) 20K1 (Note 1) 22K1M 22K2 (Note 1) 25K1	
MR-J4-DU30KB-RJ020						(Note 1) 30K1 (Note 1) 30K1M 30K2	
MR-J4-DU37KB-RJ020						(Note 1) 37K1 (Note 1) 37K1M 37K2	

Note 1. When you use this servo motor, please contact your local sales office.
2. Used by servo amplifiers with software version A1 or later.

(2) 400 V class

Servo amplifier	Servo motor	
	HC-SFS	HA-LFS
MR-J4-60B4-RJ020	524	
MR-J4-100B4-RJ020	1024	
MR-J4-200B4-RJ020	1524 2024	
MR-J4-350B4-RJ020	3524	
MR-J4-500B4-RJ020	5024	
MR-J4-700B4-RJ020	7024	(Note) 6014 (Note) 701M4
MR-J4-11KB4-RJ020		(Note) 8014 (Note) 11K1M4 (Note) 11K24 (Note) 12K14
MR-J4-15KB4-RJ020		(Note) 15K14 (Note) 15K1M4 (Note) 15K24
MR-J4-22KB4-RJ020		(Note) 20K14 (Note) 22K1M4 (Note) 22K24
MR-J4-DU30KB4-RJ020		(Note) 25K14 (Note) 30K14 (Note) 30K1M4 30K24
MR-J4-DU37KB4-RJ020		(Note) 37K14 (Note) 37K1M4 37K24
MR-J4-DU45KB4-RJ020		(Note) 45K1M4 45K24
MR-J4-DU55KB4-RJ020		(Note) 50K1M4 55K24

Note. When you use this servo motor, please contact your local sales office.

(3) 100 V class

Servo amplifier	Servo motor	
	HC-KFS	HC-MFS
MR-J4-10B1-RJ020	053 13	053 13
MR-J4-20B1-RJ020	23	23
MR-J4-40B1-RJ020	43	43

App. 2 Linear encoders compatible with MR-J2S

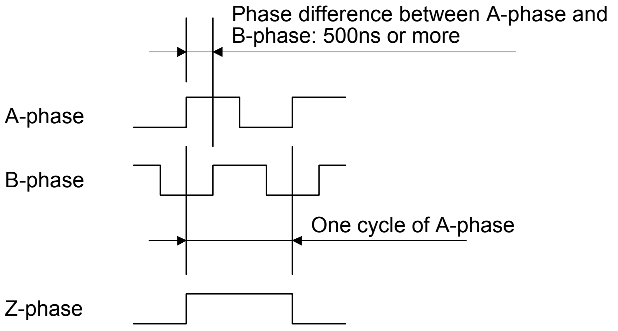
The following table shows compatible linear encoders.
For details of each linear encoder, refer to chapter 2 of "MR-J2S-_BPY096 MR-J2S-_B-S096 (5.7 kW) Instruction Manual" (SH(NA)030035).

Linear encoder type		Manufacturer	Model	Resolution	Rated speed (Note 1)	Effective measurement length (maximum)	Communication method	Absolute position system
Mitsubishi serial interface compatible	Absolute position type	Mitutoyo	AT343A	0.05 μm	2.0 m/s	3,000 mm	Two-wire type	○
			AT543A			1,500 mm		
		Heidenhain	LC491M	0.05 μm	2.0 m/s	2,040 mm	Four-wire type	○
	Incremental type	Magnescale	SL710 + PL101R + MJ830	0.2 μm (Note 2)	6.4 m/s	3,000 mm	Two-wire type	×
			SH13 + MJ830	0.005 μm (Note 2)	1.4 m/s	1,240 mm		×
		Renishaw	RGH26P	5.0 μm	4.0 m/s	70,000 mm	Two-wire type	×
			RGH26Q	1.0 μm	3.2 m/s			×
			RGH26R	0.5 μm	1.6 m/s			×
A/B/Z-phase differential output type A/B/Z signal required (Note 3)	Incremental type	Not specified (Note 3)		Depends on the linear encoder (Note 4)	Depends on the linear encoder	Depends on the linear encoder	A/B/Z-phase differential output method	×

Note 1. The upper limit value of the linear servo motor speed is a lower one of the maximum speed of the linear servo motor and the rated speed of the linear encoder.

2. Changes depending on the setting of the interpolator.
Set the resolution within a range of the minimum resolution to 5 μm.

3. The phase difference between the A-phase pulse and B-phase pulse must be 500 ns or more, and the Z-phase pulse width must be equivalent to one cycle of the A-phase pulse.
Also, the Z-phase must be synchronized with the A-phase/B-phase.



4. The tolerable resolution range is between 0.005 μm and 5 μm. Select a linear encoder within the range.

App. 3 Peripheral equipment manufacturer (for reference)

Names given in the table are as of May 2016.

Manufacturer	Contact information
NEC TOKIN	NEC TOKIN Corporation
Kitagawa Industries	Kitagawa Industries Co., Ltd.
JST	J.S.T. Mfg. Co., Ltd.
Junkosha	Purchase from Toa Electric Industrial Co. Ltd., Nagoya Branch
3M	3M
SEIWA ELECTRIC	Seiwa Electric Mfg. Co. Ltd.
Soshin Electric	Soshin Electric Co., Ltd.
TE Connectivity	TE Connectivity Ltd. Company
TDK	TDK Corporation
Molex	Molex
Toa Electric Industrial	Toa Electric Industrial Co. Ltd.
Heidenhain	Heidenhain Corporation
Hirose Electric	Hirose Electric Co., Ltd.
Magnescale	Magnescale Co., Ltd.
Mitutoyo	Mitutoyo Corporation
Renishaw	Renishaw Inc.
NIDEC SANKYO	NIDEC SANKYO CORPORATION
Toho Technology	Toho Technology Corp. Yoshida Terminal Block Division

App. 4 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods

United Nations Recommendations on the Transport of Dangerous Goods Rev. 15 (hereinafter Recommendations of the United Nations) has been issued. To reflect this, transport regulations for lithium metal batteries are partially revised in the Technical Instruction (ICAO-TI) by the International Civil Aviation Organization (ICAO) and the International Maritime Dangerous Goods Code (IMDG Code) by the International Maritime Organization (IMO).
To comply the instruction and code, we have modified the indication on the package for general-purpose AC servo batteries.
The above change will not affect the function and performance of the product.

(1) Target model

(a) Battery (cell)

Model	Option model	Type	Lithium content	Mass of battery	Remark
ER6	MR-J3BAT	Cell	0.65 g	16 g	Cells with more than 0.3 grams of lithium content must be handled as dangerous goods (Class 9) depending on packaging requirements.
ER17330	MR-BAT	Cell	0.48 g	13 g	
	A6BAT	Cell	0.48 g	13 g	

(b) Battery unit (assembled battery)

Model	Option model	Type	Lithium content	Mass of battery	Remark
ER6	MR-J2M-BT	Assembled battery (Seven)	4.55 g	112 g	Assembled batteries with more than two grams of lithium content must be handled as dangerous goods (Class 9) regardless of packaging requirements.
CR17335A	MR-BAT6V1	Assembled battery (Two)	1.20 g	34 g	Assembled batteries with more than 0.3 grams of lithium content must be handled as dangerous goods (Class 9) depending on packaging requirements.
	MR-BAT6V1SET(-A)	Assembled battery (Two)	1.20 g	34 g	
	MR-BAT6V1BJ	Assembled battery (Two)	1.20 g	34 g	

(2) Purpose

Safer transportation of lithium metal batteries.

(3) Change in regulations

The following points are changed for lithium metal batteries in transportation by sea or air based on the revision of Recommendations of the United Nations Rev. 15 and ICAO-TI 2009-2010 edition, and IATA Dangerous Goods Regulations 54th Edition (effective January 1, 2013). For lithium metal batteries, cells are classified as UN3090, and batteries contained in or packed with equipment are classified as UN3091.

(a) Transportation of lithium metal batteries alone

Packaging requirement	Classification	Main requirement
Less than eight cells per package with less than one gram of lithium content	UN3090 PI968 Section II	The package must pass a 1.2 m drop test, and the handling label with battery illustration (size: 120 × 110 mm) must be attached on the package.
Less than two assembled batteries per package with less than two grams of lithium content		
More than eight cells per package with less than one gram of lithium content	UN3090 PI968 Section IB	The package must pass a 1.2 m drop test, and the handling label with battery illustration (size: 120 × 110 mm) must be attached on the package. The Class 9 hazard label must be attached or others to comply with dangerous goods (Class 9).
More than two assembled batteries per package with less than two grams of lithium content		
Cells with more than one gram of lithium content	UN3090 PI968 Section IA	The package must be compliant with Class 9 Packages, and the Class 9 hazard label must be attached or others to comply with dangerous goods (Class 9).
Assembled batteries with more than two grams of lithium content		

(b) Transportation of lithium metal batteries packed with or contained in equipment

1) For batteries packed with equipment, follow the necessary requirements of UN3091 PI969. Batteries are classified into either Section II/Section I depending on the lithium content/packaging requirements.

2) For batteries contained in equipment, follow the necessary requirements of UN3091 PI970. Batteries are classified into either Section II/Section I depending on the lithium content/packaging requirements.
The special handling may be unnecessary depending on the number of batteries and gross mass per package.

CAUTION!

IF DAMAGED

Lithium Metal batteries

DO NOT LOAD OR TRANSPORT
PACKAGE IF DAMAGED

For more information,call
+81-3-3218-3639
International

Fig. Example of Mitsubishi label with battery illustration

(4) Details of the package change
The following caution is added to the packages of the target batteries.
"Containing lithium metal battery. Regulations apply for transportation."

(5) Transportation precaution for customers
For sea or air transportation, attaching the handling label (figure) must be attached to the package of a Mitsubishi cell or battery. In addition, attaching it to the outer package containing several packages of Mitsubishi cells or batteries is also required. When the content of a package must be handled as dangerous goods (Class 9), the Shipper's Declaration for Dangerous Goods is required, and the package must be compliant with Class 9 Packages. Documentations like the handling label in the specified design and the Shipper's Declaration for Dangerous Goods are required for transportation. Please attach the documentations to the packages and the outer package.

The IATA Dangerous Goods Regulations are revised, and the requirements are changed annually. When customers transport lithium batteries by themselves, the responsibility for the cargo lies with the customers. Thus, be sure to check the latest version of the IATA Dangerous Goods Regulations.

App. 5 Symbol for the new EU Battery Directive

Symbol for the new EU Battery Directive (2006/66/EC) that is plastered to general-purpose AC servo battery is explained here.

Note. This symbol mark is for EU countries only.

This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.
Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration.
This will be indicated as follows.
Hg: Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)
In the European Union there are separate collection systems for used batteries and accumulators. Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.
Please, help us to conserve the environment we live in!

App. 6 Compliance with global standards for servo amplifier

POINT

- The content of the functional safety description applies to the MR-J4-_B_-RJ020 servo amplifier only when it is in the J4 mode.

App. 6.1 Terms related to safety (IEC 61800-5-2 Stop function)

STO function (Refer to IEC 61800-5-2:2007 4.2.2.2 STO.) The MR-J4 servo amplifiers have the STO function. The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the servo amplifier. In addition, MR-J4-03A6 and MR-J4W2-0303B6 don’t support this function.

App. 6.2 About safety

This chapter explains safety of users and machine operators. Please read the section carefully before mounting the equipment. In this installation guide, the specific warnings and cautions levels are classified as follows.

App. 6.2.1 Professional engineer

Only professional engineers should mount MR-J4 servo amplifiers.
Here, professional engineers should meet the all conditions below.

(1) Persons who took a proper training of related work of electrical equipment or persons who can avoid risk based on past experience.

(2) Persons who have read and familiarized himself/herself with this installation guide and operating manuals for the protective devices (e.g. light curtain) connected to the safety control system.

App. 6.2.2 Applications of the devices

MR-J4 servo amplifiers comply with the following standards.

- IEC/EN 61800-5-1, IEC/EN 61800-3, IEC/EN 60204-1
- ISO/EN ISO 13849-1 Category 3 PL e, IEC/EN 62061 SIL CL 3, IEC/EN 61800-5-2 (STO) (Except for MR-J4-03A6 and MR-J4W2-0303B6. Refer to app. 6.8.1 for compatible models.)

MR-J4 servo amplifiers can be used with the MR-D30 functional safety unit, MR-J3-D05 safety logic unit, or safety PLCs. (except for MR-J4-03A6 and MR-J4W2-0303B6)

App. 6.2.3 Correct use

Always use the MR-J4 servo amplifiers within specifications (voltage, temperature, etc. Refer to section 1.3 for details.). Mitsubishi Electric Co. accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

⚠WARNING

- It takes 15 minutes maximum for capacitor discharging. Do not touch the unit and terminals immediately after power off.

(1) Peripheral device and power wiring

The followings are selected based on IEC/EN 61800-5-1, UL 508C, and CSA C22.2 No.14.

(a) Power Wiring (local wiring and crimping tool)

Use only copper wires or copper bus bars for wiring. The following table shows the stranded wire sizes [AWG] and the crimp terminal symbols rated at 75 °C/60 °C.

Table app. 1 Recommended wires

Servo amplifier (Note 7)	75 °C/60 °C stranded wire [AWG] (Note 2)			
	L1/L2/L3 ⏚	L11/L21	P+/C	U/V/W/⏚ (Note 3)
MR-J4-03A6/MR-J4W2-0303B6	19/- (Note 5)			19/- (Note 6)
MR-J4-10_(1)/MR-J4-20_(1)/MR-J4-40_(1)/MR-J4-60_(4)/MR-J4-70_/MR-J4-100_(4)/MR-J4-200_(4) (T)/MR-J4-350_4	14/14	14/14	14/14	14/14
MR-J4-200_ (S)	12/12			
MR-J4-350_				12/12
MR-J4-500_ (Note 1)	10: a/10: a	14: c/14: c	14: c/14: c	10: b/10: b
MR-J4-700_ (Note 1)	8: b/8: b		12: a/12: a	8: b/8: b
MR-J4-11K_ (Note 1)	6: d/4: f		12: e/12: e	4: f/4: f
MR-J4-15K_ (Note 1)	4: f/3: f		10: e/10: e	3: g/2: g
MR-J4-22K_ (Note 1)	1: h/-: -		10: i/10: i	1: j/-: -
MR-J4-500_4 (Note 1)	14: c/14: c		14: c/14: c	12: a/10: a
MR-J4-700_4 (Note 1)	12: a/12: a			10: a/10: a
MR-J4-11K_4 (Note 1)	10: e/10: e		14: k/14: k	8: l/8: l
MR-J4-15K_4 (Note 1)	8: l/8: l		12: e/12: e	6: d/4: d
MR-J4-22K_4 (Note 1)	6: m/4: m		12: i/12: i	6: n/4: n
MR-J4W_-_B	14/14 (Note 4)	14/14	14/14	14/14

Note 1. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.

2. Alphabets in the table indicate crimping tools. Refer to table app. 2 for the crimp terminals and crimping tools.

3. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the servo amplifiers.

4. Use the crimp terminal c for the PE terminal of the servo amplifier.

5. This value is of 24/0/PM/⏚ for MR-J4-03A6 and MR-J4W2-0303B6.

6. This value is of U/V/W/E for MR-J4-03A6 and MR-J4W2-0303B6.

7. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

Table app. 2 Recommended crimp terminals

Symbol	Servo amplifier-side crimp terminals		Manufacturer
	Crimp terminal (Note 2)	Applicable tool	
a	FVD5.5-4	YNT-1210S	JST (J.S.T. Mfg. Co., Ltd.)
b (Note 1)	8-4NS	YHT-8S	
c	FVD2-4	YNT-1614	
d	FVD14-6	YF-1	
e	FVD5.5-6	YNT-1210S	
f	FVD22-6	YF-1	
g	FVD38-6	YF-1	
h	R60-8	YF-1	
i	FVD5.5-8	YNT-1210S	
j	CB70-S8	YF-1	
k	FVD2-6	YNT-1614	
l	FVD8-6	YF-1	
m	FVD14-8	YF-1	
n	FVD22-8	YF-1	

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

(b) Selection example of MCCB and fuse

Use T class fuses or molded-case circuit breaker (UL 489 Listed MCCB) as the following table. The T class fuses and molded-case circuit breakers in the table are selected examples based on rated I/O of the servo amplifiers. When you select a smaller capacity servo motor to connect it to the servo amplifier, you can also use smaller capacity T class fuses or molded-case circuit breaker than ones in the table. For selecting ones other than Class T fuses and molded-case circuit breakers below, refer to section 11.10.

Servo amplifier (100 V class)	Molded-case circuit breaker (120 V AC)	Fuse (300 V)
MR-J4-10_1/MR-J4-20_1/MR-J4-40_1	NV50-SVFU-15A (50 A frame 15 A)	20 A

Servo amplifier (200 V class) (Note)	Molded-case circuit breaker (240 V AC)	Fuse (300 V)
MR-J4-10_/MR-J4-20_/MR-J4-40_/MR-J4-60_ (T)/MR-J4-70_ (T)/ MR-J4W2-22B (T)	NF50-SVFU-5A (50 A frame 5 A)	10 A
MR-J4-60_ (S)/MR-J4-70_ (S) /MR-J4-100_ (T)/MR-J4W2-22B (S)/ MR-J4W2-44B (T)/MR-J4W2-77B (T)/MR-J4W3-222B/ MR-J4W3-444B (T)	NF50-SVFU-10A (50 A frame 10 A)	15 A
MR-J4-100_ (S)/MR-J4-200_ (T)/MR-J4W2-44B (S)/ MR-J4W2-1010B	NF50-SVFU-15A (50 A frame 15 A)	30 A
MR-J4-200_ (S)/MR-J4-350_/MR-J4W2-77B (S)/ MR-J4W3-444B (S)	NF50-SVFU-20A (50 A frame 20 A)	40 A
MR-J4-500_	NF50-SVFU-30A (50 A frame 30 A)	60 A
MR-J4-700_	NF50-SVFU-40A (50 A frame 40 A)	80 A
MR-J4-11K_	NF100-CVFU-60A (100 A frame 60 A)	125 A
MR-J4-15K_	NF100-CVFU-80A (100 A frame 80 A)	150 A
MR-J4-22K_	NF225-CWU-125A (225 A frame 125 A)	300 A

Note. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

Servo amplifier (400 V class)	Molded-case circuit breaker (480 V AC)	Fuse (600 V)
MR-J4-60_4/MR-J4-100_4	NF100-HRU-5A (100 A frame 5 A)	10 A
MR-J4-200_4	NF100-HRU-10A (100 A frame 10 A)	15 A
MR-J4-350_4	NF100-HRU-10A (100 A frame 10 A)	20 A
MR-J4-500_4	NF100-HRU-15A (100 A frame 15 A)	30 A
MR-J4-700_4	NF100-HRU-20A (100 A frame 20 A)	40 A
MR-J4-11K_4	NF100-HRU-30A (100 A frame 30 A)	60 A
MR-J4-15K_4	NF100-HRU-40A (100 A frame 40 A)	80 A
MR-J4-22K_4	NF100-HRU-60A (100 A frame 60 A)	125 A

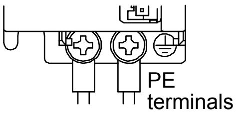
(c) Power supply

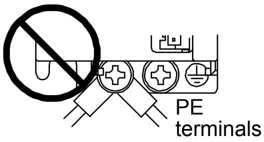
This servo amplifier can be supplied from star-connected supply with grounded neutral point of overvoltage category III (overvoltage category II for 1-phase servo amplifiers, MR-J4-03A6, and MR-J4W2-0303B6) set forth in IEC/EN 60664-1. For the interface power supply, use an external 24 V DC power supply with reinforced insulation on I/O terminals.

In case of MR-J4-03A6 and MR-J4W2-0303B6, use DC power supplies of reinforced insulation type to main circuit, control circuit, and UL listed (recognized) 48 V DC/24 V DC power supplies which can generate more than 1.2 A/2.4 A per axis.

(d) Grounding

To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet. Do not connect two grounding cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one.
This product can cause a DC current in the protective earthing conductor. To protect direct/indirect contact using an earth-leakage current breaker (RCD), only an RCD of type B can be used for the power supply side of the product.
The MR-J4-700_4 is high protective earthing conductor current equipment, the minimum size of the protective earthing conductor must comply with the local safety regulations.





(2) EU compliance

The MR-J4 servo amplifiers are designed to comply with the following directions to meet requirements for mounting, using, and periodic technical inspections: Machinery directive (2006/42/EC), EMC directive (2014/30/EU), and Low-voltage directive (2014/35/EU).

(a) EMC requirement

MR-J4 servo amplifiers comply with category C3 in accordance with EN 61800-3. As for I/O wires (max. length 10 m. However, 3 m for STO cable for CN8.) and encoder cables (max. length 50 m), use shielded wires and ground the shields. Install an EMC filter and surge protector on the primary side for input and output of 200 V class and for output of 400 V class servo amplifiers. In addition, use a line noise filter for outputs of the 11 kW and 15 kW of 400 V class servo amplifiers. The following shows recommended products.

EMC filter: Soshin Electric HF3000A-UN series (200 V class), TF3000C-TX series (400 V class)
Surge protector: Okaya Electric Industries RSPD-250-U4 series
Line noise filter: Mitsubishi Electric FR-BLF

MR-J4 Series are not intended to be used on a low-voltage public network which supplies domestic premises; radio frequency interference is expected if used on such a network. The installer shall provide a guide for Installation and use, including recommended mitigation devices. To avoid the risk of crosstalk to signal cables, the installation instructions shall either recommend that the power interface cable be segregated from signal cables.
Use the DC power supply installed with the amplifiers in the same cabinet. Do not connect the other electric devices to the DC power supply.

(b) For Declaration of Conformity (DoC)

Hereby, MITSUBISHI ELECTRIC EUROPE B.V., declares that the servo amplifiers are in compliance with the necessary requirements and standards (2006/42/EC, 2014/30/EU, and 2014/35/EU). For the copy of Declaration of Conformity, contact your local sales office.

(3) USA/Canada compliance

This servo amplifier is designed in compliance with UL 508C and CSA C22.2 No.14.

(a) Installation

The minimum cabinet size is 150% of each MR-J4 servo amplifier's volume. Also, design the cabinet so that the ambient temperature in the cabinet is 55 °C or less. The servo amplifier must be installed in the metal cabinet. Additionally, mount the servo amplifier on a cabinet that the protective earth based on the standard of IEC/EN 60204-1 is correctly connected. For environment, the units should be used in open type (UL 50) and overvoltage category shown in table in app. 4.8.1. The servo amplifier needs to be installed at or below of pollution degree 2. For connection, use copper wires.

(b) Short-circuit current rating (SCCR)

Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum (Not More Than 5 kA rms Symmetrical Amperes, 48 Volts Maximum for MR-J4-03A6 and MR-J4W2-0303B6).

(c) Overload protection characteristics

The MR-J4 servo amplifiers have solid-state servo motor overload protection. (It is set on the basis (full load current) of 120% rated current of the servo amplifier.)

(d) Over-temperature protection for motor

Motor Over temperature sensing is not provided by the drive.
Integral thermal protection(s) is necessary for motor and refer to app. 6.4 for the proper connection.

(e) Branch circuit protection

For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.
For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

(4) South Korea compliance

This product complies with the Radio Wave Law (KC mark). Please note the following to use the product.

이 기기는 업무용 (A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으 로 합니다.

(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point, and use the product in a place except for home.)
In addition, use an EMC filter, surge protector, ferrite core, and line noise filter on the primary side for inputs. Use a ferrite core and line noise filter for outputs. Use a distance greater than 30 m between the product and third party sensitive radio communications for an MR-J4-22K_(4).

App. 6.2.4 General cautions for safety protection and protective measures

Observe the following items to ensure proper use of the MR-J4 servo amplifiers.

(1) For safety components and installing systems, only qualified personnel and professional engineers should perform.

(2) When mounting, installing, and using the MELSERVO MR-J4 servo amplifier, always observe standards and directives applicable in the country.

(3) The item about noises of the test notices in the manuals should be observed.

App. 6.2.5 Residual risk

(1) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.

(2) Perform all risk assessments and safety level certification to the machine or the system as a whole.

(3) If the upper and lower power module in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.

(4) Only qualified personnel are authorized to install, start-up, repair or service the machines in which these components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1 Table F.1 No.5)

(5) Separate the wiring for safety observation function from other signal wirings. (ISO 13849-1 Table F.1 No.1)

(6) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).

(7) Keep the required clearance/creepage distance depending on voltage you use.

App. 6.2.6 Disposal

Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste disposal regulations. (Example: European Waste 16 02 14)

App. 6.2.7 Lithium battery transportation

To transport lithium batteries, take actions to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO).
The batteries (MR-BAT6V1SET, MR-BAT6V1SET-A, MR-BAT6V1, and MR-BAT6V1BJ) are assembled batteries from two batteries (lithium metal battery CR17335A) which are not subject to the dangerous goods (Class 9) of the UN Recommendations.

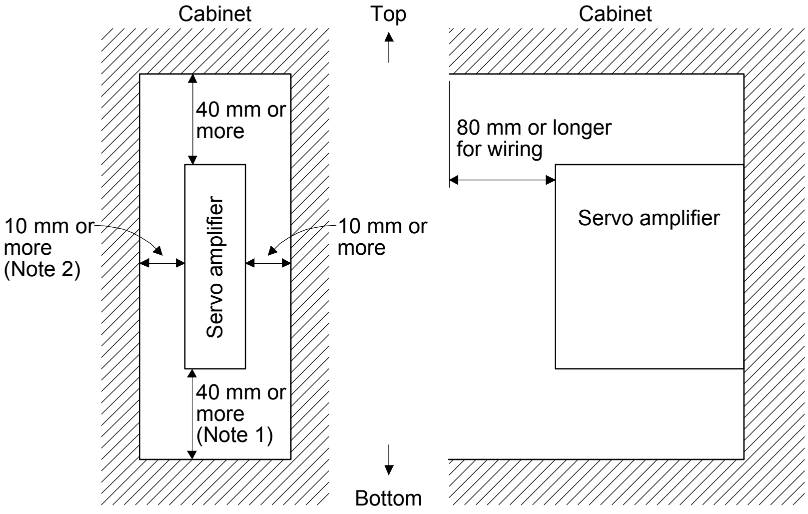
App. 6.3 Mounting/dismounting

Installation direction and clearances

⚠CAUTION

- ●The devices must be installed in the specified direction. Not doing so may cause a malfunction.
- ●Mount the servo amplifier on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.
- ●The regenerative resistor supplied with 11 kW to 22 kW servo amplifiers does not have a protective cover. Touching the resistor (including wiring/screw hole area) may cause a burn injury and electric shock. Even if the power was shut-off, be careful until the bus voltage discharged and the temperature decreased because of the following reasons.
  - ･It may cause a burn injury due to very high temperature without cooling.
  - ･It may cause an electric shock due to charged capacitor of the servo amplifier.

To adapt your machine using MR-J4-03A6 or MR-J4W2-0303B6 to IEC/EN 60950-1, either supply the amplifier with a power supply complying with the requirement of 2.5 stated in IEC/EN 60950-1 (Limited Power Source), or cover the amplifier and motors connected to the outputs with a fire enclosure.



Note 1. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

2. For MR-J4-500_, the clearance on the left side will be 25 mm or more.

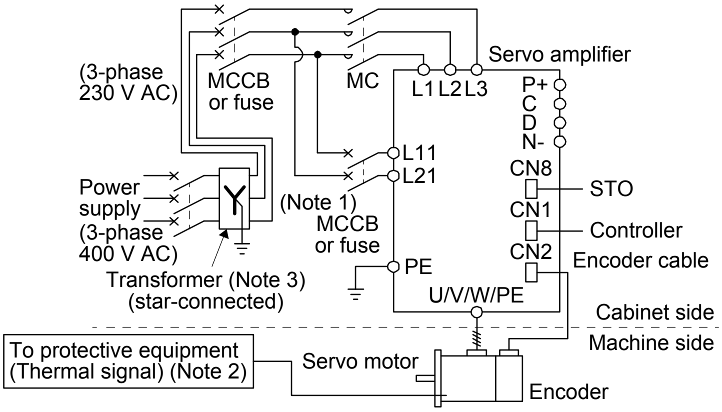
App. 6.4 Electrical Installation and configuration diagram

⚠WARNING	●Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or damages to the product before starting the installation or wiring.

⚠CAUTION	●The installation complies with IEC/EN 60204-1. The voltage supply to machines must be 20 ms or more of tolerance against instantaneous power failure as specified in IEC/EN 60204-1. ●Connecting a servo motor for different axis to U, V, W, or CN2_ of the servo amplifier may cause a malfunction.

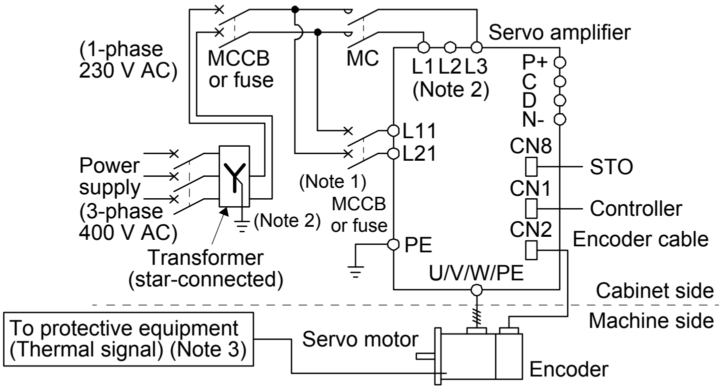
The following shows representative configuration examples to conform to the IEC/EN/UL/CSA standards.

(1) 3-phase input for MR-J4 1-axis servo amplifier



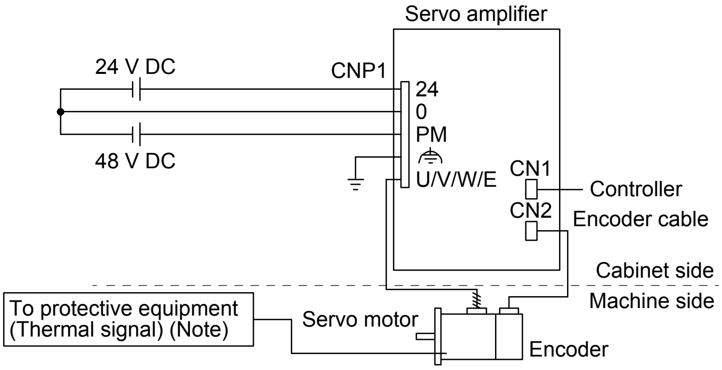
Note 1. When the wire sizes of L1 and L11 are the same, MCCB or fuse is not required.
2. Please use a thermal sensor, etc. for thermal protection of the servo motor.
3. For 400 V class, a step-down transformer is not required.

(2) 1-phase input for MR-J4 1-axis servo amplifier



Note 1. When the wire sizes of L1 and L11 are the same, MCCB or fuse is not required.
2. When using a 100 V class servo amplifier, step down the power supply voltage to 100 V and connect the main circuit power supply lines to L1 and L2. For 1-phase 200 V AC servo amplifiers, connect the lines to L1 and L3.
3. Please use a thermal sensor, etc. for thermal protection of the servo motor.

(3) Main circuit 48 V DC input for MR-J4 1-axis servo amplifier



Note. Please use a thermal sensor, etc. for thermal protection of the servo motor.

The connectors described by rectangles are safely separated from the main circuits described by circles.
The connected motors will be limited as follows.

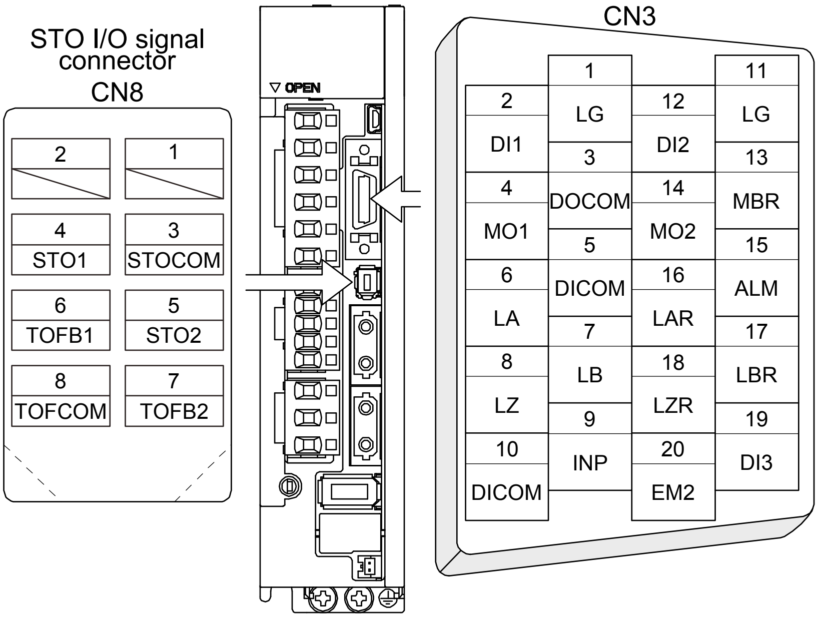
(1) HG/HF/HC/HA series servo motors (Mfg.: Mitsubishi Electric)

(2) Using a servo motor complied with IEC 60034-1 and Mitsubishi Electric encoder (OBA, OSA)

App. 6.5 Signal

App. 6.5.1 Signal

The following shows MR-J4-10B signals as a typical example. For other servo amplifiers, refer to each servo amplifier instruction manual.



App. 6.5.2 I/O device

Input device

Symbol	Device	Connector	Pin No.
EM2	Forced stop 2	CN3	20
STOCOM	Common terminal for input signals STO1/STO2	CN8	3
STO1	STO1 state input		4
STO2	STO2 state input		5

Output device

Symbol	Device	Connector	Pin No.
TOFCOM	Common terminal for monitor output signal in STO state	CN8	8
TOFB1	Monitor output signal in STO1 state		6
TOFB2	Monitor output signal in STO2 state		7

Power supply

Symbol	Device	Connector	Pin No.
DICOM	Digital I/F power supply input	CN3	5, 10
DOCOM	Digital I/F common		3
SD	Shield		Plate

App. 6.6 Maintenance and service

⚠WARNING	●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

App. 6.6.1 Inspection items

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.(Except for MR-J4-03A6 and MR-J4W2-0303B6)

Servo amplifier	Tightening torque [N•m]														
	L1	L2	L3	N-	P3	P4	P+	C	D	L11	L21	U	V	W	PE
MR-J4-10_(1)/MR-J4-20_(1)/ MR-J4-40_(1)/MR-J4-60_(4)/ MR-J4-70_/MR-J4-100_(4)/ MR-J4-200_(4)/MR-J4-350_(4)															1.2
MR-J4-500_	1.2									0.8		1.2			
MR-J4-700_(4)/MR-J4-500_4	1.2									0.8		1.2			
MR-J4-11K_(4)/MR-J4-15K_(4)	3.0									1.2		3.0			
MR-J4-22K_(4)	6.0									1.2		6.0			
MR-J4W_-_B															1.2

(2) Servo motor bearings, brake section, etc. for unusual noise.

(3) Check the cables and the like for scratches or cracks. Perform periodic inspection according to operating conditions.

(4) Check that the connectors are securely connected to the servo motor.

(5) Check that the wires are not coming out from the connector.

(6) Check for dust accumulation on the servo amplifier.

(7) Check for unusual noise generated from the servo amplifier.

(8) Check the servo motor shaft and coupling for connection.

App. 6.6.2 Parts having service life

Service life of the following parts are listed below. However, the service life vary depending on operation and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service life. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	(Note 3) 10 years
Relay	Number of power-on, forced stop and controller forced stop times: 100 000 times Number of on and off for STO: 1,000,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
(Note 1) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C)
(Note 2) Battery life	5 years from date of manufacture

Note 1. The time is for using MR-J4 1-axis servo amplifier with a rotary servo motor using MR-BAT6V1SET, MR-BAT6V1SET-A, or MR-BAT6V1BJ. For details and other battery backup time, refer to chapter 12.

2. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

3. The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will be the end of its life in 10 years of continuous operation in normal air conditioned environment (ambient temperature of 40 °C or less for use at the maximum 1000 m above sea level, 30 °C or less for over 1000 m to 2000 m).

App. 6.7 Transportation and storage

⚠CAUTION	●Transport the products correctly according to their mass. ● Stacking in excess of the limited number of product packages is not allowed. ●Do not hold the front cover to transport the servo amplifier. Otherwise, it may drop. ●Install the product in a load-bearing place of servo amplifier and servo motor in accordance with the instruction manual. ●Do not get on or put heavy load on the equipment. ●For detailed information on transportation and handling of the battery, refer to app. 4 and app. 5.

When you keep or use it, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation [°C]	0 to 55 Class 3K3 (IEC/EN 60721-3-3)
	Transportation (Note) [°C]	-20 to 65 Class 2K4 (IEC/EN 60721-3-2)
	Storage (Note) [°C]	-20 to 65 Class 1K4 (IEC/EN 60721-3-1)
Ambient humidity	Operation, transportation, storage	5 %RH to 90 %RH
Vibration resistance	Test condition	10 Hz to 57 Hz with constant amplitude of 0.075 mm 57 Hz to 150 Hz with constant acceleration of 9.8 m/s^2 to IEC/EN 61800-5-1 (Test Fc of IEC 60068-2-6)
	Operation	5.9 m/s^2
	Transportation (Note)	Class 2M3 (IEC/EN 60721-3-2)
	Storage	Class 1M2 (IEC/EN 60721-3-2)
Pollution degree		2
IP rating		IP20 (IEC/EN 60529), Terminal block IP00
		Open type (UL 50)
Altitude	Operation, storage	Max. 2000 m above sea level
	Transportation	Max. 10000 m above sea level

Note. In regular transport packaging

App. 6.8 Technical data

App. 6.8.1 MR-J4 servo amplifier

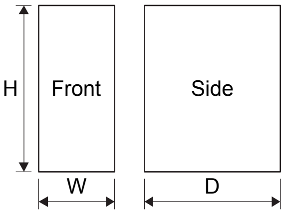
Item		MR-J4-10_/ MR-J4-20_/ MR-J4-40_/ MR-J4-60_/ MR-J4-70_/ MR-J4-100_/ MR-J4-200_/ MR-J4W2-22B/ MR-J4W2-44B/ MR-J4W2-77B/ MR-J4W3-222B/ MR-J4W3-444B	MR-J4-350_/ MR-J4-500_/ MR-J4-700_/ MR-J4W2-1010B/ MR-J4-11K_/ MR-J4-15K_/ MR-J4-22K_	MR-J4-10_1/ MR-J4-20_1/ MR-J4-40_1	MR-J4-60_4/ MR-J4-100_4/ MR-J4-200_4/ MR-J4-350_4/ MR-J4-500_4/ MR-J4-700_4/ MR-J4-11K_4/ MR-J4-15K_4/ MR-J4-22K_4	MR-J4-03A6/ MR-J4W2-0303B6
Power supply	Main circuit (line voltage)	3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz (Note 2)	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz (Note 2)	1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz	3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz	48 V DC or 24 V DC
	Control circuit (line voltage)	1-phase 200 V AC to 240 V AC, 50/60 Hz (Note 2)		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz	1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz	24 V DC
	Interface (SELV)	24 V DC (required current capacity: MR-J4-_A_, 500 mA; MR-J4-_B_, 300 mA; MR-J4W2-_B_, 350 mA; MR-J4W3-_B, 450 mA; MR-J4-_ GF_, 300 mA)				
Control method		Sine-wave PWM control, current control method				
Safety observation function (STO) IEC/EN 61800-5-2 (Note 3)		EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL 3, and EN 61800-5-2				
Mean time to dangerous failure		MTTFd ≥ 100 [years] (314a)				
Effectiveness of fault monitoring of a system or subsystem		DC = Medium, 97.6 [%]				
Average probability of dangerous failures per hour		PFH = 6.4×10^{-9} [1/h]				
Mission time		T_M = 20 [years]				
Response performance		8 ms or less (STO input off → energy shut off)				
Pollution degree		2 (IEC/EN 60664-1)				
Overvoltage category		1-phase 100 V AC/200 V AC: II (IEC/EN 60664-1), 3-phase 200 V AC/400 V AC: III (IEC/EN 60664-1)				II (IEC/EN 60664-1)
Protective class		I (IEC/EN 61800-5-1)				III (IEC/EN 61800-5-1)
Short-circuit current rating (SCCR)		100 kA				5 kA (Note 1)

Note 1. For the use in US/Canada, constitute a branch circuit including the power supply which endures SCCR of 5 kA minimum in the industrial cabinet.

2. For MR-J4-_-RJ, 283 V DC to 340 V DC are also supported.

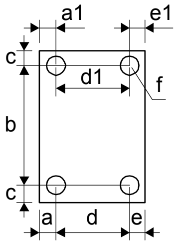
3. Servo amplifiers manufactured in June 2015 or later comply with SIL 3 requirements. However, MR-J4-_A_/MR-J4-_B_ servo amplifiers manufactured in China comply with SIL 3 requirements from the December 2015 production.

App. 6.8.2 Dimensions/mounting hole process drawing



Servo amplifier	Variable dimension table [mm]			Mass [kg]
	W	H	D	
MR-J4-03A6	30	100	90	0.2
MR-J4-10_(1)/MR-J4-20_(1) (Note)	40 (50)	168	135 (155)	0.8 (1.0)
MR-J4-40_(1)/MR-J4-60_ (Note)	40 (50)	168	170 (155)	1.0
MR-J4-70_/MR-J4-100_	60	168	185	1.4
MR-J4-200_(4)	90	168	195	2.1
MR-J4-350_	90	168	195	2.3
MR-J4-500_	105	250	200	4.0
MR-J4-700_	172	300	200	6.2
MR-J4-11K_(4)/MR-J4-15K_(4)	220	400	260	13.4
MR-J4-22K_(4)	260	400	260	18.2
MR-J4-60_4/MR-J4-100_4	60	168	195	1.7
MR-J4-350_4	105	250	200	3.6
MR-J4-500_4	130	250	200	4.3
MR-J4-700_4	172	300	200	6.5
MR-J4W2-0303B6	30	168	100	0.3
MR-J4W2-22B/MR-J4W2-44B	60	168	195	1.4
MR-J4W2-77B/MR-J4W2-1010B	85	168	195	2.3
MR-J4W3-222B/MR-J4W3-444B	85	168	195	2.3

Note. The value in the parenthesis shows the value of MR-J4-_GF_.



Servo amplifier	Variable dimensions [mm]								Screw size
	a	a1	b	c	d	d1	e	e1	f
MR-J4-03A6			90 ± 0.5	5			4	4	M4
MR-J4-10_(1)/MR-J4-20_(1)/ MR-J4-40_(1)/MR-J4-60_	6	6	156 ± 0.5	6					M5
MR-J4-70_/MR-J4-100_	12	12	156 ± 0.5	6	42 ± 0.3				M5
MR-J4-200_(4)/MR-J4-350_	6	45	156 ± 0.5	6	78 ± 0.3				M5
MR-J4-500_	6	6	235 ± 0.5	7.5	93 ± 0.5	93 ± 0.5			M5
MR-J4-700_	6	6	285 ± 0.5	7.5	160 ± 0.5	160 ± 0.5			M5
MR-J4-11K_(4)/MR-J4-15K_(4)	12	12	380 ± 0.5	10	196 ± 0.5	196 ± 0.5			M5
MR-J4-22K_(4)	12	12	376 ± 0.5	12	236 ± 0.5	236 ± 0.5			M10
MR-J4-60_4/MR-J4-100_4	12	12	156 ± 0.5	6	42 ± 0.3				M5
MR-J4-350_4	6	6	235 ± 0.5	7.5	93 ± 0.5	93 ± 0.5			M5
MR-J4-500_4	6	6	235 ± 0.5	7.5	118 ± 0.5	118 ± 0.5			M5
MR-J4-700_4	6	6	285 ± 0.5	7.5	160 ± 0.5	160 ± 0.5			M5
MR-J4W2-0303B6	6	6	156 ± 0.5	6					M5
MR-J4W2-22B/MR-J4W2-44B	6	6	156 ± 0.5	6					M5
MR-J4W2-77B/MR-J4W2-1010B	6	6	156 ± 0.5	6	73 ± 0.3				M5
MR-J4W3-222B/MR-J4W3-444B	6	6	156 ± 0.5	6	73 ± 0.3				M5

App. 6.9 Check list for user documentation

MITSUBISHI
ELECTRIC

MR-J4 installation checklist for manufacturer/installer

The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items.
Maintain and keep this checklist with related documents of machines to use this for periodic inspection.

1. Is it based on directive/standard applied to the machine? Yes [ ], No [ ]
2. Is directive/standard contained in Declaration of Conformity (DoC)? Yes [ ], No [ ]
3. Does the protection instrument conform to the category required? Yes [ ], No [ ]
4. Are electric shock protective measures (protective class) effective? Yes [ ], No [ ]
5. Is the STO function checked (test of all the shut-off wiring)? Yes [ ], No [ ]

Checking the items will not be instead of the first test operation or periodic inspection by professional engineers.

App. 7 Compliance with global standards for converter unit and drive unit

POINT

- ●Descriptions of functional safety is applicable only when the MR-J4-DU_B_-RJ020 drive unit is used in the J4 mode.

Converter units and drive units are written as servo amplifiers in app. 7 under certain circumstances.

App. 7.1 Terms related to safety

App. 7.1.1 IEC 61800-5-2 Stop function

STO function (Refer to IEC 61800-5-2: 2007 4.2.2.2 STO.)
MR-J4 servo amplifiers have the STO function. The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the servo amplifier.

App. 7.2 About safety

This section explains safety of users and machine operators. Please read the chapter carefully before mounting the equipment.

App. 7.2.1 Professional engineer

Only professional engineers should mount MR-J4 servo amplifiers.
Here, professional engineers should meet the all conditions below.

(1) Persons who took a proper training of related work of electrical equipment or persons who can avoid risk based on past experience.

(2) Persons who have read and familiarized himself/herself with this installation guide and operating manuals for the protective devices (e.g. light curtain) connected to the safety control system.

App. 7.2.2 Applications of the devices

MR-J4 servo amplifiers comply with the following standards.
ISO/EN ISO 13849-1 category 3 PL e, IEC/EN 62061 SIL CL 3, IEC/EN 61800-5-2 (STO) IEC/EN 61800-5-1, IEC/EN 61800-3, IEC/EN 60204-1
MR-J4 servo amplifiers can be used with the MR-J3-D05 safety logic unit, or safety PLCs.

App.7.2.3 Correct use

Always use the MR-J4 servo amplifiers within specifications (voltage, temperature, etc. Refer to section 14.1.3.). Mitsubishi Electric Co. accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

⚠WARNING	●It takes 20 minutes maximum for capacitor discharging. Do not touch the unit and terminals immediately after power off.

(1) Selection of peripheral equipment and wire
The followings are selected based on IEC/EN 61800-5-1, UL 508C, and CSA C22.2 No.14.

(a) Local wiring and crimping tool
Use only copper wires or copper bus bars for wiring. The following table shows the stranded wire sizes [AWG] and the crimp terminal symbols rated at 75 °C/60 °C.

Table app. 3 Recommended wire (Note 1)

Drive unit	Converter unit	75 °C/60 °C stranded wire [AWG] (Note 2)			
		L1/L2/L3 ⏚	L11/L21	P2/C	U/V/W/⏚ (Note 3)
MR-J4-DU30K_	MR-CR55K	1: c/1/0: d	14: g/14: g	10: a/10: a	2/0: d/2/0: d
MR-J4-DU37K_		2/0: d (Note 4)/-: -			2/0: d (Note 4)/-: -
MR-J4-DU30K_4	MR-CR55K4	4: e/3: f			3: f/2: f
MR-J4-DU37K_4		2: f/1: c			2: f/1: c
MR-J4-DU45K_4		2: c/2: c			1/0: d/1/0: d
MR-J4-DU55K_4		2: c/1/0: d			1/0: d/2/0: d

Note 1. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
2. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to table app. 4.
3. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the servo amplifiers.
4. This wire size applies only to the units with rated current less than 175 A.

Table app. 4 Recommended crimp terminal

Symbol	Servo amplifier-side crimp terminals		Manufacturer
	Crimp terminal (Note 2)	Applicable tool	
a	FVD5.5-10	YNT-1210S	JST (J.S.T. Mfg. Co., Ltd.)
b	FVD22-10	YF-1/E-4	
c (Note 1)	R38-10	YPT-60-21	
		YF-1/E-4	
d (Note 1)	R60-10	YPT-60-21	
		YF-1/E-4	
e	FVD22-8	YF-1/E-4	
f (Note 1)	R38-8	YPT-60-21	
		YF-1/E-4	
g	FVD2-4	YNT-1614	

Note 1. Coat the crimping part with an insulation tube.
2. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

(b) Selection example of MCCB and fuse

Use a fuse (T class) or the molded-case circuit breaker (UL 489 Listed MCCB) indicated in the table below. The T class fuses and molded-case circuit breakers in the table are selected examples based on rated I/O of the servo amplifiers. When you select a smaller capacity servo motor to connect it to the servo amplifier, you can also use smaller capacity T class fuses or molded-case circuit breaker than ones in the table. For selecting ones other than Class T fuses and molded-case circuit breakers below, refer to section 14.9.5.

Converter unit	Drive unit	Molded-case circuit breaker (240 V AC)	Fuse (300 V)
MR-CR55K	MR-J4-DU30K_	NF225-CWU-150A (225 A frame 150 A)	250 A
	MR-J4-DU37K_	NF225-CWU-175A (225 A frame 175 A)	300 A

Converter unit	Drive unit	Molded-case circuit breaker (480 V AC)	Fuse (600 V)
MR-CR55K4	MR-J4-DU30K_4	NF100-HRU-75A (100 A frame 75 A)	125 A
	MR-J4-DU37K_4	NF100-HRU-100A (100 A frame 100 A)	150 A
	MR-J4-DU45K_4	NF100-HRU-100A (100 A frame 100 A)	175 A
	MR-J4-DU55K_4	NF125-SVU-125A (125 A frame 125 A)	200 A

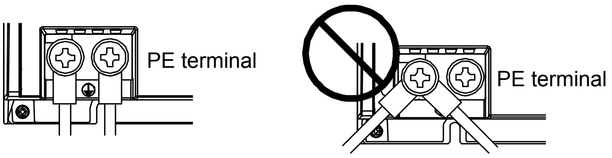
(c) Power supply

This servo amplifier can be used on the condition of overvoltage category III set forth in IEC/EN 60664-1. For the interface power supply, use an external 24 V DC power supply with reinforced insulation on I/O terminals.

(d) Grounding

To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet. Do not connect two grounding cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one.

This product can cause a DC current in the protective earthing conductor. Where a residual current-operated protective (RCD: earth-leakage current breaker) device is used for protection in case of direct or indirect contact, only an RCD of Type B is allowed on the supply side of this product.



(2) EU compliance

The MR-J4 servo amplifiers are designed to comply with the following directions to meet requirements for mounting, using, and periodic technical inspections: Machinery directive (2006/42/EC), EMC directive (2014/30/EU), and Low-voltage directive (2014/35/EU).

(a) EMC requirement

MR-J4 servo amplifiers comply with category C3 in accordance with EN 61800-3. As for I/O wires (max. length 10 m. However, 3 m for STO cable for CN8.) and encoder cables (max. length 50 m), use shielded wires and ground the shields. Install an EMC filter and surge protector on the primary side of the servo amplifier. In addition, use a line noise filter for outputs of the servo amplifiers. The following shows recommended products.

EMC filter: Soshin Electric HF3000A-UN series (200 V class), TF3000C-TX series (400 V class)
Surge protector: Okaya Electric Industries RSPD-250-U4 series
Line noise filter: Mitsubishi Electric FR-BIF

MR-J4 Series are not intended to be used on a low-voltage public network which supplies domestic premises; Radio frequency interference is expected if used on such a network. The installer shall provide a guide for Installation and use, including recommended mitigation devices. To avoid the risk of crosstalk to signal cables, the installation instructions shall either recommend that the power interface cable be segregated from signal cables.

(b) For Declaration of Conformity (DoC)

Hereby, MITSUBISHI ELECTRIC EUROPE B.V., declares that the servo amplifiers are in compliance with the necessary requirements and standards (2006/42/EC, 2014/30/EU, and 2014/35/EU). For the copy of Declaration of Conformity, contact your local sales office.

(3) USA/Canada compliance

This servo amplifier is designed in compliance with UL 508C and CSA C22.2 No.14.

(a) Installation

The minimum cabinet size is 150% of each MR-J4 servo amplifier's volume. Also, design the cabinet so that the ambient temperature in the cabinet is 55 ˚C or less. The servo amplifier must be installed in a metal cabinet. Additionally, mount the servo amplifier on a cabinet that the protective earth based on the standard of IEC/EN 60204-1 is correctly connected. For environment, the units should be used in open type (UL 50) and overvoltage category shown in table in app. 7.8. The servo amplifier needs to be installed at or below of pollution degree 2. For connection, use only copper wires.

(b) Short-circuit current rating (SCCR)

Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.

(c) Overload protection characteristics

The MR-J4 servo amplifiers have servo motor overload protective function. (It is set on the basis (full load current) of 120% rated current of the servo amplifier.)

(d) Over-temperature protection for motor

Motor Over temperature sensing is not provided by the drive.
Integral thermal protection(s) is necessary for motor and refer to app. 6.4 for the proper connection.

(e) Branch circuit protection

For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.
For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

(4) South Korea compliance

This product complies with the Radio Wave Law (KC mark) Please note the following to use the product.
이 기기는 업무용 (A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으 로 합니다.

(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point, and use the product in a place except for home.)
In addition, use an EMC filter, surge protector, ferrite core, and line noise filter on the primary side for inputs. Use a ferrite core and line noise filter for outputs. Use a distance greater than 30 m between the product and third party sensitive radio communications.

App. 7.2.4 General cautions for safety protection and protective measures

Observe the following items to ensure proper use of the MELSERVO MR-J4 servo amplifiers.

(1) For safety components and installing systems, only qualified personnel and professional engineers should perform.

(2) When mounting, installing, and using the MR-J4 servo amplifier, always observe standards and directives applicable in the country.

(3) The item about noises of the test notices in the manuals should be observed.

App. 7.2.5 Residual risk

(1) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.

(2) Perform all risk assessments and safety level certification to the machine or the system as a whole.

(3) If the upper and lower power modules in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.

(4) Only qualified personnel are authorized to install, start-up, repair or adjust the machines in which these components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1 Table F.1 No.5)

(5) Separate the wiring for safety observation function from other signal wirings. (ISO 13849-1 Table F.1 No.1)

(6) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).

(7) Keep the required clearance/creepage distance depending on voltage you use.

App. 7.2.6 Disposal

Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste disposal regulations. (Example: European Waste 16 02 14)

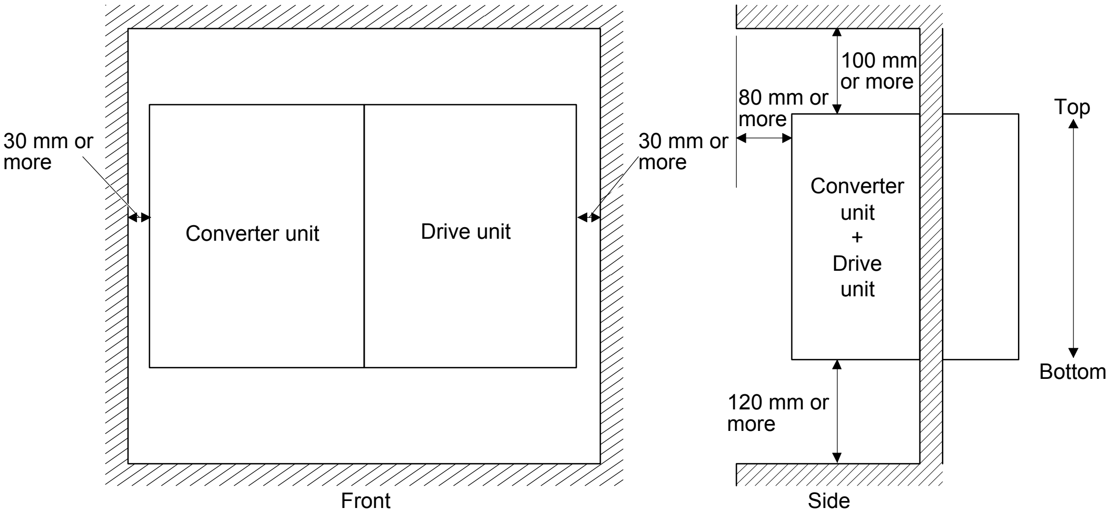
App. 7.2.7 Lithium battery transportation

To transport lithium batteries, take actions to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO).
The batteries (MR-BAT6V1SET, MR-BAT6V1, and MR-BAT6V1BJ) are assembled batteries from two batteries (lithium metal battery CR17335A) which are not subject to the dangerous goods (Class 9) of the UN Recommendations.

App. 7.3 Mounting/dismounting

Installation direction and clearances

⚠CAUTION	●The devices must be installed in the specified direction. Not doing so may cause a malfunction. ●Mount the servo amplifier on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.



App. 7.4 Electrical Installation and configuration diagram

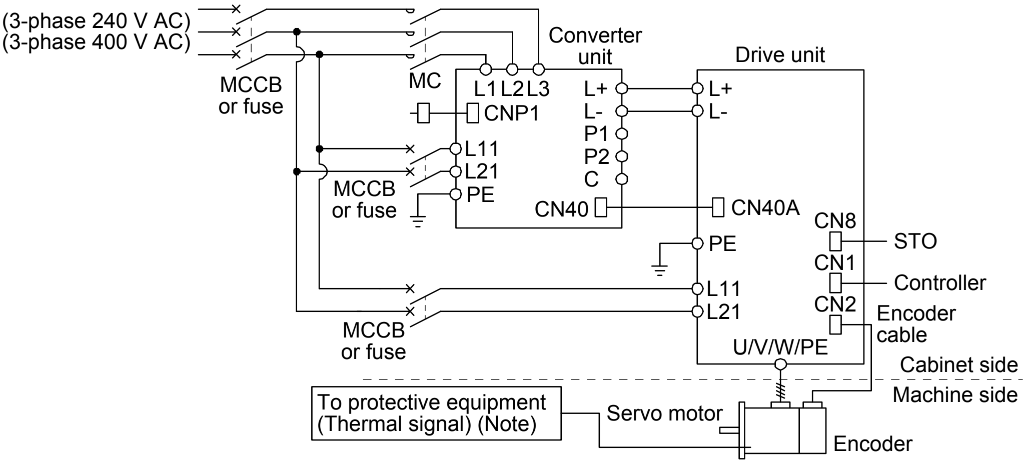
⚠WARNING

- Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or damages to the product before starting the installation or wiring.

⚠CAUTION

- The installation complies with IEC/EN 60204-1. The voltage supply to machines must be 20 ms or more of tolerance against instantaneous power failure as specified in IEC/EN 60204-1.
- Connecting a servo motor of the wrong axis to U, V, W, or CN2_ of the servo amplifier may cause a malfunction.

The following shows representative configuration examples to conform to the IEC/EN/UL/CSA standards.



Note. Please use a thermal sensor, etc. for thermal protection of the servo motor.

The connectors described by rectangles are safely separated from the main circuits described by circles. The connected motors will be limited as follows.

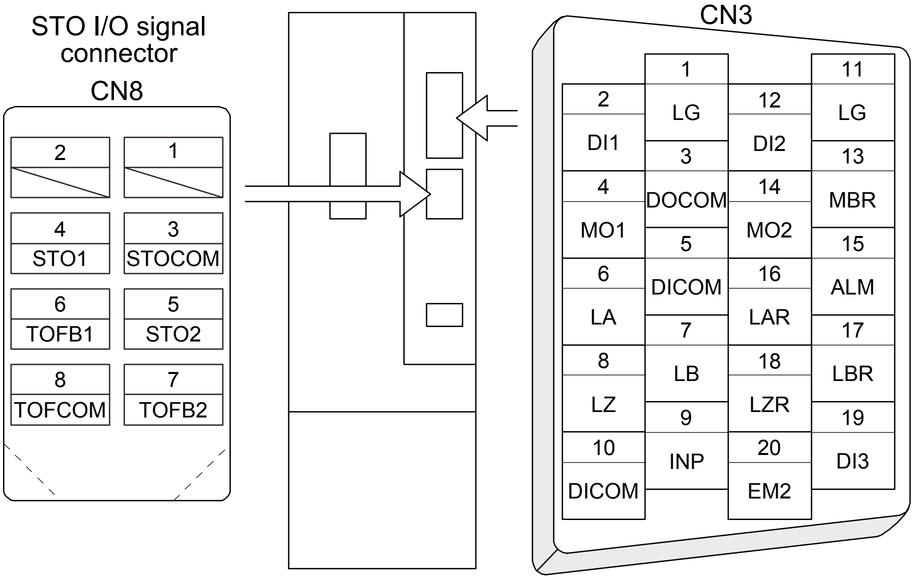
(1) HG/HF/HC/HA series servo motors (Mfg.: Mitsubishi Electric)

(2) Using a servo motor complied with IEC 60034-1 and Mitsubishi Electric encoder (OBA, OSA)

App. 7.5 Signals

App. 7.5.1 Signal

The following shows MR-J4-DU30KB signals as a typical example. For other servo amplifiers, refer to each servo amplifier instruction manual.



App. 7.5.2 I/O device

Input device

Symbol	Device	Connector	Pin No.
EM2	Forced stop 2	CN3	20
STOCOM	Common terminal for input signals STO1/STO2	CN8	3
STO1	STO1 state input		4
STO2	STO2 state input		5

Output device

Symbol	Device	Connector	Pin No.
TOFCOM	Common terminal for monitor output signal in STO state	CN8	8
TOFB1	Monitor output signal in STO1 state		6
TOFB2	Monitor output signal in STO2 state		7

Power supply

Symbol	Device	Connector	Pin No.
DICOM	Digital I/F power supply input	CN3	5, 10
DOCOM	Digital I/F common		3
SD	Shield		Plate

App. 7.6 Maintenance and service

> WARNING ●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

App. 7.6.1 Inspection items

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

Drive unit/converter unit	Tightening torque: [N•m]													
	L1	L2	L3	P1	P2	C	L+	L-	L11	L21	U	V	W	PE
MR-J4-DU30K_/MR-J4-DU37K_/ MR-J4-DU45K_4/MR-J4-DU55K_4							3.0		1.2		12.0			
MR-J4-DU30K_/MR-J4-DU37K_4											6.0			
MR-J4-CR55K(4)	12.0													12.0

(2) Check servo motor bearings, brake section, etc. for unusual noise.

(3) Check the cables and the like for scratches or cracks. Perform periodic inspection according to operating conditions.

(4) Check that the connectors are securely connected to the servo motor.

(5) Check that the wires are not coming out from the connector.

(6) Check for dust accumulation on the servo amplifier.

(7) Check for unusual noise generated from the servo amplifier.

(8) Check the servo motor shaft and coupling for connection.

App. 7.6.2 Parts having service life

Service life of the following parts are listed below. However, the service life varies depending on operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service life. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	(Note 3) 10 years
Relay	Number of power-on, forced stop and controller forced stop times: 100,000 times Number of on and off for STO: 100,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
(Note 1) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C)
(Note 2) Battery life	5 years from date of manufacture

Note 1. The time is for using MR-J4 1-axis servo amplifier with a rotary servo motor using MR-BAT6V1SET or MR-BAT6V1BJ. For details and other battery backup time, refer to chapter 12.

2. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

3. The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will be the end of its life in 10 years of continuous operation in air conditioned environment (40 °C surrounding air temperature or less for use at the maximum 1000 m above sea level, 30 °C or less for over 1000 m to 2000 m).

App. 7.7 Transportation and storage

⚠CAUTION	●Transport the products correctly according to their mass. ●Stacking in excess of the limited number of product packages is not allowed. ●Do not hold the front cover to transport the servo amplifier. Otherwise, it may drop. ●For detailed information on transportation and handling of the battery, refer to the servo amplifier instruction manual. ●Install the product in a load-bearing place of servo amplifier and servo motor in accordance with the instruction manual. ●Do not get on or put heavy load on the equipment.

When you keep or use it, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation [°C]	0 to 55 Class 3K3 (IEC/EN 60721-3-3)
	Transportation (Note) [°C]	-20 to 65 Class 2K4 (IEC/EN 60721-3-2)
	Storage (Note) [°C]	-20 to 65 Class 1K4 (IEC/EN 60721-3-1)
Ambient humidity	Operation, transportation, storage	5 %RH to 90 %RH
Vibration resistance	Test condition	10 Hz to 57 Hz with constant amplitude of 0.075 mm 57 Hz to 150 Hz with constant acceleration of 9.8 m/s^2 to IEC/EN 61800-5-1 (Test Fc of IEC 60068-2-6)
	Operation	5.9 m/s^2
	Transportation (Note)	Class 2M3 (IEC/EN 60721-3-2)
	Storage	Class 1M2 (IEC/EN 60721-3-2)
Pollution degree		2
IP rating		IP20 (IEC/EN 60529), Terminal block IP00
		Open type (UL 50)
Altitude	Operation, storage	2000 m or less above sea level
	Transportation	10000 m or less above sea level

Note. In regular transport packaging

App. 7.8 Technical data

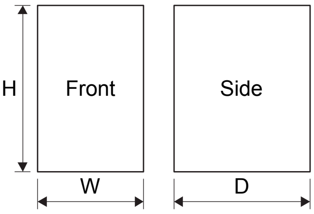
App. 7.8.1 Converter unit

Item		MR-CR55K	MR-CR55K4
Output	Rated voltage	270 V DC to 324 V DC	513 V DC to 648 V DC
	Rated current [A]	215.9	113.8
Power supply	Main circuit (line voltage)	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz, 191.3 A	3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz, 100.7 A
	Control circuit (line voltage)	1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz, 0.3 A	1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz, 0.2 A
	Interface (SELV)	24 V DC ± 10% (required current capacity: 150 mA)	
Pollution degree		2 (IEC/EN 60664-1)	
Overvoltage category		3-phase 200 V AC/400 V AC: III (IEC/EN 60664-1)	
Protective class		I (IEC/EN 61800-5-1)	
Short-circuit current rating (SCCR)		100 kA	

App. 7.8.2 Drive unit

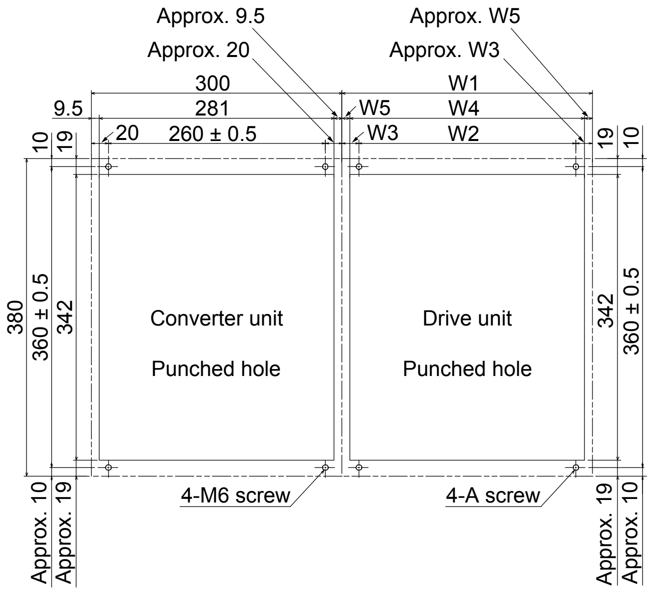
Item		MR-J4-DU30K_	MR-J4-DU37K_	MR-J4-DU30K_4	MR-J4-DU37K_4	MR-J4-DU45K_4	MR-J4-DU55K_4
Output	Rated voltage	3-phase 170 V AC, 360 Hz		3-phase 323 V AC, 360 Hz			
	Rated current [A]	174	204	87	102	131	143
Power supply	Main circuit	The main circuit power of the drive unit is supplied by the converter unit.					
	Control circuit (line voltage)	1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz, 0.3 A		1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz, 0.2 A			
	Interface (SELV)	24 V DC ± 10% (required current capacity: MR-J4-DU_A_, 500 mA; MR-J4-DU_B_, 300 mA)					
Control method		Sine-wave PWM control, current control method					
Safety observation function (STO) IEC/EN 61800-5-2		EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL3, EN 61800-5-2					
Mean time to dangerous failure		MTTFd ≥ 100 [years] (314a)					
Effectiveness of fault monitoring of a system or subsystem		DC = Medium, 97.6 [%]					
Average probability of dangerous failures per hour		PFH = 6.4×10^{-9} [1/h]					
Mission time		TM = 20 [years]					
Response performance		8 ms or less (STO input off → energy shut off)					
Pollution degree		2 (IEC/EN 60664-1)					
Overvoltage category		3-phase 200 V AC/400 V AC: III (IEC/EN 60664-1)					
Protective class		I (IEC/EN 61800-5-1)					
Short-circuit current rating (SCCR)		100 kA					

App. 7.8.3 Dimensions



Converter unit/drive unit	Variable dimension table [mm]			Mass [kg]
	W	H	D	
MR-CR55K(4)	300	380	300	22
MR-J4-DU30K_/MR-J4-DU37K_	300	380	300	21
MR-J4-DU30K_4/MR-J4-DU37K_4	240	380	300	16
MR-J4-DU45K_4/MR-J4-DU55K_4	300	380	300	21

App. 7.8.4 Mounting hole process drawing



Drive unit	Variable dimensions [mm]					Screw size
	W1	W2	W3	W4	W5	A
MR-J4-DU30K_ MR-J4-DU37K_ MR-J4-DU45K_4 MR-J4-DU55K_4	300	260 ± 0.5	20	281	9.5	M6
MR-J4-DU30K_4 MR-J4-DU37K_4	240	120 ± 0.5	60	222	9	M5

App. 7.9 Check list for user documentation

MITSUBISHI ELECTRIC

MR-J4-DU/MR-CR installation checklist for manufacturer/installer

The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items.

Maintain and keep this checklist with related documents of machines to use this for periodic inspection.

1. Is it based on directive/standard applied to the machine? Yes [ ], No [ ]
2. Is directive/standard contained in Declaration of Conformity (DoC)? Yes [ ], No [ ]
3. Does the protection instrument conform to the category required? Yes [ ], No [ ]
4. Are electric shock protective measures (protective class) effective? Yes [ ], No [ ]
5. Is the STO function checked (test of all the shut-off wiring)? Yes [ ], No [ ]

Checking the items will not be instead of the first test operation or periodic inspection by professional engineers.

App. 8 Analog monitor

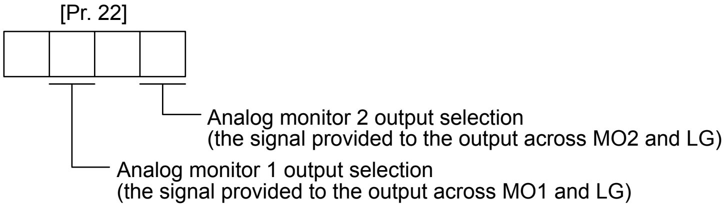
POINT

- ●A voltage of analog monitor output may be irregular at power-on.
- ●App. 6 explains when the MR-J4-_B_-RJ020 servo amplifier is in the J2S compatibility mode.

The servo status can be outputted to two channels in terms of voltage.

(1) Setting

Change the following digits of [Pr. 22].



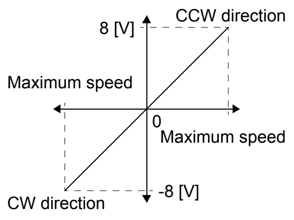
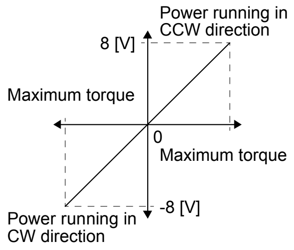
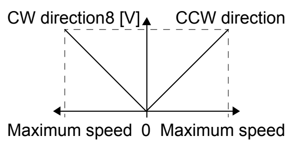
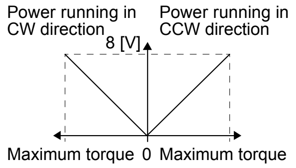
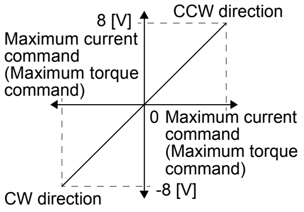
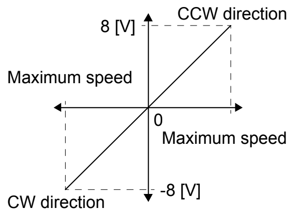
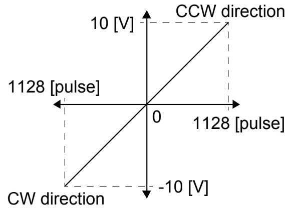
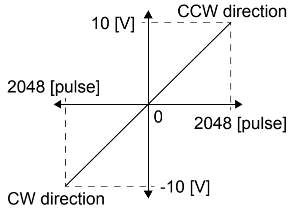
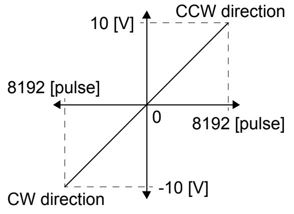
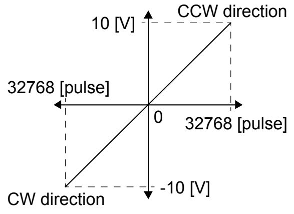
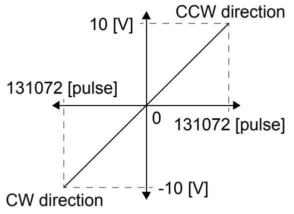
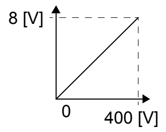
[Pr. 27] and [Pr. 28] can be used to set the offset voltages to the analog output voltages. Setting value is -999 mV to 999 mV.

Parameter	Description	Setting range [mV]
27	This is used to set the offset voltage of MO1 (Analog monitor 1).	-999 to 999
28	This is used to set the offset voltage of MO2 (Analog monitor 2).	

(2) Setting

The servo amplifier is factory-set to output the servo motor speed to MO1 (Analog monitor 1) and the torque to MO2 (Analog monitor 2). The setting can be changed as listed below by setting the [Pr. 22] value.

Refer to (3) for the detection point.

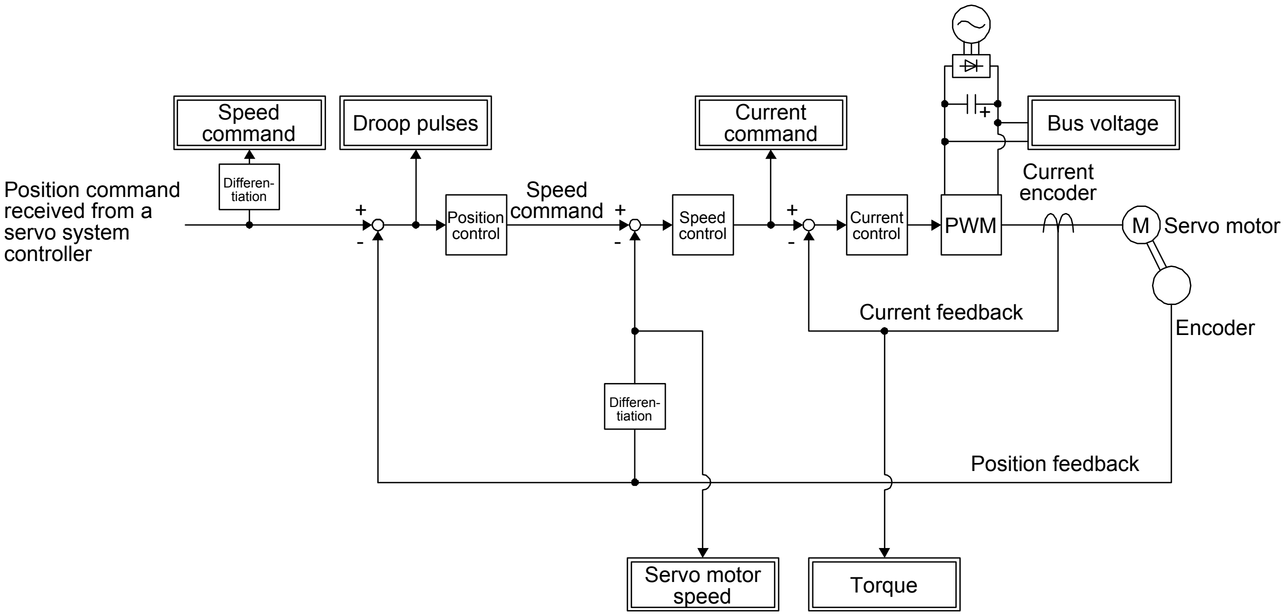
Setting value	Output item	Description	Setting value	Output item	Description
0	Servo motor speed		1	Torque (Note 1)	
2	Servo motor speed		3	Torque (Note 1)	
4	Current command		5	Speed command	
6	Droop pulses (Note 2) (±10 V/1128 pulses)		7	Droop pulses (Note 2) (±10 V/2048 pulses)	
8	Droop pulses (Note 2) (±10 V/8192 pulses)		9	Droop pulses (Note 2) (±10 V/32768 pulses)	
A	Droop pulses (Note 2) (±10 V/131072 pulses)		B	Bus voltage (Note 3)	

Note 1. 8 V is outputted at the maximum torque.

2. Encoder pulse unit

3. For 400 V class servo amplifier, the bus voltage becomes +8 V/800 V.

(3) Analog monitor block diagram



App. 9 Special specification

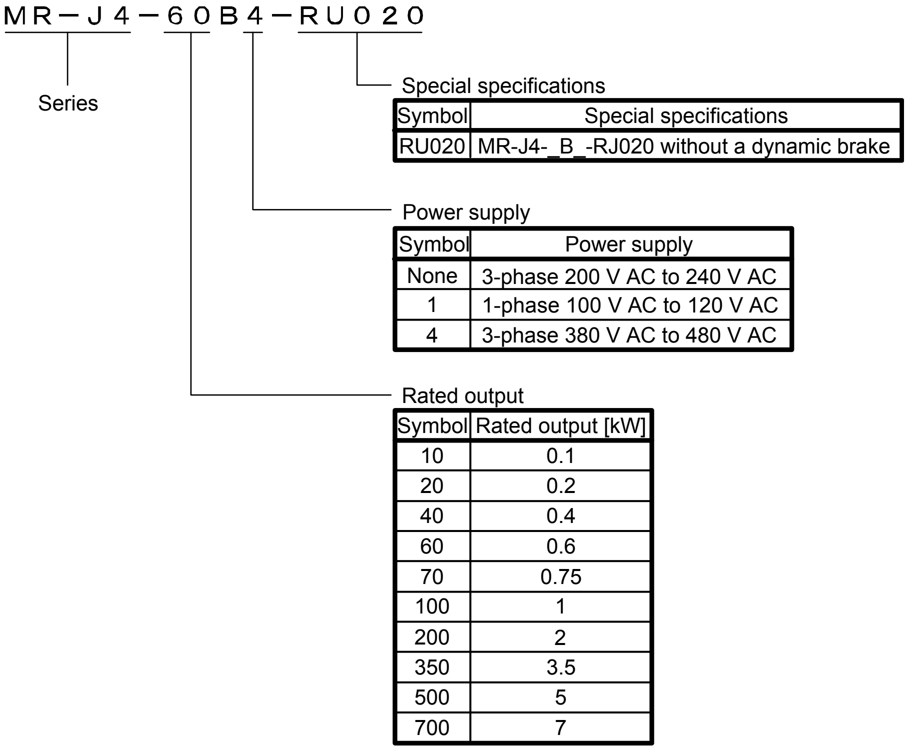
App. 9.1 Amplifier without dynamic brake

App. 9.1.1 Summary

This section explains servo amplifiers without dynamic brakes. Items not given in this section will be the same as MR-J4-_B_-RJ020.

App. 9.1.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



Special specifications

Symbol	Special specifications
RU020	MR-J4-_B_-RJ020 without a dynamic brake

Power supply

Symbol	Power supply
None	3-phase 200 V AC to 240 V AC
1	1-phase 100 V AC to 120 V AC
4	3-phase 380 V AC to 480 V AC

Rated output

Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
60	0.6
70	0.75
100	1
200	2
350	3.5
500	5
700	7

App. 9.1.3 Specifications

The dynamic brake built-in the 7 kW or lower servo amplifier is removed.
Take safety measures such as making another circuit in case of an emergency stop, alarm, and servo motor stop at power supply shut-off.
When the following servo motors are used, the electronic dynamic brake can start at an alarm occurrence.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52

Setting the following parameter disables the electronic dynamic brake.

(1) At J2S compatibility mode

Servo amplifier	Parameter	Setting value
MR-J4-_B_-RU020	[Pr. 56]	2 _ _ _

(2) At J4 mode

Servo amplifier	Parameter	Setting value
MR-J4-_B_-RU020	[Pr. PF06]	_ _ _ 2

Additionally, when [Pr. PA04] is "2 _ _ _" (initial value) for an MR-J4-_B_-RU020 in J4 mode, an alarm may trigger the forced stop deceleration. Setting "0 _ _ _" in [Pr. PA04] disables the forced stop deceleration.

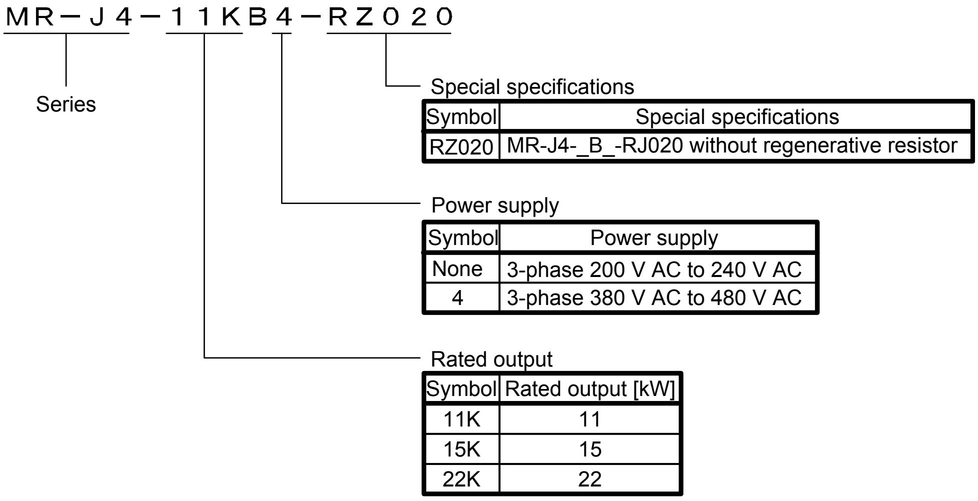
App. 9.2 Without regenerative resistor

App. 9.2.1 Summary

This section explains servo amplifiers without regenerative resistors. Items not given in this section will be the same as MR-J4-_B_-RJ020.

App. 9.2.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



Special specifications

Symbol	Special specifications
RZ020	MR-J4-_B_-RJ020 without regenerative resistor

Power supply

Symbol	Power supply
None	3-phase 200 V AC to 240 V AC
4	3-phase 380 V AC to 480 V AC

Rated output

Symbol	Rated output [kW]
11K	11
15K	15
22K	22

App. 9.2.3 Specifications

These are servo amplifiers of 11 kW to 22 kW that does not use a regenerative resistor as standard accessory. When using any of these servo amplifiers, always use the MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4 or MR-RB6K-4 regenerative option.

App. 10 Setting of added parameters for MR-J4-_B_-RJ020 servo amplifier

The following explains the setting procedures of parameters added for the MR-J4-_B_-RJ020 servo amplifier (at J2S compatibility mode) using a motion controller.

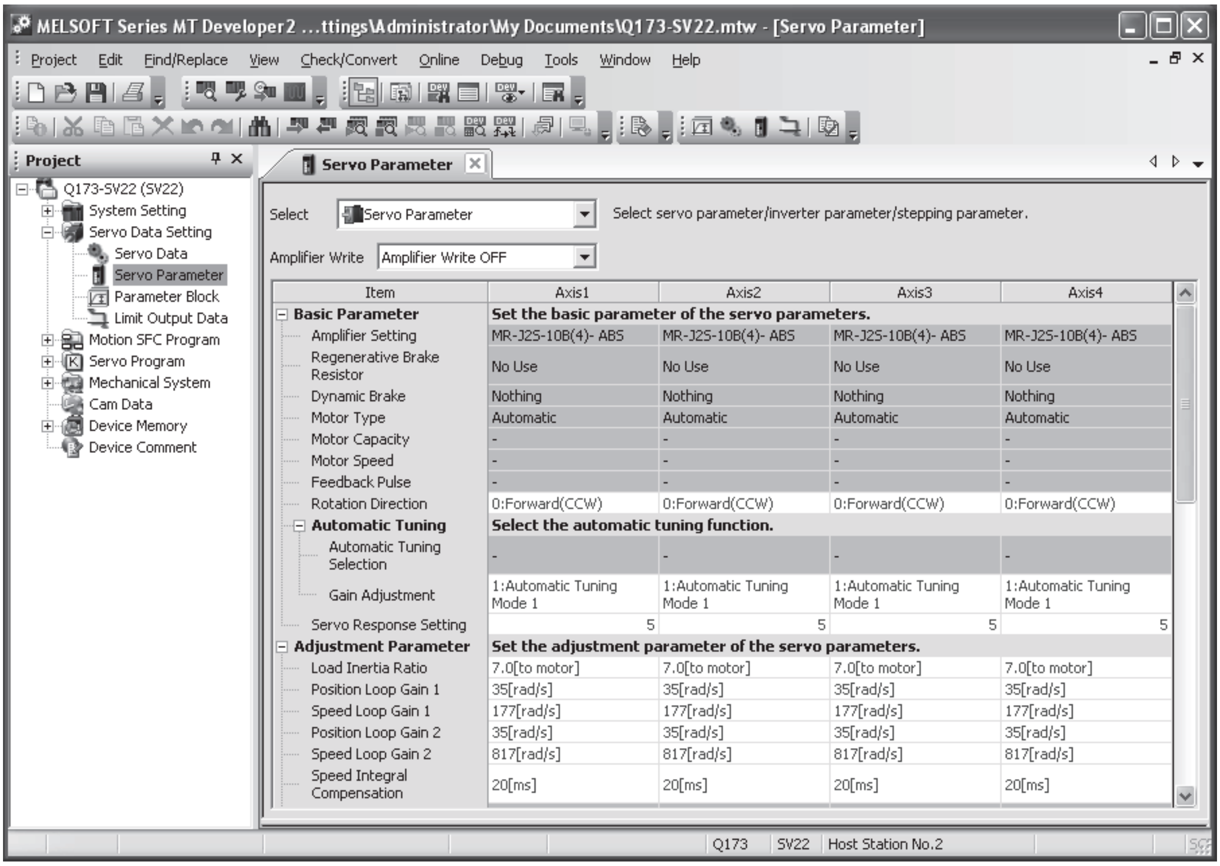
App. 10.1 Combination of target motion controllers and peripheral software

Series	Motion controller model	Peripheral software for motion controller
Q series	Q172CPU(N) Q173CPU(N)	MELSOFT MT Works2 (SW1DNC-MTW2-E) MT Developer (SW6RNC-GSVE)
A series	A171SHCPU(N) A172SHCPU(N) A173UHCPU A273UHCPU	SW3RNC-GSVE

App. 10.2 Parameter setting procedure

App. 10.2.1 MELSOFT MT Works2

(1) Open the "Servo Parameter" window.

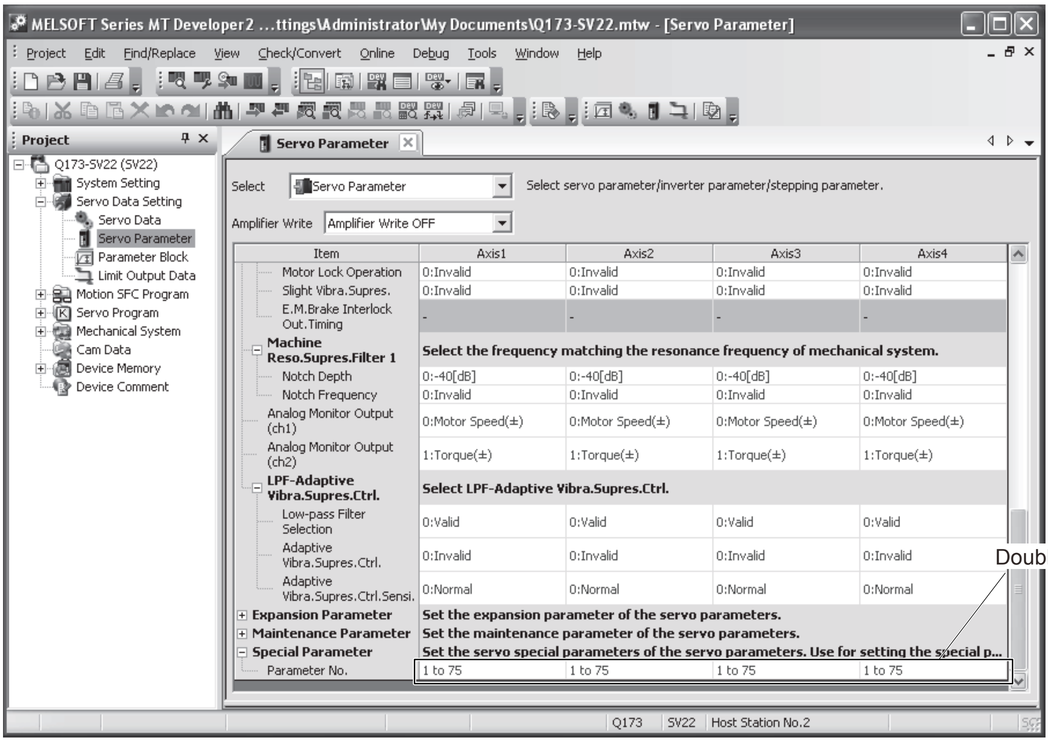


Select: Servo Parameter — Select servo parameter/inverter parameter/stepping parameter.

Amplifier Write: Amplifier Write OFF

Item	Axis1	Axis2	Axis3	Axis4
Basic Parameter	**Set the basic parameter of the servo parameters.**			
Amplifier Setting	MR-J2S-10B(4)- ABS	MR-J2S-10B(4)- ABS	MR-J2S-10B(4)- ABS	MR-J2S-10B(4)- ABS
Regenerative Brake Resistor	No Use	No Use	No Use	No Use
Dynamic Brake	Nothing	Nothing	Nothing	Nothing
Motor Type	Automatic	Automatic	Automatic	Automatic
Motor Capacity	-	-	-	-
Motor Speed	-	-	-	-
Feedback Pulse	-	-	-	-
Rotation Direction	0:Forward(CCW)	0:Forward(CCW)	0:Forward(CCW)	0:Forward(CCW)
Automatic Tuning	**Select the automatic tuning function.**			
Automatic Tuning Selection	-	-	-	-
Gain Adjustment	1:Automatic Tuning Mode 1	1:Automatic Tuning Mode 1	1:Automatic Tuning Mode 1	1:Automatic Tuning Mode 1
Servo Response Setting	5	5	5	5
Adjustment Parameter	**Set the adjustment parameter of the servo parameters.**			
Load Inertia Ratio	7.0[to motor]	7.0[to motor]	7.0[to motor]	7.0[to motor]
Position Loop Gain 1	35[rad/s]	35[rad/s]	35[rad/s]	35[rad/s]
Speed Loop Gain 1	177[rad/s]	177[rad/s]	177[rad/s]	177[rad/s]
Position Loop Gain 2	35[rad/s]	35[rad/s]	35[rad/s]	35[rad/s]
Speed Loop Gain 2	817[rad/s]	817[rad/s]	817[rad/s]	817[rad/s]
Speed Integral Compensation	20[ms]	20[ms]	20[ms]	20[ms]

(2) To display the "Servo Special Parameter Setting" dialog box, double-click the "1 to 75" setting cell of "Parameter No." of special parameter.

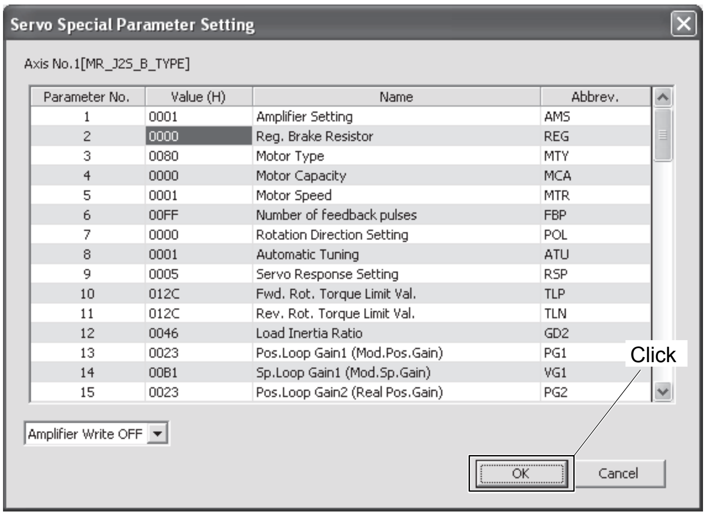


Select: Servo Parameter — Select servo parameter/inverter parameter/stepping parameter.

Amplifier Write: Amplifier Write OFF

Item	Axis1	Axis2	Axis3	Axis4
Motor Lock Operation	0:Invalid	0:Invalid	0:Invalid	0:Invalid
Slight Vibra.Supres.	0:Invalid	0:Invalid	0:Invalid	0:Invalid
E.M.Brake Interlock Out.Timing	-	-	-	-
Machine Reso.Supres.Filter 1	**Select the frequency matching the resonance frequency of mechanical system.**			
Notch Depth	0:-40[dB]	0:-40[dB]	0:-40[dB]	0:-40[dB]
Notch Frequency	0:Invalid	0:Invalid	0:Invalid	0:Invalid
Analog Monitor Output (ch1)	0:Motor Speed(±)	0:Motor Speed(±)	0:Motor Speed(±)	0:Motor Speed(±)
Analog Monitor Output (ch2)	1:Torque(±)	1:Torque(±)	1:Torque(±)	1:Torque(±)
LPF-Adaptive Vibra.Supres.Ctrl.	**Select LPF-Adaptive Vibra.Supres.Ctrl.**			
Low-pass Filter Selection	0:Valid	0:Valid	0:Valid	0:Valid
Adaptive Vibra.Supres.Ctrl.	0:Invalid	0:Invalid	0:Invalid	0:Invalid
Adaptive Vibra.Supres.Ctrl.Sensi.	0:Normal	0:Normal	0:Normal	0:Normal
Expansion Parameter	**Set the expansion parameter of the servo parameters.**			
Maintenance Parameter	**Set the maintenance parameter of the servo parameters.**			
Special Parameter	**Set the servo special parameters of the servo parameters. Use for setting the special p...**			
Parameter No.	1 to 75	1 to 75	1 to 75	1 to 75

(3) Change any setting values of parameters.
To enable the settings, change relevant parameters and click "OK".



Axis No.1[MR_J2S_B_TYPE]

Parameter No.	Value (H)	Name	Abbrev.
1	0001	Amplifier Setting	AMS
2	0000	Reg. Brake Resistor	REG
3	0080	Motor Type	MTY
4	0000	Motor Capacity	MCA
5	0001	Motor Speed	MTR
6	00FF	Number of feedback pulses	FBP
7	0000	Rotation Direction Setting	POL
8	0001	Automatic Tuning	ATU
9	0005	Servo Response Setting	RSP
10	012C	Fwd. Rot. Torque Limit Val.	TLP
11	012C	Rev. Rot. Torque Limit Val.	TLN
12	0046	Load Inertia Ratio	GD2
13	0023	Pos.Loop Gain1 (Mod.Pos.Gain)	PG1
14	00B1	Sp.Loop Gain1 (Mod.Sp.Gain)	VG1
15	0023	Pos.Loop Gain2 (Real Pos.Gain)	PG2

Amplifier Write OFF

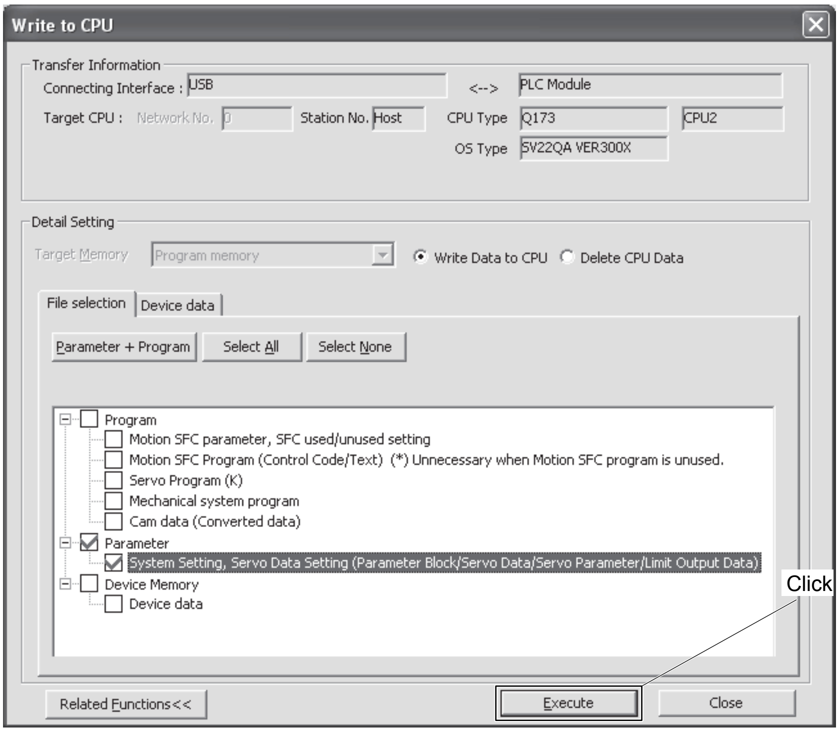
The following shows changing examples of parameter settings.

(a) Change of [Pr. 2 Reg. Brake Resistor] (hexadecimal parameter)
When changing the setting value to "0020", input "0020" directly.

(b) Change of [Pr. 12 Load Inertia Ratio] (decimal parameter)
When changing the setting value to "7.0", input "0046", the value "70" converted to hexadecimal.

(c) Change of [Pr. 39 Electronic dynamic brake operating time] (decimal parameter)
When changing the setting value to "10000", input "2710", the value "10000" converted to hexadecimal.

(4) Write the changed parameter with communication. Clicking "Execute" will start writing.



Write to CPU

Transfer Information

Connecting Interface : USB <--> PLC Module

Target CPU : Network No. 0 Station No. Host CPU Type Q173 CPU2

OS Type SV22QA VER300X

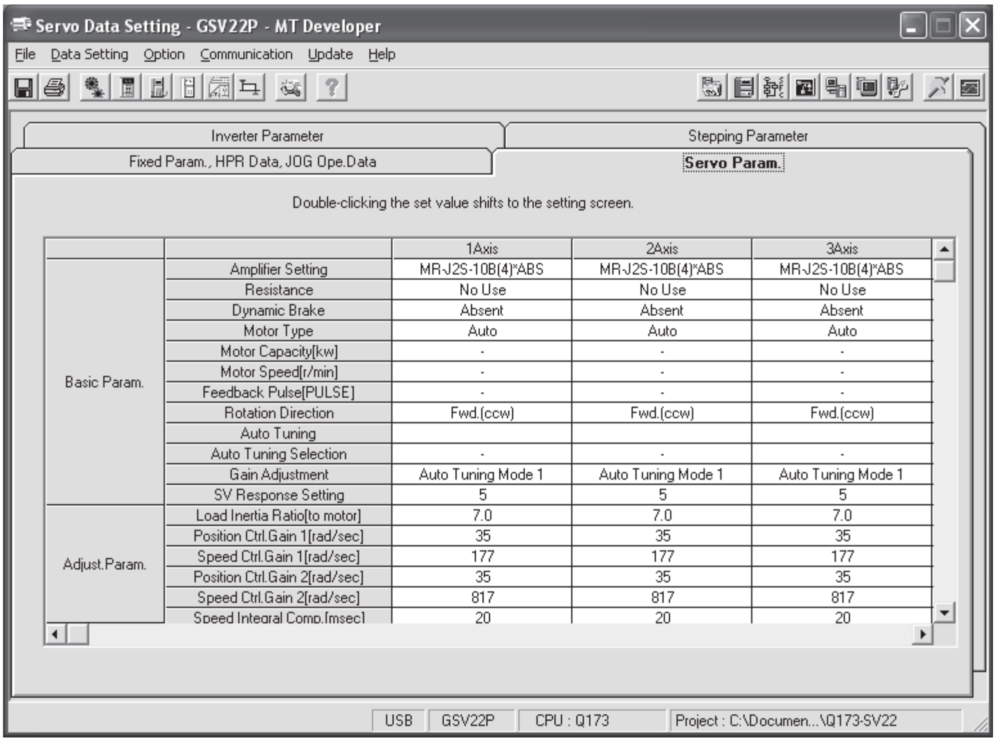
Detail Setting

Target Memory Program memory ● Write Data to CPU ○ Delete CPU Data

- ☐ Program
  - ☐ Motion SFC parameter, SFC used/unused setting
  - ☐ Motion SFC Program (Control Code/Text) (*) Unnecessary when Motion SFC program is unused.
  - ☐ Servo Program (K)
  - ☐ Mechanical system program
  - ☐ Cam data (Converted data)
- ☑ Parameter
  - ☑ System Setting, Servo Data Setting (Parameter Block/Servo Data/Servo Parameter/Limit Output Data)
- ☐ Device Memory
  - ☐ Device data

App. 10.2.2 MT Developer (software version 00K or later)

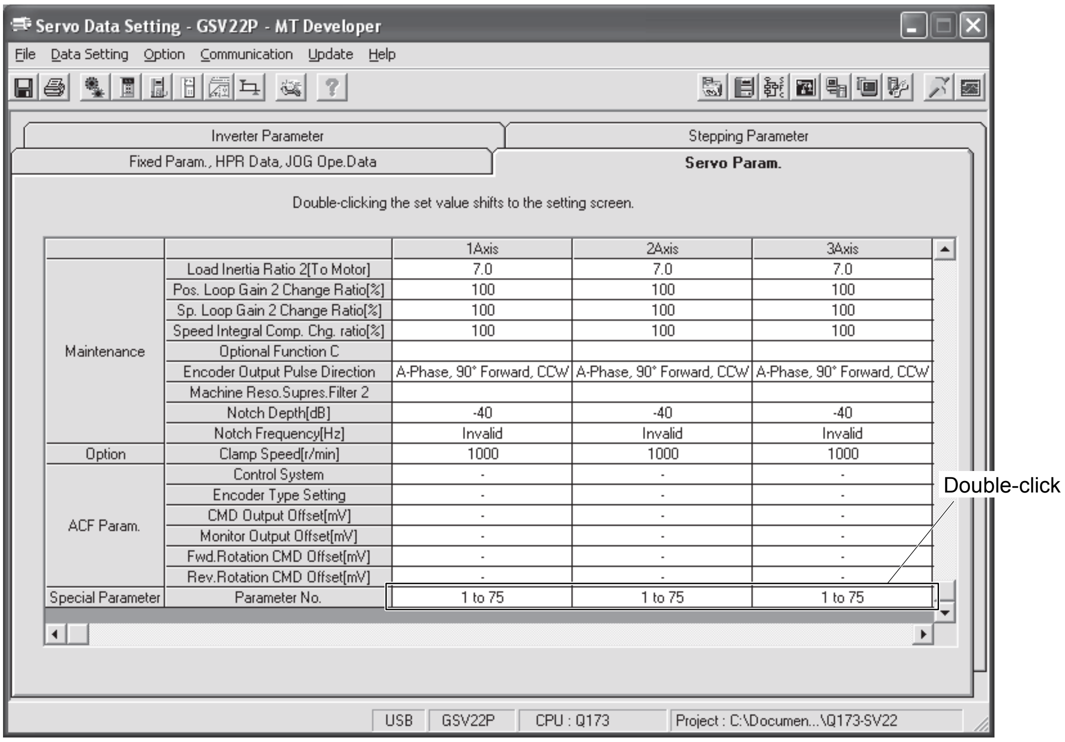
(1) Open the "Servo Data Setting" window.



Double-clicking the set value shifts to the setting screen.

		1Axis	2Axis	3Axis
Basic Param.	Amplifier Setting	MR-J2S-10B(4)*ABS	MR-J2S-10B(4)*ABS	MR-J2S-10B(4)*ABS
	Resistance	No Use	No Use	No Use
	Dynamic Brake	Absent	Absent	Absent
	Motor Type	Auto	Auto	Auto
	Motor Capacity[kw]	-	-	-
	Motor Speed[r/min]	-	-	-
	Feedback Pulse[PULSE]	-	-	-
	Rotation Direction	Fwd.(ccw)	Fwd.(ccw)	Fwd.(ccw)
	Auto Tuning			
	Auto Tuning Selection	-	-	-
	Gain Adjustment	Auto Tuning Mode 1	Auto Tuning Mode 1	Auto Tuning Mode 1
	SV Response Setting	5	5	5
Adjust.Param.	Load Inertia Ratio[to motor]	7.0	7.0	7.0
	Position Ctrl.Gain 1[rad/sec]	35	35	35
	Speed Ctrl.Gain 1[rad/sec]	177	177	177
	Position Ctrl.Gain 2[rad/sec]	35	35	35
	Speed Ctrl.Gain 2[rad/sec]	817	817	817
	Speed Integral Comp.[msec]	20	20	20

(2) To display the "Servo Special Parameter Setting" dialog box, double-click the "1 to 75" setting cell of "Parameter No." of special parameter on the "Servo Param." tab.

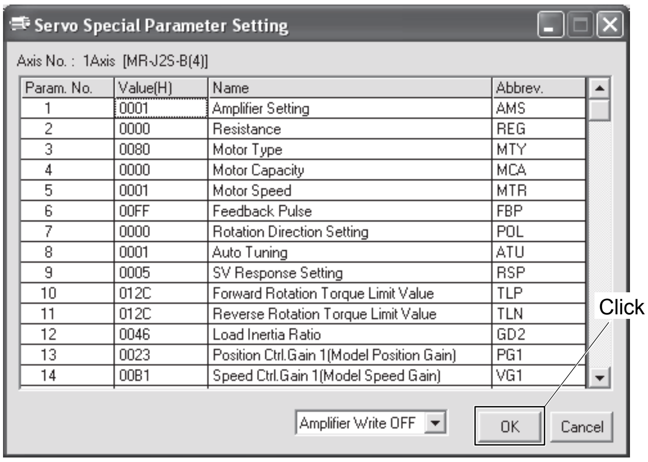


Double-clicking the set value shifts to the setting screen.

		1Axis	2Axis	3Axis
Maintenance	Load Inertia Ratio 2[To Motor]	7.0	7.0	7.0
	Pos. Loop Gain 2 Change Ratio[%]	100	100	100
	Sp. Loop Gain 2 Change Ratio[%]	100	100	100
	Speed Integral Comp. Chg. ratio[%]	100	100	100
	Optional Function C			
	Encoder Output Pulse Direction	A-Phase, 90° Forward, CCW	A-Phase, 90° Forward, CCW	A-Phase, 90° Forward, CCW
	Machine Reso.Supres.Filter 2			
	Notch Depth[dB]	-40	-40	-40
	Notch Frequency[Hz]	Invalid	Invalid	Invalid
Option	Clamp Speed[r/min]	1000	1000	1000
ACF Param.	Control System	-	-	-
	Encoder Type Setting	-	-	-
	CMD Output Offset[mV]	-	-	-
	Monitor Output Offset[mV]	-	-	-
	Fwd.Rotation CMD Offset[mV]	-	-	-
	Rev.Rotation CMD Offset[mV]	-	-	-
Special Parameter	Parameter No.	1 to 75	1 to 75	1 to 75

Double-click

(3) Change any set values of parameters.
To enable the settings, change relevant parameters and click "OK".



Axis No. : 1Axis [MR-J2S-B(4)]

Param. No.	Value(H)	Name	Abbrev.
1	0001	Amplifier Setting	AMS
2	0000	Resistance	REG
3	0080	Motor Type	MTY
4	0000	Motor Capacity	MCA
5	0001	Motor Speed	MTR
6	00FF	Feedback Pulse	FBP
7	0000	Rotation Direction Setting	POL
8	0001	Auto Tuning	ATU
9	0005	SV Response Setting	RSP
10	012C	Forward Rotation Torque Limit Value	TLP
11	012C	Reverse Rotation Torque Limit Value	TLN
12	0046	Load Inertia Ratio	GD2
13	0023	Position Ctrl.Gain 1(Model Position Gain)	PG1
14	00B1	Speed Ctrl.Gain 1(Model Speed Gain)	VG1

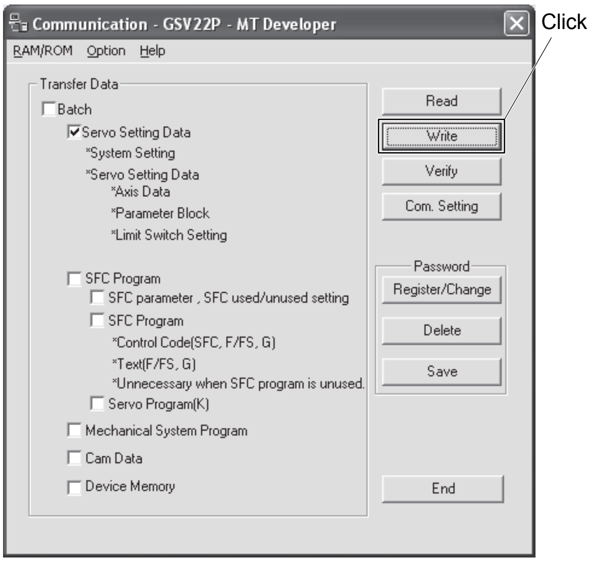
The following shows changing examples of parameter settings.

(a) Change of [Pr. 2 Reg. Brake Resistor] (hexadecimal parameter)
When changing the setting value to "0020", input "0020" directly.

(b) Change of [Pr. 12 Load Inertia Ratio] (decimal parameter)
When changing the setting value to "7.0", input "0046", the value "70" converted to hexadecimal.

(c) Change of [Pr. 39 Electronic dynamic brake operating time] (decimal parameter)
When changing the setting value to "10000", input "2710", the value "10000" converted to hexadecimal.

(4) Write the changed parameter with communication. Clicking "Write" will start writing.



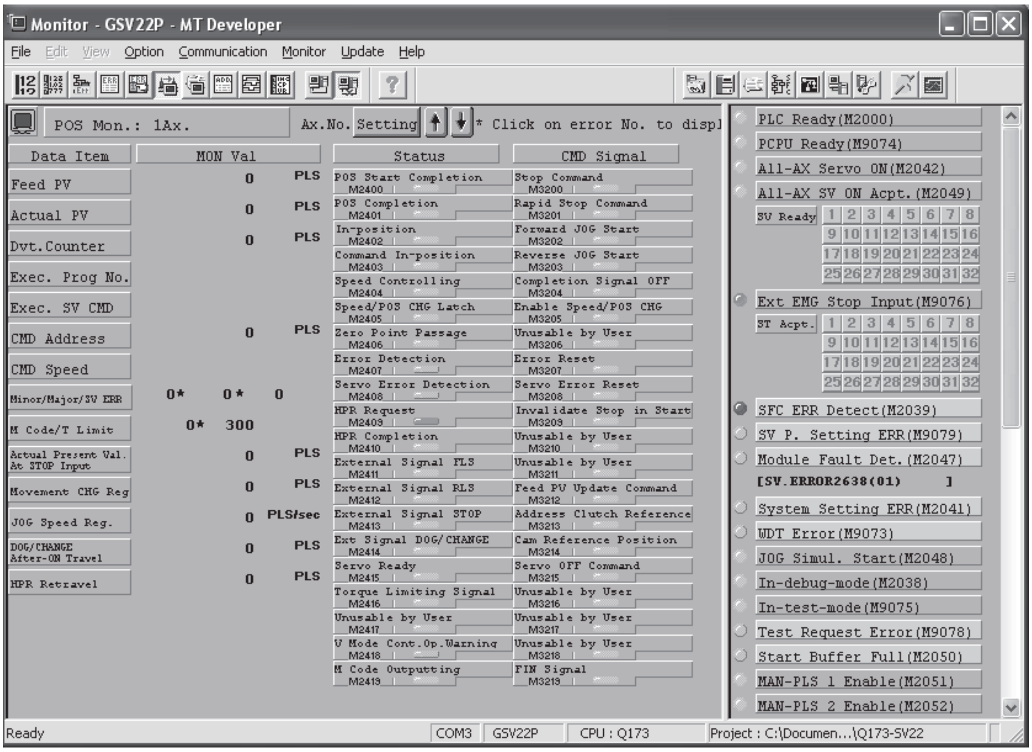
Transfer Data
- ☐ Batch
  - ☑ Servo Setting Data
    - *System Setting
    - *Servo Setting Data
      - *Axis Data
      - *Parameter Block
      - *Limit Switch Setting
  - ☐ SFC Program
    - ☐ SFC parameter , SFC used/unused setting
    - ☐ SFC Program
      - *Control Code(SFC, F/FS, G)
      - *Text(F/FS, G)
      - *Unnecessary when SFC program is unused.
    - ☐ Servo Program(K)
  - ☐ Mechanical System Program
  - ☐ Cam Data
  - ☐ Device Memory

App. 10.2.3 MT Developer (software version 00H or earlier) or SW3RNC-GSVE

> POINT
>
> ●Set as follows when the servo system controller and servo amplifier are in communication.

(1) Setting procedure

(a) Open the monitor window.
Set the monitor window to the monitor stop condition with the positioning monitor.

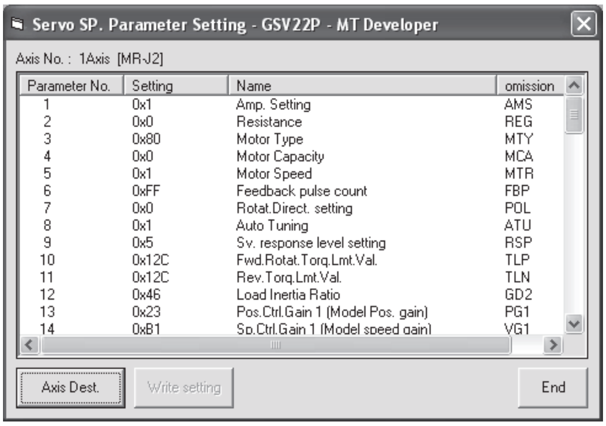


Data Item	MON Val	
Feed PV	0	PLS
Actual PV	0	PLS
Dvt.Counter	0	PLS
Exec. Prog No.		
Exec. SV CMD		
CMD Address	0	PLS
CMD Speed		
Minor/Major/SV ERR	0* 0 * 0	
M Code/T Limit	0* 300	
Actual Present Val. At STOP Input	0	PLS
Movement CHG Reg	0	PLS
JOG Speed Reg.	0	PLS/sec
DOG/CHANGE After-ON Travel	0	PLS
HPR Retravel	0	PLS

Status	CMD Signal
POS Start Completion M2400	Stop Command M3200
POS Completion M2401	Rapid Stop Command M3201
In-position M2402	Forward JOG Start M3202
Command In-position M2403	Reverse JOG Start M3203
Speed Controlling M2404	Completion Signal OFF M3204
Speed/POS CHG Latch M2405	Enable Speed/POS CHG M3205
Zero Point Passage M2406	Unusable by User M3206
Error Detection M2407	Error Reset M3207
Servo Error Detection M2408	Servo Error Reset M3208
HPR Request M2409	Invalidate Stop in Start M3209
HPR Completion M2410	Unusable by User M3210
External Signal FLS M2411	Unusable by User M3211
External Signal RLS M2412	Feed PV Update Command M3212
External Signal STOP M2413	Address Clutch Reference M3213
Ext Signal DOG/CHANGE M2414	Cam Reference Position M3214
Servo Ready M2415	Servo OFF Command M3215
Torque Limiting Signal M2416	Unusable by User M3216
Unusable by User M2417	Unusable by User M3217
V Mode Cont.Op.Warning M2418	Unusable by User M3218
M Code Outputting M2419	FIN Signal M3219

[SV.ERROR2638(01)]

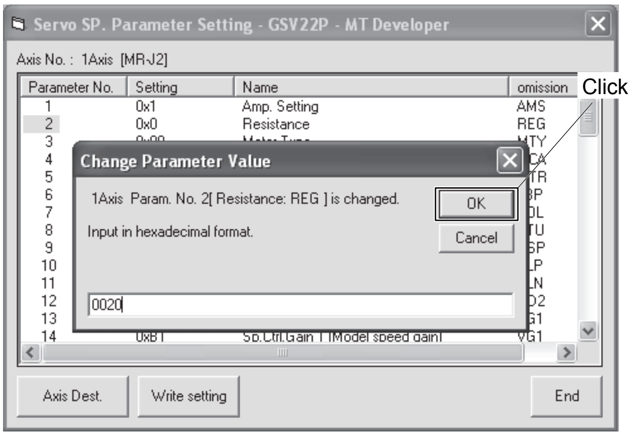
(b) To display the "Servo SP. Parameter Setting" dialog, use the shortcut key "Ctrl" + "Shift" + "Alt" + "0" on monitor window.



Axis No. : 1Axis [MR-J2]

Parameter No.	Setting	Name	omission
1	0x1	Amp. Setting	AMS
2	0x0	Resistance	REG
3	0x80	Motor Type	MTY
4	0x0	Motor Capacity	MCA
5	0x1	Motor Speed	MTR
6	0xFF	Feedback pulse count	FBP
7	0x0	Rotat.Direct. setting	POL
8	0x1	Auto Tuning	ATU
9	0x5	Sv. response level setting	RSP
10	0x12C	Fwd.Rotat.Torq.Lmt.Val.	TLP
11	0x12C	Rev.Torq.Lmt.Val.	TLN
12	0x46	Load Inertia Ratio	GD2
13	0x23	Pos.Ctrl.Gain 1 (Model Pos. gain)	PG1
14	0xB1	Sp.Ctrl.Gain 1 (Model speed gain)	VG1

(3) Change any set values of parameters.
After the setting of a relevant parameter, click "OK" to write the setting to the motion controller and servo amplifier.



Axis No. : 1Axis [MR-J2]

Parameter No.	Setting	Name	omission
1	0x1	Amp. Setting	AMS
2	0x0	Resistance	REG

1Axis Param. No. 2[Resistance: REG] is changed.

Input in hexadecimal format.

0020

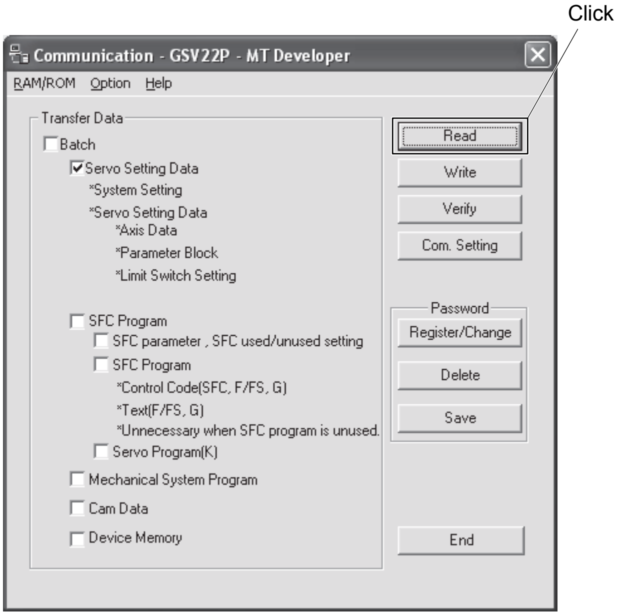
The following shows changing examples of parameter settings.

(a) Change of [Pr. 2 Reg. Brake Resistor] (hexadecimal parameter)
When changing the setting value to "0020", input "0020" directly.

(b) Change of [Pr. 12 Load Inertia Ratio] (decimal parameter)
When changing the setting value to "7.0", input "0046", the value "70" converted to hexadecimal.

(c) Change of [Pr. 39 Electronic dynamic brake operating time] (decimal parameter)
When changing the setting value to "10000", input "2710", the value "10000" converted to hexadecimal.

(4) The parameter value set in (3) will not be reflected in a project. Read the servo parameter with communication and save it in the project.

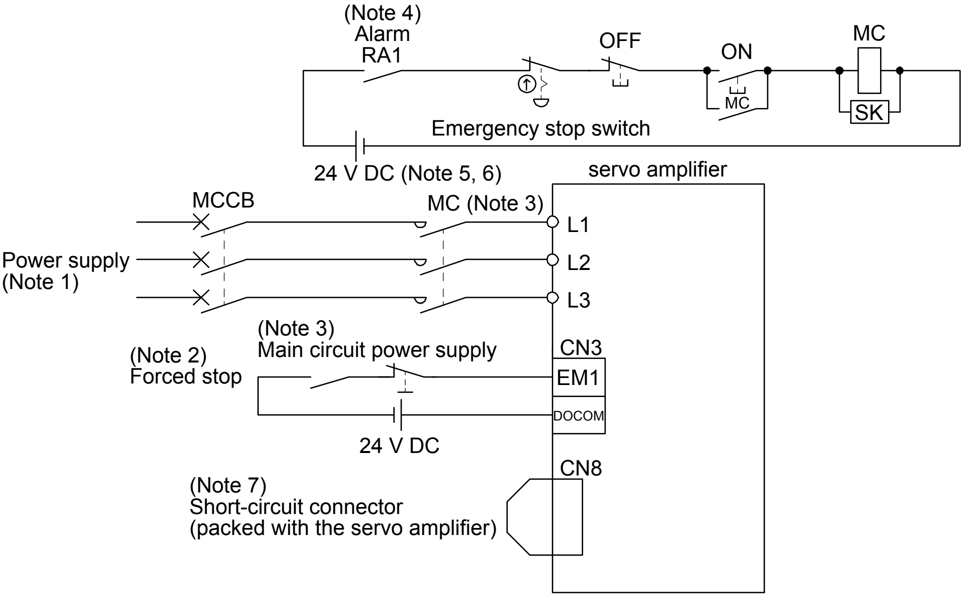


Transfer Data
☐ Batch
☑ Servo Setting Data
*System Setting
*Servo Setting Data
*Axis Data
*Parameter Block
*Limit Switch Setting
☐ SFC Program
☐ SFC parameter , SFC used/unused setting
☐ SFC Program
*Control Code(SFC, F/FS, G)
*Text(F/FS, G)
*Unnecessary when SFC program is unused.
☐ Servo Program(K)
☐ Mechanical System Program
☐ Cam Data
☐ Device Memory

App. 11 Driving on/off of main circuit power supply with DC power supply

App. 11.1 Connection example

The power circuit is common to the servo amplifier of 22 kW or less. For the signal and wirings not given in this section, refer to section 3.1.1 to 3.1.3.



Note
1. For power supply specifications, refer to section 1.3 or 14.1.3.
2. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
3. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. Driving the on switch and off switch with the DC power supply meets IEC/EN 60204-1 requirements.
6. Do not use the 24 V DC interface power supply for the magnetic contactor DC power supply. Always use the power supply designed exclusively for the magnetic contactor.
7. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with the servo amplifier or drive unit.

App. 11.2 Magnetic contactor

Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.

Servo amplifier	Magnetic contactor
MR-J4-10B-RJ020	SD-N11 SD-T12
MR-J4-20B-RJ020	
MR-J4-40B-RJ020	
MR-J4-60B-RJ020	
MR-J4-70B-RJ020	
MR-J4-100B-RJ020	
MR-J4-200B-RJ020	SD-N21 SD-T21
MR-J4-350B-RJ020	
MR-J4-500B-RJ020	SD-N35
MR-J4-700B-RJ020	SD-N50
MR-J4-11KB-RJ020	
MR-J4-15KB-RJ020	SD-N65
MR-J4-22KB-RJ020	SD-N95

Servo amplifier	Magnetic contactor
MR-J4-60B4-RJ020	SD-N11 SD-T12
MR-J4-100B4-RJ020	
MR-J4-200B4-RJ020	
MR-J4-350B4-RJ020	SD-N21 SD-T21
MR-J4-500B4-RJ020	
MR-J4-700B4-RJ020	
MR-J4-11KB4-RJ020	SD-N25
MR-J4-15KB4-RJ020	SD-N35
MR-J4-22KB4-RJ020	SD-N50
MR-J4-10B1-RJ020	SD-N11
MR-J4-20B1-RJ020	
MR-J4-40B1-RJ020	

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision	
Jun. 2013	SH(NA)030125-A	First edition	
Aug. 2013	SH(NA)030125-B	MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.	
		Safety Instructions (1) Transportation and installation	Partially changed.
		Section 1.1	Partially added.
		Section 1.2 (3)	Newly added.
		Section 1.3.1	Specifications of MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 1.4	Servo motors for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 1.6	Partially added and partially changed.
		Section 1.7.1 (1) to (6)	Partially changed.
		Section 1.7.1 (7), (8)	Newly added.
		Section 1.7.2	Partially changed.
		Section 1.7.3	Partially changed.
		Section 1.8	CAUTION is partially changed.
		Section 1.8 (1)	Partially added and partially changed in POINT.
		Section 1.8 (2)	Partially changed.
		Section 1.8 (3)	Newly added.
		Section 1.9 (7), (8)	Newly added.
		Chapter 2	CAUTION is partially changed. POINT is partially changed.
		Section 2.1 (1)	Partially added and partially changed.
		Section 3.1 (1) to (6)	Partially changed.
		Section 3.1 (7), (8)	Newly added.
		Section 3.2.1	Partially added and partially changed.
		Section 3.2.2	Partially added and partially changed.
		Section 3.3.1	Partially changed.
		Section 3.3.2	CAUTION is added. POINT is partially deleted.
		Section 3.4	CN3 connector 15 pin is changed to DB.
		Section 3.5.2	DB (Dynamic brake interlock) is added.
		Section 3.7.1	Circuit diagram of CN3 connector 15 pin (DB) is added.
		Section 4.3.1	Partially changed.
		Section 4.5.2	Partially changed.
		Section 5.1.1	Partially added and partially changed.
		Section 5.1.2	Partially added and partially changed.
		Section 5.1.3	Partially added and partially changed. [Pr. 58] is added.
		Section 5.2.1	[Pr. 2] setting is changed.
		Section 5.2.2	Partially changed. Initial values (11 kW or more) are added to [Pr. 13] to [Pr. 17].
		Section 5.2.3	Partially changed. [Pr. 58] is added.
		Section 7.2.3	Partially changed.
		Section 8.1	Partially changed.
		Section 8.2	Partially added and partially changed.
		Section 8.3	Partially added and partially changed.
		Section 8.4	Partially added and partially changed.
		Section 9.1 (9)	Partially added and partially changed.
		Section 9.1 (12), (13)	Newly added.
		Section 10.1	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 10.2	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 10.3.1	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.

Print Data	*Manual Number	Revision	
Aug. 2013	SH(NA)030125-B	Section 10.3.2	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 10.5	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.1.2	Partially changed.
		Section 11.2.1 (1), (2)	Regenerative options for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.2.2 (2)	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.2.3	Partially added and partially changed.
		Section 11.2.4	Partially added.
		Section 11.2.5	Partially added.
		Section 11.3	POINT is partially changed.
		Section 11.3.1	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.3.3	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.3.4	Partially added.
		Section 11.4	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.5	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.6 (2)	DB is added to 15 pin.
		Section 11.7	Partially added and partially changed.
		Section 11.9	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.10	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.11	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.12	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.14 (2) (b)	Partially changed.
		Section 11.15	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.16	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.17	Newly added.
		Section 11.18	Newly added.
		Chapter 12	POINT is partially changed.
		Section 13.2.1 (2)	Partially changed.
		Section 13.2.2 (1)	[Pr. PA02] setting is changed.
		Section 13.2.2 (2)	Partially changed.
		Section 13.2.2 (4)	Setting value "06: DB (Dynamic brake interlock)" is added to [Pr. PD07].
		Section 13.3.1	Partially changed.
		App. 1	Partially added and partially changed.
		App. 5	MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
Mar. 2014	SH(NA)030125-C	100 V class MR-J4 series servo amplifiers are added.	
		«About the manual»	Partially changed.
		Section 1.1	Partially changed.
		Section 1.2 (1) to (3)	Partially changed.
		Section 1.2 (4)	Newly added.
		Section 1.3.1 (1), (2)	Partially added and partially changed.
		Section 1.3.1 (3)	Newly added.
		Section 1.4 (3)	Newly added.
		Section 1.5	Partially added.
		Section 1.6	Partially added and partially changed.
		Section 1.7.1	Partially changed.
		Section 1.7.2	Partially changed.

Print Data	*Manual Number	Revision	
Mar. 2014	SH(NA)030125-C	Section 1.7.3	Partially changed.
		Section 1.8	Partially changed.
		Section 1.9 (1) to (8)	Partially changed.
		Section 1.9 (9)	Newly added.
		Chapter 2	POINT is partially changed.
		Section 2.1 (1)	Partially added and partially changed.
		Section 3.1 (1) to (8)	Partially changed.
		Section 3.1 (9)	Newly added.
		Section 3.2.1	Partially changed.
		Section 3.3.1	Partially added and partially changed.
		Section 3.3.2	Partially changed.
		Section 3.3.3	Partially added and partially changed.
		Section 3.8.1	Partially changed.
		Section 3.8.2	Partially changed.
		Section 3.9	Partially changed.
		Section 4.1.1	Partially changed.
		Section 4.1.2	Partially changed.
		Section 4.2	Partially changed.
		Section 4.3.1	Partially changed.
		Section 5.1.1	Partially changed.
		Section 5.2.1	Partially changed.
		Section 5.2.2	Partially changed.
		Section 5.2.3	Partially changed.
		Section 8.2	Partially added and partially changed.
		Section 8.3	Partially added and partially changed.
		Section 9.1 (1) to (13)	Partially changed.
		Section 9.1 (14), (15)	Newly added.
		Section 10.1	Partially changed.
		Section 10.2	Characteristics for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 10.3.2	Partially changed.
		Section 10.5	POINT is added. Characteristics for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.1.1	Partially added and partially changed.
		Section 11.2.1 (3)	Regenerative options for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.2.2 (2)	Characteristics for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.2.3	Partially added.
		Section 11.2.4	Partially changed.
		Section 11.2.5	Partially changed.
		Section 11.3.3	Partially changed.
		Section 11.5	Partially changed.
		Section 11.7	Partially changed.
		Section 11.8	The MR-BAT6V1BJ battery for junction battery cable is added.
		Section 11.9	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.10	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.12	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.13	Partially added.
		Section 11.14	Partially changed.
		Section 11.15	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.16	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.17	Partially added and partially changed.
		Section 11.18	Partially changed.

Print Data	*Manual Number	Revision	
Mar. 2014	SH(NA)030125-C	Chapter 12	Using MR-BAT6V1BJ battery for junction battery cable is added.
		Chapter 13	Partially added and partially changed in POINT.
		Section 13.1.1	Partially changed.
		Section 13.1.2	Partially changed.
		Section 13.2	[Pr. PD11], [Pr. PD15] to [Pr. PD17], [Pr. PD20], [Pr. PD30] to [Pr. PD32] are added.
		Section 13.2.2 (1) to (3), (5)	Partially changed.
		Section 13.2.2 (4)	[Pr. PD11], [Pr. PD15] to [Pr. PD17], [Pr. PD20], [Pr. PD30] to [Pr. PD32] are added.
		Section 13.3.1	[AL. 3D] and [AL. 82] are added.
		App. 1 (3)	Newly added.
		App. 2	Partially added.
		App. 3	Partially added and partially changed.
		App. 5	Contents of MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		App. 6	Partially changed.
		App. 7	Newly added.
		App. 8	Newly added.
Sep. 2015	SH(NA)030125-D	HG-JR servo motor, large capacities, and fully closed loop system (7 kW or less) are added.	
		Front cover	The title is changed.
		Safety Instructions	Partially added.
		About the manuals	Partially added.
		Chapter 1	POINT is added.
		Section 1.1	Partially changed.
		Section 1.3	Partially added.
		Section 1.4	Partially added.
		Section 1.5	Functions are added.
		Section 1.8	Partially changed.
		Section 3.1	CAUTION is added.
		Section 3.2.1	Partially added.
		Section 3.3.3 (2)	Partially changed.
		Chapter 5	Added.
		Section 5.1.4	Added.
		Section 5.2	The description of the fully closed loop system is added.
		Chapter 8	The description of the fully closed loop system is added. The description of large capacities (MR-J4-DU30KB(4)-RJ020 to MR-J4-DU55KB4-RJ020) is added.
		Chapter 10	HG-JR servo motor is partially added.
		Section 10.3	POINT is added.
		Section 11.1.1	Partially added.
		Section 11.2.4 (3)	CAUTION is changed.
		Section 11.5.2 (3)	Note is added.
		Section 11.8	Changed.
		Section 11.6	Partially changed.
		Section 11.10	The caution and the note are added.
		Section 11.15	Partially changed.
		Chapter 12	Changed.
		Chapter 13	The description of large capacities (MR-J4-DU30KB(4)-RJ020 to MR-J4-DU55KB4-RJ020) is added. POINT is added.
		Chapter 14	Added.
		Chapter 15	Added.
		App. 2	Added.
		App. 3	Partially added.
		App. 4	Partially changed.
		App. 6	Partially changed.

Print Data	*Manual Number	Revision	
Sep. 2015	SH(NA)030125-D	App. 7	Added.
		App. 10	Partially added.
		App. 11	Added.
Apr. 2016	SH(NA)030125-E	Software version A6 and fully closed loop control system (11 kW or more) are added	
		4. Additional instructions	Partially changed.
		About the manual	Note is partially changed.
		Section 1.1	Partially changed.
		Section 1.2	Illustration is partially changed.
		Section 1.3	Partially added.
		Section 1.5	Partially added.
		Section 1.6	Partially added.
		Section 1.7	Partially changed.
		Section 2.5 (1)	Partially changed.
		Section 2.6	Added.
		Section 3.3.3	Open tool is added.
		Section 3.4	Partially added.
		Section 5.1.1	Note is added.
		Section 8.2	Partially added.
		Section 10.2	Partially changed.
		Section 10.3.2	Partially added.
		Section 11.1.1	Open tool is added.
		Section 11.5.2 (6)	Magnetic contactor is added.
		Section11.7	Partially changed.
		Section 11.8.3	Partially changed.
		Section 11.10	Magnetic contactor is added.
		Section 11.16	Partially changed.
		Chapter 13	Partially changed.
		Section 13.2.2	Partially changed.
		Section 13.3	Partially changed.
		Chapter 14	Contents of fully closed loop system are added.
		Section 14.2.5	Added.
		Section 14.9.9	Partially changed.
		Chapter 15	Partially changed.
		App. 3	Partially changed.
		App. 6	Partially changed.
		App. 7	Partially changed.
		App. 12	Magnetic contactor is added.
May 2016	SH(NA)030125-F	Section 13.2.2	[Pr. PB52], [Pr. PB53], [Pr. PB54], and [Pr. PB55] are partially changed.
		App. 6.2.3 (2)	Partially changed.
		App. 7.2.3 (2)	Partially changed.

MEMO

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Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first (“Warranty Period”). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
- (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
- (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
- (iii) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
- (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
- (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
- (vi) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
- (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
- (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.

(2) Our General-Purpose AC Servo is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

MODEL	MR-J4-B-RJ020 MR-J4-T20 INSTRUCTION
MODEL CODE	1CW814

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BLDG MARUNOUCHI TOKYO 100-8310

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